Call for Participation

2011 Work Programme

INTEGRATED TOKAMAK MODELLING TASK FORCE

Deadline for Responses: 14 January 2011

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This Call for Participation aims to implement the Integrated Tokamak Modelling Work Programme for 2011 under Task Agreements as foreseen in the new EFDA Art. 5

Introduction

At its meeting in Dublin on 23 June 2010, the EFDA Steering Committee approved elements of the EFDA 2011 Work Programme, among which the Task Force on Integrated Tokamak Modelling programme (EFDA (10) 45/4.1.1, Annex IV). The ITM-TF Work Programme will be implemented within the Integrated Modelling Projects (IMPs), the ITER Scenario Modelling project (ISM) and the Infrastructure and Software Integration Project (ISIP), which is providing the technology backend and framework technology for the Task Force as a whole. IMPs have in their conception a dual responsibility, on one hand, developing and manifesting the physics foundations for Integrated Modelling in standalone packages targeting the code platform environment and on the other hand supporting the integration efforts towards scenario modelling tools. The latter have become more evident in the 2011 Work Programme.

This programme is implemented on the basis of the EFDA Art. 5 provisions. The tasks will be defined following the present Call for Participation. The outcome of the Call is assessed by the ITM-TF leadership and the EFDA-CSU and implemented under the Task Agreements, listed in table 1. Following the assessment, it may be required to revise the scope and resources for specific tasks. New tasks could be also introduced at this stage to properly implement the ITM Work Programme.

Table 1: Summary of Task Agreements proposed for 2011

Proposed Task Agreement for 2011	**Activity**
WP11-ITM-AMNS	Atomic, Molecular, Nuclear and Surface Physics Data (*Task under Task Force Leadership*)
WP11-ITM-EDRG	Experimentalists and Diagnosticians Resource Group (*Task under Task Force Leadership*)
WP11-ITM-IMP12	MHD equilibrium, stability and disruptions
WP11-ITM-IMP3	Transport Code and Discharge Evolution
WP11-ITM-IMP4	Transport Processes and Micro stability
WP11-ITM-IMP5	Heating, Current Drive and Fast Particle Physics
WP11-ITM-ISIP	Infrastructure and Software Integration Project
WP11-ITM-ISM	ITER scenario modelling
WP11-ITM-TFL	TF leadership

Programmatic Background

Project Leadership

The ITM-TF Project leadership runs on a two–year appointment schedule. The current project leaders will reach end of term December 31 2011.

Priority Support

The priority support is foreseen for well identified actions, including:

- **TF and project leadership (0.75 ppy for TF leader, 0.5 ppy for TF deputies, 0.25 ppy for project leaders and deputies)**
- **Tasks and activities considered to be on the critical path for ITM-TF to meet its mission, which are summarized in Table 2**

Table 2: Summary of Tasks under priority support for 2011

Proposed Task Agreement	Activities under Priority Support	Specific Tasks under Priority Support
WP11-ITM-AMNS	ACT1 partial ACT2	Coordination and contribution of AMNS data Further development, maintenance and documentation of modules to provide AMNS data to ITM-TF codes.
WP11-ITM-EDRG	ACT1 partial ACT2 ACT3 partial	Machine Descriptions, data mappings and experimental data Coordination of plasma control activities Integration of synthetic diagnostics
WP11-ITM-IMP12	ACT1 partial ACT2 partial ACT3 ACT4	Code integration / documentation Adaptation and integration of 3D MHD code and development of interpolation tools Verification and validation of IMP12 codes Exploitation of mature workflows: from equilibrium reconstruction to MHD stability analysis
WP11-ITM-IMP3	ACT1 partial ACT2 partial	Maintenance support for integration and verification of ETS / workflow development Core-edge ETS coupling
WP11-ITM-IMP4	ACT1 partial ACT2 partial	Cross-verification data analysis/report generation Interfacing with HPC-FF /CPO implementation/ interface with ITM database /validation

WP11-ITM-IMP5	ACT1 partial ACT2 ACT3 ACT4 ACT5 partial	Creation of Kepler actors / documentation / integration to workflows Integration of IMP5 modules in the ETS Benchmarking and validation of codes Development and integration of models for synergies between heating schemes and self-consistent coupling of IMP5 heating codes Fast particle Data Structure
WP11-ITM-ISIP	All (ACT1, ACT2, ACT3)	Support the users of the ITM platform Maintain and update the existing platform tools Identify missing functionalities in the platform and develop the required new functionalities
WP11-ITM-ISM	ACT1	Support to Validation of ETS

A feature since the implementation of the 2010 ITM-TF work programme is the focused use of coordinated joint activities as integral part of the activity. In particular, for activities falling under Priority Support a significant part of the work will be organised in working sessions and code camps. Attendance to the Code Camps planned for a Priority Support activity under a Physics Project is mandatory for the approval of Priority Support and the corresponding time duration should be accounted for in the committed manpower. Tentative Code Camp dates and duration are specified at the project level. Use of the mobility agreement is foreseen in support to the exchange of scientists between the involved Associations, covering the participation in code camps and attendance at the TF meetings.

Documentation

A critical issue for ITM aim of supplying a transparent and long-lasting solver is the documentation, which necessarily enters as an integral part of the ITM code release (see Appendix A Phase IV). Documentation is mandatory for participants under priority support, in particular ITM members involved in the creation of Kepler modules and their integration into workflows are expected to provide the following documentation:

> **I. An end-user operational manual describing how the code or suite of codes is coupled with the tested workflows. The manual should also describe in detail which entries of the relevant CPOs are effectively used, and describe how to operate possible code switches, if any.**

II. A physics description document targeting a non-specialist end-user audience. The description should highlight strength and weaknesses of the model, possible limitations and identify, whenever possible, future model extensions.

For 2011, a total ceiling of 35 ppy under Baseline Support and 700 kEuro under Priority Support for manpower is foreseen.

Main programmatic priorities of the 2011 ITM Work Programme

The ITM-TF has by now reached the capability of integrating modules building up physics workflows. The first demonstrated prototype workflow is the equilibrium reconstruction to MHD stability analysis chain; in 2011 its exploitation for the analysis of a significant set of experimental shots as well as further integration of additional microstability, fast-particle stability and neoclassical modules is envisaged. Integration of modules with the ETS is foreseen with the ambition of developing an integrated ITM tools workflow mimicking JET "chain 2". Furthermore current ramp up simulations and feedback control will be demonstrated as well as validation of turbulence predictions versus probe experimental data. These integration activities lead besides to the emergence of TF wide coordinated efforts.

The following activities proposed in 2011 Call for Participation are integral parts of ITM-TF wide milestones. Support of Associations to those Activities will contribute to the demonstration of ITM-TF tools capability and to the achievement of ITM-TF milestones. Associations are therefore encouraged to consider applying for the following coordinated activities as a whole, i.e. committing manpower for the complete set of tasks involved.

I. Exploitation of the equilibrium reconstruction to MHD stability analysis workflow
Activities involved:

WP11-ITM-EDRG-ACT1
WP11-ITM-IMP12-ACT4

Objectives:
Equilibrium workflow that is able to perform equilibrium reconstruction based on automatic access to the experimental data available from existing devices databases (on a significant set of shots provided by at least two experiments of relevance for the Associations) and perform standard linear MHD stability analysis and verification against existing stability analysis tools.

