



**FUSION
FOR
ENERGY**

**Consolidated Annual Activity Report (CAAR) for 2022
of the European Joint Undertaking for ITER and
the Development of Fusion Energy
(Fusion for Energy – F4E)**

This report fulfils the requirement of Article 48 of F4E's Financial Regulation on the provision of a Consolidated Annual Activity Report.

Fusion for Energy

**The European Joint Undertaking for ITER
and the Development of Fusion Energy**

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List of Acronyms

A/E	Architect Engineer
ABAC	(Accrual-based Accounting); Accounting and budgetary tool of the European Commission and F4E
AC	Audit Committee
AHG	Ad-Hoc Group
AMC	Administration and Management Committee
ANB	Authorised Notified Body
B2B	Business-to-business
BA	Broader Approach Agreement
BAUA	Broader Approach Units of Account
BCM	Blanket Cooling Manifold
BIPS	Buildings, Infrastructures and Power Supplies project team
Body PS & MHVPS	Body Power Supply and Main High Voltage Power Supply
BPM	Business Process Management
BSM	Blanket Shield Module
CA	Contract Agent
CAAR	Consolidated Annual Activity Report
CAD	Computer Aided Design
CAS	Credit Allocation Scheme
CB	Cryostat Base
CEL	Conventional Exceptional Loads (convoys)
CER coils	Continuous External Rogowski coils
CMA	Construction Management-as-agent
CMM	Cassette Multifunctional Mover
CN-DA	Chinese ITER Domestic Agency
COSO	Committee of Sponsoring Organizations of the Treadway Commission
CPRHS	Cash and Plug Remote Handling System
CS	Central Solenoid
CSC	Computational Simulation Centre
CVB	Cold Valve Boxes
CVBCS	Cryostat Vessel Body Cylindrical Section
CW	Continuous Wave

CW gyrotron	Continuous Wave gyrotron
CW pumping station	Cooling Water pumping station
DA	Domestic Agency
DACC	Deviations Amendments and Contract Changes tool
DC	Direct Current
DCC	Document Comment Communication
DEMO	Demonstration Fusion Reactors
DG ENER	Directorate-General for Energy
DNB	Diagnostic Neutral Beam
DP	Double Pancake for superconducting magnets
DR	Deviation Request
D-T	Deuterium-Tritium
DTP2	Divertor Remote Handling Test Platform
DWS	Detailed Work Schedules
EAC	Estimate At Completion
EBBTF	European Breeding Blanket Test Facilities
EC	Electron Cyclotron
ECA	European Court of Auditors
ECH	Electron Cyclotron Heating
EcoSys®	Enterprise Project Control System
ECPS	Electron Cyclotron Power Supplies
ECRH	Electron Cyclotron Resonance Heating
EDPS	European Data Protection Supervisor
EF	Equilibrium Field
EU	European Union
EU-DA	European Union ITER Domestic Agency (Fusion for Energy)
EUROFER	A 9% Chromium reduced activation ferritic-martensitic steel
EUROfusion	European Consortium for the Development of Fusion Energy
EVEDA	Engineering Validation and Engineering Design Activities
EVM	Earn Value Management
F4E	Fusion for Energy
FAT	Factory Acceptance Test
FC	Framework Contract
FO	Official staff

FP7 grants	Seventh Framework Programme for Research and Technological Development European Union grants
FR/IR	Financial Regulation/Implementing Rules
FSP	Full-Scale Prototype
FTE	Full Time Equivalent
FW	First Wall
FWC	Framework Contract
GB	Governing Board
GDols	General Declarations of Interest
GHe tank	Gas Helium Tank
H&CD	Heating and Current Drive
HCLL	Helium-Cooled Lithium-Lead (Test Blanket Module)
HEL	Highly Exceptional Loads (convoys)
HFTM	High Flux Test Module
HHF	High Heat Flux
HIP	Hot Isostatic Pressing
HNB	Heating Neutral Beam
HPC	Hold Point Clearance
HR	Human Resources
HRS Water treatments	Heat Rejection System Water treatments
HTS CL	High Temperature Superconducting Current Leads
HV	High Voltage
HVPS	High Voltage Power Supply
I&C	Instrumentation and Control
IAC	Internal Audit Capability
IAEA	International Atomic Energy Agency
IAS	Internal Audit Service
IC	ITER Council
ICRH	Ion Cyclotron Resonance Heating
ICT	Information and Communication Technology
IDM	ITER Document Management (software)
IFERC	International Fusion Energy Research Centre
IFMIF	International Fusion Materials Irradiation Facility
IMS	Integrated Management System

IMSS	Integrated Management System Standards
IN-DA	Indian ITER Domestic Agency
IO	ITER Organization
IP	Intellectual Property
IPR	Intellectual Property Rights
IPTs	Integrated Project Teams
IRP	Internal Review Panel
IRS	Integrated Reporting System
ISC	Improvement Steering Committee
ISEPS	Ion Source and Extraction Power Supplies
ISS	Isotope Separation System
IT	Information Technology
ITER IO	ITER International Organization (Central Team)
IUA	ITER Unit of Account
IVT	Inner Vertical Target
IVVS	In-Vessel Viewing System
JAEA	Japanese Implementing Agency (Broader Approach)
JET	Joint European Torus
JA-DA	Japanese ITER Domestic Agency
KO-DA	Korean ITER Domestic Agency
KPI	Key Performance Indicator
LC	Load Centre
'Lean Six Sigma' methodology	A set of techniques and tools for process improvement
LIFUS	Lithium for Fusion
LIPAc	Linear International Fusion Materials Irradiation Facility Prototype Accelerator
LN2	Liquid Nitrogen
MAD	Material Acceptance Document
MAP	Multi-Annual Plan
MFF	Multi-Annual Financial Framework
MITICA	Megavolt ITER Injector and Concept Advancement
MS	Management Standards
MTA	Milestone Trend Analysis
MV DC	Mega Volt Direct Current

NB	Neutral Beam
NBI	Neutral Beam Injector
NBTF	Neutral Beam Test Facility
NbTi	Niobium Titanium
NCR	Non-Conformity Report
NHF	Normal Heat Flux
NPC	Notification Point Completion
OLAF	European Anti-Fraud Office
OPS	Overall Project Schedule
PA	Procurement Arrangement
PBS	Plant Breakdown Systems
PCC	Procurement and Contracts Committee
PCR	Project Change Request
PCR	Pre-Compression Rings
PF	Poloidal Field (coils)
PGM M/IMP	Programme Management and Implementation
PoE	Port of Entry
PPEN	Pulsed Power Electrical Network
PRIMA	Padova Research on ITER Megavolt Accelerator
PS	Power Supply
PSM	Project Steering Meeting
PTC	Prototype Torus Cryopump
Q1/2/3/4	Quarter
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
QPC	Quench Protection Circuit
R&D	Research and Development
RAMI	Reliability, Availability, Maintenance and Inspectability
RAMIO	Reliability, Availability, Maintenance and Inspectability Officer
RAPID	F4E-developed tool which follows up on the implementation of audit actions
RASCI	Responsible, Accountable, Support, Consulted and Informed
RF	Radio Frequency
RFE	Ready for Equipment

RFQ	Radio Frequency Quadrupole
RH	Remote Handling
RMV	Requirements Management and Validation
RF-DA	Russian ITER Domestic Agency
RWM	Resistive Wall Mode Control
RWMPS	Resistive Wall Modes (Coils) Power Supplies
SAT	Site Acceptance Test
SCMPS	Superconducting Magnets Power Supplies
SF6 gas	Sulphur hexafluoride gas
SMEs	Small and Medium Enterprises
SNE	Seconded National Expert
SOAP	Sign-Off Authorisation Policy
SPI	Schedule Performance Index
SPIDER	Source for Production of Ions of Deuterium Extracted from Radio Frequency plasma
SR2FP	Straight Road to First Plasma
SRF Linac	Superconducting Radio Frequency Linear Accelerator
SSEN	Steady State Electrical Network
TA	Temporary Agent
TAP	Technical Advisory Panel
TB	Tender Batch (building contracts)
TBM	Test Blanket Modules
TF	Toroidal Field (coils)
TSS	Technical Support Services
US-DA	United States ITER Domestic Agency
VC	Voluntary Contributor
VV	Vacuum Vessel
WBS	Work Breakdown Structure
WDS	Water Detritiation System
WP	Work Programme
WRL	Warm Regeneration Lines
WRS	Warm Regeneration System

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Governing Board's Analysis and Assessment

Having regard to Art. 4 of the Statutes annexed to the Council decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and Art. 48 of F4E's Financial Regulation, *the Governing Board*:

1. Notes that there have been several management changes at F4E during 2022 following the dismissal of the Director from his post in June 2022. Pending the selection of a new Director through a selection process launched in 2022, the F4E Governing Board appointed Pietro Barabaschi as acting Director. Following his nomination as Director-General of the ITER Organization (IO) in October 2022, the F4E Governing Board appointed Jean-Marc Filhol as acting Director.
2. Notes that the ITER Organization identified serious non-conformities in some key ITER components (vacuum vessel and thermal shields) already delivered to the site by the Korean Domestic Agency. The repair of these components will incur additional costs and delays to be determined. The experience of the Korean Domestic Agency can provide useful input into F4E's procurement of the vacuum vessel sectors under EU responsibility.
3. Notes that the ITER Council tasked the Director General of the ITER Organization to prepare a proposal to re-baseline the whole project considering not only the above-mentioned repairs but also seeking opportunities to simplify some of the project requirements and minimise the time to a meaningful first plasma. F4E participates closely in the IO re-baselining exercise.
4. Expresses concern that the sustained under-performance of F4E against its objectives combined with reduced needs for cash contributions to the ITER Organization, have caused a lower level of operational budget implementation in 2022 (72% and 92% in commitments and payments respectively) and increased the level of unused appropriations.
5. Notes that F4E's 2022 staff engagement survey (referenced to the situation in mid-June 2022) showed a worsening compared to previous years particular in the areas related to trust and decision-making while the appreciation of line management improved.
6. Acknowledges that F4E, in collaboration with the Staff Committee and the Trade Unions have been taking steps to address concerns about the working environment following the suicide of a staff member in 2021. Noted the "*change agenda*" and "*expression directe*" initiatives.
7. Takes note of the status of the Euratom contribution to the ITER and Broader Approach projects in 2022 including:
 - a. Progress with civil works on the Tokamak Complex buildings. The ITER Organization took over the Tokamak and Diagnostics Building. There was significant progress on civil works for the Tritium Building. The situation of the buildings' interfaces and their possible cost implications required a close monitoring and additional reporting to the GB.
 - b. Manufacture and delivery to the IO of the eighth of ten superconducting Toroidal Field magnets. This is the result of several complex technical operations involving more than 30 EU industrial partners.

- c. Manufacture and delivery of three of the five Poloidal Field magnets of up to 17 metres in diameter. For the two remaining coils, F4E completed vacuum pressure impregnation of one winding pack.
 - d. Ongoing challenges for F4E's industrial partners to maintain the schedule and quality for the manufacturing of the five European Vacuum Vessel sectors. This is mostly due to difficulties with the complex welding procedures under the applicable nuclear code.
 - e. Signature of the contracts for the manufacturing of the 215 Blanket First Wall panels that Europe is providing with two industrial partners after an extensive qualification process.
 - f. Installation of the Liquid Nitrogen Plant and Auxiliary systems, F4E continued with commissioning. Cryogens (liquid nitrogen) were delivered to site for the commissioning of the liquid nitrogen tank and the associated distribution system.
 - g. At the Neutral beam Test Facility in Padova, F4E delivered its contributions for the SPIDER neutral beam ion source and transferred them to ITER. For the MITICA neutral beam source the power supplies, vessel and all auxiliaries managed by F4E were transferred to ITER.
 - h. F4E made significant progress on F4E's twelve diagnostic systems, ten ancillary systems and integration of six port plugs. During 2022, F4E also delivered the 2nd and 3rd batches of inner vessel diagnostic coils completing F4E's obligations for these components.
 - i. Together with the Japanese partners, F4E supported the repairs of the JT-60SA Satellite Tokamak in Japan as part of the Broader Approach agreement aiming at a first plasma during 2023.
 - j. F4E continued to support the major upgrade of the prototype accelerator LIPAc for testing fusion materials. Among other achievements, we validated the continuous wave of the deuteron beam produced by the injector with the required characteristics.
8. Has decided, in view of the situation of some buildings' projects and related contracts, that the 2023 annual assessment will focus on the buildings programme as one of the most critical areas of F4E operational activities in terms of cost and schedule.
 9. Noted that according to F4E's assessment of its own internal control system, which has been conducted in line with the Commission framework, all the components of internal control are operating in an integrated manner. As a combination of deficiencies exists, it can be concluded that the system is partially effective. No reservation is included in the Director's Declaration of Assurance.

Cadarache, 7 July 2023

Carlos Alejandre
[e-signed in IDM]
Chair of the Governing Board

Executive Summary/The Year in Brief

Imagine if we could create a small Sun on Earth as a virtually inexhaustible and clean energy source – and although this may sound like science fiction, it is the ultimate mission of Fusion for Energy (“F4E”).

We are the main contributor to ITER – an international project to build and operate the largest research machine to create solar fusion. In parallel, we are collaborating with Japan on three smaller fusion projects to improve our technical know-how.

This has been a challenging year for F4E and the ITER project at large in several respects.

We signed new contracts with industrial partners and laboratories for a total of €500m, bringing F4E’s total financial contribution since the beginning of the project close to €6.5bn. The impact of this investment spread into technology transfers, job creation, and new commercial opportunities.

In terms of technical achievements:

Civil works on the **Tokamak Complex buildings** progressed and we handed over the whole Tokamak Building and Diagnostics Building to the ITER Organization. There was also significant progress with the Tritium Building

We manufactured and delivered the **eighth of ten superconducting Toroidal Field magnets**. This is the result of several complex technical operations involving more than 30 EU industrial partners

We completed and delivered three of the five **Poloidal Field magnets** of up to 17 metres in diameter. For the two remaining coils, F4E completed vacuum pressure impregnation of one winding pack and started this for the other

We continued working with our industrial partners to maintain the schedule and quality for the manufacturing of the five European **Vacuum Vessel** sectors that each stand 11 metres tall and weigh over 5000 tonnes, the completion of which is challenging due mostly to difficulties with the complex welding procedures under the applicable nuclear code

We signed the contracts for the manufacturing of the 215 **Blanket First Wall Panels** that Europe is providing with two industrial partners. These panels will protect ITER’s vacuum vessel from the high heat fluxes from the fusion plasma

After installation of the **Liquid Nitrogen Plant** and Auxiliary systems, F4E continued with commissioning. Cryogenics (liquid nitrogen) were delivered to the ITER site for the commissioning of the liquid nitrogen tank and the associated distribution system

At the Neutral beam Test Facility in Padova, we delivered all our contributions for the **SPIDER neutral beam ion source** and transferred them to ITER. With regards to the **MITICA neutral beam source**, the power supplies, vessel and all auxiliaries managed by F4E were transferred to ITER Organization

There was significant progress with F4E's twelve **diagnostic**, ten ancillary systems and integration of 6 port plugs. During 2022, among many achievements, we delivered the 2nd and 3rd batches of inner vessel diagnostic coils completing our obligations for these components

Together with our Japanese partners, we supported the repairs of the **JT-60SA Satellite Tokamak** in Japan as part of the Broader Approach agreement aiming at a first plasma during 2023

We continued to support the major upgrade of the **prototype accelerator LIPAc** for testing fusion materials. Among other achievements, we validated the continuous wave of the deuteron beam produced by the injector with the required characteristics.

Late in 2022, the ITER Organization detected the need for repairs in some key ITER components already delivered on the site by other members. This will have an impact on the schedule and budget of the whole project that has not yet been determined. Consequently, this led to a slow-down in some areas of the project, and impacted F4E's 2022 budget execution. A new baseline (scope, schedule and cost) will be presented to the ITER Council for a decision during the second half of 2024. This will have impacts on some of the F4E in-kind delivery programs.

With regards to improving our work environment, we took several initiatives to actively listen to our staff. A "Change Agenda" exercise was launched to identify areas of improvement and propose a list of actions. In collaboration with the trade unions, we carried out a wide consultation to take stock of any concerns.

Several changes at senior management level took place in F4E and the ITER Organization. In June 2022, the F4E Governing Board appointed Pietro Barabaschi as acting Director, whom I replaced in October 2022 when he took up duties as Director General of the ITER Organization following the sad passing of his predecessor, Dr. Bernard Bigot.

Finally, F4E acted as Chair of the European Union Agencies Network (EUAN), co-ordinating the work of 49 different EU entities by overviewing strategic priorities and exchanging best practice in different areas.

As I have taken up my duties as F4E Director on 16 June 2023, I would like to conclude by thanking warmly Jean-Marc Filhol, Acting Director, the F4E staff and the teams of our industrial partners for their dedication, resilience, and hard work, often under very challenging circumstances.

Marc Lachaise

Director
19 June 2023

Part I: Achievements of the year

1.1 Contributions to the ITER Project

1.1.1 Introduction

ITER is under construction in Cadarache in the south of France. Europe, as the Host Party, and France, as Host State, have special responsibilities for the success of the Project. Europe bears 45.46 % of the construction cost including all the buildings. It will provide 34.00 % of the cost of operation, deactivation and decommissioning of ITER^[1].

Europe budgeted € 6.6bn until the end of 2020 and an additional €5.6 billion for the period 2021-2027. This does not include the French contribution which amounts to approximately 20%. Most of the budget is earmarked for contracts placed by F4E with European industry, SMEs and research laboratories. F4E signed new contracts with industrial partners and laboratories for a total of €500 m in 2022 bringing the total investment made by F4E into European industries and research organisations since 2007 to almost €6bn helping to create jobs and support innovation.

The following subsections present a brief report on a selection of the activities undertaken in 2022 on the major systems needed to achieve 'First Plasma' in ITER (marking the start of ITER operations), namely Site and Buildings (subsection 1.1.2.1 Site and Buildings), Vacuum Vessel (1.1.2.2 Vacuum Vessel) and Magnets (1.1.2.3 Magnets).

The subsequent subsections within this chapter deal with the many other complex, first-of-a-kind technological systems for ITER, most of which are still in the design and development phase, which Europe is responsible for. The ITER schedule requires installation of some of these systems, fully or partially, before First Plasma, although delivery, in most cases, is only required for subsequent assembly phases

1.1.2 Major Achievements in EU First Plasma Systems

1.1.2.1 Site and Buildings

Thirty-nine buildings and areas will house the systems necessary for the operation of ITER. The 'Tokamak Complex' will house the main ITER components and will be one of the largest buildings of its type ever constructed: 60 m tall (with an additional 20 m underground), 120 m long and 80 m wide; requiring 16,000 tonnes of iron reinforcement bars, 150,000 m³ of concrete and 7,500 tonnes of steel.

As shown in Figure 1 and Figure 2, the Tokamak Complex civil works have well progressed, materialised with the Taking Over by IO on the Tokamak Building B11 and Diagnostics Building

^[1] *Final Report of Negotiations on ITER Implementation, 1 April 2006. Attachment 2_C*

(B74) on the Civil and Finishing works, and the significant progress on civil works for the Tritium Building (B14).

The effects of the COVID-19 and the global shortage of material due to the conflict in Ukraine heavily impacted the contractors' performance. Despite these difficulties, the Buildings team was able to continue progressing activities on worksite with significant achievements and deliveries to IO again in 2022, as well as in design activities in the area of building services.

The construction works continued progressing for the Tritium Building (B14) civil works, with level 4 completion and level 5 start, the Neutral beam Power Supplies Buildings (B37), Control Building (B71) (Figure 4), Fast Discharge Resistor Building (B75) (both B71 and B75 Ready For Equipment by IO in Sept 2022) and the cryoline bridge (Figure 5) and started for the medium voltage distribution buildings (B44, B45, B46 and B47) (Figure 3), NB Power Supply Building (34) as well as the busbar bridges from January 2022.

The construction works for Control building (B71 Non PIC part) and the Fast Discharge Resistor building (B75) progressed up to a state where IO contractors were able to start working (Ready for Other Contractors). All the networks (drainage, galleries...) and surface infrastructures (roads, outdoor lighting...) works were completed.

In 2021, due to serious difficulties met on the design, procurement and installation of the Building services in the Tokamak Complex and auxiliary buildings, F4E started to implement mitigation actions, negotiating with the contractor while transferring some of its scope to other contractors. Good progress in auxiliary buildings after the change of contractor operated by F4E was already achieved in 2021 and continued during 2022, in line with the target to get all buildings taken over in 2023. This increase of progress is visible on the remaining service works activities on the Auxiliary Buildings with the achievement of the Radio frequency building (B15) 3th and 4th IO Early Accesses and Cryoplant Buildings (B51 and B52) Ready For Other Contractors stage. Painting, doors installation and finishing works continued in the Tokamak Complex with the Civil and finishing works for the Tritium building (B14) Levels 1 and 2 Taken Over by IO. Manufacturing of the first elements of the Tokamak Cargo Lift started.

Limited Building services design activities continued for the Tokamak building (B11) with the previous contractor with a target of completion by mid-2023. The remaining design activities (Execution Design essentially) were transferred to existing and future engineering contracts.

In late 2015, by benchmarking against other civil engineering projects, independent expert assessments concluded that a much larger budget contingency for the buildings work should have been set aside in 2010. A 'Reserve Fund' created in 2015 at the level of the whole ITER Project now provides a mechanism to compensate F4E (and other Domestic Agencies) for subsequent change requests, however not for those of the past. F4E and the ITER Organization, in consultation with F4E's Governing Board, are working closely together to minimize the ongoing cost increases and schedule delays. F4E has further implemented organizational, project-management-related, scope-related and contractual measures to stabilize this project, giving priority to the First Plasma milestone. These include:

- Postponement or de-scoping (including future optimisation) of non-First Plasma buildings;
- Design-to-cost, resulting in requests by F4E to ITER Organization to accept changes;
- Dedicated variation and claim management team established by F4E;
- Dedicated re-measurement (of activities) team on the worksite;

- Change of contract set-up for the delivery of building services equipment to IO, with framework contract with multiple contractors to avoid standby costs (due to IO late or changing input data) and monopoly situation
- Permanent supervision of on-site activities;
- Very conservative approach in the Change Control Board to resist to changes requested by IO;
- Permanent optimisation of construction methods and processes;
- Maximum acceleration of civil works to contain run-rate related cost and secure the First Plasma schedule

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU62.05.435	IPL > Cryoplant Compressor Building (51) RFE (RFE #8B)	Q2 2022	GB19	Achieved
EU62.05.66020	NPC - RFOC Site Control Bldg (71 Non PIC part)	Q4 2022	Predecessor of GB34	Achieved
EU62.05.66060	NPC - RFOC FDU & SNR Bldg 75 PIC / Non PIC part	Q4 2022	WP22 objective	Achieved
EU62.134699	MRR#15 approved by Steering Committee (Closure meeting) - Services for Cryolines and BusBar Bridges (MRR#15)	Q4 2022	Predecessor of GB57	Achieved

Table 1: Site and Buildings and Power Supplies – Annual Objectives presented in the F4E Work Programme 2022.



Figure 1: Aerial view of the ITER construction site. Photo: ITER Organization (April 2022)



Figure 2: TB18 (Vinci-Ferrovial-Razel, VFR) B14 Tritium Building work status in May 2021 (left) versus April 2022 (right) Photos: © ITER Organization



Figure 3: TB13 (Ansaldo - Monsud) B44, B45, B46 and B47 Power Supply and Distribution Buildings work status in Jan 2022 (left) versus November 2022 (right) Photos: © ITER Organization



Figure 4: TB12 (Demathieu Bard) B71 Control Building North work status in December 2021 versus November 2022



Figure 5: TB12 (Demathieu Bard) Cryoline bridge (connecting Cryoplant Building B52 with Tokamak Building B11) metallic structure installation (left) and flooring and roofing installation (right).

1.1.2.2 Vacuum Vessel

The ITER plasma, where the fusion reactions will take place, will be under vacuum inside a special double-walled container, the **Vacuum Vessel**. This doughnut-shaped vessel is 19 metres across and 11 metres high. It weighs in excess of 5 000 tonnes, similar to the Eiffel Tower.

F4E is providing five of the nine Vacuum Vessel ‘sectors’. Manufacturing is time-consuming and labor-intensive due to the size of the sectors (13.6 metres high, 6.5 metres wide, 7.8 metres deep and weighing 400 - 500 tonnes).

Each sector is composed of 4 Poloidal Segments (PS1-PS4). Each segment is manufactured independently from the others during the Segment Manufacturing phase. Once all 4 segments of one sector are completed, the Sector Assembly phase can start, where the 4 segments are joined together to form the complete Sector.

By the end of 2022, AMW (the industrial consortium responsible for the manufacturing of all 5 sectors) has completed the welding of 17 out of the total of 20 segments to be produced, while already half of the segments have been machined to their final dimensions.

The sector assembly activities on Sectors 5 and 4 have been progressing slowly than expected due to several complex technical challenges.

The F4E schedule for the delivery of all sectors has been reviewed and thoroughly overhauled taking into account the new information related to the impact of the first of a kind manufacturing and use of new techniques such as Phase Array Ultrasound Test examination of the welds with a complex geometry and ITER-grade material.

F4E relentlessly supports and motivates the consortium to progress at the fastest rate possible, while at the same time sticking to the stringent geometrical tolerances and in strict compliance with the nuclear safety codes.

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU15.1A.3090420	S9PS4 - Machining 1st Step	Q3 2022	Predecessor of GB25	Achieved
EU15.1A.3091120	S9 Machining of PS2 completed	Q4 2022	Predecessor of GB25	Achieved
EU15.1A.3099200	S9PS4 - RT inspection, incl. repairs	Q4 2022	Predecessor of GB25	Achieved
EU15.1A.3104800	Sector 5 - Critical and sub-critical Segment Outer Shell repairs completed	Q4 2022	Predecessor of GB16	Not achieved, due to first of a kind complexity related to PAUT inspections and repairs

Table 2: Vacuum Vessel – Annual Objectives presented in the F4E Work Programme 2022



Figure 6: Sector 5 in Sector Assembly phase at Mangiarotti

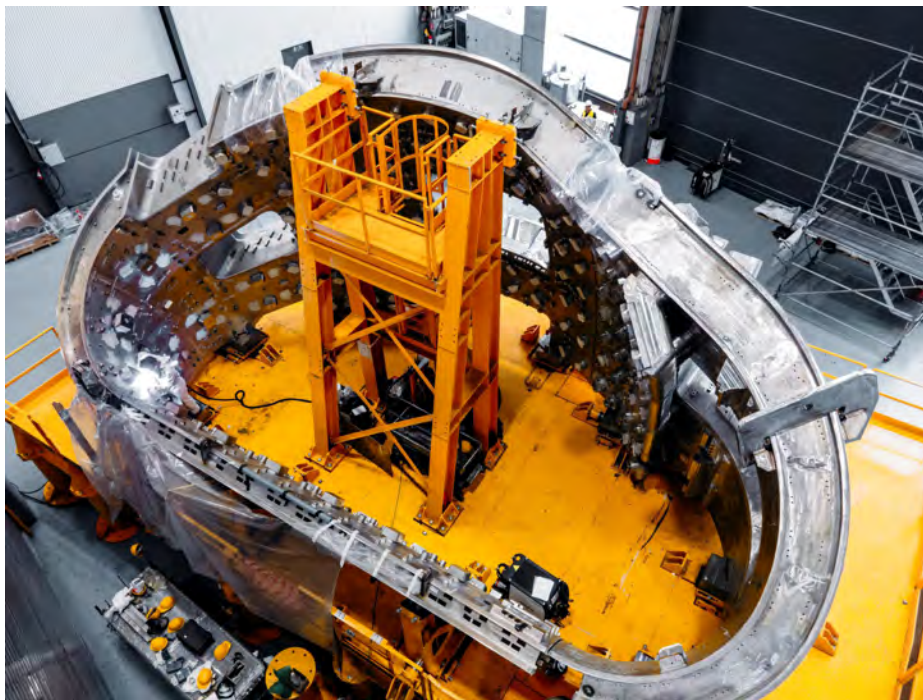


Figure 7: Sector 4 in Sector Assembly phase at Walter Tosto

1.1.2.3 Magnets

30 superconducting magnetic coils hold the hot plasma inside ITER and stop it touching the walls. These are among the largest and most powerful such magnets ever made.

F4E is providing 10 of 18 Toroidal Field (TF) coils installed in the tokamak, 20% of the Nb₃Sn superconductor for the TF coils, five of six Poloidal Field (PF) coils, 11% of the NbTi superconductor for the PF coils and nine fibreglass 'pre-compression rings', which keep the coils in place during operation.

1.1.2.3.1 Toroidal Field Magnets

Each Toroidal Field (TF) coil, weighing 310 tonnes, comprises a superconducting Winding Pack (WP), mounted in a stainless steel case. To form the WP, seven Double Pancakes (DPs) are impregnated with a special resin and then stacked together.

Each DP consists of a D-shaped stainless steel plate with spiral grooves on both sides that support two 700-metre-long length of superconductor, wound into shape, heat-treated and electrically insulated before insertion into the grooves.

By the end of 2022, 9 TF Coils have been completed and 8 of them delivered to IO and the 9th one is already being transported. The delivery of the last 2 Coils will be completed in 2023. The production of these Coils has been slowed down in order to accommodate overall project need dates.

1.1.2.3.2 Poloidal Field Magnets

F4E will deliver to ITER IO 5 ITER Poloidal Field (PF) coils.

European industries are fabricating four (PF 2, 3, 4 and 5) giant PF coils (ranging between 17 m and 25 m in diameter) under F4E responsibility and coordination at the PF coils workshop at the ITER site.

The Institute of Plasma Physics (ASIPP), Chinese Academy of Sciences-ASIPP has fabricated another one (PF6) under an international cooperation agreement with F4E.

PF Coils #6, #5 and #2 have been already delivered.

In 2022 F4E successfully completed the Vacuum Pressure Impregnation of the PF Coil #4 Winding Pack and started the final assembly activities before the final Cold Test.

Regarding PF Coil #3, all Double Pancakes were successfully wound, impregnated and stacked. The Winding Pack Vacuum Pressure Impregnation activities are on-going.

In parallel, PF Coils tooling de-commissioning for the stations that will no longer be used has also started.

1.1.2.3.3 Pre-Compression Rings

Before 2022, F4E had already delivered to IO all nine **Pre-compression Rings (PCRs)** that keep the 18 TF Coils in place during ITER operation, in addition to a spare PCR #10 and 8 off “1/5 scale” rings.

Each PCR is made from fiberglass and epoxy resin, weighs > 3 tonnes and has a diameter of 5.5 m. These are among the largest composite structures ever manufactured as a single piece.



Figure 8: PF Coil #4 final assembly at the PF Coils Workshop



Figure 9: PF Coil #3 Winding Pack stacking completed at the PF Coils Workshop



Figure 10: 9th TF Coil loading in Porto Marghera – Italy

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU11.1A.11800	IPL > Delivery of TF17 (EU 07) by EU-DA to ITER Site (GB 23)	Q2 2022	GB23	Achieved
EU11.1A.28125	HPC- Approval by IO TFWP Acceptance Report (HP 8.4.6) / TFWP14	Q2 2022	Predecessor of GB54	Achieved
EU11.3B.41980	Placing DP7 for PF3 Stacking/Connections/Ground Insulation/Impregnation	Q2 2022	WP22 objective	Achieved
EU11.3B.571090	PF4 WP VPI Completed	Q3 2022	WP22 objective	Achieved

Table 3: Magnets – Annual Objectives presented in the F4E Work Programme 2022

1.1.3 Achievements in Other EU Systems

Europe is responsible for many other complex, first-of-a-kind technological systems for ITER, most of which are largely in the design and development phase. Even if not all are required for the First Plasma milestone, the ‘Staged Approach’ of the updated ITER schedule requires installation of some parts of these systems (e.g. ‘captive’ components) before First Plasma that are impossible or very costly to install at a later date.

1.1.3.1 In-Vessel Components

Whilst the ITER magnets will confine most of the hot plasma, radiation and some particles will inevitably escape from this magnetic ‘cage’. To protect the Vacuum Vessel and the external systems from this energy flux, the inside surface of the Vacuum Vessel will be covered by 440 special blocks, called Blanket Modules.

Each module is made from a Shield block and a First Wall panel. Europe will provide 215 First Wall panels. The cooling water of all the Blanket Modules is supplied by pipe bundles running inside recesses at the back side of the Shield Blocks: The Blanket Cooling Manifolds, which are also to be delivered by Europe. The blanket system removes heat from the inside of the Vacuum Vessel and transfers it to the Tokamak Water Cooling System.

A device at the bottom of the Vacuum Vessel, the Divertor, removes excess heat and plasma 'ash' keeping the plasma clean enough to continue operation. F4E is responsible for many key components of the Divertor, in particular the Inner Vertical Target and the Cassette Body, which is the supporting structure of the Divertor plasma facing components (Inner and Outer Vertical Target and Dome).

The main achievement in 2022 for the Blanket First Wall was the start of the manufacturing of the Pre-Series panels, in the frame of the continuation of the qualification activities of the two first of a kind cost plus fee contracts in Fusion for Energy for the series production of the Blanket First Wall panels. The two contractors, ALSYMEX and FUSION BUSINESS LEADERSHIP have progressed in the activities for the set up and qualification of the production lines and for the development of the manufacturing design of the pre-series panels, allowing the start of the mentioned manufacturing operations. In parallel, the procurement of main raw materials (Beryllium and Copper-Chromium-Zirconium) provided as free issue items to these suppliers has been almost completed for what concerns the needs for the Pre-Series and is on-going for the Series. Financial audits necessary for the monitoring of the above cost-plus fee contracts were performed.

For the Blanket Cooling Manifolds, following the signature of the Procurement Arrangement between F4E and the ITER Organization (IO) in 2020, the award decision was signed in 2022 for the Framework Contracts of Blanket Cooling Manifold series. Furthermore, the work continued on the development of an alternative support design as an action to potentially reduce costs versus current IO baseline design.

The Divertor Cassette Bodies Framework Contract (CB), for the manufacturing of 58 CBs, continued in 2022 for both contractors CNIM-SIMIC and WALTER TOSTO for the Stage 1, including final machining activities for the FOAK by CNIM-SIMIC, and machining of sub-assemblies, welding on pipes and structural welds of subassemblies by WALTER TOSTO. The Stage 2 of the same framework contract, with WALTER TOSTO, progressed with the release of engineering documentation and start of manufacturing activities (machining activities). In 2022 was also signed the contract for the procurement of ancillary items of pins, sleeves, and links of the CB Series.

2022 was also an important year for the Inner Vertical Target project achieving the signature of the framework contracts with 3 contractors and first specific contract with RESEARCH INSTRUMENTS for the IVT series. The qualification activities progressed at ALSYMEX.

Blanket First Wall



Figure 11: Production lines being completed at FBL (Spain) and Alsymex (France) workshops for Blanket First Wall series production. Pre-series panels manufacturing started.

Blanket Cooling Manifolds



Figure 12: Testing activities for the development of an alternative support design

Divertor Inner Vertical Target



Figure 13: Full scale IVT prototype

Divertor Cassette Body

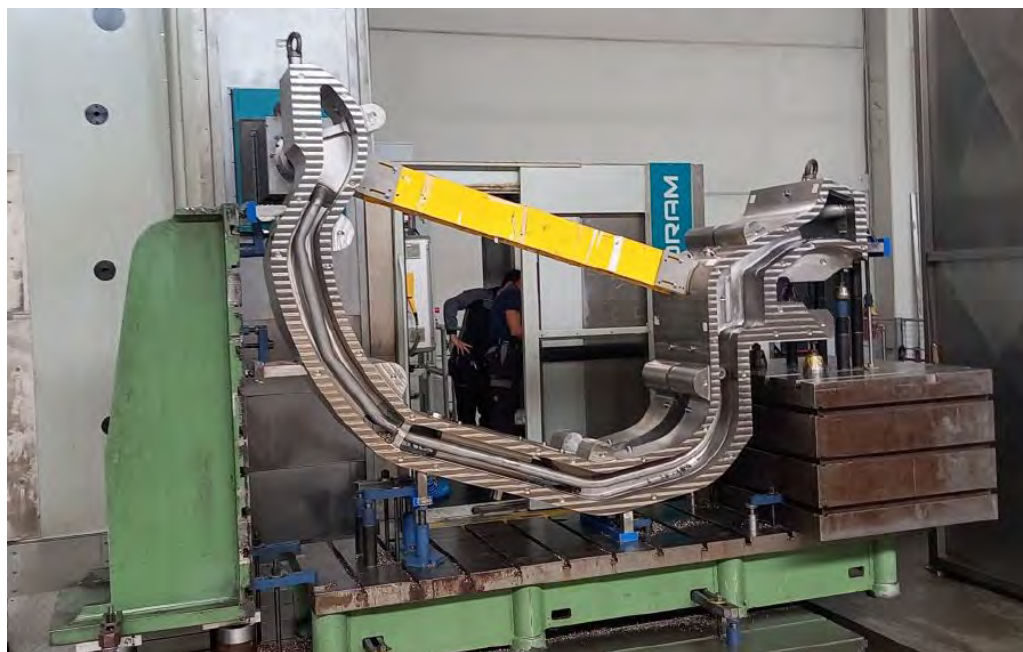


Figure 14: 2nd Divertor Cassette at SIMIC (Italy), before starting welding of closure plates.

In Vessel – Blanket

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU15.2A.10170	Signed Award Decision for FwC BCM	Q4 2022	WP22 objective	Achieved
EU.16.01.207500	Task Order Signed for Procurement of CuCrZr (Series) (TO#02) - LOT 1	Q3 2022	WP22 objective	Achieved
EU16.01.83020	MS3.A.1 - PPRR1 / MRR - OMF-900 LOT 1 Approved by MRR panel	Q4 2022	WP22 objective	Not achieved
EU16.01.83880	MS3.A.1 - PPRR1 / MRR - OMF-900 LOT 3 Approved by MRR panel	Q4 2022	WP22 objective	Achieved

Table 4: In Vessel-Blanket – Annual Objectives presented in the F4E Work Programme 2022

Milestone 16.01.83020: The completion of this activity depends on the outcome of some manufacturing qualifications. There were some delays due to the special processes' qualification activities (bending mainly). These are intrinsically risky activities as the number of mock-ups/iterations cannot be defined in advance and is needed to get suitable results to consider the qualification process completed.

PPRR1 was then closed in March 2023, with some minor residual chits.

In Vessel – Divertor

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU17.01.1151850	Contract Signed for Ancillary Items of Pins Sleeves and Links of the CB Series	Q4 2022	WP22 objective	Achieved
EU17.01.1192180	MRR for CBST Stage II Approved (MSII_CBST_S13)	Q4 2022	WP22 objective	Achieved
EU17.2B.140500	Contract Signed for IVT Pre-Series and Series (Lot-1)	Q4 2022	Predecessor of GB45	Achieved
EU17.2B.86650	HP - Send to IO the report of the Final dimensional check of the Prototype - OPE-567-03-01	Q1 2022	WP22 objective	Achieved

Table 5: In Vessel-Divertor – Annual Objectives presented in the F4E Work Programme 2022

1.1.3.2 Breeding Blanket Modules

Europe will test in ITER a necessary feature of future fusion reactors: the generation of their own fuel. Tritium is one of the two fusion fuels (the other being deuterium); and, unlike deuterium, tritium is not naturally available. To that end, F4E will test in ITER two breeding systems, one developed in collaboration with ITER Korea, called Test Blanket Modules (TBM), which are experimental tools to validate tritium “breeding” for future fusion reactor concepts. The TBMs are not part of the EU’s in-kind contributions to ITER.

In 2022 the Water-Cooled Lead-Lithium TBM System (WCLL-TBS) Project has significantly progressed in different areas of design and R&D. In the area of the TBM Set design two main important updates have to be mentioned: (i) introduction of the vertical stiffening plate in the TBM-box, in substitution of the stiffening rods in the TBM-box, (ii) development of the first elements of integration of the instrumentation in TBM-box and in the TBM shield. In the area of the Ancillary Systems design important progresses have been performed in: (i) preparing the first comprehensive RAMI analysis of all systems following the ITER recommended methodology, (ii) integrating WCS (Water Cooling Systems) and CPS (Coolant Purification System) in the ITER room B11-L4-04, (iii) adding the secondary structure in the glove box at B14-L2-24 for the integration of TES (Tritium Extraction System), TAS (Tritium Accountancy System) and NAS (Neutron Activation System), (iv) identifying new safety functions and detailing their implementation in terms of I&C devices and hardware components. In the area of the R&D in support of the TBS design several tasks have been carried out in 2022. A particular mention is deserved for: (i) the development of a model and tool integrating RELAP-5 and SIMMER numerical codes for PbLi TH simulation in normal operation and accidental conditions due to an in-TBM LOCA, (ii) the development of the IC (ionization chambers) design, starting from a detailed market survey, for the TBS tritium management, including TAS.

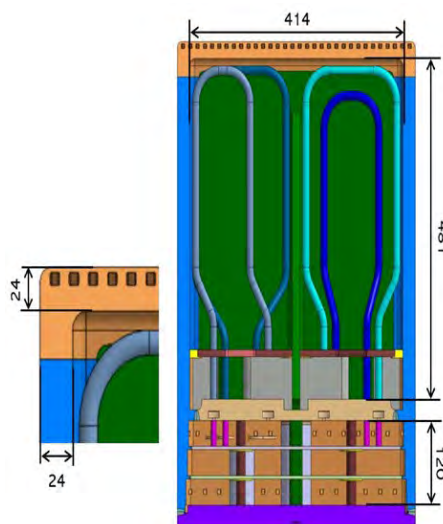


Figure 15: details of the updated WCLL-TBM box

In 2022, the final versions of the Partnership Arrangement between F4E and ITER KOREA along with the Helium-Cooled Pebble-Bed (HCCP) TBM-Arrangement to be signed with IO were prepared. It was supported by a thorough analysis of Intellectual Property in collaboration with the concerned European Fusion Laboratories (EFLs) and industrial partners. The operational aspect on the collaboration started mid-2022 through pre kick-off meetings which were held monthly with ITER KOREA in order to tackle specific aspects such as e.g. system engineering and preparation

of the joined quality plan. According to the EU work packages ownership, the design activities progressed in 2022 focusing on the Tritium Extraction and Tritium Accountancy systems and their relocation for solving design integration issue in the Port Cell 16 hosting the two EU/EU-KO TBSs. For the in-vessel part of the HCCP-TBS (the TBM set), activities were focused on solving long term design issues related to the manifold area. The R&D activities conducted by EUROfusion¹ progressed on functional material production by upgrading KALOS facility, KIT, Germany, and comparative evaluation of getter beds material performances for tritium systems. Collaboration with IO was intense in reviewing/ updating Interface Control Documents and Interface Sheets for those key systems serving the TBS and for which the design is much more developed.

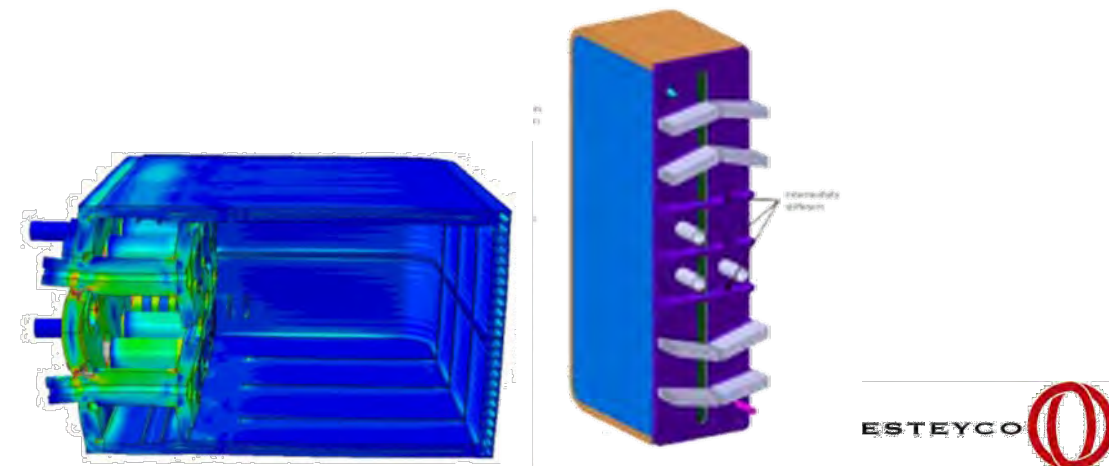


Figure 16: finite element engineering simulations of the HCCP TBM manifold area behaviour

In parallel, for both the WCLL-TBS and HCCP-TBS, F4E has consolidated elements of safety demonstration and radwaste management. The TBM Safety Demonstration Team has accomplished several achievements, mainly related to severe accident analysis, R&D and licensing. First collaborations between F4E and consortium of EFLs (ENEA Italy, KIT Germany and others) allowed a significant progress in the modelling and simulation of severe accidents, as well as important studies on compatibility of key materials. Besides, contracts with industrial partners were managed, in particular with Jacobs Clean Energy Limited, UK, to study several accidental studies (e.g., in-vessel Loss-of-Coolant Accident) and by organising specific workshops. Finally, the advances in the field of nuclear licensing of ITER was marked by the delivery to ITER Nuclear Operator of a first package of technical documentation including in particular 14 Checklists in total (7 per each TBM system), to be used in preparation of an update of the ITER Preliminary Safety Report scheduled in 2023.

During 2022 R&D activities have carried out by EUROfusion for both the HCCP and the WCLL TBM TBSs, with focus on the development and qualification of functional materials, predictive tools, sensors, integrated testing of the main relevant technologies, safety analyses as well as EUROFER97 qualification and experimental campaigns in support of design rules. The work has

¹ EUROfusion, the 'European Consortium for the Development of Fusion Energy', manages and funds European fusion research activities on behalf of Euratom.

included the preparation of specification, monitoring and review, progress meetings, technical workshops related to more than 70 technical deliverables.

The new TBM-set fabrication development framework contract “Proof of the TBM Sets Fabrication and Assembly Process Feasibility” was awarded to the European consortium CEA/FRAMATOME, France, and first implementation contract focused on “Consolidation of welding processes and related technologies for manufacturing of EUROFER97 structures and components” was launched. Activities within this contract were focused on: (i) EUROFER97 weldability demonstration for TIG/GTAW, Laser Beam and Electron Beam fusion welding and for a Hot Isostatic Pressure (HIP) diffusion welding, (ii) procurement and qualification of a filler material THERMANIT MTS3 for TIG/GTAW fusion welding operations, (iii) an assessment of the effect of multiple Post-Weld Heat Treatment (PWHT) operations, (iv) elaboration of a Welding Procedure Specification (WPS) for dissimilar weld joints between EUROFER97 and austenitic steel SS316L(N)-IG, (v) manufacturing of a Double-Wall Tube (DWT) in collaboration with Industrial partners, and (vi) consolidation of the WCLL and HCCP TBM assembly sequences and weld matrices. The implementation of these fabrication development activities was conducted with the support of APAVE EXPLOITATION FRANCE, a French agreed notified body in its consultancy capacity. A new specific contract with PUT Firmus, Poland, on continuation of storage and handling of EUROFER97 and P91 steel products started its implementation. Upon EUROfusion request, an available EUROFER97 material required for implementation of the EUROfusion-WPMAT R&D activities on EUROFER97 characterization and qualification was identified (>2.2 tons) and transported from Poland to SCK-CEN, Mol, Belgium. In this respect, a Lease agreement between F4E and SCK-CEN was prepared and signed allowing distribution of EUROFER97 material among EFLs involved in the material characterization, mechanical testing and realization of a neutron irradiation campaign. Implementation of the EUROfusion-WPMAT activities should provide complementary results/data on EUROFER material to be included in the next edition of the RCC-MRx code planned for 2025.

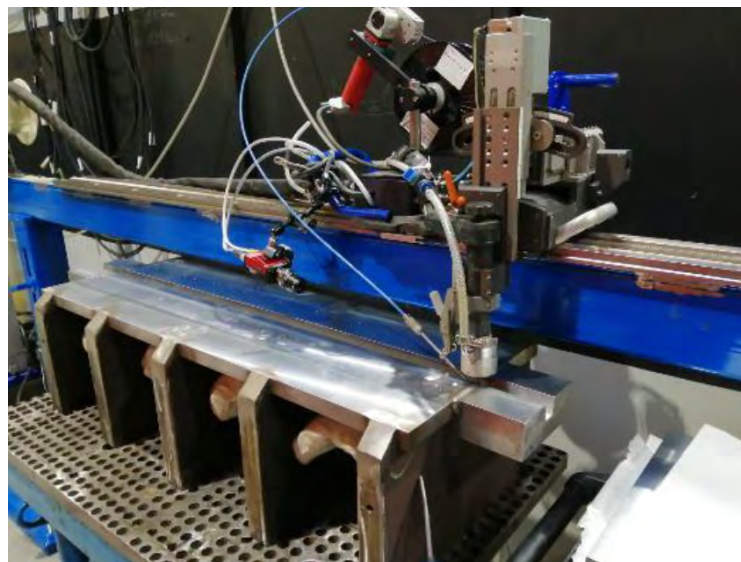


Figure 17: TIG welding of a Test Mock-up for Filler material acceptance (THERMANIT MTS3)
(FRAMATOME credit)

1.1.3.3 Remote Handling

Remote Handling (RH) will play an essential role in ITER. Once the fusion reactions will have produced significant radiation and activation of the ITER components, robotic tools will be required to inspect and repair components close, or within, the ITER machine. This is challenging since some of the items weighs up to 50 tonnes and needs precision positioning. F4E will provide many elements of ITER's RH systems, namely: the Divertor Remote Handling System (DRHS), the Cask and Plug Remote Handling System (CPRHS) for transportation of the components from the Tokamak to the Hot Cell Building, the Neutral Beam Remote Handling System (NBRHS) and the In-Vessel Viewing System (IVVS).

For the DRHS, in 2022 the main effort has been devoted to the final design of the Cassette Multifunctional Mover (CMM, see Figure 18) and of the Cassette Toroidal Mover (CTM), the two major DRHS subsystems. Like for the other RH systems, each subsystem is the integration of many different devices, components and technologies. The design activities, complemented by prototyping and testing (e.g. water-hydraulic digital valves, or optical markers – see Figure 19), continued during 2022 and will go on in 2023. As the DRHS is a complex plant system spanning from in vessel to hot cell, F4E is producing a huge amount of technical documentation in view of the final design review.

In the CPRHS area (a massive plant system travelling all across tokamak and hot cell buildings and with eight different cask variants), during 2022 F4E's main technical achievements have been the significant progress towards the Final Design Review for the cask system needed for first assembly (see also Figure 18), including the successfully passed interim final design review. The preliminary design of the cask variants needed for ITER second assembly (nuclear-grade units) progressed in the areas of Systems Engineering and design preparation.

The NBRHS monorail crane prototyping phase has been successfully completed (see Figure 19), with positive test results, and some additional final design tasks of the crane subsystems have also been performed. Other subsystems needed, for first assembly and later stages, have been specified and their design and interfaces have been developed further internally and together with industries.

The IVVS main effort has been devoted to the preparation of the final design contracts for the two main subsystems, i.e. the measurement and the deployment systems, that have been successfully negotiated and signed during the year 2022.

F4E has also made further progress with common RH technologies in particular with the rad-hard electronics needed for cameras and multiplexers. Control system related activities have been also performed with the integration of innovative software (GENROBOT) in the DTP2 facility in Finland.

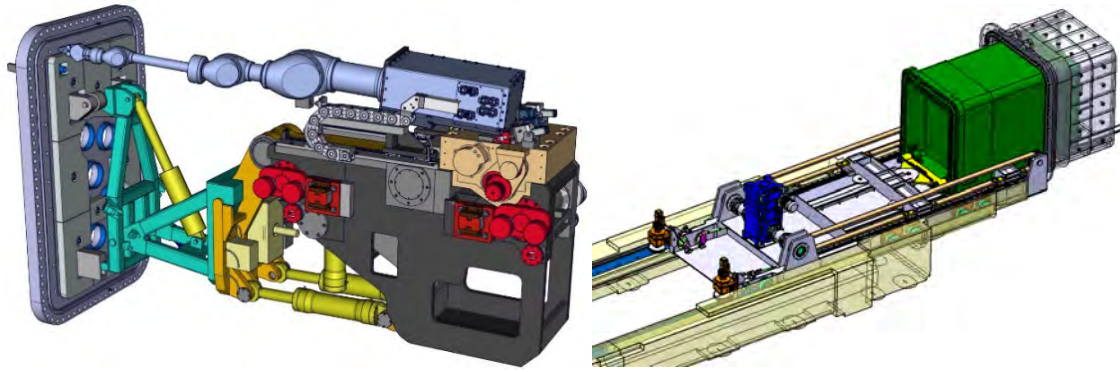


Figure 18: Final design of DRHS CMM handling the Primary Closure Plate (left). CPRHS EPP assembly cask in final design phase (right)

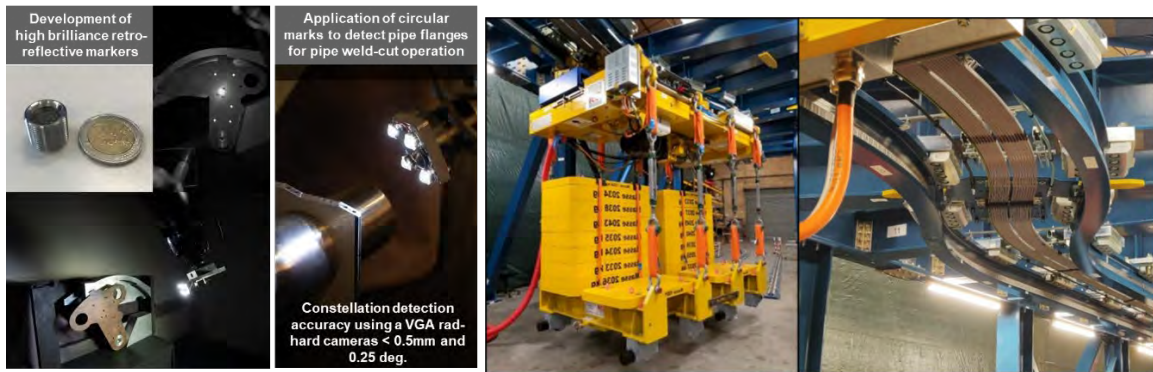


Figure 19: tests on markers for divertor cassette remote handling (left) and on the NBRHS crane prototype (right)

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU23.03.14059280	M4 - Approval of deliverables from D4.07 to D4.11 and D4.13	Q4 2022	WP22 objective	Achieved
EU23.03.14060380	Approval of CAD Models for CTS, EPP and UPP (DDL-207)	Q4 2022	Predecessor of GB40	Achieved
EU23.05.25520	M12. Final ADP	Q4 2022	WP22 objective	Achieved
EU57.01.50420	TO (383-01-06) Signed for Final Design Phase 2 for IVVS	Q4 2022	Predecessor of GB47	Achieved

Table 6: Remote Handling – Annual Objectives presented in the F4E Work Programme 2022

1.1.3.4 Cryoplant & Fuel Cycle

The ITER Cryoplant, a complex system and one of the largest of its type in the world, will provide the cryogenic fluids necessary to cool ITER's superconducting magnets. F4E is responsible for the Liquid Nitrogen Plant and Auxiliary Systems, about one-half of the Cryoplant, along with part of the network to distribute and regulate the cryogenic fluids; the front-end Cryodistribution lines and Cold Valve Boxes. F4E is also providing all the main Cryopumps, which maintain a high vacuum in the Vacuum Vessel and the Cryostat.

As well as being an expensive resource, tritium is radioactive. Careful management and recycling of tritium on ITER is therefore essential. This is the purpose of the Tritium Plant, a part of which, consisting of a Water Detritiation System and a Hydrogen Isotope Separation System, will be provided by Europe.

The Radiological and Environmental Monitoring Systems (REMS) provide monitoring to ensure protection of the workers against occupational exposures (ionizing radiation and beryllium) and of the public and the environment against the hazards of ionizing radiation and chemical products. The whole scope of REMS is supplied by F4E.

In 2022 the commissioning of the Cryoplant continued. Cryogens (liquid nitrogen) were delivered to site for the commissioning of the liquid nitrogen tank and the associated distribution system.

The front-end cryodistribution system that will manage the cryogens needed for the operation of the cryopumps has seen several achievements in 2022. Four Cold Valve Boxes (out of eight) were delivered to the ITER site in December and the assembly of the Torus and Cryostat cryojumpers, that link the Cold Valve Boxes to the cryopumps, was completed. A contract was also placed for the Neutral Beam cryojumpers.

The Torus and Cryostat Cryopumping System will pump the vacuum vessel and cryostat volumes. A new solution was engineered to glue the charcoal to the panels and three casing and valves assemblies were completed. The assembly of the MITICA cryopump was also completed, ready to be shipped to the Mitica Neutral Beam testing facility early 2023.

Sophisticated leak detection systems are required to detect potential leaks from the vacuum vessel, cryostat and neutral beam equipment. The final design was advanced and the first component qualification test carried out.

The various REMS components will be delivered in stages. The design for First Plasma items was continued and an integrated project team set up with our colleagues in the ITER Organization for more efficient project delivery.



