



## 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 2009 WORK PROGRAMME OF THE EUROPEAN JOINT UNDERTAKING FOR ITER AND THE DEVELOPMENT OF FUSION ENERGY

THE GOVERNING BOARD OF FUSION FOR ENERGY

HAVING REGARD to the Statutes annexed to the Council Decision (Euratom) No 198/2007 of 27<sup>th</sup> March 2007 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy (hereinafter "Fusion for Energy") and conferring advantages upon it<sup>1</sup> and in particular Articles 6(3)(d) and 11 thereof;

Having regard to the Financial Regulation of Fusion for Energy<sup>2</sup> adopted by the Governing Board on 22<sup>nd</sup> October 2007 (hereinafter "the Financial Regulation") and in particular Article 64 thereof;

Having regard to the Implementing Rules of the Financial Regulation<sup>3</sup> adopted by the Governing Board on 22<sup>nd</sup> October 2007 (hereinafter "the Implementing Rules") and in particular Article 53 thereof;

Having regard to the Fusion for Energy 2008 Work Programme adopted by the Governing Board on 18<sup>th</sup> December 2007<sup>4</sup> last amended on 31<sup>st</sup> October 2008<sup>5</sup>;

Having regard to the comments and recommendation of the Executive Committee on the proposal for the amended 2009 Work Programme at its meeting of 25<sup>th</sup> June 2009;

Having regard to the comments and recommendations of the Technical Advisory Panel at its meeting on 23<sup>rd</sup> June 2009,

Whereas:

- (1) The Director should, in accordance with Article 8(4)(c), draw up an annual work programme;
- (2) The Governing Board should adopt the work programme.

HAS ADOPTED THIS DECISION:

#### *Article 1*

The amended 2009 Work Programme of Fusion for Energy annexed to this Decision is hereby adopted.

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<sup>1</sup> O.J. L 90, 30.03.2007, p. 58.

<sup>2</sup> F4E(07)-GB03-11 Adopted 22/10/2007

<sup>3</sup> F4E(07)-GB03-12 Adopted 22/10/2007

<sup>4</sup> F4E(07)-GB04-12 Adopted 18/12/2007

<sup>5</sup> F4E(08)-GB07-05 Adopted 31/10/2008

*Article 2*

This Decision shall have immediate effect.

Done at Barcelona, 9<sup>th</sup> July 2009

For the Governing Board

A handwritten signature in black ink, appearing to read 'Caa.FVarandas', written in a cursive style.

**Carlos Varandas**  
Chair of the Governing Board

ANNEX  
FUSION FOR ENERGY WORK PROGRAMME 2009  
(VERSION 2)

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## INTRODUCTION, ASSUMPTIONS AND OVERALL OBJECTIVES

### 1.1. Introduction

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

Fusion for Energy was established for a period of 35 years from 19th April 2007 and is situated in Barcelona, Spain. The objectives of 'Fusion for Energy' are threefold:

- Providing Europe's contribution to the ITER International Fusion Energy Project as the designated Domestic Agency for Euratom;
- Implement the Broader Approach agreement between Euratom and Japan as the designated Implementing Agency for Euratom;
- Prepare in the longer term for the construction of demonstration fusion reactors (DEMO).

In addition, F4E is technically managing the technology tasks previously launched by EFDA and that are ongoing.

In accordance with the Financial Regulation, this Work Programme lays down the activities of F4E that are to be implemented and financed through the 2009 budget.

### 1.2. Assumptions

The Amendment to the 2009 F4E Work Programme (WP2009) is based on the following assumptions:

- The European schedule, agreed with IO, for the procurement of the ITER components was used as basis for this document with a date for the first plasma in December 2018 (Scenario 1) as a working target date;
- F4E will receive on time from IO the necessary inputs foreseen in the ITER Quality Management process deposited with the Nuclear Safety Authorities and in accordance with Build-to-Print, Detailed Design and Functional Specification status agreed in 2001;
- The necessary inputs from the IO will be provided in time to allow the associated PAs to be signed according to the foreseen schedule;
- The planning of the activities and the corresponding delivery of components, by the other ITER Domestic Agencies will be respected;
- A current understanding of the ITER Design and that some modifications might be required in 2009 to adjust it to the possible ITER developments;
- No additional delays in the ongoing tasks launched under EFDA for which the results may be required to launch certain F4E activities;
- To launch preparatory activities for the Heating and Current Drive systems according to the agreed procurement sharing of ITER components, taking due consideration of the assessment conducted by F4E on the current heating systems mix in the ITER Baseline Design and the possible consequences for the achievement of the ITER scientific goals of optimising the H&CD schemes;

And regarding the Broader Approach activities,

- The project plans presented in this document are those approved by the Broader Approach Steering Committee;
- The Work Programmes for the projects IFMIF/EVEDA, IFERC and the Satellite Tokamak Programme will be approved by the Broader Approach Steering Committee.

### **1.3. ITER Credits for Preparatory Activities**

This WP2009 includes an extensive programme of R&D and preparatory activities that have to be carried out prior to signing the Procurement Arrangement for the Procurement Packages agreed to be at Build-to-Print level. Recognising that F4E is carrying out work that should have been completed by the IO, additional credit from the IO is being requested by F4E through ITER Task Agreements (ITAs). The activities indicated in this WP2009 as receiving additional (ITA) credits may be cancelled in the event that the IO would not make the requested credits available.

### **1.4. Overall Objectives**

#### **1.4.1. ITER**

With respect to activities related to ITER, the main objectives are:

- The negotiation and signature of the ITER Procurement Arrangements, proposed by the ITER Organisation (IO), according to the present schedule;
- The launch of the procurements for those components on the critical path;
- The continuation of design and R&D activities in areas including Remote Handling, Heating and Current Drive, Diagnostics and Test Blanket Modules;
- The continuation of the preparation of safety and licensing documentation for ITER in Cadarache and related safety studies;
- The investigation of manufacturing methods and non-destructive tests of critical components from the technical point of view with the objective of minimising the cost and risk of not meeting the technical requirements (divertor, vacuum vessel, shield modules);
- The preparation of new facilities to test prototypes and components during the qualification process and construction respectively;
- The continuation of the activities for the preparation of the ITER site.

F4E also continues to be responsible for the technical follow-up of a number of technology contracts previously managed by EFDA. The outcome of these contracts is an important input for many of the activities that will be launched by F4E.

#### **1.4.2. Broader Approach**

With respect to activities related to the Broader Approach (BA), the main objectives are:

- The re-baselining of the JT60SA device has been completed in 2008 and is expected to be approved by the BA Steering Committee in Dec 2008. In 2009 procurement on some long lead items will commence while the design will be detailed further in all areas. Most of the procurements will be undertaken through Arrangements with the Voluntary Contributors with the exception of the TF coil conductor which will be carried out directly by F4E;

- The IFMIF-EVEDA project includes four main lines of activity: 1) the engineering design of the IFMIF facility; 2) the design, construction, commissioning and operation of an accelerator which is the low energy prototype of the two IFMIF accelerators; 3) the engineering design and validation activities for the Target Facility and 4) the engineering design and validation activities for the Test Facility.. All these activities will be undertaken through Arrangements with the Voluntary Contributors and the PAs for lines 2, 3 and 4 are under preparation. Activity 1 has not started yet due to the lack of staff in the Project Team in Rokkasho;
- For the IFERC Project, to initiate the building of the centre, to continue the DEMO R&D activities and report through joint workshops, with the aim of converging on DEMO design issues, and to prepare the suit of benchmark codes which will be used to prepare the procurement of the super computer. All these activities will be undertaken through Arrangements with the Voluntary Contributors.

**1.4.3. DEMO**

With respect to activities related to DEMO, in addition those undertaken under the BA IFERC project, no specific activities are foreseen to be implemented during 2009.



### Summary of the WP09 Budget (in M€)

Ref.	Budget	Activities	2009 Budget		
			Grants	Procurement	Cash
	3.1+3.5	Main Procurements in support of ITER	-	220.2	-
1.27	3.1+3.5	Contribution in Cash to CEA for ITER Site Support	-	-	7.8
1.28	3.1+3.5	Contribution in cash in support of ITER	-	-	25.0
1.29	3.1+3.5	Contribution in cash for transfer of procurements to Japan	-	-	29.2
	3.1	Design and R&D in support of ITER, Credited by ITER (incl. ITA)	28.4	14.2	-
	3.6	ITER task agreements, Credited by ITER	0	0	-
<b>3.1+ 3.5 + 3.6 Total ITER Construction</b>			<b>324.8</b>		
	3.2	Design and R&D in support of ITER (incl. Materials Development, TBM, nuclear data), Not credited by ITER	3.9	10.3	-
<b>3.2 Technology for ITER and DEMO</b>			<b>14.200</b>		
1.30	3.3	Activities in support of Broader Approach	-	10.000	-
1.31	3.3	Contribution to the Common Expenses of the IFMIF-EVEDA Project Team	-	-	0.210
<b>3.3 Technology for Broader Approach</b>			<b>10.210</b>		
1.28	3.4	Appointment of Experts for Technical Assistance to F4E	-	-	1.54
<b>3.4 Other Expenditure</b>			<b>1.54</b>		
<b>3 Total operational expenditure</b>			<b>350.75</b>		

Notes

- This table includes only the activities under Priority 1 (activities to be committed under the 2009 budget).
- A table showing the indicative budget for grants to be awarded in this Work Programme, both credited and non-credited by ITER, is provided in annex II.
- Priority 2 items in this Work Programme are intended to be launched in 2009 but committed under the 2010 budget subject to its approval by the Governing Board.

## ITER

In the following the activities of Fusion for Energy related to ITER are described according to the agreed Work Breakdown Structure. The tables provided in the text use the following abbreviations.

Abbreviation	Meaning
WBS	Work Breakdown Structure
PP	Procurement Package
G/P	Grant (G) or Procurement (P)
Title	Title of the Contract
Deliverable	Deliverable of the Contract
ToC	Time of Call
Prio	Priority
DoC	Indicative Duration of Contract (years)
Credit	ITER Credit allocation for that contract: <ul style="list-style-type: none"> <li>• N: not credited</li> <li>• Y: credited as part of the PA</li> <li>• Yes (ITA): additional credit via ITA</li> </ul>

Activities marked with an asterisk (\*) and in italics are have been globally committed under the 2008 Budget but the individual commitment and contract is to be signed in 2009.

Activities indicated with Priority 1 are planned to be launched in 2009 and committed under the 2009 budget.

Activities indicated with Priority 2 are planned to be launched in 2009 and individually committed in 2010.

In case Priority 2 activities are committed under the 2009 Budget, either individually or globally, this will be done in consultation with the Executive Committee.

### 1.5. WBS 1.1 -MAGNETS

#### 1.5.1. Summary

Activities will focus on the procurement of the ITER magnets and associated design and R&D to validate the design or assess the manufacturing/testing procedures.