II. workflows coupling a fixed boundary equilibrium code, ETS, source modules and physics modules from several IMPs, aimed at plasma core simulations
Activities involved:

WP11-ITM-IMP12-ACT1
WP11-ITM-IMP3-ACT1
WP11-ITM-IMP4-ACT2
WP11-ITM-IMP5-ACT2
WP11-ITM-ISM-ACT1

Objectives:
Prototypes of transport code workflows including as a minimum a fixed boundary equilibrium module, a neoclassical transport module, a local core electromagnetic turbulence code providing anomalous transport coefficients, a number of source modules including existing heating and current drive codes (electron beam tracing "momentum conservation" models, state-of-art NBI, alpha heating and ICRH codes aiming at describe self-consistently wave+Fokker-Planck solver), a module for impurities treating density evolution of impurities. Subsets of the workflow should have passed a minimum set of benchmarking against existing transport codes with the same capability

III. prototype workflow coupling a free boundary equilibrium code with ETS
Activities involved:
WP11-ITM-IMP12-ACT1
WP11-ITM-IMP3-ACT1

Objectives:
Delivery of a prototype workflow coupling transport and free boundary equilibrium codes with at least open-loop verification to existing codes with the same capability

Relation to Experiments

Considering the maturity level of some of the ITM-TF modules and prototype workflows, in coordination with the official Contact Persons assigned to each device (see WP11-ITM-EDRG-ACT1), a roadmap for V&V activities to be carried out is anticipated. The provision of a representative shot testbed from the experimental devices engaged with the ITM-TF (see WP11-ITM-EDRG-ACT1), covering the needs of ITM projects, is therefore crucial for a favourable execution of the 2011 Work Programme. It is foreseen that the current working version (v4.08b) and upgrades of the data structures and planned installations of corresponding data mappings are sufficient.

In particular the ITM-TF seeks partnership with at least two experimental devices for the exploitation of the prototype MHD equilibrium and stability chain (see workflow I detailed in the above section. The exploitation and concomitant production runs foreseen during 2011 will be performed on the ITM Gateway). Coordination with JET is dealt jointly with the TFL.

Implementation

All software development is expected to be implemented on the ITM-TF Gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM projects that adhered to.

Intellectual Property Rights Monitoring

IPR is managed according to the Gateway User Agreement.
A Right of access form (October 2009 version attached) is required for all codes being contributed. For any given code, this document states the current list of contributors, the code's ITM-TF Responsible Officer and technical reference(s) that should be used in publications involving the code.

Appendix A: ITM modules release cycle

Phase I (initial porting)

(A) porting to the ITM Gateway (runs on ITM Gateway, compilers, libraries, etc.)
(B) completion of "grant of software license and rights to the ITM-TF" procedure
(C) creation of a project under GForge and code under subversion (on the ITM Gateway or mirrored there)

Phase II (preparation of stand-alone module)

(D) conversion into a module using CPOs
(E) conversion of code specific input to XML
(F) creation of standalone wrapper for testing ("test bed")
(G) provision of standard test cases
(H) standardized build procedure (make)
(I) standardized test procedure

Phase III (preparation of Kepler actor)

(J) creation of a Kepler actor
(K) creation of a Kepler test workflow
(L) benchmark of Kepler module against original version of code
(M) verification of Kepler module (code-code benchmarks)

Phase IV (documentation)

(N) code documentation (for developers and maintainers)
(O) user documentation (for users)

Phase V (release candidate)

(P) validation by module author/responsible officer
(Q) release candidate for Kepler module (approved by Project Leader)

Phase VI (release)

(R) validation by IMP

(S) release of Kepler module (approved by Task Force leader)

1. AMNS:

Task Agreement WP11-ITM-AMNS:

Atomic, Molecular, Nuclear and Surface Physics Data (Task under Task Force Leadership)

1.1 Introduction

Contact Person: David Coster, David.Coster@ipp.mpg.de

The atomic, molecular, nuclear and surface data (AMNS) activities have the following scope:

- **Coordination of the work in the four different sub areas (Atomic, Molecular, Nuclear and Surface).**
- **Supply of data not presently residing in easily accessible databases.**
- **Identify any Intellectual Property Rights (IPR) protection needs in view of a broader collaboration with ITER partners.**
- **Provide software for delivery of AMNS data to ITM-TF code**

The AMNS data should include:	
Atomic Physics data	• Rate coefficients and cross sections for ionization, recombination, charge exchange, electron cooling etc. for elements: H, D, T, He, Be, C, O, N, Ne, Ar, Mo, Ni, Li, Si, B • Line radiation • Bundled charge state descriptions
Molecular Physics data	• H2, D2, T2, HD, HT, DT • Cw Hx Dy Tz
Surface data	• Sputtering/Reflection coefficients • Chemical sputtering • Mixed materials effects
Nuclear data	• Nuclear reactions for: D-D, D-T • Cross sections for diagnostics

All AMNS data to used by the ITM-TF should bind to the following conditions: version control; accurate provenance and approval by experts when used for "production runs"; communication to ITM-TF codes via a standardised interfaces. The work on providing the AMNS data can be split into two parts:

1. **contact with different databases, including recommendation of the best data to be used/stamp of approval, and transfer of appropriate data to the ITM-TF data repository;**

2. **development of modules that take AMNS data from the ITM-TF data repository and provide them in a standardized form to ITM-TF codes.**

The activities in 2011 aim in particular at the consolidation of the ITM AMNS database with more elements (Carbon was the first goal), the integration of Nuclear data (coordination is needed to promote both the datastructure and interfacing modules) and the extension of the existing modules for devolving AMNS data to the ITM database via the AMNS CPO, e.g. finalizing the C++ wrapper.

1.2 Objectives

The purpose is to provide the ITM-TF as a whole with up-to-date Atomic, Molecular, Nuclear and Surface (AMNS) data. Delivery of the data to codes is made by ITM developed standardised modules, where traceability (including provenance) of the data is ensured.

1.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-AMNS-ACT1

Coordination and contribution of AMNS data

Description
Two categories of people are called for this activity.
The coordinators should:

- **ensure that appropriate data are transferred from existing data bases to the ITM-TF data repository, if necessary, should contact researchers who have access to such data and ensure that the ITM-TF is allowed access to them.**
- **notify concerned parties in the ITM-TF when an update of the ITM-TF database is necessary or has been effectuated.**
- **Identify database applicability ranges in parameter domain**
- **identify any Intellectual Property Rights (IPR) protection issues associated with the data used by the ITM-TF.**

Researchers who have access to data of interest to the ITM-TF not residing in easily accessible databases, such as private ones, are invited to contribute towards the building up of the ITM-TF data base of AMNS data. Contributors should supply the data in a form suggested by the coordinator of the area and provide adequate information on their provenance and accuracy.

Implementation Method:

Priority and Baseline support

Requested manpower/skills:

Experts in the areas of Atomic, Molecular, Nuclear and Surface physics are requested to respond.

The coordination activity is expected to require up to 3 pm for each area and these will fall under priority support, a total of 12pm is requested. The coordinator will report to the ITM leadership.
Data contributors are expected to spend at least a 1 pm on database delivery and their participation to code camps (up to 2 weeks) is sought.

By reply to this call, please indicate a willingness to take the coordinating responsibility for one of the areas.

Existing Commitments: In 2010 the ITM data structure Atomic data was finalised; a module taking Carbon data from the ADAS database and write them to the and ITM AMNS database via the data structure was devolved (more elements are in the pipeline); and a first version modules for reading AMNS data from the ITM database and deliver them to ITM codes were written. In 2011 it is important to consolidate the advances made, including comprehensive documentation of the developed elements, and to extend the work to the areas not yet covered. Renewal of commitments made in 2010 is encouraged.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Report	01/01/11	31/12/11	Documentation of data transfers to the ITM-TF, including software used for this purpose, and other activities carried out for the task.	Transport modelling in IMP#3 and NBI modelling in IMP#5 needs AMNS data.
Documentation	01/01/11	31/12/11	Documentation of modules used for taking data from external databases and to store them in the ITM database via the AMNS data structure.	Transport modelling in IMP#3 and NBI modelling in IMP#5 needs AMNS data

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Feb/Mar 2011	2 weeks	Integration of data and modules for data delivery for Atomic and Nuclear data with the ETS and IMP5 codes
Code Camp	May 2011	2 weeks	Integration of data and modules for data delivery for Atomic, Molecular and Surface data with the IMP3 Edge Codes
Code Camp	Oct. 2011	2 weeks	Integration of data and modules for data delivery for Atomic, Molecular and Surface data with the IMP3 Edge Codes

External connections / requirements

Requires connections and cooperation with external AMNS data bases (ADAS, HYDKIN etc.)