Figure 20: MITICA cryopump – final assembly stage



Figure 21: 2 of the 4 cold valve boxes ready to be delivered



Figure 22: Torus and Cryostat cryopump – Casing and valve assembly



Figure 23: Cryoplant commissioning

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU31.01.12131	Cold Valve Box 1 completed	Q3 2022	Predecessor of GB28	Achieved
EU31.01.30920	Frame 1 of Mitica Cryopump completed	Q3 2022	Predecessor of GB50	Achieved
EU31.01.41160	M12.1. 1st installation of one all-metal double seal on an ITER style flange completed #1	Q3 2022	Predecessor of GB33	Achieved
EU31.03.40280	Mechanical design of Cryostat Remote Leak Detection System completed	Q1 2022	Predecessor of GB18	Achieved
EU31.03.40320	Electrical and Instrumentation and control (I&C) Design of Cryostat direct Leak Detection system (CDLDS)	Q2 2022	Predecessor of GB35	Achieved

Table 7: Cryoplant and Fuel Cycle – Annual Objectives presented in the F4E Work Programme 2022

1.1.3.5 Plasma Diagnostic Systems

Ensuring the safe operation of ITER and optimising its performance will require comprehensive information on the behaviour of the fusion plasma. Providing this information will be the responsibility of ITER's many 'Diagnostic' systems, which will number around fifty and measure parameters of the plasma and plasma-facing components such as the First Wall Blanket Modules and Divertor targets. Europe is responsible for twelve Diagnostics and ten ancillary systems. So far, more than 70 European research laboratories and SMEs have been involved in the design, development and/or manufacture of these systems.

During 2022, F4E delivered the 2nd and 3rd batches of Inner Vessel Coils (IVC), completing the Procurement Arrangement obligations for these components. The IVC, which form part of the ITER Magnetics Diagnostic suite, comprise around 450 compact 'low temperature co-fired ceramic' sensors and 'high-frequency' coils mounted on electrical platforms that bolt to the ITER Vacuum Vessel.

The Magnetics Diagnostic suite will produce 1,700 signals in all. During 2022, F4E progressed with manufacture of the many specialist electronics systems required to interface with these signals, successfully overcoming significant supply challenges introduced by the global shortage of key electronics components. The specialist electronics includes, amongst others, 1,700 state of the art 'integrators' that remain phenomenally stable for the long ITER plasma duration. By the end of 2022, over 400 units had been assembled and successfully tested and delivery of all units is expected to be completed in 2023.

During 2022, F4E successfully completed a Manufacturing Readiness Review for the In-Vessel mechanical supports and junction boxes; 10,000's of components and assemblies which attach electrical cabling to the ITER Vacuum Vessel and connect the cables to the various diagnostic sensors. Manufacture and delivery of the first batches will take place in 2023.

F4E has progressed significantly during 2022 with systems in the design phase, closing a preliminary design review for the port-mounted Bolometers cameras and 8 final design reviews: for

the VV Electrical Feedthroughs (see below), for In-Port components of the Collective Thomson Scattering system and for integration of the 6 Diagnostic Ports under F4E’s responsibility. These Ports, which extend over fifteen metres from the vacuum vessel in three separate zones, provide access to the ITER plasma for the Diagnostics whilst maintaining the ITER vacuum and providing necessary radiation shielding. Closure of these final design reviews represents the culmination of eight years of design and development on the Diagnostic Ports, which involved a massive activity to coordinate integration of twenty ‘tenant’ Diagnostic systems in the Ports from four Domestic Agencies and ITER Organization.

In addition, during 2022 F4E undertook a final design review for In-Vessel components of the First Plasma Equatorial Wide-Angle Viewing System (WAVS) and a preliminary design review for In-Vessel components of the Charge Exchange Recombination Spectrometer (CXRS). These diagnostics are spread across five Diagnostic Ports and use emissions of visible and infra-red light from the ITER Plasma to derive a wide range of parameters; such as the power arriving to surfaces facing the plasma, which is an essential parameter for ITER operations, and the density of alpha particles in the plasma; a key measure of the fusion reactions.

During 2022 two major contracts were signed, for design of the Divertor and Vacuum Vessel Bolometer Cameras and for manufacture of the VV Electrical Feedthroughs. There are 75 feedthrough assemblies, transmitting over 3000 signals across the ITER Tritium boundary, to and from Diagnostics inside the Vacuum Vessel. All the feedthroughs are needed for First Plasma. Each is an important component for nuclear safety and, as such, must be manufactured to the highest standards.

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU55.01.12366680	Approval of D14 Digital integrator first of series	Q4 2022	Predecessor of GB39	Achieved
EU55.06.68040	Kick-off Meeting for Feedthroughs for Tokamak Services	Q4 2022	Predecessor of GB36	Not achieved
EU55.06.68320	ITER Dept Review & Approval of Final Tech Specs for Task Order for Feedthroughs & IO Concurrence Review	Q1 2022	Predecessor of GB36	Achieved
EU55.16.10875	Integrated system FAT v1.0	Q4 2022	Predecessor of GB39	Achieved

Table 8: Plasma Diagnostic Systems – Annual Objectives presented in the F4E Work Programme 2022

Milestone EU55.06.68040: The contract was signed on 22nd December 2022, a little later than planned due to a more complicated evaluation than expected. As a result, it was not possible to hold the KoM until the beginning of 2023. Due to availability of the Supplier in January, the KoM was eventually held on 3rd February 2023 (meeting the milestone around 5 weeks late)

1.1.3.6 Plasma Heating Systems

The extremely high temperature required by the ITER plasma to achieve the conditions for nuclear fusion to occur calls for additional heating systems, as the heat generated by the electric current forming the plasma column is not sufficient on its own. ITER will be therefore equipped with three different systems to provide the overall heating: Neutral Beam Heating, Electron Cyclotron Resonance Heating, and Ion Cyclotron Resonance Heating. F4E provides in-kind contributions to the first two.

Milestone ID	Scope Description	Forecast Achievement Date	Type of Milestone	End 2022 status
EU52.01.2001282	Completion of Initial Optical Design Refinement	Q4 2022	WP22 objective	Achieved
EU52.01.2001312	Completion of UL Plug Architecture & I/F Definition	Q3 2022	WP22 objective	Achieved
EU52.02.12660	Signature of F4E-OMF-1108 for European Gyrotrons Procurement FWC	Q1 2022	Predecessor of GB48	Achieved
EU52.04.12761	Procurement of the MHVPS Transformer for 52HV12 (AAG Set#8) Completed	Q2 2022	Predecessor of GB48	Achieved
EU53.06.08510	NP - Start of Manufacture of EU-Bushing of IHNB-1 & IHNB-2 (first items)/MRR Closure	Q4 2022	Predecessor of GB30	Achieved
EU53.06.447392	Start of Manufacturing of AGPS-CS of IHNB-1 for Inverters	Q4 2022	Predecessor of GB27	Achieved
EU52.01.171055	Contract Signed for Procurement of GCC Waveguides for ITER	Q4 2022	WP22 objective	Achieved
EU52.01.3012220	Contract Signed for GCC Instrumentation & Support for slow controller	Q4 2022	WP22 objective	Not achieved as scope was implemented as part of FwC OMF-0989

Table 9 Neutral Beam and Electron Cyclotron Annual Objectives presented in the F4E Work Programme 2022 (AGPS - CS: Acceleration Grid Power Supply – Conversion System, IHNB: ITER Heating Neutral Beam, GCC: Gyrotron Commissioning Components, MHVPS: Medium and High Voltage Power Supply, MRR: Manufacturing Readiness Review, FWC: Framework Contract, UL: Upper Launcher)

1.1.3.6.1 Neutral Beam Heating System

The Heating Neutral Beam (HNB) system is one of the additional heating systems commonly used in the presently operating fusion devices. Its principle is based on the injection into the plasma of high-energy neutral atoms. Ions are initially produced into an ion source and then accelerated to high energies by means of an electrostatic accelerator. The ion beam emerging from the beam source (ion source + accelerator) is then neutralised via two steps: by means of a neutraliser and a residual ion dump, before being injected into the magnetically confined plasma.

Most of the HNB systems are based on the acceleration of positive ions, which is efficient up to energies of about 100keV. In ITER there is a need to reach much higher energies, in the range of 1MeV, which requires the use of negative ion beams.

Each of the two (or three) HNB of ITER is expected to provide an injected power of 16.5MW. This is achieved by accelerating a 40 Amps negative ion beam up to the energy of 1MeV. These parameters are well beyond the ranges of the presently operating negative ion HNB systems.

Therefore, to develop and test the HNB injector for ITER a dedicated test facility, the so-called Neutral Beam Test Facility (NBTF), was established in Padua, Italy. The NBTF hosts two test beds:

- SPIDER (Source for Production of Ions of Deuterium extracted from a Radio Frequency Plasma) where the ion source will be tested up to an acceleration voltage of 100KeV
- MITICA (Megavolt ITER Injector & Concept Advancement) which is the full-scale prototype of the ITER HNB Injector

F4E is currently responsible for most of the manufacturing and on-site assembly of the HNB injector components, including the necessary specific tooling. ITER will use two (or three, if required) Neutral Beam Injectors, and Europe is responsible for providing most of their components:

- The outer mechanical confinement components. This includes:
 - Two NB Vessels (including the draining tank and connecting pipes)
 - Two Drift Ducts
 - Two Absolute Valves
 - Two Fast Shutters
 - Two Exit Scrapers
 - Two Lead Walls
- Two sets of Magnetic Shielding equipment:
 - Compensation and Active Correction Coils together with a
 - Passive Magnetic Shielding structure surrounding the injector.
- Injector core components:
 - two Ion Sources,
 - one Accelerator and
 - two of each Beam Line Component (Residual Ion Dump, Neutralizer and Calorimeter).
- Low voltage part of the Power Supplies system, as well as a high voltage deck hosting the ion source power supplies
- The Control system for the HNB injectors

Starting from 2020, the management of the NBTF activities - which are moving more and more towards the integrated commissioning and operation phase- is performed directly by IO.

As of the end of 2022:

- SPIDER:
 - All contributions of F4E are completed, and all components and systems transferred to IO
- MITICA:
 - Power Supplies, Vessel and all auxiliaries managed by the F4E Heating & Current Drive (HCD) Program have been transferred to ITER Organization (IO), except for:
 - MITICA control, Interlock & safety system
 - These are gradually under development, in parallel with the components and systems to be controlled

- Remaining to be delivered under the responsibility of the F4E HCD Program are:
 - Beam Source - currently under assembly
 - Beam Line Components - under manufacturing
 - Some of the diagnostics and the assembly activities for these components

The following annual objectives were set in 2022 for the HNB systems (Table 10):

Milestone ID	Scope Description	Forecast Achievement Date	Type of Milestone	End 2022 status
EU53.06.08510	NP - Start of Manufacture of EU-Bushing of IHNB-1 & IHNB-2 (first items)/MRR Closure	Q4 2022	Predecessor of GB30	Achieved
EU53.06.447392	Start of Manufacturing of AGPS-CS of IHNB-1 for Inverters	Q4 2022	Predecessor of GB27	Achieved

Table 10: Neutral Beam - Annual Objectives presented in the F4E Work Programme 2022(AGPS - CS: Acceleration Grid Power Supply – Conversion System, IHNB: ITER Heating Neutral Beam)

MITICA Beam Source

The manufacturing and testing of the components and the sub-assemblies of the MITICA Beam Source (BS) has been practically completed in 2022, with only few non-critical items still to be fabricated.

Assembly of the accelerator has progressed up to the installation of the 4th grid. The assembly tolerances have been mostly achieved; only small non-compliances were recorded, of the order of microns for the apertures' alignment and few tenths of mm for the distance between grids, but with no impact on the beam optic.

The ion source assembly started in September 2022, and was stopped after a few weeks due to the appearance of stains on some of the parts coated with a thin layer of molybdenum. The ITER Organisation, having identified a risk of impact on the ion source performance, is investigating the issue in-depth, with intention to proceed with the de-coating and recoating of the parts affected. As a direct consequence of this additional scope of work, the delivery of the BS will likely be postponed by eight months.

- Completion of manufacturing and testing of most of the production parts

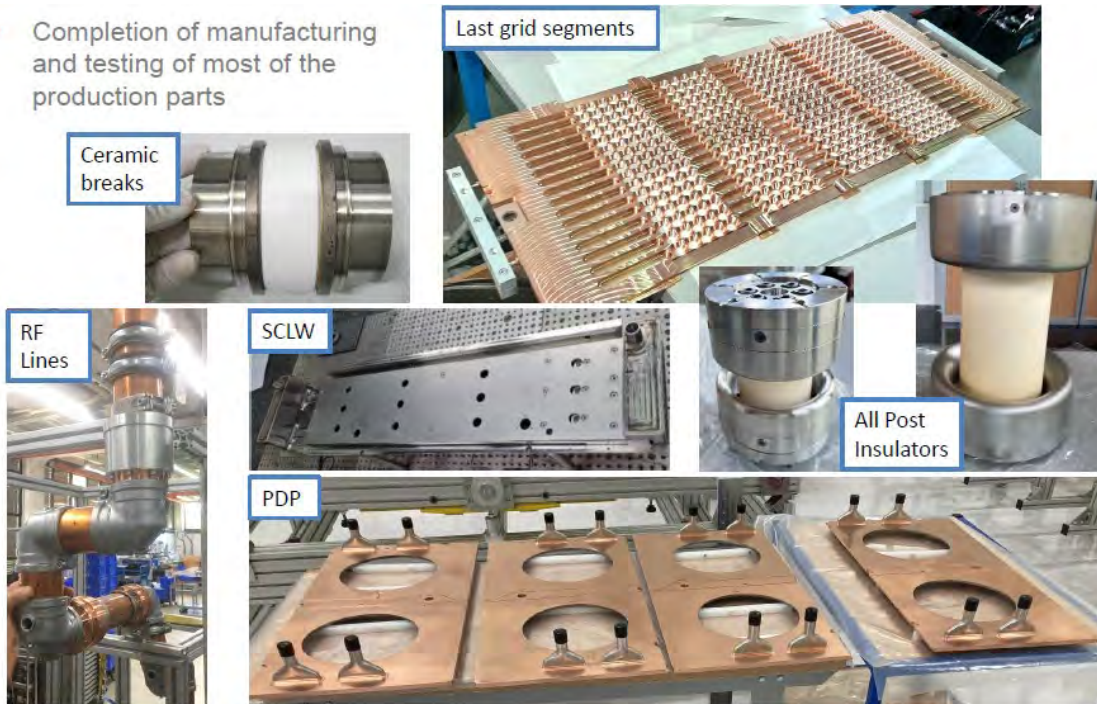


Figure 24: The main 2022 manufacturing achievements for the MITICA Beam Source supply contract (SCLW: Source Case Lateral Wall, PDP: Plasma Driver Plate)

- Major progress on assembling and testing activities on the Beam Source

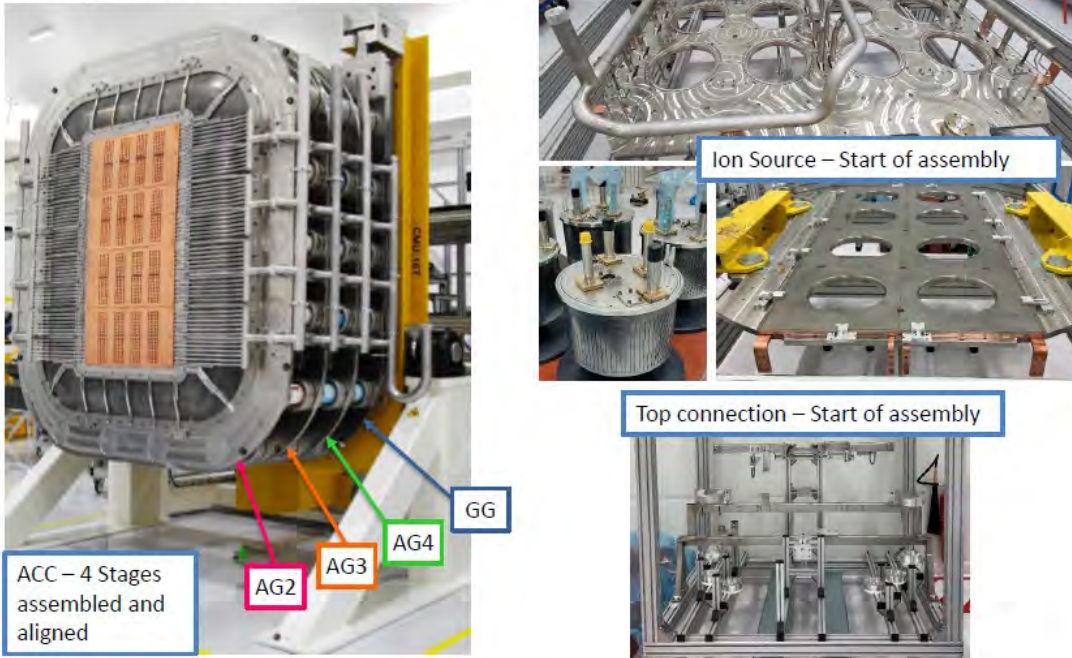


Figure 25: The assembly and alignment of four accelerator (ACC) grids (left) and ion source assembly (right)

- Assembly and test of TS and SADS completed
- Assembly and test of BSHT completed
- Intermediate Functional tests with BS Mock-up completed
- Start of installation of the equipment in clean room



Figure 26: The main sub-assemblies of the MITICA Beam Source completed in 2022 (MUBS: Mock-Up of the Beam Source, BSHT: Beam Source Handling Tool, MUIS; Mock-Up of the Installation, TS: Tilting System, SADS: Supporting and Adjustment System)

MITICA Beam Line Components

The manufacturing of the MITICA Beam line components is advancing well for the 3 components: Residual Ion Dump, Neutralizer and Calorimeter; all the critical parts are under manufacturing and being prepared to start the assembly process.

F4E delivered the free-issue items (sensors and cabling) necessary to start the installation of those parts in the beam line components by the Supplier.

The copper panels of the Neutralizer are manufactured, and the electron beam welds of the cooling tubes connecting the panels completed. The panels are now ready to start with the installation of the sensors on them.

100 elements of the copper alloy panels for the Residual Ion Dump have been manufactured and the cooling pipes have been electron-beam welded, with the intermediate leak tests successfully completed. The installation of the sensors in each of the elements has begun and will continue over the following year. Preparatory works for the assembly of the elements of the panels were executed during the last part of the year and preliminary results showed good confidence with the upcoming assembly process.

The 196 swirl tubes of the Calorimeter have been manufactured, welded and bended. The joining of the pairs of tubes and the subsequent dimensional measurement is progressing well. The four manifolds for the Calorimeter have been manufactured and the welding of the stubs is advancing. The manufacturing and assembly of the Supporting structures and adjustable beds for the three

beam line components have been completed this year, and those parts are ready to be used during the assembly of each of the beam line components.

The second and the third prototypes of the Ceramic Break for the Residual Ion Dump failed during the testing. Consequently, the specifications have been deeply reviewed: the design of the joint between the metal and the alumina was updated following the latest state-of-the-art feedback from specialized Suppliers, and the conditions of the testing were reviewed. A new prototype shall be tested in 2023, with updated specifications.

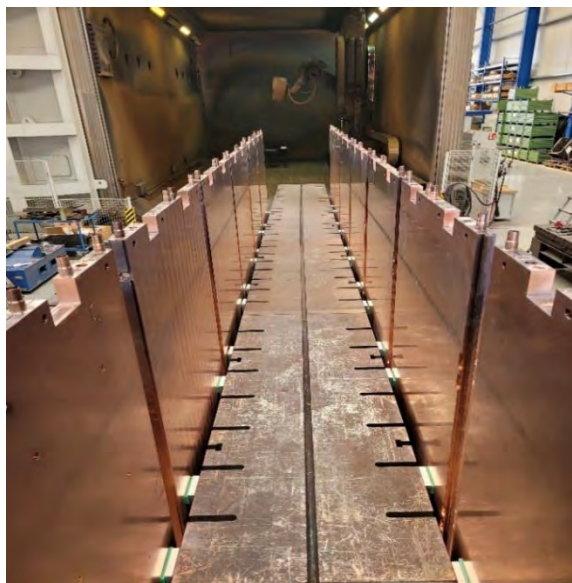


Figure 27: Panels of the Neutralizer ready to enter in the vacuum chamber for the electron-beam welding



Figure 28: A manifold of the Calorimeter undergoing a leak test after welding NBTF auxiliary systems

NBTF Auxiliary Systems

As far as the auxiliary systems of the Neutral Beam Test Facility (NBTF) are concerned, another important achievement was reached thanks to successful completion of the Site Acceptance Tests of the MITICA Cryoplant, and the transfer to IO of the Gas and Vacuum System.

NBTF Integrated Commissioning

During the first half of the year, several tests were performed to identify the location of the breakdown events that caused damages to several Power Supply (PS) components supplied by QST. The second half of the year was devoted to make analysis and simulations, to better understand the results of the tests. The repair works of the damaged components have started and some improvements of the protection systems of those components were discussed.

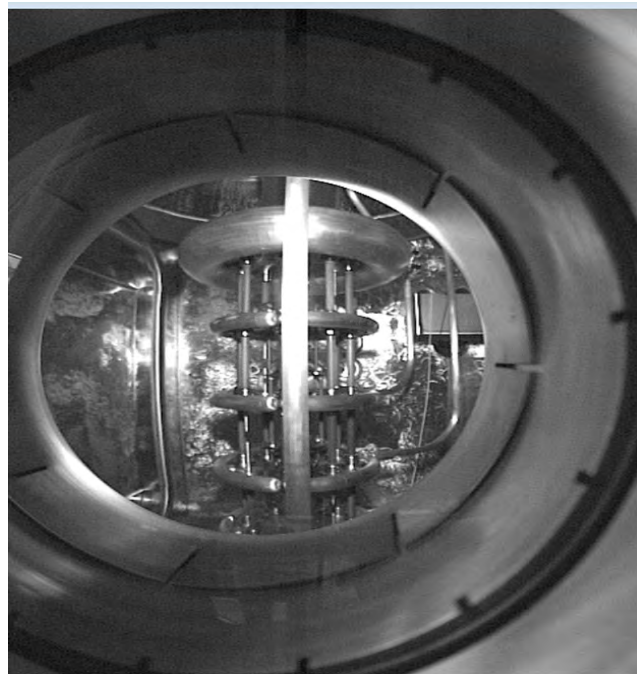


Figure 29: The Short-Circuiting Device during the integrated tests

ITER HNB Mechanical Components

Meanwhile, activities related to the ITER units of the HNB system progressed well. The first part of the Procurement Arrangement (PA) on the HNB Assembly & Tooling - for the procurement of the assembly tooling - was signed in June 2021. A staged approach for the procurement of the tooling equipment, aligned with the delivery of the different NB components, was agreed with IO. In total, more than 40 different tools will be procured to the IO under the PA. The corresponding call for tender was launched in June 2022, with the signature expected in 2023. For the second part of the PA (HNB general assembly activities), F4E and IO organised a specific joint technical working group to analyse the assembly sequence by means of resource loaded schedule, in detail. The purpose was to consolidate the definition of the scope and revise the cost estimate of the general assembly, in view of a potential transfer of the assembly activities to IO.

The PA for NB Confinement and Shielding, comprising the NB Vessels, the Exit Scrapers, the Lead Walls and some of the so-called Front-End Components (Drift-Ducts, Absolute Valves and Fast Shutters), has been also divided into several batches, to allow timely completion by IO of the built-to-print technical specifications for each of the complex mechanical components. The part related to the two NB Vessels was signed in July 2021, and the call for tender process was launched in Autumn 2021. The contract signature is currently planned for mid-2023. These are nuclear safety components, due to their confinement function. F4E also contributed substantially to the Final Design Review (FDR) of the Drift Duct and the preparation with IO of the technical documentation necessary for the signature of that part of the PA.

Preparation of the PA for the NB Magnetic Shielding - comprising the NB Passive Magnetic Shielding (PMS) and the Active Compensation and Correction Coils (ACCC) – is in progress, together with the finalisation of the design where F4E is contributing on aspects related to materials, magnetic analysis, and control.

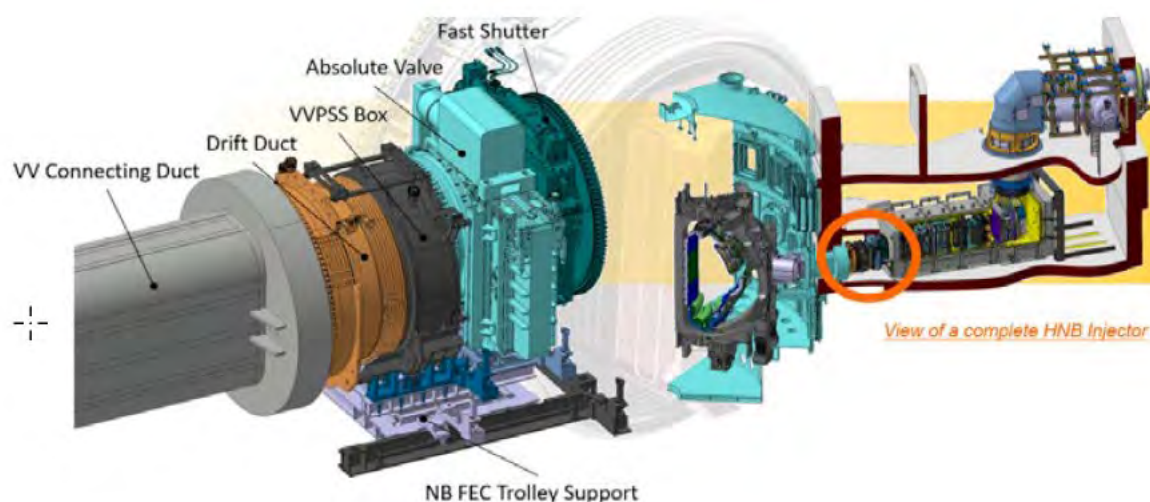


Figure 30: CAD view of the Front-End Components (FEC) of the ITER HNB injector

ITER HNB Power Supplies

With regards to the HNB Power Supplies (NBPS):

- The Final Design Review for the Conversion System of the Acceleration Grid Power Supply was completed
- The Final Design Review for the High Voltage Bushing Assembly was completed
- The Final Design Review meeting for the High Voltage Deck was held
- The manufacturing started for the Residual Ion Dump Power Supply, the Acceleration Grid Power Supply and the High Voltage Bushing Assembly



Figure 31: Manufacturing of the inverters for the Conversion System of the Acceleration Grid Power Supply of ITER



Figure 32: Manufacturing of the first Power Module for the Residual Ion Dump Power Supply of ITER

1.1.3.6.2 Microwave Heating system

Another way to heat up the plasma is to use radio waves to make the ions and electrons in the plasma vibrate, much like the way a microwave oven heats food. ITER is using two systems: Ion Cyclotron (IC) Heating, which heats the ions, and Electron Cyclotron (EC) Heating, which heats the electrons. Each system comprises power supplies, radio wave generators, transmission lines to transport the radio waves, and antennas inside the Vacuum Vessel to launch these waves into the plasma.

F4E is responsible for providing 4 upper port plugs (each housing one EC Upper Launcher), together with ex-vessel components of both the EC Upper and Equatorial Launchers as well as control systems for the EC plant. F4E is also responsible for providing 8 sets of power supplies for the EC Heating system and 6 gyrotrons, with their superconducting magnets and auxiliaries. Gyrotrons are high power microwave generators.

The following annual objectives were set in 2022 for the EC system (Table 11):

Milestone ID	Scope Description	Forecast Achievement Date	Type of Milestone	End 2022 status
EU52.01.2001282	Completion of Initial Optical Design Refinement	Q4 2022	WP22 objective	Achieved
EU52.01.2001312	Completion of UL Plug Architecture & I/F Definition	Q3 2022	WP22 objective	Achieved
EU52.02.12660	Signature of F4E-OMF-1108 for European Gyrotrons Procurement FWC	Q1 2022	Predecessor of GB48	Achieved
EU52.04.12761	Procurement of the MHVPS Transformer for 52HV12 (AAG Set#8) Completed	Q2 2022	Predecessor of GB48	Achieved
EU52.01.171055	Contract Signed for Procurement of GCC Waveguides for ITER	Q4 2022	WP22 objective	Achieved
EU52.01.3012220	Contract Signed for GCC Instrumentation & Support for slow controller	Q4 2022	WP22 objective	Not achieved as scope was implemented as part of FwC OMF-0989

Table 11: Electron Cyclotron – Annual Objectives presented in the F4E Work Programme 2022 (GCC: Gyrotron Commissioning Components, MHVPS: Medium and High Voltage Power Supply, MRR: Manufacturing Readiness Review, FWC: Framework Contract, UL: Upper Launcher)

The EC Plant Controller is the control system that oversees the configuration and operation of the whole EC plant and implements the integrated plant protection functions. These main functions include managing EC plant parameters, plant size machine, time and events and implementing control functions.

EC Upper Launchers (UL) and Ex-Vessel Waveguides (EW)

Following the change of the procurement strategy defined in 2020, and the signature in December 2021 of the amendment to the PA for the supply of the EC Upper Launchers (UL) and Ex-Vessel Waveguides (EW), a contract for the design and manufacturing of the UL and EW systems and associated ancillary systems was signed with an industrial Technical Integrator in March 2022, as planned. This contract is now under execution and the finalisation of the design of the UL and EW systems is progressing well.

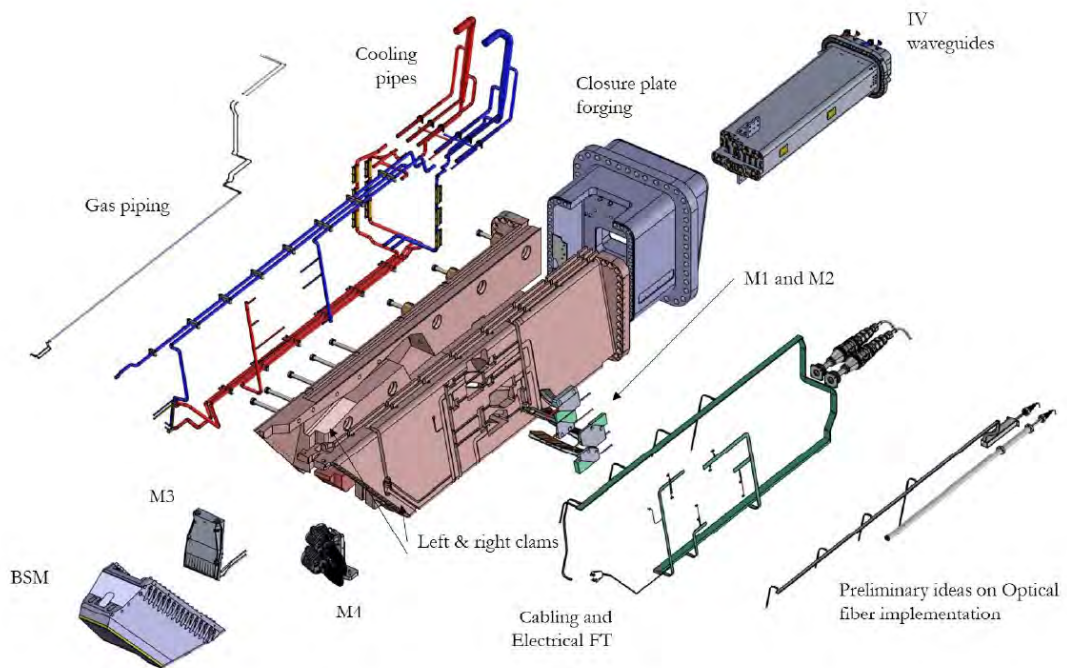


Figure 33: 3D view of the current Upper Launcher system current design

In addition, a negotiation procedure for the design finalisation and manufacturing of the EC isolation valves is on-going, and the signature of the contract is planned for second quarter of 2023. Furthermore, 95% of diamond disks required for ITER were manufactured by Diamond Materials and are now being tested. These disks will be assembled into the diamond window unit that will be manufactured by the Technical Integrator.

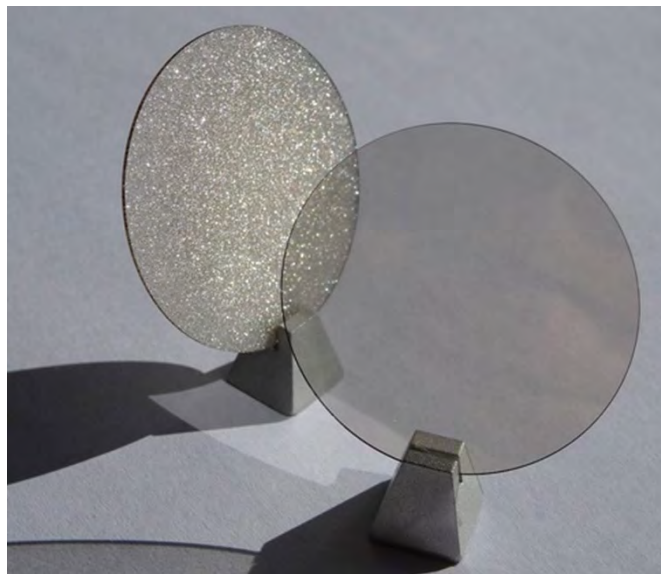


Figure 34: Unpolished and Polished Carbon Vapor Deposition (CVD) Diamond Disks

Electron Cyclotron Power Supplies

The fabrication of all 8 sets of the Electron Cyclotron Power Supply (ECPS) system has been completed, factory tests of the last units successfully passed and equipment delivered to the ITER site. The installation of the EC HV Feeder Line and all the switchgears for the EC system has been carried out in the ITER building #15 (RF building) and the mobilisation and installation of the 2 first plasma sets (52HV05 and 52HV07) started in Levels 1 and 2 of the same building, in close collaboration with BIPS and IO. A system has been developed to validate the ECPS interface with ITER CODAC team, and the EC plant and gyrotron controllers.



Figure 35: Inspection of the two first Main High Voltage Power Supplies (MHVPS) installed in the ITER Radio Frequency (RF) Building, Cadarache, France, April 2022



Figure 36: (left) Connection of the power converter modules for the charging procedure carried out during the installation of the 2 first Power Supply sets in the ITER RF Building, Cadarache, France, May 2022.; (right) Installation of the coaxial Feeder Line that

Electron Cyclotron Power Sources

The International Call for Tender for the Gyrotrons joint procurement of 22 units (6 units for F4E, for ITER, and 16 units for the Divertor Tokamak Test facility, DTT, in Frascati, Italy) was awarded in March 2022 and the F4E Framework Contract signed with Thales AVS shortly after, in April-2022. In parallel, DTT contract for the procurement of the first pre-series gyrotron was also signed with Thales AVS and related activities started in August 2022. The signature of F4E Specific Contract for ITER Gyrotrons related activities is foreseen in 2023.

Concerning the qualification tests performed on the EU Gyrotron improved prototype, designed by EU Fusion Labs and F4E, manufactured by the EU Industry (Thales AVS) and tested by the EU Fusion Labs, the successful results obtained during the tests campaigns showed power level (1 MW CW) and pulse lengths (above 100 s) compatible with the ITER requirements. Thanks to these results, Thales AVS is now qualified by F4E for the ITER project. The tests campaigns for the EU industry qualification were started in 2021 and completed in spring 2022.

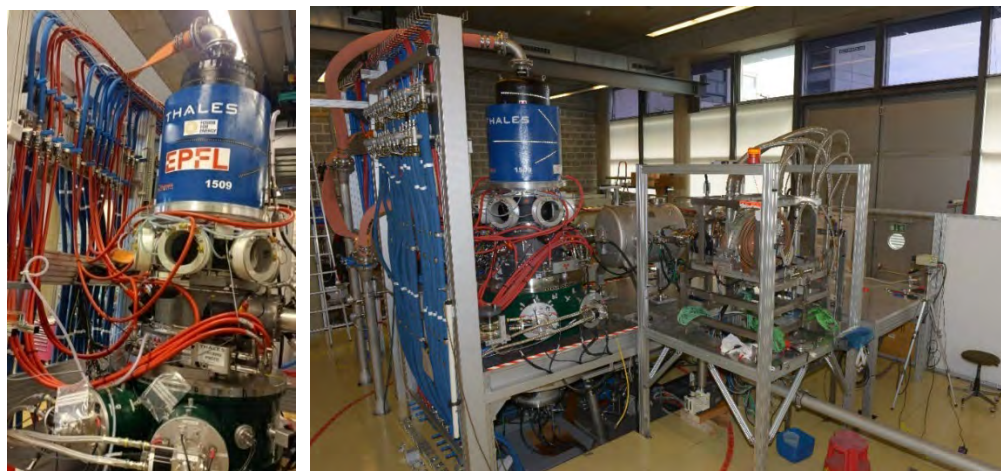


Figure 37: F4E Gyrotron prototype and its auxiliaries as installed in the F4E test facility (FALCON) at the Swiss Plasma Center (SPC) in EPFL-Lausanne (left), and setup at FALCON with Matching Optical Unit and RF Dummy Load for the RF high power and long pulse qualification tests (right)

EC Control system

Activities in 2022 were focused on the commissioning and integration of the EC Plant Control System Stage 2, delivered in 2021. The system was accepted in 2022 and the corresponding PA credits were recognized to F4E. The system was integrated with the existing Subsystem Control Units and with the CODAC environment.

1.2 Contributions to the Broader Approach Projects

1.2.1 Satellite Tokamak Programme (JT-60SA)

The Satellite Tokamak Project (or JT-60SA), the largest super conducting tokamak to date, is located in QST site of Naka (Japan). While re-utilising the site and some of the infrastructures of the former JT-60U (dismantled to make space to the new machine) it is a superconducting device capable of long pulse operation, with the aim of carrying out experiments which should be complementary to those studied in ITER.

Most of the activities in the year 2022 have been devoted to repair and reinforcement of magnets insulation, following the incident in March 2021 which triggered a vast plan to reduce the risk of arcing during high voltage operation of the magnets.

The original plan was based on:

- a) reinforcement of all insulations. with the aim to obtain a machine fully 'Paschen-tight' (safe for operation under the most unfavourable conditions of vacuum in the cryostat);
- b) modifications of the power supplies to reduce voltage during normal operation by different grounding scheme and filtering of spurious high voltage spikes.

By July 2022, a vast program of reinforcement has been completed, all magnets' joints and high-temperature current leads have been reinsulated and all passages for diagnostic wiring have reinforced. Diagnostic wires have been replaced and rewired.

During the execution of repair, it became clear that the original plan to bring the full machine to 'Paschen tightness' was most probably impossible on a short timescale. During the execution of local tests, after repairing, it was found that the equilibrium field coil pancake joints and helium inlets had Paschen weaknesses, that could not be repaired without more extensive dismantling of the thermal shields. Moreover, the central solenoid was expected to have similar problems on the helium inlets, for which access for repair is not readily achievable.

The Global Paschen test started on 15 August 2022. Web cameras (137 units) and spark sensors (76 units) were installed to identify discharge locations in the cryostat. The global Paschen tests are performed at the pressure of 1, 10, 50, 100, 500, and 1000 Pa in an Argon atmosphere.

The results confirmed that the equilibrium field and central solenoid coils were not Paschen tight (as expected) beyond 500-800 Volt.

More disappointingly, the toroidal field coils were still not Paschen-tight (though all repaired locations were passing the test).

A new strategy for the operation of the machine has been developed, accepting the limitations of voltage holding in Paschen Region and relying on early detection of vacuum deterioration and de-energization of the coils (the the equilibrium field and central solenoid coils can be safety de-energized in about 10 sec). This strategy has more limitations for the toroidal field coils which, while normally operated at 90 V, require about 1800 sec for de-energization (not using the fast discharge system which generates high voltage at the terminals).

From September to December a further set of repairs have been executed primarily on the TF coils (still aiming to "Paschen tightness) and secondarily on easily accessible defects identified on the the equilibrium field and central solenoid coils.

On the front of the power supplies, two critical improvements were designed and partially implemented in 2022:

- F4E designed, procured and installed an alternative grounding system of the poloidal superconducting magnets, by early July 2022. This system halves the max voltage of the coils without restricting the design performance. The system was successfully tested without any critical problem at the beginning of September 2022;
- the Booster power supply, which provides the high voltage to the coil for plasma initiation, causes large 400 Hz ripple (around 5.8 kV peak to peak, due to its circuit thyristor-based configuration. To avoid the possible harmful effect for the coil insulation, F4E has designed and procured the voltage ripple reduction filters for booster power supplies (see fig. 28) of EF1, EF2, EF5 and EF6 circuits With this filter, the voltage ripple can be reduced to around 440 V.

By December 2022, as part of the new strategy for machine protection, F4E has designed, fabricated, and tested (under high magnetic field), Cold Cathode Gage vacuum-sensors (see fig. 27) which can identify minimum variations of vacuum level (e.g., deriving from a small helium leak) and command the coil de-energization).

In parallel to the repair activities machine maintenance of improvements have continued steadily for power supplies, cryoplant and vacuum pumping system.

On the positive side, this vast scope of activities has produced a large amount of knowledge (repair and test techniques and materials, development of new devices etc.), developed a strong project integration (EU and JA working closely together) and enhanced management skills and resilience to cope with unforeseen circumstances.

While large human resources were focused on machine repair, the planned activities for Machine Enhancement (M/E) have continued unchanged in scope.

EU contribution in M/E is concentrated on several complementary diagnostics and in-vessel and ex-vessel components, Consistent progress has been done on the procurement of the Divertor Cryopumps (qualification completed and series assembly started), the Thomson Scattering System (Polychromators fabrication approaching completion, collection optics and solid-state laser tested), Vertical UV spectrometer (spectrometer and part of the optics ready for integration), the Massive Gas Injection System (Final tests completed)

Substantial delays are reported on the procurement of the Pellet Launching System due to technical issues with the Russian supplier, eventually compound with issues associated to the Russian invasion to Ukraine and associated sanctions.

For the power supplies, the factory tests of the Error Field Coil Power Supplies have been successfully completed, and the commissioning of the first set of Electron Cyclotron Resonance Heating power supplies has progressed (after a long stop due to travel restrictions due to Covid pandemic) solving critical issues on protection intervention times (long distances and limited signal transmission speed).

Note should be taken that, in parallel, on QST side a large set of activities have been progressing on integration on the machine of the vertical port, refurbishing of the positive and negative ion beam sources, installation of additional gyrotrons, fabrication and assembly of in-vessel components (inertially cooled divertor, stabilizing plate and first wall protection), water cooling system, metal supporting frames for diagnostics and auxiliary equipment. The large program for diagnostics and improvements of the control system/data access for Operation Phase 2 has also progressed as planned.

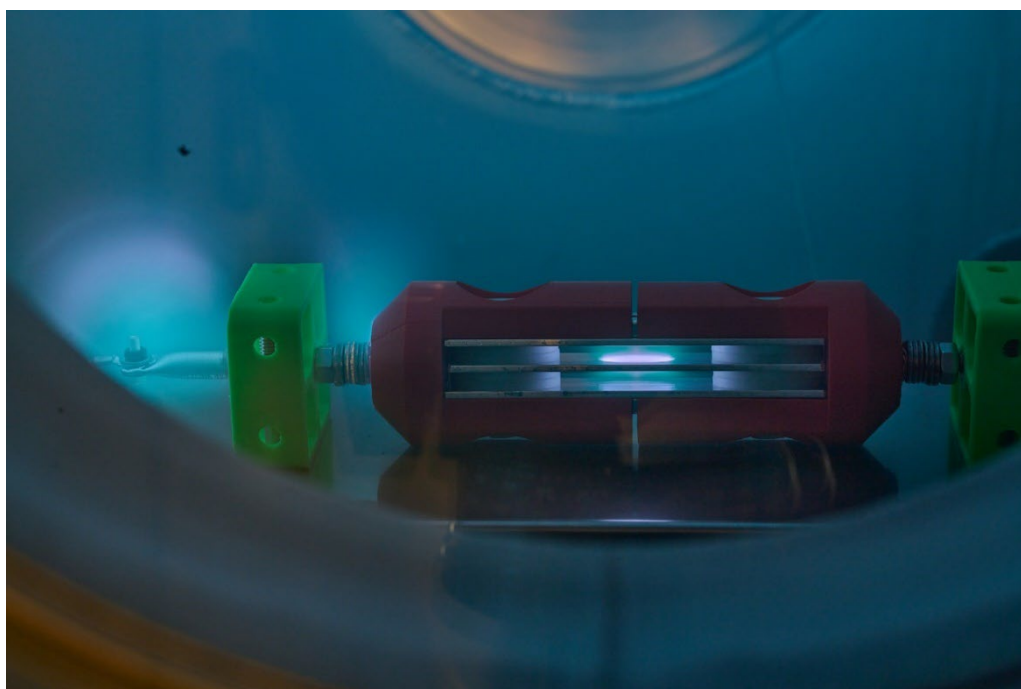


Figure 38: F4E Cold Cathode Vacuum Gage – Under calibration



Figure 39: JT-60SA Booster Power Supply Filter

1.2.2 IFMIF/EVEDA

The International Fusion Materials Irradiation Facility - IFMIF is an accelerator-based neutron source to produce a large neutron flux to qualify materials for future fusion reactors. The Engineering Validation and Design Activities (EVEDA) for IFMIF are being conducted in Rokkasho (Japan). Because the IFMIF accelerator has to reach unprecedented performances, the engineering design is being validated with the manufacturing, installation and commissioning of the LIPAc accelerator (Linear IFMIF Prototype Accelerator), which is a 1:1-scale prototype accelerator from the injector to the first cryomodule. This initiative brings together QST (Japan) and F4E, coordinating the contributions to IFMIF from INFN (Italy), CIEMAT (Spain), CEA Saclay (France) and SCK CEN (Belgium).

After the validation with probe beams at low duty cycle in December 2021 of the first stage of the phase B+ configuration alongside with the different processes, procedures and diagnostics to operate safely the LIPAc accelerator, 2022 was devoted to the preparation of the second and third stages. Phase B+ is the third out of four configurations of the LIPAc accelerator to be tested (cf. Figure 40). This has been the result of three years of work, including two years of installation of all the components, in difficult conditions due to the travel restrictions imposed by the COVID-19 outbreak. In order to implement the phase B+ configuration, a new intermediate transport line (MEBT - Medium Energy Beam Transport Extension Line) was designed and manufactured to stand in place of the cryomodule, connecting the medium- and high-energy parts of the accelerator.

Such a configuration, not planned at the beginning of the project, was devised to optimise beam operation time and commission all the LIPAc subsystems apart from the cryomodule at nominal beam current up to continuous wave (CW) at 5 MeV. The validation until the nominal energy of 9 MeV will be done after the completion of the assembly and integration into the beam line of the cryomodule. The stages 2 and 3 of the phase B+ will consist of the ramping up in current and power until 125 mA deuteron beam and continuous waves are reached.

In 2022 the onsite activities were focused on the implementation of the main 2 prerequisites before starting stage 2 and 3, namely:

1) The validation in continuous wave of the deuteron beam produced by the injector with characteristics meeting the requirements for beam injection into the Radio Frequency Quadrupole. Several injector beam operation campaigns took place with 10 mm, 11 mm and 12 mm plasma electrodes from February to July, including the test of a new emittance-meter procured by F4E. This activity will continue also in 2023 with an intermediate electrode of 11.5 mm until the optimal and stable beam characteristics are obtained.

2) The RF conditioning in CW at nominal accelerating field of the RFQ. Despite some promising results (reaching CW at 80% of the full power in February 2022), a vacuum leak occurred in a RFQ coupler when increasing the injected power. It was then decided to dismantle the couplers from the RFQ in May 2022 for inspection. It showed that an O-ring of a coupler was partially melted and 4 others damaged. Black rings of copper-like deposit could be observed on the inner conductors and ceramic windows of the couplers. The nominal solution to resume operation in a timely manner was to use the current O-ring couplers with an improved cooling of the inner conductor while the RF properties were kept identical. The improved inner conductor was designed by F4E and INFN, and the parts were procured by F4E early 2023.

Another critical problem that occurred in February 2022 was the failure of a circulator because of arcing. It was repaired onsite. However, in order to reduce the risks of a future failure, and by taking benefit from the period to implement the solution to fix the aforementioned coupler issue, it was decided to ship it back to the manufacturer premises for a refurbishment, which was done during the rest of the year — The circulator was returned on 1 March 2023.

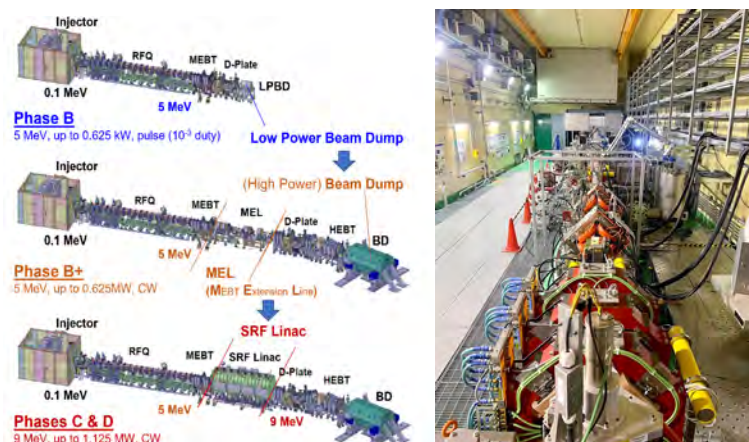


Figure 40: Left, three configurations of the LIPAc commissioning phases. View of LIPAc in October 2022.

The close collaboration with the IFERC/REC project was pursued in 2022 in order to develop a safe ICT environment so that experts can have a remote access to the LIPAc data and operator interfaces. A Remote Computer Access, based on a data diode solution with server located in Barcelona, had been developed allowing the access to operational tools via a web interface, and tested in 2021. However, some limitations were noticed due to maintenance (lack of resources) and responsiveness (time zone). So, another similar solution was proposed with a Remote Computer Access with server located in Rokkasho. An alternative solution was also proposed: It is a Remote Data Access based on PV gateway solution (data PVs are directly shared via a gateway), again with a server located in Rokkasho, Japan. This solution necessitated to install Control System Studio (CSS) on the user local computer, so expertise in operation is required. Feasibility tests were performed and complete test plans are in preparation by June 2023 for both solutions with servers in Japan in order to compare and eventually figure out the best solution.

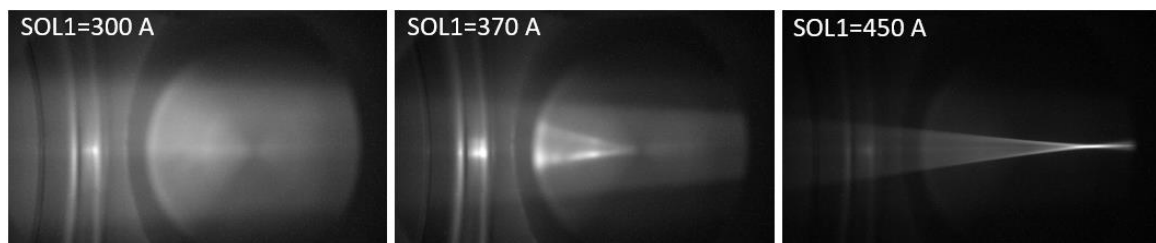


Figure 41: CMOS camera images of vertical beam profiles in the longitudinal plan after the first LEBT solenoid, observed for 150 mA extracted current beam in CW mode and at various solenoid magnetic fields (current from 300 to 450A)

In parallel to the Phase B+, the preparation of Phases C and D is in progress with the assembly of the SRF-Linac, which consist of one cryomodule (5 cryomodules in the DONES case).

It started in the Joint Research Building in August 2022, after the delivery of the last batch of solenoids on December 2021, their High Pressure Rinsing in June 2022, and the lifting of the entry restrictions into Japan that prevented the technicians and engineer of the European assembly contractor to come to Japan. Despite good progress with the mounting of the power couplers to the SRF cavities (cf. picture below), the assembly had to be paused again due to vacuum leak issues on a BPM interface flange and a cold-warm-transition flange. The implementation of the repair work and mitigation procedures will be continued during in 2023. Then the assembly work in the Joint Research Building is expected to resume in the second part of 2023 and completed by the time of completion of Phase B+ operation before its transfer into the accelerator vault in 2024, and its integration into the LIPAc beam line. LIPAc will be then in its final configuration.



Figure 42: All 8 cavity-coupler assemblies mounted on the support frame

The Fusion Neutron Source engineering design activities and the Lithium Target Facility engineering validation activities, which restarted in 2020 in collaboration with EUROfusion in the framework of the BA phase II, have been implemented as planned in 2022 by both implementing agencies.

Within the Lithium Target Facility activities, aiming to perform additional R&D in order to improve the reliability of the individual systems from the standpoints of long-term operation, the design of the Li loop facility was completed both in JA (1:10 scale) and EU (1:1 scale), allowing to start the construction phase.

In parallel, the first experimental results of the erosion-corrosion of Target Assembly and ELTL (EVEDA Lithium Test Loop) material were discussed before being used to feed its modelling. The experimental setup for the study of the stabilization method of used/leaked Li including radioisotopes was completed and enabled the start of the experiments. Following the finalisation of the Li fire experimental setup, the conclusion of the first experiments on Li fire risks allowed to determine the levels of humidity without ignition.

The erosion-deposition modelling in the target system for FNS enabled the evaluation of the absorbed dose rate of the primary heat exchanger oil due to the activated erosion-corrosion products. In order to complement the safety accident analysis, an environmental impact assessment was performed using the PUFF code developed to study the tritium atmospheric release from FNS facilities.

Lastly, the irradiation campaigns up to 13 MGy of the candidate oils for the heat transfer fluid in the primary heat exchanger were performed with simulations in JA using the dibenzyl toluene properties and experiments in EU using hydrogenated terphenyls to investigate the radiation hardness at different gamma dose rates.

1.2.3 IFERC

The International Fusion Energy Research Centre (IFERC) Project is hosted in Rokkasho, Japan, and comprises three sub-projects:

- The Computational Simulation Centre (CSC) provides supercomputer resources for simulation projects in support of ITER, JT60-SA and other high priority areas. The third annual cycle of simulation projects was conducted in 2022 including simulations within the collaboration with ITER on uncontrolled disruptions and divertor physics.
- The Demonstration Reactor (DEMO) activities are done in collaboration with EUROfusion. In 2022, joint DEMO Design activities have been defined and progress continued in research in materials where the experimental results and simulations continued to produce data for databases.
- ITER Remote Experimentation Centre (REC) has continued the tests with ITER organisation of remote participation tools to give access to ITER data to the Parties. REC also continues an active collaboration with IFMIF/EVEDA on remote participation as described in the IFMIF/EVEDA section.

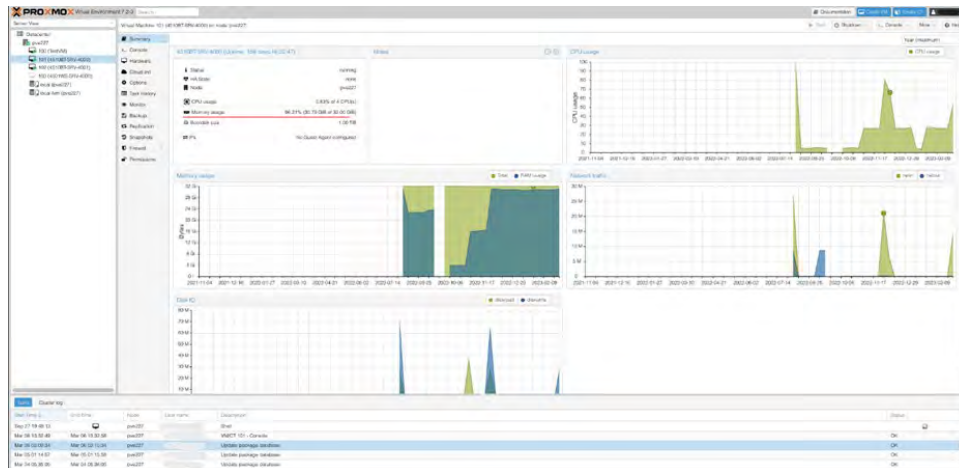


Figure 43: VM status monitor for the ITER data access

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU.BA.01.13520	Delivery of the LIPAC Injector Spare parts completed	Q2 2022	WP22 objective	Achieved
EU.BA.01.18620	Contract placement for Supply of JT-60SA actively cooled Divertor HHF elements - Stage 1	Q3 2022	WP22 objective	Achieved
EU.BA.01.25300	Supply of equipment or services for tests with BA Projects and ITER, and establishment of control room	Q4 2022	WP22 objective	Achieved
EU.BA.01.32480	Contract placement for the Supply of the Centrifuge Accelerator for JT-60SA Pellet Launching System	Q2 2022	WP22 objective	Achieved
EU.BA.01.36380	Start of the SRF Linac assembly in the Joint Research Building	Q4 2022	WP22 objective	Achieved

Table 12: Broader Approach – Annual Objectives presented in the F4E Work Programme 2022

1.3 Engineering Unit

1.3.1 Engineering Unit Support Activities

The F4E Engineering Unit provides specific technical expertise in engineering and fusion technologies to the F4E Project Teams delivering systems to the ITER Project and, to a more limited extent, also supports the Broader Approach Projects. Technical support is provided in the following areas:

- **CAD and technical data management group:** Providing Computer Aided Design (CAD) support to F4E's Project Teams in setting up the CAD infrastructure for design collaboration with suppliers and ITER organization; reviewing drawings for Procurement Arrangement signature; warranting the traceability of CAD data exchanges; checking the CAD data at different design maturity levels; performing in-house mechanical design tasks and specifying CAD task to be subcontracted. The group provides support to the Project teams in the management of technical data and documentation to ensure the technical data/documentation is produced, controlled and reviewed according the requirements specified in the IO Procurement Arrangement. During 2022 the group has extended the support on data/documentation management to the following PgTs: Cryo-Plant & FC, H&CD, In-Vessel and Diagnostics it is expected during 2023 the support will cover the remaining PgTs within ITER-D. The group provided as well strong CAD support to BIPS, Antennas, Diagnostics, Magnets and In-Vessel by performing in-house design activities, monitoring the work done by suppliers and participating in the design reviews of several components. The group has contributed to the approval of the 3D models for the PFC02, as well the group has contributed to the preparation of the 3D models and drawings for FDR and Built-to-Print of the following diagnostic systems: UP01, EP01, UP03,UP10, UP17, RNC and CTS. As well the group has participated in the preparation of the 3D models for the DPG FDR and the implementation of the post-FDR modifications of the Electrical Feed-outs. Here below some pictures illustrating the different systems.