#### 1.5.2. Procurement Arrangements

WBS	Title	ITER Credit (kIUA)	Signature due
1.1.3A+ 1.1.3B	Poloidal Field Coils PF2 to PF6	41.4	June 2009
1.1.2A1	Magnet Structures: Pre-compression Rings	0.6	Sept 2009
1.1.P6C	Poloidal Field Magnet Conductors	11.2288	May 2009

### 1.5.3. Main Procurements

#### *WBS 1.1.1A – Toroidal Field Magnet Windings*

Activities are proposed in order to reduce the risk and cost of the manufacture. In particular:

- The radial plates have been kept separate from the main TF winding supply. Due to their large cost, estimated to be about half of the winding pack manufacture, it is proposed to launch a separate call for tender to manufacture one or two full scale prototypes with the goal to demonstrate the manufacturing feasibility and find the cheapest fabrication route. This activity should be carried out in parallel with the JA Domestic Agency.
- For the winding it has been decided to proceed with the full scale production, which includes about three years of R&D and preparation to be completed with the manufacture of a full-scale dummy double pancake, to check again the feasibility and reduce risks & costs. In 2008 the restricted procedure was launched and four industries/consortia have been qualified. With these companies, the technical specifications, including R&D activities, have been defined. It may be needed to reduce the delivery time and, as a consequence, split the total supply between two contracts. The final decision will be taken after an assessment of cost/schedule/risk.

#### *WBS 1.1.2A – Toroidal Field Magnet Structure*

Activities include the procurement of twelve fibreglass composite rings (six to be installed in the machine and six spares) for the pre-compression system of the TF coils.

#### *WBS 1.1.3A + 1.1.3B – Poloidal Field Magnets (PF2 to PF6)*

Activities include the manufacture of the 5 Poloidal Field coils. The design and specifications of the coils are being finalized. The activities foreseen include the preparation of the procurement contracts and the launch of the procurement of the tooling and the fabrication of the five PF coils.

#### *WBS 1.1.6A + 1.1.6C – Toroidal and Poloidal Field Magnet Conductors*

The unit conductor lengths for the TF and PF conductors will be produced. Procurement contracts have been launched in 2008 following the signature of the PAs for the TF conductors in December 2007, while the PF conductor one has been signed in May 2009. The production will be carried out with the following contracts:

- One or two contracts (depending upon the production rate which the suppliers can achieve) for the supply of the Nb<sub>3</sub>Sn wire for the TF conductors.
- One single contract for cabling and jacketing of all TF and PF conductor lengths, including dummy copper lengths, in order to reduce the equipment, tooling and facility costs. It will also include the manufacture of a PF conductor sample (early qualification before beginning a full scale production) and the manufacture of the stainless steel tubes for these conductors. The activity takes into account the agreement negotiated with the Russian Federation that foresees the jacketing of the conductor lengths to be produced by the Russian Federation for PF1 and PF6 in return for NbTi cables, which will not be purchased by F4E. A qualification test for the manufacture of one PF conductor sample with RF cable will be launched through a separate contract.

WBS	Title	Priority	Indicative Number of Contracts	Call Launch	DoC (years)
1.1.1A	Procurement of TF coils: Phase 1: Manufacture of a full-scale dummy double pancake and preparation of tooling for the TF coils	2	1-2 (Supply)	Preselecti on Launched 2008 Final call in Q3	3 (phase I of contract)
1.1.1A	Radial Plate Prototypes	1	1-2 (Supply)	Q1	2
1.1.2A1	Magnet Structures: Pre-compression Rings	2	1 (Supply)	Q3	5
1.1.3A1 1.1.3B	Poloidal Field Coils PF2 to PF6 -Tooling and fabrication	2	1 (Supply)	Q3	5
1.1.6A	Supply of 95 tons of Nb <sub>3</sub> Sn wire*		1-2 (Supply)	Launched 2008	44 months
1.1.6A	Chromium-plated Cu strand for TF conductor*		1 (Supply)	Launched 2008	2
1.1.6C+ A	Cabling and jacketing of TF & PF conductor lengths (incl. manufacture of one PF Conductor sample)	1	2 (Supply)	Q2	4

#### 1.5.4. Design and R&D Activities

##### WBS 1.1.1A – Toroidal Field Magnet Windings

The R&D activities in support of the F4E procurement strategy include:

- Development of the closure welding techniques in order to assess the feasibility of a joint made by laser welding + arc welding (TIG, MIG or SAW (Submerged Arc Welding)). This is a critical activity in preparation for the insertion of the winding pack into the casing. Development of semi-automatic non-destructive inspection techniques, to be applied to the TF coil radial plates and case closure welds, as well as the PF jacket base material and welds;
- Qualification tests on samples of the proposed DGEBF epoxy resin + cyanate ester blend, which is proposed to withstand the integrated irradiation fluence estimated on the TF coils;
- Preliminary design/analysis and cost estimates of the cold test facilities for the TF and PF coils;
- Analysis work to support the design and procurement of the coils, as well as the analysis of the operational and fault electrical conditions to determine the high voltage test values and suggested testing techniques.

##### WBS 1.1.6A + 1.1.6C – Toroidal and Poloidal Field Magnet Conductors

- Testing of the Nb<sub>3</sub>Sn strand with interpretation of the results: a support contract is foreseen to be launched in the course of 2009 to perform independent testing of the main

strand characteristics, while extended characterization (such as sensitivity to bending) will be covered by a separate grant to be awarded in 2009.

- Tests at the SULTAN facility of TF and PF cables including preparation of the samples;
- A grant for the interpretation of the Sultan test results.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
1.1.1A	P (Service)	TF Coil Case Closure Welding	Development of welding and NDE procedures	Q3	1	2	N
	G	Irradiation-Resistant Resin	Independent qualification of proposed high-irradiation resin for TF coils	Q3	2	2	Y
	G	Cold Test Facility Preparation for TF & PF Coils	Detailed design of test facility Testing plan Cost Estimate	Q3	1	2	Yes (ITA)
	G	Analysis Work to Support Magnet Procurement (Engineering Support)	1) Electrical simulations 2) Electromagn. and structural 3) Thermo-hydraulic 4) Error fields	Q2	1	2	Yes (ITA)
1.1.6A	G	Extended Charact. of ITER TF Strands	Definition of the required characteristics of the strand to be qualified for ITER	Q2	1	4	Y
	P	Testing of TF Nb <sub>3</sub> Sn strands	Test Report	Q4	2	3	Y
1.1.6.A&C	G	SULTAN Sample Manufacturing and tests (TF + PF) <sup>6</sup>	Test Report	Q3	2	1.5	Y
	G	Interpretation of SULTAN test results	Report	Q4	2	5	Y

## 1.6. WBS 1.5 -VACUUM VESSEL

### 1.6.1. Summary

According to IO decision of early October 2008, the design of VV will evolve on two parallel tracks: one which is the Baseline design (recently improved by IO with the support of F4E), whose maturity is not yet completely assessed as concerning interfaces impact and

<sup>6</sup> Unique beneficiary (CRPP) - Unique facility (SULTAN)

manufacturing issues, and another track which is alternative designs studied by IO with the support of the F4E (and others DAs as well) A final decision is planned to be taken by IO for Summer 2009. Due to this revised schedule, it cannot be anticipated any important commitment in the course of 2009.

**1.6.2. Procurement Arrangements**

WBS	Title	ITER Credit (kUA)	Signature due
1.5.1.A	Vacuum Vessel Sector Production	99.36	Sept 2009

**1.6.3. Main Procurements**

In order to fulfil scenario 1, the fabrication of the 7 Sectors has to go as much as possible in parallel. A number of segments (and assembly) lines in parallel are foreseen. The optimization of the production, including cost/schedule and risk analysis will be performed before launching the contract.

The supply of the material for the sectors will be part of the vacuum vessel sectors fabrication contracts because without the “first-of-the-kind” no material is needed in advance. In addition, the market situation is now more favourable to procure material in a relatively short time

Activities such as UT inspection and EB local system, will be implemented during the contract to provide the main manufacturer(s) with the tools necessary to expedite the production.

The following tasks are necessary to prepare the manufacturing phase and to guarantee the achievement of the technical requirements and possibly reduce costs.

- i. Qualification of Ultrasonic Testing (UT) Inspection Procedures one-side butt welds for ITER VV for RCC-MR. The full qualification for use under the RCC-MR Code on the VV sectors will be produced.
- ii. Local Vacuum EB weld system development.
- iii. Weld Distortion Control of VV segment manufacture

WBS	Title	Priority	Indicative Number of Contracts	Call Launch	DoC (years)
1.5.1.A	Vacuum Vessel Sectors fabrication (incl.material)	2	1-3 (Supply)	Q4	5

**1.6.4. Design and R&D Activities**

Activities are necessary to prepare the manufacturing phase and to guarantee the achievement of the technical requirements:

- Consultancy with ANB about testing and expediting policy during the manufacture of VV sectors;
- Design, FEM analysis and concept design, for the alternative VV proposal and finalization of drawings for manufacturing contract use, for the selected design;

- Consultancy in support to material procurement.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
15.1A	P (service)	Consultancy with ANB about expediting and inspection policy	Study with VV ANB	Q3	2	1	N
	P (service)	Engineering Support	Engineering analysis also for alternative VV proposal design	Q2	1	2	N
			CAD Models & Drawings for main sector manufacturing	Q3			Yes (ITA)
	G	Corrosion Issues	Results of experiments and tests on rig with different geometries	Q1	1	1	N
G	Consultancy in support to material procurement	Report on material definition	Q3	2	1	N	

## 1.7. WBS 1.6 BLANKET

### 1.7.1. Summary

Activities in relation to the Shielding Blanket are:

- to perform the conceptual design of the revised ITER First Wall (FW) and Shield concept for the modules to be procured by EU,
- to further improve the Be/CuCrZr joint performance to cope with the expected new higher power handling requirements.

The design, although progress has been achieved thanks to the Integrated Product Teams (IPT) activities, cannot be considered as a final concept due to the still open vacuum vessel alternatives. Therefore in 2009 more design work needs to be performed.