WP11-ITM-AMNS-ACT2

Further development, maintenance and documentation of modules to provide AMNS data to ITM-TF codes

Description
Standardised modules delivering AMNS data in a standardised form to ITM codes have been developed in Fortran90. They are now able to take data from an ITM database via the AMNS CPO. The existing modules are written in F90 and work on a C++ wrapper has started. This work needs to be completed, including the documentation.
Developed modules need to be updated as more AMNS data are put into the ITM database. Extensions to other programming languages supported by the ITM are also needed.

Implementation Method:

Priority Support

Requested manpower/skills:

Software/code developers, ideally with an ability to work with codes in different languages, are required. Some knowledge of AMNS data would be an advantage. The work is foreseen to be supported by priority support of 4pm during 2011.Participation to Code Camps is required (up to four weeks).

Existing Commitments: The work got off to a good start in 2010. It is necessary to consolidate and expand on the advances made. For this reason renewal of commitments made in 2010 is very much encouraged.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Updates of for F90 modules	01/01/11	31/12/11	Update and adaptation, to new data, of modules in F90 for delivering AMNS data using ITM data structures to retrieve data from the ITM database.	Transport modelling in IMP3 and NBI modelling in IMP5 needs AMNS data.
Update of C++ wrapper and development of modules for other languages supported	01/01/11	31/12/11	Adaptation of C++ wrapper to changes in the F90 modules; development of modules/wrappers for other supported programming	Transport modelling in IMP3 and NBI modelling in IMP5 needs

by ITM			languages.	AMNS data.
Documentation	01/01/11	31/12/11	Report documentation of the Fortran 90, C++ and other modules mentioned above.	Transport modelling in IMP3 and NBI modelling in IMP5 needs AMNS data.

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Feb/Mar 2011	1-2 weeks	Modules for Atomic and Nuclear data
Code Camp	May 2011	1-2 weeks	Modules for Atomic, Molecular and Surface data
Code Camp	Oct. 2011	1-2 weeks	Aiding the implementation of modules for Atomic, Molecular and Surface data in IMP3 codes.

External connections / requirements

Requires cooperation with external data providers.

JET related activities

not relevant

Resources

The Implementation of the AMNS work programme for 2011 is estimated to require a minimum of 0.5 Ppy under Baseline support and a minimum of 1.3 Ppy under Priority Support in order to be able to provide a minimum level of project fulfillment of the deliverables and milestones.

1.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

- **Rate coefficients and cross sections for ionization, recombination, charge exchange, electron cooling etc. for elements: H, D, T, He, Be, C, O, N, Ne, Ar, Mo, Ni, Li, Si, B accessible from the ITM repository with standardised interfaces**
- **Molecular Physics data for H2, D2, T2, HD, HT, DT accessible from the ITM repository**
- **Sputtering/Reflection coefficients of quality equivalent to Eckstein TRIM data accessible from the ITM repository**
- **Nuclear reaction rates for D-D and D-T accessible from the ITM repository**

Deliverables:

described at activity level

2. EDRG:

Task Agreement WP11-ITM-EDRG:

Experimentalists and Diagnosticians Resource Group (Task under Task Force Leadership)

2.1 Introduction

Contact Person: Rui Coelho, rui.coelho@ipfn.ist.utl.pt

The validation and consolidation of the simulation tools that the ITM-TF aims to provide for ITER and existing experiments requires a strong interaction with the experimentalists and diagnosticians fusion community. The former are promoted and coordinated by the Experimentalist and Diagnosticians Resource Group (EDRG). Acting as a contact point within the ITM towards the full range of experiments and some of the EFDA Topical Groups and Working Group initiatives, the EDRG group promotes the provision of a machine independent approach to modelling, to encompass realistic operational conditions and to facilitate verification and validation of the modelling codes. EDRG main action comprises the development of a comprehensive set of Machine Descriptions (MD) and Data Mappings (DM) to access both experimental and simulation databases, the coordination of the overall plasma control activities to be carried on within the ITM-TF in liaison with other EFDA initiatives and the development and integration of synthetic diagnostic modules, covering as broad range of European fusion devices as possible.

Activities in 2011, in line with the EFDA 2011 Work Programme, will address the consolidation of the Machine Description and Data Mappings and the provision of experimental data for representative scenarios for at least two devices.

This is crucial for the validation of the mature ITM modules that are now emerging from applicability domains other than equilibrium reconstruction, e.g. MHD stability analysis, ETS with H&CD sources.

Additionally, EDRG activities will also focus on the deployment of a 3D visualization/defeaturing (automatic rasterization of the wall domain to reduce overall complexity, eliminating e.g. screws, slits between tiles from the original drawing) tool for the full vessel domain and interfacing with the grid CPO, development of new diagnostic CPOs on request by IMPs and integration of forward model based synthetic diagnostics. The integration and testing of the 3D synthetic reflectometer effort led by the ERCC group will also be pursued.

2.2 Objectives

2.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-EDRG-ACT1

Machine Descriptions, data mappings and experimental data

Description

- **Maintenance and support on the Machine Descriptions and Data Mapping for each of the participating devices.**
- **Consolidation of H&CD elements, 2D vessel qualifying for discontinuous elements, pfsystems CPO and upcoming diagnostic CPOs (Strike point, Bremsstrahlung, LIDAR, neutral particle analyser, X-ray, fusion product and electrostatic probe diagnostics are requested).**
- **Support team to assist all V&V activities in the ITM-TF by delivering Data Mappings of "testbed" shots (coherent and reasonably complete set of plasma profiles of representative scenarios). Priority will be given to devices that already have well consolidated MD and DM.**
- **Coordination of the local support to the verification and validation (V&V) activities agreed with the ITM Leadership to be carried on the experimental data of the affiliated laboratory, in collaboration with the relevant IMPs of ITM.**
- **Local installation at the Gateway of a numerical tool for the visualization and defeaturing (rasterization) option of the full domain vessel surface from CAD construction drawings.**
- **Whole device wall surface mesh for representative tokamak devices (e.g. JET, AUG) with different physics requirements (gas-tight vs ports).**
- **Requirement analysis and first trials of adaptation of the 3D wall mesh to the GRID-CPO framework.**

Implementation Method:

Baseline and Priority Support

Requested manpower/skills:

- **Experimentalists from each of the participating experiments are requested. Estimated 1.5pm per device (6pm) for Machine Descriptions and Data Mapping maintenance.**
- **For the support team providing the Data Mapping for the "testbed", experimentalists with experience in data validation are requested 1pm commitment per device is required. Minimal estimated manpower required amounts to 0.25 ppy under PS**
- **For the coordination of the overall effort and V&V roadmap agreement, a high level representative of the associated laboratory is called for (0.25 pm per device)**
- **Experts on 3D visualization tools (QT, VTK,…) for development of UI for reading tool; installation CAD file post-processing; experts on ITM-TF Data Structure. In 2011, this effort will be carried out under baseline support with a minimal estimated manpower required amounts to 0.75 ppy.**

Existing Commitments:

