FUSION FOR ENERGY

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

THE GOVERNING BOARD

DECISION OF THE GOVERNING BOARD ADOPTING THE PROJECT PLAN (2012 EDITION) OF THE EUROPEAN JOINT UNDERTAKING FOR ITER AND THE DEVELOPMENT OF FUSION ENERGY

THE GOVERNING BOARD

HAVING REGARD to the Statutes annexed to the Council Decision (Euratom) No 198/2007 of 27th March 2007 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy (hereinafter "Fusion for Energy") and conferring advantages upon it[1] and in particular Article 6(3)(d);

HAVING REGARD to the Financial Regulation of Fusion for Energy[2] adopted by the Governing Board on 22nd October 2007, last amended on 25th November 2011[3] (hereinafter "the Financial Regulation"), and in particular Article 30 thereof;

HAVING REGARD to the Implementing Rules of the Financial Regulation[4] adopted by the Governing Board on 22nd October 2007 last amended on the 8th July 2008[5] (hereinafter "the Implementing Rules");

HAVING REGARD to the comments and recommendations of the, Administration and Finance Committee, Executive Committee, Technical Advisory Panel and the Bureau;

WHEREAS:

(1) The Director should, in accordance with Article 8(4)(c), draw up and regularly update the Project Plan;

(2) The Governing Board should adopt the Project Plan.

HAS ADOPTED THIS DECISION:

Article 1

The Project Plan (2012 Edition) of Fusion for Energy annexed to this Decision is hereby adopted.

Article 2

This Decision shall have immediate effect.

Done at Barcelona, 11 December 2012

For the Governing Board

Stuart Ward
Chair of the Governing Board

[1] O.J. L 90, 30.03.2007, p. 58.
[2] F4E(07)-GB03-11 Adopted 22/10/2007
[3] F4E(11)-GB21-10c Adopted 25/11/2011
[4] F4E(07)-GB03-12 Adopted 22/10/2007
[5] F4E(08)-GB06-06a Adopted 08/07/2008

For the Secretariat

Digitally signed by (SIGN) RAYMOND MONK
DN: c=ES, o=FUSION FOR ENERGY. EUROPEAN AGENCY FOR ITER PROJECT, cn=(SIGN) RAYMOND MONK
Date: 2012.12.18 09:25:03 +01'00'

Raymond Monk
Secretary of the Governing Board

ANNEX I

FUSION FOR ENERGY PROJECT PLAN (2012 EDITION)

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1. INTRODUCTION, ASSUMPTIONS AND OVERALL OBJECTIVES

1.1. INTRODUCTION

The European Joint Undertaking for ITER and the Development of Fusion Energy or 'Fusion for Energy' (F4E) was created under the Euratom Treaty by a decision of the Council of the European Union.

F4E was established for a period of 35 years from 19th April 2007 and its offices are situated in Barcelona, Spain. The objectives of F4E are three fold:

- Providing Europe's contribution to the ITER International Fusion Energy Organisation (IO) as the designated EU Domestic Agency for (DA) Euratom;
- Implementing the Broader Approach Agreement between Euratom and Japan as the designated Implementing Agency for Euratom;
- Preparing in the longer term for the construction of demonstration fusion reactors (DEMO).

In accordance with the Financial Regulation of F4E and its Implementing Rules, this Project Plan lays down an indicative programme of activities that are foreseen to be implemented in the period 2009-2020. This information is complemented by the Resource Estimates Plan.

The legal basis and organization of Broader Approach Agreement and the role of F4E in its implementation differ from ITER case. As a consequence the part of F4E for the Broader Approach Agreement activities is presented in a separate section with a format appropriate to the nature of the activities.

All F4E activities presently planned for DEMO are covered under the Broader Approach Agreement and presented in the BA section of the Project Plan.

The information presented in this Project Plan which is intended to be adopted by the Governing Board is complemented by four annexes provided for information: annex 1 provides a detailed Work Breakdown Structure of the European in kind contributions to ITER, while annexes 2-4 provide the Project Plans for each of the Broader Approach projects.

2. ITER

2.1. OVERALL SCENARIO

At the 9th ITER Council (IC-9) in November 2011 the latest developments of the ITER schedule were presented and it was noted that the estimated first plasma (FP) date of November 2020 is within the baseline approved in July 2010.
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The F4E Detailed Work Schedules (DWS), on which this Project Plan is based, provide the schedule for the ITER components with special emphasis on those on the critical path for the machine construction.

The F4E schedule used for the preparation of this document is as of August 2012 (submitted to ITER IO on 20th July 2012).

The F4E DWS taken into account for this document largely include the modifications agreed with the ITER International Organization (IO) at special review meetings held in the period June-July 2012. In a limited number of cases, the discussions are still in progress to finalise a set of milestones to allow the accurate tracking of the project progress. In addition, a special MAC meeting at the end of August 2012 addressed the specific issues in the areas of the components on the critical path, which, for the EU, are the magnets, vacuum vessel and buildings. On that occasion F4E presented an update of the F4E schedules taking into account the latest developments such as the availability of frozen design data from ITER IO, procurement strategies and contracts implementation. The resulting main dates are summarized in Fig. 1. Such dates modifications affected primarily the buildings (see Table I) and were a preliminary information to ITER IO and the other Domestic Agencies (DAs), and not taken into account in this version of the Project Plan. They need to be further analysed and the impact checked in detail with ITER IO, together with a plan for adoption of a mitigation strategy to allow decreasing the delay.

In its schedule F4E always assumes that all input (e.g. design, subcomponents) from IO and other Parties would arrive on time, according to the F4E schedule. Otherwise delays would directly impact the delivery dates of the EU components.

As a result of the F4E-ITER IO review meetings during Summer 2012, the F4E DWS was modified accordingly. The September schedule submissions to ITER IO by all DAs allowed ITER IO to integrate all received input into a single planning in order to check the overall impact of the submitted schedules. At the same time, an updated version of the

Strategic Management Plan (SMP) to include all main milestones was prepared and made available for monitoring project progress. The analysis of these data is still in progress.

Negotiations are still in progress with ITER IO and all DAs to identify both de-scoping and deferrals of in-kind procurements to the operation phase. This exercise would allow ITER IO to receive additional cash during the construction phase, while still keeping the cost ceiling in the construction phase and the machine objectives throughout the D-T phase. Cost containment and cost reduction measures are also the topic of ongoing discussions at ITER Project level.

Table 1 shows a summary of the delivery dates for the components on the critical path, comparing those included in the Project Plan Annex 1 with those presented by F4E at the special MAC end of August 2012. As already mentioned, the impact and the possible mitigation of these delays are still under investigation.

	PP-2011 (FP Nov. 2019)	**PP-2012 (FP Nov. 2020)**	**MAC August 2012 (FP Nov. 2020)**
Buildings:			
Assembly Hall (Ready For Equipment – RFE- 1A)	June 2015	February 2016	Feb - July 2016
Partial Access to Tokamak Pit (RFE 1B)	September 2015	April 2016	Jun - Dec 2016
Tokamak Building Ready for Equipment (RFE 1C)	November 2015	July 2016	Apr - Oct 2017
Completion Tokamak Building	January 2018	July 2018	July 2019
Delivery Date for the first EU TF Coil	July 2015	August 2016	July 2016
Delivery Date for PF Coil #5	September 2015	April 2017	April 2017
Delivery Date for first EU Vacuum Vessel Sector	November 2015	August 2017	August 2017
Delivery Date for last EU TF Coil	January 2017	February 2018	January 2018
Delivery Date for last EU Vacuum Vessel Sector	April 2017	December 2018	December 2018
Delivery Date for PF Coil #3	July 2018	April 2019	April 2019

Table 1 – Comparison of delivery dates for EU components on the critical path as in Project Plan 2012 Annex 1 and those presented by F4E at the special MAC (end-August 2012). PP stands for Project Plan and FR for First Plasma.

The dates in the schedules of the main critical components have either been supported by the contractors working in these areas or by an analysis carried out within F4E. The large manufacturing contracts in the critical areas already in place, as well as the Architect Engineer, allow a real-time analysis of the impact of any variations of the design due either to a delay of input data or to a modification of design.

Risks are being evaluated internally in F4E for all critical components in order to put in place the necessary mitigation actions to avoid any impact that would cause a delay on the date of first plasma.

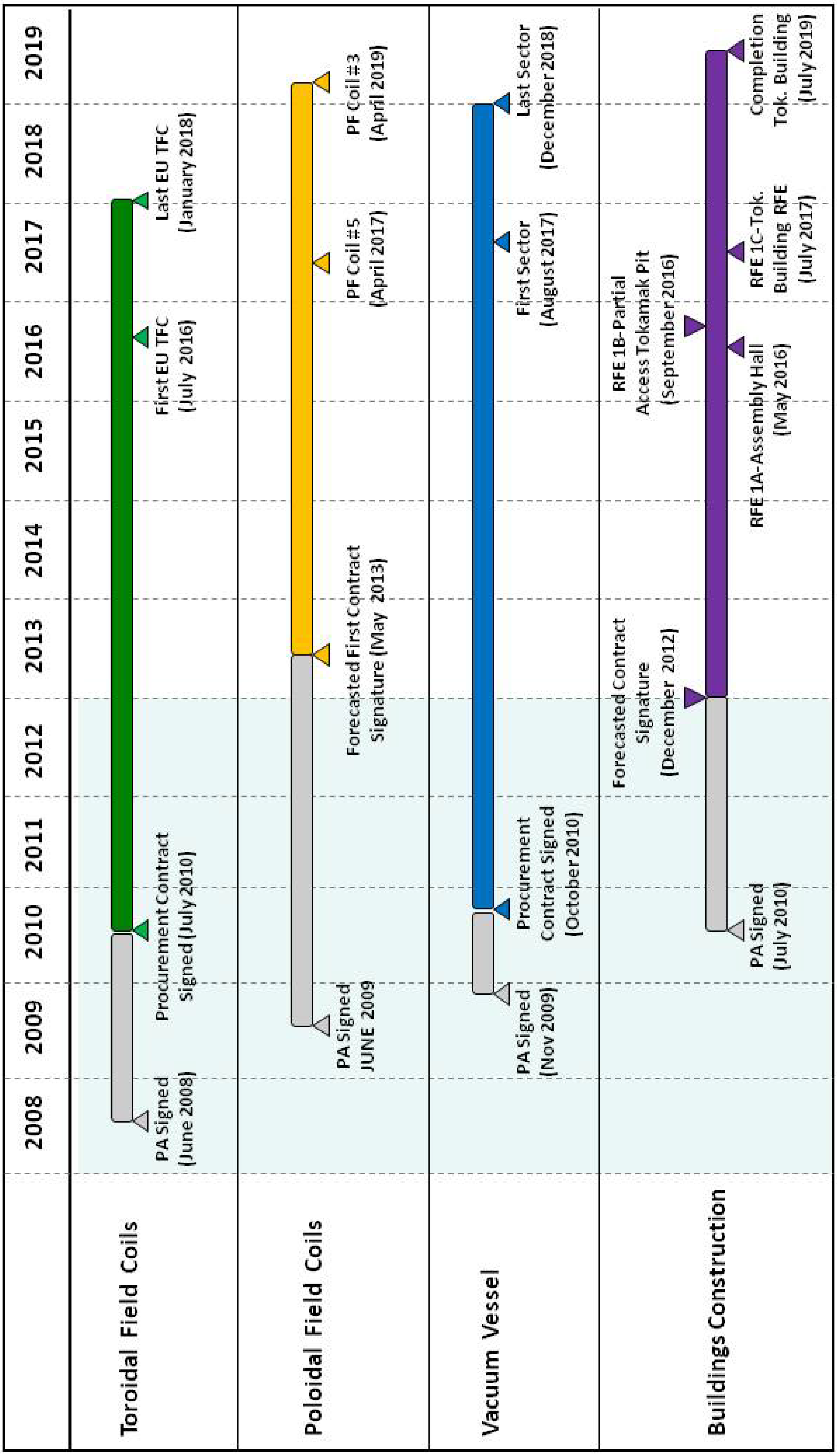
The F4E schedule takes into account the following assumptions:

- the Procurement Arrangements (PAs) between F4E and the ITER IO are concluded on time and according to the agreed level of design;
- the required input data (i.e. 3D models/2D drawings, load distribution data, etc.) are provided on time by ITER IO;
- The input data required to either launch procurement calls or to run an existing contract are frozen and no further modification is issued by ITER IO;
- the planning of the activities and the corresponding delivery of components, by the other ITER Domestic Agencies will be respected, according to the official schedule input provided by the Parties;
- F4E has the appropriate level of resources, both financial and manpower, to carry out the necessary activities according to the agreed baseline schedule.

The first four assumptions are true for the PAs to be signed. As for the PA signature, mitigation actions are being implemented, such as an earlier start of the PA negotiations and a better identification of the requirements defined by ITER IO. This allows a better visibility of the procurement package and therefore a better check that no additional scope is included. As for the data to be provided by ITER IO and other DAs, long discussions on the identification of SMP milestones have improved the situation and now such milestones are more closely followed. As for the level of resources in F4E, the issue of lack of manpower has been flagged, but it is still present and it is a major risk. As a mitigation action, a request of increase of staff has been submitted to the F4E committees and will be re-submitted to the GB in December 2012. In the case that the level of resources will not be increased, the activities highlighted in this project plan will have to be delayed accordingly.

The schedules from the F4E suppliers, taking into account the agreed fabrication routes and showing the real development of the work, are being reviewed every month and the main data, once analysed, integrated into the overall F4E schedule in Primavera.

Fig. 1 – Schedules Summary of the main EU in-kind procurements (Status: As presented at MAC in August 2012)



2.2. THE WORK BREAKDOWN STRUCTURE

F4E has defined its own Work Breakdown Structure (WBS), a common basis across the whole organization to allow the integration of scheduling, estimating, procurement and finance systems. The WBS is focussed on the PAs. The development has taken into account the boundary conditions given by the necessity to be aligned with the ITER WBS and to be close to the approach followed in the Primavera schedules to avoid a major change that could lead to difficult readjustments. After having defined the whole WBS, the existing F4E schedules have been migrated into the new structure.