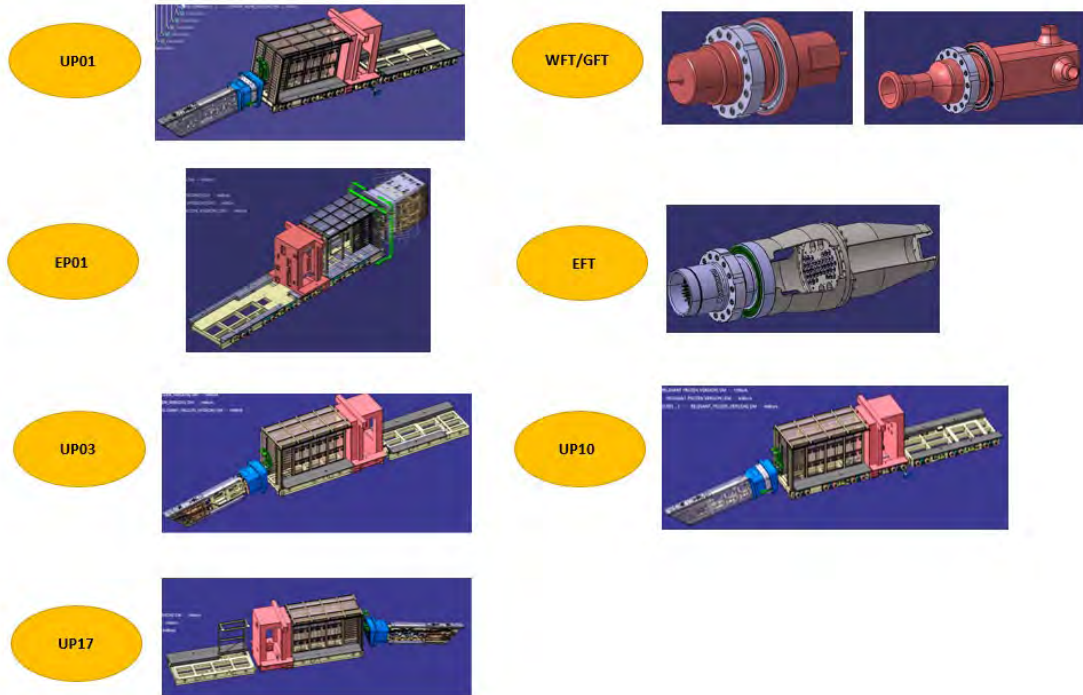


Figure 44: 3D models of the UP01, EP01,UP03, UP10, UP17, WFT/GFT and EFT

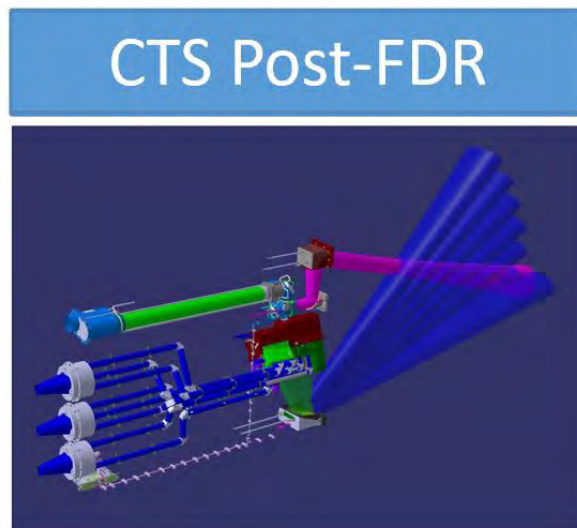


Figure 45: 3D model of the CTS diagnostic system

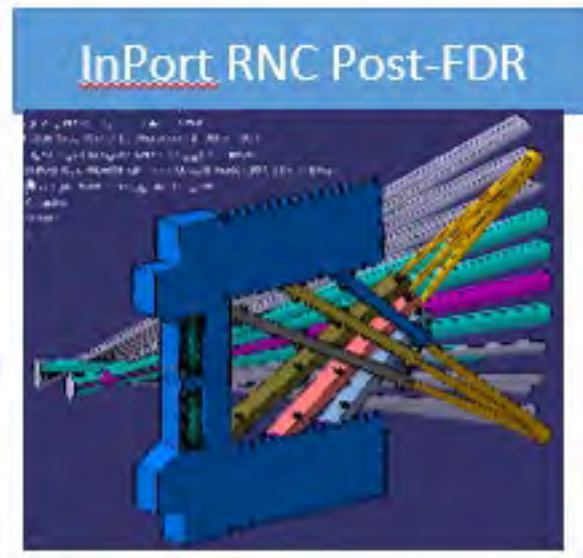


Figure 46: 3D model RCN diagnostic system

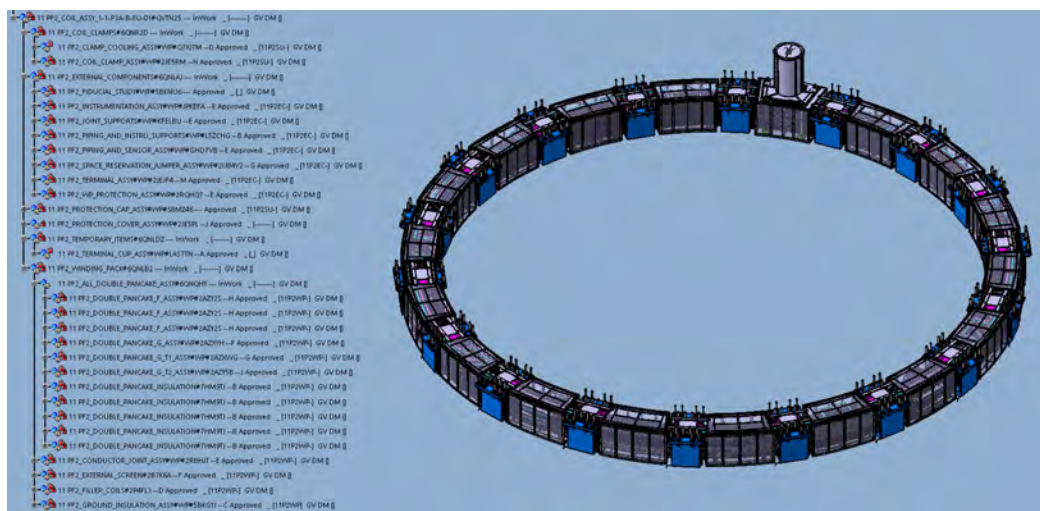


Figure 47: 3D Model approved for the PFC02

- **Analysis (mechanical, structural dynamics, civil engineering, fluid dynamics, electro magnetism, nuclear analyses)**
 - **Knowledge Management Activities:** In 2022, 18 scientific seminars 2 workshops were organised. In particular, one of these workshops was the first neutronic workshop organised by F4E and hosted remotely with selected invitees from all over the world. All presentations are available in 27ZHTW. Some group members contributed directly to the seminars and workshops. The other workshop focused on the superconducting magnet design topics for tokamaks. Among the various seminars it is worth recalling the one reporting the detailed results obtained in the DTE2 campaign at JET with the ITER-like wall at the end of 2021
 - **Analysis Activities:**
 - **Support to project teams.** Group members have routinely supported our F4E PTs by reviewing hundreds of technical documents, participating to gate reviews, carrying out detailed analysis of various systems (e.g. diagnostics CTS, ECH

Launcher, NBI shields, etc.) as well as instructing younger, external analysts dedicated to different projects tasks (e.g. vacuum vessel NCRs, RH systems design and analysis, etc.). Last but not list, key support has been provided by liaising on behalf of the PTs with their suppliers and assisting them by transferring knowledge in various field of engineering analysis (e.g. neutronic for ECH, electromagnetic analysis of various diagnostics, etc.).

- **Pre-compression rings analysis.** A series of six reports have been issued summarizing the activities performed in house in the frame of ITA C11TD197FE for the analysis by Finite Element Models of the Pre Compression Ring tightening process. These includes simulating single as well as multi-step sequences, different loading on different set of coils, effects on PCR ripples, etc. Simulation of the entire 30 steps sequence able to successfully reach nominal preload on every coil is also reported.
- **Magnet protection and linear response matrices.** A detailed analysis was carried out to study the Toroidal Field coils contact behaviour during the reference inductive 15 MA scenario and the identification of stress hot spots in TF case. Moreover, several ANSYS TF and PF equilibrium configurations were studied by varying the PF and CS currents in different steps to derive a linear response of the TF current centre line displacement. By doing so, we can understand, in real time during operation, if dangerous stress states are reached or are being approached.
- **Magnet commissioning procedures.** A detailed report has been issued summarizing a preliminary mechanical analysis of the TF coil in test conditions based of the 2-Coil Model. The TF coil is supported horizontally and subject to gravity load, cool down to 4 K, and self-field induced by the nominal current of 68 kA. Different smeared properties are used for the homogenized Winding Pack
- **Update of nuclear responses in PF, Cs, CCs and CSs ITER magnets using the E-lite 360° model.** A comprehensive update of the nuclear responses expected in the ITER superconducting magnets during the operation of fusion power plasmas (mode-0) has been reported. The parameters of interest have been computed using the E-lite 360o reference analysis model of the ITER tokamak for both the plasma and TCWS activated water sources. Integral responses values have been produced for PFCs, CCs and CSs and ICFs. Also for the first time, and owing to the novel use of 360o modelling, detailed data has been computed for each of the CCs, PFCs and for PFC-4, TCC and CS1L ICFs with unprecedented detail and completeness. An update of the calculation uncertainty levels has also been performed and updated upper values of the integral heating produced by application of uncertainties factors derived from the uncertainty analysis. The post-processing of Nuclear Loads for SuperMagnet models of ITER PF Coils. Python and Matlab scripts are also reported
- **JT60SA divertor analysis and design.** A detailed thermomechanical analysis of the JT60SA divertor was carried out in house as well as rationalization of several cassettes and vertical targets design features. This has allowed our BA colleagues to progress in the tender technical specifications for the divertor procurement, which is responsibility of F4E/EU

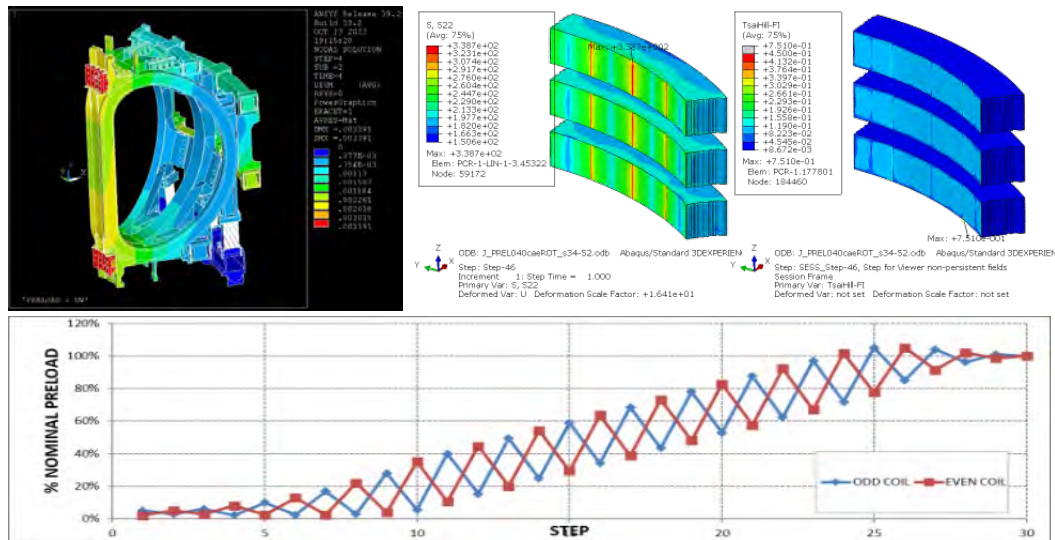


Figure 48: Pre-Compression Ring preloading simulation; Top Left: Global FEM model; Top Right: stress in the sub-model; Bottom: Preload evolution.

- Design Codes and Standards:** Tracking developments in, and the application of, standard codes (e.g. ASME, RCC-MR, RCC-MRx) to the design of the key ITER mechanical components (e.g.: Vacuum Vessel, Buildings and Magnets); assuring the ACO role (Analyses & Codes) in the review of all technical specifications prepared by F4E; managing F4E code & standards repository and consultations from teams; negotiating and assuring access to AFCEN Nuclear Codes and relevant Codes & Standards via subscriptions contracts for F4E users; participating in international codes and standards organizations for the drafting and/or evolution of files.
- Reliability, Availability, Maintenance and Inspection (RAMI):** Coordinating internally with F4E Project Teams and with ITER Organization/Operations all actions concerning RAMI processes and due analyses; assuring the RAMIO role (Reliability, Availability, Maintenance and Inspection Officer) for the review of RAMI deliverables by suppliers; support F4E suppliers in the rightful application of ITER RAMI Analysis Programme (PA AD), promoting the focus on availability aspects during design to mitigate failure risks occurrence and impact, and their impact of ITER schedules operation and research plan).
- Assembly, Integration and Validation (AIV):** Coordinating internally within F4E and with the ITER Organization Construction Domain the applicable framework for assembly works at ITER Site, relevant for F4E Suppliers with assembly scope of work. Support the continuous improvement of AIV activities on site by proposing organizational, technical, management, etc. enhancements. Negotiate with IO AIV applicable documents and assess impacts of them on F4E suppliers (e.g., the General Management Specification for Executing Entities on Site); sharing and exploitation of AIV lessons learned from one system to the next and to all F4E stakeholders: support to MAC for the review of AIV files prepared by ITER IO for approval.
- Instrumentation and Control:** Leveraging the synergy of 4 framework contracts provides integrated solutions to projects; from support and consultancy to fully managed product developments. Provides necessary development and managerial/technical support resources to the development and integration of plant system instrumentation, from the conception to the final acceptance: control system modelling and design, electronics modelling and design,

requirements analysis and formalization, system design and documentation, preparation of design reviews, FAT (Factory Acceptance Test) and SAT (Site Acceptance Test) manning.

Issues during the delivery of certain systems prompted for an increased synergy between F4E and IO I&C teams. The two teams jointly focus at avoiding future issues, resulted in the co-development of a PLC software framework. After a first application to the vacuum project, it has been further improved and is been used as the standard for all F4E industrial I&C projects. Collaboration with IO continue on both F4E software framework for high performance/real-time software and a mechanism to coordinate the configuration of all ITER plants.

- **Metrology:** Defining strategies for the managing of geometrical requirements and metrology activities both for manufacturing related processes and final acceptance of components during Factory Acceptance Test and Site Acceptance Test processes; providing technical support to programmes on activities related to metrology and definition, verification and acceptance of geometrical requirements. Expertise and services are provided for: verification of supplier metrological procedures, participation to the assessment of Non-Conformities related to metrology, witnessing of geometrical survey campaigns, carrying out of independent geometrical surveys, supporting programmes in the definition, checking and propagation of geometrical requirements, supporting programmes/suppliers in fit-up/assembly activities of components using reverse engineering and virtual fitting techniques, designing of novel metrological hardware/software solutions.

During 2022, several work-packages related to projects which have been approaching (or almost approaching) the final stages have been finalised. The effort spent in the follow-up of manufacturing contracts by putting in place efficient processes and detailed metrology and reverse engineering strategies for the managing of geometrical as-built data has allowed the review of thousands of documents related to metrology, as in the case of the Cassette Body project and the Vacuum Vessel project, and the easing of the acceptance of different components during Factory Acceptance Tests, as in the case of Poloidal Field Coils and Toroidal Field Coils.

New work-packages have been taken on board aiming at supporting different projects for building long term strategies for the managing and follow-up of geometrical requirements behind product lifecycles and/or manufacturing contracts. Support have been mainly given to the Diagnostic, Remote Handling and Heating & Current Drive programmes in trying to improve the quality of drawings defining the main geometrical contractual requirements to be meet during manufacturing and to the In Vessel programme proposing long term-strategies for easing the follow-up of metrology activities behind manufacturing endorsed both in the First Walls and IVT projects.

Active collaboration has started with Neutral Beam in close collaboration with ITER IO for supporting the project in the preparation of the strategy for the assembly of the system in the Neutral Beam cell. Complex dimensional inspections have been carried out by the team supporting specific requests by programmes, for guiding difficult assembly processes (as in the case of the aligning activities of some Poloidal Field Coils manufacturing stations in the Poloidal Field coil building in Cadarache and in the case of the installation of ECPS cabinets in Building 15 in Cadarache) and for reconstructing the as-built geometry and/or positions of manufactured/assembled parts (as in the case of ITER embedded plates in Cadarache, or Vacuum Vessel bevels of Sector 5 in Italy).

A number of supervision activities on metrology related topics has also been accomplished working together with the F4E quality team in order to monitor the implementation of metrology related quality requirements in different supplier chains. Knowledge management activities have been also implemented by launching a technical community on geometric dimensioning and tolerancing (GD&T) with the objective of sharing lesson learned and increasing awareness in F4E about the importance of a proper definition of geometrical requirements aiming at increasing the quality of their definition in drawings.

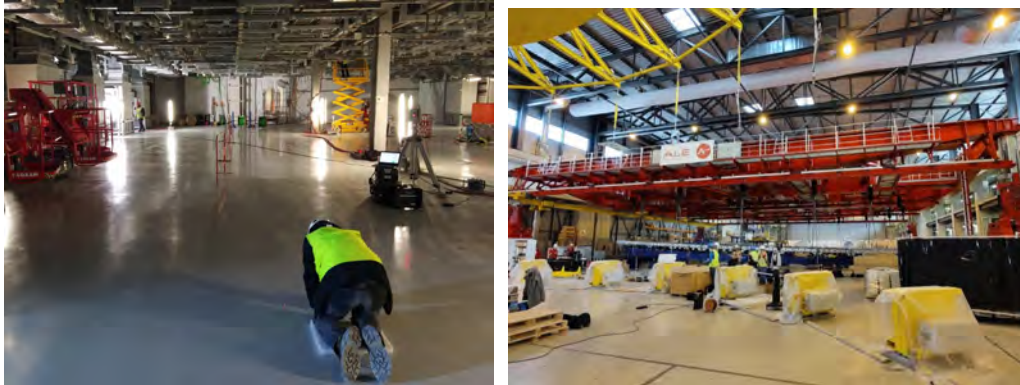


Figure 49: Dimensional Inspection Survey for the Installation of ECPS cabinets in B15 (left) and alignment of Station F in Poloidal Field Coils building (right)

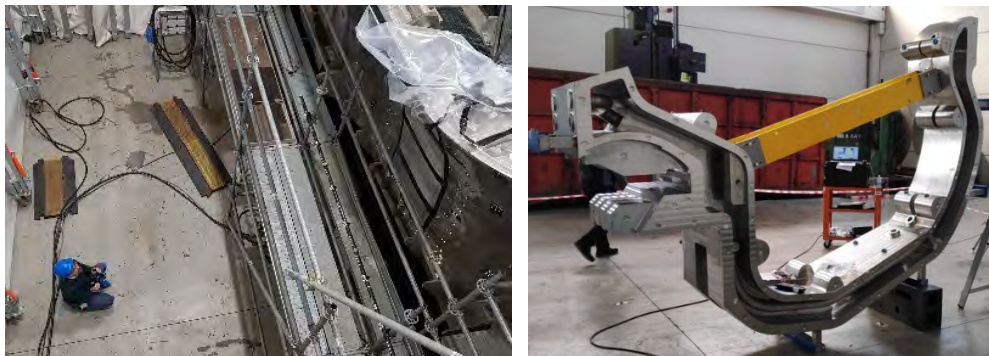


Figure 50: In-process Control Activities with photogrammetry for the follow-up of Vacuum Vessel Manufacturing (left) and Divertor Cassette Body (right)



Figure 51: Reconstruction of As-Built Data of Toroidal Field Coil in form of Point Cloud

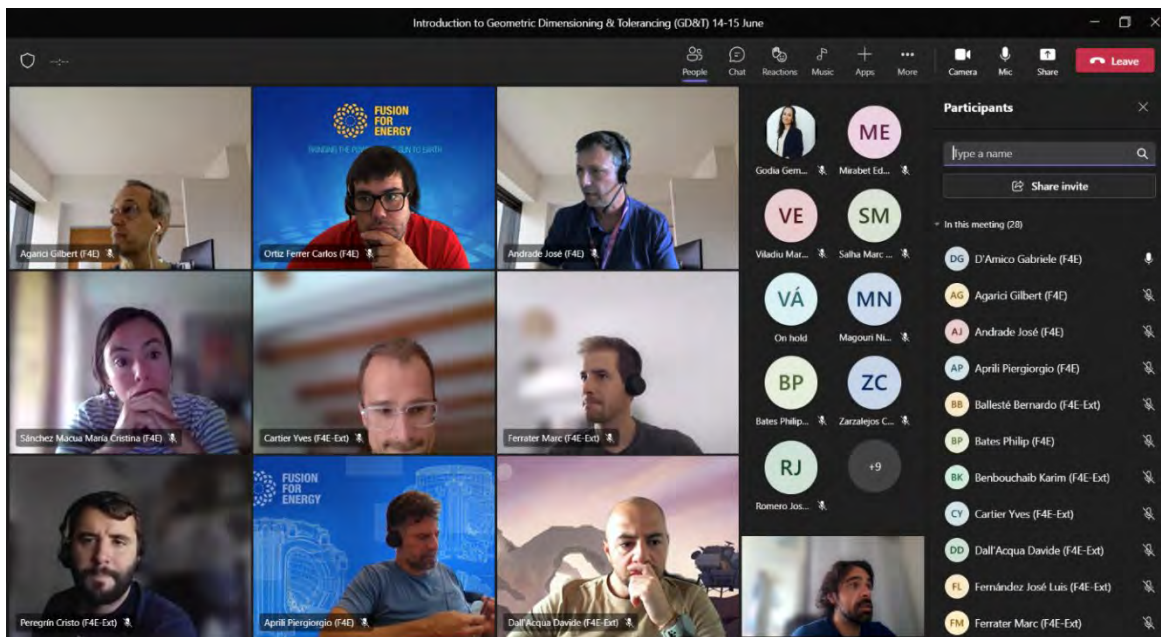


Figure 52: Meeting of the F4E Geometric Dimensioning and Tolerancing (GD&T) technical community



Figure 53: Supervision Activities on the ITER Neutral Beam cell for preparing dimensional inspection activities for reconstructing the as-built of the Cell and prepare the metrology network installation

- **Materials and Manufacturing Technologies and Processes:** The main task is providing human resources or service contribution by allocation of engineers to ITER Programmes' activities in the scope of materials and fabrication related technologies. The services range from R&D, technical specifications, and prototyping, to commissioning and manufacturing follow-up, on-site support and trainings. The key to achieve success of the group is linked to utilizing the best transversal knowhow at F4E with support from framework contracts. The versatile services embrace a variety of joining technologies such as welding, electron beam welding and hot isostatic pressing followed up by non-destructive testing feasibility surveys. Activities are also carried out to assess materials properties after exposure to ITER operational conditions (neutrons, cyclic heat flux, mechanical loads and coolant) and health & safety.

Materials testing, qualification of joints, mock-ups and manufacturing processes are always supported via Framework contracts, presently with F4E-OFC-1082 by ISQ, Portugal.

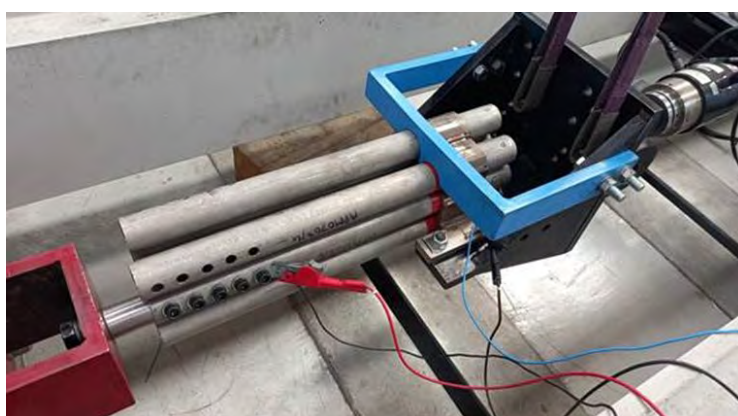


Figure 54: Thermo-mechanical testing to qualify new support concepts for ITER Cooling Manifold System. Extensive combined thermal conductance (TCC) and cyclic mechanical tests being carried out in a dedicated test facility at ISQ laboratories in Portugal."

- **System Design and Mechanical Engineering** To provide effective technical support in system design and mechanical engineering topics, all group Members are “embedded” in the Project Teams and their contribution will be part of the Programs reporting. The last three SDME’s members still working under PF Coils will be progressively moved out PF Program in agreement with the fabrication progress to avoid any disruption.

Actually, three team members are working under the H&CD drive on the design of the Upper Launcher System and work is progressing well and with good collaboration with IO colleagues, and other four members are on other Projects related with Power lines and NB System. Four are deployed in the In Vessel Program and respectively two resources are allocated on Diagnostic and Cry Plant Program. One resource is actually working under the TBM Program.

Special mention deserves the fact that seven resources are assigned to RH Program taking care of the design development of such complex system.

- **New Engineering FWC:** The renewal of an Engineering Support Contract, providing services in a wide variety of engineering fields to most F4E Programmes and Projects was signed in early 2022, and around 100 Specific Contracts have already been signed. The contract, which is divided in two Lots, will have a duration of four years and a total ceiling of 36 M€’.



Figure 55: Picture taken during the Kick-Off Meeting of Framework Contract F4E-OMF-1159-01-01 with ATG Europe (02/03/2022)

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU.ES.01.8140	Contract signed for Engineering Support Contract LOT1	Q2 2022	WP22 objective	Achieved
EU.ES.01.8380	Contract signed for Engineering Support Contract LOT2	Q2 2022	WP22 objective	Achieved
EU.PM.4022095	Task Order Signed for TO 16 for Convention 4 for Real Convoys for Gendarmerie Services	Q2 2022	WP22 objective	Achieved
EU.PM.4022215	Task Order Signed for TO 17 for Convention 4 for Real Convoys for Gendarmerie Services	Q4 2022	WP22 objective	Achieved

Table 13: Engineering Unit Activities – Annual Objectives presented in the F4E Work Programme 2022

1.3.2 Transportation

This activity reflects the management, on F4E’s side, of technical aspects of the joint procurement with the ITER Organization for the transportation of ITER components to the site in Cadarache. The scope includes the transportation of large ITER components from all ITER Domestic Agencies, from the point of entry (the port of Marseille at Fos or Marseille’s Marignane Airport) to the ITER site as well as F4E technical support on transportation and logistics activities.

The main cost driver is transportation of Highly Exceptional Loads that follow the dedicated ITER itinerary. During 2022, this activity mainly covered transportation of non-EU loads and EU-loads between Fos and Cadarache (EU-leg): The third VV sector (from the Korean Domestic Agency) arrived successfully at the ITER site in April 2022, the heaviest HEL, according to these dimensions and weight ITER Itinerary was designed and tested. Also from Japan, one more TF Coil was delivered in March 2022. Two TF coils from Europe were transported to the site.

In order to transport the Highly Exceptional Loads in a safe manner, support from the French Gendarmerie is provided. Two Task Orders ordering for these services were timely signed in Q2 and Q4 2022.

In 2022, the focus was put on the optimisation of the staging area, this has led to a cost saving.

20 Conventional loads and 30 CEL were transported in this reporting period between maritime and airport and ITER site.

During 2022, loads were delivered successfully and on time; risks were mitigated; and opportunities used productively, thus resulting in significant cost-savings.



Figure 56: KO-DA VV sector during the Barge transfer from Fos sur mer to La Pointe harbour with the opening of the Martigues Bridge in March 2022 then transported during 4 nights to the ITER Site and arrived the 1st of April 2022. The picture captures the openin

Part II (a): Management

2.1 Major Developments

2022 has been a transitional year for the organisation, characterised by changes at the top management of the organisation and the subsequent appointment of two distinct Acting Directors, before a permanent Director was designated. While F4E staff and our industrial partners coped well with the Covid-19 pandemic and kept on delivering their contributions, some delays and difficulties were still going on.

Some highlights include:

- New Chairs and Members of its advisory Committees started in January 2022, ensuring the appropriate level of skills, experience, and leadership to fulfil the mandates of F4E's governing bodies.
- Following the untimely passing of an F4E colleague in 2021, and a preliminary enquiry by the GB, F4E launched a Change Agenda to safeguard the well-being of staff and ensure a fair distribution of workload within the organization. With the participation of a great number of volunteers amongst staff, the Change Agenda addresses 3 distinct pillars (Staff Wellbeing, Relations with Stakeholders, Internal Processes and Procedures)
- During 2022, special attention was given to the wellbeing and mental health of F4E staff. A health campaign *It's ok not to feel ok* was launched and a series of talks were provided to F4E staff on related topics such as burn-out, addictions or suicide prevention, while managers had the opportunity to attend a workshop on mental health. An external Personal Coach provided coaching sessions to staff members in need of personal and professional guidance after prior assessment by the Medical Advisor.
- In terms of the management of the final operational budget, the implementation has been 72% in commitments and 91% in payments. For administrative one it was 100% in commitments and 90,3% in payments.
- In 2022, F4E's Internal Audit Capability (IAC) performed two main assurance engagements on the Validation of User Access Rights in ABAC and in DACC, and on the management of digitalisation and Cyber-Security Management, giving rise to 17 new recommendations, of which 11 were accepted by the management, 6 were partially accepted or rejected.
- The assessment of the F4E's Internal Control System was conducted in line with the EC framework. All the components are operating together in an integrated manner. As a combination of deficiencies exists, it can be concluded that the system is partially effective. However, it has not been deemed necessary to include a reservation in the Director's Declaration of Assurance.
- We continue to make internal improvements at F4E and staff well-being had a renewed focus in 2022. Among a range of actions, we launched a campaign and implemented a number of actions stemming from a change agenda involving and engaging our staff. 96% of Corporate Actions foreseen and 87.3% of Internal Audit Actions were implemented.
- We signed 61 new contracts with industrial partners and laboratories for a total of €514m in 2022 bringing the total investment made by F4E into European industries and research organisations since 2007 to €6bn helping to create jobs and support innovation.

The implementation of multiannual and annual objectives set in SPD 2022-2026 is shown below.

Three multiannual objectives:

1/GB-IC milestones: There were 6 IC-GB milestones planned for 2022 out of which 2 were achieved.

GB/IC Reference	AREA	MILESTONE	AGREED QUARTER	STATUS
GB23	MAGNETS UNIT	TF Coil: Seventh EU TF Coil delivery to site	Q1 2022	Achieved
GB24/IC64	SITE, BUILDINGS AND POWER SUPPLIES PROJECT TEAM	Buildings: Medium Voltage distribution LC1A Ready for Equipment	Q4 2022	Not achieved
GB32	REMOTE HANDLING UNIT	Remote Handling: Task Order Signed for Manufacturing for Cask and Plug Remote Handling System (CPRHS)	Q3 2022	Not achieved
GB34/IC90.2	SITE, BUILDINGS AND POWER SUPPLIES PROJECT TEAM	Buildings: B71 North ready for IO Installation	Q2 2022	Achieved
GB57/IC90.1	SITE, BUILDINGS AND POWER SUPPLIES PROJECT TEAM	Buildings: Cryoline Bridge available for installation of systems	Q2 2022	Not achieved
GB58/IC91.1	SITE, BUILDINGS AND POWER SUPPLIES PROJECT TEAM	Buildings: Busbar Bridge available for installation of systems	Q4 2022	Not achieved

Table 14: GB-IC milestones

Milestone GB24/IC64: MV distribution LC1A RFE (TB13): TB13 contract was signed with an extremely aggressive schedule (in particular on the design and design review durations), following strong pressure from IO top management on the basis that TB13 scope was estimated to be on ITER critical path. Due to:

- additional duration in design reviews and qualification process (initial schedule for IO/F4E design review of electro-mechanical scope was not realistic, this is a lesson learned we will implement in future contracts)
- revised IO input data (PCRs providing updated electrical load lists)
- consequences of international context and raw material shortage

it was necessary to revise the RFE dates. Due to the slippage of IO assembly schedule, TB13 scope is no more on critical path and updated RFE dates (December 2025) were agreed with IO without impact on IO schedule, as per [IO- TB13 schedule workshop - April 2023 update \(8WUNJY v1.0\)](#)

Milestone GB32: As a result of the FP 2028 date discussions with the IO back in 2021/22 and the F4E exercise related to rescheduling based upon resource limitations an agreement was reached with IO Remote Handling to start the manufacturing in Q3 2023, i.e. GB32. This date is the current target following the FDR this year and current preparations for manufacturing under OMF-1034. To summarise in two bullets:

- There is an agreement with IO Remote Handling for manufacturing to start in Q3 2023.
- Current activities are aligned with achieving GB32 within this timeframe.

Milestone GB57/IC90.1: Cryoline bridge available for installation of systems (TB12):

Milestone achieved on 5th May 2023. Delay was due to:

- additional duration in design and design reviews
- consequences of international context and raw material shortage (cladding material in particular was delayed)

Milestone GB58/IC91.1: Busbar bridge available for installation of systems (TB12):

Delay was due to:

- additional duration in design reviews,
- high coactivity in this area (the busbar bridges erection was conditioned by the prior erection of Buildings 45/47 level 1 civil works by another contractor),
- consequences of international context and raw material shortage

2/Schedule Performance Index:

AREA	OBJECTIVE	PERFORMANCE
Schedule Performance Index	Schedule Performance Index above 0.95	0.94

Table 15: Schedule Performance Index

The multiannual Schedule Performance Index (SPI) encompasses short term and long term milestones. The non-achievement of this objective is partially due to delayed activities in VV and TB04 (resulting in TB04 re-structuring). As a consequence of the start of the re-baseline exercise, some other activities were delayed due to the changing IO need dates. The lack of F4E staff also impacted negatively the performance of this KPI.

3/Overall Costs:

AREA	OBJECTIVE	PERFORMANCE
Overall Costs	Cost estimation for ITER + Broader Approach for period up to 2027 should be less than the total budget available for this period.	Failed Budget/Cost=0.99

Table 16: Overall Costs

Due to the 7.5 % cut in the Multiannual Financial Framework (MFF) the cost estimation is higher than the Budget and the KPI therefore displays a value below the target of 1.

Annual objectives:

AREA	OBJECTIVE	PERFORMANCE
Schedule Performance Index	NEW! Annual M-SPI equal or above 0.7	0.57
Work Programme objectives	Implement 95% of Work Programme objectives [including GB milestones and predecessors] by end of the year	92%
Credit Allocation Scheme [CAS]	Reach 95% of achieved CAS by end of the year	98%
Quality	Reduce percentage of long aging NCRs compared to total number of open NCRs (KPI≤0.22).	0.28
Annual budget	Implement a 96% of Commitment Appropriations by end of the year	72%
Annual payment	Implement 96% of Payment Appropriations by end of the year	91%
Human Resources	Vacancy rate to be less than 4% by end of the year	3.78%

Table 17: Annual Objectives

Comments to table above:

- Schedule performance index: *F4E achieved 57% of the 361 milestones of the 2022 reference. When analysing the root-cause of delays, 71% was due to causes internal to F4E (i.e. including supplier performance) while 29% to external causes (i.e. IO or international situation).*
- Work Programme objectives: *F4E achieved 92% of the 60 Annual objectives set for 2022. When analysing the root-cause of delays, 40% was due to technical issues affecting manufacturing or qualification, 40% were due to delays during the procurement process and 10% to a change in procurement strategy*
- Quality: *In 2022, the NCR KPI measuring the percentage of long aging NCRs versus the number of open NCRs was 28%. This result is mainly affected by the NCRs coming from the following two programmes:*
 - *BIPS: at the end of 2022, BIPS has 276 open NCRs and 79 were long-aging (over one year). All these NCRs are known and followed up according to their own target date of closure, which is over 1 yearlong due to:*
 - *technical resolution reasons (for the majority of these NCRs),*
 - *or affecting other systems (PBS or CAD). These NCRs shall get the affected PBS users or CAR Unit feedback to proceed. The users are not in position to provide feedback yet due to the maturity of their system.*
 - *Vacuum Vessel: at the end of 2022, VV has 144 open NCRs and 64 were long aging (over one year). The quantity of long aging NCRs in VV is due to the lead time to proceed with welding defects repair actions and their necessary time to assess the repair effectiveness requesting specific qualified personnel (more specifically in Phased Array Ultrasonic Tests).*
- Annual budget & Annual payment: *The execution rate of F4E's final available budget stood at 72% in commitments and 91% in payments .*
- *The main factors impacting F4E's ability to execute it, were largely outside of its control and in particular:*

- *Reduction of Euratom's Cash Contribution to ITER IO from EUR 336.8 million included in the IO Draft Budget 2023 as approved by the 29th ITER Council in November 2021 versus EUR 224.4 million finally requested and committed (- **EUR 112.4 million** underexecution in commitments)*
- *Increase of Euratom's contribution to F4E's Operational Budget, whereby F4E was requested to absorb available appropriations coming from the European Fusion Research programme in commitment and payment appropriations (- **EUR 14.7 million** underexecution in commitments)*
- *Increase of the ITER Host State contribution corresponding to the balance due for the period 2007-2020 (- **EUR 14.95 million** in commitments)*
- *Successful negotiations with the ITER Organisation resulting in additional ex-post reimbursement of cost of changes associated with two Project Change Requests (PCR 698 and PCR 662) and one Task Agreement (Tokamak Crown) (- **EUR 60.5 million** underexecution in commitments and **EUR 58.5 million** underexecution in payments)*
- *Delays related to international situation, which caused additional - **EUR 30 million** of under-execution in commitments*

In 2022, in consultation with the Governing Board, F4E introduced a new SPI – Annual SPI in order to track schedule performance more transparently. As this measure does not differentiate between performance of F4E and IO as far as F4E scope is concerned, the values of Annual SPI are by definition lower than the measures previously used.

The Annual SPI was negatively affected by performance of ongoing contracts, in particular delayed VV activities, continued issues with TB04 scope, and timely availability of expected IO inputs. Additionally, many activities were delayed as a result of ongoing re-baselining exercise. Lack of F4E staff also impacted negatively value of this KPI.

The Work Programme KPI covers short term objectives that are listed in the annual Work Programme. The non-achievement of the 95% target is mainly due to delays related to suppliers, both during the procurement phase and the implementation phase of the contracts.

For Credit Allocation Scheme (CAS), the objective of reaching 95% of achieved CAS by end of the year has been achieved in 2022 (actual value is 98%).

2.2 Safety

2.2.1 Health and Safety

In line with the “Safety first” objective, the Health & Safety (H&S) Management System was tested and implemented through a complete set of defined and operational procedures and instructions in order to safeguard the occupational health of the staff members. Reporting, records, and necessary adjustments were concluded accordingly, with a stable and functioning Management System as a result.

All H&S documents are in line with Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (89/391/EEC).

Throughout 2022, an extensive work led to the approval of the risk assessments per category of staff. Based on the score risk, a series of preventive measures were identified, including training and procurement of Personal Protective Equipment (PPE), with the intention to reduce the risks at the working place at minimal level. When necessary, this PPE was delivered to the workplace (e.g. staff based in Rokkasho).

H&S trainings were organised to increase the awareness and improve the knowledge of F4E staff, reducing the risks in activities like works at height, works in nuclear restricted areas, activities in Beryllium workshops, electrical areas, ATEX zones, etc.

During 2022, special attention was given to the wellbeing and mental health of F4E staff. The health campaign *It's ok not to feel ok* was launched with the objective of ending with the mental health stigma within the organisation. Through Obertament, an external organisation specialised in the preparation and provision of mental health campaigns, a series of talks were provided to F4E staff and external collaborators. These talks tackled several mental health related topics such as burn-out, addictions or suicide prevention and had an average of 100 attendees. Besides, managers had the opportunity to attend a workshop on mental health.

An external Personal Coach provided coaching sessions to staff members in need of personal and professional guidance after prior assessment by the Medical Advisor.

Regarding the Medical Service, further improvements have been put in place to increase the number of medical check-ups performed. In this sense, the number of staff members who undertook the annual medical check-up went from 48% in 2021 to 73% in 2022. These check-ups now also include a psychosocial questionnaire to better identify and guide colleagues at risk of distress.

Following the COVID preventive actions taken in previous years, the H&S team and the Medical Adviser were directly involved in monitoring and issuing the preventive measures for combating the pandemic. In cooperation with the H&S Committee, a set of specific documents were updated whenever the local authority was issuing new rules, when there was a major variation in the COVID key indicators or when new restrictions in the transportation appeared.

2.2.2 Nuclear Safety

F4E, as a major contributor and the principal external "intervener" to the ITER Project, has the responsibility to design and build safe systems, buildings and equipment and, overall, to give to nuclear safety the attention it deserves by maintaining a high level of nuclear safety culture across the whole organization and its supply chain.

In this perspective, since 2021, the Nuclear Safety Unit has launched a series of actions to enhance the nuclear safety awareness across F4E. In 2022, a Nuclear Safety and Quality Assurance Week was organised in November, jointly with the QA Unit with a cumulative attendance of more than 1800 hours of trainings and talks by international safety and quality experts. With new issues in 2022, the nuclear safety bulletin launched in 2021 continues to bring to F4E staff the latest news and developments about nuclear safety. According to F4E Policy, training of F4E staff (PIA performers and other staff) and external collaborators continued in 2022. A new e-learning tool managed by UNED has been put in place to raise safety culture awareness among our external collaborators.

Following the signature in 2021 of a new framework contract with the objective to significantly increase nuclear safety support to the project teams, the NS Unit is supported in 2022 by six external Nuclear Safety Officers and one technical officer in charge of support and assistance. 3 new expert contracts were also signed.

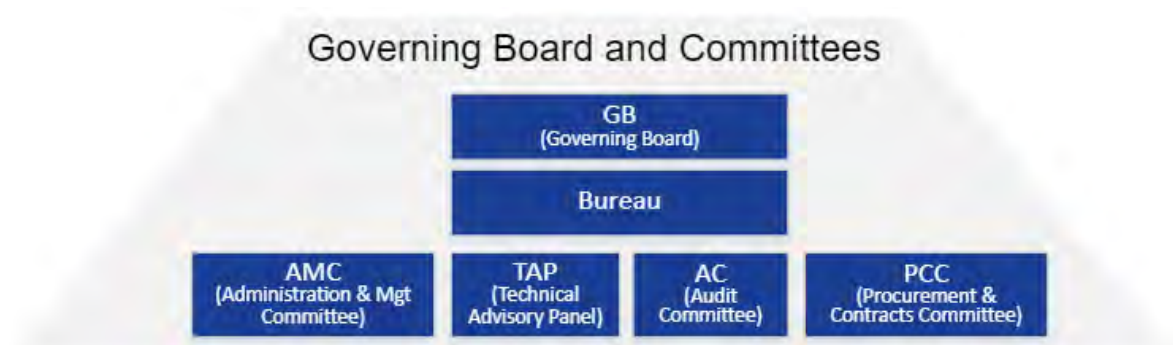
F4E's Nuclear Safety Unit main mission consists of supervising, implementing and ensuring the propagation of nuclear safety requirements into the supply chain and checking the final compliance of built and manufactured systems, structures and components to these requirements. It provides the relevant expertise and assistance to F4E's programs, and executes various controls during design and manufacturing phases. This year, the team performed eight nuclear safety inspections under a new NS inspection scheme (coordinator, procedure, training) that should allow to increase the number and quality of NS inspections. Inspection results have not shown any major discrepancy and tend to show a good trend in 2022.

The French Nuclear Safety Authority (ASN) also controls F4E activities: it conducted five inspections on the ITER site. None of them showed any major issue related to the F4E work.

In January 2022, ASN informed ITER Organization that the Assembly Hold Point would not be released and pointed out 4 technical topics for which a complementary technical report is required. A task force was created by ITER Organization with the participation of F4E. F4E was mainly involved in civil structure modelling with the support of ENGAGE and ESTEYCO (BIPS). F4E was also involved in the design review with the participation of experts from ITER-P (Office of Chief Engineering), ITER-D (Nuclear Analysis) and PM (Nuclear Safety Unit). In November 2022, IO DG decided to put on hold the submission of the self-supporting file and initiate a new strategy on Nuclear Safety.

2.3 Governing Board

The governance framework of F4E provides strategic orientation to the Joint Undertaking and ensures the supervision of its activities through the Governing Board (GB) – representing the Member States and Euratom – and a system of specialised Committees providing advice and preparing the decisions of the Board.



As the body responsible for the supervision of F4E in the implementation of its activities, the GB convened for a total of four meetings two ordinary and two extraordinary sessions, while the Bureau – its preparatory body which gathers Euratom, France, the Committees' Chairs and up to three GB members elected every two years by the Board – convened 9 times with the aim of reviewing key documents and propose recommendations on GB decisions.

The summaries of the meetings of the Governing Board are made public and accessible via F4E's website: <https://fusionforenergy.europa.eu/governance-committees/governing-board/>

In its statutory supervisory capacity, the GB paid close attention to the main technical, financial, and operational risks facing the ITER project, and accompanied the organisation in a period of transition marked by important organisational and leadership changes. F4E's governance has played a key role in ensuring continuity and stability, and has provided guidance to the management on a number of strategic dossiers through the close collaboration of the Bureau and the strong involvement of its members.

In June 2022, the Board appointed Pietro Barabaschi as interim Director and – following his subsequent nomination as Director General of ITER– appointed the Head of the ITER-Programme Jean-Marc Filhol as Director ad interim, until the selection of a new Director for a full-term is decided by the Board upon a shortlist of candidates proposed by Euratom following an open competition.

The main discussions held, and decisions taken by the Board in 2022 are outlined as follows:

Governance

Following the recommendation of the Bureau, the GB has decided to reinforce its strategic focus by holding annual meetings dedicated to forward-looking matters starting from 2023. Along these lines and building on the developments and lessons learned in the project, the GB decided to update

the Rules of Procedure of the Board and Committees to clarify their respective mandates and reflecting the GB's enhanced role in providing strategic orientation to F4E.

The GB appointed the Danish Representative, Morten Scharff, as member of the Administration and Management Committee. In addition, the GB appointed the Polish GB Representative, Ms Ewelina Majuk-Puzyńska, as a new Member of the Administration and Management Committee, for a term of four years starting on 1 January 2023.

The GB also extended by one year the mandate of the current members of the TAP and PCC members and approved the second renewal of Ms Tea Enting as a Member of the AC in accordance the updated mandates established in the above-mentioned amended Rules of Procedure.

Human Resources

The GB has been particularly attentive to the developments in the Human Resources domain, and supported F4E's management efforts aiming at improving the work environment, ensure the staff wellbeing and foster diversity and inclusion.

On the basis of the approval Action Plan in response to the 10th Annual Assessment, F4E continues to pursue gender-related actions to increase diversity among F4E staff and management that is supervised by the GB.

Project Management

The GB received regular updates in 2022 regarding the status of schedule, cost and risk related to the European contribution to ITER and Broader Approach. The GB welcomed the ongoing efforts to develop a proposal to improve the project management reporting to the governance, to be presented by F4E in 2023. The GB requested the AMC to review the proposed methodology for the measurement of schedule performance, including the new annual and multiannual targets and recommend a revised document for approval by the July 2023 GB.

Annual Assessments

The GB approved the action plan following the 2022 (10th) Annual Assessment of F4E and approved the Terms of Reference for the 2023 (11th) Annual Assessment, a yearly exercise mandated by the EU Council. For the 2023 Assessment, the Governing Board decided that it should focus on the assessment of the Buildings programme and requested to launch the exercise as soon as possible.

Project Planning and Budget

In 2022 the GB closely monitored the potential impact of the geopolitical and economic disruptions generated by the war in Ukraine and COVID-19 pandemic on F4E's activities. In particular, the GB obtained detailed information on the supply chain disruptions and ensuing cost increase of raw materials and manufacturing cost, and commended F4E for the prompt reporting and comprehensive set of mitigation measures put in place.

The GB approved in July 2022 the planning and key assumptions for the 2024-2028 Single Programming Document (SPD), approved the indicators for the 2023-2027 SPD and adopted the final 2023-2027 SPD in December 2022. The GB postponed the endorsement of the Draft SPD 2024-2028 and delegated this task to the Bureau, for a decision by the end of January 2023.

The Governing Board also adopted in July 2022 amendments to the 2022 Work Programme and Budget and in December the Budget for 2023. It noted that the high-level of unused appropriations must be reabsorbed according to an updated planning taking into consideration the future project's needs.

Annual Accounts and Audit matters

The GB approved the 2021 Annual Accounts of F4E and approved in December the 2023 Internal Audit Capability (IAC) Annual Plan, and requested that a revision of the plan is submitted to the GB in July 2023.

International Agreements

In December 2022, the Governing Board approved:

- The Cooperation agreement between F4E and École Polytechnique Fédérale de Lausanne (EPFL).
- A decision confirming the power of the Director to conclude arrangements on additional cash compensation with the ITER Organization modifying F4E- IO Procurement Arrangements.
- The Test Blanket Module (TBM) Arrangement between the ITER Organization, ITER Korea and F4E on the Helium Cooled Ceramic Pebble (HCCP) TBM System.
- The TBM Partnership Arrangement between ITER Korea and F4E.

Upon a delegation from the Governing Board, in November 2022 the AMC approved the following technical, non-strategic agreements:

- Agreement between F4E and IO concerning the TB04 novated scope.
- Arrangement between F4E and the IO for additional deployment of ANB Inspectors for the Vacuum Vessel Contract.
- Complementary Arrangement between F4E and IO on the payment for the Transfer of Scope for the Ion Cyclotron Antenna.

DONES

The GB welcomed the signature on 17 November 2022 of the Memorandum of Understanding between Croatia and Spain defining the Croatian contribution to DONES, noting the strong interest expressed by the scientific community of several Members, and requested F4E to prepare a work programme on the specific involvement of F4E in the DONES Program in view of the July 2023 ordinary GB.

2.4 Budgetary and Financial Management

This section gives information on the establishment of 2022 Budget, its evolution and its implementation. More details are available in the 2022 Annual Accounts and in the 2021 Budgetary and Financial Management Report.

2.4.1 Establishment of the 2022 Budget

F4E 2022 budget was originally adopted by F4E's Governing Board (GB) for the amount of EUR 854.49 million in commitment appropriations and EUR 845.45 million in payment appropriations. It was modified in two amendments in the GB meetings of July and December 2022.

The final available appropriations, including the carry-over from the previous year were EUR 981.18 million in commitment appropriations and EUR 844.02 million in payment appropriations.

2.4.2 Budget 2022 in Revenue (Payments): Contributions

The distribution of the 2022 revenue ensures a fair balance between contributors to the F4E budget, in line with their proportional participation during the overall period of ITER construction².

The final available appropriations, including the carry-over from the previous year amount to EUR 844.02 million.

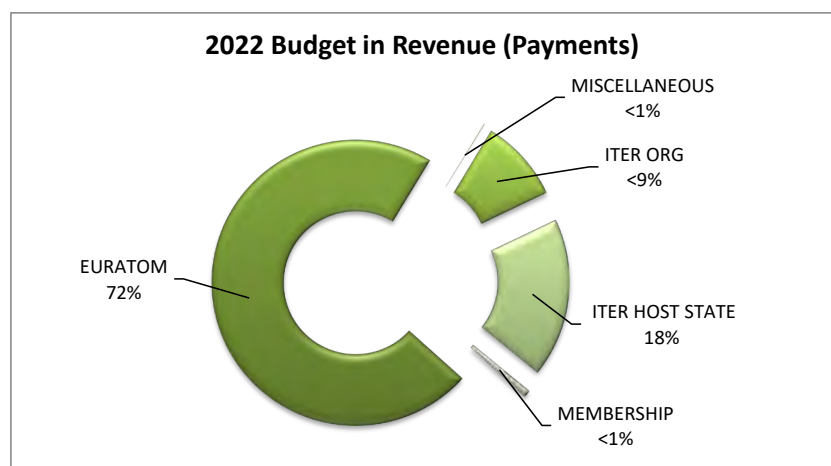


Figure 57: 2022 revenue (Payment)

² Detailed figures are presented in Annex IV. b. Evolution of Expenditure in Payments for the 2022 Budget

2.4.3 Budget 2022: Implementation

Commitments	72% execution of the final available budget	Final Budget: 981.18	Execution: 703.98	EUR million
	82% compared to the original budget	Original Budget: 854.49	Execution: 703.98	EUR million
	77% without additional revenue from ITER IO	Standard Budget: 887.74	Execution: 679.93	EUR million
	99% in individual commitments	Execution: 703.98	Ind. Commit: 695.85	EUR million
Payments	91% execution of the final available budget	Final Budget: 844.02	Execution: 765.72	EUR million
	91% compared to the original budget	Original Budget: 845.45	Execution: 765.72	EUR million
	99% without additional revenue from ITER IO	Standard Budget: 760.73	Execution: 749.89	EUR million

Figure 58: Implementation in Commitments and Payments

2.4.3.1 Implementation of the 2022 Administrative Expenditure

The administrative budget increased from the original amount of EUR 66 million to final appropriations of EUR 76.6 million. The F4E Director approved a series of transfers resulting in an increase of the administrative budget amounting in total of EUR 10.6 million. Those transfers allowed to adjust the detailed allocation to the evolution of the needs, in particular to cover the employer's pension contributions.

The administrative budget was fully executed in commitments, while the execution in payments was 94% for Staff Expenditure (Title 1) and 69% for Infrastructure and Operating Expenditure (Title 2). The main factor causing the lower execution of administrative payment budget was due to the pension contributions for the year 2022 paid in the year 2023 as the final amount of the non-Euratom revenue was not known, and due to natural delay of paying part of the 2022 commitments of administrative nature in the year 2023.

2.4.3.2 Implementation of the 2022 Operational Commitments

The Statement of Expenditure³ for operational commitments was amended in December 2022 by F4E Governing Board in order to align the operational budget in commitment appropriations with the evolution of the Statement of Revenue and with the successive amendments to the 2022 Work Programme. The final execution of the budget was 72%, of which 99% in individual commitments. Four on-going procurement procedures have been globally committed, amounting in total to EUR 8.13 million.

³ Detailed figures presented in Annex IV. a. Evolution of Expenditure in Commitments for the 2022 Budget

2.4.3.3 Implementation of the 2022 Operational Payments

Title 3 – Operational expenditure⁴ was amended by F4E Governing Board in December 2022 too, in order to align the operational payments with the changes in the Statement of Revenue. In accordance with Article 26 of F4E Financial Regulation, the F4E Director adopted a series of transfers within the Title 3 to cover the operational needs on each chapter at the year-end and to ensure the best possible implementation.

Title 4 – Earmarked expenditure, the appropriations from the ITER Host State contribution (France), have been allocated entirely to the domain of ITER construction in full, and were modified in 2022 to reflect 14.95 increase due to financial closure of the previous period. The appropriations received from ITER Organization covered tasks implemented by F4E on ITER Organization request, including extraordinary revenue received because of successful negotiation on the ex-post recognition of cost of PCRs. The other earmarked expenditure were related the call for funds to Japan.

The final implementation rate for all operational payments was 91% by the end of 2022. The non-execution is mainly due to extraordinary assigned revenue cashed from ITER IO as a result of the negotiations referred to above. Without considering the extraordinary assigned revenue, the final implementation is 99%. The amounts not spent on Title 3 were cancelled and those on Title 4 automatically carried over to the budget 2023.

2.4.4 Impact of the 2022 Budget in Commitment

2.4.4.1 Main Commitments

The main operational commitments for the 2022 budget representing EUR 444.37M or 71% of the executed operational budget (EUR 627.3M) were:

- EUR 224 million for the in-cash contribution to the ITER Organization
- EUR 45.47 million for the Architect Engineer Service contract (Buildings)
- EUR 40.18 million for the preparation of the production line and pre-series IVTS and the manufacturing, testing and supply of 10 series IVTS
- EUR 39.87 million for TB04 (Mechanical and Electrical Services)
- EUR 36.38 million for the completion of the tokamak complex doors
- EUR 25.38 million for amendment of the vacuum vessel contract
- EUR 18.11 million for the TB12 design (Site Infrastructure Works)
- EUR 14.67 million for the emergency electrical power distribution

The balance to the executed budget for Title 3 and 4 consisted of 534 commitments for smaller contracts, amounting in total to EUR 182.94 million.