### 1.7.2. Procurement Arrangements

None in 2009

### 1.7.3. Main Procurements

None in 2009

**1.7.4. Design and R&D Activities**

The main activities are:

- high heat flux and thermal fatigue testing of FW mock-ups fabricated with improved Be/CuCrZr joints, of irradiated FW mock-ups and of FW mock-ups fabricated for the definition of acceptance criteria for the FW series production;
- Be/CuCrZr joining development aiming at improving the performance of the joints and at developing repair techniques;
- CuCrZr power-solid HIP development to make easier the fabrication route of complex FW panels as those next to the NBI openings;
- irradiation and testing of blanket material and joints;
- Be waste disposal from FW mock-ups after destructive examination;
- performance of design and analysis work for the conceptual design of the blanket components to be procured by the EU DA.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
1.6.1A	G	High heat flux testing of FW mock-ups before and after irradiation, including transportation	Test report	Q3	1	2	Yes (ITA)
	G	CuCrZr powder-solid HIP development	Test report	Q2	1	2	Yes (ITA)
	G	Be/CuCrZr HIP joining development	Test report	Q3	1	2	Yes (ITA)
	P (supply)	Be/CuCrZr joint repair technique	Manufacture of mock-ups Study report	Q3	2	2	Y
	G	Irradiation and testing of powder HIPped 316L SS material and joints	Test report	Q3	1	2	Yes (ITA)
	G	Mechanical characterisation of irradiated and unirradiated CuCrZr alloy	Test report	Q3	1	2	Yes (ITA)
	P* (supply)	Procurement of CuCrZr alloy material	Material for testing	Q3		5 months	Yes (ITA)



	<i>P*</i> (supply)	<i>Ultrasonic testing of Be-coated FW mock-ups</i>	<i>Test Report</i>	<i>Q4 (2008)</i>		2	<i>Yes (ITA)</i>
1.6.1B	P (service)	Engineering Support	Conceptual design of ITER Shield and FW panels	Q3	1	3	N  Yes (ITA)

**1.8. WBS 1.7 DIVERTOR**

**1.8.1. Summary**

The main objective is to complete the R&D activities aiming at increasing competition among possible material suppliers and decreasing manufacturing cost. In addition, R&D to develop the full W divertor will be performed.

**1.8.2. Procurement Arrangements**

WBS	Title	ITER Credit (kIUA)	Signature due
1.7.2B	Divertor Inner Vertical Target	20.2	Dec.2009
1.7.1	Divertor Cassette and Integration	11.2	June 2011

**1.8.3. Main Procurements**

The following contracts are planned to be launched in 2009:

WBS	Title	Priority	Indicative Number of Contracts	Call Launch	DoC (years)
1.7.2B	Carbon Fibre Composite Materials for the inner vertical target including prototype.	2	1 (Supply)	Q3	4

**1.8.4. Design and R&D Activities**

Activities include:

- qualification of an alternative CFC grade with the characterisation and manufacture of representative mock-ups to promote supplier competition;
- manufacturing of small mock ups and medium scale prototypes for the full W divertor;
- qualification of repair techniques on full size plasma facing units to allow the manufacturing cost to be reduced by reducing the scrape rate during series production.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
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1.7.2 B	G	Characterization of alternative CFC material	Material properties	Q3	1	12 months	Y
	G	Destructive examination of EU qualification prototypes and mock-ups	Interim report on cutting plan Final report	Q1	1	1	Y
	G*	<i>Preparation of high-heat flux testing of CFC and W mock-ups: IR examinations and test set up</i>	<i>Interim report on infra red testing Final Report</i>	<i>Q4 (2008)</i>		<i>21 months</i>	<i>Y</i>
	P* (service)	<i>High-heat flux testing of CFC and W mock-ups (testing execution)</i>	<i>Initial report on test set up Final Report</i>	<i>Q4 (2008)</i>		<i>18 months</i>	<i>Y</i>
	P (supply)	Manufacturing of mock ups with alternative CFC grade	Mock ups	Q2	1	1	Y
	P (supply)	Manufacturing of mock ups and prototypes for the full W divertor	Mock up and prototypes	Q2	1	1	Y
	P (supply)	Qualification of repair technologies on full size PFC components	Mock ups	Q4	2	2	Y

## 1.9. WBS 2.3-REMOTE HANDLING (RH)

### 1.9.1. Summary

Design and R&D activities will focus on:

- i) the development of functional specifications and interfaces, and of the reference design, for the various RH packages allocated to Europe;
- ii) development of facilities and prototypes for R&D on the EU RH packages

### 1.9.2. Procurement Arrangements

None

### 1.9.3. Main Procurements

None in 2009

### 1.9.4. Design and R&D Activities

Activities will focus on complementing the functional specifications by the definition of a set of interface requirements, in particular the geometrical interfaces of the components to be handled, the VV ports and ducts, hot cell, building etc. The following activities will be implemented for all the WBS's:

- Engineering support activities for studies in general areas such as RH pipe tooling, ATS and IVVS.
- Qualification of radiation hard components (motors, sensors, electronics etc.)

WBS 2.3.2. *Divertor Remote Handling:*

- Further testing of the existing Divertor Test Platform (DTP-2) and support in the preparation and follow-up of DTP-2 upgrade procurement.

WBS 2.3.5. NB RH:

- Design activities in view of the PA signature (procurement to begin in 2010).

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
	G	Irradiation of RH components (motors, sensors etc.)	Database on components suitable for use in ITER RH devices	Q3	2	3	Y
	P (service)	Engineering Support	Studies in areas like: RH pipe tooling and interfaces, Air Transfer System Prototype and IVVS layout studies	Q3	1	1	Yes (ITA)
2.3.2	G	Further testing of the existing DTP-2 and support in the preparation and follow-up of its upgrade procurements. <sup>7</sup>	Reports	Q4	2	2	Yes (ITA)
2.3.3	G*	<i>Studies on transfer cask path in the ITER building and on rescue scenarios; start of preparation of tender packages for ATS prototype</i>	<i>Reports</i>	<i>Q4 (2008)</i>		2	<i>Yes (ITA)</i>
2.3.4	G*	<i>Gathering of requirements for final IVVS; Specification of IVVS prototype and start of preparation of tender package Lab-test new series</i>	<i>Report and drawings Test report</i>	<i>Q4 (2008)</i>	<i>±</i>	2	<i>Yes (ITA)</i>

<sup>7</sup> Unique Beneficiary (Tekes); Unique facility: DTP-2 for testing purposes

2.3.5	G	Gathering of requirements for NBI RH, and feedback to/from NBI design.  Start of engineering design of NBI RH	Report and drawings on the final NB RH System in view of its procurement	Q3	1	2	Yes (ITA)
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**1.10. WBS 3.1 – VACUUM PUMPING AND FUELLING**

**1.10.1. Summary**

Activities will focus on validation of the design of components via the manufacture and testing of prototypes, e.g. for the torus cryopump (PTC) and heating neutral beam (HNB) cryopanel.

**1.10.2. Procurement Arrangements**

None in 2009

**1.10.3. Main Procurements**

None in 2009

**1.10.4. Design and R&D Activities**

*WBS 3.1.1 – Cryopumps*

Activities are described in the table below:

*WBS 3.1.3 - Leak Detection*

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
3.1.1	G*	<i>Completion of final design for the PTC and testing of PTC in TIMO-2 facility to qualify design.</i>	<i>Design for PTC and technical specs for manufacturing.</i>	<i>Q1</i>		<i>46 months</i>	<i>Yes (ITA)</i>
	G*	<i>Upgrading of TIMO-2 facility</i>	<i>Upgraded TIMO-2 facility</i>	<i>Q1</i>		<i>7 months</i>	<i>N (incl. in voluntary ITA)<sup>#</sup></i>
	G	Development/ design of vacuum/ cryopump instrument.	Design of instrument. needed for vacuum components	Q2	1	8 months	N (incl in voluntary ITA) <sup>#</sup>

<sup>#</sup> Included among the voluntary urgent ITER tasks agreed by EFDA in Summer 2007

	G	Optimisation study on flow distribution and pressure loss in manifolds in HNB cryopumps	Determine pressure loss in HNB cryopump	Q4	2	6 months	Yes (ITA)
	G	Activities for final design of NB cryopump mockup and validation via pumping tests, etc. in TIMO-2 <sup>8</sup>	Final design of NB cryopump mockup	Q4	2	20 months	Yes (ITA)
	G	Detailed design and specification for the CVBs and cryojumpers	Preparation of reports	Q3	1	2	Yes (ITA)
3.1.3	G	Optimisation and performance studies for leak detection system including proof-of-principle tests (part 1). Review of leak localization concepts and their possible realization.	Study on performance and optimisation of leak detection system and plan for Leak Localisation system concept	Q3	1	1	Yes (ITA)

**1.11. WBS 3.2 – TRITIUM PLANT**

**1.11.1. Summary**

- i) Finalisation of system studies for the ITER Isotope Separation System (ISS) and Water Detritiation System (WDS), including Process Flow Diagrams (PFD), Process and Instrumentation Diagrams (P&ID), Hazard and Operability (HAZOP) studies and technical specification for the fabrication of WDS-tanks;
- ii) A cost assessment for the procurement of the Analytical System (ANS) is also planned in order to evaluate the possibility for F4E to participate to a future possible Call for Interest by ITER

**1.11.2. Procurement Arrangements**

None in 2009

**1.11.3. Main Procurements**

None in 2009

**1.11.4. Design and R&D Activities**

*WBS 3.2.3 + 3.2.5 - Hydrogen Isotope Separation System and Water Detritiation System*

Activities are described in the table below:

*WBS 3.2.5 - Water Detritiation System*

<sup>8</sup> Unique Beneficiary (FZK); Unique facility: TIMO-2 for testing purposes – monopoly situation

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
3.2.3 + 3.2.5	G	Finalization of the system capacity, and enhancements studies for ISS and WDS (Part 1)	Preliminary Design (incl. production of PFDs & P&IDs)	Q3	1	10 months	Yes (ITA)
	G	Test of a further type column packing (CY) <sup>9</sup> .	Determine of hydrogen (tritium) hold-up	Q1	1	6 months	Yes (ITA)
3.2.5	G	Safety studies (HAZOP) for WDS	HAZOP study of the system	Q3	1	6 months	Yes (ITA)
	G	Preparation of tender specs for WDS-Tanks	Technical specs and drawings for the proc. of the tritium holding tanks	Q3	1	6 months	Y
	P (service)	Engineering Support	Production of drawings for the procurement of WDS tanks	Q4	2	3 months	Y
3.2.6	P (service)	Engineering Support	Cost assessment of the ANS package	Q3	1	4 months	N

## 1.12. WBS 3.4 -CRYOPLANT

### 1.12.1. Summary

Activities will focus on the optimisation of cryoplant procurement sub-packages directly under F4E responsibility and in strategic activities like flow-dynamic analysis, operational modes analysis and test program.

### 1.12.2. Procurement Arrangements

None in 2009

### 1.12.3. Main Procurements

None in 2009

### 1.12.4. Design and R&D Activities

Activities are described in the table below:

<sup>9</sup> Unique beneficiary (FZK). Unique facility: Tritium Laboratory.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
3.4.1	P (service)	Optimization of Cryoplant Design	LN2 and 80K loop optimization	Q3	1	1	Y
	P (service)	Engineering support	Cryoplant Process Design Analysis	Q3	1	1	Y
	G	Cryoplant Design Review	Optimization of the integrated conceptual design of all cyoplant sub-systems	Q3	1	1	Y
	G	Cryogenic Test Loop	Detailed engineering, procurement follow up and installation	Q4	2	2	Yes (ITA)
	G	Numerical flow-dynamic analysis	Numerical flow-dynamic analysis of operation and transient modes	Q3	2	1	Yes (ITA)
	G	Cryoplant Procurement Preparation	Preliminary Functional Specs for Cryoplant sub-systems	Q3	2	3	Y

**1.13. WBS 4.1 and 4.3 – POWER SUPPLIES**

**1.13.1. Summary**

Activities to prepare for the procurement of the Pulsed Power electrical network and the Steady State electrical network including:

- i) direct support to PA activities as requested by IO (finalization of the technical requirements for the PA);
- ii) qualification of components with respect of operation under magnetic field;
- iii) refinement of costs and schedule analysis.