- **Representatives from TS, AUG, MAST, FTU committed during 2010. Renewal of commitments is expected.**

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
MD maintenance	01/01/11	31/12/11	Provide validated MD file for current and future ITM datastructure versions	Incomplete MD implies limited exploitation of ITM-TF tools
DM maintenance	01/01/11	31/12/11	Provide validated DM file for current version and future ITM datastructure versions	Incomplete DM implies limited exploitation of ITM-TF tools
DM for testbed data	01/03/11	31/03/11	Provide DM files for best fit data of plasma profiles to be used in test bed shot selection.	All V&V activities in ITM-TF are impacted.
V&V roadmap	01/01/11	28/02/11	Report on V&V activities roadmap and support staff allocation.	IMP12-ACT3, IMP3-ACT1,2, IMP5-ACT3
Numerical tool	01/01/11	31/07/11	Development/installation of numerical tool for visualization/defeaturing	
Defeatured meshes	01/08/11	31/09/11	Defeatured meshes of pending type for some devices.	IMP3-ACT2
GRID CPO	01/10/11	31/12/11	Trials on mesh adaption to GRID-CPO structure	

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Working Session with ISIP-ACT2-T11	not decided yet	0.3 week	Roadmap assessment for QT/VTK integration of reading/defeaturing tool.

External connections / requirements

- **The ITM-TF activities on V&V targeting JET will require support staff to assist ITM-TF effort namely on the provision of validated experimental shot data building up a**

representative "testbed". Collaboration from ITER to provide an official machine description file is also encouraged in liaison with ISM activities.

- **Drawing offices from participating experiments to provide CAD files and collaborate on the validation of defeatured meshes.**

WP11-ITM-EDRG-ACT2

Coordination of plasma control activities

Description

Coordinate and stimulate the activities related to control within the ITM:,

- **Feedback plasma position&shape control using free-boundary equilibrium codes**
- **Extension to MHD plasma control**
- **Kepler workflow development for the plasma control use cases building on the SCICOS based Control toolbox and Simulink integration via RT Workshop/C++ wrappers.**
- **Paving layout for prospective PCS layout**

Provide an external connection to other EFDA related control activities and promote/coordinate the collaborative effort.

Implementation Method:

Priority Support

Requested manpower/skills:

Experts in plasma position/shape and MHD feedback control and in modelling of plasma evolution are requested (3pm).

Existing Commitments: Continued task from 2010 where 0.33ppy were allocated.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Report	1/07/11	21/07/11	Preliminary Progress Report on overall IMP activities + external connection + WS/code camp.	IMP12-ACT1, ISIP-ACT2-T10, IMP3-ACT1
Report	15/11/11	30/11/11	Final report on control activities	

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**

WS+Code Camp	July2011	1 week	Mid-term assessment of control activities status and roadmap evaluation. Stimulate contributions from WG and control experts.

External connections / requirements

Evident synergies with EFDA Feedback Control WG and MHD-TG to integrate new control schemas and thus enrich the ITM-TF tool set that will be in use in Associations. Assistance from control experts in supporting the control dedicated ITM-TF tasks is essential.

WP11-ITM-EDRG-ACT3

Synthetic diagnostics integration

Description

Synthetic diagnostics play a crucial role in the validation of tokamak modelling codes. The ITM has identified both a 3D synthetic reflectometer suite and other general efforts building on forward modelling. There are therefore two activity lines

- **Forward modelling integration**

    1. **Integration on the ITM platform of appropriate synthetic diagnostics based on the forward modelling concept (neutron spectrometer and cameras) and conclude ongoing efforts (MSE).**

- **Synthetic 3D reflectometer**

    1. **Optimization of the finite difference time domain (FDTD) kernel, potentially including 4th order E & H solvers and 4th order J-solver.**
    2. **Parallelization of the kernel module using ITM hardware configurations.**
    3. **Implementation of ITM turbulence CPO input.**
    4. **Deployment of post-processor tool-box.**
    5. **Code benchmarking studies on present tokamaks.**

Implementation Method:

Baseline and Priority Support

Requested manpower/skills:

- **Expert modellers of diagnostics to integrate synthetic diagnostic (2pm per diagnostic). A minimal of 0.4ppy of Priority support is foreseen.**

- **The 3D full-wave reflectometry simulation code requires microwave reflectometry modellers and computer scientists specialized in parallel programming (1.4 ppy) but the task can be split up between different individuals to cover the necessary areas of expertise and deliverables. Priority support amounting to 1.0 ppy will be allocated to sub-activities 1,2,3. Sub-activities 4 and 5 will be carried out under Baseline Support.**

- **Participation at Working Session dedicated to synthetic diagnostics is mandatory.**
- **Participation at Code Camps, including discussions on 3-D reflectometer, is mandatory.**

Existing Commitments:

- **0.08ppy of BS for synthetic MSE requirement analysis.**
- **The 3D full-wave reflectometry simulation is continued from 2010 where 1.45ppy was allocated.**

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
	01/01/11	31/12/11	Integration of synthetic diagnostic modules, driven by IMP needs	
	01/01/11	31/12/11	Kernel optimization	
	01/01/11	31/12/11	Parallelization on Gateway	
	01/01/11	31/12/11	Turbulence CPO integration and testing	
	01/01/11	31/12/11	Post-processor toolbox	
	01/01/11	31/12/11	Code Benchmarking	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Oct. 2011	1 week	Progress and roadmap assessment, cross-project outreach on the code evaluation and testing.

Working Session	not decided yet	0.5 week	Open forum to promote adaptation/integration of synthetic diagnostics from outside the ITM.

External connections / requirements

- **Evident synergies should be promoted between the Data Analysis and Calibration Techniques WG (auspices of the Diagnostic TG, see task WP10-DIA-05-01 and WP11-DIA) and the ITM-TF regarding the synthetic diagnostics integration.**

JET related activities

The EDRG group has direct interfacing with all fusion experiments engaged with the ITM-TF effort, assisted by a task assigned to Contact Persons. Coordination with JET is dealt at the TFL level with input from the several IMPs. Considering the level of maturity reached by a significant number of physics modules, on some cases in TF wide efforts, a special emphasis on high-quality validated experimental plasma profile data of representative scenarios ("testbed" shot database) is given in 2011.

Resources

The Implementation of the EDRG work programme for 2011 is estimated to require a minimum of 2.3 Ppy under Baseline support and a minimum of 1.9 Ppy under Priority Support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones

2.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

- **Consolidate the machine descriptions, data mappings and experimental data from the tokamak devices engaged in the ITM-TF modelling activities.**

Deliverables:

described at activity level

3. IMP12:

Task Agreement WP11-ITM-IMP12:

Equilibrium, MHD and disruptions

3.1 Introduction

Project leadership 2011:

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This IMP12 project aims at providing a comprehensive ITER relevant modelling capability covering essential areas in an MHD simulation chain starting from equilibrium reconstruction and advancing towards linear and non-linear MHD stability and plasma disruptions. The provision of free boundary equilibrium modules with added feedback control schemes is also targeted in view of the coupling to the ETS and application to further development for VDE/disruption capability, paving the path to a robust discharge simulator. Owing to different levels of maturity in the code integration effort within the IMP12 domain, the action plan for 2011 will focus on the following activities :

- **Workflow Integration, Support and Maintenance of mature codes. Such effort clearly aims at assisting the cross-project interoperability involving IMP12 codes and leading up to devising jointly high level workflows. Both physics basis and workflow integration documentation is mandatory to pave the way to a future public release of the modules.**
- **Development and Integration of standalone modules. This activity accommodates all IMP12 relevant modules that are entering the adaptation/integration stage and encompasses among others, 3D equilibrium codes, equilibrium solvers with plasma flow, RWMs, ELMs, error field modes,"ab initio" MHD codes (2D or 3D) and consolidation of the ITM toolbox. It also applies to upgrades/extensions on the physics of existing modules such as the sawtooth and NTM module.**
- **Verification and Validation, targeting certain "mature" codes, already at the integration stage, employing Kepler workflows, e.g. equilibrium reconstruction and cross-benchmarking of linear MHD stability codes.**
- **Exploitation of mature workflows: equilibrium reconstruction to stability analysis. This activity is a first step towards the future deployment of the first set of ITM tools for assisting the Work Programme related activities ongoing at the Associations.**

Note: for the purpose of this Call for Participation, a code is considered as "mature" if a tested Kepler actor has been made available, that is, the code has passed phase III.K of the code release cycle given in Appendix A.