⁴ Detailed figures presented in Annex IV. b. Evolution of Expenditure in Payments for the 2022 Budget

2.4.4.2 Actions Carried Forward to 2022

The F4E obligations amount to EUR 1 273.92 million at the closure of the 2022 budget. It corresponds to the total amount left over on open budgetary commitments, as detailed below:

2022 budget Heading	(EUR)				
	from previous years (1)	from 2022 budget (2)	Total (3)=(1)+(2)	To be de-committed (4)	Net Total (5)=(3)-(4)
TITLE 1 - STAFF EXPENDITURE	0.00	3 633 084.35	3 633 084.35	0.00	3 633 084.35
TITLE 2 - INFRASTRUCTURE AND OPERATING EXPENDITURE	0.00	3 292 985.20	3 292 985.20	0.00	3 292 985.20
Total TITLE 1 & 2	0.00	6 926 069.55	6 926 069.55	0.00	6 926 069.55
B31 - ITER CONSTRUCTION INCLUDING SITE PREPARATION	626 345 854.47	282 819 632.96	909 165 487.43	42 508.50	909 122 978.93
B32 - TECHNOLOGY FOR ITER AND DEMO	3 221 202.84	3 150 665.25	6 371 868.09	0.00	6 371 868.09
B33 - TECHNOLOGY FOR BROADER APPROACH	10 113 912.38	13 162 242.79	23 276 155.17	0.00	23 276 155.17
B35 - EXTERNAL SUPPORT ACTIVITIES	10 017 494.51	24 631 167.93	34 648 662.44	0.00	34 648 662.44
B36 - OTHER OPERATIONAL EXPENDITURE	0.00	3 087 927.93	3 087 927.93	0.00	3 087 927.93
Total TITLE 3	649 698 464.20	326 851 636.86	976 550 101.06	42 508.50	976 507 592.56
B41 - ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	201 625 326.35	65 556 047.00	267 181 373.35	0.00	267 181 373.35
B42 - ACTIVITIES LINKED TO ITER ORGANIZATION	9 974 916.70	13 326 163.82	23 301 080.52	0.00	23 301 080.52
B43 - OTHER EARMARKED EXPENDITURE	0.00	0.00	0.00	0.00	0.00
Total TITLE 4	211 600 243.05	78 882 210.82	290 482 453.87	0.00	290 482 453.87
Total TITLE 3 & 4	861 298 707.25	405 733 847.68	1 267 032 554.93	42 508.50	1 266 990 046.43
Total	861 298 707.25	412 659 917.23	1 273 958 624.48	42 508.50	1 273 916 115.98

Table 18: Open budgetary commitments at the closure of F4E's 2022 Budget

The total amount of open commitments has decreased by EUR 257.34 million in 2022 compared to the end of 2021.

Notes:

- **Title 1 and 2:** Administrative expenditure carried forward from 2021 and not paid were cancelled;
 - **Title 1:** There was no leftover on the 2021 commitments related to direct staff cost, normally cancelled at the end of the current year. The balance as shown in the table above corresponds to other expenses linked to staff: pension contributions, missions, interim staff, schooling, training, etc. for which the commitments are carried over for one year;
 - **Title 2:** The commitments that are carried over should be consumed at the latest by 31 December of the following year;
- **Title 3 and 4:** The open operational commitments are carried over to the following year with no limitation in time, to be paid according to the advancement of the contracts.
- Four on-going procurement procedures have been globally committed on the budget 2022, amounting in total to EUR 8.1 million.

2.4.4.3 Action Extending for More than One Financial Year

The entire operational budget of F4E consists of differentiated appropriations. About 1223 open commitments positions from the 2022 budget, amounting to EUR 1.208 million, cover actions extending for more than one financial year (final date of implementation after 31 December 2023).

2.4.5 Interest Charged by Suppliers through Late Payments

During 2022, F4E has processed 2961 payment transactions (excluding salaries). Payments of invoices falling under Title 3 and Title 4 (operational expenditure) represent a decrease by 5 % in 2022 (2628 payments) compared to 2021 (2768 payments).

F4E paid EUR 5 856 of late interests in 2022.

2.4.6 Procurement Procedures in 2022

In line with the focus that F4E has on the achievement of ITER First Plasma, procurement procedures continued in 2022 to further progress, with focus on the production of the systems and components part of the EU in-kind obligation.

During 2022, 29 operational procedures were launched, 34 operational procurement procedures were awarded (including multiple lots) and 47 operational contracts were signed (direct and framework), for a total value of around 495 million euro, covering strategic areas such as Heating Systems (Electron Cyclotron Heating), Diagnostics and In Vessel (Divertor).

Of the 34 operational procedures awarded, 7 were awarded following a Negotiated Procedure for a total awarded value of 2 million euro, 12 following an Open Procedure representing 70 million euro, 14 following a Competitive Procedure with Negotiation amounting to 899 million euro, and 1 following a Competitive Dialogue with an awarded value of 36 million euro. No Restricted Procedures have been concluded by F4E during 2022.

For what concerns administrative expenditure, 9 administrative procurement procedures were launched, and 14 contracts were signed (direct and framework), for a total value of 18 million euro.

In 2022 no grant was launched or signed.

In the same period F4E also held the Chairmanship of NAPO (Network of Agencies Procurement Officers) and progressed with the implementation of the Key Account Managers to improve the contract management relationships with its main Contractors.

2.4.6.1 Type of Operational Procurement Procedures

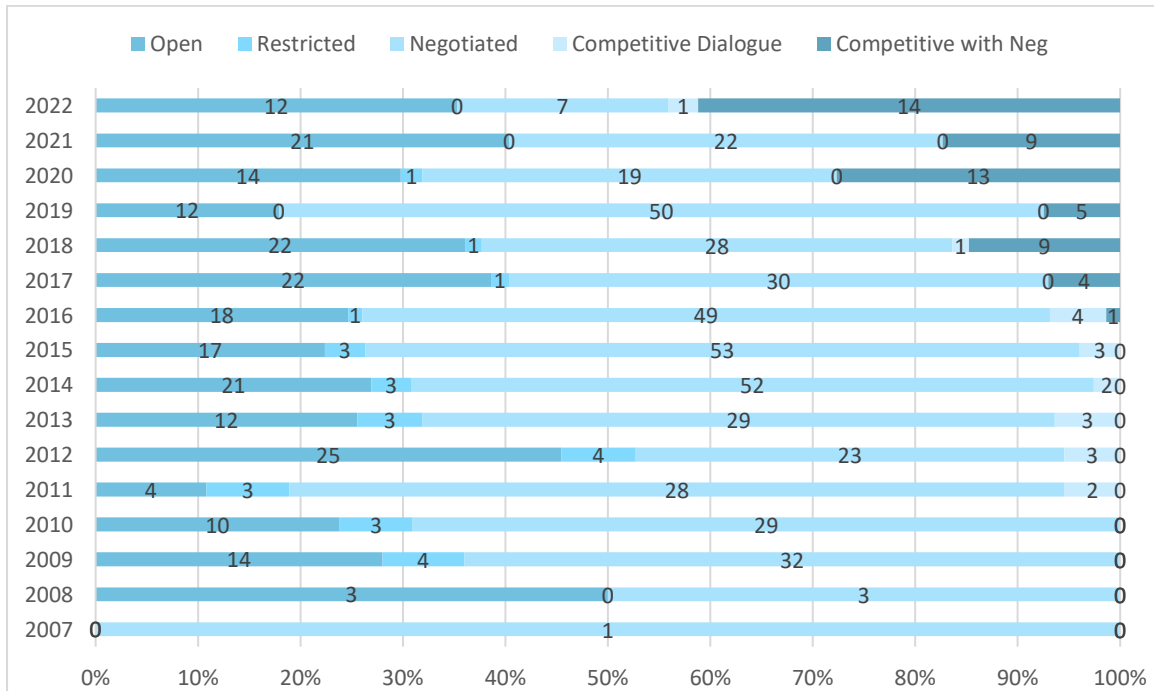


Figure 59: Number of operational procedures (LOT level) awarded by type of procurement procedure

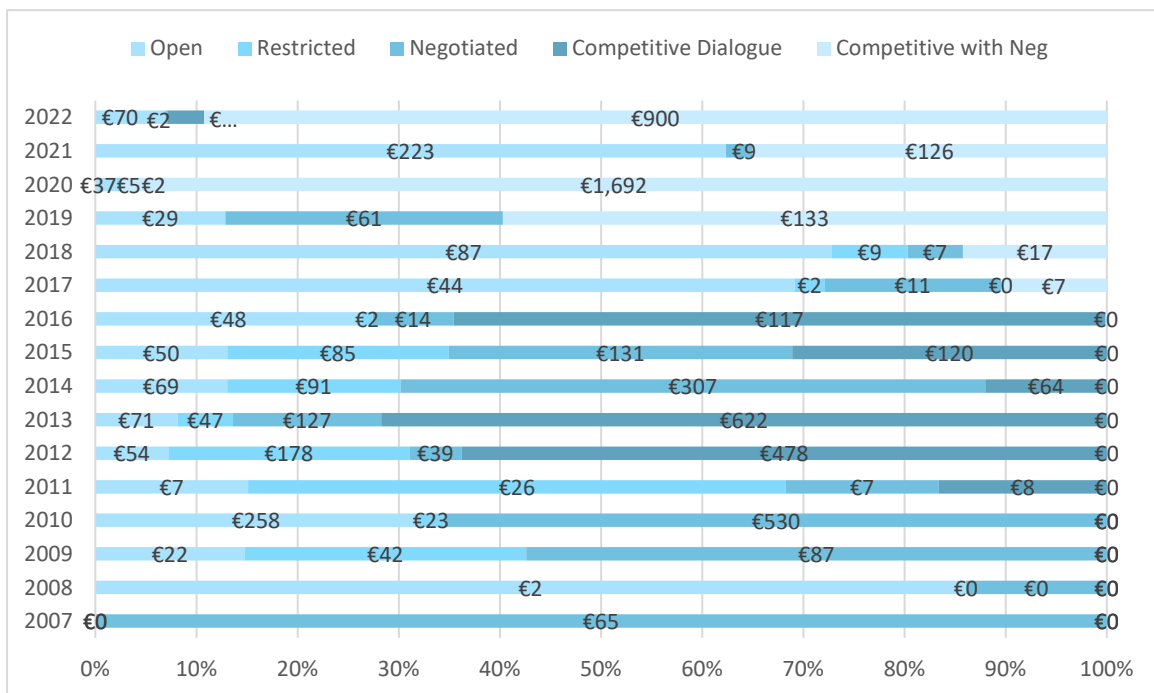


Figure 60: Value of operational procedures (LOT level) awarded by type of procurement procedure (€ million)

2.4.7 Budget Evolution for 2008-2022

The graphs below show the evolution of available F4E budgets in commitment and payment appropriations and their final execution since F4E financial autonomy in 2008.

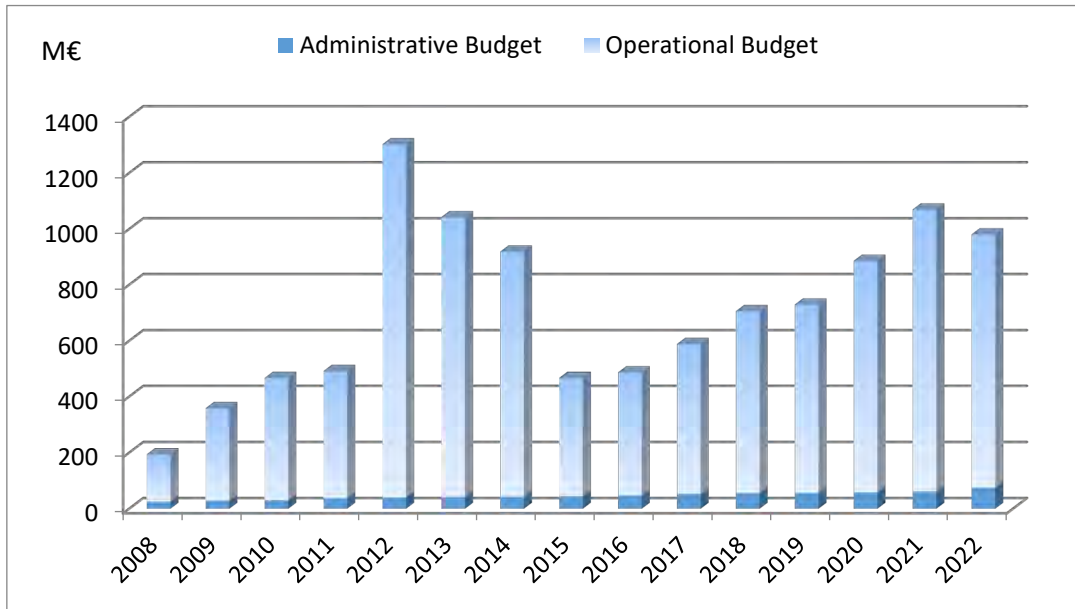


Figure 61: Budget evolution in commitment appropriations for 2008 – 2022

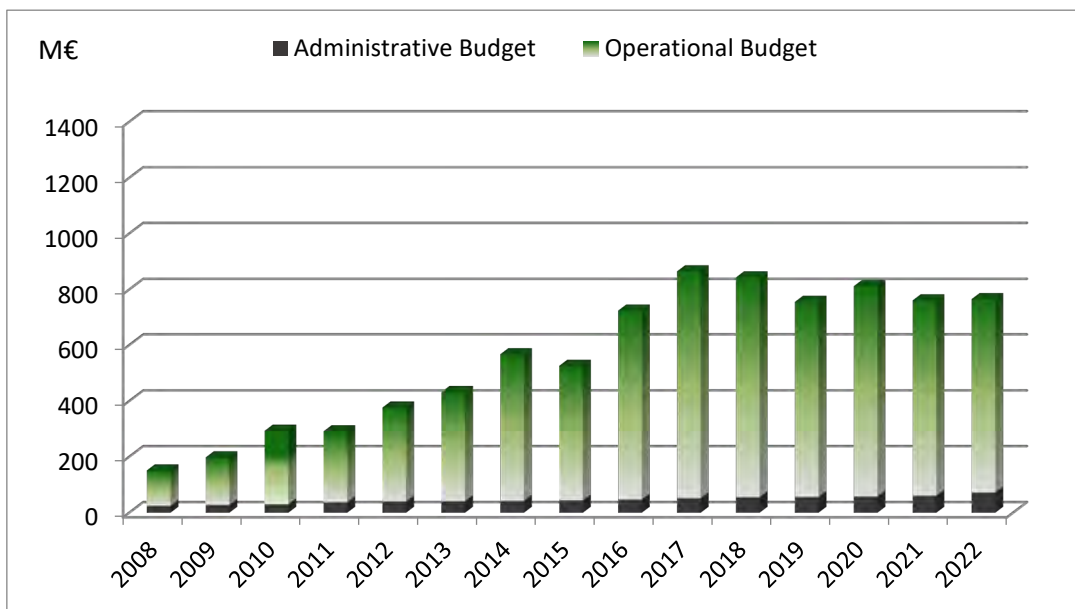


Figure 62: Budget evolution in payment appropriations for 2008 - 2022

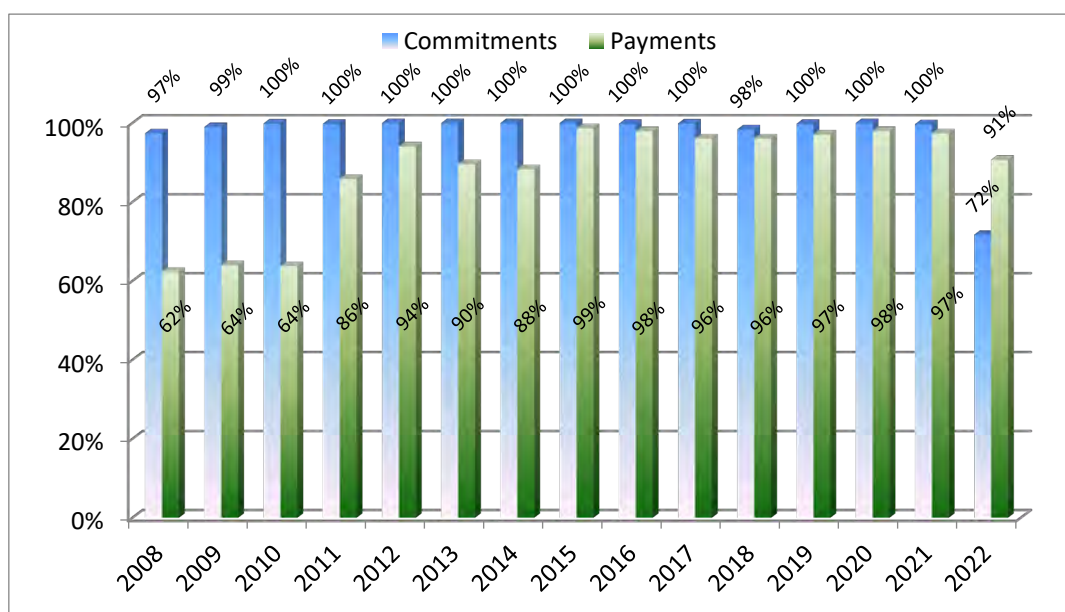


Figure 63: Evolution of Budget Execution for 2008 – 2022

2.4.8 Budget Implementation Tasks Entrusted to Other Services and Entities

There are no F4E activities delegated to other European Institutions or Bodies.

2.4.9 Cost of Controls

F4E has continued to apply the methodology endorsed by the Improvement Steering Committee in 2018, due to the continuity of the same organisational structure. A consultation exercise with the Heads of Department confirmed the implementation of this approach for 2022. The percentage distribution was updated to reflect some minor changes.

All F4E activities remain grouped into four main categories: (1) Operational Control, (2) Internal Control, (3) Governance and (4) Support. Of these four categories, the two first ones, (1) Operational Control and (2) Internal Control, are considered as being control activities. Based on the guidelines of the Commission a detailed list of activities has been included for each of the four main categories.

The result of this calculation is that out of the 433 staff members at F4E, 82% (356 FTEs) spend their time in control activities (Operational Control and Internal Control). The cost of these FTEs dedicated to control activities was calculated by using a pro rata of the number of staff by category (Administrator, Assistant, Contractual Agent FG-IV and the rest of contractual agents) and using the yearly costs per category as indicated by the Commission. The result of this calculation is that the 356 FTEs dedicated to control activities at F4E have an estimated cost of 40,479,363 EUR.

In addition to this, F4E made an estimation of the cost of External Service Providers (ESPs) supporting F4E in internal and operational control activities. These are defined as services contracted by F4E with a service provider to support F4E in carrying out its core technical tasks at F4E premises or remotely upon F4Es request. The amount of these services for 2022 is 20,207,201 EUR.

Finally, F4E also calculated the payments made on contracts for audit services, inspection and adjudicators, which resulted in a total of 5,335,777 EUR.

As a conclusion and based on the principles provided by the Commission for the calculation of the Cost of Control activities, the value for F4E in 2022 is 66,022,340 EUR representing 9% of the 2022 executed budget in commitment appropriations (704M EUR) and 9% of the 2022 executed budget in payment appropriations (766M EUR).

2.5 Delegation and sub-delegation

Delegations and sub-delegations in 2022 followed the organisational structure, with a clear segregation between administrative and operational project management, empowering staff members within their areas of responsibility. During 2022, there were 105 authorising officers in F4E (11 Authorising Officers by Delegation, 29 Authorising Officers by Sub-Delegation and 65 Authorising Officers by Sub-Delegation level 2).

Each staff member who received a (sub)-delegation for the implementation of the 2022 budget provided his/her individual 'Declaration of Assurance' for the budgetary area for which they were responsible. None of these contained a reservation nor raised any issue of significance that may have an impact on the F4E Director's Declaration of Assurance.

Notwithstanding this, one observation has been included in the F4E Director's Declaration of Assurance to draw the attention of the reader to the most significant operational risks F4E is addressing at corporate level. It relates to those risks that may lead to cost increases and schedule delays, which are inherent to the magnitude and complexity of the ITER in-kind delivery project.

The declarations of assurance of the different authorising officers, together with the reports from the different assurance functions form the basis for the "Declaration of Assurance" of the F4E Director (see Part V).

2.6 People & Culture (HR) Management

2.6.1 People & Culture and F4E’s change agenda

F4E’s Change Agenda – the journey of transformation based on reflection, discussions and concrete actions to make F4E a better place to work – is structured around three areas of focus which are included in the 2022 Corporate Objectives, namely Pillar 1 "We value our People"; Pillar 2 "We have strong stakeholder relations"; and Pillar 3: "Our processes and structure are simple and aligned".

The change of name from Human Resources (HR) to People & Culture in 2021 was a signal of our ambition to do things for and with staff rather than to staff. In addition, the responsibility for health and wellbeing was transferred to F4E’s Health and Corporate Services Unit, for greater coherence and focus. During the year a lot of effort has gone into aligning the work of HR with the objectives of the Change Agenda. The sections that follow feature the main examples of what this has involved.

2.6.2 Major HR Developments

As of 31 December 2022, the occupied staff posts at F4E included 46 Officials, 224 Temporary Agents and 164 Contract Agents. In addition, F4E relied on the support of 12.5 interim staff (in FTE) and three Seconded National Experts. The staff evolution at the end of the year can be seen in the following table:

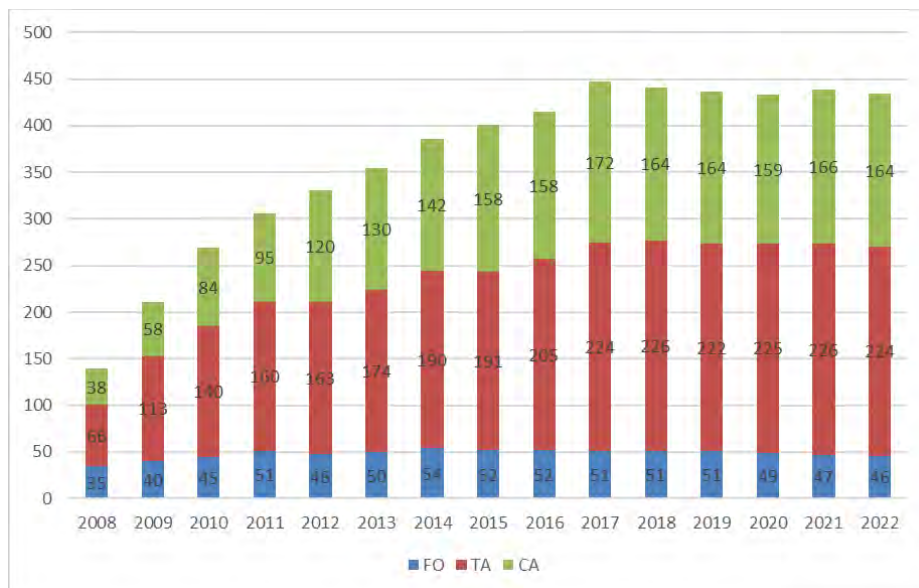


Figure 64: Staff evolution from 2008 to 2022 where FO stands for Officials, TA for Temporary Agents and CA for Contract Agents.

A total of 11 newcomers (six Temporary Agents and four Contract Agents and one Seconded National Expert) took up duties in 2022. In addition, four staff members (all Contract Agents) became Temporary Agents on the basis of selection procedures. The following table shows those figures distributed by type of contract, category and department:

DEPARTMENT	FO	CA FGIII	CA FGIV	TA AD	SNE
ADMINISTRATION DEPARTMENT	-		2		
BROADER APPROACH PROGRAMME & DELIVERY DEPARTMENT	-				1
COMMERCIAL DEPARTMENT	-			1	
DIRECTOR	-	1		1	
ITER DELIVERY DEPARTMENT	-			3	
ITER PROGRAMME DEPARTMENT	-	1		1	
Grand Total		2	2	6	1

Table 19: Recruitments distributed by type of contract, category and department

Changes to the Establishment Plan during 2022

The changes consisted in the conversion of one FO AD post into one TA AD following the departure of one official in 2021 and in line with the F4E Policy to replace vacant FO positions by TA ones.. Additionally, the conversion of five short-term AD posts into AST made in FIFI 2022 / SPD 2022, to align with actual allocation of posts.

Learning & Development/Career Development

F4E's Learning & Development (L&D) function continued to offer a diverse blended learning offer suitable for the current hybrid working conditions. This includes a large variety of online and digital resources giving increased flexibility and the freedom to learn when desired and needed. With the objective of offering F4E staff innovative learning initiatives, several initiatives to facilitate access and encourage engagement to learning were set up, for example: curated learning collections, bite-sized learning materials gathered from different channels, peer-to-peer collaborative learning and knowledge sharing activities.

A total of 95% of F4E staff members enrolled to at least one learning activity during 2022 (compared to 94% in 2021). The rate of satisfaction from F4E staff concerning internal L&D activities was high – 91% of F4E staff rated them either excellent or good (an increase from 88% in 2021).

L&D continued to support F4E's corporate priorities, and the focus during 2022 was on raising awareness and building a more respectful work environment. This was primarily done by ensuring that all staff members attended the compliance training on Prevention of Harassment and offering the possibility to go further and join Active Bystander Intervention courses.

Learning is also contributing to diversity, equity and inclusion and several initiatives took place to raise awareness on this area and bring further clarity to staff members. This included L&D initiatives such as learning collections on diversity, the International Women's and Men's Days, unconscious bias or imposter syndrome. It is also amongst F4E's priorities to support women's professional development and exposure. In this context, F4E sponsored the attendance of a select group of women to attend a conference on Women in Project Management. After the conference took place, the group of participants shared within F4E the main elements that they had learnt, thus increasing the organisation's knowledge-sharing internal capability.

Leadership development was also a priority during 2022. Several courses were organised with the aim of reinforcing authentic leadership and a leadership culture based on self-awareness, stress management and resilience within the teams, understanding how bias affects decision-making and managing performance. To further revamp the training offer, the design of a new leadership programme was finalised. The implementation of this new programme is foreseen to take place during 2023.

Launch of HR Management e-tools SysPer and PeopleEx

In line with the further development of digitalised solutions, People & Culture introduced SysPer, the Commission's integrated HR management platform. People & Culture will continue operating some pre-existing in-house software solutions, but SysPer has provided staff with a better all-round user experience for routine administrative tasks and is expected to yield a number of efficiency gains over time.

In addition, the online portal PeopleEx was launched to offer staff a one-stop consolidated, HR information point with instant and easy-to-access to support and information to all their queries, whilst at the same time enabling an optimisation of resources within the People & Culture Unit.

People & Culture led the set-up of both SysPer and PeopleEx by working with F4E's Digital Transformation Unit. Both projects also involved communicating the new system and its workings to F4E Staff and ensuring data protection continued to be upheld.

Traineeship Programme

The People & Culture Unit launched a new F4E traineeship programme in June 2022. The new programme provides for longer traineeships, i.e. between six and twelve months, with the possibility of renewal and, when renewed, for a higher remuneration. Against the backdrop of the on-going war, applications from Ukrainian nationals were accepted in addition to European candidates. The programme also aimed at attracting more young female candidates into STEM positions within F4E. The main profiles sought by the F4E Units were primarily within the fields of Engineering, Economics but equally in the field of Law, Human Resources and Communication.

Between October and November 2022, 30 trainees joined F4E – all but one signed for a one-year contract. A number of induction sessions and documentary resources were offered to maximise their trainee onboarding experience. Trainees were mainly assigned to the F4E Barcelona Headquarters, while one trainee was assigned to F4E Cadarache and two to F4E Garching. Most trainees were assigned to the Project Management, ITER Delivery, Commercial and Administration Departments, while two trainees were assigned to the Broader Approach Department, and one in the Office of the Director.

The gender balance amongst the trainees has improved compared to previous years: 60% are female, and the rest are male. In STEM positions, there are 53% female trainees.

People Matters Newsletter

In an on-going effort to enhance internal communication, the collaboration to produce the internal newsletter, People Matters, was heightened amongst all Administration Units while People & Culture retained ownership of the final product. Through the Internal Communication Board (ICB), the upcoming newsletters topics were presented, and F4E's Communication Team coordinated the

input from the representatives of the other services. The informal feedback received has been very positive and a total of three editions were issued in 2022.

Confidential Counsellors Network

As part of the sustainability agenda, the Confidential Counsellors Network underwent a revamp during 2022. In addition to new members joining in late 2021, a new Coordinator joined and the work with the external psychologist was strengthened.

Targeted efforts were carried out in terms of communication towards F4E Staff: a video explaining the work of the Confidential Counsellors and the support which is available to staff was produced. In addition, personal interviews with Confidential Counsellors were published and interactive exchanges between Confidential Counsellors and staff on F4E social media informed and engaged staff. Regular updates on the work of the Network were provided in the quarterly F4E internal newsletter, People Matters. The support of the Confidential Counsellors and their availability to F4E Staff was highlighted at several trainings related to the prevention of harassment and how to be an active bystander. In addition, the Network sought to establish solid relationships and collaboration with other F4E actors active in the area of respect and dignity such as the Ethics Officer, the HR Business Partners, the Medical Advisor and the Health and Corporate Services Unit (HCSU), as well as F4E's Staff Committee. Finally, the Network joined the EU Agencies Task Force on the use of Confidential Counsellors and the work is ongoing on this project.

Flexitime Data

The number of authorised days of leave under the flexitime scheme is provided in Annex VI d. Flexitime Scheme in 2022. The table shows the number of days recuperated per type of contract category and grade as well as the additional hours worked. On average, in 2022, 26% of the additional hours declared by the staff members was recuperated. While the recuperated overtime represents 7.4 FTE, the non-recuperated overtime amounts to 21 FTE.

Diversity

In 2022, F4E continued its journey of striving for a working environment where diversity and inclusion play an important role.

F4E promoted diversity and inclusion which, among other things, included celebrating key dates such as the International Women's and Men's Day, the International Day of Persons with Disabilities and the Pride Month. F4E also commemorated the Diversity Month in May by organising different actions, including internal talks and awareness campaigns.

Other steps forward in developing concrete measures for equality include keeping colleagues informed of the extensive (and growing) learning collection on diversity to help understanding the issues behind that concept, campaigns on mental health awareness and a video clip of F4E's Presidency of the EU Agencies Network (EUAN) highlighting "United in Diversity". In addition, the establishment of the F4E Women's Network resulted in F4E – amongst 49 other EU Agencies – being awarded the 2022 EUAN award for promoting Diversity & Inclusion.

As part of the Strategy for the Rights of Persons with Disabilities 2021-2030, the European Commission called all EU Institutions, Bodies and Agencies to designate disability coordinators. F4E replied positively to this call and a disability coordinator was appointed this year by F4E's Health and Corporate Services Unit.

While chairing the EU Agencies Network, F4E has also been working closely with the Diversity & Inclusion Interagency Working Group – for example on projects such as co-organising a Women’s Day EUAN Talk and actions during the Diversity Month.

Gender balance: Gender imbalance has slightly improved, reaching a distribution of 62% male and 38% female in F4E’s workforce.

As per the corporate goal to reach 35% of Senior Management and 45% of Middle Management positions filled by women by the end of 2025, progress has been recorded as shown in the tables below. While we are grateful for the improvement, F4E cannot be complacent further efforts are underway towards reinforcing the measures adopted to reach the targets set.

Gender / Category	CA		FO		TA		Grand Total	
	Staff	%	Staff	%	Staff	%	Staff	%
Female	89	54.3%	19	41.3%	57	25.4%	165	38.0%
AD	N/A		11	23.9%	47	21.0%	58	13.4%
AST	N/A		8	17.4%	10	4.5%	18	4.1%
GFII	11		N/A				11	2.5%
GFIII	46	54.3%	N/A				46	10.6%
GFIV	32		N/A				32	7.4%
Male	67	40.9%	27	58.7%	167	74.6%	269	62.0%
AD	N/A		22	47.8%	146	65.2%	168	38.7%
AST	N/A		5	10.9%	21	9.4%	26	6.0%
GFII	2		N/A				2	0.5%
GFIII	7	45.7%	N/A				7	1.6%
GFIV	66		N/A				66	15.2%
Grand Total	164	100.0%	46	100.0%	224	100.0%	434	100.0%

Table 20: Gender balance on 31 December 2022

	2015		2019		2020		2021		2022	
	Number	%	Number	%	Number	%	Number	%	Number	%
Female Senior Managers	0	0	0	0	1	14%	1	14%	1	25%
Male Senior Managers	3	100%	7	100%	6	86%	6	86%	3	75%
Total	3		7		7		7		4	
Female Middle Managers	2	8%	4	16%	4	16%	5	20%	5	19%
Male Middle Managers	22	92%	21	84%	21	84%	20	80%	22	81%
Total	24		25		25		25		27	

Table 21: Gender balance within Senior and Middle Management on 31 December 2022

The represented nationalities at F4E are in line with the observed phenomenon in all agencies - it does not condone our situation, nevertheless it indicates something more systemic, all agencies are very well aware of.

Geographical balance: F4E endeavours to have a balanced geographical balance. Nevertheless, this is highly dependent on the nationality of applicants to the vacancies or calls for expression of interest. In this respect, the strong representation of Spanish nationals (35%) reflects the location of the F4E Headquarters in Spain. They are followed by Italian nationals (18%) and French nationals (20%).

Nationality	AD + CA FGIV		AST + CA FGII/FGIII		TOTAL	
	Number of staff	% of total staff in AD and FGIV categories	Number of staff	% of total staff in AST and FGII&FGIII categories	Number of staff	% of total staff
Belgium	7	2.2%	10	9.1%	17	3.9%
Bulgaria	5	1.5%	1	0.9%	6	1.4%
Croatia	1	0.3%		0.0%	1	0.2%
Czechia	2	0.6%	2	1.8%	4	0.9%
Estonia	1	0.3%		0.0%	1	0.2%
Finland	3	0.9%	1	0.9%	4	0.9%
France	66	20.4%	19	17.3%	85	19.6%
Germany	8	2.5%	6	5.5%	14	3.2%
Greece	6	1.9%	3	2.7%	9	2.1%
Hungary	6	1.9%		0.0%	6	1.4%
Ireland	5	1.5%	3	2.7%	8	1.8%
Italy	59	18.2%	19	17.3%	78	18.0%
Lithuania		0.0%	3	2.7%	3	0.7%
Malta	1	0.3%		0.0%	1	0.2%
Netherlands	4	1.2%		0.0%	4	0.9%
Poland	5	1.5%		0.0%	5	1.2%
Portugal	10	3.1%	1	0.9%	11	2.5%
Romania	9	2.8%	1	0.9%	10	2.3%
Slovakia	1	0.3%		0.0%	1	0.2%
Spain	113	34.9%	37	33.6%	150	34.6%
Sweden	4	1.2%		0.0%	4	0.9%
United Kingdm	8	2.5%	4	3.6%	12	2.8%
TOTAL	324	100.0%	110	100.0%	434	100.0%

Table 22: Geographical balance on 31 December 2022

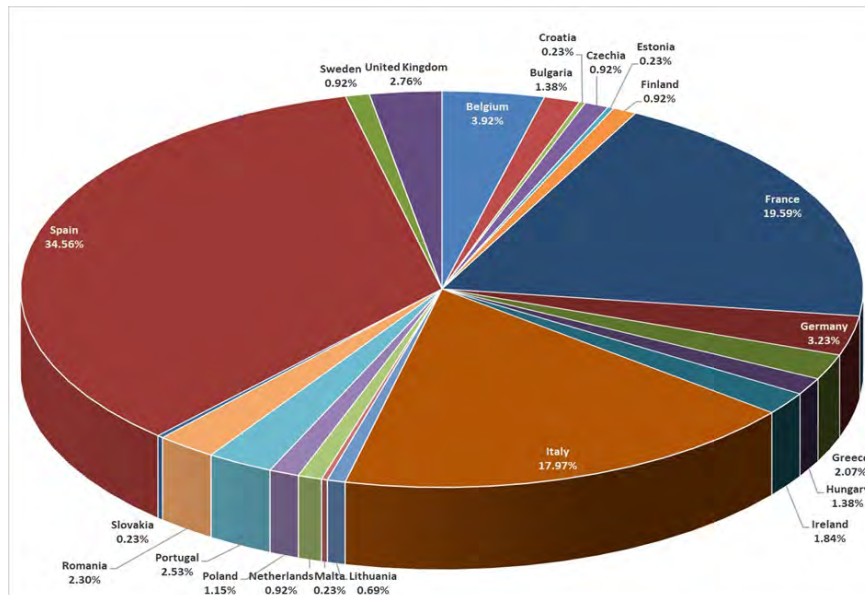


Table 23: Geographical distribution 2022 - All F4E staff

2.7 Strategy for efficiency gains

Upon the direction of its senior management team, F4E manages its corporate improvement projects through an **Improvement Steering Committee (ISC)** that provides a dedicated forum to set priorities on corporate improvement actions and align management views. This committee monitors results and proposes corrective actions if needed.

F4E uses the DMAIC (Define, Measure, Analyse, Improve, and Control) approach that forms part of the Lean Six Sigma methodology (a set of techniques and tools for process improvement). This ensures that processes are more efficient and effective to achieve efficiency gains. F4E measures results over a certain period with key performance indicators to confirm the positive trends, and corrective actions taken if needed to streamline F4E's core activities. F4E achieved the following efficiency gains from a series of improvement projects:

Project Name	Achievements	Conclusion (objective vs achievement)
Time to recruit	Reduction of the average lead time to recruit, 26 % of efficiency gain: <ul style="list-style-type: none"> Before (2017) = 152 days 2022 = 113 days 	Improvement project successfully completed in 2021 on the time to finalise a selection procedure from the launch of the publication to the reserve list of candidates. An Improvement project had been successfully completed in 2021. Longer term confirmation of the efficiency gains and systematic reporting thereon will follow from the electronic recruitment tool for which development is on-going.
Time to procure	Reduction of the average lead time to procure for open procedure, 36 % of efficiency gain: <ul style="list-style-type: none"> Before (2017) = 287 days 2022 = 184 days 	Improvement achieved on the time from approved Contract Procurement Strategy to contract signature. F4E performs procurement (up to award) through an electronic tool facilitating the reception and management of tenders.
Time to sign and pay	Reduction of the average time to sign a contract (from award to legal commitment), 63% of efficiency gain: <ul style="list-style-type: none"> Before (2017) = 35 days 2022 = 13 days Reduction of average time to prepare the Technical Assessment Report, of the supplier deliverables related to a payment, 31% of efficiency gain: <ul style="list-style-type: none"> Before (2017) = 16 days 2022 = 11 days Reduction of the average time to pay for the 30 days payment type by 17%. <ul style="list-style-type: none"> Before (2017) = 23 days 2022 = 19 days 	Financial Transactions – improvement achieved and good performance of the improved process for the time to sign and to pay. Further financial modules were piloted to the existing contract management electronic tool (DACC) to perform budgetary commitments, contract signature (legal commitments), supplier deliverable acceptance and payments. This means that F4E has digitised all the core processes of the contractual cycle as the process reached a high maturity and efficiency level. F4E envisages further developments and improvements to the documentation exchange with suppliers.

DACC (Deviation, Amendment and Contract Changes) tool	Reduction of the average time to perform a contractual change or deviation, 46 % of efficiency gain: <ul style="list-style-type: none"> • Before: 90 days • End of 2022: 49 days 	to F4E added an additional scope of contract signature in April 2020 to provide F4E with business continuity during the Covid-19 pandemic. All Deviations and Contract changes being performed through DACC as well as all operational contracts signed in DACC.
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Table 24: Overview of Improvement Projects

In 2017, a **Business Process Management frame** was introduced and fully rolled out since 2019 with full process mapping and the compilation of a complete portfolio of working procedures. This strengthens the process approach and aligns improvement priorities with IT tool developments, key to optimising efficiency.

2.8 Assessment of audit and ex-post evaluation results during the reporting year

2.8.1 Internal Audit Service (IAS)

The Internal Audit Service (IAS) of the European Commission concluded one audit engagement, on Delegations and efficiency of decision making in F4E and cooperation mechanisms with DG ENER (report issued on 22/01/2022) and one follow up on Project Management of ITER deliverables. In addition, the IAS issued the new strategic audit plan for 2023-2025 (as result of an in-depth risk assessment carried out by the IAS in June 2022).

Project Management of ITER deliverables

The IAS performed a 2nd follow-up on the “Project management of ITER deliverables”, which was finalised in February 2023. The audit aimed to assess if the management and control systems put in place by F4E are adequately designed, effective and efficient to ensure that project management activities related to deliverables to ITER support the timely delivery of the planned project deliverables, at the required level of quality and within the planned budget.

The 2nd follow up left open two recommendations related to: a) Human Resources needs analysis and allocation; and b) risk reporting roles. At present both recommendations are reported as ready for review.

Delegations and efficiency of decision making in F4E and cooperation mechanisms with DG ENER.

The objective of this audit was to assess the adequacy of the design and the effective implementation of F4E's internal control processes for financial circuits and financial delegations and deputising arrangements for its key operational processes. Furthermore, the audit assessed DG ENER's and F4E's cooperation and supervision mechanisms.

The audit report was finalised in January 2022 and concluded that although F4E has generally executed transactions in accordance with the principle of segregation of duties (at transaction level), and despite the challenging environment resulting from the Covid-19 pandemic, significant weaknesses exist as regards their design as well as their effective and efficient implementation. The IAS issued three very important findings (resulting in 12 recommendations) in the areas of roles and responsibilities, automated controls and management of conflicts of interest.

Annual Report of the IAS

Article 78(7) of the F4E Financial Regulation⁵ provides that, beyond reporting on its findings and recommendations in audit reports, "the internal auditor shall also report to the Governing Board, or where the Constituent instrument allows it, a body delegated by the Governing Board and to the Director in any of the following cases:

- Critical risks and recommendations have not been addressed;
- There are significant delays in the implementation of the recommendations made in previous years.

The IAS reported on two recommendations from the audit on Project Management of ITER Deliverables, related to a) Human Resources needs analysis and allocation, and b) risk reporting roles. These two recommendations have been re-opened (downgraded from Very Important to Important) as per IAS' follow-up made in early 2022. The delays from the original target dates are 21 and 14 months respectively. At present both actions are reported as ready for review.

The status of implementation of the IAS audit actions is set out in section 2.9a Follow up of recommendations and action plans for audits and evaluations of this report.

2.8.2 Internal Audit Capability (IAC)

In 2022, F4E's Internal Audit Capability (IAC) performed two main assurance engagements:

- the Validation of User Access Rights in ABAC and in DACC,
- the audit of Digitalisation and Cyber-Security Management – Phases II and III

⁵ https://industryportal.f4e.europa.eu/IP_PAGES/keyreference.aspx

The new engagements resulted in 17 new recommendations. 11 were accepted by the management, 6 were partially accepted or rejected.

IAC did not perform field follow-up activities in 2022.

Audit management tasks were also performed in 2022 such as preparation of IAC's 2021 Annual Report, the initial version of the 2023 Annual Plan, and management of the framework contract for "Provision of Internal Audit Support Services for Internal Audit Capabilities".

As a consequence of the departure of the Head of IAC as of 01/01/2022, and the appointment of his successor on 01/10/2022, the assessment of compliance with the IAC Charter and the professional standards of internal audit, and the statement on IAC's independence only apply to the 4th Quarter of 2022. For the same reason, IAC's opinion on the overall system of internal control will not be provided for the year 2022.

2.8.3 European Court of Auditors (ECA)

In November 2022, the European Court of Auditors (ECA) adopted the final Annual report on the EU Joint Undertakings for the financial year 2021, where Chapter 3.10 is devoted to F4E accounts. The ECA 2021 report is structured in three Chapters, where Chapter 1 describes the Joint Undertakings, and the nature of the audit performed by the Court, Chapter 2 presents the overall result of the audit and an analysis of the human resources situation, and finally, Chapter 3 contains, for each of the nine JUs, a statement of assurance with the opinions and observations on, firstly, the reliability of their accounts and, secondly, the legality and regularity of the underlying transactions.

The ECA provides a reasonable assurance for the implementation of the budget of F4E, concluding that:

- the accounts of the JU for the year ended 31 December 2021 present fairly, in all material respects, the financial position of the JU at 31 December 2021, the results of its operations, its cash flows, and the changes in net assets for the year then ended, in accordance with its Financial Regulation and with accounting rules adopted by the Commission's accounting officer. These are based on internationally accepted accounting standards for the public sector.
- revenue and payments underlying the accounts for the year ended 31 December 2021 are legal and regular in all material respects.

"Emphasis of matter"

Since 2013 the Annual Report from the ECA includes, in the Statement of Assurance section, a sub-section 'Emphasis of Matter' raising awareness on the problems faced by F4E in relation to the cost and schedule of the overall project. The ECA refers to the estimation of the total cost for completing F4E's delivery obligations for the ITER project assessed at €18,3 billion (in 2021 values); and that changes in key assumptions for the estimate and risk exposure could lead to significant costs increases and/or to further delays in the implementation of the ITER project.

“Other matters”

The 2021 Annual report from ECA has a specific point, called “other matters” where the Court draws attention to the fact that Russia is a member of the ITER-IO, with the obligations to deliver to the ITER assembly site in France (Cadarache) several components for the ITER projects and to provide annual contributions to the ITER IO. Therefore, this presents a risk of further delays and increased costs for the ITER project.

Observations of current and previous years

The 2021 ECA report contains 8 observations which do not affect the overall statement of assurance. F4E will enhance its overall control environment in the areas reported by the ECA as 3 out of those 8 observations require some actions.

The ECA 2021 report also maintains as on-going two observations from 2019, and 2 observations from 2020, and confirms that F4E has fully and effectively implemented seven observations from previous year (2020).

The following table provides an overview of the status of these observations at the end of 2022:

Area		In Progress	Implemented	No Action	Total
Cost estimate at completion for ITER				1	1
Risks on cost increases and project delays				1	1
F4E's employer contributions to the EU pension scheme			1	1	2
Working environment and wellbeing of staff		1	1	1	3
Audits and assessments – administrative burden				1	1
TOTAL from 2021		1	2	5	8
Follow up of previous years comments					
2019	Risks at senior management and corporate culture level		1		1
	Insourced resources	1			1
2020	EU e-Procurement too			1	1
	Impact of the COVID 19 pandemic – risks of delays and cost increases	1			1
	DACC staff understanding		1		1
	Functional accounts with virtual identities		1		1
	Electronic Signatures of Legal commitments in DACC		1		1
	DACC certification		1		1
	Validation of the accounting system		1		1
	Recruitment procedures – shortlist of candidates		1		1
	Calculation of 2020 annual membership contributions		1		1
Total from Follow up		2	8	1	11
GRAND TOTAL		3	10	6	19

Table 25: Observations and actions taken by F4E

The status of the actions in progress is the following:

- Working environment and wellbeing of staff:** Staff wellbeing and mental health continue to be a matter of attention. F4E completed the implementation of the action plan in response to the psychosocial risk assessment carried out in 2021 and has communicated on the actions already implemented to Staff. F4E has put in place processes to prevent (awareness campaign, medical check-up), react (reintegration process) and monitor (absenteeism). However, F4E is not yet able to measure the effectiveness of the actions taken as there is a lack of recent indicators to assess the current situation. The improvement of the staff perception on the working conditions will be monitored by

launching a new psycho-social survey in Q3 2023. This new survey will help identify where / if more actions should be launched.

- **Impact of the COVID 19 pandemic – risks of delays and costs increases** F4E will continue reporting to its Governing Board on the cost status by producing the Estimate At Completion update document and report twice a year on any additional delays in its regular reporting. The ITER Organization is preparing a new baseline (scope, schedule and cost) for presentation to the ITER Council in the second half of 2024.
- **Inourced resources:** F4E has set up a Working Group devoted to the management of external services providers (ESP), with the goal of centralising the management of inourced externals ensuring that the externals support the areas identified in the strategic workforce planning. This would allow the adequate monitoring, control and follow-up of external staff, and facilitate the reporting increasing transparency. The different measures to mitigate the different risks identified are being implemented throughout 2023.

2.9 a Follow up of recommendations and action plans for audits and evaluations

The status of the implementation of the internal audit action plans as of 31 December 2022 is as follows:

Audit Name	Audit Source	Recs	Actions	In Progress	Implemented	Cancelled	Obsolete	Implemented %
Action plans issued before 2022								
Nuclear Safety Management	IAC	10	24	0	24	0	0	100.00%
Project Management of ITER deliverables	IAS	20	26	2	24	0	0	92.31%
ECOSYS - Systems and Controls ensuring reliability of financial planning data	IAC	28	28	0	27	0	1	100.00%
Vacuum Vessel contract	IAC	14	17	0	17	0	0	100.00%
Corporate Governance Audit	IAC	7	14	7	6	0	1	46.15%
total before 2022		79	109	9	98	0	2	91.59%
action plans issued from 2022								
Delegations and efficiency of decision making	IAS	12	19	14	5	0	0	26.32%
Total from 2022		12	19	14	5	0	0	26.32%
TOTAL PORTFOLIO		91	128	23	103	0	2	81.75%
				18%	80%	0%	2%	

* Implemented % is equal to the number of actions implemented per total number of actions that can be executed (Cancelled and Obsolete actions are not taken into account)

Table 26: Overview of implementation of action plans per Audit

F4E's portfolio includes five action plans issued before 2022, for which the implementation rate has reached 91,6% (with 98 actions already implemented), and one action plan from 2022, related the IAS audit on Delegations and efficiency of decision making, already implemented at 26%.

On the 6 action plans in F4E's portfolio, 3 have been fully implemented, from management point of view, and are subject to be followed up by the IAC. The other 3 action plans are in the process of being implemented. The detailed status is as follows:

- **IAS audit on Project Management of ITER deliverables:** The final report, issued in May 2020, resulted in 20 recommendations (14 Very Important and 6 Important), and one "Issue for Consideration". F4E accepted 19 recommendations and rejected one recommendation (rated as Important). F4E agreed with IAS an action plan containing 26 actions. The IAS performed the 1st follow up in January 2022, and concluded that out of 26 actions, 22 actions have been fully implemented (84%) and other 4 actions were re-opened and downgraded from Very Important to Important. A 2nd follow up was made in February 2023, where the IAS confirmed that there were 2 actions in progress, with target dates February and March 2023. At present, those two actions have been reported as ready for review.
- **IAC Corporate Governance audit:**—The action plan includes a total of 14 actions. In December 2022, 7 actions were in progress, and one has been considered as obsolete, related to the "Director Progress Report for all Committees" as the Bureau (66th meeting, 29 September 2022) decided that this action should be considered as obsolete, given the importance for the Board and Committees to receive information from the Director according to their specific mandates. Of the seven actions in progress, all rated as "Important", the target dates for 4 of them were delayed till July 2023. Those delays were considered in the assessment of the internal control system for 2022 (see section 3.1.3).
- **IAS Delegations and efficiency of decision-making audit:** The action plan, agreed with IAS in March 2022, includes a total of 19 actions, where 5 actions have been already implemented.

Evolution of F4E's portfolio of actions in progress

Looking at the evolution of the portfolio it can be concluded that F4E has timely implemented most of the action plans. As regards audit reports issued before 2022, the rate of implementation has reached 92%, with only 9 actions in-progress, and 26% of actions are implemented for the action plan that was issued in 2022.

By end 2022, 3 action plans included in F4E's portfolio are ready for review; Nuclear Safety audit (IAC), ECOSYS Systems and Controls ensuring reliability of financial planning data (IAC), and Vacuum Vessel contract (IAC).

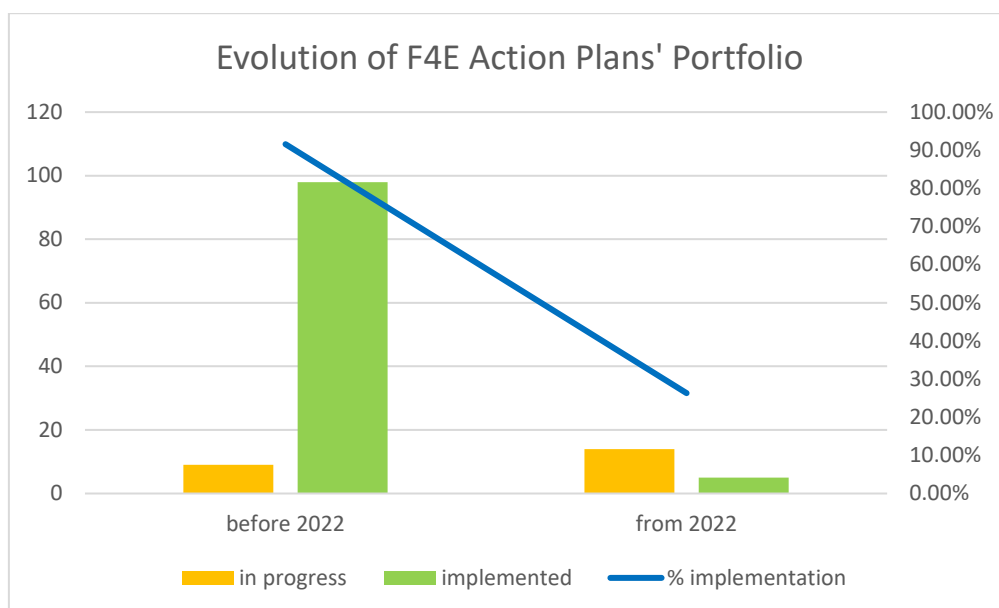


Table 27: Evolution of F4E's portfolio and status of implementation by year of audit

Overview per Criticality of Actions

	In Progress	Implemented	Cancelled	Obsolete	Totals	Implemented %*
Critical	0	0	0	0	0	00,00%
Very Important	14	53	0	1	67	42,06%
Important	9	40	0	1	49	31,75%
Desirable	0	10	0	0	10	7,94%
Totals	23	103	0	2	126	81,75%

*Implemented % is equal to the number of actions implemented per total number of actions that can be executed (Cancelled and Obsolete actions are not taken into account)

Table 28: Overview per Criticality of Actions

2.9 b Follow up of recommendations issued following investigations by OLAF

The Anti-Fraud and Ethics Officer is the contact point for OLAF. F4E has implemented a generic administrative recommendation of clarifying the period for which professional interests have to be declared in GDoI

2.10 Follow up of observations from the discharge authority

For the financial year 2020, the European Parliament (EP) granted, in its plenary session of May 2022, the Discharge in respect of the implementation of the budget to F4E and the closure of its accounts. They issued 38 observations with regards to some aspects of the project, in relation to the “Emphasis of Matter” of the European Court of Auditors raising concerns on the cost and schedule risk of F4E and the ITER project, impact of the COVID 19, working environment at F4E and wellbeing of the staff, insourcing of workers, and in relation to procedural aspects of F4E internal control.

In July 2022, F4E submitted a report to the EP on the measures taken in the light of the observations accompanying the EP’s discharge decision for 2020, in accordance with Article 107 of the F4E Financial Regulation. Out of 38 observations of the European Parliament, 8 were reported as “No Action” required from F4E, 11 were reported as “Implemented” and the remaining 19 as “Ongoing”. At the end of 2022, there were 17 actions in progress, still within the initially proposed deadlines, in the following areas:

- Significant costs increases and further delays, including impact of COVID-19 – updated schedule (new ITER baseline)
- Euratom-UK agreement - UK' membership in F4E and the associated financing provisions.
- Lack of a common project identity and common goal
- Problems and risks at senior management and corporate culture level
- Staff wellbeing and working environment
- Lack of sufficient statutory staff and increased contractual insourcing of workers
- Diversity strategy - gender balance and geographical representation
- Improvement of risk management process (cost and schedule contingencies)
- E-Procurement

2.11 Environment Management

As Chair of the Greening Network, F4E multiplied efforts to raise the awareness on sustainability issues at all levels. As a result, the Greening Network has been recognised by its peers and sustainability has been integrated in the reflection and work programme of several EU Agencies subnetworks. Fruitful discussions among GN members have nurtured a global strategy "The EU Agencies and JUs towards a sustainable future" to implement the ambitions set in the EUAN 2021-2027 Strategy ("Greening and Sustainability in the EU Agencies Network") in the context of the European Green Deal and the Commission's ambitions.

At local level, fruitful exchanges took place with the Building Management of Barcelona premises on energy efficiency (air condition and ventilation) and mobility (installation of plugs for electric cars).

2.12 Assessment by Management

2022 was a challenging year for F4E and the ITER project at large in several respects.

Late in 2022, the ITER Organization detected the need for repairs in some key ITER components already delivered to the site by some members. This will have an impact on the schedule and budget of the whole project that has not yet been determined. Consequently, this led to a slow-down in some areas of the project, and impacted F4E's 2022 budget execution. A new baseline (scope, schedule and cost) will be presented to the ITER Council for a decision during the second half of 2024. This will have impacts on some of the F4E in-kind delivery programs.

With regards to improving our work environment, we took several initiatives to actively listen to our staff. A "Change Agenda" exercise was launched, involving many F4E staff on a voluntary basis, to identify areas of improvement and propose a list of actions. In collaboration with the trade unions, F4E carried out a wide consultation to take stock of any concerns.

Several changes at senior management level took place in F4E and the ITER Organization. In June 2022, the F4E Governing Board appointed Pietro Barabaschi as acting Director. He was replaced by Jean-Marc Filhol in October 2022 when he took up duties as Director General of the ITER Organization following the sad passing of his predecessor, Dr. Bernard Bigot. Acting heads of departments were nominated for this period until the incoming new Director will implement a new organisation.