### 1.13.2. Procurement Arrangements

WBS	Title	ITER Credit (kUA)	Signature due
41.1.A; 43.8A; 43.8B; 43.8C (EU25%)	Pulsed Power & Steady State Power Supply Studies	31	Sep 2009

### 1.13.3. Main Procurements

None in 2009

### 1.13.4. Design and R&D Activities

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC	Credit
4.1.1.A 4.3.8 A/B/C	P (service)	Finalization of the technical requirements for the PA	Functional specs	Q3	2	9 months	Yes (ITA)
	P (service)	Engineering Support	Cost and schedule analysis and electrical simulations	Q3	2	6 months	N
	G	Technical specs of the qualification contract	Tech specs for the qualification program	Q3	2	6 months	Yes (ITA)

## 1.14. WBS 4.5 - CODAC

### 1.14.1. Summary

The CODAC system, up to the local controllers, will be developed by ITER using Fund, with the help of the Domestic Agencies and with direct help from industry. The Fusion for Energy contributions will be credited by ITER Task Agreements and will be implemented through Grants and Service Contracts.

### 1.14.2. Procurement Arrangements

Not applicable

### 1.14.3. Main Procurements

Not applicable



**1.14.4. Design and R&D Activities**

The ITER CODAC Work Plan is still a preliminary development phase which limits the level of detail here. F4E will respond positively in 2008 to an ITER call for “Technical Specification and Statement of Work for developing a Plant System Simulator and a prototype Fast Control Plant System” and the corresponding Grant and Procurement will be launched in 2009. As soon as a detailed ITER CODAC Workplan is received a strategy for the F4E responses to Calls will be drawn up.

WBS	G/P	Title	Deliverable	ToC	Prio	Credit
n/a	G	Specify and Develop a Plant System Simulator and a prototype Fast Control Plant System	(i) Design and implement a Plant System Simulator. (ii) Prototype technology for a fast high performance Plant System.	Q1	1	Yes (ITA)
	P (supply/ service)	ditto	Hardware required for prototype plant system simulator and High Performance Plant System.	Q3	1	Yes (ITA)

**1.15. WBS 5.1.1 – ION CYCLOTRON H&CD ANTENNA**

**1.15.1. Summary**

The IC Antenna procurement type is Build-to-Print, with 100% EU sharing. The original PP included the ICH antenna port plug with an internal matching system, a spare antenna and parts of a testing facility. The procurement arrangement is foreseen in 2011. The antenna design is at conceptual level and two years of design and R&D work are necessary to produce the built to print design. The scope of WP 2009 is to launch contacts and grants to progress towards the built to print design: basic R&D, prototyping and design analysis.

**1.15.2. Procurement Arrangements**

None in 2009.

**1.15.3. Main Procurements**

None in 2009.

**1.15.4. Design and R&D Activities**

Activities include:

- The antenna mockup electrical measurements and the detailed design of an ICH antenna, which will incorporate the results of the following R&D:
- For the vacuum window – materials compatible with long-pulse operation and water cooling at high temperature; BeO properties, characterization of bonding methods, braze qualification/optimization, H embrittlement of Ti alloys, vacuum compatibility of Ti and other tests as needed.

- Faraday screen bar (fabrication technology similar to the first wall but the attachment of the bar is specific to this design) with test at high power density; qualification of the screen protection bars, validate thermal capability of the bars. Evaluate industrial capability for plating and test small prototypes.
- Specify the RF grounding and the diagnostics (RF voltage probes, arc detection system, reflectometer, and study other possible diagnostics)
- Upgrade the existing test stand to connect to hot water cooling system and other modifications in preparation for RF tests.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
5.1.1	G	Detailed design of the ITER ICH antenna	Report on antenna mockup measurements Detailed design of the ICH antenna Incorporation the R&D results in the design as a start of BtP	Q1	1	1.5	Yes (ITA)
	P (service)	RF Vacuum windows R&D <sup>Ⓞ</sup>	Tests Report Technical Specs	Q2	1	2.5	Yes (ITA)
	P (service)	Faraday Screen R&D <sup>Ⓞ</sup>	Tests Report Technical Specs	Q3	2	2.5	Yes (ITA)

**1.16. WBS 5.2 ELECTRON CYCLOTRON**

*WBS 5.2.1B –ELECTRON CYCLOTRON UPPER LAUNCHER*

**1.16.1. Summary**

Activities to launch contracts and grants to finalize the design, substantially progress prototyping and analysis, and prepare documentation in accordance with the schedule for the 4 Upper Electron Cyclotron Upper Launchers (EC UL), for MHD mode control in ITER.

**1.16.2. Procurement Arrangements**

None in 2009.

**1.16.3. Main Procurements**

None in 2009.

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<sup>Ⓞ</sup> The three procurements have been regrouped according to the now known exact contractual implementation.

**1.16.4. Design and R&D Activities**

Activities include:

- Procurement of a prototype of the First Wall Panel and Blanket Shield Module, joining technique with a mock-up First Wall Panel, others and required instrumentation for testing.
- Procurement of mm-wave components for testing including: steering mechanisms, mirrors, tapers and instrumentation required for testing.
- Procurement of CVD window, isolation valves, auxiliaries and required instrumentation for testing.
- Procurement of some components for dummy launcher tests, including; dummy side plates, closure plate and required instrumentation for testing
- Independent verification of cost estimates, analysis and maintenance concepts
- Produce final design of the launcher, carry out and document testing, analyse performance and control, produce documentation (including that required for the first PA for windows, isolation valves and related components)

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
5.2.1B	P (supply)	EC UL prototypes	Prototype FWP, BSM, joining technique with (mock) FWP, others and instrumentation  Steering mechanisms, mirrors, tapers, other mm-wave components and instrumentation.  CVD window, isolation valves, auxiliaries, others and instrumentation.	Q3	1	2	Yes (ITA)
	P (supply)	Components for dummy launcher tests (part 1)	Dummy side plates, closure plate, others + required instrumentation for testing	Q3	1	2	Yes (ITA)
	P (service)	Engineering analysis	Independent verification of cost estimates, analysis and maintenance concepts	Q4	1	2	Yes (ITA)

	G	Detailed design, analysis, testing and documentation	Final design of the launcher, Carry out and document testing, analysis (including performance and control) documentation	Q3	1	2	Yes (ITA)
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*WBS 5.2.3 ELECTRON CYCLOTRON POWER SOURCES AND WBS 5.2.4 EC POWER SUPPLIES*

**1.16.5. Summary**

Activities to continue the development of the European gyrotron for ITER will focus on the refurbishment of the first gyrotron prototype on the basis of the results of the first test campaign. The second test campaign is moved to 2010 for the demonstration of the 2MW coaxial cavity concept for ITER. In parallel, investigations for the improvement of some internal components of the tube will be pursued. These steps will provide essential information for the decision between the 2MW coaxial concept and the more traditional 1MW cylindrical one, planned in 2010. In addition, support will be provided to the IO on some critical issues on the area of ECH, e.g. space allocation in the RF building, preparation of specification for the PA for the gyrotrons and the EC Power Supplies.

**1.16.6. Procurement Arrangements**

None in 2009.

**1.16.7. Main Procurements**

None in 2009.

**1.16.8. Design and R&D Activities**

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
5.2.3	G	Tests with the refurbished 2MW 1 <sup>st</sup> prototype gyrotron <sup>10</sup>	Execution of experiments .Final Report	Q3	1	1	Y

<sup>10</sup> Unique Beneficiary (CRPP) – Unique facility – EC Test Facility

	G	Support for ITER Organization	Preparation of the PAs for the gyrotrons and analysis of the design issues, performances and interfaces  Final Report	Q2	1	1.5	Yes (ITA)
	G	Design and Development of the EU Gyrotron and Participation to experimental activities	Technical Reports on design activities and experimental results	Q3	1	1	Y
	G*	<i>Design and development of the EU gyrotron</i>	<i>Technical reports with results of the design activities</i>	<i>Q4 (2008)</i>		<i>1</i>	<i>Y</i>
	P (supply)	Auxiliaries for the CRPP EC Test Facility	Additional power supplies for the gyrotron magnet	Q3	1	2	Y
	P (service)	Engineering Support	Analysis of gyrotron high heat flux components and He-free magnets and cost analysis	Q3	1	1	Y
	P* (supply)	<i>Refurbishment of the 1<sup>st</sup> prototype of 2MW coaxial gyrotron</i>	<i>Supply of the item</i>	<i>Q4 (2008)</i>		<i>1</i>	<i>Y</i>
	P* (supply)	<i>Supply of extra consumables for gyrotron testing</i>	<i>Supply of liquid helium</i>	<i>Q4 (2008)</i>		<i>1</i>	<i>Y</i>
5.2.4	G	Design and verification of the PS system	Specifications of the EC PS system and verification of the preliminary design	Q4	2	1.5	Yes (ITA)

## 1.17. WBS 5.3 – NEUTRAL BEAM SYSTEM

### 1.17.1. Summary

Activities for the development of the NB system and the preparation of the technical specifications of NB components, including the ELISE experiment, the conclusion of procurement contracts to meet the EU obligations foreseen in the ITER Agreement and progress the Design and R&D covering the NB components. As concerns the Neutral Beam

Test Facility, F4E will engage into construction of the Facility if and when Euratom takes this obligation.

An agreement was reached among IO, JA DA and EU to prepare the Procurement Arrangement of the power supplies for the two NBIs to be installed in ITER. As soon as the ITER Council will approve the NBTF, one power supply will be moved to Padova.

#### 1.17.2. Procurement Arrangements

WBS	Title	ITER Credit (kIUA)	Signature due
5.3.6	Procurement of NB power supplies and related systems	19.52	July 2009
5.7	The full size ITER injector Ion Source Test Facility and MV Test Facility	60 + 8.8 (from IO R&D budget)	TBD

The second PA in the above table is specific and not included in the PAs already foreseen in the agreed sharing among ITER Parties. The signature of this PA is therefore conditional on the positive decision of the ITER Council to include the NBTF into the ITER baseline and on the subsequent agreement by the EU that this facility will be the subject of an in-kind procurement of the EU.

#### 1.17.3. Main Procurements

WBS	Title	Priority	Indicative Number of Contracts	Call Launch	DoC (years)
5.3.6	Procurement of NB Power Supplies and related systems	1	1 (Supply)	Q3	2.5

#### 1.17.4. Design and R&D Activities

##### *WBS 5.3.2 - NB-Beam Source and HV Bushing & WBS 5.3.3 - NB-Beam Line Components*

Activities on the NB source, the HV bushing and the beamline components:

- The development of the ITER half-size source with extraction at IPP, Garching, will be implemented with the preparation of the test facility ELISE.
- Use of ultra-high voltage facilities for experiments on insulation in vacuum and conditioning techniques.
- R&D on manufacturing techniques for NB components and preparation of technical specifications.