3.2 Objectives

3.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-IMP12-ACT1

Integration, support and maintenance

Description

Scope and tasks

This action concerns all the IMP12 codes, modules or packages at a mature stage. As a minimum, a working Kepler actor (or a suite of Kepler actors) must have been made available during WP10, i.e. corresponding to Phase III (K) of the release cycle (see Appendix A).

Scope of this action is integration of IMP12 modules and support for code integration in selected workflows, in conjunction with other IMPs. This activity is under priority support. Upon reception of the response to this Call for Participation, this activity will be divided in subtasks defining the role of each participant code.

This action also covers continued maintenance of mature IMP12 codes under baseline support.

As a guideline, it is foreseen that IMP12 codes under this action will participate in the construction of the following workflows:

- **A workflow coupling ETS, a fixed boundary equilibrium code, and physics modules from several IMPs, aimed at plasma core simulations (see TF wide coordinated effort II).**
- **A prototype workflow coupling the ETS with a free boundary equilibrium code (see TF wide coordinated effort III).**
- **A prototype workflow coupling a free boundary equilibrium code with a feedback controller.**

Qualifying codes

Qualifying codes are of the following type:

- **Equilibrium reconstruction codes**
- **High resolution fixed-boundary equilibrium codes**
- **Free-boundary equilibrium codes.**
- **MHD stability codes**
- **Sawtooth module suite of codes**
- **NTM module suite of codes**
- **Complementary tools, like profile generators and other workflow initialisers.**

As a reference, a non-exclusive list of codes targeted for this action is: EQUAL, FIXFREE, HELENA, CHEASE, CAXE, ILSA, KINX, PROGEN, CEDRES++, the sawtooth module, the NTM module.

Mandatory documentation

Participants under priority support are expected to provide the code and user documentation, as an integral part of the code release (see Appendix A Phase IV):

Implementation Method:

Baseline Support and Priority Support

Requested manpower/skills:

Specialists in equilibrium and MHD codes and models .Total estimated priority support for this action is 3 ppy. Baseline support for code maintenance is 1 ppy.

Existing Commitments: Codes qualifying for this action are issued from WP10 under IMP12 actions ACT1, ACT2, ACT3, ACT7, ACT10.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Code integration	1/1/2011	31/12/2011	Integration of participant code in selected workflows (see TF wide coordinated effort II-IV)	Work to be carried out in coordination with IMP3 and ISIP
Code documentation	1/1/2011	31/12/2011	Code documentation (Phase IV (N))	
Physics description document	1/1/2011	31/12/2011	physics description document of code (Phase IV (O))	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Feb/Mar 2011	1-2 weeks	Progress in workflow construction
Code Camp	July 2011	1-2 weeks	Progress in workflow construction
Code Camp	Nov/Dec 2011	1-2 weeks	Finalisation of workflow

WP11-ITM-IMP12-ACT2

Adaptation of IMP12 modules and standalone packages

Description

Scope

This action concerns the adaptation up to the stage of tested Kepler actor (phase III(K) of release cycle, see Appendix A) of all the IMP12 codes, modules or packages still at a development stage. In most cases, it involves continuation of WP10 work. It may include newly proposed work matching the TF remit.

This action is under baseline support except the special cases listed below.

Qualifying codes
Qualifying codes are of the following type:

- **Conventional equilibrium and MHD stability codes of interest to IMP12 and not yet integrated in the ITM platform.**
- **3D equilibrium codes.**
- **Equilibrium solvers with plasma flow.**
- **Modules for MHD processes RWMs, ELMs, error field modes,...**
- **"Ab initio" MHD codes (2D or 3D).**
- **ITM toolbox.**

As a reference, a non-exclusive list of codes targeted for this action, is: EQUINOX, CREATE-NL, CLISTE, FLOW, ANIMEC, CARMA for RWMs, the MEdC code for RWMs, the ELM module, the module for error field modes, JOREK, a 2D MHD code, CARIDDI, the ITM utility library (ITM toolbox).

Possibility of Priority Support
3D MHD codes and development of certain ITM tools could be assigned as priority support tasks.
3D MHD codes and the development of routines for the ITM toolbox may eligible for priority support. After a review of the responses to this call, priority support may be awarded to the most urgent tasks.

Implementation Method:

Baseline Support and Priority Support

Requested manpower/skills:

Specialists in MHD numerical models and codes. Total baseline support for this action is 5 ppy. Up to 0.5 ppy under priority support can be assigned to certain tasks. Participation to Code Camps (see General Introduction Table) is encouraged if support for the adaptation is needed and required when the participant code has reached phase III(J)

Existing Commitments: Codes qualifying for this action are issued from WP10 under IMP12 actions ACT4, ACT6, ACT8, ACT9, ACT11, ACT12, ACT13, ACT14 and ACT15.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Porting to the Gateway	1/1/2011	31/12/2011	Porting of code to the ITM Gateway. Test runs and report	
Adaptation to	1/1/2011	31/12/2011	Adaptation of code to ITM standard,	

ITM format			with use of relevant CPOs, in standalone form. Test runs and report.	
Kepler actor	1/1/2011	31/12/2011	Generation of Kepler actor of code. Tests on the ITM platform and report.	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Feb/Mar 2011	1-2 weeks	Support to the adaptation of code to ITM standards
Code Camp	July 2011	1-2 weeks	Support to the generation of Kepler actor and test in simple workflow

WP11-ITM-IMP12-ACT3

Verification and validation of IMP12 codes

Description

Scope and tasks

Verification and validation (V&V) is an essential part of the ITM TF code release cycle. This action targets IMP12 codes qualifying for Phase III (K) (see Appendix A), to carry out V&V on the ITM platform, employing Kepler workflows. This is a cross-project action targeting code developers as well as experimentalists to cooperate in the validation work.
The following are minimal objectives for WP11, although contribution to code validation is sought for all IMP12 codes qualifying for Phase III (K).

- **Continued validation of the EQUAL equilibrium reconstruction code on JET data.**
- **Verification of equilibrium and MHD stability codes by code-code comparison within the equilibrium and stability chain and assessment of code inter-operability**

Implementation Method:

Priority Support

Requested manpower/skills:

Specialists of equilibrium and stability codes. Experimentalists in the relevant diagnostics for code validation. The total estimated manpower for this action is 1 ppy under priority support. Participation to ITM Code Camps (see General Introduction Table)is encouraged if support is needed from other projects .