The WBS is a formal document that will be part of the F4E Baseline and, as such, under configuration control. Table 2 below shows, according to the current F4E WBS, the associated ITER credit, taking into account the Project Change Requests (PCRs) and the Additional Direct Investments (ADIs) approved by the ITER Council. At the 8th meeting of the ITER Council (June 2011) a new set of guidelines for the evaluation of the ADI credit was endorsed and they are now used in the definition of the eligible credit.

WBS	**Description**	**Value (kIUA)**
EU.01.11.01-04	Magnets "Magnets (20% of the conductor for the TF and PF coils, 10 TF Coils, 5 PF coils – PF2-PF6)	185.829
EU.01.15.01	Vacuum vessel (7 sectors of the main vessel)	92.19
EU.01.15.02 and EU.01.16.01	Blanket Cooling Manifold and Blanket First Wall (48.4% of the first wall)	46.752
EU.01.17.01- 03	Divertor (cassette body and integration, inner vertical target and divertor rail)	33.78
EU.01.23. 02-05	Remote Handling (RH) (divertor RH, cask and plug RH system, in vessel viewing system, and NBI RH)	40.72
EU.01.31.01-02	Vacuum Systems (8 torus and 2 cryostat cryopumps, panel cryopumps for the neutral beam system, valve boxes and associated cryolines, and leak detection/localisation system). *Note: Re-packaging of EU PAs with credit sharing in progress*	14.226
EU.01.32.01 - 02	Tritium plant (consisting mainly of the Water Detritiation System (WDS) and the Hydrogen Isotope Separation System (ISS))	18.216
EU.01.34.01	Cryoplant system (50%) - LN2 Plant and Auxiliary Systems	30.677
EU.01.41.01	Electrical Power Supply & Distribution Systems (shared with other parties)	31.00
EU.01.51.01	ICRH (equatorial port plug incorporating 1 IC antenna) *Note: Negotiations with ITER IO are in place concerning the 2nd antenna. F4E total credit request of 14.73 kIUA shown in Annex 1.*	3.96
EU.01.52.01-03	ECRH (four upper port plugs incorporating EC launchers each fed by 8 waveguides + 32% gyrotron sources + 62% power supplies)	31.12
EU.01.53.01 - 07	Neutral beam Heating System (100% assembly and testing/and active correction and compensation coils/Beam Line components + ~41% beam source and high voltage bushing, ca 76% pressure vessel, magnetic shielding, ca 31% power supplies) and Neutral Beam Test Facility (64.7%)	83.40
EU.01.55.15	Diagnostics (roughly 25% of all diagnostic systems) *Note: The credit is being further revised as a result of PCR-450 (Deferral of Diagnostic Scope to Operations). To be updated following the IC-10 meeting.*	31.74517
EU.01.62.02 and Office Building	Buildings (all concrete and steel frame buildings incl. IO 's Annex Office building)	454.87
EU.01.66.01	Waste treatment and storage	10.10
EU.01.64.01	Radiological protection	4.20
	Total	**1112.785**

Table 2 - ITER credit for EU In-kind procurements taking into account PCRs and PA Value Refinements

The table below shows a summary of the EU Procurement Arrangements with the dates of signatures (grey shading for those already signed). The forecasted dates provided in Project Plan 2011 are also shown on the table. The PA Signature date F4E forecast table, however, shows the dates as per F4E's schedule submission at the end of July 2012, Where the forecast shows a date in the past, negotiations are in progress aiming at signing the PA as soon as possible, but no updated agreed signature date has been provided, yet. Shifting of PA signature dates could be due to: longer PA negotiations (e.g. on credit distribution, detailed PA schedule, etc.), lack of data from IO to reach the right level requested by the PA, delayed PA from another Party, negative outcome of design reviews, etc.

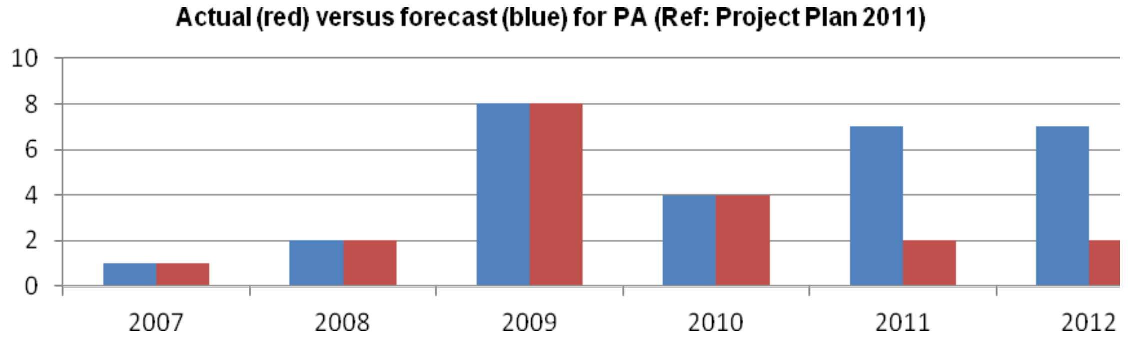
PA Title	**PA Signature Date (F4E PP2011)**	**PA Signature Date (F4E Forecast)**	**Credit (kIUA)**
Magnets - Toroidal Field Coils	June 2008	June 2008	89.74000
Magnets - Poloidal Field Coils	June 2009	June 2009	40.87000
Magnets - Pre-Compression rings	May 2010	May 2010	0.60000
Magnets - PF Conductor	May 2009	May 2009	11.22881
Magnets - TF Conductor	Dec 2007	Dec 2007	43.39000
Vacuum Vessel Sectors	Nov 2009	Nov 2009	92.19000
Blanket Cooling Manifolds	April 2013	March 2014	4.65200
Blanket First Wall	April 2013	Dec 2014	42.10000
Divertor Cassette Integration	Dec 2011	May 2012	11.20000
Divertor – Inner Vertical Target	March 2010	March 2010	20.20000
Divertor Rails	July 2014	Sept 2014	2.38000
Divertor Remote Handling	Oct 2011	Sept 2012	9.62000
Remote Handling –Cask and Plug RH System	July 2012	July 2013	18.30000
Remote Handling - In-Vessel Viewing System	Sept 2012	June 2013	6.80000
Neutral Beam Remote Handling	Sept 2012	Jan 2013	6.00000
Torus and Cryostat Cryopumps and Cold Valve Boxes	July 2014	July 2014	7.36200
Neutral Beam Cryopumps	Nov 2015	Nov 2015	2.46400
Leak Detection Systems	June 2014	June 2014	4.40000
Water Detritiation System - 1st part: Tritiated water holding tanks (storage and emergency)	Oct 2011	Sept 2012	2.55200
Water Detritiation System – 2nd part: residual WDS system (process components without tritiated water holding tanks)	Dec 2013	Dec 2014	10.20800
Isotope Separation System	Feb 2015	Sept 2016	5.45600
Cryoplant: LN_2 Plant and Auxiliary Systems	June 2011	June 2011	30.67700
Detailed design of the Steady-State Electrical Network (SSEN) and Pulsed Power Electrical Network (PPEN)	Oct 2009	Oct 2009	7.00000
Installation and Commissioning of the Steady-State Electrical Network (SSEN) and Pulsed Power Electrical Network (PPEN) and SSEN cables	Nov 2011	June 2012	13.30000
Material procurement for SSEN	April 2012	June 2012	5.00000
Material procurement for SSEN Emergency Power Supply	April 2012	Dec 2012	5.70000
Ion Cyclotron Heating Antenna	Sept 2013	May-2016	3.96000
Electron Cyclotron Upper Launcher – Primary Confinement System	June 2014	Nov 2014	6.49920
Electron Cyclotron Upper Launcher – Plug	July 2016	Nov 2016	3.13280
Electron Cyclotron Radio-Frequency Power Sources	June 2012	December 2013	9.86000
Electron Cyclotron Radio-Frequency Power Supplies	Dec 2011	May 2012	11.62800
Neutral Beam – Assembly and Testing	June 2014	Dec 2015	3.80000
Neutral Beam -Beam sources and high voltage bushings	Oct 2018	July 2018	3.89300
Neutral Beam -Beam line components	Sept 2017	July 2018	3.90000

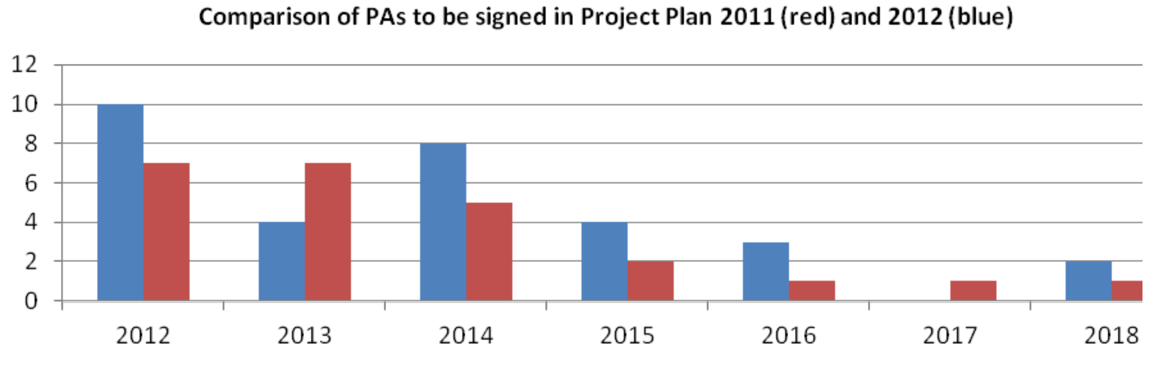
PA Title	PA Signature Date (F4E PP2011)	PA Signature Date (F4E Forecast)	Credit (kIUA)
Neutral Beam –Pressure Vessel and Magnetic Shielding	June 2013	July 2015	9.02500
Neutral Beam –Active Correction and Compensation Coils	Nov 2013	July 2015	4.40000
Neutral Beam Power Supplies and Related Systems	July 2009	July 2009	31.38200
Neutral Beam Test Facility	Oct 2010	Oct 2010	27.00000
Diagnostics 1st Part	Nov 2011	Dec 2011	1.11200
Diagnostics 2nd Part	-	Dec 2012	30.633
Poloidal Field Coil Manufacturing Building	Nov 2008	Nov 2008	12.80000
Architectural and Engineering Services	May 2009	May 2009	54.38000
Tokamak Excavation and Support Structure	May 2009	May 2009	31.00000
Anti-seismic Bearings	May 2009	May 2009	6.20000
Construction (Reinforced Concrete Buildings and Steel Frame Buildings)	July 2010	May 2010	336.64000
New ITER Headquarters Building	-	Oct 2012	13.85000
Radiological and Environmental Monitors Sys	June 2012	Oct 2012	4.20000
Waste Treatment System	Nov 2013	Sept 2014	10.1

Currently none of the delays in the PA signature is considered as critical. A detailed description of each PA is provided in Annex I.

2.3. ITER CREDIT

In numerical terms, the number of EU PAs that have been signed by F4E as of August 2012 is 40% of the total, whereas in terms of value this figure rises to 77%. Figure 2 shows the number of signed PAs against the planning set out in the 2011 Project Plan is shown while figure 3 shows the change in the planning for PA signature between the 2011 and 2012 (present) Project Plan.





Figs. 2 and 3: Comparison of actual and forecasted signature dates for PAs in the Project Plans 2011 and 2012.

It should be mentioned that credits are linked to deliverables and therefore credits at the beginning of the activities are only minor ones. Credit distribution is more peaked toward the end of the PA. Details on the credits allocated to the single systems are available in the Annex 1 of the Project Plan on EU In-kind procurements.

2.4. CASH CONTRIBUTION TO JAPAN

According to the ITER Agreement, there is a transfer of procurement responsibility from EURATOM to Japan under the supervision of the ITER Organisation. This happens through a cash contribution from EU to Japan paid by F4E according to the PA milestones reached by JA and validated by IO. The initial allocation of the milestones with relative EU payments is agreed at the time of the signature of the relevant Japanese PA, but it can shift due to delays in the progress of the contract. The table here after shows the percentage and the value (in kIUA) of the EU contribution together with the F4E payments from the signature date of the Japanese PA until end of July 2012 (also in kIUA). In orange are the Japanese PAs already signed.

System	Description	Approx. % of System financed by EU	Value of Cash Contribution (kIUA)	F4E Payments until July 2012 (kIUA)
Magnets	Toroidal Field Magnet windings 1B	9.4%	**7.7362**	**0.00**
	Toroidal Field Magnet Structure 2A	90%	**46.2600**	**0.00**
	Toroidal Field Magnet Structure 2B	6.5%	**3.1005**	**0.0178**
	Toroidal Field Magnet Conductors	10%	**21.5000**	**16.5126**
	Central Solenoid Magnet Conductors	100%	**90.000**	**11.70**
	Atmosphere Detritiation	50%	**15.100**	**0.00**
Neutral Beam H&CD	Beam Source and High Voltage Bushing	21.8%	**2.0750**	**0.1038**
	Magnetic Shielding	24.2%	**2.8750**	**0.00**
	Power Supply for Heating Neutral Beam	57.7%	**42.9180**[6]	**1.1311**

2.5. MAIN MILESTONES

Milestones included in the following tables 3 and 4 are extracted from Annex I and take into account the baseline date of a First Plasma in November 2020. The status is as of August 2012. The "Agreed date" shall be in line with FP Nov 2020 and shows the date agreed, for those milestones, with ITER IO at the schedule review meetings in June-July 2012. However, not all these listed milestones have been among those discussed with ITER IO and, in a few cases, agreement is still pending. This date is compared with the one in the DWS submission to ITER IO on 20th July 2012. Table 3 lists the main milestones where the baseline date is in the range 2010 – August 2012. Table 4 lists the main short-term (with baseline dates included in the range September 2012 – End 2014) milestones Additional milestones can be seen in Annex I. More details until the end of ITER construction phase are available in the Annexes together with the individual detailed descriptions according to the proposed F4E Work Breakdown Structure (WBS).