##### *WBS 5.3.4 - NB-Pressure Vessel and Magnet Shielding & WBS 5.3.5 - NB-Active Correction and Compensation Coils*

Activities on the NB pressure vessel, the magnetic shielding and the correction and compensation coils

- Design of the “NB components outside the scope of the NB Test Facility”, which include the beam line and beam source vessels, the passive magnetic shield, the drift duct, the active correction and compensation coils and the fast shutter.

*WBS 5.7 – Neutral Beam Test Facility (NBTF)*

For the Neutral Beam Test Facility called “Prima”, which includes “Spider” (ion source test facility) and “Mitica” (1 MV test facility), the following activities are included:

- The detailed design and technical specification of the components and infrastructures of the NBTF will be undertaken
- Procurement of hardware for the Ion Source Test Facility will commence
- Procurement of infra-structure for the NBTF will commence
- Technical consultancy including assessment of technical documents.
- procurements under 5.7 related to NBTF construction are subject to the conditions described above in §1.17.1.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
5.3.2	P (service)	Experiments on a Large radio frequency Ion Source with Extraction (ELISE) <sup>11</sup>	ELISE test facility and experimentation Final Report	Q2	1	4	N
	G*	Continuation of the development of RF ion source	Technical report on the outcome of the activities	Q4 (2008)		1	N
	G	R&D on existing facilities	Reports on experiments	Q4	2	2	Yes (ITA)
5.3.4 + 5.3.5	G	Components outside the scope of the NB test facility	Complete Design	Q1	1	3	Yes (ITA)
5.7	G	Components and infrastructures of the NBTF <sup>12</sup>	Detailed design/technical specifications and procurement follow-up	Q2	1	2	Yes (ITA)

<sup>11</sup> Unique beneficiary (IPP): Unique facility – ELISE – Monopoly situation

<sup>12</sup> Unique beneficiary (Consorzio RFX): Unique facility – NBTF – Monopoly situation

	G*	<i>Design, development and specifications of the NBTF system.<sup>13</sup></i>	<i>Details of the design</i>	Q4 (2008)		1	Yes (ITA)
	P (supply)	Ion source test facility SPIDER	Hardware	Q3	2	2	Y <sup>14</sup>
	P (supply)	Infrastructures of the neutral beam test facility PRIMA	Hardware (cryosystem and cooling system)	Q3	2	2	Y <sup>15</sup>
	P (service)	Engineering Support	Technical consulting	Q3	1	1	Y

**1.18. WBS5.5 – DIAGNOSTICS**

**1.18.1. Summary**

Activities will focus on completion of the designs for the diagnostics and associated port plugs in the nine diagnostic procurement packages for which the EU is responsible, to the level appropriate for a conceptual design review. In a few cases the design may be advanced to a more detailed level. The activities will include design and engineering studies; system-level optimisation to meet measurement requirements to be agreed with ITER IO; prototyping and testing of relevant components; and assessment of the Procurement Arrangement technical specifications.

Most of the diagnostic procurement packages include a mixture of functional specification components and detailed design specification components (primarily in the vacuum vessel). These procurement packages do not follow the functional WBS of the ITER systems, but are nevertheless expected to form the basis of the Procurement Arrangements issued by ITER IO. WBS elements associated with the principal diagnostic systems or components in each package are indicated.

The diagnostic Procurement Packages for which the EU is responsible are:

- i. Diagnostic Procurement Package 1, including low field side Plasma Position Reflectometer (WBS 55 F.03)
- ii. Diagnostic Procurement Package 2, including Core Plasma Charge-Exchange Recombination Spectroscopy system (CXRS) (WBS 55 E.01)

<sup>13</sup> Unique beneficiary (Consorzio RFX): Unique facility – NBTF – Monopoly situation

<sup>14</sup> Identified as improvement by the ITER Organization. PA expected after November.

<sup>15</sup> Identified as improvement by the ITER Organization. PA expected after November.



- iii. Diagnostic Procurement Package 11, including Equatorial Visible/IR Wide-Angle Viewing System (WAVS) (WBS 55 G.01) and Radial Neutron Camera (RNC) (WBS 55 B.01)
- iv. Diagnostic Procurement Package 14, including Core Thomson Scattering system (LIDAR) (WBS 55 C.01)
- v. Diagnostic Procurement Package 21, including Bolometers (WBS 55 D.01) and Pressure Gauges (WBS 55 G.03)
- vi. Diagnostic Procurement Package 22, including Magnetics Diagnostic (in-vessel and ex-vessel) (WBS 55 A.01-A.06)
- vii. Diagnostic Procurement Package 26, includes Thermocouples (in-vessel and inner-divertor target) (WBS 55 G.11)
- viii. Diagnostic Procurement Package 30, In-vessel Services (Cables, Conduits, Feedthroughs and Connectors) (WBS 55 N.01)
- ix. Diagnostic Procurement Package 34, including enabling of Low Field Side Collective Thomson Scattering system (LFS-CTS) (WBS 55 C.07)

The EU will be responsible for supply, or enabling, of diagnostics in the nine procurement packages listed above. Two of these packages (11 and 21) contain more than one diagnostic system and four packages (1, 2, 11 and 14) include responsibility for provision of port plugs and diagnostic radiation shielding modules, together with the design activities to integrate all diagnostics using these ports (which include those of other ITER Parties).

**1.18.2. Procurement Arrangements**

WBS	Title	ITER Credit (kIUA)	Signature due
5.5	All Procurement Arrangements for diagnostics (not yet defined)	35.487	Sept 2010

**1.18.3. Main Procurements**

None in 2009.

**1.18.4. Design and R&D Activities**

Activities are described in the table below:

WBS	G/P	Title	Deliverables	ToC	Prio	DoC (years)	Credit
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1 21 22 26 30	G	Complete Design of in-vessel Diagnostics to Conceptual Design Review level	<p>Recommendations for diagnostic system-level optimisations</p> <p>Synthesis of R&amp;D and evaluation of diagnostic prototypes</p> <p>Proposals for the design of optimised diagnostics</p> <p>Assessment of diagnostic measurement requirements in context of design status</p> <p>Quantification of impact of QA and RAMI requirements</p>	Q3	1	3	Y  Yes (ITA)
22	G	R&D on ex-vessel magnetics and construction of a magnetics test facility	Design report and test facility	Q4 (2008)	1	1	Yes (ITA)
2 11 14 34	G	Support for finalisation of technical specifications for port-based diagnostics <sup>16</sup>	<p>Review of diagnostic design status</p> <p>Production of functional block diagram</p> <p>Specific analysis of diagnostic performance</p>	Q3	1	1	Y
2 11 14 34	G	Complete Design of port plug-based Diagnostics to Conceptual Design Review level	<p>Recommendations for diagnostic system-level optimisations</p> <p>Synthesis of R&amp;D and evaluation of diagnostic prototypes</p> <p>Proposals for the design of optimised diagnostics</p> <p>Assessment of diagnostic measurement requirements in context of design status</p> <p>Quantification of impact of QA and RAMI requirements</p>	Q4	2	3	Y  Yes (ITA)
11 14	G	Complete designs of generic equatorial port plug and representative internal shield modules	<p>Design of generic equatorial port plug and internal shielding</p> <p>CATIA models and 'draft' engineering drawings</p>	Q1	1	1	Y  Yes (ITA)

<sup>16</sup> Activities with respect to the grant below (planned as priority 2) have been anticipated to provide support to F4E in the preparation of the Diagnostic Procurement Arrangements, currently envisaged for signature in late 2010

1 2 11 14	G	Port plug design, testing and diagnostic integration	Design of generic upper port plug and internal shielding, including models and 'draft' engineering drawings  Preliminary design integration for diagnostics in upper, equatorial and divertor ports  Proposals for port plug and payload testing strategies	Q4	2	3	Y
	P (service)	Engineering Support for diagnostic integration	Analysis of remote handling compatibility for diagnostic port plug integration  Mechanical engineering analysis for diagnostic port plug integration	Q4	2	2	Y
All	G	Irradiation and post-irradiation testing of diagnostic components and assemblies	Neutron and Gamma irradiated samples  Results of post-irradiation testing  Development and population of radiation effects database	Q4	2	3	Y Yes (ITA)
2 11 14	G	Development of design solutions for optimising first mirror lifetime	Strategy for identifying solutions for first mirrors on affected EU diagnostics  Tests of identified damage mitigation strategies	Q4	2	2	Y
1 2 11 14 21 20 22	P (supply)	Supplies and support for design of in-vessel diagnostics and port plugs <sup>17</sup>	Parts, components and prototype assemblies	Q4	2	3	Y Yes (ITA)

<sup>17</sup> This activity replaces the five procurements allowing to place framework contract(s), with separate lots reflecting components of specific functional characteristics (e.g. commercial off-the-shelf laboratory equipment, precision engineered structures etc.). With this procedure, the efficiency is improved allowing to launch tasks as soon as they are ready.

**1.19. WBS 6.1 SITE and WBS 6.2 BUILDINGS**

**1.19.1. Summary**

Activities include bringing the ITER building design from conceptual to preliminary. The approved changes, since 2001, and safety requirements contained in the Preliminary Safety Report (now submitted to the Licensing Authorities) needed also to be systematically included in the design

The outcome of the activity will be the preparation of the input data to launch the contract for the Architect Engineer (A/E) of the Tokamak complex. The procurement contracts shall include the following main topics:

- General support to F4E on tender preparation, follow-up of A/E and construction contracts;
- Health and Safety Coordination Protection related to F4E responsibility (general rules and follow-up);
- Architectural and Engineering Services covering the preparation of the detailed specifications for all buildings and the support to the tender;
- PF Coil Winding Building: the design and construction, including follow-up, of this building;
- Tokamak pit excavation and drainage: for the early works of excavation of the time critical buildings in anticipation of the final detailed design of the complex;
- Seismic Isolation: covering a fundamental topic on the critical path for nuclear building;
- Value engineering for ITER buildings;
- Construction Insurance

**1.19.2. Procurement Arrangements**

WBS	Title	ITER Credit (kIUA)	Signature due
6.2.P2.EU.02**	Architectural and Engineering Services	54.7	May 2009
6.2.P2.EU.03**	Tokamak pit excavation and drainage	31	May 2009
6.2.P2.EU.04**	Seismic Isolation Pads & Assembly Hall Cranes	6.2	May 2009
6.2.P2.EU.05**	ITER Buildings	273.2	Nov 2009
	ITER Office Building Annex	14.4	

\*\* F4E and IO have tentatively agreed a new subdivision of the Procurement Arrangements related to the ITER building construction.