Despite the difficult conditions described above, F4E continued to do its utmost to respect the ITER project baseline. Achievements in 2022 included:

- Civil works on the Tokamak Complex buildings progressed and the ITER Organization took over the whole Tokamak Building and Diagnostics Building. There was also significant progress on civil works for the Tritium Building

- We manufactured and delivered to ITER the eighth of ten superconducting Toroidal Field magnets. This is the result of several complex technical operations involving more than 30 EU industrial partners
- We already manufactured and delivered three of the five Poloidal Field magnets of up to 17 metres in diameter. For the two remaining coils, F4E completed vacuum pressure impregnation of one winding pack and started this for the other
- We continued working with our industrial partners to maintain the schedule and quality for the manufacturing of the five European Vacuum Vessel sectors that each stand 11 metres tall and weigh over 5000 tonnes, the completion of which is challenging due mostly to difficulties with the complex welding procedures under the applicable nuclear code
- We signed the contracts for the manufacturing of the 215 Blanket First Wall Panels that Europe is providing with two industrial partners. These panels will protect ITER's vacuum vessel from the high heat fluxes from the fusion plasma
- After installation of the Liquid Nitrogen Plant and Auxiliary systems, F4E continued with commissioning. Cryogenics (liquid nitrogen) were delivered to site for the commissioning of the liquid nitrogen tank and the associated distribution system
- At the Neutral beam Test Facility in Padova, we delivered all our contributions for the SPIDER neutral beam ion source and transferred them to ITER. For the MITICA neutral beam source the power supplies, vessel and all auxiliaries managed by F4E were transferred to ITER
- We made significant progress on F4E's twelve diagnostic systems, ten ancillary systems and integration of 6 port plugs. During 2022, among many achievements, we delivered the 2nd and 3rd batches of inner vessel diagnostic coils completing our obligations for these components
- Together with our Japanese partners, we supported the repairs of the JT-60SA Satellite Tokamak in Japan as part of the Broader Approach agreement aiming at a first plasma during 2023
- We continued to support the major upgrade of the prototype accelerator LIPAc for testing fusion materials. Among other achievements, we validated the continuous wave of the deuteron beam produced by the injector with the required characteristics.

F4E is informing its Governing Board and subsidiary committees on a regular basis about the risks associated with the above projects.

Finally, F4E acted as Chair of the European Union Agencies Network (EUAN), co-ordinating the work of 49 different EU entities by overseeing strategic priorities and exchanging best practice in different areas.

Part II. (b) External Evaluations

The April 2018 Council Conclusions on the reformed ITER project state that “the independent annual assessments of the progress of ITER have to be continued and intensified with a focus on the performance and project management, including cost containment, schedule project control as well as risk management”.

To meet the Council’s request for 2022, F4E’s Governing Board appointed a panel of three independent experts of recognized standing to conduct an assessment of F4E’s contribution to the ITER project with a focus on the human resources management and risk management

The outcome of the assessment was presented to F4E’s Governing Board in July 2022 and entrusted F4E’s Bureau to approve any urgent actions to be taken in response to the recommendations.

The assessment panel put forward nine recommendations of which five focused on human resource aspects and four on risk management. An action plan in response to these recommendations was approved by F4E’s Governing Board in December 2022.

Throughout 2022 F4E continued to implement actions in response to previous annual assessments and ad-hoc groups. By the end of the year, F4E had implemented 96% of 279 actions with pending actions mostly in the area of buildings and neutral beams.

Part III Assessment of the effectiveness of the internal control systems

3.1 Effectiveness of internal control systems

At the end of 2018, the Governing Board adopted a revised framework ‘F4E Management and Internal Control Standards’ (MICS) adapting it to the 2017 EC Internal Control Framework covering the five components: control environment, risk assessment (including risks of fraud), control activities, information and communication and monitoring activities.

Monitoring criteria, comprising baselines, indicators and targets for measuring the effectiveness of the implementation of the MICS were also introduced with the aim of facilitating the identification of any deficiencies in the internal control system as part of the overall procedure for conducting the Internal Control System Annual Assessment (from now on, the assessment).

In 2021, F4E further aligned its MICS, indicators and procedures with the EC Internal Control Framework.

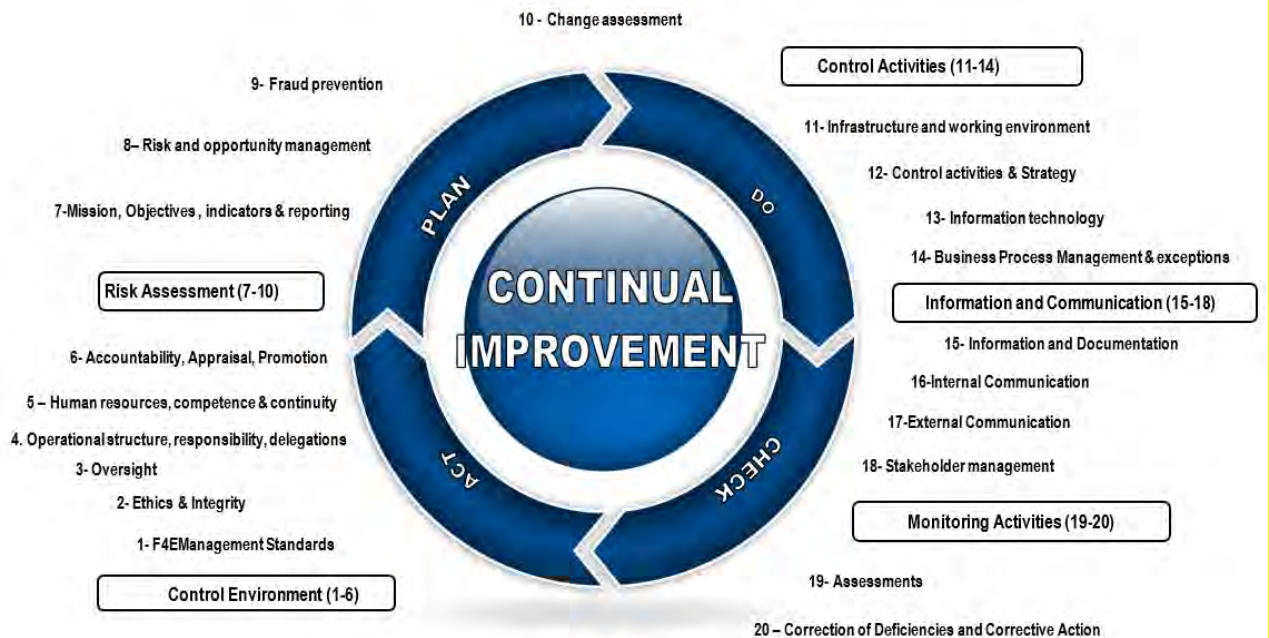


Figure 65: F4E Management and Internal Control Standards (MICS)

F4E has followed a step-by-step approach on the identification of strengths and weakness of the Internal control system based on any deficiencies identified in the functioning of the MICS and formulated corresponding corrective action, leading to the conclusions for the establishment of the Director’s Declaration of Assurance and reporting in the CAAR.

3.1.1 Actions undertaken during the year to respond to the priority areas identified in the 2021 CAAR

In last year's Consolidated Annual Activity Report, F4E concluded that all the components were operating together in an integrated manner. However, one critical deficiency had been found as regards the component "Control activities" - Issue on wellbeing of staff, as set out in section 4.3 'Reservation'. The overall internal control system was thus qualified as partially effective.

In response to this non-quantified, reputational reservation, F4E initiated a wide dialogue and developed a three pillar "Change Agenda" which provided a bottom-up approach to the development of actions to improve the working environment and well-being of F4E staff and enhance trust across the organisation. In parallel, the F4E Director and Senior Management continued to have regular meetings with a Joint Working Group composed of the Staff Committee and Unions.

Furthermore, the following actions were achieved:

- 1) Completion of the implementation of the action plan in response to the psychosocial risk assessment;
- 2) Communication on the measures already implemented to Staff;
- 3) Discussion for extra resources with Governance instances after which new posts were granted.

The following actions were pursued throughout 2022 with the aim of addressing the deficiencies identified in the 2021 CAAR, as well as the ongoing implementation of actions of auditors and assessors.

MICS	CATEGORY	2021 DEFICIENCIES	STATUS
2 Ethics and Integrity	Effective with moderate deficiencies	Ongoing actions under the IAC audit on Corporate Governance	Ongoing: Actions are being implemented
4 Operational Structure, Responsibility, Delegations and Reporting Lines	Partially effective with 1 major deficiency	Overall trust issue in the organisation (SM/MM/Staff)	Ongoing: Management trust remains one of the areas needing more improvement building further on actions which have already been implemented to increase transparency and clarity of decisions. The changes in the top management (Director and Senior Managers) that are taking place since mid-2022 are having a direct impact.
5 Human Resources, Competence and Continuity	Partially effective with 1 major deficiency	Workload risk	Ongoing: New posts granted by the budgetary authority and F4E will continue to monitor the situation. In the context of the new baseline, F4E will adjust the work capacity to the available resources.

		Risks of increased use of external resources	Ongoing: Project to address external resources management to be implemented throughout 2023
8. Risk and Opportunity Management	Effective with moderate deficiency	Risk of further cost increases and delays in project implementation	Ongoing/continuous nature: Implementation of mitigating actions in the ongoing ITER in-kind delivery projects, in particular Buildings and VV
11 Infrastructure and Work Environment	Not fully effective with critical deficiency	Wellbeing of staff	F4E completed the implementation of the action plan in response to the psychosocial risk assessment carried out in 2021 and has communicated on the actions already implemented to Staff. F4E has put in place processes to prevent (awareness campaign, medical check-up), react (reintegration process) and monitor (absenteeism).
12 Control Activities and Strategy	Partially effective with moderate deficiency	Delays and non-compliances in administrative procurement	Ongoing, will be addressed through the ongoing IAC audit
13 Information Technology	Effective with moderate deficiency	Minor weaknesses in the areas of fraud prevention, HR, Finance and procurement	Ongoing

MICS 8, 12 and 13 had moderate deficiencies and the actions are ongoing. The actions undertaken as regards MICS 3,6,7,14 and 15 were successfully completed.

3.1.2 Methodology for the Internal Control System annual assessment for 2022

F4E implements its specific procedure for conducting its annual assessment. This includes:

- I. Assessment of the Internal Control Monitoring Criteria and Staff MICS questionnaire results;
- II. Analysis of sources available in RAPID (F4E's database to follow-up actions): ECA Annual Report, Annual Assessments of External Assessors and ad hoc group reports, Reports from IAC, IAS audits, Actions proposed for each exception and non-compliance and Anti-Fraud Strategy Action Plan;
- III. Other sources: Corporate Risk and Opportunity register, Declarations of Assurance of the Responsible Authorising Officers (RAOs), Annual report of Internal Auditors, weaknesses reported by Staff;
- IV. Determination of the Severity of Deficiencies per MICS and proposal of corrective actions;
- V. Workshops with the Internal Control Coordinator and the Risk and Opportunity Manager with assurance providers and the staff responsible for the areas covered by the 20 MICS;

- VI. Preliminary assessment made by the Internal Control Coordinator;
- VII. Conclusion of assessment per Standard, Component and Overall System;
- VIII. Workshop for Senior Management and Director endorsement; and,
- IX. Preparation of the Director's Declaration of Assurance and CAAR.

The results of the preliminary assessment and a final corrective action plan for 2022 were endorsed as follows:

- 9 MICS have been identified as effective and functioning well
- 9 MICS have been identified as effective with moderate deficiencies
- 2 MICS have been identified as effective with major deficiencies

The corrective actions proposed as a result of the assessment will be regularly monitored by the Assurance Network, in charge of the ongoing monitoring of the F4E internal control system.

3.1.3 Classification of the MICS resulting from the assessment and corrective actions

The following classification has been applied to determine the severity level of the deficiency.

Category	Definition
Effective, functioning well – Minor corrective actions	The MICS is present and functioning well, in some cases minor corrective actions are needed.
Effective with moderate deficiencies – Moderate corrective actions	The MICS is present and functioning but some moderate corrective actions are needed.
Partially Effective – Major corrective actions	The MICS is partially present and functioning, major corrective actions are needed.
Not Fully Effective – Critical corrective actions	The MICS is not fully present and functioning.

On the level of the MICS

Below is a summary of the assessment by MICS, detailing the deficiencies identified, the corrective actions.

MICS	CATEGORY	DEFICIENCIES	CORRECTIVE ACTIONS	TARGET DATE
1 Management and Internal Control Standards	Effective, functioning well			
2 Ethics and Integrity	Effective with moderate deficiencies	Ongoing actions under the IAC audit on Corporate Governance	Actions being implemented, no new action needed	

3 Oversight responsibility	Effective, functioning well			
4 Operational Structure, Responsibility, Delegations and Reporting Lines	Effective with moderate deficiencies	<p>Ongoing actions in response to the IAS audit on Delegations and Efficiency of Decision Making.</p> <p>Some actions related to management trust yet to be addressed.</p> <p>The organisation of work and internal cooperation (teamwork)</p> <p>In relation to the different assessments and surveys, there is a lack of clarity, uncertainty, and perception of dilution of responsibilities and lack of progress</p>	Actions being implemented, no new action needed	
5 Human Resources, Competence and Continuity	Partially effective with a major and a moderate deficiency	Risks in relation to the use of external resources (Major)	Actions being implemented, no new action needed	
		Career development (Moderate)	Actions being implemented, no new action needed	
6 Accountability, Appraisal and Promotion	Effective, functioning well			
7. Mission, Objectives, Indicators and Reporting	Effective with moderate deficiency	Lack of clarity on beyond 5-year vision and strategy	Action being implemented, no new action needed	
8. Risk and Opportunity Management	Effective, functioning well			
9 Fraud Prevention	Effective with moderate deficiency	Implementation of action-plan and monitoring	Actions being implemented, no new action needed	
10 Change Assessment	Effective, functioning well			
11 Infrastructure and Work Environment	Partially effective with major deficiency	Staff wellbeing and mental health continue to be a matter of attention	Actions being implemented, no new action needed	
12 Control activities and Strategy	Effective with moderate deficiency	Ongoing actions in response to the IAS audit on Delegations and efficiency of decision making and to non-compliances	Actions being implemented, no new action needed	

13 Information Technology	Effective with moderate deficiency⁶	Ongoing actions as part of the Anti-Fraud Strategy action plan, and to enhance the controls in DACC, the contract management system.	Actions being implemented, no new action needed	
14 Business Process Management and Exceptions	Effective with moderate deficiency	Ongoing actions in response to a non-compliance.	Actions being implemented, no new action needed	
15 Information and Documentation	Effective, functioning well			
16 Internal Communication	Effective, functioning well			
17 External Communication	Effective, functioning well			
18 Stakeholder Management	Effective with moderate deficiency	Ongoing actions in response to the IAC audit on Corporate Governance	Actions being implemented, no new action needed	
19 Assessments	Effective with moderate deficiency	Ongoing actions in response to the External Assessors to optimise the number of audits, controls and reporting bodies.	Actions being implemented, no new action needed	
20 Correction of Deficiencies and Corrective action	Effective, functioning well			

MICS 5 Human Resources, Competence and Continuity has been identified as partially effective due to the major deficiency linked to risks regarding to the growing use of contracted or insourced resources (External Service Providers - ESPs) . A working group under the auspices of the Improvement Steering Committee has significantly moved forward with a set of detailed actions linked to responding to the legal risk of assimilation and exercise of public authority, retention of competencies, improving resource management, enhancing accountability, and optimising productivity by means of the development of a policy, processes, tools and user-friendly visuals. Significant progress has been made in establishing a corporate approach to external services providers to enable the strategic management of an integrated workforce.

It considered the steps made to achieve a homogenous approach, consolidate lifecycle steps, define the IT landscape and engrain knowledge sharing and best practices among all F4E actors providing assurance that risks were being mitigated adequately not to have a significant impact on assurance. A second project on Knowledge Management, was launched in 2022 to enhance communications, knowledge retention, lessons learnt, introduce knowledge mapping and knowledge communities. Several tasks have been completed including a lessons learnt portal,

⁶ The IAC Cybersecurity and digitalisation audit was finalised in April 2023 (after the annual assessment was performed). It contains a critically-rated recommendation on vulnerability assessments and penetration tests that was immediately addressed by F4E.

knowledge management plans, proposal for a knowledge structure and 4 knowledge communities are live. Both projects are being monitored with indicative target dates set for the series of actions.

For 2021 a critical deficiency had been identified for MICS 11 Infrastructure and Work Environment, which in 2022 has been downgraded to a major deficiency. Many actions were carried out throughout 2022 linked to staff wellbeing and mental health. F4E completed the implementation of the action plan in response to the psychosocial risk assessment carried out in 2021 and has communicated on the actions already implemented to Staff. F4E also put in place processes to prevent (awareness campaign, medical check-up), react (reintegration process) and monitor (absenteeism). F4E launched the 2023 psychosocial survey in June 2023 which will provide corroborative data to measure the effectiveness of the actions and initiatives launched. Furthermore, with regards to improving the F4E work environment, several initiatives to actively listen to Staff were taken. The “Change Agenda” exercise was launched in 2022, involving many F4E staff on a voluntary basis, to identify areas of improvement and propose a list of actions. This approach aimed to complement F4E’s day to day work and gives another channel for Staff to have their voice heard and give feedback.

For the rest of deficiencies identified, corrective actions had been already launched in order to respond to the auditors’ and external assessors’ recommendations. In particular, F4E is investing many resources in managing its responses to the multiple assessments, surveys, observations and recommendations, many of them in the area of Human Resources and wellbeing of staff. F4E endeavours to respond to them in a rational, streamlined and timely manner, bringing clarity and transparency without losing accountability/ownership for each of the actions. Consequently the focus during year 2023 will be to:

Continue implementing ongoing actions in response to audits, and non-compliances;

Address all actions identified in the various staff assessments and surveys in a centralised and streamlined manner, with clarity, transparency and accountability.

On the level of the System

All the components are operating together in an integrated manner. As a combination of major deficiencies exists, it can be concluded that the system is partially effective.

3.1.4 Prevention, Detection, Correction of Fraud

The Anti-Fraud and Ethics Officer oversees the implementation of the F4E Anti-Fraud Strategy and the accompanying Anti-Fraud Action Plan. In this context, the Anti-Fraud and Ethics Officer has notably monitored and guided the execution of the actions outlined in the current Anti-Fraud Action Plan for 2022 through targeted communications, individual meetings with action owners, and transversal compliance-oriented meetings. The implementation of the actions in the Anti-Fraud Action Plan has been systematically followed up using a dedicated database (RAPID) which documents further progress as regards the implementation of anti-fraud actions in 2022.

Throughout the year, the Anti-Fraud and Ethics Officer provided information and support on fraud prevention matters to staff involved in procurement, contracts management, finance, and human resource management. Anti-fraud awareness-raising events were organised for F4E staff and

management, including training sessions for newcomers. The implementation status was reported at Audit Committee meetings. In addition, the F4E internal network of fraud correspondents was kept informed individually and in the context of the regular Assurance Network meetings.

To prepare the update of the F4E Anti-Fraud Strategy and Action Plan for the following years, initial steps have been taken to develop a new risk assessment.

3.1.5 Ethics and Prevention & Management of Conflicts of Interest (CoI)

Rules, procedures, processes, and best practices related to Ethics and Conflict of Interest Prevention & Management were communicated to staff, notably through the F4E Manual on the F4E intranet.

The Anti-Fraud and Ethics Officer instructed F4E staff and managers on the purpose, correct use, and assessment of declarations of interest to prevent and manage conflicts of interest. Individually on an *ad hoc* basis, he also guided staff in the preparation, and managers in the assessment, of declarations of interest and maintained a Conflict of Interest Register. From 2022 on, all F4E staff have been obliged to issue a General Declaration of Interest every year. The issuing and assessment of the declarations is now managed through a newly created digitalised F4E Conflict of Interest Register, improving follow-up and traceability, and thereby the prevention and management of conflicts of interest at F4E.

Furthermore, the Anti-Fraud and Ethics Officer advised on the prevention of conflicts of interest as regards F4E committee chairs and members.

The F4E Charter of Engagement, an intra-organisational code of conduct for staff, was revised to reflect updated corporate values and their prioritisation in the context of the F4E Change Agenda. The Charter identifies a catalogue of concrete dos and don'ts based on the values of integrity, trust, respect, teamwork, high achievement, contribution, flexibility, and innovation, and foresees recourse to the Ethics Officer and/or the F4E Ethics Committee. In 2022, the Ethics Officer and the Ethics Committee intervened in a number of cases, and awareness-raising communications and information sessions were organised. Team-specific trainings are foreseen for 2023.

3.2 Conclusions of assessment of internal control systems

All the components of the F4E internal control system are operating together in an integrated manner. As a combination of major deficiencies exists (in MICS # 5 Human Resources,

Competence and Continuity and MICS #11 Infrastructure and Work Environment), it can be concluded that the system is **partially effective**.

F4E continues to implement a recognised, mature and well-functioning internal control system. Furthermore, F4E recognises that the changes in the top management (Director and Senior Managers) that are taking place since mid 2022 have a direct impact on the implementation of some of the actions as well as on F4E's organisational culture, and that the visibility of full implementation of initiatives may take some time. In applying the principle of prudence, two deficiencies in relation to ESPs (MICS 5) and Workload and Wellbeing of staff (MICS 11) have been classified as major. F4E Senior Management is continuously monitoring the actions launched in those areas identified as having major deficiencies and consider that F4E has significantly mitigated the related risks and has formulated concrete action plans to address outstanding concerns, hence justifying the removal of the 2021 reservation in 2022.

3.3 Statement of the Senior Manager in charge of risk management

I, NEIL COLLINGS the undersigned, make the following declaration.

In my capacity as Senior Manager in charge of risk management, I declare that in accordance with F4E's Internal Control System, I have reported my advice and recommendations on the corporate and project risks and opportunities to the Director and to the F4E governance bodies.

Neil Collings
Head of Project Management Department

2 May 2023

3.4 Statement of the Senior Manager in charge of internal control

I, the undersigned, Alessia Vecchio, Head of Administration Department of the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E),

In my capacity as Senior Manager in charge of internal control,

I declare that in accordance with F4E's Internal Control System, I have reported my advice and recommendations on the overall state of internal control in F4E to the Director.

I hereby certify that the information provided in the present Consolidated Annual Activity Report and in its annexes is, to the best of my knowledge, accurate, reliable and complete.

Alessia Vecchio
Head of Administration

8 May 2023

Part IV. Management assurance

4.1 Review of the elements supporting assurance

The Internal Control System comprising F4E’s Integrated Management System is based on the 3 layers of defence of the IIA (Institute of Internal Auditors) and combines the two control environments within which F4E operates - the ITER-wide quality system which is intended to ensure the performance of ITER and the compliance with the nuclear safety requirements, and the European Commission Internal Control Framework which is inspired in the internationally recognised COSO framework. The main elements supporting the assurance of the F4E Director are the following:

- 1st LAYER (or 1st LINE OF DEFENCE) ESTABLISH AND INFORM: Internal controls as defined by F4E Management for application by all F4E Staff and providing adequate training and raising awareness.
- 2nd LAYER (or 2nd LINE OF DEFENCE) MANAGEMENT ASSURANCE: The Management (in its role of 1st line of defence) puts in place the 2nd layer of defence by establishing risk management and assurance functions to help build and/or monitor the first line-of-defence controls.
- 3rd LAYER (or 3rd LINE OF DEFENCE) INDEPENDENT ASSURANCE Internal auditors (IAS/IAC) who provide the Governance bodies and Senior Management with comprehensive assurance based on the highest level of independence and objectivity within the organisation. IAS/IAC activities (including ex post audit on contracts) are described in the IAS/IAC annual audit plan. OLAF carries out independent investigations.

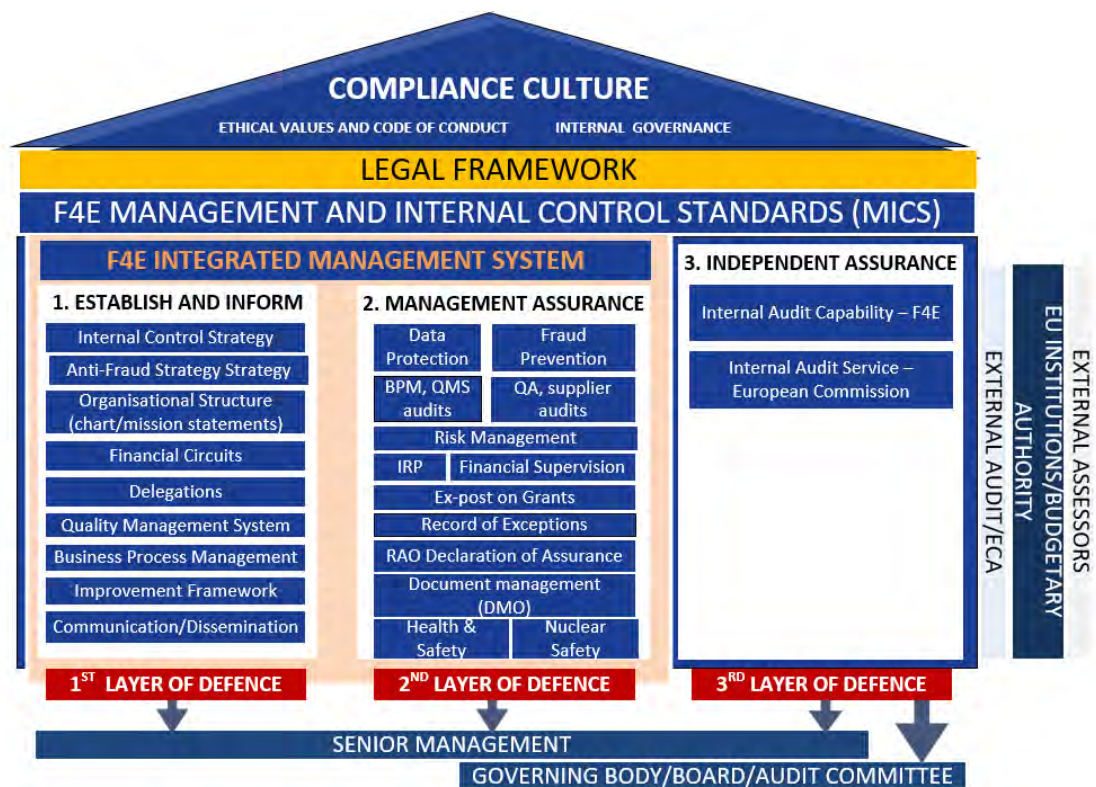


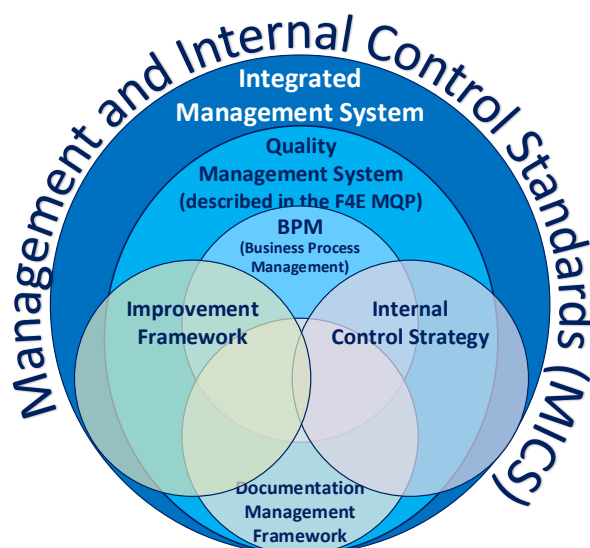
Figure 66: F4E Internal Control System

The F4E Internal Control Strategy defines internal control roles and responsibilities and outlines how the Internal Control System provides reasonable assurance of achieving the objectives based on Article 30 of the F4E FR.

4.1.1 Integrated Management System

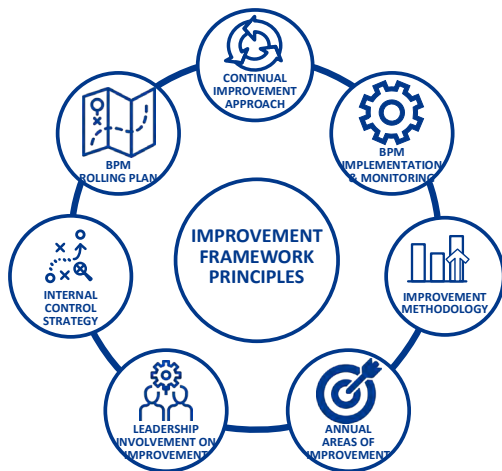
The development and establishment of a Quality Management System is part of the F4E overall management strategy included in the obligations as ITER Project items provider (ITER International Organization – IO - and Host Country Authority Regulations requirements) and to assist compliance with the European Commission (EC) Internal Control Framework.

The Management and Internal Control Standards (MICS) are the backbone of the Integrated Management System, implemented with the objective to provide reasonable assurance regarding the achievement of the organisation’s mission and objectives in line with the EC Internal Control Framework and the ITER-wide quality system based on the ISO standards.



Operationally, this Integrated Management System is implemented through the Quality Management System (as described in the F4E Management and Quality Programme) that provides an effective and efficient method to perform the tasks, a perspective on the organisation and its risks. It allows F4E to continually improve the way of working and to reinforce the F4E corporate culture towards the stakeholder’s expectations.

Improvement is an integral part of the MICS and its requirements, in particular: MICS#3 Oversight Responsibility, MICS#19 Assessments and MISC#20 Correction of Deficiencies and Corrective Action.



The F4E Improvement framework defines the frame of activities to enhance performance and has seven principles: Continual Improvement approach; Business Process Management (implementation and monitoring), Improvement Methodology, Annual Focus on Areas of Improvement, Leadership Involvement on Improvement (Improvement Steering Committee), Internal Control Strategy and Continuous Improvement Action Plan (BPM Rolling Plan).

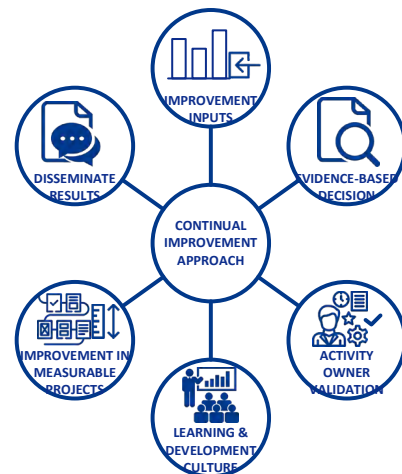
These principles ensure the standardisation of the system implemented to enhance performance in F4E, to ensure compliance with the Internal Control framework and overall maintenance of the Integrated Management System.

In 2016, F4E set up an **Improvement Steering Committee (ISC)** to provide a dedicated forum to set priorities on corporate improvement actions and align management views. This committee monitors results and proposes corrective actions if needed.

The ISC together with the Senior Management Meeting (SMM) and the Project Steering Meeting (PSM) form the internal governance strategy and decision-making bodies of F4E. The SMM is the main decision-making body of F4E, and the PSM scope covers activities linked to fulfilling the technical programmes of the ITER Project.

The Director continually improves the Quality Management System, by planning and managing the necessary processes. **Continual improvement** is achieved through the use of the Quality policy, BPM policy, audit results, data analysis, stakeholders' feedback, continuous training, corrective and preventive actions and the Improvement Steering Committee review.

Continual Improvement approach in F4E is based on the following concepts: Improvement Inputs; Evidence-based decision, Activity Owner validation; Learning and Development Culture; Improvement is made in measurable projects; and Results must be disseminated.



4.1.1.1 Quality Management System and Supplier Audits

A Quality Management System Audit aims to provide F4E and its stakeholders reasonable assurance that the system is adequately implemented according to the standards. The objective of Supplier Audits is to ensure that F4E Suppliers comply with the approved Quality Plan and that it is effectively implemented.

A Quality Management system and Supplier Audit process frames the methodology to be followed for each key step of those audits (planning, preparation, implementation, follow-up of actions and recording). The audit result is presented in an audit report, which includes the identification of any strong areas describing the strengths of the implemented quality system, improvement areas and nonconformities. When improvements or nonconformities are identified, the report is followed by an action plan from the auditee to address the findings. Once the action plan is approved it is followed to ensure correct implementation and closure of the audit.

In 2022, out of the 18 planned Supplier Audits: 15 Supplier audits were performed (12 with result meeting the audit criteria, 1 partially meet the criteria and 2 with result below expectation). Unfortunately, due to the exceptional circumstances to support the digitalisation of the processes no internal Quality Management System audits were performed in 2022.

These audits resulted in 127 findings, classified as follows: 33 strong areas, 73 improvement areas and 21 nonconformities. As foreseen in the related process, all the Supplier nonconformities found triggered a Nonconformity Report issued by the auditee with the action to address the weaknesses.

All the reported situations were of a technical nature (documentation, performance and/or planning) and were adequately processed (including remedial and corrective actions) and monitored by F4E at the contract or procurement arrangement level.

4.1.2 Corporate Risk Management

The Integrated Management System (IMS) and its Management and Internal Control Standards (MICS) provide the basis for the Risk Management framework at F4E. MICS # 8 specifies that F4E has a system to manage risks and opportunities at corporate and project level. In particular, F4E performs regular risk analysis at project and corporate level, proposes mitigating actions and monitors and reports on its implementation.

Overview of Risk and Opportunity Management (ROM) activities in 2022

The process to identify, assess and monitor the risks and opportunities is based on the “market standard” process and ISO 31000 for risk management.

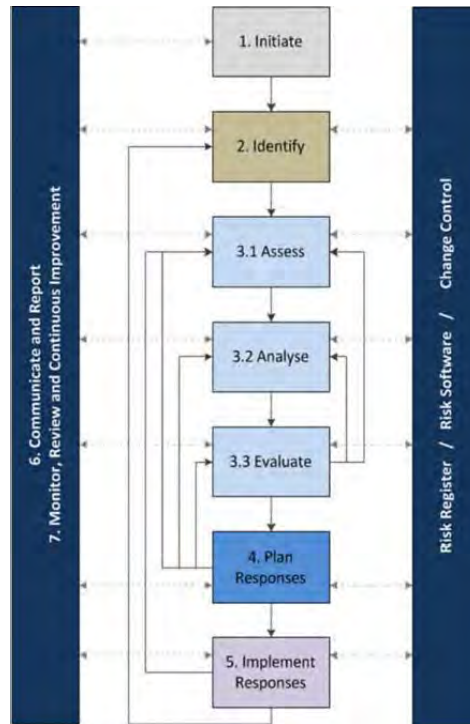


Figure 67: Risk & Opportunity Management Procedure

With the support of the tool Active Risk Management (ARM), risks and opportunities are included in the Risks register and evaluated with an assessment in the following categories: Probability, Cost impact, Schedule impact, technical impact and reputational impact.

This information is then analysed on the three levels of the current framework: Corporate, Project and Supplier level depending on the needs.

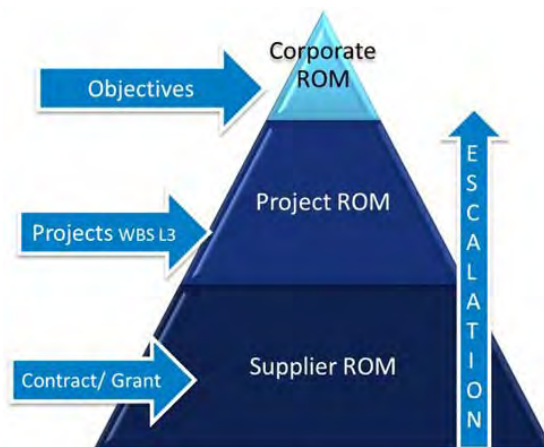


Figure 68: Risk & Opportunity Management Framework

During 2022, F4E participated in several risk management forums and has driven the Agencies risk peer review (PDN Network), proposing a methodology for all agencies to benchmark and consolidate the risks and opportunities identified.

The risks identified have been sufficiently addressed with appropriate mitigating measures. The material risks have been included in the declaration of assurance of the F4E Director (see Part V. Declaration of assurance), in the areas of buildings, vacuum vessel, the Hot Cell and the Divertor Remote Handling system.

Part V. Declaration of assurance

I, the undersigned, Marc Lachaise, Director of the European Joint Undertaking for ITER and the Development of Fusion Energy since 16 May 2023,

In my capacity as authorising officer,

Declare that the information contained in this report gives a true and fair view.

State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.

This reasonable assurance is based on the declaration of assurance provided by the Acting Director who was in function from 16 October 2022 to 15 May 2023 (see Annex I) and on my own judgment which is limited by the time of my appointment on 16th May 2023 only.

Based on the above confirm that I am not aware of anything not reported here which could harm the interests of the agency.

Marc Lachaise
F4E Director

Barcelona, 19 June 2023

Annexes

Annex I Declaration of Assurance by the Acting Director (16 October 2022 to 15 May 2023)

I, the undersigned, Jean-Marc Filhol,

Acting Director of the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E) ad interim,

In my capacity as authorising officer,

- Declare that the information contained in this report gives a true and fair view.
- State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.

This reasonable assurance is based on my own judgment and on the information at my disposal, such as the results of the annual assessment of the Internal Control System. It also takes into account the reports from:

- the Internal Audit Service;
- the Internal Audit Capability;
- the observations of the European Court of Auditors (ECA); and,
- the recommendations from the Governing Board annual assessment.

Without qualifying this reasonable assurance, I would like to highlight the fact raised by the ECA in the “Emphasis of Matter” section of their 2021 Annual Report *“any changes in key assumptions concerning the estimate and the risk exposure could lead to significant cost increases and/or further delays in the implementation of the ITER project”*.

I confirm that F4E is addressing this risk together with the F4E Governing Board and the ITER Organization through the implementation of mitigating actions in the ongoing ITER in-kind delivery projects, in particular the buildings and the vacuum vessel. The GB decided in December 2022 that the annual assessment of F4E will be focused on the building programme.

It should be noted that late in 2022, the ITER Organization detected the need for repairs in some key ITER components already delivered on the site by other members. This will have an impact on the schedule and budget of the whole project that has not yet been determined. Consequently, this led to a slow-down in some areas of the project, and impacted F4E’s 2022 budget execution. Under the impulse of the new IO Director General, a new baseline (scope, schedule and cost) will be presented to the ITER Council for a decision during the second half of 2024. This will have impacts on some of the F4E in-kind delivery programs as well as on the cash contribution to IO.

Some actions have been implemented in 2022 to mitigate the risks related to some of the largest and most challenging projects: The risks related to the Hot Cell project (not yet in the procurement phase), reported precedingly, have been significantly mitigated by an efficient collaboration with IO to redefine its specifications. The upcoming new baseline of the ITER project as proposed by the new IO DG will further simplify the requirements for the Hot Cell. A major Project review involving internal and external experts was performed in April 2023 on the Divertor Remote Handling system.

F4E is informing its Governing Board and subsidiary committees on a regular basis about the risks associated with the above projects.

Several changes at senior management level took place in F4E and the ITER Organization. In June 2002, the F4E Governing Board appointed Pietro Barabaschi as acting Director, whom was replaced by Jean-Marc Filhol in October 2022, when he took up duties as Director General of the ITER Organization following the sad passing of his predecessor, Dr. Bernard Bigot. Acting heads of departments were nominated for this period until the incoming new Director will implement a new organisation.

These did not prevent F4E to implement actions to improve the working environment and wellbeing of the F4E staff as well as mutual trust across the organization. In particular, F4E took several initiatives to actively listen to our staff. A “Change Agenda” exercise was launched to identify areas of improvement and propose a list of actions. F4E will continue to monitor the situation and related indicators, while addressing the numerous actions identified in the various staff assessments and surveys in a centralized and streamlined manner, with clarity, transparency and accountability.

I confirm that I am not aware of anything not reported here which could harm the interests of the Joint Undertaking.

Jean-Marc Filhol
Acting Director ad interim

15 May 2023

Annex II Core Business Statistics

Key Performance Indicators for 2022

ITER Project Progress

- 77.5% for the scope of work achieved for First Plasma in December 2025
- 62.8% for all the work required for the construction of ITER

Broader Approach Project Progress

- 55% of the EU contributions to the Satellite Tokamak (JT-60SA) delivered
- 76% of the EU contributions to the IFMIF/EVEDA project delivered
- 88% of the EU contributions to the IFERC project delivered

F4E Project Performance

- F4E's current and planned budget compared to Estimate at Completion is 97%
- 57% Annual Schedule Performance achieved on a basket of reference milestones. As the reference dates don't change throughout the year regardless of IO imposed changes, this schedule SPI results in lower values compared to previously used SPIs. However, this KPI is useful to transparently show F4E and IO (as far as F4E scope is concerned) annual performance.
- 92% implementation of Work Programme objectives
- For the main ITER Council and Governing Board milestones, F4E has:
 - 27 achieved
 - 13 which are expected to be delivered on time
 - 17 at risk of being delayed

F4E Procurement

- 61 contracts signed in 2022 for a value of €514m
- Total cumulative value of contracts €6bn

F4E Annual Budget Performance

- Annual Commitments 72 %, 82 % compared to original budget.
- Annual Payments 91 %, 91 % compared to original budget.

F4E Quality

F4E has 162 F4E Non-Conformity Reports (NCRs) open for > 12 months compared to 588NCRs still open giving a ratio of 28% (not achieving the 2022 target of ≤22%)

F4E Human Resources

- Assignment of human resources to different areas:
 - 55% for ITER and PM
 - 7% Broader Approach and DEMO
 - 38% Commercial and Administration
- 3,6% Vacancy Rate below target of 4%
- 2,4% Turnover Rate
- 3,0% Absenteeism Rate

F4E Organisational Improvement

- Implemented 96% of Corporate Actions
- Implemented 87.3% of Internal Audit Actions

Background

F4E has identified specific Key Performance Indicators (KPI) in order to measure how effectively the organisation achieves the target set in different project (i.e. schedule, cost, risk, etc.) and programmatic areas (i.e. annual budget consumption, quality, etc.). F4E updates these KPIs on a monthly basis and reviews them at the level of its Senior Management and takes action to address events or risk that could threaten their achievement.

For the EU contributions to ITER, the basis for the adopted KPIs is the F4E current baseline, in schedule, cost and budget. F4E ensures that the baseline is maintained through change control processes together with the ITER Organization. Dashboards are available with the possibility of drilling down for more details, both at a global F4E level and individually per Programme. KPI information is included in many F4E documents and reports to its governing bodies.

Key Performance Indicators

In relation to F4E's obligation to provide in kind contributions to the **ITER Project**:

- The ITER Council approves, monitors and updates a set of high-level monitoring milestones, the so-called **ITER Council (IC) milestones**, which track the overall progress of the project in all the seven ITER Domestic Agencies (including F4E) and the ITER Organization. These milestones are suitable for tracking progress as they cover a larger group of components at different stages of their development. Most of them are key to achieve the ITER First Plasma, but some of them also relate to post-First Plasma systems;
- To complement the ITER Council milestones, an expanded set of high-level milestones are approved, monitored and updated by F4E's Governing Board – the **Governing Board (GB) milestones** which are solely applicable to F4E. Their status is reported to F4E's Governing Board and other governance bodies on a monthly basis and subject to change control by the Governing Board. The complete list of F4E's Governing Board and ITER Council milestones for 2022 is provided in F4E's Single Programming Document (SPD);
- In addition, F4E uses a basket of **additional technical milestones** to monitor more precisely its own performance. F4E has selected such milestones by making sure that they cover important activities inside the organisation and therefore can provide a meaningful measure of F4E performance. These include Procurement Arrangement signatures, commitments >€ 2m, Calls for tender, contract signatures >€ 2m and project execution milestones. These are described in Table 29.

- **Earned Value Management (EVM)** is a project management technique for measuring project performance and progress in an objective manner. F4E has implemented an Earned Value Management system which provides monthly Schedule Performance Index (SPI) and Cost Performance Index (CPI), and the trend of these metrics. This EVM system is based on ITER Credits and Actual Payment data. The EVM Dashboard is shared with F4E's external stakeholders at the end of each month.

PA Signature	Signatures of PAs. ITA signatures and PA amendment signatures are not included.
Call for Tender	Publication of a Call for Tender.
Commitments above €2m	Any commitment above 2 million Euros.
Project Execution Milestones	Milestone in the on-going execution of a project. These milestones are selected by the project teams at the end of the previous year.
Work Programme Objectives	Objectives set in the Work Programme
F4E Gates Design Review	F4E Gates Design Reviews
Delivery	Delivery Milestones

Table 29: Technical objectives and KPIs used for monitoring purposes

- To monitor projects against their budgets, the **Estimate at Completion (EAC)** is calculated by F4E on a monthly basis using three elements (a) actual costs already incurred, (b) estimate of future costs, (c) estimate of likely impact of future risks. F4E follows an industry standard process for its EAC. The monthly update process is complemented by biannual deep-dive reviews to assess in more detail the quality of the estimates and the associated assumptions at programme and project level. F4E systematically presents the EAC at each biannual Governing Board meeting.

Contributions to Broader Approach (BA) projects are formalised under Procurement Arrangements between F4E and the Japanese Implementing Agency (QST), which in turn are backed by Agreements of Collaboration between F4E and institutions chosen by the Voluntary Contributors. The accounting of contributions is tracked by an Earned Value Management approach using credits. In addition, the Broader Approach projects are monitored by the achievement on time of

the milestones defined in the Project Plan approved by the Broader Approach Steering Committee. The complete list of F4E's Broader Approach milestones for 2022 are provided in F4E's SPD. Each of these milestones is assigned a credit value that is used to allow an Earned Value calculation of the overall level of achievement against the Planned Value.

Multiannual and annual Indicators

F4E has defined a set of multiannual objectives that are shown in Table 30: Multiannual objectives and KPIs used by F4E and a set of annual objectives that are show in Table 31: Annual objectives and KPIs used by F4E.

Other indicators but for which targets are not currently set but are monitored internally and, in some cases, reported on a biennial basis to F4E's Governing Board, include the staff attrition rate, gender balance, time to place contracts and grants and time to recruit.

AREA	Objective
GB/IC milestones	Achieve the GB and IC milestones within "agreed quarters"
Overall Costs	Cost estimation for ITER + Broader Approach for period up to 2027 should be less than the total budget available for this period.

Table 30: Multiannual objectives and KPIs used by F4E

AREA	Objective
Annual M-SPI	Reach a minimum SPI value by end of the year
Quality	Reduce percentage of long aging NCRs compared to total number of open NCRs.
Annual budget	Implement a defined percentage of Commitment Appropriations by end of the year
Annual payment	Implement a defined percentage of Payment Appropriations by end of the year
Human Resources	Vacancy rate to be less than a defined value by end of the year

Table 31: Annual objectives and KPIs used by F4E

To ensure the widespread awareness of F4E's performance against the above annual and multiannual objectives, F4E has created a 'dashboard' showing the most important KPIs which is not only used for monthly reporting to the Project Steering Meeting and stakeholders but also shown on screens located on every floor of F4E's offices at the Barcelona headquarter offices.

The F4E dashboard consists of four parts:

1. **General part on the overall progress.** It provides a summary of the progress through the current status, against the baseline, for the achieved ITER credits for EU in-kind procurements, milestones completion, ratio of assigned budget vs cost, commitments and payments implementation;
2. **A multiannual part:** it shows the evolution over the past months of indexes such as the achieved ITER credit, the estimate at completion (EAC), the forecast of completion of the key milestones selected by the F4E and ITER Organization supervising boards;
3. **An annual part:** it shows, for the current year, both achieved and forecast evolution of achieved ITER credit, Annual SPI, commitments, payments and annual objectives of the organisation;
4. **Earned Value Management (EVM):** this system provides monthly Schedule Performance Index (SPI) and Cost Performance Index (CPI), and the trend of these metrics. This EVM system is based on ITER Credits and Actual Payment data.

Annex III Achievement of 2022 Work Programme Objectives

Action 1. Magnets

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU11.1A.11800	IPL > Delivery of TF17 (EU 07) by EU-DA to ITER Site (GB 23)	Q2 2022	GB23	Achieved
EU11.1A.28125	HPC- Approval by IO TFWP Acceptance Report (HP 8.4.6) / TFWP14	Q2 2022	Predecessor of GB54	Achieved
EU11.3B.41980	Placing DP7 for PF3 Stacking/Connections/Ground Insulation/Impregnation	Q2 2022	WP22 objective	Achieved
EU11.3B.571090	PF4 WP VPI Completed	Q3 2022	WP22 objective	Achieved

Action 2. Vacuum Vessel

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU15.1A.3090420	S9PS4 - Machining 1st Step	Q3 2022	Predecessor of GB25	Achieved
EU15.1A.3091120	S9 Machining of PS2 completed	Q4 2022	Predecessor of GB25	Achieved
EU15.1A.3099200	S9PS4 - RT inspection, incl. repairs	Q4 2022	Predecessor of GB25	Achieved
EU15.1A.3104800	Sector 5 - Critical and sub-critical Segment Outer Shell repairs completed	Q4 2022	Predecessor of GB16	Not achieved

Action 3. In Vessel – Blanket

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU15.2A.10170	Signed Award Decision for FwC BCM	Q4 2022	WP22 objective	Achieved
EU.16.01.207500	Task Order Signed for Procurement of CuCrZr (Series) (TO#02) - LOT 1	Q3 2022	WP22 objective	Achieved
EU16.01.83020	MS3.A.1 - PPRR1 / MRR - OMF-900 LOT 1 Approved by MRR panel	Q4 2022	WP22 objective	Not achieved
EU16.01.83880	MS3.A.1 - PPRR1 / MRR - OMF-900 LOT 3 Approved by MRR panel	Q4 2022	WP22 objective	Achieved

Action 4. In Vessel – Divertor

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU17.01.1151850	Contract Signed for Ancillary Items of Pins Sleeves and Links of the CB Series	Q4 2022	WP22 objective	Achieved
EU17.01.1192180	MRR for CBST Stage II Approved (MSII_CBST_S13)	Q4 2022	WP22 objective	Achieved
EU17.2B.140500	Contract Signed for IVT Pre-Series and Series (Lot-1)	Q4 2022	Predecessor of GB45	Achieved
EU17.2B.86650	HP - Send to IO the report of the Final dimensional check of the Prototype - OPE-567-03-01	Q1 2022	WP22 objective	Achieved

Action 5. Remote Handling

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU23.03.14059280	M4 - Approval of deliverables from D4.07 to D4.11 and D4.13	Q4 2022	WP22 objective	Achieved
EU23.03.14060380	Approval of CAD Models for CTS, EPP and UPP (DDL-207)	Q4 2022	Predecessor of GB40	Achieved
EU23.05.25520	M12. Final ADP	Q4 2022	WP22 objective	Achieved
EU57.01.50420	TO (383-01-06) Signed for Final Design Phase 2 for IVVS	Q4 2022	Predecessor of GB47	Achieved

Action 6. Cryoplant and Fuel Cycle

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU31.01.12131	Cold Valve Box 1 completed	Q3 2022	Predecessor of GB28	Achieved
EU31.01.30920	Frame 1 of Mitica Cryopump completed	Q3 2022	Predecessor of GB50	Achieved
EU31.01.41160	M12.1. 1st installation of one all-metal double seal on an ITER style flange completed #1	Q3 2022	Predecessor of GB33	Achieved
EU31.03.40280	Mechanical design of Cryostat Remote Leak Detection System completed	Q1 2022	Predecessor of GB18	Achieved
EU31.03.40320	Electrical and Instrumentation and control (I&C) Design of Cryostat direct Leak Detection system (CDLDS)	Q2 2022	Predecessor of GB35	Achieved

Action 7. Plasma Engineering & Operations

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU52.01.171055	Contract Signed for Procurement of GCC Waveguides for ITER	Q4 2022	WP22 objective	Achieved
EU52.01.3012220Contract Signed for GCC Instrumentation & Support for slow controllerQ4 2022WP22 objectiveEU52.01.171055	Contract Signed for GCC Instrumentation & Support for slow controller	Q4 2022	WP22 objective	Not achieved
Contract Signed for Procurement of GCC Waveguides for ITERQ4 2022WP22 objectiveEU52.01.3012220			WP22 objective	Achieved

Action 8. Heating & Current Drive

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU52.01.2001282	Completion of Initial Optical Design Refinement	Q4 2022	WP22 objective	Achieved
EU52.01.2001312	Completion of UL Plug Architecture & I/F Definition	Q3 2022	WP22 objective	Achieved
EU52.02.12660	Signature of F4E-OMF-1108-01 for European Gyrotrons Procurement FWC	Q2 2022	Predecessor of GB48	Achieved
EU52.04.12761	Procurement of the MHVPS Transformer for 52HV12 (AAG Set#8) Completed	Q2 2022	Predecessor of GB48	Achieved
EU53.06.08510	NP - Start of Manufacture of EU-HVD1 & EU-Bushing of IHNB-1 & IHNB-2 (first items)/MRR Closure	Q4 2022	Predecessor of GB30	Achieved
EU53.06.447392	Start of Manufacturing of AGPS-CS of IHNB-1 for Inverters	Q4 2022	Predecessor of GB27	Achieved

Action 9. Diagnostics

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU55.01.12366680	Approval of D14 Digital integrator first of series	Q4 2022	Predecessor of GB39	Achieved
EU55.06.68040	Kick-off Meeting for Feedthroughs for Tokamak Services	Q4 2022	Predecessor of GB36	Not achieved
EU55.06.68320	ITER Dept Review & Approval of Final Tech Specs for Task Order for Feedthroughs & IO Concurrence Review	Q1 2022	Predecessor of GB36	Achieved
EU55.16.10875	Integrated system FAT v1.0	Q4 2022	Predecessor of GB39	Achieved

Action 10. Test Blanket Modules

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU56.01.10380	F4E-OMF-1091-01-02 - TO 02 Signed for Preliminary Design of WCLL AS	Q4 2022	WP22 objective	Achieved
EU56.01.1226470	HCCP Consortium agreement signed with Korea	Q4 2022	WP22 objective	Achieved
EU56.01.81635	Published Call for Tender for WCLL TBM Set PD & FD	Q2 2022	WP22 objective	Achieved
EU56.01.89050	Signature of TO 06 for FWC ANB Consultancy	Q4 2022	WP22 objective	Not achieved

Action 11. Site and Buildings and Power Supplies

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU62.05.435	IPL > Cryoplant Compressor Building (51 RFE (RFE #8B))	Q2 2022	GB19	Achieved
EU62.05.66020	NPC - RFOC Site Control Bldg (71 Non PIC part)	Q4 2022	Predecessor of GB34	Achieved
EU62.05.66060	NPC - RFOC FDU & SNR Bldg 75 PIC / Non PIC part	Q4 2022	WP22 objective	Achieved
EU62.134699	MRR#15 approved by Steering Committee (Closure meeting) - Services for Cryolines and BusBar Bridges (MRR#15)	Q4 2022	Predecessor of GB57	Achieved
EU62.05.435	IPL > Cryoplant Compressor Building (51 RFE (RFE #8B))	Q2 2022	GB19	Achieved

Action 12. Cash Contributions

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EUCC.01.240	Cash Contributions to ITER Organization 2023	Q4 2022	WP22 objective	Achieved

Action 13. Technical Support Activities

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU.ES.01.8320	Contract Signed for Engineering Support Contract LOT 1	Q2 2022	WP22 objective	Achieved
EU.ES.01.8380	Contract Signed for Engineering Support Contract LOT 2	Q2 2022	WP22 objective	Achieved
EU.PM.3051650	Published Call for Tender of FWC F4E-OMF-1321 for Quality Control Inspectors for ITER and BA Projects (2023-2027)	Q4 2022	WP22 objective	Achieved
EU.PM.3076660	Specific contract #01 signed under FwC OMF-1127-01 for System Engineering Supports at F4E Barcelona	Q1 2022	WP22 objective	Achieved
EU.PM.3105110	Specific contract #14 signed under FwC OMF-1159-LOT1-01 for Support in the area of Technical Integration to the OCE	Q3 2022	WP22 objective	Achieved
EU.PM.4022095	Task Order Signed for TO 16 for Convention 4 for Real Convoys for Gendarmerie Services	Q2 2022	WP22 objective	Achieved
EU.PM.4022215	Task Order Signed for TO 17 for Convention 4 for Real Convoys for Gendarmerie Services	Q4 2022	WP22 objective	Achieved
EU.PM.3076190	Contract Signed of FWC F4E-OMF-1220 for PPM Support (2022-2026)	Q3 2022	WP22 objective	Achieved
EU.PM.3092200	Specific contract #08 signed under F4E-OMF-0895 Lot 2 for Risk Management Senior Support (cont. F4E-OMF-0895-LOT2-01-05)	Q2 2022	WP22 objective	Achieved

Action 14. Broader Approach

Milestone ID	Scope Description	Forecast Date	Milestone Type	End 2022 Status
EU.BA.01.13520	Delivery of the LIPAC Injector Spare parts completed	Q2 2022	WP22 objective	Achieved
EU.BA.01.18620	Contract placement for Supply of JT-60SA actively cooled Divertor HHF elements - Stage 1	Q3 2022	WP22 objective	Achieved
EU.BA.01.25300	Supply of equipment or services for tests with BA Projects and ITER, and establishment of control room	Q4 2022	WP22 objective	Achieved
EU.BA.01.32480	Contract placement for the Supply of the Centrifuge Accelerator for JT-60SA Pellet Launching System	Q2 2022	WP22 objective	Achieved
EU.BA.01.36380	Start of the SRF Linac assembly in the Joint Research Building	Q4 2022	WP22 objective	Achieved