Table 3 – Recent Milestones (2010 - August 2012) with shaded cells indicating completion

F4E WBS	Milestone Title	Agreed Date	Date DWS (Jul 2012)
EU.01.11.01.51 **Magnets – Toroidal Field**	Contract Signature for TF Coils Winding Packs	Jul-2010	Jul-2010
	Qualification mock-ups for TF coils	Aug 2011	Sep-2013
	Radial plate prototypes completed	Nov 2011	Sep-2012
	Contract signature for Radial Plate procurement	Mar 2012	Dec-2012
	Contract Signed for Cold Test and Assembly of TFWP into Coil Cases	Mar 2012	Jun-2013

6 20.296kIUA out of total kIUA not yet signed

F4E WBS	Milestone Title	Agreed Date	Date DWS (Jul 2012)
EU.01.11.02.51 **Magnets – Pre-Comp Rings**	Contract signature for pre-compression rings	June 2011	Aug 2012
EU.01.11.03.53 **Magnets – Poloidal Field**	Contract signature for PF coils	Mar 2011	May-2013[7]
EU.01.11.04.51 – 52 EU.01.11.04.52 **Magnets – TF & PF Conductors**	Signature of contract for cabling and jacketing of TF and PF conductors	Jan-2010	Dec-2010
	End of Cu strand production	Apr-2011	Dec-2010
	TF & PF Conductor Manufacture Phase 2: Process Qualification	June 2011	TF: Mar 2012
	TF & PF Conductor Manufacture Phase 2: Process Qualification	June 2011	PF: Dec-2012
	TF Conductor Manufacture Phase 3: TF Production Readiness	TF: July 2011	TF: Nov 2012
EU.01.03.01.01 **Vacuum Vessel**	3D CATIA (frozen) Model delivered by IO for sector 5	Nov-2010	May-2012
	F4E, IO approval of Detailed Design – VV Sector 5	Aug-2011	May-13
	F4E, IO approval of Detailed Design – VV Sector 4	Oct-2011	Ago-13
	F4E, IO approval of Detailed Design – VV Sector 3	Feb-2012	Nov-13
	F4E, IO approval of Detailed Design – VV Sector 2	May-2012	Feb-14
	F4E, IO approval of Detailed Design – VV Sector 9	Aug-2012	May-14
EU.01.17.02.51 **Divertor Inner Vertical Target**	Publication of Award Decision for Pre Production Qualification-Lot 1	May-2012	Apr-2012
	Publication of Award Decision for Pre Production Qualification-Lot 2	Mar-2012	Feb-2012
EU.01.17.01.51 **Divertor Cassette Body & Assembly**	Signature of PA	May-2012	May-2012
EU.01.31.02.51 **Vacuum Systems / Leak Detection Systems**	Start manufacture of Pre-Production Cryopump	Aug-2012	Aug-2012
	Completion of R&D on Leak Localization in the Tokamak Cooling Water System (GRT158)	Aug-2012	Aug-2012
EU.01.32.02.51-52 **Tritium Systems / Water Detritiation System (WDS)**	Conceptual Design entire Water Detritiation System (WDS) approved by IO	Jun-2012	Jun-2012
EU.01.34.01.51 **Cryoplant**	PA Signature	June-2011	June-2011
	Supply of a full set of technical input data by IO	Mar-2012	Mar-2012
EU.01.41.01.53-56 **Power Supplies**	A/E Tender design complete for 400 kV part	Mar 2011	Apr 2011
	A/E Tender design complete for High Voltage and Medium Voltage distribution except 400kV part	Sep 2011	Sep 2011
	A/E Tender design complete for High Voltage, Medium Voltage and Low Voltage distribution. Emergency Power Supply except 400kV part	Sep 2011	Mar 2012
EU.01.51.01.51 **H&CD / Ion Cyclotron Antenna**	Preliminary design review of the antenna	May-2012	May-2012
EU.01.52.02.51 **H&CD / Electron Cyclotron Power Sources**	Decision to Continue on the Coaxial Cavity Gyrotron Programme	Jul 2012	Jul 2012

[7] Date presented by F4E at the special MAC end of August 2012

F4E WBS	Milestone Title	Agreed Date	Date DWS (Jul 2012)
EU.01.52.03.51 **H&CD / Electron Cyclotron Power Supplies**	PA for EU 5.2P4 RF Power Supplies signed	May 2012	May 2012
EU.01.53.(01-07).51 **H&CD – Neutral Beam**	Signature of NBTF Back to Back agreement	Jan-2012	Jan-2012
	Signature of PRIMA Cooling plant contract	Aug-2012	Aug-2012
	Ion Source and Extraction PS start of manufacturing	Jun-2011	Dec 2011
	First Design Report SPIDER ISEPS Accepted by IO	Dec-2010	May-2011
EU.01.62.02.53 57 **Buildings**	PF Coils Manufacturing Building -Final acceptance	Jun 2012	Jun 2012
	Excavation and support structure - Final acceptance	Jun 2012	Jul 2012
	Anti-seismic bearings - Final acceptance	June 2012	June 2012
Site	Handover of ITER Headquarters to IO	Jun 2012	Oct 2012
EU.01.64.01.51 **Radiological & Environmental Monitoring Systems (REMS)**	REMS Conceptual design review meeting	Aug 2012	Aug 2012

Table 4 – Short-Term Milestones (September 2012 – End-2014)

F4E WBS	Milestone Title	Agreed Date	Date DWS (Jul 2012)
EU.01.11.01.51 **Magnets – Toroidal Field**	Dummy double pancake completed	Jun-2013	Sep-2013
	Last Delivery of conductors from EU	Mar-2014	Oct-2014
EU.01.11.02.51 **Magnets – Pre-Compression Rings**	Qualification (excluding option for the manufacturing and testing of first-of-the-kind ring)	Oct 2012	May 2014
EU.01.11.04.51-52 **Magnets – TF & PF Conductors**	NbTi cable delivery (including PF1 cable lengths)	Apr-2014	Apr-2015
	Conductors for PF6 coils delivery	Mid-2013	Aug- 2013
	Delivery of conductors from EU (TF conductors)	July-2014	Nov-2014
	Phase 4: TF Production	Jun-2013	Nov-2014
EU.01.03.01.01 **Vacuum Vessel**	F4E, IO approval of Detailed Design – VV Sector 8	Oct-12	Jun-14
	F4E, IO approval of Detailed Design – VV Sector 7	Jan-13	Jun-14
EU.01.15.02.51 **Blanket Cooling Manifolds**	Complete final analyses (EM loads, thermo-mechanical, pressure, seismic)	Jul-2013	Jul-2013
	Final Design Review (FDR)	Nov-2013	Nov-2013
	Signature of PA	Mar-2014	Mar-2014
EU.01.16.01.52 **Blanket – First Wall**	Contract for Test Facility signed	Mar-2013	Mar-2013
	Contract - fabrication of full-scale prototypes signed	Jul-2013	Jul-2013
	Signature of PA	Dec-2014	Dec-2014
EU.01.17.02.51 **Divertor Inner Vertical Target**	Process Qualification (Lot 2)	Mar-2013	Mar-2013
	Start manufacturing of Full CFC-W Prototype PFC (Lot 1)	July-2013	July-2013
	Pack and Ship of Full CFC-W Prototype PFC from EU-DA to Test Facility (Lot 2)	Aug-2014	Aug-2014
EU.01.17.01.51 **Divertor Cassette Body & Assembly**	Contract Signed for Cassette Body Prototype	July-2013	July-2013
	Qualification of Manufacturing Processes	Aug-2014	Aug-2014
	Start Manufacture & Testing of Cassette Body Prototype	Oct-2014	Oct-2014
EU.01.23.02.51	Signature of PA	Sep-2012	Sep-2012

F4E WBS	Milestone Title	Agreed Date	Date DWS (Jul 2012)
Divertor Remote Handling	Contract signature	May-2013	May-2013
EU.01.23.03.51 **Cask & Plug Remote Handling (CPRH)**	Conceptual Design review completed	Apr-2013	Apr-2013
	Signature of PA	July 2013	Jul-2013
	Contract signature for CPRHS	Jan-2014	Jan-2014
EU.01.23.04.51 **In-Vessel Viewing System (IVVS)**	Conceptual Design Review completed	May-2013	May-2013
	Signature of PA	Jun-2013	Jun-2013
	Contract award	Feb-2014	Feb-2014
EU.01.23.05.51 **Neutral Beam Remote Handling**	Conceptual Design Review completed	Oct-2012	Oct-2012
	Signature of PA	Jan-2013	Jan- 2013
	Contract signature for NB RH	Sept-2013	Sep-2013
EU.01.31.01.52, 54-55 **Vacuum Systems / Cryopumps and Cold Valve Boxes (CVB)** Note: This splitting only for reference. It is still under discussion with IO as stated in correspondent Annex 1, Sec.2	Completion of the design of the Cold Valve Boxes	Sep-2014	Sep-2014
	Completion of Pre-Production Cryopump manufacture	Mar-2014	Mar-2014
	Start installation and Engineering tests of Pre-Production Cryopump at TIMO-2	Jan-2014	Jan-2014
	PA Signature (CVBs, WRB, Cryojumpers)	Dec-2013	Dec-2013
	PA Signature (Torus and Cryostat Cryopumps)	Jul-2014	Jul-2014
	PA Signature (Warm Regeneration lines)	Sep-2012	Sep-2012
EU.01.31.02.51 **Vacuum Systems / Leak Detection Systems**	PA Signature	Jun 2014	Jun 2014
EU.01.31.01.53 **Vacuum Systems / NB Cryopumps**	Complete the design of the HNB and MITICA cryopumps	Sep-2012	Sep-2012
	Place contract for the MITICA cryopump	Nov-2013	Nov-2013
EU.01.32.01.51 **Tritium Systems / Isotope Separation System (ISS)**	Contract signed for procurement of Conceptual Design for ISS	Jan-2013	Jan-2013
	Experimental characterisation of the distillation column packing completed	Mar-2014	Mar-2014
	Conceptual design approved for ISS	Aug-2014	Aug-2014
EU.01.32.02.51-52 **Tritium Systems / Water Detritiation System (WDS)**	PA for procurement of tanks signed	Sep-2012	Sep-2012
	Preliminary Design of “Large Tanks” completed and approved by IO	Sep-2012	Sep-2012
	Contract signed for procurement of preliminary design for WDS (excluding Tanks)	Jan-2013	Jan-2013
	Contract signed for procurement of WDS tank final design, manufacturing, testing and delivery to ITER sites	Jun-2013	Jun-2013
	Preliminary design review of Main WDS completed and approved by IO	Sep-2014	Sep-2014
	PA for Main WDS signed	Dec-2014	Dec-2014
EU.01.34.01.51 **Cryoplant**	Call for Tender for LN_2 Plant & Auxiliary Systems	Sept-2012	Sept-2012
	Contract signature for LN_2 Plant & Auxiliary Systems	Oct-2013	Oct-2013
	Preliminary Design Review & Launch of Long Lead Items	June-2014	June-2014
EU.01.41.01.53-56 **Power Supplies**	Architect Engineer Assembly and Installation Design	Sep 2012	Jul 2013
	Signature of contract TB06 Electrical Power Distribution (EPD)	June 2012	March 2013
EU.01.52.02.51 **H&CD / Electron Cyclotron**	PA for EU 5.2P3 RF Power Sources Signed	Dec 2013	Dec 2013

F4E WBS	Milestone Title	Agreed Date	Date DWS (Jul 2012)
Power Sources			
EU.01.52.03.51 **H&CD / Electron Cyclotron Power Supplies**	Main Contract for Main and Body PS Signed	Jul 2013	Jul 2013
EU.01.52.01.51-52 **H&CD / Electron Cyclotron Upper Launcher**	Window design ready for final prototype	Oct-2012	Oct-2012
	Isolation Valve Prototype design ready for prototype	Oct-2012	Oct-2012
	Blanket Shield Module and First Wall design ready for prototype	Apr-2013	Apr-2013
	Final design review of the PCS of the EC Upper Launcher & design Grant II signed	May-2014	May-2014
EU.01.53.(01-07).51 **H&CD – Neutral Beam**	Signature of SPIDER Beam Source and Vessel contract	Sep-2012	Sep-2012
	PRIMA buildings available (RFI)	Dec-2013	Dec-2013
	Completion of MITICA Design	Oct-2013	Oct-2013
	Ion Source and Extraction Power Supplies SPIDER ISEPS ready for Site Acceptance Test	Sep-2014	Sep-2014
	Ion Source and Extraction Power Supplies MITICA ISEPS delivered at Padua site	May-2014	May-2014
EU.01.55.15 **Diagnostics**	Signature of PA 5.5.P02.EU.01	Dec 2012	Dec 2012
EU.01.62.02.53 57 **Buildings**	A/E construction design complete (except Hot Cell Bldg)	Aug 2013	Oct 2013
	Contract Signed for Cask Lift & Assembly Hall Cranes (TB02)	Nov 2012	Feb 2013
	Contract Signed for Civil Works Buildings 11,13-17,36,42-47,51-53,61,71-75 & PCD (TB03)	Dec 2012	Dec 2012
	Contract Signed for Design & Build Buildings 32, 33, 38, 39, 41 (TB05)	Dec 2012	Jan 2013
	Contract Signed for Site Infrastructure (TB08)	Nov 2012	Jan 2013
	Contract Signed for Design & Build Buildings 67, 68, 69 (TB07)	May 2013	May 2013
	Start of Tokamak Building Construction	Aug 2013	Oct 2013
EU.01.64.01.51 **Radiological Protection (REMS)**	Signature of PA	Oct 2012	Oct 2012

2.6. RISK MANAGEMENT

Risk Management at F4E currently consists of two different levels: Corporate and Project Level. The Project Risk management implementation started in 2011 and will continue in the following years, while the Corporate Risk Management is an objective to be implemented in the second part of 2012, and updated and monitored in the following years.