**1.19.3. Main Procurements**

WBS	Title	Priority	Indicative Number of Contracts	Call Launch	DoC (years)

07

6.1	Adaptation of site before starting construction (prepared access roads, contractor areas, additional fences / access)	2	1	Q4	1
6.2	General Support-to-the-Owner Contract for the procurement of ITER Buildings	1	4 (service)	Q2	6
6.2	General Safety and Health Coordination Protection for ITER Buildings	1	2 or 3 (service)	Q2	6
6.2	Architect Engineer for the procurement of ITER Buildings	1	1 (service)	Q2	6
6.2	PF Coil Fabrication Building Design-and construction	1	1 (service/works)	Q2	1.5
6.2	Excavation and drainage of the Tokamak Complex Foundations	1	1 or 2 (works)	Q4	1
6.2	Tokamak Complex Seismic Isolators Fabrication	2	1 (supply)	Q4	1
6.2	Buildings value Engineering	1	1 (service)	Q1	1
6.2	<i>Revision of cost estimates and construction schedule of ITER building*</i>		1 (service)	Q4 (2008)	3 months
6.2	Construction Insurance	1	1 (service)	Q3	10

#### 1.19.4. Design and R&D Activities

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
6.2	P (service)	Analysis, design optimization and cost reduction strategies for the ITER building structures.	Models and reports	Q1	1	1	N
	G	Participation of F4E in European and international benchmarks for civil engineering codes in support to the design and assessment of the ITER building structures.	Models and reports	Q3	1	1	N

#### 1.20. MATERIALS DEVELOPMENT

The activities in 2009 include EUROFER, EUROFER ODS (oxide dispersion strengthened) EUROFER and SiC-Dual composite material. Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
N/A	G	EUROFER base materials & welds for TBM use: Irradiation campaigns Characterization and validation	Stage-1a to complete data base for design analyses and licensing process and qualification program for base and weld material..	Q2	1	4	N
	G	EUROFER and EUROFER welds Characterization for TBM use.	Stage-1b to complete data base for design analyses and licensing process Focus to characterize under fusion environment	Q3	2	2	N
	G	EUROFER Qualification of welds for TBM Irradiation campaigns for qualification of welds for TBM	Stage-2 to complete data base for design analyses and licensing process; (second batch of material produced from mock-up fabrication)	Q4	2	4	N
	P (service)	EUROFER TBM design rules Rules for welds	Stage-1 Industrial assessment. Strategy for future cooperation with Associates	Q2	1	2	N
	P (service)	EUROFER TBM design rules High Temperature rules	Stage-1: Review by industry. Evaluation of current proposals. Definition of future steps	Q4	2	2	N
	G	EUROFER design rules (Creep-fatigue)	Stage 1- Draft design rules for creep-fatigue. Justification from accompanying tests	Q2	1	2	N
	G	Qualification of EUROFER for TBM	Maintenance of database. Design code development	Q4 (2008)	1	1	N
	G	EUROFER data base and design rules	Maintenance and upgrade of data base and design allowables for TBM design	Q4	2	2	N
	G	Development: EUROFER ODS [Optimisation of properties]	Stage-1: Improvements of properties	Q4	2	2	N

	G	Development of EUROFER and EUROFER ODS [Optimisation of properties and processes. Ion Beam and n-Irradiation campaigns]	Improvement of EUROFER towards low activation  Optimisation of ODS properties Stage-2: Improvement of fabrication processes and preparation for procurement  Stability of nano-clusters under irradiation	Q4	2	2	N
	G	Development of SiC-SiC composites	Qualification of SiC-Dual material fabricated by industry in 2008, Stage-1: Basic physical properties.	Q4	2	2	N
	G	Development of SiC-SiC composites  Basic characterisation and irradiations	Stage-2: Basic characterisation and first screening of degradation of properties under irradiation	Q4	2	3	N

It should be noted that some irradiation campaigns are in delay (e.g. high flux reactor in Petten was down for 6 months) and also some information from tasks launched in the past are not yet available.

**1.21. TEST BLANKET MODULES**

Activities include the development of TBM box fabrication procedures and feasibility/test mock-ups of TBM box components, delivery of the HCLL/HCPB TBMs Preliminary Safety Reports, experimental activities in support of selection/qualification of tritium extraction technologies, development of predictive tools and of supporting experimental activities, development and characterization of functional materials (breeder, neutron multiplier), conceptual design of Dummy TBMs Plug and support to upgrade test facilities.

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
N/A	G	Tritium Extraction System (TES) for HCLL-TBM: Test campaign in TRIEX <sup>18</sup>	Report on the result of experimental activities	Q3	1	2	N

<sup>18</sup> Unique beneficiary ENEA (TRIEX test facility in ENEA/Brasimone)

	G	TBMs functional materials (Be, ceramic pebbles, PbLi) development/qualification	Development/characterization/procurement plan for functional materials (Be, ceramic, PbLi) Development of an alternative production route/capacity for Be/Be-alloy pebbles PIE of Be materials irradiated in HIDOBE-01 campaign	Q2	1	1 2 3	N
	P (supply)	Development and supply of qualified TBM box fabrication procedures specifications	Development of fabrication procedures specifications. Fabrication of TBM box components feasibility/test mock-ups EUROFER semi-finished products EUROFER steel procurement	Q2 Q2 Q3	1 1 2	2.5	N
	G	H/D sensor / technology development for HCLL-TBM: Construction of a lab-scale test device	Delivery of a lab-scale device and report on the acceptance tests	Q2	1	2	N
	G	Development / validation of predictive tools and their TBM diagnostics systems	Development of predictive tools & diagnostic system for TBM application and DEMO relevancy analyses in the field of EM, thermal-hydraulics, MHD, pebble beds, tritium transfer & cycle, He/T behaviour in Be	Q4	2	2	N
	G	HCLL/HCPB TBMs Preliminary Safety Report (PrSR)	Follow-up and support to PrSR; complementary conceptual safety studies	Q3	1	1	N



G	Support Test Facilities: Upgrade of DACS for EBBTF <sup>19</sup>	Integrated software/hardware delivery for EBBTF and report on the acceptance tests	Q2	1	2	N
G	Study of design constraints imposed by TF ripple	Sensitivity study of the TBMs mass and position in Port	Q2	1	1	N
P (service)	Engineering Support	Engineering support to Preliminary Safety Report	Q4	1	1	N
P (service)	Engineering Support	Industry support for the design of TBM mock-ups Engineering support to TBMs / dummy plugs design/fabrication, systems integration in ITER, (RH) support equipment, etc.	Q4	2	2	N
G	Dummy TBM Plugs	Conceptual design	Q4	2	2	N
G	Be coating on EUROFER First Wall	Preliminary design and technical specifications	Q4	2	1	N
G	Development / validation of predictive tools and their TBM diagnostics systems	Development of neutronics predictive tools and diagnostic system Design/ construction/ experiments for validation of predictive tools	Q4	2	2	N
G	Development, validation and application of computer codes for safety assessment of EU Test Blanket Modules	Report on validation of computer codes and on EU-TBM safety assessment	Q3	1	1	N

### 1.22. PLASMA ENGINEERING

Activities here are ground on the draft 2009-2011 ITER Physics R&D Workplan including those associated with WBS 4.7 (plasma poloidal field control), in particular analysis, modelling and optimization of magnetic configuration and PF scenarios, plasma position and

<sup>19</sup> Unique beneficiary ENEA (EBBTF test facility in ENEA/Brasimone)

shape control, plasma scenarios, TF ripple and 3D magnetic effects (TF coils, TBMs, etc.), plasma properties (including disruptions, PFC loads, etc.), Resistive Wall mode analysis & control, ELM control. Plasma Engineering activities also include specific studies related to plasma-wall interaction and plasma facing components. Plasma engineering analysis provides support to several other WBS, with the analysis of design changes, specification requirements, interfaces with plasma and operation. Preparation for installation & commissioning (without and with plasma) will continue.

Activities are described in the table below. As far as credit is concerned it is to be noted that all ITAs are on a competitive basis among Domestic Agencies.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
N/A	G*	<i>PF System analysis &amp; compatibility with plasma control (TF part not included)</i>	<i>Analysis of PF coils and PS performance against requirements</i>	<i>Q4 (2008)</i>	<i>1</i>	<i>1</i>	<i>Yes (ITA)</i>
	G	Ripple analysis and optimisation and 3D magnetic analysis	Develop and produce 3D ITER equilibria  Ion transport and loss simulation in 3D, plasma effects and power loads to PFCs	Q2	1	2	Yes (ITA)
	G	ELM coil analysis	Modelling of ELM control with RMP, impact on plasma parameters and loads in PFCs.	Q3	2	2	Yes (ITA)
	G	Scenario development and optimization	Analysis of ITER operational space and support to PF coils system optimization.  Analysis and optimization of ITER scenarios	Q2	1	2	Yes (ITA)
	G	Simulation of ITER pulses	Self consistent simulation of ITER pulses.	Q2	1	1	Yes (ITA)
	G	Control system design and analysis	Non linear code coupling a 2D plasma model to a 3D model of the eddy and halo currents  Analysis and optimization of the ITER plasma control system including RWM	Q3	1	2	Yes (ITA)

	G	Diagnostic modelling and optimization	Plasma shape and position reconstruction code with a 2D and 3D model of passive structures.	Q3	2	3	Yes (ITA)
	G	Disruption Studies	Study of plasma disruptions and evaluation of loads in support to components design. Computation of forces due to AVDEs with assigned halo currents path	Q3	1	2	Yes (ITA)
	G	Runaway electron characterisation and control	Run-away electrons characterisation and calculation of loads on PFCs Requirements for run-away suppression with ELM control coils Study control of run-away beams with in vessel VS coils	Q4	2	2	Yes (ITA)
	G	First Wall and Materials	Calculate plasma loads on specified locations	Q4	2	1	Yes (ITA)
	P (service)	Engineering Support <sup>20</sup>	3D models of the passive structures in support to the plasma control and diagnostics activities.	Q3	1	1	Yes (ITA)

It should be noted that IO (Fusion Science & Technology) has reviewed their strategy in the implementation of their programme. The modification in terms of priorities are reflected in the amended WP2009.

<sup>20</sup> The activity is coordinated by Plasma Engineering as it spans over multiple WBS (15, 16, 17 and 55)

**1.23. SAFETY**

Activities on ITER related R&D activities will continue in support of the ITER Preliminary Safety Report (RPrS). Activities are described in the table below.