Annex IV. Statistics on Financial Management

Annex IV. a. Evolution of Expenditure in Commitments for the 2022 Budget

Heading of the 2022 Budget Commitment Expenditure	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Evolution of the statement of expenditure					Implementation		
				Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)	
A1 STAFF EXPENDITURE											
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	38 981 810.00			8 048 916.53	47 030 726.53			47 030 726.53	47 030 726.53	100.0%	
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	11 906 562.00			2 508 252.02	14 414 814.02			14 414 814.02	14 414 814.02	100.0%	
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	814 000.00			-101 768.46	712 231.54			712 231.54	712 231.54	100.0%	
A13 MISSION EXPENSES	582 000.00			-201 000.00	381 000.00			381 000.00	381 000.00	100.0%	
A14 SOCIO-MEDICAL INFRASTRUCTURE	504 000.00			-2 000.00	502 000.00			502 000.00	502 000.00	100.0%	
A15 TRAINING	676 620.00			-8 550.66	668 069.34			668 069.34	668 069.34	100.0%	
A16 EXTERNAL SERVICES	550 000.00			410 000.00	960 000.00			960 000.00	960 000.00	100.0%	
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-4 726.19	5 273.81			5 273.81	5 273.81	100.0%	
A18 SOCIAL WEALFARE	46 000.00			16 200.00	62 200.00			62 200.00	62 200.00	100.0%	
A19 OTHER STAFF RELATED EXPENDITURE	3 277 000.00			-156 377.00	3 120 623.00	12 039.50		3 132 662.50	3 132 662.50	100.0%	
TITLE A1 - Total	57 347 992.00			10 508 946.24	67 856 938.24	12 039.50		67 868 977.74	67 868 977.74	100.0%	
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE											
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 499 000.00			110 000.00	1 609 000.00	7 056.59		1 616 056.59	1 616 056.59	100.0%	
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 935 000.00			61 977.04	3 996 977.04			3 996 977.04	3 996 977.04	100.0%	
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	375 000.00			-220 147.78	154 852.22			154 852.22	154 852.22	100.0%	
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 616 000.00			-1 881.79	1 614 118.21			1 614 118.21	1 614 118.21	100.0%	
A25 POSTAGE / TELECOMMUNICATIONS	547 000.00			-21 500.00	525 500.00			525 500.00	525 500.00	100.0%	
A26 MEETING EXPENSES	443 000.00			-19 450.00	423 550.00			423 550.00	423 550.00	100.0%	
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES				0.00			30 473.55	30 473.55	30 473.55	100.0%	
A28 INFORMATION AND PUBLISHING	38 000.00			-18 000.00	20 000.00			20 000.00	20 000.00	100.0%	
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	250 800.00			162 792.97	413 592.97			413 592.97	413 592.97	100.0%	
TITLE A2 - Total	8 703 800.00	0.00	0.00	53 790.44	8 757 590.44	7 056.59	30 473.55	8 795 120.58	8 795 120.58	100.0%	
TITLE A1 & A2 - Total Administrative Expenditure	66 051 792.00	0.00	0.00	10 562 736.68	76 614 528.68	19 096.09	30 473.55	76 664 098.32	76 664 098.32	100.0%	

Heading of the 2022 Budget Commitment Expenditure	Evolution of the statement of expenditure							Implementation		
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
B3 OPERATIONAL EXPENDITURE										
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	569 331 726.00	1 733 575.20	23 481 524.24	-14 262 736.68	580 284 088.76	41 412.11		580 325 500.87	429 211 076.71	74.0%
B32 TECHNOLOGY FOR ITER AND DEMO	4 339 492.00	214 943.39	55 142.61	0.00	4 609 578.00			4 609 578.00	3 497 256.59	75.9%
B33 TECHNOLOGY FOR BROADER APPROACH	41 009 373.00	-9 809 138.99	-7 957 380.01	0.00	23 242 854.00			23 242 854.00	16 842 430.93	72.5%
B35 EXTERNAL SUPPORT ACTIVITIES	24 156 472.00	7 744 181.05	-2 231 229.05	2 230 000.00	31 899 424.00	34 333.08		31 933 757.08	30 868 787.56	96.7%
B36 OTHER OPERATIONAL EXPENDITURE	5 801 600.00	121 439.35	1 488 571.65	1 470 000.00	8 881 611.00	103 864.69		8 985 475.69	7 287 206.54	81.1%
Title B3 - Total	644 638 663.00	5 000.00	14 836 629.44	-10 562 736.68	648 917 555.76	179 609.88	0.00	649 097 165.64	487 706 758.33	75.1%
B4 EARMARKED EXPENDITURE										
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	143 800 000.00	14 950 574.00			158 750 574.00		3 226 238.47	161 976 812.47	115 556 047.00	71.3%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	79 213 457.32	14 231 771.74	93 445 229.06	24 056 684.21	25.7%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00			0.00	0.00	
Title B4 - Total	143 800 000.00	14 950 574.00	0.00	0.00	158 750 574.00	79 213 457.32	17 458 010.21	255 422 041.53	139 612 731.21	54.7%
Titles B3 & B4 - Subtotal	788 438 663.00	14 955 574.00	14 836 629.44	-10 562 736.68	807 668 129.76	79 393 067.20	17 458 010.21	904 519 207.17	627 319 489.54	69.4%
Total BUDGET in Commitment appropriations	854 490 455.00	14 955 574.00	14 836 629.44	0.00	884 282 658.44	79 412 163.29	17 488 483.76	981 183 305.49	703 983 587.86	71.7%

Annex IV. b. Evolution of Expenditure in Payments for the 2022 Budget

Heading of the 2022 Budget Payment Expenditure	Evolution of the statement of expenditure								Implementation			
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2022 commitments (9)	On B2021 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
A1 STAFF EXPENDITURE												
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	38 981 810.00			8 048 916.53	47 030 726.53			47 030 726.53	45 330 726.53		45 330 726.53	96.4%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	11 906 562.00			2 508 252.02	14 414 814.02		48 805.94	14 463 619.96	13 803 630.90	41 895.91	13 845 526.81	95.7%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	814 000.00			-101 768.46	712 231.54		98 072.60	810 304.14	646 067.91	56 216.24	702 284.15	86.7%
A13 MISSION EXPENSES	582 000.00			-201 000.00	381 000.00		133 578.58	514 578.58	306 909.56	42 440.77	349 350.33	67.9%
A14 SOCIO-MEDICAL INFRASTRUCTURE	504 000.00			-2 000.00	502 000.00		117 711.67	619 711.67	293 600.78	83 593.57	377 194.35	60.9%
A15 TRAINING	676 620.00			-8 550.66	668 069.34		488 514.92	1 156 584.26	280 945.10	324 909.56	605 854.66	52.4%
A16 EXTERNAL SERVICES	550 000.00			410 000.00	960 000.00		72 937.94	1 032 937.94	690 213.94	50 186.19	740 400.13	71.7%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-4 726.19	5 273.81		125.00	5 398.81	1 725.00	125.00	3 170.00	34.3%
A18 SOCIAL WELFARE	46 000.00			16 200.00	62 200.00		29 100.00	91 300.00	35 048.02	16 815.75	51 863.77	56.8%
A19 OTHER STAFF RELATED EXPENDITURE	3 277 000.00			-156 377.00	3 120 623.00	12 039.50	366 211.82	3 498 874.32	2 847 025.65	300 901.01	3 147 926.66	90.0%
TITLE A1 - Total	57 347 992.00	0.00	0.00	10 508 946.24	67 856 938.24	12 039.50	1 355 058.47	69 224 036.21	64 235 893.39	917 084.00	65 152 977.39	94.1%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE												
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 499 000.00			110 000.00	1 609 000.00	7 056.59	351 200.76	1 967 257.35	1 019 087.35	285 168.89	1 304 256.24	66.3%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 935 000.00			61 977.04	3 996 977.04		1 881 492.92	5 878 469.96	2 514 443.12	1 755 974.74	4 270 417.86	72.6%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	375 000.00			-220 147.78	154 852.22		131 163.07	286 015.29	81 835.91	120 884.26	202 720.17	70.9%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 616 000.00			-1 881.79	1 614 118.21		591 921.32	2 206 039.53	977 203.61	482 532.38	1 459 735.99	66.2%
A25 POSTAGE / TELECOMMUNICATIONS	547 000.00			-21 500.00	525 500.00		160 155.54	685 655.54	285 065.11	80 827.79	365 892.90	53.4%
A26 MEETING EXPENSES	443 000.00			-19 450.00	423 550.00		205 891.69	629 441.69	262 975.92	110 291.42	373 267.34	59.3%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES				0.00	0.00		30 473.55	30 473.55	15 942.67	0.00	15 942.67	52.3%
A28 INFORMATION AND PUBLISHING	38 000.00			-18 000.00	20 000.00		7 647.71	27 647.71	16 229.15	6 257.84	22 486.99	81.3%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	250 800.00			162 792.97	413 592.97		101 636.49	515 229.46	329 352.54	76 416.39	405 768.93	78.8%
TITLE A2 - Total	8 703 800.00	0.00	0.00	53 790.44	8 757 590.44	7 056.59	3 461 583.05	12 226 230.08	5 502 135.38	2 918 353.71	8 420 489.09	68.9%
TITLE A1 & A2 - Total Administrative Expenditure	66 051 792.00	0.00	0.00	10 562 736.68	76 614 528.68	19 096.09	4 816 641.52	81 450 266.29	69 738 028.77	3 835 437.71	73 573 466.48	90.3%

Heading of the 2022 Budget Payment Expenditure	Evolution of the statement of expenditure								Implementation			
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2022 commitments (9)	On B2021 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
B3 OPERATIONAL EXPENDITURE												
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	589 603 166.00	5 000.00	-92 003 891.76	-945 680.54	496 658 593.70	41 412.11		496 700 005.81			496 699 311.88	100.0%
B32 TECHNOLOGY FOR ITER AND DEMO	7 000 000.00			-4 581 517.65	2 418 482.35			2 418 482.35			2 418 482.35	100.0%
B33 TECHNOLOGY FOR BROADER APPROACH	13 000 000.00		129 961.20	-8 524 178.21	4 605 782.99			4 605 782.99			4 605 782.99	100.0%
								0.00				
B35 EXTERNAL SUPPORT ACTIVITIES	15 000 000.00		10 560.00	2 003 919.65	17 014 479.65	34 333.08		17 048 812.73			17 027 979.65	99.9%
B36 OTHER OPERATIONAL EXPENDITURE	6 000 000.00			1 484 720.07	7 484 720.07	103 864.69	608.27	7 589 193.03			7 538 122.62	99.3%
Title B3 - Total	630 603 166.00	5 000.00	-91 863 370.56	-10 562 736.68	528 182 058.76	179 609.88	608.27	528 362 276.91	0.00	0.00	528 289 679.49	100.0%
B4 EARMARKED EXPENDITURE												
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	148 800 000.00				148 800 000.00		1 384 899.99	150 184 899.99			148 024 185.17	98.6%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	76 973 579.10	6 315 804.48	83 289 383.58			15 834 380.79	19.0%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00		736 527.90	736 527.90			0.00	0.0%
Title B4 - Total	148 800 000.00	0.00	0.00	0.00	148 800 000.00	76 973 579.10	8 437 232.37	234 210 811.47			163 858 565.96	70.0%
Titles B3 & B4 - Subtotal	779 403 166.00	5 000.00	-91 863 370.56	-10 562 736.68	676 982 058.76	77 153 188.98	8 437 840.64	762 573 088.38			692 148 245.45	90.8%
Total BUDGET in Payment appropriations	845 454 958.00	5 000.00	-91 863 370.56	0.00	753 596 587.44	77 172 285.07	13 254 482.16	844 023 354.67			765 721 711.93	90.7%

Annex IV. c. Transfers Adopted by the F4E Director

Budget 2022 Transfers (EUR)		Transfer no 1		Transfer no 2		Transfer no 3		Transfer no 4		Transfer no 5	
Title Chapter	Heading	Commitment	Payment	Commitment	Payment	Commitment	Payment	Commitment	Payment	Commitment	Payment
A-1	STAFF EXPENDITURE										
A-10	SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS							5 605 480.46	5 605 480.46	1 250 000.00	1 250 000.00
A-11	SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL							1 675 387.44	1 675 387.44	380 000.00	380 000.00
A-12	EXPENDITURE RELATING TO STAFF RECRUITMENT										
A-13	MISSION EXPENSES	-200 000.00	-200 000.00								
A-14	SOCIO-MEDICAL INFRASTRUCTURE									28 000.00	28 000.00
A-15	TRAINING										
A-16	EXTERNAL SERVICES	200 000.00	200 000.00	100 000.00	100 000.00	110 000.00	110 000.00				
A-17	RECEPTIONS, EVENTS AND REPRESENTATION										
A-18	SOCIAL WEALFARE					20 000.00	20 000.00				
A-19	OTHER STAFF RELATED EXPENDITURE										
	Title 1 Total	0.00	0.00	100 000.00	100 000.00	130 000.00	130 000.00	7 280 867.90	7 280 867.90	1 658 000.00	1 658 000.00
A-2	BUILDINGS, EQUIPMENT AND MISCELLANEOUS OPERATING EXPENDITURE										
A-21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS									137 000.00	137 000.00
A-22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING			185 000.00	185 000.00						
A-23	MOVABLE PROPERTY AND ASSOCIATED COSTS									-105 000.00	-105 000.00
A-24	CURRENT ADMINISTRATIVE EXPENDITURE			230 000.00	230 000.00						
A-25	POSTAGE / TELECOMMUNICATIONS										
A-26	MEETING EXPENSES					100 000.00	100 000.00				
A-28	INFORMATION AND PUBLISHING									-15 000.00	-15 000.00
A-29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE			265 000.00	265 000.00					-45 000.00	-45 000.00
	Title 2 Total	0.00	0.00	680 000.00	680 000.00	100 000.00	100 000.00	0.00	0.00	-28 000.00	-28 000.00
	Titles 1 & 2 : Administrative expenditure - Subtotal	0.00	0.00	780 000.00	780 000.00	230 000.00	230 000.00	7 280 867.90	7 280 867.90	1 630 000.00	1 630 000.00
B-3	OPERATIONAL EXPENDITURE										
B3-1	ITER CONSTRUCTION INCLUDING SITE PREPARATION			-780 000.00	-780 000.00	-230 000.00	-230 000.00	-7 280 867.90	-7 280 867.90	-1 630 000.00	-1 630 000.00
B3-2	TECHNOLOGY FOR ITER AND DEMO										
B3-3	TECHNOLOGY FOR BROADER APPROACH										
B3-5	EXTERNAL SUPPORT ACTIVITIES										
B3-6	OTHER OPERATIONAL EXPENDITURE										
	Title 3 Total	0.00	0.00	-780 000.00	-780 000.00	-230 000.00	-230 000.00	-7 280 867.90	-7 280 867.90	-1 630 000.00	-1 630 000.00
	TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Budget 2022 Transfers (EUR)		Transfer no 6		Transfer no 7		Transfer no 8		Transfer no 9		Total Transfers	
Title Chapter	Heading	Commitment	Payment	Commitment	Payment	Commitment	Payment	Commitment	Payment	Commitment	Payment
A-1	STAFF EXPENDITURE										
A-10	SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS			743 436.07	743 436.07	450 000.00	450 000.00			8 048 916.53	8 048 916.53
A-11	SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL			280 864.58	280 864.58	172 000.00	172 000.00			2 508 252.02	2 508 252.02
A-12	EXPENDITURE RELATING TO STAFF RECRUITMENT			-74 972.01	-74 972.01			-26 796.45	-26 796.45	-101 768.46	-101 768.46
A-13	MISSION EXPENSES			-1 000.00	-1 000.00					-201 000.00	-201 000.00
A-14	SOCIO-MEDICAL INFRASTRUCTURE			-11 000.00	-11 000.00			-19 000.00	-19 000.00	-2 000.00	-2 000.00
A-15	TRAINING							-8 550.66	-8 550.66	-8 550.66	-8 550.66
A-16	EXTERNAL SERVICES									410 000.00	410 000.00
A-17	RECEPTIONS, EVENTS AND REPRESENTATION			-4 726.19	-4 726.19					-4 726.19	-4 726.19
A-18	SOCIAL WELFARE							-3 800.00	-3 800.00	16 200.00	16 200.00
A-19	OTHER STAFF RELATED EXPENDITURE			-152 727.00	-152 727.00			-3 650.00	-3 650.00	-156 377.00	-156 377.00
	Title 1 Total	0.00	0.00	779 875.45	779 875.45	622 000.00	622 000.00	-61 797.11	-61 797.11	10 508 946.24	10 508 946.24
A-2	BUILDINGS, EQUIPMENT AND MISCELLANEOUS OPERATING EXPENDITURE										
A-21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS							-27 000.00	-27 000.00	110 000.00	110 000.00
A-22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING							-123 022.96	-123 022.96	61 977.04	61 977.04
A-23	MOVABLE PROPERTY AND ASSOCIATED COSTS			-79 450.00	-79 450.00			-35 697.78	-35 697.78	-220 147.78	-220 147.78
A-24	CURRENT ADMINISTRATIVE EXPENDITURE			-104 775.38	-104 775.38			-127 106.41	-127 106.41	-1 881.79	-1 881.79
A-25	POSTAGE / TELECOMMUNICATIONS			-16 000.00	-16 000.00			-5 500.00	-5 500.00	-21 500.00	-21 500.00
A-26	MEETING EXPENSES			-112 450.00	-112 450.00			-7 000.00	-7 000.00	-19 450.00	-19 450.00
A-28	INFORMATION AND PUBLISHING			-3 000.00	-3 000.00					-18 000.00	-18 000.00
A-29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE			-56 970.86	-56 970.86			-236.17	-236.17	162 792.97	162 792.97
	Title 2 Total	0.00	0.00	-372 646.24	-372 646.24	0.00	0.00	-325 563.32	-325 563.32	53 790.44	53 790.44
	Titles 1 & 2 : Administrative expenditure - Subtotal	0.00	0.00	407 229.21	407 229.21	622 000.00	622 000.00	-387 360.43	-387 360.43	10 562 736.68	10 562 736.68
B-3	OPERATIONAL EXPENDITURE										
B3-1	ITER CONSTRUCTION INCLUDING SITE PREPARATION	-1 100 000.00	-4 000 000.00	-777 229.21	-2 407 229.21	-2 852 000.00	-622 000.00	387 360.43	16 004 416.57	-14 262 736.68	-945 680.54
B3-2	TECHNOLOGY FOR ITER AND DEMO								-4 581 517.65	0.00	-4 581 517.65
B3-3	TECHNOLOGY FOR BROADER APPROACH								-8 524 178.21	0.00	-8 524 178.21
B3-5	EXTERNAL SUPPORT ACTIVITIES		4 000 000.00			2 230 000.00			-1 996 080.35	2 230 000.00	2 003 919.65
B3-6	OTHER OPERATIONAL EXPENDITURE	1 100 000.00		370 000.00	2 000 000.00				-515 279.93	1 470 000.00	1 484 720.07
	Title 3 Total	0.00	0.00	-407 229.21	-407 229.21	-622 000.00	-622 000.00	387 360.43	387 360.43	-10 562 736.68	-10 562 736.68
	TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Annex IV. d. Implementation of the F4E Work Programme 2022

2022 Work Programme		Grant		Procurement		Cash Contribution		TOTAL	
		Amount (€)	Variation (%)	Amount (€)	Variation (%)	Amount (€)	Variation (%)	Amount (€)	Variation (%)
B3-1 & B4-1 ITER Construction	Original WP	3 236 677	-	401 890 814	-	308 004 235	-	713 131 726	-
	Last amended WP	799 028	-75%	505 176 874	26%	242 145 512	-21%	748 121 414	5%
	Execution	309 346	-61%	320 146 093	-37%	224 311 685	-7%	544 767 124	-27%
B3-2 Technology for ITER	Original WP	0	-	4 189 492	-	150 000	-	4 339 492	-
	Last amended WP	0	-	4 459 578	6%	150 000	0%	4 609 578	6%
	Execution	0	-	3 497 257	-22%	0	-	3 497 257	-24%
B3-3 Technology for Broader Approach	Original WP	0	-	38 654 373	-	2 355 000	-	41 009 373	-
	Last amended WP	0	-	20 845 862	-46%	2 396 992	2%	23 242 854	-43%
	Execution	0	-	14 445 439	-31%	2 396 992	0%	16 842 431	-28%
B3-5 External Support Activities	Original WP	0	-	24 156 472	-	0	-	24 156 472	-
	Last amended WP	0	-	29 669 424	-	0	-	29 669 424	-
	Execution	0	-	30 868 788	4%	0	-	30 868 788	4%
B3-6 Other Expenditure	Original WP	0	-	5 801 600	-	0	-	5 801 600	-
	Last amended WP	0	-	7 411 611	28%	0	-	7 411 611	28%
	Execution	0	-	7 287 207	-2%	0	-	7 287 207	-2%
B4-2 Activities linked to ITER Organization	Original WP	0	-	17 190 000	-	0	-	17 190 000	-
	Last amended WP	0	-	107 033 247	523%	0	-	107 033 247	523%
	Execution	0	-	24 056 684	-78%	0	-	24 056 684	-78%
B4-3 Other earmarked expenditure	Original WP	0	-	0	-	0	-	0	-
	Last amended WP	0	-	0	-	0	-	0	-
	Execution	0	-	0	-	0	-	0	-
TOTAL	Original WP	3 236 677	-	491 882 751	-	310 509 235	-	805 628 663	-
	Last amended WP	799 028	-75%	674 596 596	37%	244 692 503	-21%	920 088 128	14%
	Execution	309 346	-61%	400 301 467	-41%	226 708 677	-7%	627 319 490	-32%

Variations: Last amended WP compared to Original WP and Execution to Last amended WP

Annex IV. e. Statistics on Financial Management Budget – Procurement Data

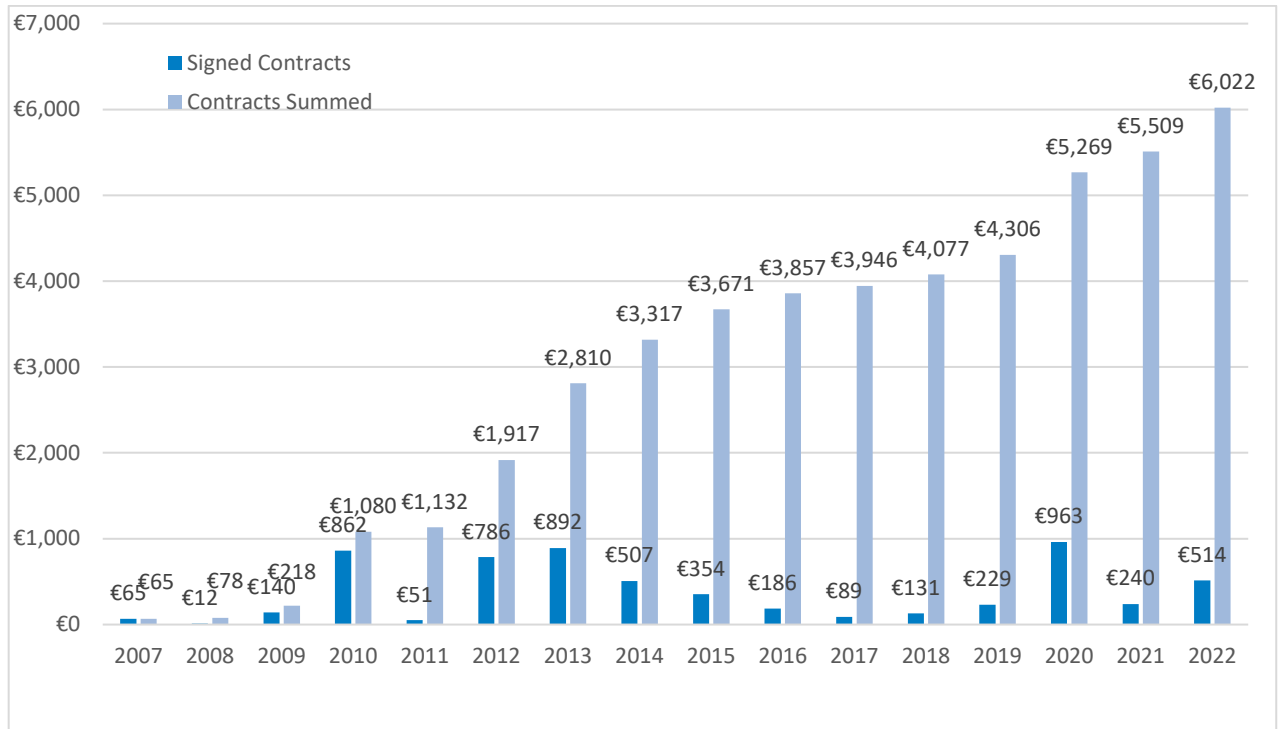


Figure 69: Annual and cumulative value of operational and administrative contracts and grants signed by F4E (€ million, in-year values)

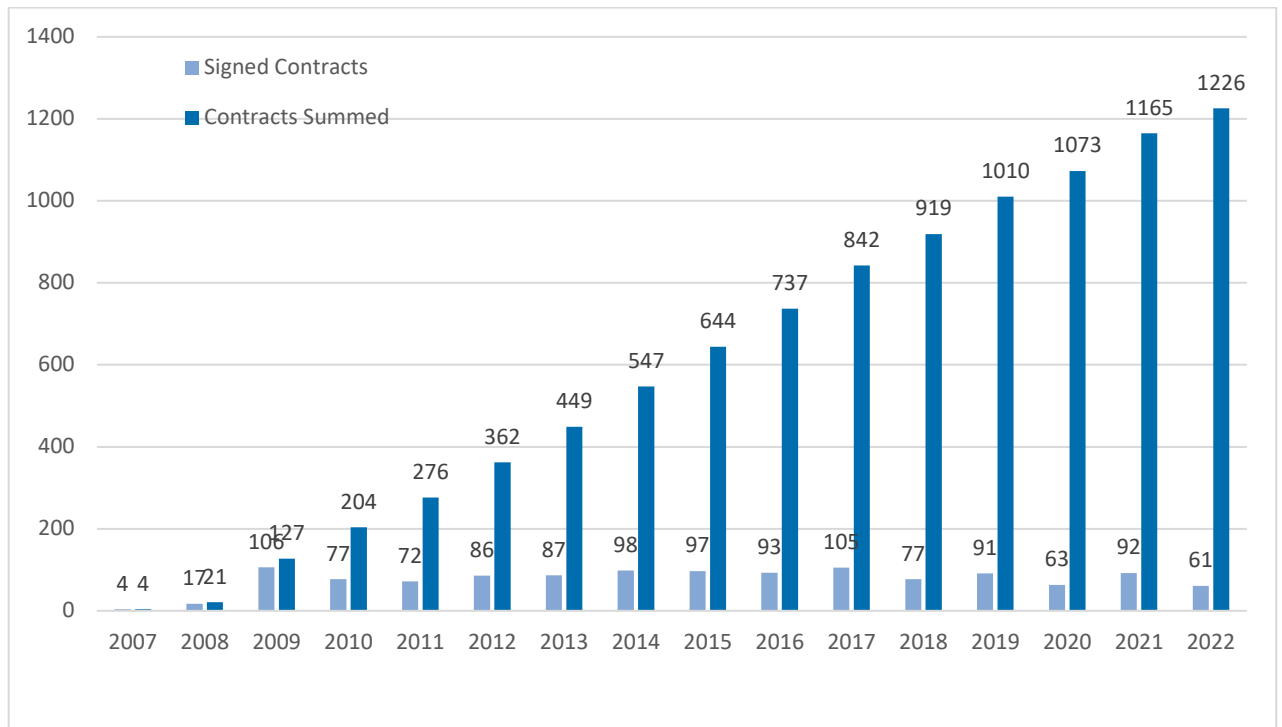


Figure 70: Annual and cumulative number of operational and administrative contracts and grants signed by F4E (in-year values)

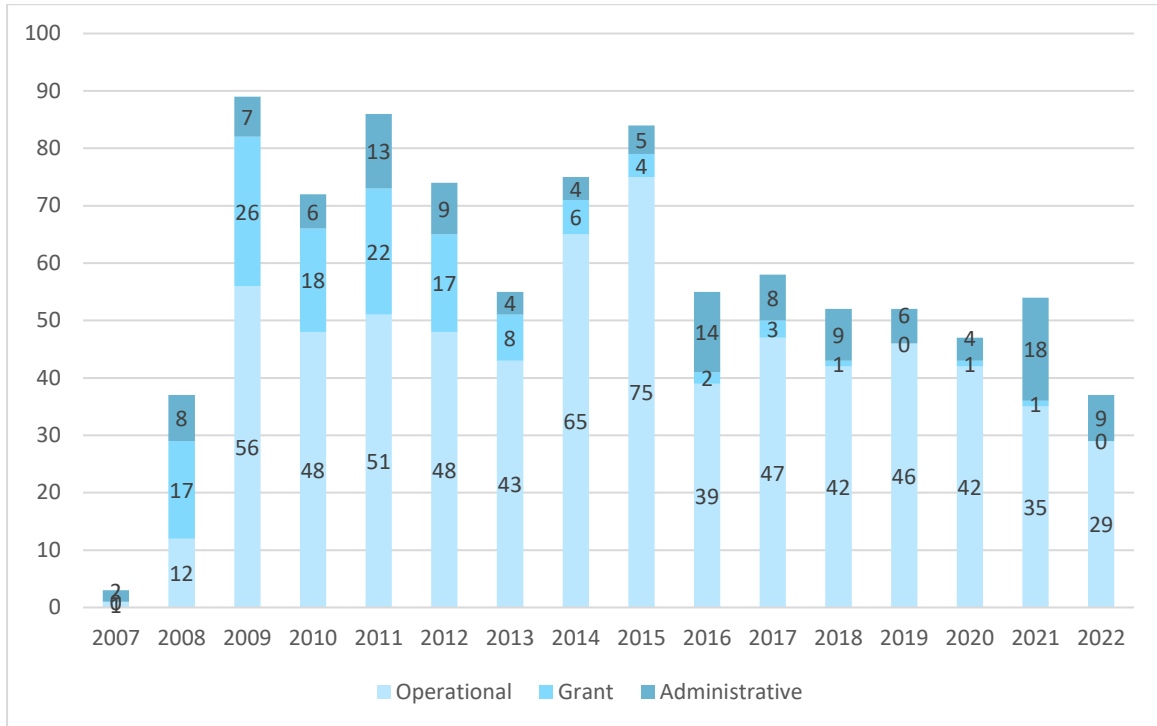


Figure 71: Procurement and grant procedures launched

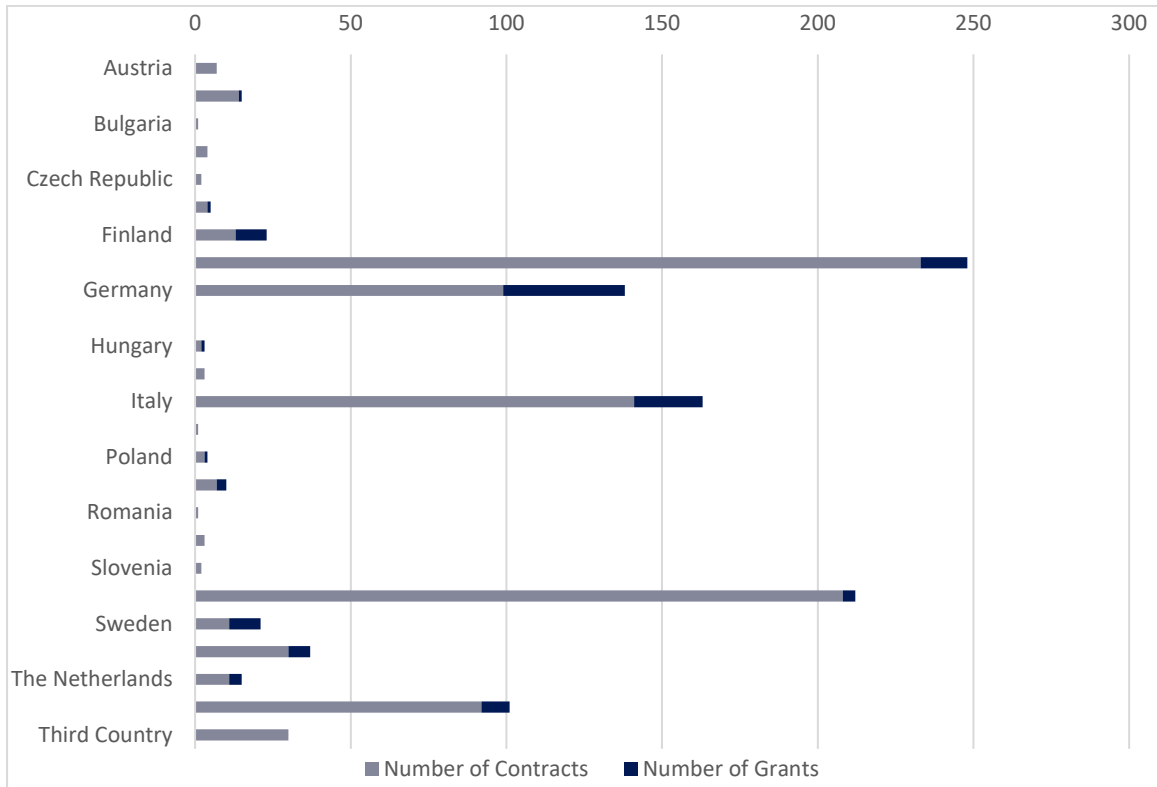
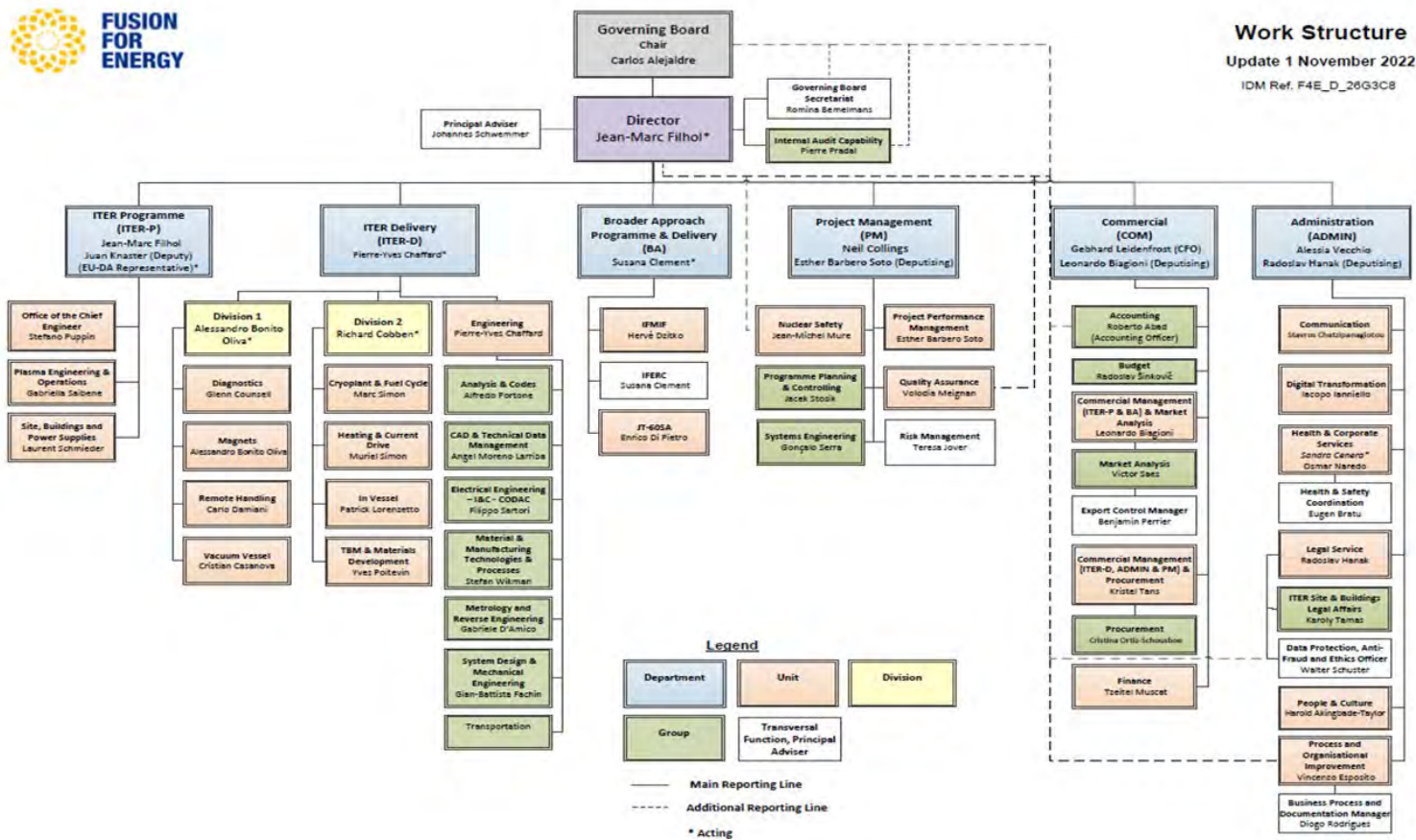


Figure 72: Geographical distribution of awarded contracts and grants (Number in the period 2007-2022). Please note that the contribution of UK and CH since 2021 is included in "Third Country".

Annex V Organisational chart



Annex VI. Establishment Plan and Additional Information on Human Resources Management

Annex VI a. Establishment Plan

	Authorised under the EU Budget (EP 2022)		Actually filled as of 31/12/2022	
	FO	TA	FO	TA
AD 16				
AD 15		1		
AD 14	3	1	2	
AD 13	7	5	6	4
AD 12	11	23	11	20
AD 11	2	21	2	16
AD 10	5	37	5	45
AD 9	5	58	4	51
AD 8	1	26	1	22
AD 7	3	20		20
AD 6		9	1	15
AD 5				
AD Total	37	201	32	193
AST 11	1		1	
AST 10	3		1	
AST 9	1	1	2	
AST 8		2	2	1
AST 7	1	6	1	1
AST 6	1	8	2	12
AST 5	2	11	2	7
AST 4	2	3	2	6
AST 3				4
AST 2				
AST 1				
AST Total	11	31	13	31
Total	280		269	

Annex VI b. Table: Job Screening/Benchmarking Against Previous Year Results

Job type	Sub-category	Year 2022 (%)	Year 2021 (%)
Administrative Support and Coordination	Administrative support	13.50 %	13.02 %
	Coordination	1.55 %	1.77 %
	Total	15.04 %	14.79 %
Operational	Top level operational coordination	6.64 %	6.62 %
	Programme management and implementation	63.94 %	63.80 %
	Evaluation and impact assessment	1.11 %	1.10 %
	General operational activities	3.10 %	3.09 %
	Total	74.78 %	74.61 %
Neutral	Finance, Control	10.18 %	10.60 %
	Linguistics	0.00 %	0.00 %
	Total	10.18 %	10.60 %

Annex VI c. Indicative Table - Information on Recruitment Grade/Function Group for Each Type Of Post

Key functions (examples – terminology should be adjusted to each agency's job titles)	Type of contract (official, TA or CA)	Function group, grade of recruitment *	Indication whether the function is dedicated to administrative support or operations [subject to definitions used in screening methodology]
<i>Adviser / Senior Expert</i>	FO/TA	AD13-14	Administrative/Operations
<i>Head of Department</i> (level 2, taking the Director as level 1)	FO/TA	From AD12 to 14	Administrative/Operations
<i>Head of Division/Head of Unit/Project Team Manager</i> (level 3)	FO/TA	From AD9 to AD14	Administrative/Operations
<i>Group Leader</i> (level 4)	FO/TA	From AD5 to AD12	Operations/Neutral
<i>Officer</i>	FO/TA	From AD5 to AD12	Administrative/Operations/Neutral
<i>Assistant</i>	FO/TA	From AST1 to AST9	Administrative/Operations/Neutral
<i>Senior Assistant</i>	FO/TA	AST10-11	Administrative/Operations/Neutral
<i>Head of Administration</i>	TA	AD12 (external)	Administrative
<i>Head of People & Culture</i>	TA	AD11 (external)	Administrative
<i>Head of Finance</i>	FO	AD10	Neutral
<i>Head of ICT</i>	TA	AD 9 to 14 (internal)	Administrative
<i>Secretary/Clerk</i>	CA	II	Administrative/Operations/Neutral
<i>Data Protection Officer</i>	FO	AD11	Administrative
<i>Accounting Officer</i>	FO	AD7	Neutral
<i>Internal Auditor</i>	TA	AD9	Administrative
<i>Assistant to the Director</i>	CA	FGIII	Operations

Annex VI d. Flexitime Scheme in 2022

Category / Grade	Overtime (days)	Recuperation (days)
AD		
10	287.52	60.75
11	124.57	15.67
12	165.59	22.33
13	37.50	0.83
14	22.17	0.00
16	9.44	0.00
6	93.07	22.67
7	110.98	42.17
8	101.89	31.33
9	270.91	44.67
AST		
10	0.00	0.00
11	7.14	1.00
3	21.63	5.00
4	24.14	12.50
5	15.36	5.92
6	73.91	20.50
7	16.69	0.17
8	37.62	12.83
9	1.60	1.00
GFII		
5	13.97	9.83
6	11.00	2.50
7	14.64	1.63
GFIII		
10	36.75	13.33
11	41.13	24.15
12	14.95	6.33
13	3.58	2.50
9	13.94	7.88
GFIV		
11	0.20	0.00
13	3.81	0.00
14	63.63	25.63
15	145.83	43.91
16	73.06	37.67
17	32.45	15.33
9	3.01	2.00
Average In F4E	55.70	14.47

Annex VII. Human and Financial Resources by WP Actions

The projects of F4E are divided in Actions, defining the structure of the Annual Work Programme (WP). F4E Staff is assigned to each Action.

F4E applies a '**flexibility**' clause in the Annual Work Programme in order to limit the changes in the implementation of the actions compared to the substance of the Work Programme adopted by the Governing Board.

The budget 2022 has been implemented in full respect of this flexibility clause, with the following breakdown of human resources per WP action:

Implementation of the Work Programme (EUR)

Action #	Action	Staff 2022	Original Budget/WP22	Final Budget/WP22	Execution	Variation Original [2] %	Variation Final [3] %
1	Magnets	19.2	5 887 034	8 148 228	7 231 942	23%	-11%
2,3,4,10 [1]	Main Vessel	92.5	112 527 825	89 868 145	85 144 390	-24%	-5%
5	Remote Handling	47.2	16 691 822	9 701 489	8 582 341	-49%	-12%
6	Cryoplat and Fuel Cycle	28.8	8 479 232	8 514 072	9 514 071	12%	12%
7 [4]	Plasma Engineering Operations	8.2	4 354 175	872 572	312 110	-93%	-64%
8 [5]	Heating and Current Drive	70.1	32 305 159	10 895 403	9 657 753	-70%	-11%
9	Diagnostics	48.7	21 342 879	21 826 016	20 460 278	-4%	-6%
11	Site and Buildings and Power Supplies	62.1	226 426 063	207 854 599	215 662 576	-5%	4%
12	Cash Contributions	2.4	308 004 235	240 446 686	224 311 685	-27%	-7%
13	Supporting Activities	34.3	28 237 365	29 546 657	29 180 908	3%	-1%
14	Broader Approach	43.4	41 372 873	23 662 778	17 261 434	-58%	-27%
Sub-total Budget WP		457	805 628 663	651 336 646	627 319 489	-22%	-4%
	Reserve stemming from cancelled appropriations to be entered in the estimate of revenue and expenditure of the following financial years as per Art.12.1 FR			171 173 522	161 390 407		
	Reserve stemming from appropriations corresponding to external assigned revenue from ITER IO as per Art.12.2.4.b FR			97 577 960	69 388 545		
	Reserve stemming from appropriations corresponding to external assigned revenue from ITER Host State				46 420 765		
Total Budget			805 628 663	920 088 128	904 519 207		

[1] The sub-actions of Vacuum Vessel, In-Vessel Divertor, In-Vessel Blanket and Test Blanket Module are presented merged in one single line due to commercial sensitive information

[2] Variation Original: Execution compared to Original WP

[3] Variance Final: Execution compared to last amended WP

[3] From WP 2022 Amendment 2, "Antennas Project" is transferred into renamed "Action 8 Heating & Current Drive"

[4] From WP 2022 Amendment 2, "Action 8 - Heating & Current Drive" includes "Neutral Beam Project" and "Antennas Project"

The evolution of the 2022 Work Programme is reflected in its amendments approved by the Governing Board in July and December 2022⁷.

The KPI of the execution of the budget allocated to the 2022 Work Programme in its last amendment is 96%. The main reason for the variance was the lower final amount requested by IO for the 2023 Cash Contribution (-16 MEUR).

⁷ Amendment 1 to WP 2022 (F4E_D_2WYUPS) and Amendment 2 to WP 2022 (F4E_2X2VMF)

The other changes (> +/-10%) in the Operational expenditure (variation of the final implementation in % of the last amended WP) are:

- **Magnets:** variance consists of minor commitments not implemented;
- **Remote Handling:** variance consists of minor commitments not implemented, the biggest one being a task order for Engineering Insourcing support of 600 kEUR;
- **Cryoplant and Fuel Cycle:** increased amount of the Manufacturing and Delivery of Neutral Beam (NB) Cryolines, Cryojumpers and Johnston coupling for Cold Valve Boxes (CVB);
- **Plasma Engineering Operations:** variance consists of minor commitments not implemented;
- **Heating and Current Drive:** variance consists of minor commitments not implemented;
- **Broader Approach:** One of the activities for the Supply of the JT-60SA Actively Cooled Divertor was postponed to 2023

Annex VIII Environmental Management

As Chair of the Greening Network, F4E multiplied efforts to raise the awareness on sustainability issues at all levels. As a result, the Greening Network has been recognised by its peers and sustainability has been integrated in the reflection and work programme of several EU Agencies subnetworks. Fruitful discussions among GN members have nurtured a global strategy "The EU Agencies and JUs towards a sustainable future" to implement the ambitions set in the EUAN 2021-2027 Strategy ("Greening and Sustainability in the EU Agencies Network") in the context of the European Green Deal and the Commission's ambitions.

At local level, fruitful exchanges took place with the Building Management of Barcelona premises on energy efficiency (air condition and ventilation) and mobility (installation of plugs for electric cars).

Annex IX Contribution, grant and service level agreements. Financial Framework Partnership Agreements⁸

On going Grants signed before 31.12.2022

Grant Agreements Reference	Date of Signature	Total Amount		Duration (In months)	Counterpart (Leader Company)	Contract Title
		Commitment Value (Euros)	of which committed in 2022			
F4E-FPA-327 (PMS-DG)-07	20-02-20	€2,081,637.00	€66,340.00	50	AGENZIA NAZIONALE PER LE NUOVE TECN	FPA-327-07_Development of the Final Design and Prototyping
F4E-FPA-364-06	22-10-18	€1,390,426.00	€0.00	62	MAX-PLANCK-GESELLSCHAFT ZUR FORDERU	Development of the Design and Critical Prototyping
F4E-FPA-384 (DG)-05	30-07-18	€2,286,133.00	€0.00	65	MAX-PLANCK-GESELLSCHAFT ZUR FORDERU	F4E-FPA-384-SG05 Development of the Design and Prototyping
F4E-GRT-0901-01	09-03-18	€1,731,559.13	€119,968.13	64	TEKNOLOGIAN TUTKIMUSKESKUS VTT OY* ^T	Development and integration of 3D Machine Vision, HLCS modules and GENROBOT at DTP2
F4E-GRT-0974-01	20-12-18	€368,536.00	€63,550.00	54	TUOTEKHEITYS OY TAMLINK*	PROTOTYPING AND TESTING OF HYDRAULIC DIGITAL VALVES FOR THE DIVERTOR REMOTE HANDLING SYSTEM
F4E-GRT-1146-01	25-07-21	€2,260,574.00	€260,633.00	48	COMMISSARIAT A L ENERGIE ATOMIQUE E	Completion of the design of Equatorial Wide Angle Viewing System (EP-WAVS) in EP12 and post-design technical support
F4E-GRT-553	09-07-14	€2,562,993.00	€0.00	88	ECOLE POLYTECHNIQUE FEDERALE DE LAU	DESIGN, DEVELOPMENT AND VALIDATION OF THE EUROPEAN GYROTRON

⁸ F4E does not provide to other entities Contribution and service level agreements nor Financial Framework Partnership Agreements

Annex X – Annual Accounts

Final Annual Accounts 2022 to be added following the Governing Board meeting.



**FUSION
FOR
ENERGY**

FINAL ANNUAL ACCOUNTS

Financial statements & Budget implementation

Fifteenth financial year – 2022

THE EUROPEAN JOINT UNDERTAKING FOR ITER AND THE DEVELOPMENT OF FUSION ENERGY

Josep Pla nº 2 · Torres Diagonal Litoral · Edificio B3· 08019 Barcelona · Tel. +34 93 320 18 00

www.fusionforenergy.europa.eu

These annual accounts have been drawn up by the Accounting Officer of Fusion for Energy (F4E).

The final accounts, together with the opinion of the F4E Governing Board, are sent to the Commission's Accounting Officer, the European Court of Auditors, the European Parliament and the Council.

The final accounts are published on F4E's website:

<https://fusionforenergy.europa.eu/key-reference-documents/>



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Certification letter from F4E Accounting Officer

I acknowledge my responsibility for the preparation and presentation of the annual accounts of Fusion for Energy (F4E) in accordance with Article 102 of the Framework Financial Regulation ('FFR')¹ and I hereby certify that the annual accounts of F4E for the year 2022 have been prepared in accordance with Title IX of the FFR and the accounting rules adopted by the Commission's Accounting Officer, as are to be applied by all the institutions and union bodies.

I have obtained from the Authorising Officer, who certified its reliability, all the information necessary for the production of the accounts that show the F4E's assets and liabilities and the budgetary implementation. Based on this information, and on such checks as I deemed necessary to sign off the accounts, I have a reasonable assurance that the accounts present fairly, in all material aspects, the financial position, the results of the operations and the cash-flow of F4E.

Mr Roberto Abad Villanueva
Accounting Officer

Done in Barcelona, 30th May 2023

¹ COMMISSION DELEGATED REGULATION (EU) 2019/715 of 18 December 2018 on the framework financial regulation for the bodies set up under the TFEU and Euratom Treaty and referred to in Article 70 of Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council.

1. Introduction

F4E is a Joint Undertaking created under the Euratom Treaty by a decision of the Council of the European Union (EU)².

F4E was established for a period of 35 years from 19th April 2007 and its seat is located in Barcelona, Spain.

The main tasks of F4E are as follows:

- In relation to the obligations stemming from the ITER International Agreement: to provide the contribution of the European Atomic Energy Community (Euratom) to the ITER International Organisation (IO).
- In relation to the obligations stemming from the Broader Approach Agreement with Japan (BA): to provide components, equipment, materials and other resources for BA activities and to prepare and coordinate Euratom's participation in the implementation of BA activities.
- In relation to DEMO: to prepare and coordinate a programme of research, development and design activities other than ITER and BA activities, in preparation for the construction of a demonstration fusion reactor and related facilities, including the IFMIF (International Fusion Materials Irradiation Facility).

Regarding the ITER project, in November 2016 the Council of IO approved a new ITER project baseline for the scope, schedule and the cost of the project. The overall project schedule is based on a progressive four-stage approach with the so-called 'First Plasma' in December 2025 and culminating in the 'Deuterium-Tritium' phase in December 2035. Following the approval of the new ITER project baseline, F4E set the new timetable and recalculated the related cost at completion of the F4E's contribution to the project construction phase.

In addition to the construction of the machine, F4E will have to contribute to the ITER operational phase and to the subsequent ITER deactivation and decommissioning phases. The F4E contribution to the deactivation and the decommissioning phases are defined as EUR 95 540 000 (in 2001 values) and EUR 180 200 000 (in 2001 values).

For the Multiannual Financial Framework (MFF) period 2021-2027, the European Council has agreed a budget for the Euratom contribution to ITER amounting to a total value of EUR 5 614 million (in current values) of which EUR 5 560 million (in current value) of direct contribution to the project. The ITER Host State and Membership contributions will be added to this figure, subject to the final decision by the relevant Budgetary Authorities.

² Council decision 2021/281/Euratom of 22 February 2021 Amending Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it.

a) F4E revenue is made up of the:

- **Euratom contribution**

The contribution from Euratom constitutes the main source of revenue for F4E.

The annual contribution is determined in the European Union General Budget in commitment and in payment appropriations, as well as the F4E establishment plan. The revenue received from Euratom is earmarked for operational expenditure and for administrative expenditure (running costs).

- **The ITER Host State Contribution (France)**

The contribution from the ITER Host State constitutes the second source of revenue for F4E. France as the ITER Host State covers 9.09% of the total costs of the ITER construction phase, this is equivalent to 20% of the total European participation to the construction of ITER. New principles and methodology to calculate the French contribution is established in the exchange of letter³ from 2022, with retroactive effect in 2021. It is calculated on the EURATOM contribution to F4E minus the domains of exclusion as agreed in the exchange of letter and defined as follows:

- Administrative expenditure,
- Test Blanket Modules cost,
- DONES cost,
- Broader Approach cost,
- The Transportation cost.

Compared to the 2011 agreement, covering the period until the end of 2020, this new methodology is no longer limited in time and covers the remaining lifetime of the project.

- **The Membership contributions (F4E Members except Euratom)**

The Annual Membership Contributions are established and adopted annually within the budget. It corresponds to 10% of the administrative budget and are universal (not assigned) revenue.

- **Reserve Fund and other tasks requested and financed by IO**

The revenue from the Reserve Fund managed by the IO is assigned to the implementation of change orders originating from IO which take place in the framework of the contractual relationships between F4E and the various suppliers.

The revenue from the Reserve Fund and from other requested tasks is earmarked for financing the corresponding requests for change from IO introduced after 5th March 2015.

³ Contribution financière française à la construction d'ITER : Lettre du Haut Représentant Français pour ITER (formal exchange of letters on 17 June 2022 and 29 July 2022 between France and the European Commission).

b) United Kingdom and Switzerland Participation in ITER Programme

On 1 February 2020 the UK ceased to be a Member State of the EU. Following the conclusion of the Agreement on the withdrawal of the UK from the EU and the Euratom (the 'Withdrawal Agreement') between the two parties, the UK committed to pay all its obligations under the 2014-2020 MFF and previous financial perspectives following from its membership of the Union. The UK has paid into the 2020 EU Budget during the year as if it was a Member State.

The UK and EU concluded negotiations on future UK relationship with the EU on 24 December 2020, however the agreement was not ratified by the EU during 2022 and therefore had no effect on the herein reported F4E financial year.

According to the 2020 agreement, after its ratification the UK will become an associate member state of Euratom and shall retain participation in all parts of the Euratom programme, under equivalent conditions as full Member States.

Article 8 of the EU-UK Joint Declaration states that the UK will continue to participate as a member of F4E. The UK financial contribution is subject to negotiation. Once Britain's membership shall take effect, UK economic operators will be able to sign new contracts and grants with F4E and British citizens will be again eligible for F4E employment. Existing contracts, with companies and individuals, are not impacted, while grants with UK beneficiaries have been terminated or suspended until ratification.

On 31st December 2020 the research cooperation agreement between Switzerland and the EU expired. This cooperation agreement covered, among other fields, the Swiss participation to Euratom research programmes (including fusion and ITER), therefore on the same date Switzerland ceased being an F4E Member.

No new agreement was negotiated between Euratom and Switzerland during 2022, therefore Switzerland remained a non-member for the whole duration of the 2022 financial year and therefore paid no contribution to the F4E budget.

Existing contracts, with companies and individuals, are not impacted, while grants with Swiss beneficiaries have been terminated or suspended.

c) Main achievements during 2022

During 2022 F4E has further progressed in the work and continued the delivery of some of the major components to ITER to continue the assembly activities for achievement of First Plasma.

Notably in 2022 F4E delivered the seventh (GB23) and eighth Toroidal Field coils on the ITER site which makes a total of 8 Toroidal Coils delivered out of 10 assigned to F4E.

F4E also made available to IO the Control Room (GB34) for installation and reached Ready For Equipment stage of the Cryopant Compressor Building (GB19).

F4E also delivered the 8th set of Main High Voltage Power Supplies & Body Power Supplies to the ITER Site (GB43).

The IO DG has communicated end of December 2022 to the Heads of the ITER domestic agencies, his intention to review in depth the ITER requirements and definition of the staged approach, including

reconsideration of the ITER neutron fluence or of some technical choices like the material for the First Wall blanket, in view of presenting those significant changes for decision by the ITER Council in June 2023. It is expected that a new ITER baseline will not be presented for approval by the ITER council before November 2023. F4E will subsequently adjust its planning accordingly.

Both design and manufacturing activities have progressed in Europe in laboratories and industry.

In 2022 F4E achieved an overall Schedule Performance Index (SPI):

$$SPI = \frac{\text{Number of milestones achieved to end of previous month}}{\text{Number of milestones in baseline to end of previous month}} = 0.87$$

The achievements during the year are detailed in the 2022 Consolidated Annual Activity report (with the annual accounts in annex).

d) Impact of international situation

During 2022 F4E experienced strong inflationary effects, initially due to COVID-19 induced supply chain issues and then (after February 2022) due to the war in Ukraine. The estimated impact of these on the total F4E EAC amounts to €144M (2008 value) per the latest estimate. This EAC increase is expected to materialize as additional expenditure in the years 2023-2026. This inflationary effect is clear in raw material prices, both in existing contracts and tenders received in 2022, and is likely to continue in the future depending on the developing international situation.

e) 2022 Accounts

The 2022 financial statements of F4E and its reports on budget implementation for 2022 have been prepared in conformity with:

- The Council Decision establishing F4E,
- The Financial Regulation (FR) applicable to the general budget of the European Union⁴,
- The F4E FR⁵,
- The « Inventory directive » (EC n° 643/2005),
- The European Commission's consolidation manual for the 2022 closure.