Existing Commitments: Validation of EQUAL is an ongoing activity (WP10-IMP12-ACT5). Cross verification of equilibrium and stability codes is a new activity.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
validation of EQUAL code	1/1/2011	31/12/2011	Validation of code EQUAL on JET data. Report on validation conforming to the ITM validation procedure.	EDRG-ACT1
cross verification of codes belonging to the equilibrium and MHD stability chain	1/1/2011	31/12/2011	Report on benchmarking exercises: cross verification of the triplet of high resolution equilibrium codes (HELENA, CHEASE, CAXE), and cross verification of the (ILSA, KINX) pair of stability codes, by code replacement in the Kepler equilibrium and stability chain.	EDRG-ACT1

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Feb/Mar 2011	1-2 weeks	Support to the adaptation of code to ITM standards
Code Camp	July 2011	1-2weeks	Support to the generation of Kepler actor and test in simple workflow

External connections / requirements

Validation of EQUAL requires access to JET data. Code validation will require contribution from experimentalists in the relevant diagnostics.

WP11-ITM-IMP12-ACT4

Exploitation of mature workflows: from equilibrium reconstruction to MHD stability analysis

Description

Scope and tasks

The aim of this action is the exploitation of the extended chain of equilibrium reconstruction to MHD stability analysis on data from selected experiments for which machine descriptions, data mappings and a suitable shot range is made available (EDRG-ACT1,2).

Specifically, the TF seeks a partnership with one or more Associations (providing suitable manpower) to adapt, when necessary, and to exploit the equilibrium reconstruction and stability chain to carry out an extensive MHD analysis of a significant set of shots, of high relevance for the Association work programme.

Computational Platform

In WP11 this work will be carried our on the ITM-TF Gateway. However, the participating Association should consider this action as a multi-year activity. In the longer term,

deployment of this workflow in the participating Associations is foreseeable.

Implementation Method:

Priority Support

Requested manpower/skills:

Experimentalists and modellers with knowledge of MHD analysis. The total estimated manpower for this task is 1.5 ppy under priority support. Participation to ITM Code Camps(see General Introduction Table) is encouraged if support is needed from other projects.

Existing Commitments: This is a new activity built on the prototype TF workflow developed in WP10.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Adaptation	28/2/2011	30/4/2011	Equilibrium reconstruction, MHD chain stability chain and public ITM database of relevant shots of device.	EDRG-ACT1, ISIP
Exploitation	1/4/2011	31/12/2011	MHD analysis of the selected data base. Report on study.	

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	July 2011	1-2 weeks	Support to the adaptation of the MHD reconstruction and stability chain to the specific machine

External connections / requirements

Requires access to data from JET and at least another experiment. Possible relation with JET WP and the MHD-TG WP.

JET related activities

described at activity level

Resources

The Implementation of the IMP12 work programme for 2011 is estimated to require a minimum of 6 ppy under Baseline support and a minimum of 6 ppy under Priority Support for the fulfilment of the stated deliverables and milestones.

3.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

- **Availability of a comprehensive set of equilibrium, linear and non-linear MHD stability modelling tools, combined into a chain capable to reconstruct the plasma equilibrium and to analyse the MHD stability.**
- **Availability of a consistent free boundary equilibrium evolution, as required for a full discharge simulator, including plasma transport, feedback control and plasma disruption modelling and prediction.**

Deliverables:

described at activity level

4. IMP3:

Task Agreement WP11-ITM-IMP3:

Transport Code and Discharge Evolution

4.1 Introduction

Project leadership 2011:

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Integrated Modelling Project #3 on "Transport Code and Discharge Evolution" plays a central role in the Integrated Tokamak Modelling Task Force (ITM-TF): virtually all the other modelling projects will need information on the plasma state (densities, temperatures etc.) simulated by IMP3 modules; at the same time the calculation of these quantities is strongly dependent on input from IMP12 (equilibrium), IMP4 (transport coefficients) and IMP5 (sources). In 2011 the emphasis will be on consolidating the achievements of 2010 that introduced the first heating and current drive sources, extending the workflows to include new modules, and in particular, the release of workflows involving the

- **ETS coupled to free boundary equilibrium codes, and**
- **ETS coupled to edge codes.**

The continuing implementation of edge codes and the development of workflows using the edge codes is planned.

Verification and Validation (V&V) of all components will also be an important part of the programme.

4.2 Objectives

4.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-IMP3-ACT1

Maintenance, continuing development, verification and validation of the ETS

Description
The following tasks are regrouped under this activity, which is mostly covered by Priority Support , exception made for the validation effort and adaptation of 0D codes (Baseline).

1. **Maintenance support for the ETS including the addition of new modules within the Kepler workflows [many of the new modules will come from other IMPs]**
2. **Release of a number of standard Kepler workflows [this activity is the central part of the "Task Force coordinated efforts" listed in General Introduction)**
3. **A free boundary version of the ETS [in strong collaboration with IMP12, see workflow IIIin General Introduction "Task Force coordinated efforts")]**
4. **Verification of ETS modules and workflows (in collaboration with other IMPs)**
5. **Validation of ETS modules and workflows (in collaboration with other IMPs)**
6. **Adaptation and maintenance of 0D codes (for fusion reactor studies) in accordance with Appendix A [Task in collaboration with ISM]**

Implementation Method:

mixed priority and base line support

Requested manpower/skills:

People with expertise in core modelling, in any of the modules required for core modelling that fall within the ambit of IMP3, and in numerics are required. In addition people with physics and/or computer experience and an interest in participating in the task are encouraged to apply.

- **Tasks 1- 4 will be covered by Priority Support with indicative manpower of 0.5-1 ppy per each task. Task 5-6 are under Baseline Support with minimal manpower required of 0.5-1 ppy.**
- **A minimal manpower of 3 ppy of PS in anticipated**

Existing Commitments: This is a continuation of the task from 2010 and all who participated in the task in 2010 are encouraged to reapply.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Kepler workflows	01/01/11	31/12/11	Release of the workflows	Other IMPs, ISIP
Free Boundary ETS	01/01/11	31/12/11	Release of the workflow	IMP12-ACT1, ISIP-ACT2-T10, EDRG-ACT2
Verification	01/01/11	31/12/11	Verification report(s)	ISM

report(s)				
Validation report(s)	01/01/11	31/12/11	Validation report(s)	ISM-ACT1, other IMPs
Integration of 0-D codes	01-03. 2011	31.12. 2011	Functioning 0D codes with documentation integrated into the Kepler environment and using the UAL	ISM-ACT3

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
ETS Code Camp	Feb./Mar. 2011	2 weeks	Development of new workflows and the incorporation of new modules; ETS V&V ; edge-core workflows
ETS Code Camp	July. 2011	2 weeks	Development of new workflows and the incorporation of new modules; ETS V&V ; edge-core workflows
ETS Code Camp	Nov./Dec. 2011	2 weeks	Development of new workflows and the incorporation of new modules; ETS V&V ; edge-core workflows

External connections / requirements

JET experimental data as identified by the validation task might be required.

WP11-ITM-IMP3-ACT2

Implementation, integration, verification and validation of edge codes

Description

(1) Implementation and release (including verification and validation) of a number of edge codes using CPOs (See appendix A, Phase V of "ITM modules release cycle") [~ 3 pm/code, BS]

(2) Definition, implementation, verification and the start of validation of a number of edge only workflows using the edge codes [0.5 ppy, PS]

(3) Further development of edge-core coupled workflow(s) including verification and the start of validation [0.5-1 ppy, PS]

Implementation Method:

mixed priority and base line support

Requested manpower/skills:

People with expertise in edge codes, and in particular, authors of edge codes, are required for this task. People with an interest in the task with physics and/or computational expertise are also sought.

- **Indicative totals of staffing are given in the description of work**
- **A minimal manpower of 1 ppy of PS is necessary**

Existing Commitments: This is a continuation of the task from 2010 and all who participated in the task in 2010 are encouraged to reapply.