As far as the Corporate Risk Management implementation is concerned, the process has been approved and the first version of the Corporate Risk Log is under review. The F4E Senior Management will report separately on the progress and on the details.

The Project risk management activity includes three main parts: (i) the analysis of event risks, (ii) the risks assessments for In-Kind Procurements, (iii) the schedule uncertainty analysis.Items (i) and (iii) have to be assessed at project level, as input of IO and the other DAs is important to reach an overall analysis. ITER IO has stopped carrying out such analyses since 2010

As far as the EU in-kind procurements are concerned, risk analysis has progressed through in-house analysis, external contracts and feedback from the suppliers (whenever a manufacturing contract was in place). The analysis has initially concentrated on the components on the critical path thus reflecting the major issues that F4E is facing at the moment. During 2011, 12 Procurement Arrangements were analysed from a risk point of view, and in 2012 this analysis have been extended to 23, with the aim to extend the analysis to all EU Procurement Arrangements in the forthcoming months:

- TF Coils Magnet Windings (PA1.1.P1A.EU.01)
- Pre Compression Rings (PA 1.1.P2A.EU.01)
- PF Coils 2, 3, 4, 5 & 6 (PA 1.1-P3A-B.EU.01)
- TF Magnet Conductors (PA1.1.P6A.EU.01)
- PF Conductors (PA1.1.P6C.EU.01)
- Vacuum Vessel (PA1.5.P1A.EU.01)
- Blanket Manifolds (PA1.5.P1A.EU.02)*
- Blanket First-Wall (PA1.6.P1A.EU.01)
- Divertor Cassette Body and Integration (PA1.7.P1.EU.01)
- Divertor Inner Vertical Target (PA1.7.P2B.EU.01)
- Divertor Remote Handling (PA 2.3.P2.EU.01)*
- Water Detritation System (PA3.2.P5.EU.02)*
- LN2 Plant and Auxiliary Systems (PA3.4.P1.EU.01)
- Electrical Power Supply (PA5.2.P4.EU.01)*
- EC-RF Gyrotrons EU (PA5.2.P3.EU.01)
- EC Power Supplies (PA5.2.P4.EU.01)*
- NB Power Supplies (PA5.3.P6.EU.01)*
- NB Test Facility (PA5.3.P1.EU.01)*
- Diagnostics (PA5.5.P1.EU.01)*
- Site Preparation (PA6.1.P2.EU.01)*
- Site and Buildings (PA6.2.P2.EU.01-05)
- Radiological and Environmental Monitoring Subsystem (PA 6.4.P1. EU.01)*
- Waste Management Systems (PA6.6.P1.EU.01)*

(*) Not reported in Project Plan 2011

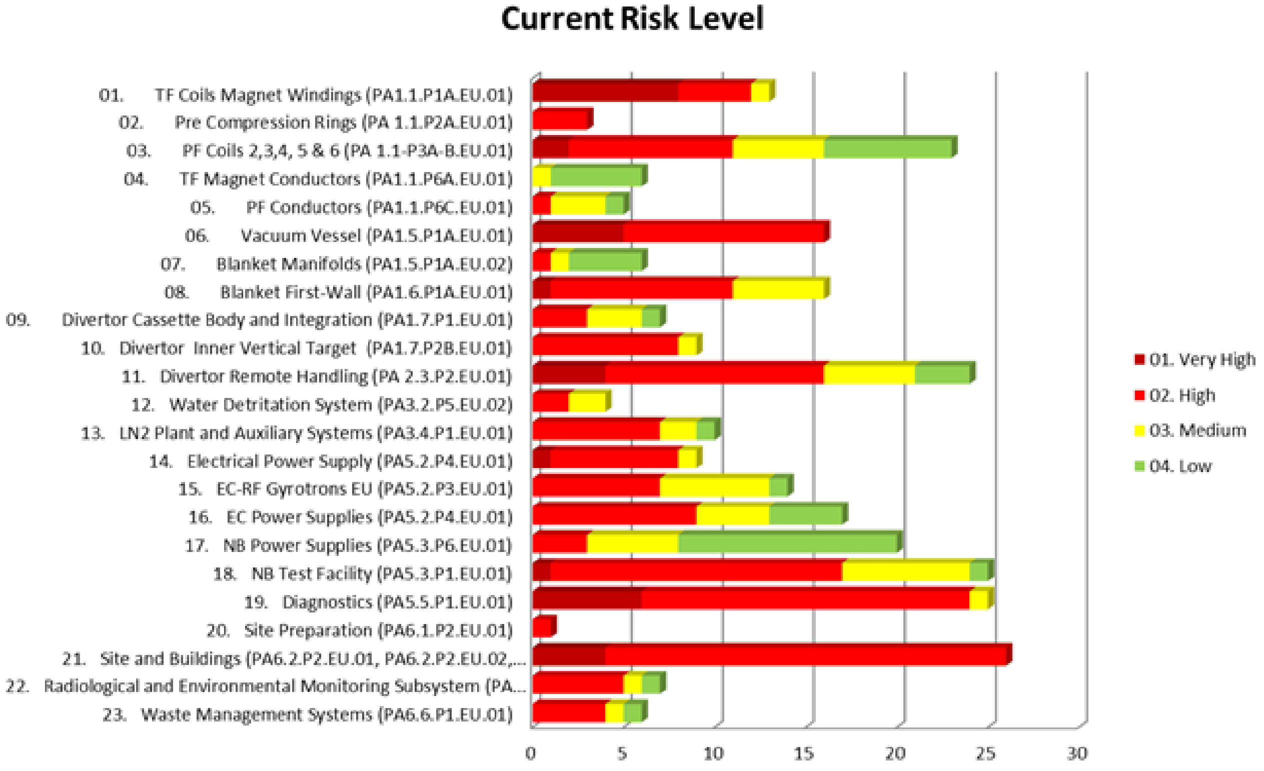
In the following months other PAs will be included in the F4E risk register and in the future versions of the Project Plan. Following the F4E Risk management process, the following Probability/ Impact matrix (PID matrix) has been used for the risk level ranking in order to define the priorities of the risk events.

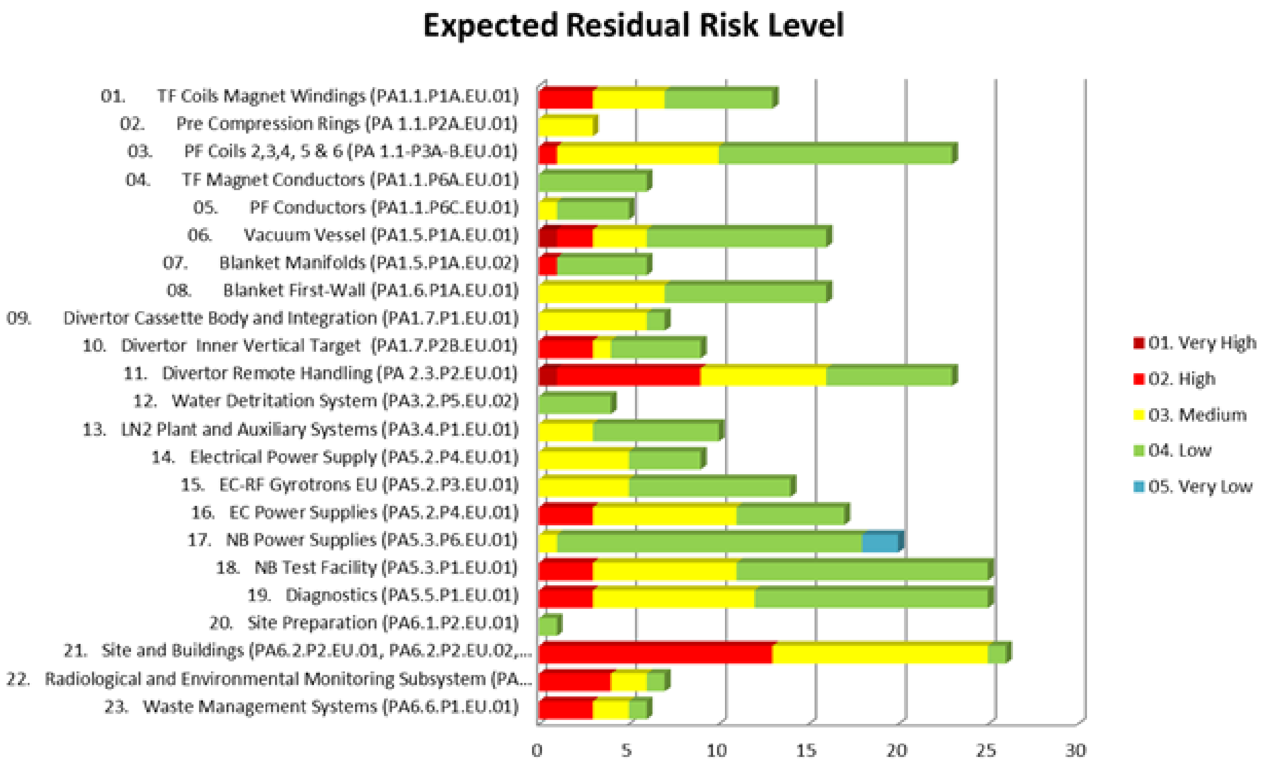
PID Matrix		Impact				
		Very Low	Low	Medium	High	Very High
Probability	Very Likely	5	20	45	80	125
	Likely	4	16	36	64	100
	Not Likely	3	12	27	48	75
	Unlikely	2	8	18	32	50
	Not Credible	1	4	9	16	25

Level	Actions
VERY LOW	They are included in the risk file and reviewed by WPM concerned. Actions are evaluated in order to reduce the risk.
LOW	They are included in the risk file and reviewed by WPM concerned. Actions are evaluated in order to reduce the risk.
MEDIUM	An owner is appointed to monitor the risk evolution and report to the WPM concerned. Actions are evaluated in order to reduce the risk.
HIGH	Same as level MEDIUM plus definition of specific mitigation actions. These actions are defined by the WPM concerned with the risk, which identifies also possible trigger events to start them. The owner monitors the risks and these trigger events.
VERY HIGH	Planned mitigation actions are started as scheduled. The risk owner is designated directly by the PM, who closely monitors the effectiveness of the mitigation actions at each project review meeting

2.6.1. *Open Risks*

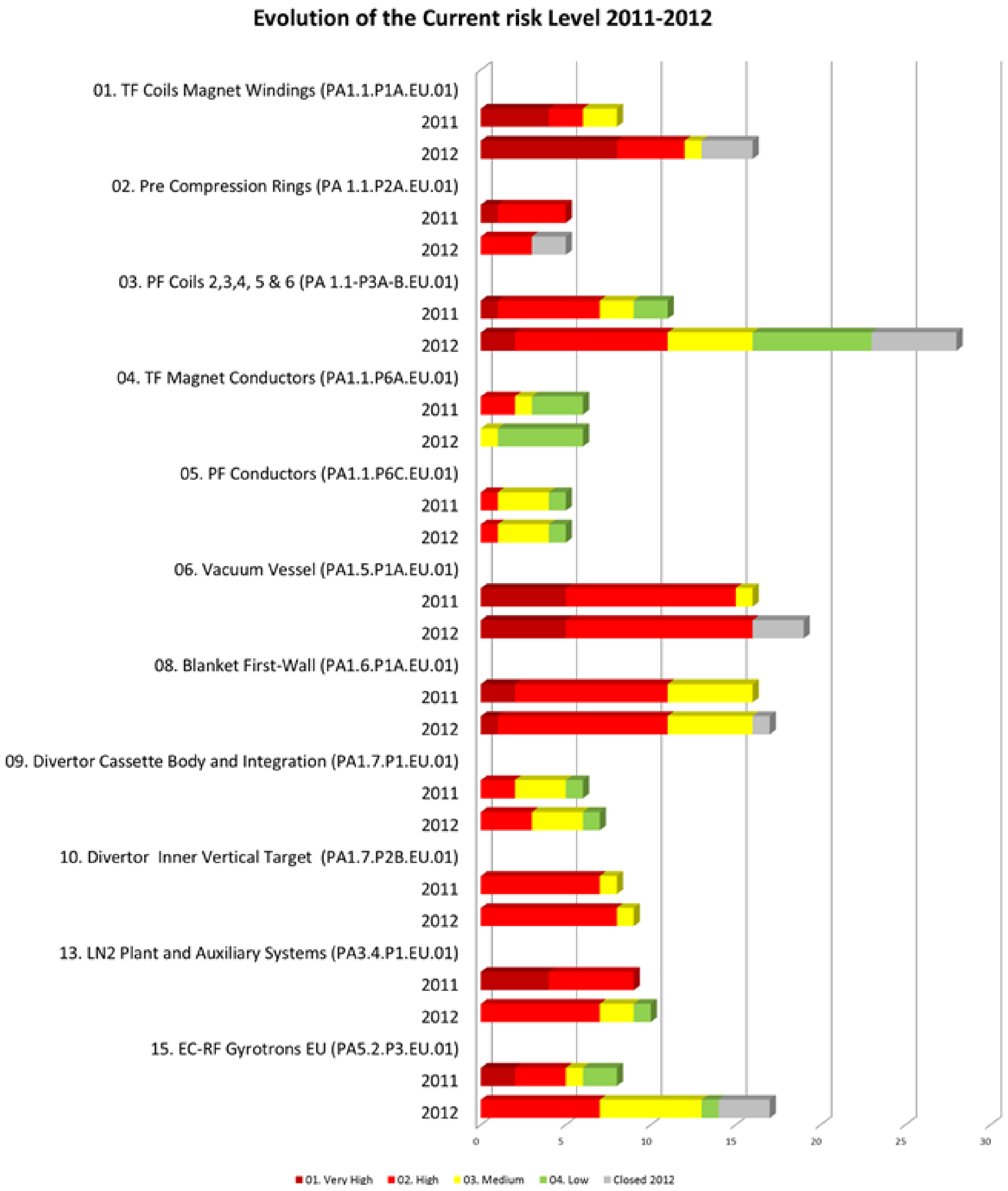
For the Open risks, here below is the distribution of the risk level per PA (number of risks) with comparison between the current and the residual ones. Most of the events categorized as High and Very High have a mitigation plan that reduces the expected residual risk to an acceptable level.