The accounts have also been drawn up in accordance with the accounting rules adopted by the Accounting Officer of the European Commission (EC). As an EU body, F4E is fully consolidated in the EU accounts. Articles 80.1 and 82.1 of the general FR state that the Accounting Officer of the EC adopts the accounting rules and the harmonised chart of accounts to be applied by all institutions and EU bodies. They are accrual

⁴ Financial Regulation (EC, Euratom) n° 966/2012 of the European Parliament and of the Council of 25 October 2012, last amended on 18/07/2018 (EU, Euratom) n° 2018/1046.

⁵ F4E Financial Regulation adopted by F4E Governing Board on 9-10/12/2019 – F4E(19)-GB45-45.

based accounting policies derived from International Public Sector Accounting Standard (IPSAS) or by default, International Financial Reporting Standards (IFRS).

F4E has implemented the ABAC system (Accrual Based Accounting) owned by the EC and used by many EU bodies. The accounting and budgetary information is integrated in one system which has SAP as a back-end for the accounting part. The workflow system in ABAC allows the Authorising Officer to ensure that the “four eyes” principle has been observed for each transaction.

The representation letter related to the accounts 2022 has been transmitted to the President of the European Court of Auditors (ECA) in a separate note. It includes no reservation from the F4E Accounting Officer.

In line with Article 70.6 of the FR applicable to the general budget of the EU, Baker Tilly has been appointed as independent external auditor in order to verify that the 2022 annual accounts properly present the income, expenditure and financial position of F4E.

ECA shall prepare a specific Annual Report in line with the requirement of Article 287 (1) TFEU. When preparing this report, ECA shall consider the audit work performed by the independent external auditor and the action taken in response to the auditor’s findings.

The European Parliament is the discharge authority within the EU. This means that, following the audit and finalisation of the annual accounts, it falls under the responsibility of the Council to recommend and then to the European Parliament to give a discharge to F4E.

Section I. 2022 Financial Statements

2. Balance Sheet

As at 31 December 2022

EUR thousands

	Note	2022	2021
CURRENT ASSETS			
Cash and cash equivalents	6.2.1.	25	46
Receivables	6.2.2.	310 904	289 869
Pre-financing	6.2.3.	13 393	37 774
		324 322	327 688
NON-CURRENT ASSETS			
Pre-financing	6.2.3.	67 308	70 356
Property, plant and equipment	6.2.4.	467	669
Intangible assets	6.2.4.	45	84
		67 821	71 110
TOTAL ASSETS		392 143	398 798
CURRENT LIABILITIES			
Accounts payable	6.2.5.	79 960	66 739
Accrued charges and deferred income	6.2.6.	119 642	62 830
Current provisions	6.2.7.	76	62 872
		199 678	192 441
NON-CURRENT LIABILITIES			
Non-Current provisions	6.2.7.	185 560	183 060
		185 560	183 060
TOTAL LIABILITIES		385 238	375 501
NET ASSETS		6 905	23 297
NET ASSETS/EQUITY			
Accumulated surplus/deficit		23 297	84 769
Economic result of the year - Profit (+)/Loss (-)		-16 392	-61 472
NET ASSETS	6.2.8.	6 905	23 297

Fig. 1 Balance Sheet

3. Statement of Financial Performance

As at 31 December 2022		EUR thousands	
	Note	2022	2021
NON-EXCHANGE REVENUES			
Revenue from Euratom		596 754	601 227
Revenue from other contributors (Member States)		155 500	135 083
Other non exchange revenue		701	173
		752 955	736 483
EXCHANGE REVENUES			
Reserve Fund		69 549	6 444
Other revenues		16	1 423
		69 565	7 867
TOTAL REVENUE	6.3.1.	822 520	744 350
OPERATIONAL EXPENSES			
Expenses with third parties	6.3.2.	752 147	639 154
		752 147	639 154
OTHER EXPENSES			
Staff costs	6.3.3.	64 994	51 608
Provisions - additions and adjustments		2 576	102 323
Property, plant and equipment related expenses		2 118	2 136
Other expenses		17 076	10 601
		86 765	166 668
TOTAL EXPENSES		838 912	805 822
SURPLUS (+) / DEFICIT (-) OF THE YEAR		-16 392	-61 472

Fig. 2 Statement of Financial Performance

4. Cash Flow Statement (indirect method)

As at 31 December 2022		EUR thousands	
	2022	2021	
Surplus/(deficit) from ordinary activities	-16 392	-61 472	
Operating activities			
Amortization (intangible fixed assets) +	-11	107	
Depreciation (tangible fixed assets) +	159	418	
Increase/(decrease) in Provisions for risks and liabilities	-60 296	100 923	
Increase/(decrease) in Value reduction for doubtful debts	0	0	
(Increase)/decrease in Stock	0	0	
(Increase)/decrease in Long term Pre-financing	3 048	5 141	
(Increase)/decrease in Short term Pre-financing	24 380	5 207	
(Increase)/decrease in Long term Receivables	0	0	
(Increase)/decrease in Short term Receivables	-21 035	-49 722	
Increase/(decrease) in Other Long term liabilities	0	0	
Increase/(decrease) in Accounts payable	70 033	-549	
	-114	53	
Investing activities			
Increase of tangible and intangible fixed assets (-)	-200	-126	
Proceeds from tangible and intangible fixed assets (+)	293	74	
	93	-53	
Net increase/(decrease) in cash and cash equivalents	-21	0	
Cash and cash equivalents at the beginning of the period	46	46	
Cash and cash equivalents at the end of the period	25	46	

Fig. 3 Cash Flow Statement

5. Statement of Changes in Net Assets

As at 31 December 2022		EUR thousands		
Net assets	Accumulated Surplus (+) / Deficit (-)	Economic result of the year	Net assets (Total)	
Balance as of 31 December 2021	84 769	-61 472	23 297	
Balance as of 1 January 2022	84 769	-61 472	23 297	
Fair value movements	0	0	0	
Allocation of the Economic Result of Previous Year	-61 472	61 472	0	
Economic result of the year	0	-16 392	-16 392	
Balance as of 31 December 2022	23 297	-16 392	6 905	

Fig. 4 Statement of Changes in Net Assets

6. Notes to the Financial Statements

6.1. Accounting Principles

The Financial statements provide information about the financial position, performance and cash flow of an entity that is useful to a wide range of users. For a public sector entity such as F4E, the objectives are more specifically to provide information useful for decision-making, and to demonstrate the accountability of the entity for the resources entrusted to it.

The accounts of the Joint Undertaking comprise the general accounts and budget accounts. These are kept in euro on the basis of the calendar year. The budget accounts give a detailed picture of the implementation of the budget. They are based on the modified cash accounting principle. The general accounts allow for the preparation of the financial statements which consist in a statement of financial performance, showing all income and expenditure for the financial year, and a balance sheet designed to establish the financial position of F4E at 31 December.

Article 98 of F4E FR sets out the accounting principles to be applied in drawing up the financial statements.

Use of estimates

In accordance with IPSAS and generally accepted accounting principles, the financial statements include amounts based on estimates and assumptions by management based on the most reliable information available.

Significant estimates include, but are not limited to, amounts for provisions, accounts receivables, accrued income and charges, contingent assets and liabilities, and the degree of impairment of intangible assets and property, plant and equipment. Actual results could differ from those estimates. Changes in estimates are reflected in the period in which they become known.

IPSAS 11 – Construction contracts

Most of the components that make up ITER will be delivered by the ITER parties (including F4E) “in-kind” (providing directly the components rather than contributing only cash).

The EU contribution to IO through F4E is established on the ITER Agreement and Common Understanding on Procurement Allocation and its amendments, and it comprises mainly buildings, magnets, vessels and other engineering components.

On the basis of the Procurement Arrangements (PA), F4E launches procurements and concludes contracts with the industry. The industry delivers usually directly to IO, which also performs the acceptance. IO then informs F4E about the acceptance, i.e. IO recognises the credits to F4E. In order to consider that the PA obligations have been fulfilled by each party, the PA value has to be fully earned, independently of the actual cost incurred for executing the scope of work of each PA.

For each PA key milestone an ITER credit is associated and this is released to the specific Party whenever the milestone has been achieved and the related documentation verified by IO. Therefore the progress in the execution of the work and in discharging the EU from its obligation toward the ITER Agreement is recognized by means of credit earned by F4E depending on the achievement of project milestones laid down in each PA.

As there is no specific EC accounting rule covering those operations, F4E refers to IPSAS rule n° 11 “Construction contracts”.

The ITER Agreement and Common Understanding on Procurement Allocation and its amendments together with the F4E Statutes can be considered as a binding arrangement and therefore as a construction contract according to IPSAS 11.

From an IPSAS 11 perspective, F4E can be considered as contractor and the agreement with Euratom as a construction contract.

Based on the accounting guidance applicable to the type of transactions managed by F4E, the cost of the items, acquired or constructed, incurred with the purpose of the final manufacture of the research components that F4E agreed to deliver **should be expensed when incurred**.

The recognition as an expense is the approach that better capture the nature of the transaction given that :

- in most of the cases the suppliers hold the economic ownership (i.e., is not presently controlled by F4E);
- F4E does not foresee using the assets for other purpose, or
- F4E agrees/foresees to provide the legal ownership to the subcontractors for no consideration after delivery.

It is to be noted that the use of IPSAS rule n° 11 (Construction contracts) is extended to the accounting of all operational contributions within the ITER and BA agreements.

6.2. Notes to the Balance Sheet

6.2.1. Cash and Cash Equivalents

Description	31.12.2022	31.12.2021
Bank accounts:		
Current accounts	0.00	0.00
Imprest accounts/Cash in hand	25 000.00	45 537.20
Short-term deposits	0.00	0.00
TOTAL	25 000.00	45 537.20
EC Central treasury:	50 889 047.15	4 964 662.70

Fig. 5 Central treasury and Cash Equivalents

The cash position at the end of 2022 is composed of three imprest accounts (petty cash).

No bank interests have been generated in 2022.

In view to increase the efficiency, F4E has externalised its treasury to the EC in May 2019. In line with the accounting guidance, those funds belonging to F4E are accounted as Sundry receivables and not anymore as Cash and cash equivalent. The comparative amounts for 2021 have been adjusted accordingly.

6.2.2. Current Receivables

All receivables are carried out at the original amount less write-down for impairment when there is objective evidence that F4E will not be able to collect all amounts due according to the original payment terms.

Current receivables: EUR 28 938 107.33 referring mainly to the recoverable VAT from France.

Sundry receivables: EUR 50 978 025.03 composed mainly of the funds belonging to F4E but managed by the EC Central treasury (see also above point 6.2.1.).

Deferrals: EUR 228 272 156.09 corresponding to the deferred charges related to the 2023 cash contribution to IO (EUR 224.3 million) and deferred charges for insurance premiums paid in advance (EUR 4.0 million).

Accrued income: EUR 2 715 705.18 corresponding to the accrued revenue from the ITER Reserve fund.

6.2.3. Pre-Financing

Pre-financing is a payment intended to provide the beneficiary with a cash advance, i.e. a float (related mainly to operational procurement contracts). It may be split into a number of payments over a period defined in the specific pre-financing agreement. The float or advance is repaid or used for the purpose for

which it was provided during the period defined in the agreement. If the beneficiary does not incur eligible expenditures, he has the obligation to return the pre-financing to F4E.

The amount of the pre-financing is reduced (wholly or partially) by the acceptance of eligible costs and amounts returned.

At year-end, outstanding pre-financing amounts are valued at the original amount(s) paid less: amounts returned, eligible amounts cleared, estimated eligible amounts not yet cleared at year-end, and value reductions.

Pre-financing without interest for F4E	31.12.2022	31.12.2021
Pre-financing given to third parties (non-current)	67 308 376.45	70 356 400.38
Pre-financing given to third parties (current)	62 946 478.82	93 569 016.33
Accrued charges on Pre-financing given to third parties	-49 553 151.76	-55 795 460.93
TOTAL	80 701 703.51	108 129 955.78

Fig. 6 Pre-Financing

It is estimated that EUR 67.3 million of the pre-financing open at 31/12/2022 will be cleared with eligible amounts after 2023.

6.2.4. Fixed Assets

An asset shall be recognised only if it is probable that the expected future economic benefits or service potential that are attributable to that asset will flow to F4E and the cost or fair value of the asset can be measured reliably. Service potential would refer to assets that are used to achieve an objective but which do not directly generate net cash inflows. In the context of F4E this comprises all assets that are used by F4E to fulfil its objectives.

F4E books as fixed assets only items with a purchase price above EUR 5 000.00. Items with a lower value, such as monitors, digital cameras, etc., are treated as expenses of the year but are however registered in the physical inventory. All assets are stated at cost less accumulated depreciation and impairment losses.

F4E has introduced the module ABAC Assets in 2008. ABAC Assets has been developed to meet the requirements of the EC "Inventory Directive" (EC n° 643/2005) and its content is replicated in SAP Assets Accounting module.

All fixed assets are depreciated monthly, with zero residual value, over a variable useful lifetime:

Asset type	Annual depreciation rate
Intangible fixed assets	25%
Tangible fixed assets	
Buildings	4%
Plant and equipment	12.5%, 25%
Furniture and vehicles	
Office furniture	10%
Transport, electrical office, printing and mailing equipment	25%
Kitchen, Printshop and postroom equipment	12.5%
Computer hardware	25%
Other fixtures and fittings	
Audiovisual and Telecommunications equipment	25%
Computer, scientific and general books, documentation	25%, 33%
Health, safety, protective, security and medical equipment,	12.5%
Other	10%
Tangible fixed assets under construction	0%

Fig. 7 Depreciation Rate

Intangible fixed assets:

An intangible asset is an identifiable non-monetary asset without physical substance.

Regarding the internally developed intangible assets (e.g. software), the requirements of the accounting rule n°6 from 1/1/2010 onwards are:

- costs directly linked to an internally developed intangible asset, providing they meet the necessary criteria, must be capitalised as asset under construction. Once the project goes live, the resulting asset will be amortised over its useful life,
- the amount of research expenses incurred on IT projects and development costs not capitalised (e.g. for small projects below threshold, see Fig.10 under note 6.3.3. below) must be disclosed in the financial statements.

As of 31/12/2022, all projects identified were below the threshold of EUR 500 000.00 used by F4E for the capitalisation of internally generated intangible assets.

Tangible fixed assets:

A tangible asset is an identifiable non-monetary asset with physical substance.

The following table Fig.8 provides the variation of the fixed assets in 2022 :

ASSETS		Intangible fixed assets			Tangible fixed assets							Fixed assets
2022		Intangible fixed assets internally generated	Computer Software	Total Intangible fixed assets	Buildings	Plant and Equipment	Computer hardware	Furniture and vehicles	Other Fixtures and Fittings	Tangible Fixed Assets under Construction	Total Tangible fixed assets	Total fixed assets
Gross carrying amounts 01.01.2022	+	0.00	2 926 797.72	2 926 797.72	0.00	765 624.39	4 344 966.83	750 127.48	836 750.62	0.00	6 697 469.32	9 624 267.04
Additions	+			0.00		87 030.00	96 127.64		16 365.99		199 523.63	199 523.63
Disposals	-		-49 982.70	-49 982.70			-194 884.57	-7 735.66	-40 132.41		-242 752.64	-292 735.34
Transfer between headings	+/-			0.00							0.00	0.00
Other changes :	+/-			0.00							0.00	0.00
Gross carrying amounts 31.12.2022		0.00	2 876 815.02	2 876 815.02	0.00	852 654.39	4 246 209.90	742 391.82	812 984.20	0.00	6 654 240.31	9 531 055.33
Accumulated amortization and impairment 01.01.2022	-	0.00	-2 842 450.72	-2 842 450.72	0.00	-584 945.39	-4 035 760.83	-705 771.48	-701 802.62	0.00	-6 028 280.32	-8 870 731.04
Depreciation	-		-38 941.00	-38 941.00		-149 556.00	-186 117.64	-17 951.00	-48 118.99		-401 743.63	-440 684.63
Write-back of depreciation	+			0.00							0.00	0.00
Disposals	+		49 982.70	49 982.70			194 884.57	7 575.66	40 132.41		242 592.64	292 575.34
Impairment	-			0.00							0.00	0.00
Write-back of impairment	+			0.00							0.00	0.00
Transfer between headings	+/-			0.00							0.00	0.00
Other changes :	+/-			0.00							0.00	0.00
Accumulated amortization and impairment 31.12.2022		0.00	-2 831 409.02	-2 831 409.02	0.00	-734 501.39	-4 026 993.90	-716 146.82	-709 789.20	0.00	-6 187 431.31	-9 018 840.33
Net carrying amounts 31.12.2022		0.00	45 406.00	45 406.00	0.00	118 153.00	219 216.00	26 245.00	103 195.00	0.00	466 809.00	512 215.00
Accounts				210000	221000	230000	241000	240000	242000	244000	200000	

Fig. 8 Intangible and Tangible Fixed Assets

6.2.5. Accounts Payable

Current and sundry payables are **EUR 78 773 267.33** and are composed of the balance of the 2022 cash contribution to IO (EUR 78.5 million) and suppliers' invoices received but not paid at year end and reimbursements to staff.

Pre-financing received from Euratom totalled **EUR 1 186 246.02** refers to the balance of the budget outturn account 2022, to be reimbursed to the EC in 2023 (Cf. point 7.6. Budget outturn account).

6.2.6. Accrued Charges and Deferred Income

In accordance with EU Accounting Rule n° 3, accruals are made to recognize the amounts to be paid for goods or services that have been received or supplied but have not been paid, invoiced or formally agreed with the supplier, including amounts due to employees. The accruals are based on project analysis performed by the Authorizing Officer and cross-checked with the amounts actually invoiced at the time of finalization of the accounts.

The amount of **EUR 119 642 143.73** which represents mainly invoices to be received in 2023 for services rendered in 2022, includes:

- EUR 109 776 992.55 for services rendered in 2022 on operational activities and not invoiced at 31/12/2022,
- EUR 8 062 868.42 for services rendered in 2022 on administrative expenditures and not invoiced at 31/12/2022,
- EUR 1 802 282.76 for F4E staff's untaken leave as at the end of December 2022. In conformity with EC Accounting Rule n° 12, an entity shall recognize the cost of holidays carried over to the following years during the year the services were rendered by the staff members.

6.2.7. Provisions

Provisions are recognised when F4E has a legal or constructive obligation towards third parties as a result of past events, for which it is more likely than not that an outflow of resources will be required to settle the obligation, and when the amount can be reliably estimated. Provisions are not recognised for future operating losses. The amount of the provision is the best estimate of the expenditures expected to be required to settle the present obligation at the reporting date. The EU Accounting rule n°10 (Provision, contingent assets and liabilities) is applicable.

As at 31 December 2022

EUR

Description	Amounts at 31.12.2021	Amounts used	Amounts cancelled	Transfer to current	Addition and value adjustments	Amounts at 31.12.2022
Decommissioning fund	173 864 652.87	0.00	0.00	0.00	2 400 123.67	176 264 776.54
Additional contribution to Japan/QST	9 195 343.86	0.00	0.00	0.00	99 771.96	9 295 115.82
TB04 Contract	62 574 171.07	-59 874 171.07	-2 700 000.00	0.00	76 338.00	76 338.00
Pension contribution	297 461.78	-297 461.78	0.00	0.00	0.00	0.00
Total	245 931 629.58	-60 171 632.85	-2 700 000.00	0.00	2 576 233.63	185 636 230.36

Fig. 9 Non-current and current Provision

Provision for the decommissioning fund :

When the construction of an asset requires removal after the end of its useful life and restoration of the site, then a present obligation arises at the time of its construction.

F4E shall contribute jointly through the Budget of the IO to the accumulation of the Decommissioning Fund from the date of First Plasma through the Operation Phase. This will be done by making regular payments through the IO budget.

Based on the Overall Project Cost approved by the ITER Council⁶, the Decommissioning cost is estimated to EUR 530.0 million in 2001 value (not including the Deactivation cost). The EU share of the estimated costs for Decommissioning is EUR 180.2 million (34 % of EUR 530.0 million).

The following assumptions have been made for the calculation :

- the percentage of completion, discharge of obligations to ITER is 63.5 % as of 31.12.2022 (according to the F4E Monthly Dashboard),
- the cost contributions will be done in equal annual instalments of EUR 15.0 million in 2001 value (180.2 divided by 12 years) during the Operation Phase 2026 to 2037,
- EU HICP annual inflation rate from 2001 to 2022,
- an annual inflation rate of 2.3 % provided by Eurostat to reflect future prices,
- the contributions in future prices are discounted on average 2.5 % (ECB – 4 to 11 years zero coupon rate).

Other provision - Additional financial contribution to Japan :

Regarding the arrangements signed between F4E, the JAEA and IO, the transfer of procurement responsibilities from Europe to Japan is implemented through annual cash contributions.

In addition to the original agreements, in January 2014, Euratom and the Japanese Ministry of Science and Technology reached an agreement for settling the transfer of procurement responsibilities, following the request by Japan for an additional financial contribution of EUR 75.0 million (2014 value).

In line with the specific agreement signed in 2020, the provision has been consumed with two payments (EUR 70.0 million in 2020 and EUR 1.4 million in 2021). The balance will be executed in 2025.

⁶ Updated Overall Project Cost (OPC) – ITER_D_26B8X9 v1.1 presented to IC-25

Therefore, in compliance with the accounting rules, the provision has been adjusted based on :

- EU HICP annual inflation rate from 2014 to 2022,
- an annual inflation rate of 2.3 % provided by Eurostat to reflect future prices,
- the contributions in future prices are discounted 2.5 % (ECB – 3 years zero coupon rate).

Other provision – TB04 Contract

The TB04 contract covers for the most part the design and supply of the equipment for electrical and HVAC services in the ITER Tokamak Building. Installation of this equipment is under IO's responsibility.

The provision booked in the 2021 accounts reflected in the settlement agreement that was signed with the contractor in December 2022 has been paid at the end of the financial year.

Following a number of Disputes, F4E won the adjudication against the TB04 Contractor. According to the binding decision of the Adjudication Panel issued on 11 May 2023, F4E has to pay EUR 76 338.00 (corresponding to 20% of the adjudicators' fee). More details are provided below under point 6.4.2. Contingent liabilities.

6.2.8. Net Assets

F4E net assets are decreased by the negative financial performance of the year (EUR 16.4 million) totalling **EUR 6 905 024.71** as of 31 December 2022.

The resources of F4E consist of contributions from Euratom and from the ITER Host State, annual membership, voluntary contributions from the Members other than Euratom and additional resources.

It is to be noted that according to F4E FR, if the balance of the outturn account is positive, it shall be repaid to the EC up to the amount of the Euratom contribution paid during the financial year (see point 7.6. Budget outturn account).

6.3. Notes to the Statement of Financial Performance

6.3.1. Revenue

F4E's revenues consist mainly of contributions granted by Euratom as a participation in the financing of F4E, the ITER Host State, annual membership contributions from other members than Euratom, the ITER Reserve Fund, recoveries of expenses as well as revenue from liquidated damages.

A distinction is made in the Statement of financial performance between :

- revenue from **non-exchange transactions** (mainly from contributors) : the related receivables and revenue are recognized when the recovery orders are issued by F4E (in line with the payment needs and within the Budget approved by F4E's GB). At the end of each financial year, the surplus assessed for budget purposes on a modified cash basis is returned to Euratom (see point 7.6. Budget outturn account). The EU Accounting rule 17 – Revenue from non-exchange transactions is applicable.
- revenue from **exchange transactions** (mainly from the ITER Reserve Fund) : the revenue recognition criteria applied are those described in the EU Accounting rule n° 4.

It is to be noted that the revenue from ITER Reserve Fund is recognised subject to the:

- authorisation for financing from the Reserve Fund, implemented through the decisions of the Executive Project Board;
- approval of the related contractual amendment, given by the IO-DG;
- implementation of the related actions by F4E's suppliers (allowing to match the cost with the revenue from ITER).

The operating revenues, **EUR 822 519 609.35** (EUR 744 350 258.95 in 2021), include mainly the 2022:

- Euratom contribution: EUR 596 753 771.07
- ITER Host State contribution: EUR 148 800 000.00
- Membership contributions: EUR 6 700 000.00
- Revenue from ITER: EUR 69 548 606.59

6.3.2. Operational Expenses – EUR 752 146 997.45 (EUR 639 153 906.14 in 2021)

The types of expenses that F4E reports include exchange expenses (where F4E receives goods or services in return) and non-exchange expenses (where F4E transfers value to another entity without receiving anything in exchange).

In line with IPSAS rule n° 11, the construction contracts for which no inflow of service potential will arise to F4E are accounted as expense (operational items that are being built by F4E's contractors and directly handed over to IO after acceptance by the latter – including tooling and work in progress).

6.3.3. Other Expenses – EUR 86 764 677.87 (EUR 166 668 076.24 in 2021)

- Staff expenses: **EUR 64 994 272.16** (EUR 51 607 812.85 in 2021)
It includes the total gross salaries (including allowances, social contributions, taxes and pension contributions), employer's contribution for social security, allowances for seconded national experts and other staff related costs. The above social contributions and taxes are transferred to and managed by the EU Paymaster Office (PMO).
- Provision for liabilities: **EUR 2 576 233.63** refers to the yearly addition and value adjustment of the provisions described here above under point 6.2.7.
- Property, plant and equipment related expenses: **EUR 2 117 891.28** refers to the yearly depreciation of fixed assets and the cost for building rent, maintenance and security.
- Other administrative expenses: the amount of **EUR 17 076 280.80** includes mainly the following items:

	2022	2021	Variation
Legal expenses	6 219 229.20	1 171 287.86	5 047 941.34
IT costs – operational/support	4 011 602.54	2 729 134.44	1 282 468.10
IT costs - development	882 896.57	707 262.83	175 633.74
Missions	1 313 947.63	252 233.77	1 061 713.86
Interim staff	900 531.15	544 344.27	356 186.88
Office supplies & maintenance	652 980.93	2 058 818.47	-1 405 837.54
Training	513 078.37	721 709.02	-208 630.65
Communications & publications	505 992.50	522 918.03	-16 925.53
Service level agreement with EU Paymaster Office	434 566.51	338 072.59	96 493.92
Experts and related expenditure	401 952.30	293 200.03	108 752.27
Recruitment	39 387.08	50 983.95	-11 596.87
Car and transport expenses	30 977.72	23 862.86	7 114.86
Interest expense on late payment	6 102.83	10 544.90	-4 442.07

Fig. 10 Other Administrative Expenses

6.4. Off Balance Sheet Items and Notes

6.4.1. Contingent Assets

A contingent asset is a possible asset that arises from past events and the existence of which will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of F4E. A contingent asset is disclosed when an inflow of economic benefits or service potential is probable.

Contingent assets are assessed at each balance sheet date to ensure that developments are appropriately reflected in the financial statements. If it has become virtually certain that an inflow of economic benefits or service potential will arise and the asset's value can be measured reliably, the asset and the related revenue are recognised in the financial statements of the period in which the change occurs.

Performance guarantees

Guarantees are possible assets (or obligations) that arise from past events and whose existence will be confirmed by the occurrence or non-occurrence of the object of the guarantee. Performance guarantees received can thus qualify as contingent assets. A guarantee is settled when the object of the guarantee no longer exists. It is crystallised when the conditions are fulfilled for calling a payment from the guarantor.

Performance guarantees are sometimes requested to ensure that beneficiaries of F4E funding meet the obligations of their contracts with F4E.

Description	31.12.2022	31.12.2021
Performance guarantees	168 242 435.58	173 301 490.76

Fig. 11 Performance guarantees

Other

An operational contract has been terminated for cause in 2019. F4E has a contractual entitlement to recover all the sums paid, as well as to claim damages suffered that amounts in total to EUR 5.7 million approximately. So far, no commercial agreement has been reached and there is a high probability that if no agreement is reached by the end of the year, it will go to litigation. Final decision is expected by end of the year/early 2024.

To be noted that as per legal opinion of an external firm, the likelihood to win the case if F4E goes to the court and have the sums/damages recovered fully or partially is between 70-90%.

6.4.2. Contingent Liabilities and Significant Legal Commitment

Contingent liabilities - TB04 Contract

A contingent liability is:

- A possible obligation that arises from past events and of which the existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of F4E; or
- A present obligation that arises from past events but is not recognised because:
 - It is not probable that an outflow of resources embodying economic benefits or service potential will be required to settle the obligation; or
 - The amount of the obligation cannot be measured with sufficient reliability.

On 8 July 2013, F4E and the TB04 Contractor entered into a contract for the Design, Construction and Maintenance of the HVAC (Heating, Ventilation & Air Conditioning), Electrical, I&C (Instrumentation and Control) Handling Equipment and Gas and Liquid Networks for the Tokamak Complex and Surrounding Buildings (the TB04 Contract).

The scope of Works was heavily varied via Variations procedure set out in the TB04 Contract.

The TB04 Contractor has submitted a number of claims to the Engineer and has constituted a number of Disputes under the TB04 Contract.

The actual Dispute referral was issued on 5 May 2022 bringing new documents, substantiation and explanations to the same Claims. The aggregate request of the TB04 Contractor is around EUR 22 million plus interest, recovery of legal fees incurred by the TB04 Contractor and payment of the adjudicators' fees by F4E.

F4E asked the external law firm White&Case LLP to review, provide legal and expert advice, represent F4E in the related proceedings and prepare the F4E submissions in relation to the Disputes.

The binding decision of the Panel was issued on 11 May 2023, together with an award of costs, according to which F4E won the adjudication against the TB04 Contractor.

F4E has nothing to pay to the TB04 Contractor and the TB04 Contractor did not receive any extension of time for completion of the works.

The decision of the Panel is binding but not yet final.

The decision of the Panel may be brought either by F4E or the TB04 Contractor before the General Court of the EU by 25 June 2023, who has the authority to review the Disputes in their entirety. While the decision of the Panel is clearly in F4E's favour, F4E will undertake the review of the decision of the Panel in detail to see how to best proceed.

Other – Future obligations

The information provided under this note refers to the F4E open obligations under the ITER and BA activities. Those future obligations are considered as net deficits from future operating activities and reported as significant legal commitment.

ITER is being constructed at Cadarache in the South of France. Europe supports 45.46% of the construction cost and 34% of the cost of operation, deactivation and decommissioning of the facility as well as preparing the site.

Most of the components that make up the ITER facility are to be manufactured by each of the ITER Parties and contributed in-kind to ITER through Domestic Agencies. F4E will provide components to ITER on behalf of the EU.

In addition to the in-kind procurements F4E has also an obligation to finance the transportation of the non-EU components from the entry site in France (i.e. either Fos-sur-Mer or the Marignane airport) to Cadarache. Additionally, as far as the Test Blanket System is concerned, in 2014 F4E has signed two TBM Arrangements for the delivery of two systems to the ITER site.

The contractual commitments for which budgetary commitments have not yet been placed refers to the outstanding activities which have not yet been awarded as procurement contracts to European industry. F4E maintains an estimate of the cost of completing its obligations to ITER. This comprises the costs already committed, and the estimate of the future commitments. This is managed in EcoSys and an extract is presented to each of the biannual GB meetings.

The table below shows an update of these figures with a cut-off date of December 2022, and expressed in EUR 2008 (used as basis to ensure a comprehensive financial monitoring).

Cost Estimate at 31/12/22 (MEUR-2008 value)	Actual Commitment (1)	Estimate to Complete (2)	Estimate at Completion (3)=(1)+(2)
BA Phase 1	65.64	0.00	65.64
BA Phase 2	17.31	192.69	210.00
IFMIF/DONES Construction	0.00	100.00	100.00
ITER Construction	7 569.85	4 231.66	11 801.51
ITER Operation	0.00	1 538.20	1 538.20
ITER Support 2036-2042	0.00	221.04	221.04
TOTAL	7 652.80	6 283.59	13 936.39

Fig. 12 Cost Estimate in Commitment (in 2008 value)

The F4E Estimate at Completion (EaC) comprises two major elements – (a) the costs incurred directly by F4E and (b) the cash contributions representing the EU share of the IO costs. EaC covers the costs of the full Construction Phase and the costs of the Operations Phase and the Decommissioning Phase that will be incurred in the same timeframe. The only costs expected after 2035 are the final parts of the cash contributions towards the Operations Phase and Decommissioning Phases and the full costs of the Deactivation Phase.

The following key assumptions have been made in the compilation of the EaC :

- The number of requirement changes (PCR's, which have been a major problem for F4E over previous years) will be minimized according to the current policy of IO and if there are any changes they will be funded via the Reserve Fund or any other IO budget.
It is recognized that despite strong management pressure at IO and F4E it is impossible to reduce the rate to zero. These changes may cause further delays and cost impacts to ongoing and future construction activities.
- The nuclear safety requirements: F4E is working with IO to ensure that the designs being developed respect the various nuclear safety requirements. Nevertheless, the French nuclear safety authority [ASN] has the ultimate authority and interacts only with IO, and any future changes required could have a high cost impact.
- There are no increases to the required cash contributions to IO.
- High level work on defining the approach to the Hot Cell complex is on-going, updated scope, as well as sharing of the related increased cost will be decided on at ITER Council level where EU interests are represented by EURATOM.
- The current ITER baseline leading to First Plasma in December 2025, and the start of the Deuterium-Tritium phase in December 2035 is maintained. This assumption will be updated when the ITER revised baseline integrating the updated schedule to First Plasma and beyond, and the updated Overall Project Cost, will have been proposed by IO and approved by the ITER Council in 2023.

Regarding the structure, the EaC is calculated as the sum of the EaC Base and the Risk Exposure over all activities. The EaC Base is the most likely commitment estimate for a given activity, plus the cost of planned risk mitigation activities. The Risk Exposure is the estimated impact value of the risk(s), multiplied by the probability of the risk(s) associated to a given activity.

Indicatively, the estimate to complete in commitments amounts to EUR 8 589.22 million in 2022 value.

Cost Estimate at 31/12/22 (MEUR-2022 value)	Actual Commitment (1)	Estimate to Complete (2)	Estimate at Completion (3)=(1)+(2)
BA Phase 1	91.09	0.00	91.09
BA Phase 2	24.19	271.61	295.80
IFMIF/DONES Construction	0.00	141.57	141.57
ITER Construction	10 435.00	5 854.76	16 289.76
ITER Operation	0.00	2 029.62	2 029.62
ITER Support 2036-2042	0.00	291.66	291.66
TOTAL	10 550.28	8 589.22	19 139.50

Fig. 13 Cost Estimate in Commitment (in 2022 value)

In payments, the estimate to complete amounts to EUR 9 919.18 million in 2022 value.

Cost Estimate at 31/12/22 (MEUR-2022 value)	Actual Payment (1)	Estimate to be Paid (2)	Estimate at Completion (3)=(1)+(2)
BA Phase 1	86.40	4.69	91.09
BA Phase 2	8.18	287.62	295.80
IFMIF/DONES Construction	0.00	141.57	141.57
ITER Construction	9 125.74	7 164.02	16 289.76
ITER Operation	0.00	2 029.62	2 029.62
ITER Support 2036-2042	0.00	291.66	291.66
TOTAL	9 220.32	9 919.18	19 139.50

Fig. 14 Cost Estimate in Payment (in 2022 value)

More details on the actual advancement of the works achieved at the end of the year are available in the F4E Annual report 2022.

6.4.3. Guarantees for pre-financing

Guarantees are possible assets (or obligations) that arise from past events and whose existence will be confirmed by the occurrence or non-occurrence of the object of the guarantee. A guarantee is settled when the object of the guarantee no longer exists. It is crystallised when the conditions are fulfilled for calling a payment from the guarantor.

In order to avoid double-counting, guarantees received on pre-financing amounts given are not disclosed as contingent assets since these amounts are already shown as pre-financing assets in the balance sheet.

Description	31.12.2022	31.12.2021
Guarantees for pre-financing (nominal-on going)	192 973 953.42	167 900 528.39

Fig. 15 Guarantees for pre-financing

These are guarantees that F4E in certain cases requests from beneficiaries when paying out advance payments (pre-financing). There are two values to disclose for this type of guarantee, the “nominal” and the “on-going” values. For the “nominal” value, the generating event is linked to the existence of the guarantee. For the “on-going” value, the guarantee’s generating event is the pre-financing payment and/or subsequent clearings.

6.4.4. Service in-kind

Under the Host agreement with Spain, the office building used by F4E is free of charge. For the year 2022, this service in-kind amounts to EUR 2 932 316.30.

6.5. Financial Instruments

Financial instruments comprise cash, current receivables and recoverables, current payables, amounts due to and from consolidated entities. Financial instruments give rise to liquidity, credit, interest rate and foreign currency risks. Information about which and how they are managed is set out below. Pre-financings and deferrals are not included.

The carrying amounts of financial instruments are as follows:

Financial assets	2022	2021
Receivables with Member States	27 642 694.17	14 584 938.64
All receivables with third parties including accruals (excluding deferrals)	54 989 143.37	16 225 263.25
Cash and deposits	25 000.00	45 537.20
TOTAL	82 656 837.54	30 855 739.09
Financial liabilities	2022	2021
Current payables	78 773 267.33	60 364 519.03
Other payables	0.00	0.00
Accounts payable with EU entities	1 186 246.02	6 374 572.42
TOTAL	79 959 513.35	66 739 091.45

Fig. 16 Financial Instruments

6.5.1. Liquidity Risk

Liquidity risk is the risk that arises from selling an asset; for example, the risk that a given security or asset cannot be traded quickly enough in the market to prevent a loss or meet an obligation. Liquidity risk arises from the ongoing financial obligations, including the settlement of payables.

Details of contractual maturities for assets and liabilities form an important source of information for the management of liquidity risk.

Bank accounts opened in the name of F4E may not be overdrawn. Treasury and payment operations are highly automated and rely on modern information systems. Specific procedures are applied to guarantee system security and to ensure segregation of duties in line with the FR, the internal control standards, and audit principles. EU budget principles ensure that overall cash resources for a given year are always sufficient for the execution of all payments.

F4E's liabilities have remaining contractual maturities as summarised below:

31 December 2022	< 1 year	1 - 5 years	> 5 years	Total
Payables with third parties	78 773 267.33	0.00	0.00	78 773 267.33
Payables with consolidated entities	1 186 246.02	0.00	0.00	1 186 246.02
Total liabilities	79 959 513.35	0.00	0.00	79 959 513.35

Fig. 17 Liquidity Risk – Payables

6.5.2. Credit Risk

Credit risk is the risk of loss due to a debtor's/borrower's non-payment of a loan or other line of credit (either the principal or interest or both) or other failure to meet a contractual obligation. The default events include a delay in repayments, restructuring of borrower repayments and bankruptcy.

Treasury resources are kept with the EC since May 2019. F4E recovers contributions from Euratom and the ITER Host State in average 3 times per year to ensure appropriate cash management, taking into account payment time limits for the recovery of contributions and the total of payments executed in 2022. Requests to the EC and ITER Host State are accompanied by cash forecasts.

Following the externalisation of the treasury to the EC the counterparty risk to which F4E is exposed is minimized.

The table below shows the maximum exposure to credit risk by F4E.

Credit quality/rating	Amount of receivables with Member States
Prime and high grade	27 532 994.17
Upper medium grade	0.00
Lower medium grade	109 700.00
Non-investment grade	0.00
Receivable from IO	1 078 990.55
EC treasury	50 889 047.15

Fig. 18 Credit Risk – Receivables

6.5.3. Market Risk

Market Risk can be split into interest rate risk and currency risk.

Interest rate risk arises from cash. F4E treasury has been externalised to the EC and consequently it is not exposed to interest rate risk. F4E's treasury does not borrow any money.

The vast majority of transactions are executed in EUR. It is recognised that exchange rates fluctuate and F4E accepts the risk and does not consider it to be material.

6.6. Related Party Disclosure

The related parties of F4E are the key management personnel. Transactions between F4E and the key management personnel take place as part of the normal operations and as this is the case, no specific disclosure requirements are necessary for these transactions in accordance with the EU Accounting rules.

Highest grade description	Grade	Number of persons of this grade
Director	AD15	1

Fig. 19 Related Party Disclosure

The transactions of F4E with key management personnel during financial year 2022 consist only of the payment of their remuneration, allowances and other entitlements in accordance with the EU Staff Regulations.

As event after the reporting date, it is also to be mentioned that the GB of F4E appointed Marc Lachaise as F4E Director as of 16th May 2023.

Section II. Budget Implementation 2022

7. Budget Implementation

7.1. Main Facts on the Implementation of the 2022 Budget of F4E

Commitments	72% execution of the final available budget	Final Budget: 981.18	Execution: 703.98	EUR million
	82% compared to the original budget	Original Budget: 854.49	Execution: 703.98	EUR million
	77% without additional revenue from ITER IO	Standard Budget: 887.74	Execution: 679.93	EUR million
	99% in individual commitments	Execution: 703.98	Ind. Commit.: 695.85	EUR million
Payments	91% execution of the final available budget	Final Budget: 844.02	Execution: 765.72	EUR million
	91% compared to the original budget	Original Budget: 845.45	Execution: 765.72	EUR million
	99% without additional revenue from ITER IO	Standard Budget: 760.73	Execution: 749.89	EUR million

Fig. 20 Budget Implementation 2022

The execution rate of F4E's final available budget stood at 72% in commitments and 91% in payments. The main factors impacting F4E's ability to execute it, were largely outside of its control and in particular:

- Reduction of Euratom's Cash Contribution to IO from EUR 336.8 million included in the IO Draft Budget 2023 as approved by the 29th ITER Council in November 2021 versus EUR 224.4 million finally requested and committed (**- EUR 112.4 million** under execution in commitments),
- Increase of Euratom's contribution to F4E's Operational Budget, whereby F4E was requested to absorb available appropriations coming from the European Fusion Research programme in commitment and payment appropriations (**- EUR 14.7 million** under execution in commitments),
- Increase of the ITER Host State contribution corresponding to the balance due for the period 2007-2020 (**- EUR 14.9 million** in commitments),
- Successful negotiations with the IO resulting in additional ex-post reimbursement of cost of changes associated with two Project Change Requests (PCR 698 and PCR 662) and one Task Agreement (Tokamak Crown) (**- EUR 60.5 million** under execution in commitments and **EUR 58.5 million** under execution in payments),
- Delays related to international situation, which caused additional **- EUR 30.0 million** of under-execution in commitments.

Following the conservative approach to use global commitments requested by Euratom based on commitment forecasts for 1st quarter of 2023 (and not the full year of 2023), F4E globally committed only EUR 8.13 million covering four well advanced procurement procedures. Without the factors above F4E would have reached the 95% of budget implementation in both commitments and payments.

7.2. Evolution of the Budget

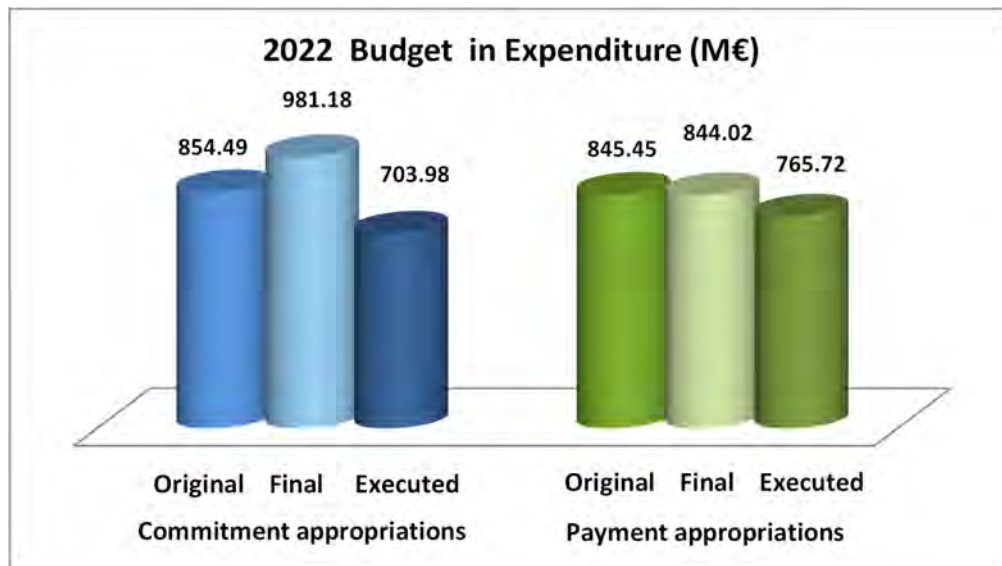


Fig. 21 Budget 2022 in Expenditure

F4E 2022 budget was originally adopted by F4E’s Governing Board (GB) for the amount of EUR 854.49 million in commitment appropriations and EUR 845.45 million in payment appropriations.

It was modified in two amendments in the GB meetings of July and December 2022.

The final available appropriations, including the carry-over from the previous year were EUR 981.18 million in commitment appropriations and EUR 844.02 million in payment appropriations.

7.3. Statement of Revenue

7.3.1. Commitment Appropriations

(EUR)								
Heading of the 2022 Budget Commitment Revenue	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Final Budget (4)=(1)+(2)+(3)	Additional revenue (5)	Final Available Revenue (6)=(4)+(5)	Carry Over From previous year (7)	Final Available Budget (8)=(6)+(7)
110 PARTICIPATION FROM THE EUROPEAN UNION TO OPERATIONAL EXPENDITURE	637 938 663.00		14 685 059.24	652 623 722.24		652 623 722.24		652 623 722.24
111 RECOVERY FROM PREVIOUS YEARS OPERATIONAL EXPENDITURE								0.00
120 PARTICIPATION FROM THE EUROPEAN UNION TO ADMINISTRATIVE EXPENDITURE	65 043 220.66			65 043 220.66		65 043 220.66		65 043 220.66
121 RECOVERY FROM PREVIOUS YEARS ADMINISTRATIVE EXPENDITURE	1 008 571.34			1 008 571.34		1 008 571.34		1 008 571.34
210 ANNUAL MEMBERSHIP CONTRIBUTIONS	6 700 000.00			6 700 000.00		6 700 000.00		6 700 000.00
310 ASSIGNED REVENUE ACCRUING FROM THE CONTRIBUTION OF ITER HOST STATE	143 800 000.00	14 950 574.00		158 750 574.00		158 750 574.00	3 226 238.47	161 976 812.47
410 MISCELLANEOUS REVENUE		5 000.00	151 570.20	156 570.20	198 705.97	355 276.17		355 276.17
<i>Of which revenue of the year</i>			151 570.20	151 570.20	195 551.50	347 121.70		347 121.70
<i>Of which revenue from previous year</i>		5 000.00		5 000.00	3 154.47	8 154.47		8 154.47
510 OTHER REVENUE	p.m.			0.00		0.00	30 473.55	30 473.55
520 REVENUE FROM ITER ORGANISATION	p.m.			0.00	79 213 457.32	79 213 457.32	14 231 771.74	93 445 229.06
<i>Of which revenue of the year</i>					79 213 457.32	79 213 457.32		79 213 457.32
<i>Of which revenue from previous year</i>							14 231 771.74	14 231 771.74
Total Revenue	854 490 455.00	14 955 574.00	14 836 629.44	884 282 658.44	79 412 163.29	963 694 821.73	17 488 483.76	981 183 305.49

Note: Column (7) Carry Over from previous year also includes decommitments of assigned revenue done during the year 2022

Fig. 22 Evolution of Statement of Revenue in Commitment Appropriations

The evolution of statement of revenue in commitment appropriations is made of:

- The revenue added or subtracted in the amendments to the budget represents the evolution of the main contributions (Euratom, France and Members). Each change in revenue is individually detailed and submitted to the GB for adoption.
- The miscellaneous revenue mainly corresponds to reimbursement of undue payments. Defined as internal assigned revenue in F4E FR, these are not net additional revenue but re-collected revenue.
- The other revenue are assigned to the implementation of specific tasks, mainly tasks requested by the IO. Defined as external assigned revenue in the F4E FR, these are net additional revenue for which the GB authorises the principle of collection, as shown with the p.m., 'Pro Memoria', in the original budget.

F4E reports to the GB on the status of miscellaneous and other revenue with each amendment to the annual budget, together with the carry-over from the previous year.

The main changes to the statement of revenue in commitment appropriations according to the table in Fig. 22 are the following:

- **Chapter 110: + EUR 14 685 059.24** of additional Euratom contribution to F4E operational expenditure, coming from the European fusion research programme,
- **Chapter 310: + EUR 14 950 574.00** in commitments only, corresponding to the balance due for the ITER Host State contribution 2007-2020,
- **Chapter 410: + EUR 355 276.17** linked to recoveries and liquidated damages on F4E operational contracts and from recoveries on contract pre-financing and regularisations on administrative expenditure in commitments and payments,
- **Chapter 520: + EUR 79 213 457.23** on available assigned revenue from IO linked to ITER Reserve Fund earmarked to the implementation of project changes requested and financed by the IO. The detailed list of requested tasks is provided in Annex 8.1.

The automatic carry-over of commitment appropriations from the 2021 budget, including the decommitments of commitments done in 2021 or before, are the following:

- **Chapter 310: EUR 3 226 238.47** from de-commitments on ITER Host State contribution related to contracts due to change of scope or from left over at the closure of the contracts. According to the F4E FR the de-committed amounts on this chapter are immediately available again (external assigned revenue),
- **Chapter 520: EUR 14 231 771.74** from decommitments and opened commitment appropriations for revenue coming from IO.

7.3.2. Payment Appropriations

(EUR)

Heading of the 2022 Budget Commitment Revenue	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Final Budget (4)=(1)+(2)+(3)	Additional revenue (5)	Final Available Revenue (6)=(4)+(5)	Carry Over From previous year (7)	Final Available Budget (8)=(6)+(7)
110 PARTICIPATION FROM THE EUROPEAN UNION TO OPERATIONAL EXPENDITURE	623 767 915.49		-92 014 940.76	531 752 974.73		531 752 974.73		531 752 974.73
111 RECOVERY FROM PREVIOUS YEARS OPERATIONAL EXPENDITURE	135 250.51			135 250.51		135 250.51		135 250.51
120 PARTICIPATION FROM THE EUROPEAN UNION TO ADMINISTRATIVE EXPENDITURE	65 043 220.66			65 043 220.66		65 043 220.66	4 786 167.97	69 829 388.63
121 RECOVERY FROM PREVIOUS YEARS ADMINISTRATIVE EXPENDITURE	1 008 571.34			1 008 571.34		1 008 571.34		1 008 571.34
210 ANNUAL MEMBERSHIP CONTRIBUTIONS	6 700 000.00			6 700 000.00		6 700 000.00		6 700 000.00
310 ASSIGNED REVENUE ACCRUING FROM THE CONTRIBUTION OF ITER HOST STATE	148 800 000.00			148 800 000.00		148 800 000.00	1 384 899.99	150 184 899.99
410 MISCELLANEOUS REVENUE		5 000.00	151 570.20	156 570.20	198 705.97	355 276.17	31 081.82	386 357.99
<i>Of which revenue of the year</i>		5 000.00	151 570.20	156 570.20	195 551.50	352 121.70		352 121.70
<i>Of which revenue from previous year</i>					3 154.47	3 154.47	31 081.82	34 236.29
510 OTHER REVENUE	p.m.			0.00		0.00	736 527.90	736 527.90
520 REVENUE FROM ITER ORGANISATION	p.m.			0.00	76 973 579.10	76 973 579.10	6 315 804.48	83 289 383.58
<i>Of which revenue of the year</i>	p.m.			0.00	76 973 579.10	76 973 579.10		76 973 579.10
<i>Of which revenue from previous year</i>	p.m.			0.00			6 315 804.48	6 315 804.48
Total Revenue	845 454 958.00	5 000.00	-91 863 370.56	753 596 587.44	77 172 285.07	830 768 872.51	13 254 482.16	844 023 354.67

Note: Column (7) Carry Over from previous year also includes decommitments of assigned revenue done during the year 2022

Fig. 23 Evolution of Statement of Revenue in Payment Appropriations

The breakdown of revenue by contributors in 2022 in payment appropriations is:



Fig. 24 Revenue Breakdown in Payment Appropriations

The main changes to the statement of revenue in payment appropriations were as follows:

- **Chapter 110: + EUR 14.7 million** additional EURATOM contribution was received from the European fusion research programme, while at the year-end - **EUR 106.7 million** were transferred back to EURATOM mainly due to lower payments needs in 2022 coming from:
 - slowdown of F4E operational activities due to delays in the execution of contractors' obligations which affected the progress of ITER delivery contracts,
 - decision of ITER Council to decrease of the Euratom cash contribution to the IO for 2023 that affected the advance payment in December 2022 and,
 - execution of payments in 2021 initially planned for 2022.
- **Chapter 520: + EUR 76 973 579.10** revenue coming from IO related to recoveries for project changes.

The main automatic carry-overs of payment appropriations from the 2021 budget were:

- **Chapter 120: + EUR 4 786 167.97** from the automatic carry-over of administrative expenditure committed,
- **Chapter 310: + EUR 1 384 899.99** carry over from ITER Host State contribution,
- **Chapter 510: + EUR 736 527.90** related to the integration of the Upper Port 10 within the contribution from Japan Domestic Agency,
- **Chapter 520: + EUR 6 315 804.48** of carry-over of revenue from IO.

7.4. Statement of Expenditure

7.4.1. Expenditure in Commitment Appropriations

The statement of expenditure adopted with the original 2022 budget was aligned to the Single Programming Document 2022-2026⁷, in particular the *Work Programme 2022* that serves as financing decision for the operational budget 2022.

The statement of expenditure has been further adjusted in the course of its implementation in accordance with the successive changes in the statement of revenue and with the amendments to the Work Programme (WP). These adjustments were implemented through the amending budgets and the transfers approved by the F4E Director within the limits foreseen in article 26 of the F4E FR.

The GB is duly informed about the transfers at each GB meeting, and in the Budgetary and Financial Management Report after the closure. The appropriations accruing from assigned revenue and not used at the end of 2021 were automatically carried over to the budget 2022. No further carry-over was requested to the GB.

The final breakdown of the statement of expenditure in commitment appropriations is as follows:

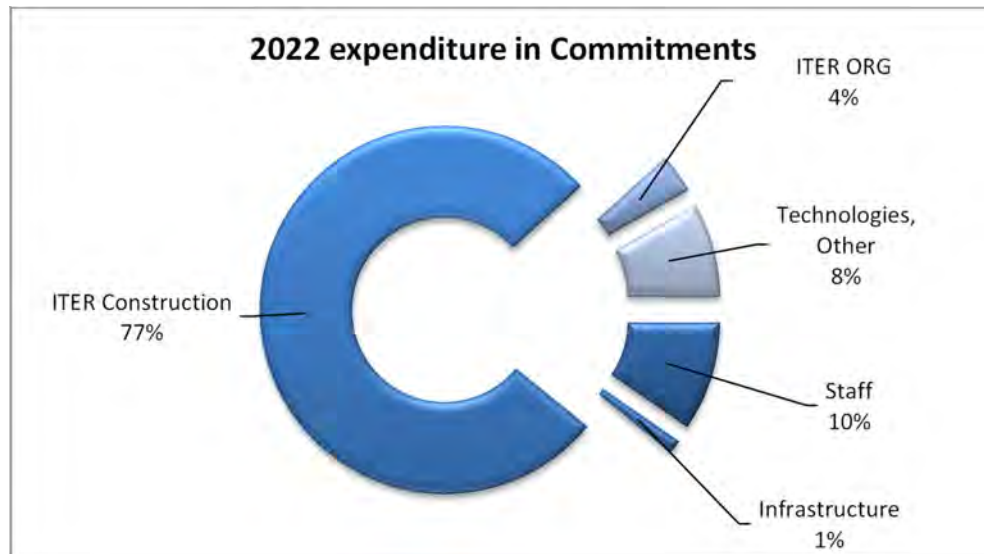


Fig. 25 Final breakdown of the Expenditure in Commitments

⁷ 2SGNZW (current) adopted by F4E GB on 10 December 2021

(EUR)

Heading of the 2022 Budget Commitment Expenditure	Evolution of the statement of expenditure								Implementation	
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
A1 STAFF EXPENDITURE										
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	38 981 810.00			8 048 916.53	47 030 726.53			47 030 726.53	47 030 726.53	100.0%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	11 906 562.00			2 508 252.02	14 414 814.02			14 414 814.02	14 414 814.02	100.0%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	814 000.00			-101 768.46	712 231.54			712 231.54	712 231.54	100.0%
A13 MISSION EXPENSES	582 000.00			-201 000.00	381 000.00			381 000.00	381 000.00	100.0%
A14 SOCIO-MEDICAL INFRASTRUCTURE	504 000.00			-2 000.00	502 000.00			502 000.00	502 000.00	100.0%
A15 TRAINING	676 620.00			-8 550.66	668 069.34			668 069.34	668 069.34	100.0%
A16 EXTERNAL SERVICES	550 000.00			410 000.00	960 000.00			960 000.00	960 000.00	100.0%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-4 726.19	5 273.81			5 273.81	5 273.81	100.0%
A18 SOCIAL WEALFARE	46 000.00			16 200.00	62 200.00			62 200.00	62 200.00	100.0%
A19 OTHER STAFF RELATED EXPENDITURE	3 277 000.00			-156 377.00	3 120 623.00	12 039.50		3 132 662.50	3 132 662.50	100.0%
TITLE A1 - Total	57 347 992.00			10 508 946.24	67 856 938.24	12 039.50		67 868 977.74	67 868 977.74	100.0%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE										
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 499 000.00			110 000.00	1 609 000.00	7 056.59		1 616 056.59	1 616 056.59	100.0%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 935 000.00			61 977.04	3 996 977.04			3 996 977.04	3 996 977.04	100.0%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	375 000.00			-220 147.78	154 852.22			154 852.22	154 852.22	100.0%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 616 000.00			-1 881.79	1 614 118.21			1 614 118.21	1 614 118.21	100.0%
A25 POSTAGE / TELECOMMUNICATIONS	547 000.00			-21 500.00	525 500.00			525 500.00	525 500.00	100.0%
A26 MEETING EXPENSES	443 000.00			-19 450.00	423 550.00			423 550.00	423 550.00	100.0%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES				0.00			30 473.55	30 473.55	30 473.55	100.0%
A28 INFORMATION AND PUBLISHING	38 000.00			-18 000.00	20 000.00			20 000.00	20 000.00	100.0%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	250 800.00			162 792.97	413 592.97			413 592.97	413 592.97	100.0%
TITLE A2 - Total	8 703 800.00	0.00	0.00	53 790.44	8 757 590.44	7 056.59	30 473.55	8 795 120.58	8 795 120.58	100.0%
TITLE A1 & A2 - Total Administrative Expenditure	66 051 792.00	0.00	0.00	10 562 736.68	76 614 528.68	19 096.09	30 473.55	76 664 098.32	76 664 098.32	100.0%

Heading of the 2022 Budget Commitment Expenditure	Evolution of the statement of expenditure								Implementation	
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	Execution (9)	% (10)=(9)/(8)
B3 OPERATIONAL EXPENDITURE										
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	569 331 726.00	1 733 575.20	23 481 524.24	-14 262 736.68	580 284 088.76	41 412.11		580 325 500.87	429 211 076.71	74.0%
B32 TECHNOLOGY FOR ITER AND DEMO	4 339 492.00	214 943.39	55 142.61	0.00	4 609 578.00			4 609 578.00	3 497 256.59	75.9%
B33 TECHNOLOGY FOR BROADER APPROACH	41 009 373.00	-9 809 138.99	-7 957 380.01	0.00	23 242 854.00			23 242 854.00	16 842 430.93	72.5%
B35 EXTERNAL SUPPORT ACTIVITIES	24 156 472.00	7 744 181.05	-2 231 229.05	2 230 000.00	31 899 424.00	34 333.08		31 933 757.08	30 868 787.56	96.7%
B36 OTHER OPERATIONAL EXPENDITURE	5 801 600.00	121 439.35	1 488 571.65	1 470 000.00	8 881 611.00	103 864.69		8 985 475.69	7 287 206.54	81.1%
Title B3 - Total	644 638 663.00	5 000.00	14 836 629.44	-10 562 736.68	648 917 555.76	179 609.88	0.00	649 097 165.64	487 706 758.33	75.1%
B4 EARMARKED EXPENDITURE										
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	143 800 000.00	14 950 574.00			158 750 574.00		3 226 238.47	161 976 812.47	115 556 047.00	71.3%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	79 213 457.32	14 231 771.74	93 445 229.06	24 056 684.21	25.7%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00			0.00	0.00	
Title B4 - Total	143 800 000.00	14 950 574.00	0.00	0.00	158 750 574.00	79 213 457.32	17 458 010.21	255 422 041.53	139 612 731.21	54.7%
Titles B3 & B4 - Subtotal	788 438 663.00	14 955 574.00	14 836 629.44	-10 562 736.68	807 668 129.76	79 393 067.20	17 458 010.21	904 519 207.17	627 319 489.54	69.4%
Total BUDGET in Commitment appropriations	854 490 455.00	14 955 574.00	14 836 629.44	0.00	884 282 658.44	79 412 163.29	17 488 483.76	981 183 305.49	703 983 587.86	71.7%

Fig. 26 Evolution of the Expenditure in Commitments in 2022

Note: the figures for the budget Title 4 refer to the available appropriations for the 2022 budget only, whereas the details of the 2022 implementation by funds source provided in Fig. 39, Annex 8.4 from ABAC refers to the appropriations of the year plus the amounts left over on the commitments carried over from the previous years. This is due to the specific management of assigned revenue in the accounting system.