The authors of the edge codes (or their "responsible officers") are particular requested for this task. In addition, people with an interest in V&V as well as experimentalists are also sought.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Implementation report	01/01/11	31/12/11	Report on the implementation of the edge codes	
Verification report	01/01/11	31/12/11	Report on the verification of the edge codes	
Validation report	01/01/11	31/12/11	Report on the validation of the edge codes	

Code Camps or other coordinated efforts

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Edge Code Camp	May 2011	2 weeks	Edge code implementation; Core-edge coupling; edge code workfkows; edge code V&V
Edge Code Camp	Oct. 2011	2 weeks	Edge code implementation; Core-edge coupling; edge code workfkows; edge code V&V

External connections / requirements

Coordination with EFDA-TF-PWI, ITPA-DIVSOL, ITER

JET related activities

described at activity level

Resources

The Implementation of the IMP3 work programme for 2011 is estimated to require a minimum of 1 Ppy under Baseline support and a minimum of 3 Ppy under Priority Support in order to be able to provide a minimum level of project fulfillment of the deliverables and milestones.

4.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

- **Delivery of the core transport framework capable of simulating a discharge from shortly after breakdown to shortly before termination;**
- **Delivery of capability to do routine core-edge coupled simulations.**

Deliverables:

described at activity level

5. IMP4:

Task Agreement WP11-ITM-IMP4:

Transport Processes and Micro stability

5.1 Introduction

Project leadership 2011:

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Anders H. Nielsen, ahnie@risoe.dtu.dk (deputy)

The main objective of IMP4 is to develop physics-based models for neoclassical and turbulent transport coefficients in all three plasma regions (core, pedestal and scrape-off layer), including models for bifurcations. The objectives are obviously long term aims. The standards of present computational models ("codes") in the turbulence area are very uneven. The first stage of effort is mostly dedicated to benchmarking present codes on standard cases which are relevant to experiment. Neoclassical transport and linear instability models are also to be benchmarked on the same cases. This verification process "vis-à-vis" the equations the codes are solving is a prerequisite to the validation of codes on standard experimental shots.
IMP4 activities in 2011 continue with a sustained effort towards the cross verification of IMP4 codes on standard cases and the integration of those into workflows. Moreover a new activity is called within which the first validation of a SOL turbulence code with experimental data from Langmuir probes is foreseen. The action plan for 2011 will focus on the following activities :

1. **Cross verification of IMP4 turbulence codes on specified standard cases.**
   In 2008 the first major benchmarking effort reached the point where it was possible to report scientific results (G L Falchetto, B D Scott et al, PPCF 50, 2008). The new benchmark effort started in late 2009, primarily with core electromagnetic gyrokinetic cases, and with edge 2D and 3D cases driven dominantly by temperature gradients. Simulations for the specified case were performed on the HPC-FF in 2010, the obtained data should now undergo analysis and comparison prompting for the prolongation of the activity in 2011. Renewal of commitments from the code developers involved in 2010 is expected.

2. **Kepler workflows and interfacing with HPC-FF.**
   Integration of IMP4 codes in Fortran workflows was demonstrated by the coupling of a turbulence code with an MHD equilibrium code (IMP12) as well as the successful integration of simple turbulence and neoclassical transport modules with the ETS (IMP3). Most of IMP4 turbulence codes can now read the input CPOs using a FORTRAN workflow. In 2011 the integration effort will be oriented towards the integration of turbulence modules into Kepler workflows, implying interfacing with Kepler and HPC-FF, as well as with real data from ITM database. In particular, the validation of a SOL turbulence code with experimental data from Langmuir probes is foreseen as a cross-project task. Continued work in the HPC-FF/Gateway

Interoperability Working Group will be particularly important for the fulfilment of the activity.

3. **Cross verification of linear and neoclassical codes on specified standard cases.**
   The cross-verification of linear and neoclassical codes was postponed due to the lack of participating pure linear and neoclassical codes. Participation of linear stability codes, which are most directly suited to self-act as modules for integration with the equilibrium reconstruction and stability chain workflow and/or with a transport code is encouraged. The participation of NCLASS code is desired.

4. **Maintenance and standards-keeping of commonly used transport model modules.**
   Since 2010, IMP4 is charged with the maintenance of transport models which can be used in 1-D or 2-D / axisymmetric transport modelling. Modules which are actually used in modelling will be collected and maintained according to ITM standards of interoperability, modularity and documentation. Import of those into IMP4 will start in 2011.

5.2 Objectives

5.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-IMP4-ACT1

Cross verification of IMP4 turbulence codes on specified standard cases

Description

This task is a continuation of WP10-ITM-IMP4-ACT1, within which the code developers involved in the cross-verification activity adapted their codes to ITM standards and ran the specified case on HPC-FF in 2010. The obtained data should now undergo analysis and comparison and it is expected that the involved code developers participate in this activity (baseline support). Priority support is foreseen for analysis and report generation. This will be the main topic of the working session in May.

Implementation Method:

Baseline Support and Priority Support

Requested manpower/skills:

- **0.1-0.2 ppy per code developer (BS) and 1.0 ppy in total.**
- **0.2 ppy (PS) for organizing analysis including report generation**

Renewal of commitments made in 2010 is expected.

Existing Commitments: This is a continuation of task WP10-ITM-IMP4-ACT1.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
report on cross-verification	01/01/11	01/06/11	A report describing in detail the outcome of the cross-verification.	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session	May 2011	1 week	Analysis of cross-verification data and report on outcome

WP11-ITM-IMP4-ACT2

Kepler workflows and interfacing with HPC-FF

Description

From the start of 2011 it is expected that all IMP4 codes can read the input CPOs using a FORTRAN workflow and have thus reached phase I, see appendix A. The aim of this task is to evolve the individual codes at least one phase forward.

1. **Generate an actor of the IMP4 code and include it in a Kepler workflow reading the EM benchmark case from 2010. Job is to be submitted to the Gateway. This corresponds to phase III (K) of ITM code release cycle (see appendix A).**

2. **As 1 but the job should be submitted to HPC-FF and the result should be collected on the Gateway in form of a HDF5 file containing the turbulence CPO. (in close cooperation with ISIP)**

3. **Read experimental data from the ITM database**

4. **By use of a SOL turbulence code a Kepler workflow will be generated reading basic plasma parameters from the ITM database and the obtained fluctuating data will be compared with experimental Langmuir probe data to be supplied by EDRG**

We expect that all IMP4 codes will evolve into level 1 and at least one code will reach level 3 and another will reach level 4. During the Code Camp new codes in IMP4 will be given priority to catch up.

Implementation Method:

Baseline Support and Priority Support

Requested manpower/skills:

Mainly code authors will be involved. We expect 1 ppm (BS) for each code (author) as a minimum commitment . We expect 0.5 ppy under Priority Support for level 2-4. Participation in at least one of the two code camps is mandatory.

Existing Commitments: This is a new task consisting partly of WP10-ITM-IMP4-ACT3 and WP10-ITM-IMP4-ACT6

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Kepler Actor	01/01/11	31/12/11	IMP4 code in phase III (K)	
HPC-FF submission	01/01/11	31/12/11	A Kepler workflow which submits to HPC-FF and receives data in form of a HDF5 file containing the turbulence CPO	ISIP-ACT3
Comparison with Langmuir probe data	01/01/11	31/12/11	A Kepler workflow comparing data from an IMP4 turbulence code and experimental Langmuir probe data	EDRG-ACT1

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar. 2011	1.5 weeks	Creating Kepler workflows
Code Camp	Oct. 2011	1.5 weeks	Creating Kepler workflows

External connections / requirements

Close relation with HPC-FF/ Gateway interoperability working group.