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
N/A	G*	<i>Combined hydrogen and dust explosion model development and validation</i>	<i>Report on code development</i>	<i>Q4 (2008)</i>	<i>1</i>	<i>17 months</i>	<i>Yes (ITA)</i>
	P (service)	Be-air reaction rate characterisation	Final report on Be dust explosion experiments	Q1	1	2	Yes (ITA)
	G	Combined H <sub>2</sub> /dust explosion & mitigation experiments and computer code validation	Final report on H <sub>2</sub> /dust explosion/mitigation experiments and on computer code validation	Q4	2	1	Yes (ITA)
	G	In-vessel dust measurements and removal techniques assessment and validation	Report on diagnostic and removal techniques and on design of a prototype	Q3	1	2	Yes (ITA)
	P (service)	In vessel dust measurement and removal techniques validation	Design report for a validation mock-up	Q3	1	1	Yes (ITA)
	G	Metal waste detritiation, T out-gassing and measurement, and Be waste management	Report on detritiation, T outgassing, measurement methods and Be waste management	Q3	2	2	Yes (ITA)
	G	The ALARA application to Occupational Radiation Exposure based on ITER design evolution.	Report on ORE assessments	Q3	1	1	Yes (ITA)

P (service)	The ALARA application to Occupational Radiation Exposure based on ITER design evolution.	Report on ORE assessments	Q3	2	1	Yes (ITA)
G	Supporting safety analyses to follow up ITER design evolution and licensing process	Report on Supporting safety analyses	Q3	1	2	Yes (ITA)
P (service)	Supporting safety analyses to follow up ITER design evolution and licensing process	Revision of accident sequences, development and validation of computer codes	Q4	2	1	Yes (ITA)
G	Busbar arc model validation and supporting experiments	Report on busbar arc model validation	Q3	2	1	Yes (ITA)
P (service)	Engineering Support	Support to occupational exposure and safety analysis in support of ITER licensing	Q4	2	1	Yes (ITA)

#### 1.24. ENGINEERING SUPPORT

Activities listed here are in addition to the ones indicated in each of the previous areas and focus upon Engineering Analyses, Code and Standards and foresees the launch of contracts in support of the design of components and systems and their cost optimization.

The Codes and Standards activity is devoted to the tracking of international codes for analyses and design of mechanical and electrical systems, assess and follow up of notified body, inspection entities, etc.

### 1.24.1. Detailed Programme

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
N/A	P (service)	Thermo-hydraulic analyses: development of computer codes and their benchmarks for the analysis and assessment of the integrated system made by the superconducting magnets, thermal shield, cryostat, cryo-lines and refrigeration system.	Models, codes and reports	Q1	1	1	Yes (ITA)
	G	Thermo-hydraulic modeling: Analysis and assessment of the main cryogenic and water cooling system performances as well as their thermodynamic and hydraulic transients.	Codes and reports	Q1	1	1	Yes (ITA)
	P (service)	Neutronic analyses. Evaluation of radiation fields in tokamak complex, shielding capacity required, streaming through gaps, requirements for components qualification under ionizing radiation, evaluation of radiation doses for operators, etc	Models and reports	Q3	1	1	Yes (ITA)
	P (service)	Electromagnetic analyses: (i) Development of computer codes for the integrated electromagnetic and electromechanic analysis of plasma driven transients (e.g. plasma disruptions, VDEs and Halo currents).  (ii) Analysis of static and transient electromagnetic events in the basic tokamak machine as well as in the main tokamak building (e.g. stray field mapping).	Models and reports	Q3	1	1	Yes (ITA)
	G	Electromagnetic analyses: see above	Models and reports	Q2	1	1	Yes (ITA)

P (service)	Mechanical analyses: <ul style="list-style-type: none"> <li>Stress analysis of main machine components. Support to the analysis of alternative design options leading to cost and/or risk reduction is also foreseen. Also analysis and support to specific aspects of components manufacturing.</li> <li>Computational tools for the study and optimization of manufacturing processing</li> </ul>	Models and reports	Q3	1	1	Yes (ITA)
G	Mechanical analyses: see above	Models and reports	Q2	1	1	Yes (ITA)
P (service)	Structural design criteria for in-vessel components	Revision of the code	Q1	1	1	Yes (ITA)

**1.25. NUCLEAR DATA**

**1.25.1. Summary**

Activities will be mainly focused on the development of tools, improvements and update of Nuclear Data files mainly in support of TBM and Broader Approach (IFMIF) activities.

In addition nuclear data experiments for validation have to be implemented and measurement techniques developed.

**1.25.2. Detailed Programme**

Activities are described in the table below:

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
N/A	G*	<i>Development of tools, improvements of data and validation in support of ITER, TBM and DEMO activities</i>	<i>Reports of calculations and assessment of experimental data</i>	<i>Q4 (2008)</i>	<i>1</i>	<i>1</i>	<i>N</i>

G	<p>Nuclear Data improvements and development of tools:</p> <ul style="list-style-type: none"> <li>• Further development and upgrade of European Fusion File (EFF) and European Activation File (EAF) as a source of nuclear data.</li> <li>• Benchmarking of updated and extended nuclear data evaluations. Development and validation of advanced numerical methods and computational tools, mainly in the field of the co-variances and uncertainties.</li> </ul>	Updated libraries and software tools	Q4	2	2	N
G	<p>Nuclear Data experiments and measurement techniques:</p> <p>(i) Detailed evaluation and assessment of neutronic experiments on the TBM mock-ups as well as design and implementation of new experiments;</p> <p>(ii) Integral activation experiments covering materials relevant to TBM and IFMIF.</p>	Assessment and benchmarking reports	Q4	2	2	N

**1.26. Activities of Quality Assurance (QA) / Quality Control (QC) and Project Management**

A follow-up of activities at the supplier's premises is necessary to assure the correct execution of the contracts in compliance with the technical and management specifications and the contractual Quality Plans. Assistance to F4E is also requested to prepare such activities, including assessment and risk management for the procurements and advise in the definition of the inspection procedures.

This follow-up is achieved by sending qualified Inspectors from verifying bodies to the suppliers' premises (and their subcontractors) to follow and verify the progress of work on F4E's behalf.

The inspectors shall be the witnesses of F4E for the correct execution of the manufacturing sequences, manufacturing procedures, test methods, test performance and test reports during the production of the services and components.

They shall report on Quality, Production and Schedule to the F4E Technical Responsible Officer defined in the relevant contract.

For a proper preparation of the inspection procedures to be included into the manufacturing contracts and in order to be ready for the time when manufacture will start, a framework contract is planned to be launched in 2009.

A framework contract for supporting the ITER Department on project management matters is also planned to be launched in 2009. Professional support (1-2 ppy) on this topic from an



engineering company is required for specific tasks such as consultancy for the preparation of technical/management specifications and cost/risk estimates, in the definition of internal processes and in the management of the documentation.

WBS	G/P	Title	Deliverable	ToC	Prio	DoC (years)	Credit
n/a	P (service)	Service of Inspectors (Production and Quality Assurance) for the ITER project contracts follow-up.	follow-up reports	Q3	1	2	N
n/a	P (service)	Support on Project Management	Reports	Q3	1	2	N

**1.27. Contribution in Cash to CEA for ITER Site Support**

F4E has the obligation to contribute in cash to CEA for the reimbursement of certain cost incurred by CEA as the Host Organization by providing site support to the ITER Organization in accordance with the Annex on Site Support attached to the ITER Agreement. Following an agreement between the ITER Host Party (EURATOM), ITER Organization, Fusion for Energy and CEA, the site support activities to be initiated in 2009 shall include a construction of the office building JWS3 for 300 persons by exercising an existing option in the Site Preparation Arrangement signed between Euratom and CEA/AIF on 5 September 2007 and assigned by Euratom to Fusion for Energy on 13 May 2008. The maximum ceiling for the construction of JWS 3 shall be 6.8 M€ (including furniture). In addition the site support activities to be financed by F4E in 2009 shall include in particular fees to be paid to CEA for the use of some of the existing temporary buildings by the ITER Organization and reimbursement of the incurred cost of the furniture for the temporary office building JWS 2 in accordance with a special arrangement to be signed between CEA, the Commission and Fusion for Energy.

**1.28. Contribution in Cash to the ITER Organization**

This corresponds to the annual EU share of the 2010 contributions in cash to the ITER Organisation for its management, to be adopted during the next ITER Council.

**1.29. Contribution in Cash to Japan**

This cash contribution to Japan corresponds to the transfer of procurement responsibility from EURATOM to Japan under the supervision of the ITER Organisation.

**1.30. Experts for Technical Assistance to F4E**

F4E has launched a call for expressions of interest for individual experts to provide technical assistance in a number of specific areas related to ITER and the Broader Approach. Provision is included here for a total number of approximately 2800 days for experts in 2009.

**1.31. Urgent Activities in support of cost and risk assessment**

Some activities (corresponding to a total of about 10 ppy) are necessary to be carried out in the estimation of costs and in the assessment of risk during the course of the year. Such activities could be both grants and procurements under the 3.2 budget line.

## **BROADER APPROACH**

### **1.32. Introduction**

The European contributions to the Broader Approach Activities are financed to a large extent by contributions in kind from the following Members of F4E: France, Germany, Italy, Spain, Switzerland and Belgium. Where no contribution by these Members is foreseen, the contribution will have to be financed by the F4E budget.

For the contributions set out below to be provided by Members of F4E, Procurement Arrangements will be concluded in 2009 between F4E and the Japanese Implementing Agency, subject to the conclusion of corresponding back-to-back procurement arrangements between F4E and the Member concerned.

### **1.33. JT60SA**

#### **1.33.1. Overall Outlook**

The re-baselining activity of the JT60SA design is complete and has led to the preparation of the IDR (Integrated Design Report) which has been reviewed and found to be in accordance with its aims. The sharing, within the EU, for the contributions from the Voluntary Contributors has also been reviewed by the Contact Persons and is in its final stage with most long lead items agreed. The IDR was agreed by the BA Steering Committee in Dec 2008 and the procurement of some long lead items will follow after.

#### **1.33.2. Procurement Arrangements in 2009**

In accordance with the EU Project Execution Plan for the JT-60SA project, the following Procurement Arrangements are expected to be signed between F4E and JAEA for components under the responsibility of the EU.

- ◆ Toroidal Field Coils (Q3) including the delivery of 18 coils complete of conductor, windings, casings, and related structures. Back to Back Agreements will be signed with CEA (France) and ENEA (Italy) for the detailed design and the supply of most of the hardware. In accordance with the revised sharing within the EU, the Conductor for the coils will be provided by F4E (see below).
- ◆ TF Coils Test Facility and Testing (Q3). A PA will be signed for the scope of the testing of the TF Coils. In accordance with the revised sharing, the Test Facility will now be taken care of by France at the Cadarache site. Additional contributions to this effort will be from ENEA(Italy), SCK-CEN (Belgium) and possibly from CRPP (Switzerland).
- ◆ High Temperature Current Leads (Q3). This Procurement Arrangement will cover the delivery of all High temperature Current Leads for all superconducting coils, including the PF Coils. A Back to back Arrangement will be signed at the same time with FZK (Germany).
- ◆ Cryostat Base (Q3). This Procurement Arrangement will cover the supply of the lower part of the cryostat (needed early on in the assembly) and will be taken over by CIEMAT (Spain).
- ◆ Quench Protection Circuit (Q4). This activity will cover the supply of the coil protection discharge circuit needed for all TF and PF coils. This supply will be covered by a Back to back Agreement with Consorzio-RFX (Italy).