2.6.1. Evolution 2011- 2012 for the Current Risk Level

For the signed PAs, where a risk analysis had already started in 2011, an analysis of the evolution in time of the current risk levels was carried out. The analysis shows that some risks have been closed in 2012 (in grey) while some others are new ones, not present in 2011.



In the following we a short description of the evolution of the risk levels per PA from 2011 to 2012 is provided:

01. **TF Coils Magnet Windings (PA1.1.P1A.EU.01)**: During this year the Radial Plate tender was published as a negotiated procedure to reduce the likelihood of a monopoly situation and this risk has been managed. Also the decision to manufacture the 2 prototypes has decreased the uncertainty in the manufacturing of the side of the radial plate. The level of detail of the risk log has been increased due to a deep analysis performed by the team. Seven new risks have been included, mainly regarding the interfaces of this project and possible additional negotiations in the open procurements. Three risks were closed without impacting this project.

Risk Description	Comment on closure
Delay in the reception of free issue components from IO	Risk Rejected. The avoidance actions put in place by F4E worked and the risk is not relevant any more
Uncertainties in the manufacturing of the side radial plate with the technique developed with the regular radial plate prototype	Risk Managed. Decision of the manufacturer of the Radial plates prototype
Lack of competition for Radial Plates contract	Risk Managed. Enough offers received during call for tender

02. **Pre Compression Rings (PA 1.1.P2A.EU.01)**: Due to the contract signature, one assembly risk has been managed as the mitigation action of including the spare rings in the PA and contract has been completed, but one of the risks has impacted, resulting in an increase of the budget.

Risk Description	Comment on closure
Damage of Pre -compression rings during the assembly of the lower rings	Risk Managed. Spare rings exist for the lower rings in the PA and in the contract to be signed
Additional activities required during qualification phase	Risk Impacted. The cost increase has been taken into account in the allocated budget for the contract.

03. **PF Coils 2, 3, 4, 5 & 6 (PA 1.1-P3A-B.EU.01)**: During the last year a lack of competition has impacted the already launched call for tender, and the proposed actions in the risk log for a new procurement strategy are under implementation at the moment. Also the decision to cancel the launched call for tender has been taken due the high risk of a legal liability due to the long term negotiation. A deep review of the risks was carried out due to the new situation, which has incremented the level of detail in the risk log. The general risk level has not decreased, and it is still pending a deep review of the risks by taking into account the new procurement strategy.

Risk Description	Comment on closure
Lack of competition or monopoly situation	Risk Impacted
Legal liability	Risk Managed. The call for tender was cancelled
Building "CCAE" (clean areas) design & installation delay the start of manufacture	Risk Managed. New procurement strategy implemented
Need of another offer or 3rd round of negotiation may be requested	Risk Impacted. The 3rd round was performed
Changing in procurement strategy, splitting the scope of supply, using experience gained with the procurement of other magnets for CERN (ATLAS, CMS) or the ITER Model Coils	Risk Impacted. Call for tender cancelled. New procurement strategy.

04. **TF Magnet Conductors (PA1.1.P6A.EU.01)**: The level of risk has been decreased as the proposed actions have been completed and the level of uncertainty in the project has decreased.

05. **PF Conductors (PA1.1.P6C.EU.01)**: No major changes regarding the level of risk.

06. **Vacuum Vessel (PA1.5.P1A.EU.01)**: The risks impacted are the same as the ones reported the previous year, impacting mainly the schedule of this project. Those risks are still recurrent and can impact this project again causing further delays.

Risk Description	Comment on closure
Delayed product and shop qualification of the (sub) supplier of Plates material	Risk Impacted, additional delay in the schedule
Delayed product and shop qualification of the (sub) supplier of Forgings material	Risk Impacted, additional delay in the schedule
Delayed finalization of the VV Sectors Concept design for the first Sector	Risk Impacted, additional delay in the schedule

08. **Blanket First-Wall (PA1.6.P1A.EU.01)**: One high risk has been identified concerning the design integration, while a very high one was closed, as the proposed mitigation actions are in place to have a procurement framework for the signature of the contract for the full scale prototypes.

Risk Description	Comment on closure
Start fabrication of the full-scale prototype(s) before PA signature.	Risk Managed. F4E agreed and received an ITER task agreement from IO. This risk is therefore cancelled

09. **Divertor Cassette Body and Integration (PA1.7.P1.EU.01)**. During the regular update of the risk log, a higher level of detail has been included. New risks have been identified for the status of the design and the manufacturing phases.

10. **Divertor Inner Vertical Target (PA1.7.P2B.EU.01)**: One additional risk, concerning design maturity, has been included as high in the risk log.

13. **LN_2 Plant and Auxiliary Systems (PA3.4.P1.EU.01)**: The level of risk has been decreased as the proposed mitigation actions have been completed. In addition, one new high risk on the applicable regulation has been added.

15. **EC-RF Gyrotrons EU (PA5.2.P3.EU.01)**: A new level of detail has been introduced in the risk log. More were added and some were closed.

Risk Description	Comment on closure
Higher thermal loads to be dissipated, the technical design of the tube is challenging (e.g. cooling)	Risk Rejected. New detail introduced in the risk log, and this risk is monitored through more detailed ones
Not all the ITER technical requirements can be met due to the very tight schedule for the R&D and design phase	Risk Rejected. New detail introduced in the risk log, and this risk is monitored through more detailed ones
Not all the ITER technical requirements can be met	Risk Rejected. New detail introduced in the risk log, and this risk is monitored through more detailed ones

As far as the closed risks are concerned, there are 5 risks that did not appear in PP2011, but have been closed in the first part of 2012 as part of the regular update during the year.

PA	Risk Description	Comment on closure
12. Water Detritation System (PA3.2.P5.EU.02)	Difficulties in estimating total costs (design and manufacture) and thus an insufficient budget for completing the PA	Risk Managed (not present in PP 2011) Information for cost estimates received from Business intelligence programme (market survey, benchmarking of organisation and contractual structure for similar industrial projects).
16. EC Power Supplies (PA5.2.P4.EU.01)	The Annex B of the PA is not finalized/agreed and PA not signed on time	Risk Managed (not present in PP 2011). PCR accepted and outcome implemented into the PA
	this additional requirement is accepted in the PCR-422 and/or PA signature	Risk Managed (not present in PP 2011). PCR accepted and outcome implemented into the PA
	The Safety classification of some components changes before PA signature	Risk Managed (not present in PP 2011). PA prepared for signature/signed
18. NB Test Facility (PA5.3.P1.EU.01)	Requirements change : HVD1 change of internal equipment's volume	Risk Managed (not present in PP 2011). ISEPS dimensions known, no change has been required for the HVD1.

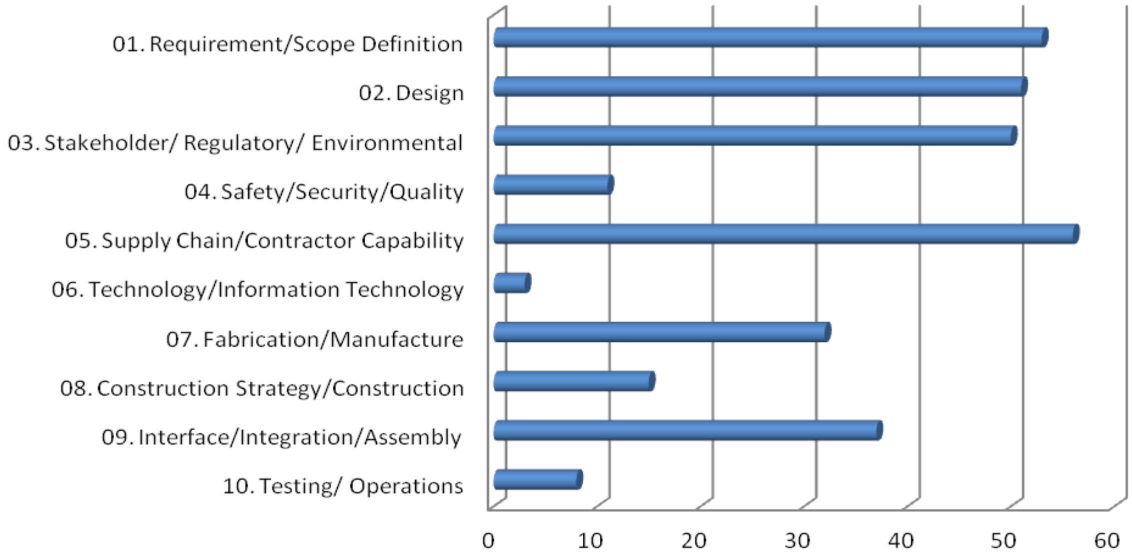
2.6.2. Distribution of the Open Risks per Catagories

The current Risk Breakdown Structure (RBS) is a categorization of the risk proposed by ITER IO, and it consists of the following categories:

1. *Requirement/Scope Definition*: risk regarding the definition and maturity of the requirements and the understanding of the scope of the project
2. *Design*: Risk regarding the design complexity, maturity, development and integration
3. *Stakeholder/Regulatory/Environmental*: Risk regarding 3 different categories, such as stakeholder (EU, ITER IO, F4E), Regulations and possible environmental risks.

4. *Safety/Security/Quality*: safety, security and Quality risks
5. *Supply Chain/Contractor Capability*: Risk regarding the supplier situation, such as e.g. lack of competition or unavailability of facilities
6. *Technology/Information Technology*: risk regarding the status of the technology (R&D), and possible risks on IT or specific software
7. *Fabrication/Manufacture*: risk regarding mainly uncertainties in the manufacturing
8. *Construction Strategy/Construction*: Risk regarding the construction strategy or the construction itself
9. *Interface/Integration/Assembly:* Risk regarding the management of the interfaces both within this project or with other projects (DA's)
10. *Testing/Operations*: Risk that can arise during the testing or operation phase. In most of the cases the operation is out of the scope of F4E projects.
11. *Other:* Free category

The distribution of open events for 2012 through the Risk Breakdown Structure is shown in the following chart.



<u>Use of Risk Handling Strategies</u>

The tendency in F4E for the risk handling strategy (reduce, accept, transfer or avoid) is to decrease the risk level of the event by using a mitigation plan. This is the reason why only 14% of the risk events are accepted.

3. QUALITY ASSURANCE (QA)

3.1. F4E RELATED QA

The development and establishment of a Quality System in F4E is part of its overall management strategy and is included among the obligations as an items provider to the ITER and Broader Approach Projects. The F4E Quality Management System implements, for safety relevant components and activities, the requirements of the 'Order of August 10 – 1984' (French Republic 'Arrêté du 10 Août 1984') and, in general, uses as a basis the IAEA Safety Requirements GS-R-3 (2006) and ISO 9001 as applicable.

3.2. QUALITY MANAGEMENT SYSTEM

The F4E Quality Management System (QMS) is composed of:

- Integrated Management System Manual: a description of the ISO9001-ICS integrated management system for F4E operations
- Specific Project Quality Assurance Programs: a description of the technical QMS and systems integration / interface harmonization management for Broader Approach and ITER procurement items
- Processes: documents that provide information about how to perform the Organisation activities and processes consistently (part of the process approach to quality management)

- Procedure, Instructions and Checklists documents that provide information about how to perform the task activities and processes consistently.
- Forms, Templates and Records
- External Documentation

3.3. QUALITY FRAMEWORK MANUALS

F4E is establishing and documenting all its quality, operational and administrative methods of working. These are documented in 3 manuals:

- Integrated Management System Manual – top level manual
- Operational Procedures Manual – manual of operational procedures and instructions
- Administrative Procedures Manual - manual of administrative procedures and instructions

The Integrated Management System Manual encapsulates the overall management of F4E:

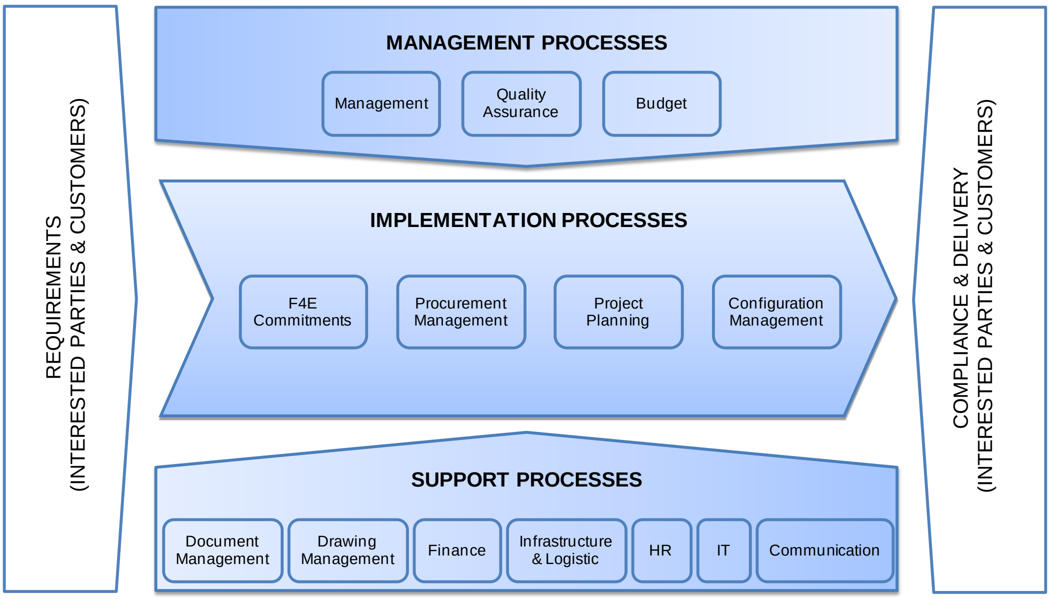
- The Integrated (ISO-9001 and F4E ICS) system;
- Integrated Management Standards;
- Quality Assurance Policy;
- Quality Management,
- Documentation;

The Planning, Implementation, Monitoring and Improvement actions with the connection with the operational and administrative manuals of procedures..