7.4.1.1. Administrative Expenditure

The administrative expenditure are made of non-differentiated appropriations (commitment and payment appropriations are in unison), therefore any transfers or budget amendments are identical in commitment and payment appropriations.

The F4E Director approved a series of transfers resulting in an increase of the administrative budget amounting in total to EUR 10 562 736.68. Those transfers allowed to adjust the detailed allocation to the evolution of the needs, in particular to cover the employer's pension contribution following the audit finding.

The major changes (> +/-10%) in the administrative expenditure (variation of the final implementation in % of the initial budget) by chapter are:

Title 1 – Staff expenditure (+18%)

- **Chapter A10 Salaries and allowances of which establishment plan posts (+) 21%**
The Budget increase is due to the payment of the pension contribution (2017-2022) in accordance with the EC guidelines and the high salaries indexation in 2022,
- **Chapter A11 Salaries and allowances for external personnel (+) 21%**
The budget increase is due to the payment of the pension contribution (2017-2022) in accordance with the EC guidelines and the high salaries indexation in 2022,
- **Chapter A12 Expenditure relating to staff recruitment (-) 13%**
The expenses linked to taking up duties and departures (daily allowances, installation/reinstallation, removals and travel expenses) have significantly decreased due to the lower number of requests from staff compared to the forecast,
- **Chapter A13 Mission expense (-) 35%**
The budget decrease in mission expenses is due to the fact that it was thought a post covid forecast which did not occur,
- **Chapter A16 External services (+) 75%**
The budget increase due to a higher use of interim staff especially due to higher than expected impact of sick leaves and maternity leaves,
- **Chapter A17 Receptions/events and representation (-) 47%**
F4E is traditionally making a very limited use of this budget,
- **Chapter A18 Social Welfare (+) 35%**
This budget increase was due the cost of social events organised for F4E staff, not organised last year because of the pandemic.

Title 2 – Infrastructure and operating expenditure (+ 1%)

- **Chapter A23 Movable property and associated cost** **(-) 59%**
 Some purchases for the refurbishment of the ground floor including equipment for the main meeting room, and also the replacement of one of the service cars were postponed due to delays in works and to changing requirements,
- **Chapter A28 Information and publishing** **(-) 47%**
 Since Covid-19, limited number of events with physical presence have been held. The production of publications is frequently linked to these events, where our publications are offered to participants. The increase of the teleworking has also affected the production of publications, replaced sometimes by electronic publications/electronic information,
- **Chapter A29 Other infrastructure and operating expenditure** **(+) 65%**
 The increase is due to the EUAN (inter-agencies network meeting) held in Barcelona.

7.4.1.2. Operational Expenditure in commitment

The statement of operational expenditure was modified with the amending budgets to reflect the changes in the statement of revenue and to align the operational budget in commitment appropriations with the successive amendments to the 2022 WP.

The major changes (> +/-10%) in the Operational expenditure (variation of the final implementation in % of the original budget) are:

Title 3 – Operational expenditure (- 24%)

The budget for operational expenditure increased by additional contribution of EUR 14.7 million coming from the European fusion research programme, which F4E was asked to absorb by EURATOM in 2022. Other small adjustment comes from the carry-over from the previous year and the transfer from administrative expenditure.

- **Chapter B31 ITER Construction including site preparation** **(-) 25%**
 Substantial reduction of Euratom’s Cash Contribution to IO for the year 2023 and the impact of sanctions due to the geopolitical situation as described in section 7.1. of this document,
- **Chapter B32 Technology for ITER and Demo** **(-) 19%**
 The decrease is related to reduced contract scope for ancillary TBM systems resulting from a scope sharing with Korean Domestic Agency,
- **Chapter B33 Technology for Broader Approach** **(-) 59%**
 The decrease is related to (i) the postponement to 2023 of the Electron Cyclotron Resonance Heating Waveguides contract as the technical discussions with QST have taken longer than expected, and (ii) uncertainties of the closure of the procurement process within the end of the year, therefore the contract signature for the supply of JT-60SA actively cooled Divertor NHF elements is moved to 2023,

- **Chapter B35 External Support Activities** **(+) 28%**
The increase is related to additional external support needs in most of the F4E’s Programme Teams;
- **Chapter B36 Other Operational Expenditure** **(+) 26 %**
The increase is related to additional external legal service support in the context of litigation with TB04 contractor.

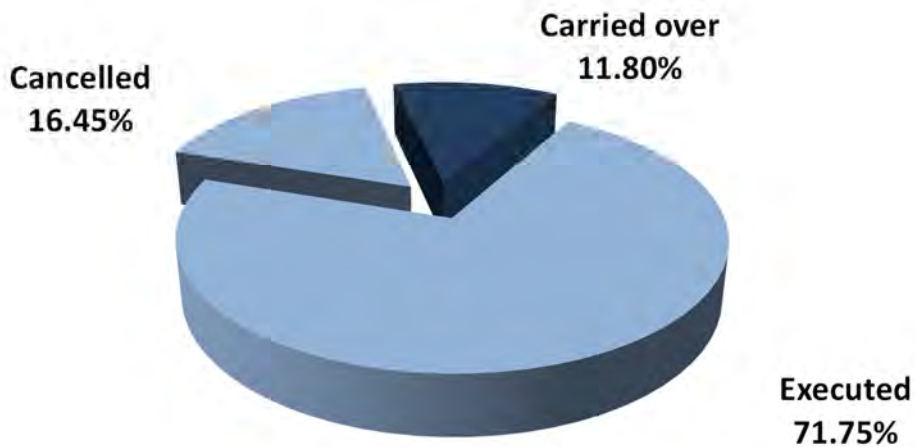
Title 4 – Earmarked expenditure (- 3%)

- **Chapter B41 ITER Construction – ITER Host State Contribution** **(-) 20%**
Substantial reduction of Euratom’s Cash Contribution to IO for the year 2023 and the impact of sanctions due to the geopolitical situation as described in section 7.1. of this document.

The budget appropriations for earmarked expenditure from IO were created based on additional revenue linked to project changes, direct implementations and other change instruments requested and financed by IO. These are described in section 7.5 of this document.

7.4.1.3. Implementation of the Budget in Commitments

Commitments 2022: 981.2 M€



MEUR	Budget	Cancelled	Carried over	Executed
Commitment 2022	981.2	161.4	115.8	704.0

Fig. 27 Implementation of the Budget in Commitments

7.4.1.4. Open Commitments at 31 December 2022

The F4E open commitments amount to EUR 1 273.9 million at the closure of the 2022 budget, representing a decrease of about EUR 257 million compared to the end of 2021.

Remarks:

- EUR 100.87 million out of the EUR 123.74 million committed globally in 2021 were implemented in 2022 as the three on-going procurement procedures have been concluded,
- F4E made use of global commitment in 2022 for a total amount of EUR 8.1 million, for implementation in individual commitment in 2023. They are included in the total of the F4E obligations/open commitments at the end of 2022.

2022 budget Heading	(EUR)				
	from previous years (1)	from 2022 budget (2)	Open Commitments Total (3)=(1)+(2)	To be de-committed (4)	Net Total (5)=(3)-(4)
TITLE 1 - STAFF EXPENDITURE	0.00	3 633 084.35	3 633 084.35	0.00	3 633 084.35
TITLE 2 - INFRASTRUCTURE AND OPERATING EXPENDITURE	0.00	3 292 985.20	3 292 985.20	0.00	3 292 985.20
Total TITLE 1 & 2	0.00	6 926 069.55	6 926 069.55	0.00	6 926 069.55
B31 - ITER CONSTRUCTION INCLUDING SITE PREPARATION	626 345 854.47	282 819 632.96	909 165 487.43	42 508.50	909 122 978.93
B32 - TECHNOLOGY FOR ITER AND DEMO	3 221 202.84	3 150 665.25	6 371 868.09	0.00	6 371 868.09
B33 - TECHNOLOGY FOR BROADER APPROACH	10 113 912.38	13 162 242.79	23 276 155.17	0.00	23 276 155.17
B35 - EXTERNAL SUPPORT ACTIVITIES	10 017 494.51	24 631 167.93	34 648 662.44	0.00	34 648 662.44
B36 - OTHER OPERATIONAL EXPENDITURE	0.00	3 087 927.93	3 087 927.93	0.00	3 087 927.93
Total TITLE 3	649 698 464.20	326 851 636.86	976 550 101.06	42 508.50	976 507 592.56
B41 - ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	201 625 326.35	65 556 047.00	267 181 373.35	0.00	267 181 373.35
B42 - ACTIVITIES LINKED TO ITER ORGANIZATION	9 974 916.70	13 326 163.82	23 301 080.52	0.00	23 301 080.52
B43 - OTHER EARMARKED EXPENDITURE	0.00	0.00	0.00	0.00	0.00
Total TITLE 4	211 600 243.05	78 882 210.82	290 482 453.87	0.00	290 482 453.87
Total TITLE 3 & 4	861 298 707.25	405 733 847.68	1 267 032 554.93	42 508.50	1 266 990 046.43
Total	861 298 707.25	412 659 917.23	1 273 958 624.48	42 508.50	1 273 916 115.98

Fig. 28 Open Commitments Carried Forward from 2022 to 2023

7.4.1.5. Status of Unused Commitment Appropriations

According to the annuality principle of the F4E FR, the unused commitment appropriations at the end of each year and the de-commitments made on the budget of the previous years are cancelled, except for assigned revenue. The F4E FR also foresees the possibility to make the cancelled appropriations available again in future F4E budgets⁸. The situation for unused appropriations at 31/12/2022 is as follows:

⁸ Article 12.1 F4E FR : "...Given the needs of the Joint Undertaking, the cancelled appropriations may be entered in the estimates of revenue and expenditure of the following financial years, in accordance with Article 32".

(EUR)

Operational Commitment Appropriations (EUR)		Budgets (Title 3)	Assigned revenue (Title 4)	Total
Under execution (since 2008)	+	162 051 363.87	136 164 175.32	298 215 539.19
De-commitments (since 2008)	+	1 066 061 943.91	217 000 067.89	1 283 062 011.80
Carry-over (since 2008)	-	551 436.18	136 164 175.32	136 715 611.50
Made available again (since 2008)	-	765 632 662.39	101 190 757.57	866 823 419.96
Amount available for future budgets	=	461 929 209.21	115 809 310.32	577 738 519.53

Fig. 29 Status of Unused Commitment Appropriations

As reported last year, F4E successfully executed the amount available for re-use since 2008 by the end of 2020, except for the last de-commitments done during the last quarter of 2020, achieving the objective of the full implementation of the allocated budget for the period 2007-2020. Subsequently important de-commitments were done during 2021, in particular in relation with the TB04 contract.

In 2022, the amount available for future budgets increased from EUR 115 million to EUR 577 million. See section 7.1 of this document, which provides the list of main factors contributing to this significant increase. In addition to that, F4E decommitted EUR 173.9 million on TB04 contract due to its partial termination.

7.4.2. Expenditure in Payment Appropriations

The statement of expenditure was modified in the course of its implementation in accordance with the successive changes in the statement of revenue. Additional adjustments between budgetary chapters were implemented through transfers authorised by the F4E Director, to honour all contractual obligations toward suppliers and to reach the highest possible rate of budget implementation at the year-end.

Heading of the 2022 Budget Payment Expenditure	Evolution of the statement of expenditure							Implementation				
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2022 commitments (9)	On B2021 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
A1 STAFF EXPENDITURE												
A10 SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	38 981 810.00			8 048 916.53	47 030 726.53			47 030 726.53	45 330 726.53		45 330 726.53	96.4%
A11 SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	11 906 562.00			2 508 252.02	14 414 814.02		48 805.94	14 463 619.96	13 803 630.90	41 895.91	13 845 526.81	95.7%
A12 EXPENDITURE RELATING TO STAFF RECRUITMENT	814 000.00			-101 768.46	712 231.54		98 072.60	810 304.14	646 067.91	56 216.24	702 284.15	86.7%
A13 MISSION EXPENSES	582 000.00			-201 000.00	381 000.00		133 578.58	514 578.58	306 909.56	42 440.77	349 350.33	67.9%
A14 SOCIO-MEDICAL INFRASTRUCTURE	504 000.00			-2 000.00	502 000.00		117 711.67	619 711.67	293 600.78	83 593.57	377 194.35	60.9%
A15 TRAINING	676 620.00			-8 550.66	668 069.34		488 514.92	1 156 584.26	280 945.10	324 909.56	605 854.66	52.4%
A16 EXTERNAL SERVICES	550 000.00			410 000.00	960 000.00		72 937.94	1 032 937.94	690 213.94	50 186.19	740 400.13	71.7%
A17 RECEPTIONS/EVENTS AND REPRESENTATION	10 000.00			-4 726.19	5 273.81		125.00	5 398.81	1 725.00	125.00	1 850.00	34.3%
A18 SOCIAL WEALFARE	46 000.00			16 200.00	62 200.00		29 100.00	91 300.00	35 048.02	16 815.75	51 863.77	56.8%
A19 OTHER STAFF RELATED EXPENDITURE	3 277 000.00			-156 377.00	3 120 623.00	12 039.50	366 211.82	3 498 874.32	2 847 025.65	300 901.01	3 147 926.66	90.0%
TITLE A1 - Total	57 347 992.00	0.00	0.00	10 508 946.24	67 856 938.24	12 039.50	1 355 058.47	69 224 036.21	64 235 893.39	917 084.00	65 152 977.39	94.1%
A2 INFRASTRUCTURE AND OPERATING EXPENDITURE												
A21 RENTAL OF BUILDINGS AND ASSOCIATED COSTS	1 499 000.00			110 000.00	1 609 000.00	7 056.59	351 200.76	1 967 257.35	1 019 087.35	285 168.89	1 304 256.24	66.3%
A22 INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	3 935 000.00			61 977.04	3 996 977.04		1 881 492.92	5 878 469.96	2 514 443.12	1 755 974.74	4 270 417.86	72.6%
A23 MOVABLE PROPERTY AND ASSOCIATED COSTS	375 000.00			-220 147.78	154 852.22		131 163.07	286 015.29	81 835.91	120 884.26	202 720.17	70.9%
A24 CURRENT ADMINISTRATIVE EXPENDITURE	1 616 000.00			-1 881.79	1 614 118.21		591 921.32	2 206 039.53	977 203.61	482 532.38	1 459 735.99	66.2%
A25 POSTAGE / TELECOMMUNICATIONS	547 000.00			-21 500.00	525 500.00		160 155.54	685 655.54	285 065.11	80 827.79	365 892.90	53.4%
A26 MEETING EXPENSES	443 000.00			-19 450.00	423 550.00		205 891.69	629 441.69	262 975.92	110 291.42	373 267.34	59.3%
A27 RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES				0.00	0.00		30 473.55	30 473.55	15 942.67	0.00	15 942.67	52.3%
A28 INFORMATION AND PUBLISHING	38 000.00			-18 000.00	20 000.00		7 647.71	27 647.71	16 229.15	6 257.84	22 486.99	81.3%
A29 OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	250 800.00			162 792.97	413 592.97		101 636.49	515 229.46	329 352.54	76 416.39	405 768.93	78.8%
TITLE A2 - Total	8 703 800.00	0.00	0.00	53 790.44	8 757 590.44	7 056.59	3 461 583.05	12 226 230.08	5 502 135.38	2 918 353.71	8 420 489.09	68.9%
TITLE A1 & A2 - Total Administrative Expenditure	66 051 792.00	0.00	0.00	10 562 736.68	76 614 528.68	19 096.09	4 816 641.52	81 450 266.29	69 738 028.77	3 835 437.71	73 573 466.48	90.3%

Heading of the 2022 Budget Payment Expenditure	Evolution of the statement of expenditure								Implementation			
	Original Budget (1)	Amending budget 1 (2)	Amending budget 2 (3)	Transfers adopted by F4E Director (4)	Final budget (5)=Σ(1 to 4)	Additional Revenue (6)	Carried over (7)	Final Appropriations (8)=Σ(5 to 7)	On B2022 commitments (9)	On B2021 commitments (10)	Execution (11)=(9)+(10)	% (12)= (11)/(8)
B3 OPERATIONAL EXPENDITURE												
B31 ITER CONSTRUCTION INCLUDING SITE PREPARATION	589 603 166.00	5 000.00	-92 003 891.76	-945 680.54	496 658 593.70	41 412.11		496 700 005.81			496 699 311.88	100.0%
B32 TECHNOLOGY FOR ITER AND DEMO	7 000 000.00			-4 581 517.65	2 418 482.35			2 418 482.35			2 418 482.35	100.0%
B33 TECHNOLOGY FOR BROADER APPROACH	13 000 000.00		129 961.20	-8 524 178.21	4 605 782.99			4 605 782.99			4 605 782.99	100.0%
								0.00				
B35 EXTERNAL SUPPORT ACTIVITIES	15 000 000.00		10 560.00	2 003 919.65	17 014 479.65	34 333.08		17 048 812.73			17 027 979.65	99.9%
B36 OTHER OPERATIONAL EXPENDITURE	6 000 000.00			1 484 720.07	7 484 720.07	103 864.69	608.27	7 589 193.03			7 538 122.62	99.3%
Title B3 - Total	630 603 166.00	5 000.00	-91 863 370.56	-10 562 736.68	528 182 058.76	179 609.88	608.27	528 362 276.91	0.00	0.00	528 289 679.49	100.0%
B4 EARMARKED EXPENDITURE												
B41 ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	148 800 000.00				148 800 000.00		1 384 899.99	150 184 899.99			148 024 185.17	98.6%
B42 ACTIVITIES LINKED TO ITER ORGANIZATION	p.m.				0.00	76 973 579.10	6 315 804.48	83 289 383.58			15 834 380.79	19.0%
B43 OTHER EARMARKED EXPENDITURE	p.m.				0.00		736 527.90	736 527.90			0.00	0.0%
Title B4 - Total	148 800 000.00	0.00	0.00	0.00	148 800 000.00	76 973 579.10	8 437 232.37	234 210 811.47			163 858 565.96	70.0%
Titles B3 & B4 - Subtotal	779 403 166.00	5 000.00	-91 863 370.56	-10 562 736.68	676 982 058.76	77 153 188.98	8 437 840.64	762 573 088.38			692 148 245.45	90.8%
Total BUDGET in Payment appropriations	845 454 958.00	5 000.00	-91 863 370.56	0.00	753 596 587.44	77 172 285.07	13 254 482.16	844 023 354.67			765 721 711.93	90.7%

Fig. 30 Evolution of the Expenditure in Payment Appropriations

7.4.2.1. Administrative Expenditure

As mentioned previously, the administrative expenditure are of non-differentiated nature with the following consequences:

- The main changes made during the year compared to the original budget are identical in commitment and in payment. The changes for the 2022 budget are described in section 7.4.1.1,
- The statement of expenditure in payment appropriations includes the carry-over of appropriations corresponding to administrative contracts committed but not yet paid at the end of the previous year. This carry-over amounted to EUR 4 816 641.52,
- The current budget committed but not paid at the end of the year is automatically carried over and entered in the statement of expenditure of the following year (total amount of EUR 6 926 069.55).

7.4.2.2. Operational Expenditure in payments

The budget for operational expenditure remained similar compared to the original budget, as the net return of payment appropriations to Euratom (EUR 92.01 million) was compensated by income from IO (EUR 83.29 million) and transfers to administrative expenditure to cover mainly the pension contributions (EUR 10.51 million).

Title 3 – Operational expenditure

- **Chapter B31 ITER Construction including site preparation** **(-) 16%**
Substantial reduction of Euratom’s Cash Contribution to IO for the year 2023 and the impact of sanctions due to the geopolitical situation as described in section 7.1. of this document,
- **Chapter B32 Technology for ITER and Demo** **(-) 65%**
The decrease is related to reduced contract scope for ancillary TBM systems resulting from a scope sharing with Korean Domestic Agency,
- **Chapter B33 Technology for Broader Approach** **(-) 65%**
The decrease is related to (i) the postponement to 2023 of the Electron Cyclotron Resonance Heating Waveguides contract as the technical discussions with QST have taken longer than expected, and (ii) uncertainties of the closure of the procurement process within the end of the year, therefore the contract signature for the supply of JT-60SA actively cooled Divertor NHF elements is moved to 2023,
- **Chapter B35 External Support Activities** **(+) 14%**
The increase is related to additional external support needs in most of the F4E's Programme Teams,
- **Chapter B36 Other Operational Expenditure** **(+) 26 %**
The increase is related to additional external legal service support in the context of the litigation with the TB04 contractor.

Title 4 – Earmarked expenditure

The budget from the ITER Host State contribution, allocated to the domain of ITER construction in full, was not modified along 2022. The Budget chapters for other earmarked expenditure and from IO arose from the cashing of the respective call for funds.

7.4.2.3. Implementation of the budget in payment

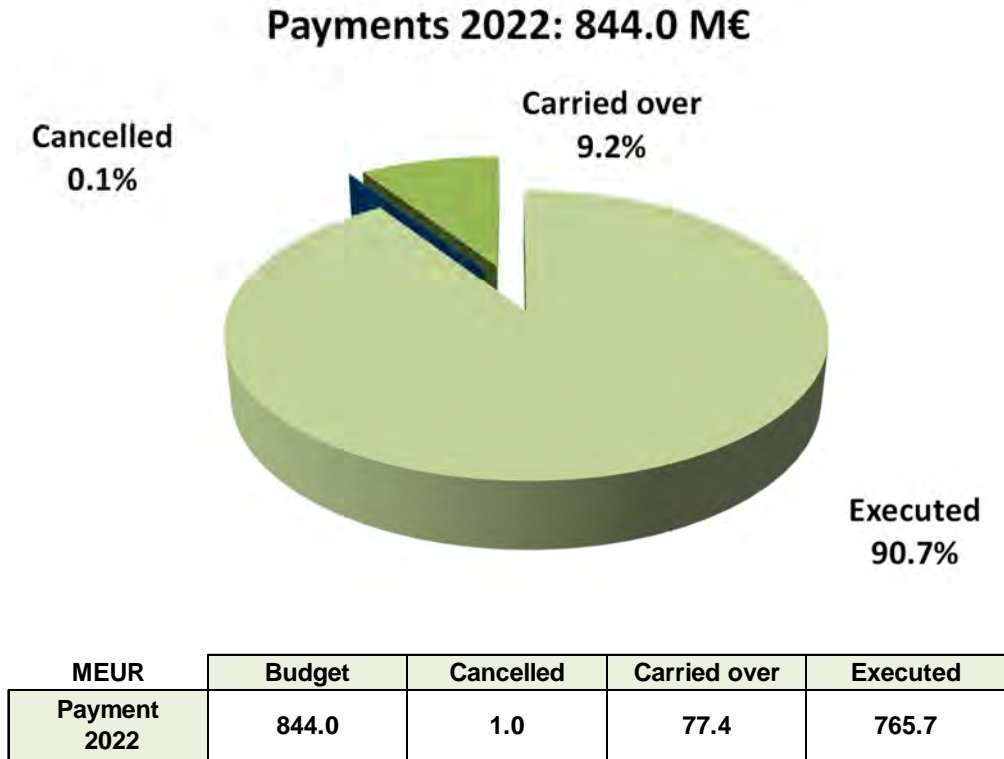


Fig. 31 Final Implementation in PA

90.7% of the available budget has been implemented.

7.4.2.4. Cancelled Payment Appropriations

2022 budget Heading	(EUR)		
	Unused Appropriations (1)	Carry over to 2023 (2)	Cancelled appropriation (3)=(1)-(2)
TITLE 1 - STAFF EXPENDITURE	4 071 058.82	3 633 084.35	437 974.47
TITLE 2 - OPERATING EXPENDITURE	3 805 740.99	3 292 985.20	512 755.79
Total TITLE 1 & 2 Payment	7 876 799.81	6 926 069.55	950 730.26
TITLE 3 - OPERATIONAL EXPENDITURE	72 597.42	72 597.42	0.00
TITLE 4 - EARMARKED EXPENDITURE	70 352 245.51	70 352 245.51	0.00
Total TITLE 3 & 4 Payment	70 424 842.93	70 424 842.93	0.00
Total BUDGET in Payment	78 301 642.74	77 350 912.48	950 730.26

Fig. 32 Cancelled Payment Appropriations

The payment appropriations not used by the 31/12/2022 are cancelled except the amount automatically carried over for non-differentiated appropriations (Title 1 and Title 2) and assigned revenue (Title 4), according to the F4E FR.

7.4.3. Additional Information on the Final Implementation of the 2021 Budget**7.4.3.1. Final Implementation of the Administrative Expenditure 2021**

The definitive execution of the administrative budget 2021 is determined at the end of 2022, when the amounts carried over from the previous year corresponding to administrative actions committed but not yet paid are executed or cancelled. The execution of the payment appropriations carried over is shown with the implementation of the statement of expenditure above, column (10) of Fig.30.

The final execution of the 2021 administrative budget is therefore as follows:

(EUR)	Title 1	Title 2	Total
Final 2021 Administrative Budget	53 605 471.19	7 681 938.22	61 287 409.41

Fig. 33 Final Implementation of the Administrative Expenditure 2021**7.4.3.2. Global Commitments from 2021**

No global commitments remained open at the end of 2021 for execution in 2022.

7.5. Tasks financed by the ITER Organization

In 2022, the GB authorised F4E to collect revenue for any tasks requested and financed by IO, under a transparency provision consisting in the publication of the detail of the variation requested and approved for financing.

As shown in Annex 8.1, in 2022 F4E opened commitment appropriations in total amount of EUR 79.21 million.

This significant amount can be attributed in particular to successful outcome of agreements with IO regarding ex-post reimbursement of costs related to PCR 698 (EUR 48 million), PCR 662 (EUR 6.6 million) and Task Agreement on the so called Tokamak Crown (EUR 5.78 million).

Recognition of assigned revenue from PCR 811 (EUR 4 million) and PCR 1323 (EUR 9.2 million) also contributed to the final balance.

A total amount of EUR 76.97 million has been recovered from ITER IO during 2022, mostly corresponding to the items listed above.

7.6. Budget Outturn Account 2022

The outturn for the financial year is calculated according to the total revenue actually cashed minus the total payment incurred during the year, minus the appropriations carried over to the following year.

		(EUR)	
Budget Outturn Account		2022	2021
REVENUE			
Euratom contribution	+	597 940 017.09	607 601 868.13
ITER Host state contributions	+	148 800 000.00	129 100 000.00
Membership contributions	+	6 590 300.00	5 983 100.00
ITER Organization	+	76 973 579.10	5 319 008.98
Other revenue	+	355 276.17	1 648 135.24
Other non budgeted revenue	+	339 540.24	28 162.61
TOTAL REVENUE (a)		830 998 712.60	749 680 274.96
EXPENDITURE			
<i>Title I: Staff</i>			
Payments	-	64 235 893.39	52 688 387.19
Appropriations carried over to the following year	-	3 633 084.35	1 355 058.47
<i>Title II: Infrastructure Expenditure</i>			
Payments	-	5 502 135.38	4 747 641.84
Appropriations carried over to the following year	-	3 292 985.20	3 461 583.05
<i>Title III: Operational Expenditure</i>			
Payments	-	528 289 679.49	545 993 873.43
Appropriations carried over to the following year	-	72 597.42	608.27
<i>Title IV Earmarked revenue</i>			
Payments	-	163 858 565.96	138 991 439.28
Appropriations carried over to the following year	-	70 352 245.51	8 437 232.37
<i>Total Payments (b)</i>		761 886 274.22	742 421 341.74
<i>Appropriations carried over to the following year (c)</i>		77 350 912.48	13 254 482.16
TOTAL EXPENDITURE (d)=(b)+(c)		839 237 186.70	755 675 823.90
OUTTURN FOR THE FINANCIAL YEAR (a-d)		-8 238 474.10	-5 995 548.94
Cancellation of unused payment appropriations carried over from previous year	+	950 730.26	708 926.68
Adjustment for carry-over from the previous year of appropriations available at 31.12 arising from assigned revenue	+	8 468 314.19	11 643 308.35
Exchange differences for the year (gain +/loss -)	+/-	5 675.67	17 886.33
BALANCE OF THE OUTTURN ACCOUNT FOR THE FINANCIAL YEAR		1 186 246.02	6 374 572.42
Of which Administrative expenditure		957 742.88	726 813.01
Of which Operational expenditure		228 503.14	5 647 759.41
Administrative outturn:			
Exchange differences for the year		5 675.67	17 886.33
Cancelled appropriation on title 1 and 2 from current year		0.00	0.00
Cancelled appropriation on title 1 and 2 from previous year		950 730.26	708 926.68
Non budgeted revenue from liquidated damages and Court decisions		1 336.95	
Operational outturn:			
Cancelled payment appropriations on title 3 from 2021		0.00	5 619 596.80
Uncashed membership contribution from the year		-109 700.00	
Uncashed budgeted amount of the Euratom Contribution		-0.15	
Non budgeted revenue from liquidated damages and Court decisions		338 203.29	28 162.61

Fig. 34 Budget Outturn 2022

For the 2022 financial year, the balance of the budget outturn amounts to EUR 1 186 246.02.

8. Annexes

8.1. Commitment Appropriations for assigned revenue from IO opened in 2022

FoR	Name	Name	Change Type	OBS	CA opened in 2022
F4E.13	PCR-672	Area 31 Safety Requirements Revision	PCR	IP.SB	766 003.32
F4E.15	PCR 1334	Baselining additional scope for 55.A0 (Magentics diagnostic system)	PCR	IP.SB	52 000.00
F4E.16	PCR 1295	Additional Embedded Plates (EP) and relocation of EPs in B14 upper levels from L2 to Roof	PCR	IP.SB	258 207.66
F4E.17	PCR-1231	Relocation of F1 Pump House, new network layout and SL3 verification of interfacing galleries	PCR	IP.SB	40 568.00
F4E.18	PCR-1188	Introduction of the IO tent (B73.3) and induced Handover of the batching plant area from F4E to IO	PCR	IP.SB	120 954.52
F4E.19	DI-94	2021/032 - Notification - Input Data/ Documents for PA 6.2.P2.EU.02 FFRs - IO System Loadings for Verification of Struct	DI	IP.SB	30 000.00
F4E.20	DI-103	F4E-2009-OPE-058-OS#680 Notification 2022-007 development of PDS Qualification for Concrete to Buildings with NSR	DI	IP.SB	196 630.00
F4E.22	DI-82	2021/006 Notification - Site Works Instruction to modify Inputs for PA 6.2.P2.EU.02 for implementation via PA 6.2.P2.EU.	DI	IP.SB	16 000.00
F4E.23	DI-86	2021/012 Notification - Site Works Instruction to modify Inputs for PA 6.2.P2.EU.02 for implementation via PA 6.2.P2.EU.	DI	IP.SB	155 432.17
F4E.24	DI-101	2022/002 - Notification - Input Data/ Documents for PA 6.2.P2.EU.02 FFRs for Implementation via PA 6.2.P2.EU.05 - PBS 62	DI	IP.SB	140 000.00
F4E.25	I-NC024	Resolution of NC related to Leak Tightness of HRS Basins	I-NC	IE.MG	137 519.07
F4E.26	PCR 811 (regularisation)	Additional scope of verification activity of the Embedded Plates within the Tokamak Complex	PCR	IP.SB	4 001 514.01
F4E.27	PCR 1306	Implementation of missing supporting structure for Electrical Enclosures in B74-B1/L1/L2 after HIT Cycle)	PCR	IP.SB	177 240.74
F4E.28	PCR 1411	Development of an alternative brazing solution and update of brazing	PCR	IP.SB	250 000.00
F4E.29	DI 40	2018/058 - Notification - Input Data/ Documents for PA 6.2.P2.EU.02 FFRs – PBS 62.13 – Direct Implementation Instruction	DI	IP.SB	1 019.52
F4E.30	PCR 1227	Modification of PBS 53 Interface requirements after PBS 63.37 and 63.34 FDR	PCR	IP.SB	245 910.12
F4E.31	TA 4500000174	Additional cost due to extra complexity in the TSS (crown) not captured in former PCRs (PCR 445 / 460 / 764)	TA	IP.SB	5 781 932.60
F4E.32	PCR 662 (regularisation)	Revise TCWS Design and Shielding to Mitigate Gamma Radiation and Fast Neutron Rates	PCR	IP.SB	6 623 887.12
F4E.33	PCR 824 (regularisation)	Reconciliation of additional costs for PBS26 new scope and quality issues on BIPS site works	PCR	IP.SB	1 952 525.54
F4E.34	PCR 698 (regularisation)	Tokamak Complex Building construction cost associated to the PCR-662 including sky-shine	PCR	IP.SB	48 071 181.40
F4E.35	TA 4500000182	Complementary Evaluation of the Tokamak Support Structure to address ASN prescriptions INB No. 174-07	TA	IP.SB	995 602.00
F4E.36	PCR 1368	Implementation of missing supporting structure for Electrical Enclosures in B74-B1/L1/L2 after HIT Cycle)	PCR	IP.SB	316 373.38
F4E.37	PCR 1323	Compensation of Construction Design Costs induced by regularization of PBS65 and PBS62 Building Services Technical Baseline in B11 and B74 Areas after MRR (daughter PCR of PCR-001225 and PCR-001321)	PCR	IP.SB	9 200 000.00
F4E.38	PCR 1048 (regularisation)	Installation of frames and sleeves in openings for AO and TCCO works	PCR	IP.SB	1 737 210.39
F4E.10	PCR-717	Revision/adding of handling cranes at L4 level of the TKM building (11-L4-04) as a consequence of PCR-662 and PCR 701 implementation	PCR	IP.SB	-
F4E.4	PCR 1048	Installation of frames and sleeves in openings for AO and TCCO works (deforecast)	PCR	IP.SB	- 209 469.76
F4E.4	PCR 824	Reconciliation of additional costs for PBS26 new scope and quality issues on BIPS site works (deforecast)	PCR	IP.SB	- 1 844 784.48
TOTAL					79 213 457.32

Fig. 35 Commitment Appropriations for Assigned Revenue from IO

8.2. Multi-Annual Payment Schedule for the Operational Budget

Year	Commitments	Paid until end of 2013	MFF 2014-2020									Outstanding amount	
			Paid 2014	Paid 2015	Paid 2016	Paid 2017	Paid 2018	Paid 2019	Paid 2020	Paid 2021	Paid 2022		
<= 2007	115 445 438.21	113 121 009.41	2 062 547.93	261 880.87	-	-	-	-	-	-	-	-	-
2008	162 357 720.16	154 330 986.04	8 026 734.12	-	-	-	-	-	-	-	-	-	-
2009	295 658 870.68	234 711 366.38	26 549 875.43	13 259 338.45	8 008 925.36	9 541 166.89	1 995 858.00	595 166.88	294 128.11	494 543.46	-	208 501.72	
2010	389 677 891.70	274 537 523.43	34 717 587.59	39 227 964.72	9 607 653.62	15 107 792.58	7 052 706.24	7 271 509.84	330 273.04	520 457.78	267 489.00	1 036 933.86	
2011	370 662 303.25	224 611 776.68	29 962 742.34	26 739 952.54	35 305 192.97	42 950 825.08	1 186 051.53	1 003 257.15	1 425 464.43	227 422.68	65 267.85	7 184 350.00	
2012	1 064 549 941.04	227 971 230.12	128 364 796.05	164 239 683.64	189 718 067.75	152 829 836.45	59 686 026.83	30 102 558.63	35 684 826.57	14 418 968.18	14 456 930.11	47 077 016.71	
2013	731 508 485.52	67 053 699.98	181 415 330.39	96 759 662.07	124 738 904.24	85 677 718.98	80 349 613.29	14 030 308.08	28 835 072.31	18 485 338.22	15 653 339.40	18 509 498.56	
2014	566 087 516.82	-	52 626 681.58	93 676 757.92	116 670 110.66	78 631 340.28	68 952 541.72	42 675 882.86	22 013 774.00	19 482 123.37	18 381 869.43	52 976 435.00	
2015	336 565 793.19	-	-	46 616 552.99	123 149 761.09	50 541 171.89	57 643 284.14	39 324 580.84	6 428 325.64	3 947 737.56	2 866 937.05	6 047 441.99	
2016	410 969 417.99	-	-	-	58 687 305.83	229 014 259.88	59 591 457.06	55 272 443.55	3 525 294.43	1 423 809.18	367 707.81	3 087 140.25	
2017	478 911 347.76	-	-	-	-	119 010 491.88	168 993 842.63	65 041 867.40	79 991 985.33	19 067 695.60	9 512 936.62	17 292 528.30	
2018	625 302 618.11	-	-	-	-	-	254 664 005.74	158 238 420.21	63 029 881.57	35 594 872.67	6 161 810.79	107 613 627.13	
2019	654 959 746.67	-	-	-	-	-	-	267 773 299.20	170 961 600.39	72 880 000.06	72 301 641.32	71 043 205.70	
2020	765 907 500.73	-	-	-	-	-	-	-	328 530 151.47	220 317 475.14	87 562 170.73	129 497 703.39	
2021	921 507 716.33	-	-	-	-	-	-	-	-	278 124 868.81	242 964 503.48	400 418 344.04	
2022	619 185 525.99	-	-	-	-	-	-	-	-	-	221 585 641.86	397 599 884.13	
Total	8 509 257 834.15	1 296 337 592.04	463 726 295.43	480 781 793.20	665 885 921.52	783 304 603.91	760 115 387.18	681 329 294.64	741 050 777.29	684 985 312.71	692 148 245.45	1 259 592 610.78	

Fig. 36 Multiannual payment schedule (Operational)

- Notes :
- The actions accounted to F4E projects and implemented by the Commission and the CEA before F4E financial autonomy in 2008 are included.
 - For information, 1 478 commitment positions are open in ABAC on the 31/12/22, representing 19% more compared to the end of 2021.
 - Indicatively, the cumulative operational expenses at 31/12/22, are estimated to EUR 7 696.44 million in current value.

Estimate cumulative expense at 31/12/22 (MEUR - current)	
Cumulative Payments	7 817 109 588.70
Open Pre-financing	-130 254 855.27
Accruals	159 315 781.57
Deferrals	-149 733 888.28
Cumulative Expenses	7 696 436 626.72

Fig. 37 Cumulative operational expenses

8.3. Reconciliation Between Budgetary and Accrual Based Accounts

	sign +/-	Amount (EUR)
Economic result (+ for surplus and - for deficit)	+/-	-16 392 065.97
<i>Adjustment for accrual items (items not in the budgetary result but included in the economic result)</i>		
Adjustments for Accrual Cut-off (reversal 31.12.N-1)	+/-	151 652 788.15
Adjustments for Accrual Cut-off (cut- off 31.12.N)	+/-	-61 792 565.79
Unpaid invoices at year end but booked in charges (class 6)	+	78 693 431.58
Depreciation of intangible and tangible assets	+	440 844.63
Provisions (impact of the year)	+/-	-60 295 399.22
Recovery Orders issued in 2022 in class 7 and not yet cashed	-	-1 404 347.43
Prefinancing given in previous year and cleared in the year	+	76 676 456.39
Prefinancing received in previous year and cleared in the year	-	0.00
Payments made from carry over of payment appropriations	+	3 851 988.65
Other : 2022 corrections/credit notes on transactions booked in charges in previous years	+/-	-88 790.63
<i>Adjustment for budgetary items (item included in the budgetary result but not in the economic result)</i>		
Asset acquisitions (less unpaid amounts)	-	-183 157.64
New pre-financing paid in the year 2022 and remaining open as at 31.12.2022	-	-43 005 894.95
New pre-financing received in the year 2022 and remaining open as at 31.12.2022	+	1 186 246.02
Budgetary recovery orders issued before 2022 and cashed in the year	+	5 000.00
Budgetary recovery orders issued in 2022 on balance sheet accounts (not 7 or 6 accounts) and cashed	+	78 588.08
Payment appropriations carried over to 2023	-	-77 350 912.48
Cancellation of unused carried over payment appropriations from previous year	+	950 730.26
Adjustment for carry-over from the previous year of appropriations available at 31.12 arising from assigned revenue	+	8 468 314.19
Other : Invoices paid in 2022 but booked in charges in previous years	+/-	-60 304 519.03
Total		1 186 734.81
Budgetary result (+ for surplus)	+/-	1 186 246.02
Including amount of exchange rate differences		5 675.67
Delta not explained		488.79

Fig. 38 Reconciliation between budgetary and accrual based accounts

8.4. 2022 Budget Implementation – Details by Fund Source

Fund Source: C1 - Credits of the year (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A10	SALARIES AND ALLOWANCES FOR ESTABLISHMENT PLAN POSTS	C1	47 030 726.53	47 030 726.53	100.00%	47 030 726.53	45 330 726.53	96.39%
A11	SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	C1	14 414 814.02	14 414 814.02	100.00%	14 414 814.02	13 803 630.90	95.76%
A12	EXPENDITURE RELATING TO STAFF RECRUITMENT	C1	712 231.54	712 231.54	100.00%	712 231.54	646 067.91	90.71%
A13	MISSION EXPENSES	C1	381 000.00	381 000.00	100.00%	381 000.00	306 909.56	80.55%
A14	SOCIO-MEDICAL INFRASTRUCTURE	C1	502 000.00	502 000.00	100.00%	502 000.00	293 600.78	58.49%
A15	TRAINING	C1	668 069.34	668 069.34	100.00%	668 069.34	280 945.10	42.05%
A16	EXTERNAL SERVICES	C1	960 000.00	960 000.00	100.00%	960 000.00	690 213.94	71.90%
A17	RECEPTIONS, EVENTS AND REPRESENTATION	C1	5 273.81	5 273.81	100.00%	5 273.81	1 725.00	32.71%
A18	SOCIAL WEALFARE	C1	62 200.00	62 200.00	100.00%	62 200.00	35 048.02	56.35%
A19	OTHER STAFF RELATED EXPENDITURE	C1	3 120 623.00	3 120 623.00	100.00%	3 120 623.00	2 834 986.15	90.85%
Total Title 1			67 856 938.24	67 856 938.24	100.00%	67 856 938.24	64 223 853.89	94.65%

Fund Source: C1 - Credits of the year (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	C1	1 609 000.00	1 609 000.00	100.00%	1 609 000.00	1 019 087.35	63.34%
A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	C1	3 996 977.04	3 996 977.04	100.00%	3 996 977.04	2 514 443.12	62.91%
A23	MOVABLE PROPERTY AND ASSOCIATED COSTS	C1	154 852.22	154 852.22	100.00%	154 852.22	81 835.91	52.85%
A24	CURRENT ADMINISTRATIVE EXPENDITURE	C1	1 614 118.21	1 614 118.21	100.00%	1 614 118.21	977 203.61	60.54%
A25	POSTAGE / TELECOMMUNICATIONS	C1	525 500.00	525 500.00	100.00%	525 500.00	285 065.11	54.25%
A26	MEETING EXPENSES	C1	423 550.00	423 550.00	100.00%	423 550.00	262 975.92	62.09%
A28	INFORMATION AND PUBLISHING	C1	20 000.00	20 000.00	100.00%	20 000.00	16 229.15	81.15%
A29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	C1	413 592.97	413 592.97	100.00%	413 592.97	329 352.54	79.63%
Total Title 2			8 757 590.44	8 757 590.44	100.00%	8 757 590.44	5 486 192.71	62.65%

Fund Source: C1 - Credits of the year (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	C1	580 284 088.76	429 170 358.53	73.96%	496 658 593.70	496 658 593.70	100.00%
B32	TECHNOLOGY FOR ITER AND DEMO	C1	4 609 578.00	3 497 256.59	75.87%	2 418 482.35	2 418 482.35	100.00%
B33	TECHNOLOGY FOR BROADER APPROACH	C1	23 242 854.00	16 842 430.93	72.46%	4 605 782.99	4 605 782.99	100.00%
B35	EXTERNAL SUPPORT ACTIVITIES	C1	31 899 424.00	30 842 187.28	96.69%	17 014 479.65	17 014 479.65	100.00%
B36	OTHER OPERATIONAL EXPENDITURE	C1	8 881 611.00	7 183 341.85	80.88%	7 484 720.07	7 484 720.07	100.00%
Total Title 3			648 917 555.76	487 535 575.18	75.13%	528 182 058.76	528 182 058.76	100.00%
Total C1			725 532 084.44	564 150 103.86	77.76%	604 796 587.44	597 892 105.36	98.86%

Fund Source: C4 - Internal assigned revenues (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A19	OTHER STAFF RELATED EXPENDITURE	C4	12 039.50	12 039.50	100.00%	12 039.50	12 039.50	100.00%
Total Title 1			12 039.50	12 039.50	100.00%	12 039.50	12 039.50	100.00%
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	C4	7 056.59	7 056.59	100.00%	7 056.59		0.00%
Total Title 2			7 056.59	7 056.59	100.00%	7 056.59	0.00	0.00%
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	C4	41 412.11	40 718.18	98.32%	41 412.11	40 718.18	98.32%
B35	EXTERNAL SUPPORT ACTIVITIES	C5	34 333.08	26 600.28	77.48%	34 333.08	13 500.00	39.32%
B36	OTHER OPERATIONAL EXPENDITURE	C4	103 864.69	103 864.69	100.00%	103 864.69	52 794.28	50.83%
Total Title 3			179 609.88	171 183.15	95.31%	179 609.88	107 012.46	59.58%
Total C4			198 705.97	190 279.24	95.76%	198 705.97	119 051.96	59.91%

Fund Source: C5 - Carried-over internal assigned revenues (EUR)

B36	OTHER OPERATIONAL EXPENDITURE	C5	0.00	0.00	#DIV/0!	608.27	608.27	100.00%
Total C5			0.00	0.00	-	608.27	608.27	100.00%

Fund Source: C8 - Carried over credits from previous years (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A11	SALARIES AND ALLOWANCES FOR EXTERNAL PERSONNEL	C8	48 805.94	41 895.91	85.84%	48 805.94	41 895.91	85.84%
A12	EXPENDITURE RELATING TO STAFF RECRUITMENT	C8	98 072.60	56 216.24	57.32%	98 072.60	56 216.24	57.32%
A13	MISSION EXPENSES	C8	133 578.58	42 440.77	31.77%	133 578.58	42 440.77	31.77%
A14	SOCIO-MEDICAL INFRASTRUCTURE	C8	117 711.67	83 593.57	71.02%	117 711.67	83 593.57	71.02%
A15	TRAINING	C8	488 514.92	324 909.56	66.51%	488 514.92	324 909.56	66.51%
A16	EXTERNAL SERVICES	C9	72 937.94	50 186.19		72 937.94	50 186.19	
A17	RECEPTIONS, EVENTS AND REPRESENTATION	C8	125.00	125.00	100.00%	125.00	125.00	100.00%
A18	SOCIAL WEALFARE	C8	29 100.00	16 815.75	57.79%	29 100.00	16 815.75	57.79%
A19	OTHER STAFF RELATED EXPENDITURE	C8	366 211.82	300 901.01	82.17%	366 211.82	300 901.01	82.17%
Total Title 1			1 355 058.47	917 084.00	67.68%	1 355 058.47	917 084.00	67.68%

Fund Source: C8 - Carried over credits from previous years (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A21	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	C8	351 200.76	285 168.89	81.20%	351 200.76	285 168.89	81.20%
A22	INFORMATION, COMMUNICATION TECHNOLOGY AND DATA PROCESSING	C8	1 881 492.92	1 755 974.74	93.33%	1 881 492.92	1 755 974.74	93.33%
A23	MOVABLE PROPERTY AND ASSOCIATED COSTS	C8	131 163.07	120 884.26	92.16%	131 163.07	120 884.26	92.16%
A24	CURRENT ADMINISTRATIVE EXPENDITURE	C8	591 921.32	482 532.38	81.52%	591 921.32	482 532.38	81.52%
A25	POSTAGE / TELECOMMUNICATIONS	C8	160 155.54	80 827.79	50.47%	160 155.54	80 827.79	50.47%
A26	MEETING EXPENSES	C8	205 891.69	110 291.42	53.57%	205 891.69	110 291.42	53.57%
A28	INFORMATION AND PUBLISHING	C8	7 647.71	6 257.84	81.83%	7 647.71	6 257.84	81.83%
A29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	C8	101 636.49	76 416.39	75.19%	101 636.49	76 416.39	75.19%
Total Title 2			3 431 109.50	2 918 353.71	85.06%	3 431 109.50	2 918 353.71	85.06%
B31	ITER CONSTRUCTION INCLUDING SITE PREPARATION	C8	1 221 848 558.82	976 653 722.60	79.93%	Payment appropriations under C1 Fund source		
B32	TECHNOLOGY FOR ITER AND DEMO	C8	5 313 565.32	5 293 093.85	99.61%			
B33	TECHNOLOGY FOR BROADER APPROACH	C8	11 240 429.23	11 039 507.23	98.21%			
B35	EXTERNAL SUPPORT ACTIVITIES	C8	21 752 881.73	20 807 854.53	95.66%			
B36	OTHER OPERATIONAL EXPENDITURE	C8	3 483 706.12	3 338 844.01	95.84%			
Total Title 3			1 263 639 141.22	1 017 133 022.22	80.49%			
Total C8			1 268 425 309.19	1 020 968 459.93	80.49%	4 786 167.97	3 835 437.71	80.14%

Fund Source: C9 - Carried over credits from previous years (EUR)

Total Title 2			0.00	0.00	-			
Total C9			0.00	0.00	-	0.00	0.00	-

Fund Source: R0 - Assigned revenues (EUR)

Official Budget Item	Budget Line Description	Fund Source	Commitment			Payment		
			Credit Com Amount (1)	Commitment Accepted Amount (2)	% Committed (2)/(1)	Credit Pay Amount (4)	Payment Accepted Amount (5)	% Paid (5)/(4)
A27	RUNNING COSTS IN CONNECTION WITH OPERATIONAL ACTIVITIES	R0	30 473.55	30 473.55	100.00%	30 473.55	15 942.67	52.32%
Total Title 2			30 473.55	30 473.55	100.00%	30 473.55	15 942.67	52.32%
B41	ITER CONSTRUCTION - ITER HOST STATE CONTRIBUTION	R0	461 626 323.99	415 205 558.52	89.94%	150 184 899.99	148 024 185.17	98.56%
B42	ACTIVITIES LINKED TO ITER ORGANIZATION	R0	108 524 006.16	39 135 461.31	36.06%	83 289 383.58	15 834 380.79	19.01%
B43	OTHER EARMARKED EXPENDITURE	R0	736 527.90	736 527.90	100.00%	736 527.90	0.00	0.00%
Total Title 4			570 886 858.05	455 077 547.73	79.71%	234 210 811.47	163 858 565.96	69.96%
Total R0			570 917 331.60	455 108 021.28	79.72%	234 241 285.02	163 874 508.63	69.96%

Fig. 39 Budget Implementation – Details by Fund Source

8.5. 2022 Establishment Plan

Function group and grade	2022 Budget			
	Authorised under the EU Budget		Filled as 31/12/2022	
	Permanent posts	Temporary Posts	Permanent posts	Temporary Posts
AD 16				
AD 15		1		
AD 14	3	1	2	
AD 13	7	5	6	4
AD 12	11	23	11	20
AD 11	2	21	2	16
AD 10	5	37	5	45
AD 9	5	58	4	51
AD 8	1	26	1	22
AD 7	3	20		20
AD 6		9	1	15
AD 5				
AD total	37	201	32	193
AST 11	1		1	
AST 10	3		1	
AST 9	1	1	2	
AST 8		2	2	1
AST 7	1	6	1	1
AST 6	1	8	2	12
AST 5	2	11	2	7
AST 4	2	3	2	6
AST 3				4
AST 2				-
AST 1				-
AST total	11	31	13	31
AST/SC total	0	0	0	0
TOTAL	48	232	45	224
GRAND TOTAL	280		269	

Fig. 40 Budget 2022 Establishment Plan

9. Glossary and Abbreviations

ABAC	Accrual Based Accounting (accounting system used by F4E and managed by the EC).
Accounts payable	Organisation's current payables due within one year. Accounts payable are current liabilities.
Accounts receivable	Organisation's current receivables due within one year. Accounts receivable are current assets
Accrual accounting	Accounting methodology that recognises income when it is earned and expenses when they occur, rather than when they are actually received or paid, as opposed to cash accounting.
Actual = Actual amounts	Budget outturn = Budget execution = Budget implementation
Assets	Assets are items owned by an individual or an organisation, which have commercial or exchange value. Assets may consist of specific property or claims against others.
BA	Broader Approach
Cash accounting	Accounting methodology based on cash flows, i.e. transactions are recognised when cash is received or paid, as opposed to accrual accounting.
Current asset	The group of assets considered to be liquid in that they can be turned into cash within one year.
Current liability	Liabilities to be paid/settled within one year of the balance sheet date. (e.g. vendor's payables, etc.).
DI	Direct implementation for tasks requested by IO
EaC	Estimate at Completion
EC	European Commission
EPB	Executive Project Board
EU	European Union
External assigned revenues	Dedicated revenue received to finance specific items of expenditure
FR	Financial regulation
Financial statements	Written reports which quantitatively describe the financial health of an organisation. They comprise the Statement of Financial Performance, the Balance Sheet, the Cash Flow Statement, the Statement of Changes in Net Assets (capital) and the explanatory notes.
GB	Governing Board
Imprest account	Bank accounts and/or cash at hand used for the payment of low value expenses.
Internal assigned revenues	Funds received for specific assigned operations and activities from amounts recovered.
IO	ITER Organisation
Liability	A financial obligation, debt, claim, payable or potential loss.
NCR	Non conformity Report is a document issued by the supplier, F4E or the Customer detailing a condition that does not comply with a specified requirement.
PA	Procurement Arrangement: the PA between F4E and IO define the F4E deliverables to IO as well as the credit allocation scheme for each deliverable under the ITER unit of account.
PCR	Project Change Request
RAL	Commitments resulting in payment appropriations remaining to be paid.
TB	Tender Batches
WP	Annual Work Programme