**1.33.3. Calls for Tender Expected to be launched in 2009 by F4E**

In accordance with the revised sharing agreed with the Voluntary Contributors F4E will now take over the supply of the TF Conductor while the originally foreseen effort on the TF Test Facility will be taken over by CEA. A total of 10ME are budgeted for this effort where its procurement is expected to start in 2009.

Scope	Indicative Number of Contracts	Type of Contract	Date to Launch Calls	Credits in kBAUA Total	Credits in kBAUA accrued in 2009
TF Coils Conductor SC and Copper Strands	1	Supply and Follow Up	Q2		
TF Coils Conductor Cabling and jacketing	1	Supply and Follow Up	Q2		
Total	2			14.75	0

**1.34. IFMIF**

**1.34.1. Overall outlook**

The sharing of activities amongst the Voluntary Contributors has been agreed by the Contact Persons at their last meeting in September. In 2009 most, if not all, the Procurement Arrangements, in which the IFMIF project activities are split, and the corresponding Agreements for collaboration with the Voluntary Contributors, are planned to be signed in order to provide a formal reference to the activities already being conducted in the delegated national agencies.

**1.34.2. Procurement arrangements in 2009**

- ◆ **Accelerator:** the decision to adopt a superconducting accelerating structure of the Half Wave Resonator type for the Drift Tube Linac, to be matched to the normal conducting RFQ by a Matching Section, has been taken by the Broader Approach Steering Committee at its May meeting this year. While the design activities of the other components of the accelerator have already been going on since the beginning of the BA Agreement, the adoption of the new type of structure, mainly due to technical advantages and the future potential reduction in the IFMIF operation costs, will probably determine some delay in the overall construction time of the accelerator. A revision of the time schedule presented in the Project Plan, which already looked rather optimistic, has been requested by the SC. The revised time schedule will be presented at the Project Committee in spring 2009. On the basis of the present advancement of the design of the different components of the accelerator, all the related Procurement Arrangements and Agreements for collaboration, with the exception of the PA concerning the Installation, Check out, Start-up & Commissioning of the accelerator, should be signed during 2009. The assembly of the Injector, which design is already well advanced, on the basis of an existing similar unit, will start during 2009.
- ◆ **Lithium Target:** the PAs covering the construction and operation of the Lithium Test Loop in Oarai, a model 1 to 3 scale of the IFMIF loop, and the Erosion-Corrosion tests of

flowing lithium on structural materials are ready to be signed. In case of an early signature of the PAs, construction of the loop will start during 2009 and the corrosion experiments in the Lifus 3 facility at Brasimone are planned to start before the end of 2008. All the other Procurement Arrangements and Agreements for collaboration concerning the Target Facility will be ready to be signed during 2009.

- ◆ **Test Facilities:** also in this case all the related Procurement Arrangements and Agreements for collaboration are under preparation and will be ready to be signed during 2009. The high flux test module rig (vertical European arrangement), which design is well advanced, will be manufactured and be ready for irradiation tests in a fission reactor. These tests will start either end of 2009 or beginning of 2010. Also planned, during the first half of 2009, are tests of the fission microchamber to measure the neutron flux.

### **1.34.3. Calls for Tender Expected to be launched in 2009 by F4E**

No calls for tender will be issued for IFMIF/EVEDA in 2009 by F4E.

#### *3.2.4 Cash contribution to the common expenses of the Project Team in 2009 by F4E*

The contribution foreseen for the common expenses of the IFMIF-EVEDA Project Team will cover the missions outside Japan of the EU members of the Project Team for a total credited amount of 0.18kBAUA in 2009.

## **1.35. IFERC**

### **1.35.1. Overall Outlook**

The activities regarding the construction of the IFERC buildings in Rokkasho will proceed under Procurement Arrangements for tasks performed by JA. The DEMO activities are restricted to coordination by the Project Team and R&D activities. In the EU, these will be performed by the Voluntary Contributors. The credits accrued in 2009 for these activities will be 7.88kBAUA. The Computer Simulation Centre activities will consist of preparatory work by the Special Working Group 1 created by the BA Steering Committee to select the suit of computer codes that will be used to benchmark the performance of the supercomputer, and preparatory work for the supercomputer procurement. No activities are foreseen for the Remote Experimentation Centre in 2009.

### **1.35.2. Procurement Arrangements in 2009**

The following Procurement Arrangements (and the correspondent Agreements for collaboration with the Voluntary Contributors) will be signed in 2009:

- Procurement Arrangement(s) for DEMO R&D activities in IFERC
- Procurement arrangement for the supply and maintenance of the supercomputer and related items for the IFERC project (CSC subproject)

### **1.35.3. Calls for Tender Expected to be launched in 2009 by F4E**

No calls for tender will be issued for IFERC by F4E in 2009

**ANNEX I**  
**TABLE OF ACRONYMS AND ABBREVIATIONS**

A/E	Architect Engineer
AGPS	Accelerator Power Supplies
ALARA	As Low As Reasonable Achievable
ANB	Authorized Notification Body
ANS	Analytical System
AVDEs	Asymmetric Vertical Displacement Event
ATS	Air Transfer System
BSM	Blanket Shield Module
BTP	Build-to-Print
C&I	Control and instrumentation
CFC	Carbon Fibre Composites
CMM	Cassette Multifunctional Mover
CVB	Cold Valve Boxes
CVD	Chemical Vapour Deposition
CXRS	Core Plasma Charge-Exchange Recombination Spectroscopy System
DA	Domestic Agency
DACS	Data Acquisition and Control System
DCLL	Dual Coolant Lithium Lead
DEMO	Demonstration Fusion Reactors
DGEBF	<i>Di-Glycidyl Ether of Bisphenol F</i> impregnation resin
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
F4E	Fusion for Energy
FS	Functional Specification
FW	First Wall
FWP	First Wall Panel
FZK	Forschungszentrum Karlsruhe
HAZOP	Hazard Operability studies
HCLL	Helium-Cooled Lithium-Lead
HCPB	Helium Cooled Pebble Bed
H&CD	Heating & Current Drive
HIP	Hot Iso-static Pressing
HNB	Heating Neutral Beam
HV	High Voltage
HVAC	Heating Ventilation & Air Conditioning
HVD	High Voltage Deck
HW	Hardware
IC	Ion Cyclotron
ICH	Ion Cyclotron Heating
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
IVT	Inner Vertical Target
IVVS	In-Vessel Viewing System
LFS-CTS	Low Field Side – Collective Thomson Scattering
MAR	Materials Assessment Report
MHB	Material Handbook
MHD	Magneto-HydroDynamics
MIG	Metal Inert Gas
MV	Medium Voltage
NB	Neutral Beam

NBI	Neutral Beam Injector
NBPS	Neutral Beam Power System
NBTF	Neutral Beam Test Facility
ODS	Oxide Dispersion Strengthened
P&ID	Process and Instrumentation Diagram
PA	Procurement Arrangement
PF	Poloidal Field
PFC	Plasma Facing Components
PFD	Process Flow Diagram
PIE	Post Irradiation Examination
PMU	Prototypical Mock-Up
PP	Procurement Package
PrSR	Preliminary Safety Report
PTC	Prototype Torus cryopump
Q <sub>1/2/3/4</sub>	Quarter
QA	Quality Assurance
R&D	Research & Development
RAFM	Reduced Activation Ferritic Martensitic
RF	Radio Frequency
RH	Remote Handling
RMP	Resonant Magnetic Perturbation
RNC	Radial Neutron Camera
RWM	Resistive Wall Mode Control
SDC	ITER SDC (Structural Design Criteria/Code)
SHPC	Safety and Health Protection Coordination
Sic-Dual	SiC/SiC composite material for electrical and thermal Insulation (for use in Dual Coolant Breeder Blankets)
SS	Steady State
SW	Software
TES	Test Extraction System
TF	Toroidal Field
TH	Thermal Hydraulical
UT	Ultrasonic
VS	Vertical Stability

VV	Vacuum Vessel
WAVS	Wide Angle Viewing System
WBS	Work Breakdown Structure
WDS	Water Detritiation System
WP	Work programme



**ANNEX II**  
**SUMMARY OF THE AVAILABLE BUDGETS FOR GRANTS**

	<b>WBS</b>	<b>CREDITED (in M€)</b>	<b>NOT CREDITED (in M€)</b>
1.1	Magnets	1.2	-
1.5	Vacuum Vessel	-	0.4
1.6	Blanket	2.2	-
1.7	Divertor	0.2	-
2.3	Remote Handling	0.4	-
3.1	Vacuum Pumping & Fuelling	0.3	0.1
3.2	Tritium Plant	0.5	-
3.4	Cryoplant	0.1	-
4.1/4.3	Power Supplies	-	-
4.5	CODAC	0.3	-
5.1	Ion Cyclotron	1.3	-
5.2	Electron Cyclotron	2.6	-
5.3	Neutral Beam System	8.4	-
5.5	Diagnostics	7.5	-
6.2	Buildings	-	0.1
	Material Development	-	1.7
	Test Blanket Module	-	1.1
	Plasma Engineering	1.7	-
	Safety	1.3	-
	Engineering Support	0.4	-
	Nuclear data	-	-
	Urgent Activities in support of cost and risk assessment	-	0.5

NB: The numbers shown in this table are the currently forecasted values. Modifications may occur within the budget limits.

### ANNEX III

#### ESSENTIAL SELECTION AND AWARD CRITERIA FOR PROPOSALS

As regards grant actions referred to in this work programme, the essential selection and award criteria, in accordance with Articles 165 and 166 of the Implementing Rules of the Financial Regulation, are:

##### **Essential Selection Criteria**

- The applicants' technical and operational capacity:  
  
professional, i.e. scientific and/or technological competencies, qualifications and relevant experience required to complete the action.
- The applicants' financial capacity :  
  
stable and sufficient sources of funding in order to maintain the activity throughout the action.

##### **Essential Award Criteria**

- Relevance and quality of the proposal with regard to the objectives and priorities set out in this work programme and in the relevant call for proposals.
- Efficiency of the implementation as well as of the management structure and procedures in relation to the proposed action.
- Budget and cost-effectiveness in particular with regard to the objectives and the respected results.

With regard to the specific action, more details will be provided in the call for proposals. Evaluation thresholds and weighting will also be given in the call for proposals.

A proposal which does not fulfil the conditions set out in the work programme or in the call for proposals shall not be selected. Such a proposal may be excluded from the evaluation procedure at any time.

The timetable and indicative amounts for the actions are defined in this Work Programme.

**ANNEX IV**  
**MAXIMUM REIMBURSEMENT RATES FOR GRANTS**

The upper limits for the reimbursement of eligible costs for grants are laid down in Article 153 of the Implementing Rules of the Financial Regulation of the Joint Undertaking and are summarised in the following table.

Research and technological development activities	40%
Demonstration activities	40%
Coordination and support actions	100%
Management, audit certificates and other specific activities	100%