3.4. PROCESS APPROACH

An expected result is achieved more efficiently when the corresponding actions and resources are managed as processes ('process approach'). Processes are being defined for all the identified processes needed for achieving the intended organization outputs. For each process all the actions, documentation, appropriate review and approval, reporting and records are defined.

Fig. 6: Overall processes interaction in F4E.



Most of the implementation and management processes have already been defined and are being implemented. These include processes (and sub processes) to deal with F4E Commitments (Procurement Arrangements, Task Agreements), Procurement Management and Configuration Management (nonconformities, deviations and project changes).

The processes are complemented by the manuals of procedures and part of the support processes is simultaneously being defined with the development of software tools to manage the Human Resources, Missions and internal requests (ICT, logistics, etc.).

3.5. QA Related to ITER Procurements

Within the scope of the specific project QA Programs of the quality system, F4E has developed a specific QA Programme for the ITER Project to establish the overall framework to achieve the quality criteria for items and services provided by F4E to the ITER project. This QA Programme (for the procurement of the EU in-kind components) has been approved by ITER IO.

As part of the formalisation and approval of the F4E commitments toward the ITER Project, F4E develops a Strategy Proposal for each project. Based on this strategy, F4E issues a Project Management Plan describing and defining:

- the provisions implemented to comply with the customer requirements and the project reporting rules;
- all interfaces within the project and in particular those between F4E responsible officers;
- the division of the project in the various work-packages that have to be contracted with economic operators.

The supplier quality and management requirements are defined in the ‘Supplier Quality Requirements’ instruction. For each work package, F4E issues a management specification (that refers to that instruction, as a base for requirements) at the time of the call for tender and the selected supplier needs to provide a thorough dedicated quality plan following the different points raised by F4E in their specifications.

Supplier certification according to a specific international standard is not always required (but recommended). The quality level is accomplished through the compliance with the F4E Management Specification.

Supplier compliance to the requirements is assured by a close follow-up and monitoring by the F4E, including regular visits, scheduled quality audits and follow-up of the specific work-package control plan.

The supplier monitoring and surveillance is being supported by framework contract of inspectors for manufacturing follow-up.

The integration of the F4E Configuration Management processes with the ITER Configuration Management is dealt by a dedicated ‘F4E-ITER Project Configuration Management Plan’ developed within the framework of the F4E quality system.

4. Broader Approach Activities

4.1. Introduction

Fusion for Energy (F4E) is the Implementing Agency for the EU contribution to the three Broader Approach (BA) projects, designated by the European Commission to discharge its obligations as defined in the BA Agreement. In particular, F4E is the organisation delegated to agree and conclude Procurement Arrangements (PAs) with the Japanese Implementing Agency (JAEA).

Nevertheless, with few exceptions, most of the activities to be undertaken in the frame of the BA agreement are to be carried out in-kind by the EU-Voluntary Contributors. These are some of the members states represented in the Governing Board of F4E which pledged to contribute to the BA projects, namely Belgium, France, Italy, Germany, Switzerland and Spain. In turn, each VC will channel its contributions through the procurement arm of “Designated Institutions” (VC-DIs). F4E concludes Agreements of Collaboration (AoC) with the VC-DI, to secure delivery of the EU contributions to meet the requirements of each Procurement Arrangement.

Each of the BA Projects, while having some important differences, share the common feature of being based on a collaboration in which the Parties contribute both to the definition of the overall integrated design and to the detailed design and realisation.

JAEA and F4E, nominated as Implementing Agencies (IA) by the Japanese Government and the European Commission, are the entities entitled to agree and sign any official document regarding the implementation of the BA agreement and in particular Procurement Arrangements.

The implementation of the projects is supervised by the Parties through the Broader Approach Steering Committee and its advisory bodies: the Project Committees for each project. In the case of the Satellite Tokamak Program and IFMIF/EVEDA, the organization put in place for their implementation includes at technical/operative level an “Integrated Project Team” which executes the project. It is formed by the union of a) the Project Team (with a very small number of staff), b) the EU-Home Team, and c) the JA-Home Team. The implementation of a similar structure for the IFERC DEMO design activities project is in progress and involves the collaboration between F4E and EFDA on this matter. The IPT for each project operates under a Common Quality Management System (CQMS). This regulates the collaboration of the IPT members, identifying the common templates and procedures, for example for configuration and procurement management. Each project’s CQMS has the same basic structure, with some additional tailoring to the specific needs of each project. At the European level each project has its own QMS, which defines how the project operates with the VCs, and how it interfaces with F4E QA Management.

4.2. PROJECT IMPLEMENTATION PLANS

For each BA project, individual Project Plans covering the whole duration of the project and that include both European as well as Japanese activities are prepared by the Project Leaders and submitted annually to the BA Steering Committee (BASC). A summary is given below and further details and the project plans themselves are provided in annex 2 and the three sub-annexes 2.1-2.3. The schedule of submission of the project plans now differs somewhat between the projects:

- The **STP** project plan (Annex 2) was approved by the BA Steering Committee in its 10th Meeting on the 24th April 2012 and will be updated again in March/April 2013. There is an important change in this new issue of the project plan which re-baselined the project to a new first plasma date of March 2019.
- The **IFMIF** project plan (Annex 3) was endorsed by the BA Steering Committee in its 10th Meeting on the 24th April 2012 and will be updated again in March/April 2013.
- The **IFERC** project plan (Annex 4) has been updated and recommended by the IFERC Project Committee on the 2nd October 2012 (for approval by the BASC on November 6th, 2012).

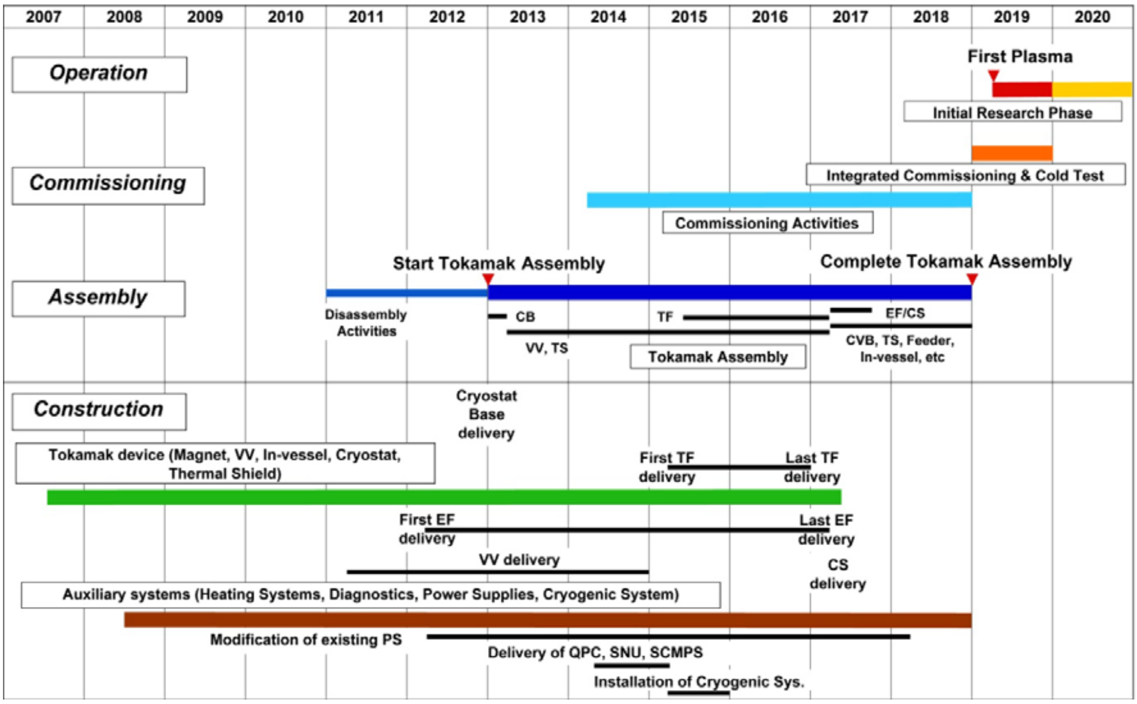
The F4E Project Plan to manage the European contribution to BA activities is constrained by these individual project plans endorsed by the BA SC.

4.2.1. Satellite Tokamak Programme

The mission of the JT-60SA project is to contribute to the early realization of fusion energy by supporting the exploitation of ITER and research towards DEMO by addressing key physics issues associated with these machines, in particular by designing , constructing and operating a device:

- capable of confining break-even equivalent class high-temperature deuterium plasmas lasting for a duration longer than the timescales characteristic of plasma processes;
- pursuing full non-inductive steady-state operation with high plasma beta close to and exceeding no-wall ideal stability limits.
- establishing ITER-relevant high density plasma regimes well above the H-mode power threshold.

In response to the request of the Steering Committee at the 9th meeting in 2011, the schedule rebaselining for JT-60SA has been developed jointly between EU and JA Home Teams. The values of the concluded PAs reached more than 80% in total for components at beginning of 2012. In line with these PAs, the revised schedule has much higher credibility than the previous one at the rebaselining in 2008 as it is largely based on contracts placed with industry, and with industry commitment to the dates of component delivery. The assembly schedule is being developed in interaction with industries. The new schedule is part of the STP Project Plan (ref. BA SC 10-7.7) endorsed by the BA Steering Committee on its 10th Meeting on 24th April 2012 and shown below.



Running EU Procurement Arrangements

Toroidal Field Coil (STP-EU-PA-TFC): the TF magnet PA was signed in July 2010.

TF superconducting strand and conductor: The contracts for the conductor cabling and jacketing and the superconducting strands was signed in late 2010. The kick-off meetings for both contracts were held in January 2011. The fabrication of both superconducting NbTi and copper strand is progressing regularly in line with schedule, reaching about 60% of the total production. The quantity of superconductor and copper strand already delivered guarantees a buffer of several months of cable production. The first two full size conductor lengths (JTF-001and JTF-002) have been pressure and flow tested and were delivered to ASG and ALSTOM in time for calibration/commissioning of the winding machines at the tooling manufacturer premises and at the companies' site. Ancillary activities for independent measurement of stand properties are routinely progressing at CEA (France), ENEA (Italy) while a third institute (University of Twente) joined the program, presently in benchmarking stage. Two qualification samples for TF conductor (TFCS2) and joint (TFJS2) were successfully tested in SULTAN facility at CRPP (Switzerland) and although data are to be further processed the first results fully consolidate both TF conductor and joint manufacture processes

TF coils: The activities of the contracts placed by ENEA (assigned to ASG on September 2011) and CEA (assigned to Alstom on July 2011) are proceeding on schedule. The winding line for ASG (control system and acquisition data, unspooling tooling, straightening unit, bending unit, conductor cleaning equipment, sandblasting unit, glass tape wrapping machine, moving/rotary winding table) is in advanced manufacturing and testing at the sub-suppliers premises,. A number of process equipments were received at ASG including the vacuum chamber and pumping unit for conductor acceptance inspection, winding pancakes support/assembly and handling tools, coil impregnation mould and TF coil winding pack vacuum testing chamber for flow and leak tests. ASG ordered all materials and components necessary for the winding packs and coil manufacturing; some of them are already available. As said above a sample for final joint qualification (TFJS2), built by CEA using JT-60SA TF Conductor, was tested in the CRPP SULTAN facility on August 2, 2012. The prototype of a "monobloc" twin-box joint tested under DC current up to 35 kA has shown a DC resistance of 0.84 nOhm without introducing any sensible degradation of the conductor performance. This successful result has completed the development program led by CEA on this joint design which was optimised for performance with respect to the JT-60SA TF coils manufacturing process, assembly procedures and joint area requirement.

TF Coil Casing: Activities now running on schedule. The ENEA contractor (Walter Tosto SpA) has completed the manufacturing procedures, the manufacturing drawing according to final user (ASG and Alstom) requirements and placed the orders for plates and forging material.

Outer Intercoil Structures and Gravity Support: The design of OIS and Gravity support was reviewed already at the end of 2010. Partial mock-ups of gravity support and OIS and associated tests have been performed at CEA to qualify the design of the two structural components at the end of 2011 (in particular the spherical bearings of the gravity supports and the friction joints of the OIS). The responses to tender for OIS have been received and currently are being evaluated by CEA. Gravity support testing continues.

TF Spare Coil: On 24th April 2012, the BA Steering Committee endorsed the construction of a 19th TF (spare) coil, providing a fundamental risk mitigation tool for the project. The strategy developed in collaboration with the Italian and French CPs and with CEA and ENEA, for a cost effective procurement of the spare coil, implying a minor redistribution of BA in-kind sharing between F4E, CEA and ENEA has been submitted in writing to the CPs (in a revised EU contributions sharing table and approved.

High Temperature Superconducting Current Leads (STP-EU-PA-HTSCL): Material purchasing is progressing as scheduled, preparation of test facility at KIT is also progressing and detail design of superconducting cable jumpers (to be provided by JAEA) is ongoing.

Quench Protection Circuit (STP-EU-PA-QPC): the PFC & TFC QPCs procurement contract has been awarded (contract kick-off meeting held in December 2010, formal signature of the contract on 4th March 2011. The QPC contractual Detailed Design Phase has been completed, on time, in July 2011, with the approval of the First Design Report. The first type-tests on the prototypes of two QPC main components i.e. the pyrobreaker and the by-pass switch, have been successfully completed as planned in June and August 2011, respectively. The type tests on the complete QPC poloidal prototype have been performed in April 2012 and the type tests for the toroidal QPC prototype have been completed in September 2012, have been successful beyond specifications requirements (an additional test with the discharge of the largest inductive load present at RFX has been also successfully performed) . The contract schedule is in line with the procurement due time (end of July 2015).

Switching Network Units (STP-EU-PA-SNU): The SNU PA has been signed on 28th December 2010. The call for tender for the SNU design, manufacture, type test and delivery to Japan has been issued by ENEA in July 2012. The contract has been assigned in September 2012 and signature is expected in November 2012, after the formal procedures.

Superconducting Coils Magnet Power Supplies (STP-EU-PA-SCMPS): the PA was concluded on 16th February 2011. After a first unsuccessful call for tender and a second market survey, in July 2012 CEA has issued a second call for Tender. The offers are due by middle October 2012 and the contract signature is expected by March 2013. The ENEA contract signature is expected in May 2013.

Cryostat (STP-EU-PA-CB01): The Cryostat Base PA was the first to be signed on 7th December 2009 and the Cryostat Base will be the first major item of EU hardware to be delivered to the Naka site for the JT-60SA project. Manufacturing is approaching the end approximately according to schedule. Machining of the three large "lower structure" components and welding of the upper "double ring" components were completed in August following some minor delays. Large components machining has been completed on 3rd October 2012 and pre-assembly is advanced. CIEMAT continues to closely monitor the progress due to the technical and symbolic importance of a timely delivery. To date the shipment of the component is foreseen for November 8th, 2012. As for the transport of the Cryostat Base to Japan, F4E signed a contract on 23rd July 2012 to ship the cryostat base from the manufacturer (in Spain) to Hitachi port in Japan. Based on shipment date of 8th November the delivery date is, under standard conditions, within first week of January 2013, respecting the PA schedule.

Cryostat Vessel Body (STP-EU-PA-CB02): The PA for the Cryostat Vessel Body Cylindrical Section was signed on the 25th July 2011. F4E has established an Agreement of Collaboration with the CIEMAT covering the full scope of supply (with the exclusion of transport which remains to be handled and paid by F4E). CIEMAT was expected to start tendering in September 2011 with the objective to place the contract at the beginning of 2012. At present although the technical documentation is ready (drawings and specification) the tender is on hold subject to ministry approval.

All the material supplied by JAEA for the construction of the CVBCS, which is around 300 tonnes of stainless steel plates, were delivered in June and formally accepted. Following incoming inspection they have been stored by CIEMAT, while waiting the award of the Cryostat Vessel Body Cylindrical Section fabrication contract.

TF coil testing (STP-EU-PA-TFCTF): At the beginning of 2010 Switzerland indicated they were no longer able to provide the previously agreed contribution (cryogenic refrigerator, current leads) to the TF coil test facility. As a consequence, the review process of the Procurement Arrangement was stopped and the share of work was re-discussed. CEA has meanwhile decided to install the test facility at its premises in Saclay, where several existing facilities, which were used for the cryogenic tests of the W7-X coils can be made available for the test of the TF coils. The infrastructure at the new site for the test facility (Saclay) is being prepared. Tests with an existing refrigeration plant showed that its capacity is sufficient for the coil test and that only minor modifications are required to meet the test requirements. On this basis the refrigerator has been relocated to the test facility. The Belgian Voluntary Contributor (SKF –CEN) has anticipated in agreement with F4E the construction of the cryostat ahead of the formal signatures. On January 2012 the PA has been actually signed. In September/October 2012 the test cryostat and the valve have been delivered to test facility at CEA-Saclay.

EU Procurement Arrangements to be placed:

Cryogenic system (STP-EU-PA-CRYO): The technical specification for the call for tender has been finalized and the call for tender has been issued mid of July 2011. Now the "Competitive Dialogue" has been completed and the final offers have been received end of June 2012. The technical and commercial evaluation is ongoing. Documents for the Commission de Marche are in preparation. F4E's objective is to have the PA signed in October 2012. CEA's objective is to have the corresponding contract signed in December 2012.

Power Supply to control Resistive Wall Modes-(STP-EU RPS): The Technical Specification for the definition of the PA has been prepared, but in the meanwhile JAEA has proposed to increase the number of PS units to be procured by EU and a new design of the control coils has been proposed. The impact on the ratings of the PS requires detailed analyses, in parallel the development of a prototype PS will be performed to gain confidence on technical feasibility and cost. These activities are expected to lead to the PA signature in the first month of 2014.

EC Power Supplies: For following the decision of Switzerland to withdraw this BA Contribution the matter is still waiting for a solution at level of EU/JA sharing or within EU sharing.

Joint exploitation Plan

It is foreseen that the JT-60SA machine will be upgraded step by step according to a phased operation plan consisting of an Initial Research Phase, an Integrated Research Phase, and an Extended Research Phase. Exploitation within the Broader Approach (BA) period is planned to be in the first part of the Initial Research Phase which includes HH operation for plasma commissioning. In the hydrogen phase of the initial research phase, the main aim will be the integrated commissioning of the system with and without plasma operation, as well as the preparation of the deuterium operation at full plasma current and high heating power up to 23 MW, including 10MW of positive ion source NB, 10MW of negative ion source NB and 3MW of ECRF at 110GHz. A lower single null divertor with partial mono-block target is planned in this phase. This should be followed by 1) DD operation for identification of issues in preparation for full DD operation. 2) an integrated research phase, and 3) an extended research phase as shown in Table 2.1.1. A collaboration between F4E and EFDA is ongoing in order to work together with JAEA for the preparation of the research plan and the joint exploitation phase of the device.

Table V - STP Operation phases and availability of key components

<table>
<tr><th></th><th>Phase</th><th>Expected Duration</th><th></th><th>Annual Neutron Limit</th><th>Remote Handling</th><th>Divertor</th><th>P-NB</th><th>N-NB</th><th>ECRF</th><th>Max Power</th><th>Power x Time</th></tr>
<tr><td rowspan="2">Initial Research Phase</td><td>phase I</td><td>1-2y</td><td>H</td><td>-</td><td rowspan="3">R&D</td><td rowspan="2">LSN partial monoblock</td><td>10MW</td><td rowspan="5">10MW</td><td rowspan="2">1.5MW x100s + 1.5MW x5s</td><td>23MW</td><td rowspan="4">NB: 20MW x 100s
30MW x 60s
duty = 1/30

ECRF: 100s</td></tr>
<tr><td>phase II</td><td>2-3y</td><td>D</td><td>4E19</td><td rowspan="3">Perp. 13MW

Tang. 7MW</td><td>33MW</td></tr>
<tr><td rowspan="2">Integrated Research Phase</td><td>phase I</td><td>2-3y</td><td>D</td><td>4E20</td><td rowspan="2">LSN full-monoblock</td><td rowspan="3">7MW</td><td rowspan="2">37MW</td></tr>
<tr><td>phase II</td><td>>2y</td><td>D</td><td>1E21</td><td rowspan="2">Use</td></tr>
<tr><td>Extended Research Phase</td><td></td><td>>5y</td><td>D</td><td>1.5E21</td><td>DN</td><td>24MW</td><td>41MW</td><td>41MW x 100s</td></tr>
</table>

4.2.2. IFMIF/EVEDA

The original objective of the Engineering Validation and Engineering Design Activities (EVEDA) of IFMIF was “to produce a detailed, complete, and fully integrated engineering design of the International Fusion Materials Irradiation Facility (hereinafter “IFMIF”) and all data necessary for future decisions on the construction, operation, exploitation and decommissioning of IFMIF and to validate continuous and stable operation of each IFMIF subsystem”. The initial duration of the project was set for 6 years, starting from June 2007. Four main lines of activity were foreseen:

- The engineering design of the IFMIF facility, which is the principal objective of the EVEDA phase in view of preparing the construction of IFMIF;
- The design, construction, commissioning and operation of an accelerator prototype which is the low energy prototype of the two IFMIF accelerators, which represents a ambitious project to demonstrate full beam current performance and reliability;
- The engineering design and engineering validation activities for the Target Facility, which depends in particular on the design, the construction and the operation of the Li Test Loop;
- The engineering design and engineering validation activities for the Test Facility.

The last two lines form two sets of R&D programmes to provide the data bases needed to proceed to the engineering design of the IFMIF facility integrating the accelerator design with the Target Facility and the Test Facility designs. Since the above concept was formulated, the context changed to some extent:

- Influenced by the ITER budget situation, the 8th Framework Programme (2014-2020) currently does not foresee a budget line for the construction of IFMIF.
- ITER will not operate in DT before 2026, delaying the need to launch IFMIF construction.
- DEMO design work is consequently also delayed, so the IFMIF users are not clearly identified today.
- Conversely, the ITER Test blanket community is increasingly interested in IFMIF as a data source, due to ITER delay.
- Due to the overall economic crisis and the consequent reduction in research budgets, it is difficult for potential hosts to register their interest.
- Nevertheless, the construction and experimental programme of the Accelerator Prototype is exceptional and challenging, and has strong interest from the worldwide accelerator community, so deserves a high priority.

As a result, the countries involved in the IFMIF-EVEDA made a detailed re-evaluation leading to the following conclusions:

- Higher priority is now given to the validation activities, and in particular to the Prototype accelerator.
- Conversely the engineering design of IFMIF, to be provided at the end of the current EVEDA phase (i.e. June 2013) will not be at the level of detail originally envisaged, in particular all Conventional Facilities will be at a preliminary design level (since the site is unknown), enabling nevertheless a reasonable estimate of the plant value;

- It is expected that all major technological deadlocks of IFMIF will have been solved, meaning that it will be possible subsequently to prepare all technical specifications of industrial contracts for its construction with the possibility for the companies to commit on performances at a reasonable cost.

The rescoping of the project was formalised in a revision of the Project Plan as approved by the BASC in December 2010. In the BASC meeting of April 2012, a modification to this revision was approved with the updates being the following ones:

- The operation of the Lithium Test Loop validation facility will be extended by 12 months to make up for the 16 month of operation time lost due to the damages of East Japan Earthquakes.
- Start of the experiments of the whole Accelerator Prototype will be delayed by one year.

The main points of the IFMIF/EVEDA Project Plan can be summarized as follows:

- Among the sub projects of IFMIF/EVEDA, the highest priority has been given to the Accelerator Prototype validation activities. All allowable resources have thus been given to its design and manufacturing, and then to its installation, checkout and commissioning at Rokkasho.
- Three main phases are considered for the Accelerator Prototype experiments:
    - Injector alone
    - Injector + RFQ + MEBT
    - The whole accelerator, for which about one year of operation is planned , from mid-2016 to mid-2017, end of the BA agreement
- The delivery of the “Intermediate IFMIF Engineering Design Report” is foreseen mid-2013. It is expected that, at the notable exception of the accelerator, all major technological barriers of IFMIF will have been solved; this means that it will be possible, after some additional engineering work, to prepare all technical specifications of industrial contracts for its construction with the possibility for the companies to commit on performances at a reasonable cost.
- All other validation activities, except the Lithium Test Loop validation activities at JAEA Oarai, will have been completed by mid-2013. It is expected that these validation activities will provide important feedback on IFMIF design in due time.

As a consequence, the master planning is now foreseeing the following four milestones:

- **June 2013**: Delivery of the Engineering Validation Reports on all the activities related to Test Facilities and Lithium Target Facility except the Lithium Loop at JAEA Oarai.
- **June 2013**: Delivery of the Intermediate IFMIF Engineering Design Report
- **March 2014**: Completion of Phase I Validation activities at Oarai Lithium Loop.
- **June 2016**: Start of the experiments of the whole Accelerator Prototype; evaluation of performances and of potential further effort needed to reach full specifications
- **June 2017**: End of the studies in the framework of the Broader Approach Agreement

Status of the Rokkasho team

The Project Leader left the project for personal reasons in June 2011. An Interim Project Leader was nominated until the new Project Leader took over in June 2012. Engineering design and engineering validation activities are being reorganised as a consequence.

Status of the EU Contributions

Li Target Facility & Test Facilities: All PAs related to the Li Target validation tasks signed. The approval process of the text of European PAs for Test Facilities design and validation is completed and with the exception of the BR2 irradiation, for which a hold point was required due to problems in capsule delivery to the reactor, the related PA and AoC signature process has been completed. The concluding delivery of diagnostic components from ENEA to JAEA for the Lithium Test Loop at Oarai has been intermitted until the end of the recommissioning period after the Tohuku earthquake.

Prototype Accelerator (LIPAc): The Injector successfully demonstrated first ion extraction in Saclay in 2011. With the signature of the PA for the superconducting RF linac, for the Medium Energy Beam Transfer line and and for the High Energy Beam transfer line all key subsystems are now fully committed. A new organization of the project was introduced with a stronger involvement of F4E.

Engineering Design: Work in progress to reorganise the activities in light of the change which have occurred in the Project Team in Rokkasho and all intermediate milestones in 2012 achieved for the scheduled completion of the Engineering Design Report by June 2013.

4.2.3. IFERC

The IFERC activities include three sub projects - DEMO Design and R&D activities, establishment and operation of a Computer Simulation Centre, and establishment and operation of a Remote Experimentation Centre - as well as the construction of the buildings to house all these activities.

Overall Schedule

The high level schedule is shown in Figure 8

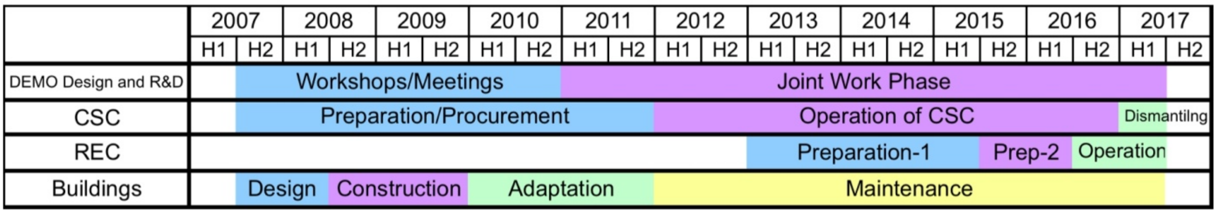


Figure 8 - IFERC High Level Project Schedule

Status of EU contributions for DEMO Design Activities

The activity is defined in two phases:

- Phase One: Analyse common elements for DEMO (2007-2010)
- Phase Two: Develop Potential DEMO Designs (2011 - mid 2017)

Phase One activities have so far been conducted by a number of workshops/meetings. At the end of Phase One a major review took place to recommend specific goals for Phase Two, and a small group of experts outlined a proposal for Phase Two joint activities. Proposed Terms of Reference for DEMO Design Activities (DDA) were approved at the BASC in December 2010, and the DDA activities were stated according to the planning as follows:

Phase Two (A), Jan 2011 – Dec 2012: Consolidation of knowledge, to define a sound common basis for DEMO design, definition of priorities for R&D tasks:

a) Definition of design criteria and cost models

b) Analysis of key design issues and options and launch preliminary work

c) Preparation and start implementation of system design code;

Phase Two (B), Jan 2013 – Dec 2014: Detailed studies

d) Follow-up work on key design issues and options and narrow down design options on which concentrate further analysis work

e) Adjustment of Design Criteria, Design Equations, and cost models

f) Evaluation of sets of DEMO parameters as a function of uncertainties

g) Preparation of intermediate documentation.

Phase Two (C), Jan 2015 – Jun 2017: Development of pre-conceptual design options for DEMO

h) Develop integrated conceptual design/ work final review and

i) Preparation of final documentation.

It is expected that this design activity will also suggest specific R&D activities, some of which would be carried out on ITER, or on the Satellite Tokamaks (JT-60SA) and other facilities.

Running EU Procurement Arrangements for DEMO Design Activities

IFERC-DDA-PA: Procurement Arrangement for the Phase Two DEMO Design Activities (DDA) for the IFERC Project: This is a joint EU-JA PA, signed in 2011 for all the activities described above, until 2017. In Europe it is backed by the activities agreed annually in the Power Plant Physics and Technology (PPPT) component of the EFDA Work Programme. In 2012 the detailed programme to implement an activity on safety has been agreed, including the transfer of safety codes developed for this activity. The EU activities in this field will be part of the DDA PA.

Status of EU contributions for DEMO R&D Activities

The DEMO R&D activities aim at establishing a common basis for a DEMO design from the technology point of view. Five R&D tasks were identified at the time of the signature of the BA Agreement

- T1: SiCf/SiC Composites
- T2:Tritium Technology
- T3: Materials Engineering for DEMO Blanket
- T4: Advanced Neutron Multiplier for DEMO Blanket
- T5: Advanced Tritium Breeders for DEMO Blanket

In 2012, a peer review of the DEMO R&D activities was performed, in order to review the results obtained so far and take into account the input from the DEMO design activities. Recommendations have been issued in order to adapt the ongoing activities to the needs expressed by the DEMO Design Activities members.

Running EU Procurement Arrangements for DEMO R&D Activities

- ***IFERC-T1PA01-EU.CIEMAT: Procurement Arrangement for the R&D activities on SiC/SiC composites for the DEMO R&D.*** This PA is concerned with R&D activities in the field of physical/chemical properties of SiC/SiC composites and ceramics under irradiation. This PA was signed in December 2010 and covers activities from 2008 to 2016. The total credit is 2.849 kBAUA, and the deliverables are reports.
- ***IFERC-T1PA21-EU.ENEA: Procurement Arrangement for the R&D activities on SiC/SiC composites for the DEMO R&D.*** This PA is concerned the procurement of an apparatus to measure corrosion of SiC/SiC in liquid metals. This PA was signed in November 2011 covers activities from 2008 to 2013. The total credit is 1.032 kBAUA, and the deliverables will be the equipment, to be installed in the DEMO R&D building in Rokkasho, and reports.
- ***IFERC-T3PA01-EU.CRPP: Procurement Arrangement for the DEMO R&D activities in DEMO Blanket for the IFERC Project:.*** This PA is concerned with R&D activities in the field of RAFM steels for the DEMO blankets. This PA was signed in December 2010 and covers activities from 2008 to 2013. The total credit is 0.51 kBAUA, and the deliverables are reports. If the Swiss party confirms its withdrawal of this activity, the PA will be amended to cover the activites until end 2012 only, and the credit accrued will be 0.425kBAUA.
- ***IFERC-T3PA01-EU.SCK.CEN: Procurement Arrangement for the DEMO R&D activities in DEMO Blanket for the IFERC Project:.*** This PA is concerned with R&D activities in the field activities on RAFM steels for the DEMO blankets. This PA was signed in December 2010 and covers activities from 2010 to 2013. The total credit is 0.885 kBAUA, and the deliverables are reports.
- ***IFERC-T3PA01-EU.KIT: Procurement Arrangement for the DEMO R&D activities in DEMO Blanket for the IFERC Project:.*** This PA is concerned with R&D activities in three fields: activities on RAFM steels for the DEMO blankets, advanced neutron multipliers for DEMO blankets, and advanced tritium breeders for DEMO blankets. This PA was signed in December 2010 and covers activities from 2008 to 2014. The total credit is 2.647 kBAUA, and the deliverables are reports.

EU Procurement Arrangements planned for DEMO R&D Activities

Two or three PAs may be considered if necessary in the future to cover the delivery of samples produced in Tasks T3, T4 and T5 to the Rokkasho DEMO R&D laboratory.

Status of EU contributions to the Computer Simulation Centre (CSC) Activities:

The objective is to provide and exploit a super-computer located in Rokkasho for large scale simulation activities to analyse experimental data on fusion plasmas, prepare scenarios for ITER operation, predict the performance of ITER, and contribute to the DEMO design physics basis and BA activities.

During Phase One (July 2007 - December 2011), the goal was to set up the supercomputer and the associated peripheral equipment in the CSC/REC Building located in the Rokkasho BA site and to commission it.

The Procurement Arrangement for the supply of a supercomputer and peripheral equipment was signed in 2010, and the contracts for the supply of the equipment, and operation and maintenance were signed in March 2011. Other Procurement Arrangements were signed to take care of the various interfaces. The main task of the EU-IA was to procure the supercomputer, the peripheral equipments and the operation and maintenance associated services. The main task of JA-IA was to prepare interfaces for the installation of the equipments and to contribute to the seamless integration of the IT equipments and services in the International Fusion Energy Research Centre, in particular by providing support for the interface with the users. The Phase one concluded as scheduled in December 2011 with the successful test and acceptance by F4E ofsupercomputer Helios in Rokkasho.

Phase Two started on schedule in January 2012 the activity being to effectively operate the HPC system and to coordinate the time-sharing for users. The first year of operation of CSC in 2012 has been dedicated to run four “lighthouse projects” during the first three months, and to normal operation for the rest of the year. In the following years of Phase Two, an enhancement of the memory capacity, and various enhancements, to be agreed, will be take place to update the performance of Helios. It is planned to dismantle Helios in the 1st semester of 2017.

One of the key issues in the Phase Two is to effectively support users. Quarterly Reports will be submitted to the PC chair in order to summarize how such support is provided and how the supercomputer system is optimized according to users’ needs.

Running EU Procurement Arrangements for the Computer Simulation Centre (CSC) Activities

- ***IFERC-CSCPA01-EU.CEA: Procurement Arrangement for the supply of the supercomputer and peripheral equipment for the IFERC project (CSC activity):*** This PA covers the supply of a supercomputer and peripheral equipment by December 2011, the operation and maintenance of the supercomputer for five years (2012-2016) and the dismantling of the equipment in 2017. The PA was signed in 2010 and lasts until June 2017. The total credit associated is 91.5kBAUA, of which 62.4 kBAUA for equipment.

Planned EU Procurement Arrangements for the Computer Simulation Centre (CSC) Activities

- ***IFERC-CSCPA02-EU.CEA: Procurement Arrangement for enhancements and others for the IFERC project (CSC activity):*** *This PA will cover such enhancements as found necessary during the first year(s) of operation of the supercomputer. These may consist of hardware or software and will be defined at a later stage. The PA is tentatively planned for 2013. The total credit associated is 6.1kBAUA.*

Status of EU contributions to the Remote Experimentation Centre (REC)

The Remote Experimentation Centre is planned to operate in the last two years of the BA Agreement, and will aim to facilitate broad participation of scientists into ITER experiments. Remote experimentation techniques will be tested on existing machines, such as JT60-SA. Preparatory activities started in 2012, with the creation of a working group by the Implementing agencies to review the requirements for ITER and JT60-SA remote experimentation and the schedule. The future use of the REC on ITER will be discussed with the ITER Parties and IO. The working group will also explore the possibility of testing REC in a functioning EU fusion device, and possible savings. A Procurement Arrangement to define in detail the requirements of REC is planned in 2013.

EU Procurement Arrangements planned for the Remote Experimentation Centre (REC)

- ***IFERC-RECPA01-EU: Procurement Arrangement for the definition of requirements for REC for the IFERC project (REC activity):*** This PA will cover such enhancements as found necessary during the first year(s) of operation of the supercomputer. These may consist of hardware or software and will be defined at a later stage. The PA is tentatively planned for 2013. The total credit associated is 0.1kBAUA.

IFERC Site

Site activities within the scope of the BA Agreement include the construction of the IFERC buildings and preparation of site infrastructure, and contribution to the management of the site, office equipment, insurance, and utilities (including data networks). The construction of the Administration and Research Building, CSC and REC Building, and the DEMO R&D Building was completed in March 2010. PAs for further adaptations of these buildings were completed in 2011, before installation and operation of the computer. PAs have been signed in 2012 regarding site management, etc. These PAs are concerned with JA activities.

5. APPENDIX I: TABLE OF ACRONYMS AND ABBREVIATIONS

A/E	Architect Engineer
AGPS	Accelerator Ground Power Supplies
ALARA	As Low As Reasonably Achievable
ANB	Authorized Notification Body
ANS	Analytical System
ASN	Autorité de Sûreté Nucléaire
AVDEs	Asymmetric Vertical Displacement Event
ATS	Air Transfer System
BA	Broader Approach
BSM	Blanket Shield Module
BtP	Build-to-Print
CD	Current Drive
CFC	Carbon Fibre Composites
CMM	Cassette Multifunctional Mover
CVB	Cold Valve Boxes
CVD	Chemical Vapour Deposition
CXRS	Core plasma charge-eXchange Recombination Spectroscopy
DA	Domestic Agency
DACS	Data Acquisition and Control System
DCLL	Dual Coolant Lithium Lead
DCR	Design Change Request
DEMO	Demonstration fusion reactor
DIV	Divertor
DNB	Diagnostic Neutral Beam
DTP	Divertor Test Platform
EAF	European Activation File
EB	Electron Beam
EBBTF	European Breeding Blanket Test Facilities
EC	Electron Cyclotron
EC UL	Electron Cyclotron Upper Launchers
ECH	Electron Cyclotron Heating
EFDA	European Fusion Development Agreement
EFF	European Fusion File
ELM	Edge Localized Mode
EPC	Engineering Procurement Contract
EUDA	European Domestic Agency
EURATOM	The European Atomic Energy Community
F4E	Fusion for Energy
FS	Functional Specification
FW	First Wall
FWP	First Wall Panel
HAZOP	HAZard Operability
HCLL	Helium Cooled Lithium-Lead
HCPB	Helium Cooled Pebble Bed
H&CD	Heating & Current Drive
HHF	High Heat Flux
HIP	Hot Iso-static Pressing
HNB	Heating Neutral Beam
HV	High Voltage
HVAC	Heating Ventilation &Air Conditioning
HVD	High Voltage Deck
HW	Hardware
HXR	Hard X-Ray
IC	Ion Cyclotron
I&C	Instrumentation and Control
ICH	Ion Cyclotron Heating
IFERC	International Fusion Energy Research Center
IFMIF	International Fusion Materials Irradiation Facility
INB	Installation Nucleaire de Base
IO	ITER Organization
IR	Infra Red
ISEPS	Ion Source and Extraction Power Supplies
ISS	Isotope Separation System
ITA	ITER Task Agreement
ITER	International Thermonuclear Experimental Reactor
IVT	Inner Vertical Target
IVVS	In-Vessel Viewing System
JAEA	Japan Atomic Energy Agency
LD&L	Leak Detection and Localization
LFS-CTS	Low Field Side – Collective Thomson Scattering
MAR	Materials Assessment Report
MDR	Modified Design Reference
MHB	Material HandBook
MHD	Magneto-Hydro-Dynamic
MIG	Metal Inert Gas
MV	Medium Voltage
NB	Neutral Beam
NBI	Neutral Beam Injector
NBPS	Neutral Beam Power System
NBTF	Neutral Beam Test Facility
NHF	Nominal Heat Flux
ODS	Oxide Dispersion Strengthened
ORE	Occupational Radiation Exposure
P&ID	Process and Instrumentation Diagram
PA	Procurement Arrangement
PBS	Product Breakdown Structure
PBS 41	High Voltage and Medium Voltage distribution
PBS 43	High Voltage, Medium Voltage and Low Voltage distribution. Emergency Power Supply
PE	Plasma Engineering
PF	Poloidal Field
PFC	Plasma Facing Components

PFD	Process Flow Diagram
PIE	Post Irradiation Examination
PMU	Prototypical Mock-Up
PP	Procurement Package
PPC	Pre-Production Cryopump
PrSR	Preliminary Safety Report
PTC	Prototype Torus Cryopump
QA	Quality Assurance
R&D	Research & Development
RAFM	Reduced Activation Ferritic Martensitic
REM	Radilogical Environmental Monitoring
RF	Radio Frequency
RFCU	Radio Frequency Control Unit
RH	Remote Handling
RMP	Resonant Magnetic Perturbation
RNC	Radial Neutron Camera
RWF	RadWaste Facility
RWM	Resistive Wall Mode
SC	Super Conductor
SDC	Structural Design Criteria/Code
SHPC	Safety and Health Protection Coordination
SiC-Dual	SiC/SiC composite material for electrical and thermal Insulation
SIP	Seismic Isolation Pit
S-NHF	Standard Normal Heat Flux
SOLPS	Scrape Off Layer Plasma Simulation
SS	Steady State
STP	Satellite Tokamak Programme
SW	Software
TBM	Test Blanket Module
TCS	Transfer cask System
TES	Test Extraction System
TF	Toroidal Field
TFC	Toroidal Field Coils
TFWP	Toroidal Field Winding Pack
TH	Thermal Hydraulical
TO	Technical Officer
UT	Ultrasonic
Vis	Visible
VS	Vertical Stability
VV	Vacuum Vessel
WAVS	Wide Angle Viewing System
WBS	Work Breakdown Structure
WDS	Water Detritiation System