WP11-ITM-IMP4-ACT3

Cross verification of linear and neoclassical codes on specified standard cases

Description

This task includes the part of the benchmarking effort specifically dedicated to neoclassical and linear codes, which are most directly suited to self-act as modules describing the underlying model and its description of transport. Linear codes will also produce a transport model based on either mixing length or weak turbulence or other of similar scope. Since the activity will be carried out on the ITM Gateway, codes should comply with ITM data structure. Developers of new participating codes still to be adapted to ITM are expected to

also apply to IMP4-ACT2 (subtask 1)

Implementation Method:

Baseline Support

Requested manpower/skills:

Skills are the ability to create and maintain IMP4 codes at the level of programming and algorithmic details. For the benchmarking efforts at least 1ppm per participant is required and participation in the related working session. New participants are welcome to the activity. Pure linear codes are needed. The participation of NCLASS code is desired. A representative with the approval of its author (W Houlberg, ITER) is appropriate.

Existing Commitments: This task is a continuation of WP10-ITM-IMP4-ACT4-T1 as neither NCLASS nor a pure linear code were available in 2010.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
NCLASS	01/01/11	31/12/11	module describing the underlying model and its description of transport	
Linear codes	01/01/11	31/12/11	Report on cross-verification	
Neoclassical codes	01/01/11	31/12/11	Report on cross-verification	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session	May 2011	1 week	Analysis of cross-verification data

External connections / requirements

Coordination with EFDA Transport TG

WP11-ITM-IMP4-ACT4

Maintenance and standards-keeping of commonly used transport model modules
Description
IMP4 is also charged with the maintenance of transport models which can be used in 1-D or

2-D/axisymmetric transport modelling (i.e., IMP3 codes). One module exists as a Gforge project on the ITM-Gateway, intended for testing purposes (ETAIGB). Modules which are actually used in modelling will be collected and maintained according to ITM standards of interoperability/modularity and documentation. In addition to this are the modules based on codes. These are either wrapped codes (i.e., linear codes used in a mixing length model) or models which are based on code results. Ultimately, all anomalous transport models used in ITM transport codes should reside within and be maintained by IMP4 .

Implementation Method:

Baseline Support

Requested manpower/skills:

Familiarity with the programming scope and use of simplified modules within transport codes. An example is a model like the Coppi/Tang or Weiland. We need one or two people with 1 pm each. The two aforementioned models are among those we desire to bring in.

Existing Commitments: This is a continuation of WP10-ITM-IMP4-ACT5-T1. Renewal of commitments made in 2010 is encouraged

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Transport models	01/01/11	31/12/11	Maintenance of the IMP4 transport models.	

JET related activities

described at activity level

Resources

The Implementation of the IMP4 work programme for 2011 is estimated to require a minimum of 0.75 ppy under Priority Support and a minimum of 3.2 ppy under baseline support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones.
As first principle elements will be more important in the integrated 2011 activities, closer relations are envisioned with HPC-FF, DEISA, PRACE or related partners, as well as with the HPC-FF/Gateway interoperability group.

5.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

Provide first principles based modules (linear stability, turbulence and neo-classical) that are necessary for the plasma simulator and other applications. Extensive cross-verification of turbulence, linear and neoclassical codes (i.e. code-code comparison using CPOs), and validation of a set of first principles fluid and potentially gyrokinetic turbulence codes with experimental data, communicating via CPOs.

Deliverables:

described at activity level

6. IMP5:

Task Agreement WP11-ITM-IMP5:

Heating, Current Drive and Fast Particle Physics

6.1 Introduction

Project leadership 2011:

Daniela Farina, farina@ifp.cnr.it

Thomas Johnson, johnso@kth.se (deputy)

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The aim of IMP5 is to develop the computational basis for a modular package of codes simulating heating, current drive and fast particle effects. The areas to be covered include, ECRH, ICRH, NBI, LH, alpha particles and fast particle interaction with instabilities. The ultimate goal is to enable self-consistent simulation of heating and current drive in the presence of fast particle instabilities, especially for ITER. Priority will be given to modelling applicable to ITER standard and advanced scenarios. Modelling of heating and current drive is a complex problem, often requiring self-consistent computations of the wave propagation and the evolution of the distribution functions of resonating particle species. Self-consistency entails taking into account synergetic effects, not always desirable, that appear in general through coupling via distribution functions of resonating particle species, in general affected by more than one heating method. In addition, finite orbit width effects of a distribution function, requiring at least the solution of a three dimensional orbit averaged Fokker-Planck equation, need also to be taken into account. Considering the challenging endeavour and the computational cost often involved, physics modules are called for at two levels: one basic enabling fast computations but less detailed and one advanced, but computationally expensive, enabling detailed computations of the distribution functions of electrons and ions during heating and current drive, ultimately incorporating non-linear effects of instabilities and their redistribution fast ions. Modelling of antennas should be included in the work, aiming to couple antenna codes and wave propagation code for analysis of, for example, RF-sheath effects.

Progress in the ongoing Work Programme during 2010 has boosted significantly the capacities of the project in terms of provisioning Kepler actors for many representative Heating and Current Drive modules and on the development of a comprehensive set of dedicated datastructures. In 2011 and onwards the completion of the adaptation, integration and assembly of dedicated workflows and V&V for all major codes in IMP5 is foreseen. A stronger effort on integration activities in cross-project workflows is therefore timely. The action plan for 2011 will focus on the following activities:

1. **Code adaptation/integration of H&CD and Fast Particles codes.**
   Such effort clearly aims at provisioning the ITM with an even more significant set of codes in this field. Codes in different phases of the release process (see Appendix A) are

considered. However, priority is given to building new capacities (new physics or codes under development during 2010) and standalone Kepler actors and testbed workflows. Both physics basis and workflow integration documentation, in agreement with Phase IV of ITM code release cycle (see Appendix A), is mandatory to pave the way to a future public release of the modules.

2. **Module coupling to the ETS.**
   This activity, supported by contributors from modules already Keplerized (adhering to Phase III (K), Appendix A) and foreseen ones, paves the way towards self-consistent integrated modelling of H&CD plasma discharges under the ITM-TF platform.

3. **Benchmarking and validation of codes.**
   Cross-verification of codes solving similar equations adapted to ITM standards is called to be performed within this activity. In case of H&CD and Fast Particles codes, the benchmark exercise will be performed within Kepler workflows, ensuring that codes addressing the same physics are using the same inputs and providing similar outputs within the same framework. Validation activities of the H&CD codes will start for a few relevant cases during 2011 and it is strongly encouraged that developers or responsible officers of codes in 1. at a mature stage also apply to this activity.

4. **Self-consistent coupling of IMP5 codes and synergies effect.**
   Implementation of models describing synergetic and self-consistent physics processes into H&CD codes will allow to describe more complex and realistic situations occurring in experiments dealing with more than one heating methods and address case of deviations from Maxwellian equilibrium.

5. **Code development and datastructure evaluation for global stability analyses of Alfvén modes in realistic geometries and in the presence of nonperturbative fast ion excitations.**
   The activity, already performed in 2010, will continue in order to integrate these codes in the ITM for a realistic plasma operation scenario, elaborate the required datastructure and investigate the nonlinear dynamics problems associated with fast ion transport and losses.

6. **Assistance on Nuclear reaction rates.**
   Profiting from the IMP5 capacity to simulate fusion reactants dynamics this activity is a joint effort with IMP3, EDRG and AMNS groups (providing fusion product diagnostic data and nuclear cross section data respectively) and aims at the calculation of fusion reaction rates on a given plasma scenario provided by IMP3.

6.2 Objectives

6.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-IMP5-ACT1

Adaptation of codes for Heating, Current Drive and Fast Particle Physics for use with ITM tools

Description

This activity concerns adaptation, up to Phase IV of the ITM codes release cycle (see Appendix A) , of existing and under development codes in the following areas:

- **NBI source codes**
- **Codes for source from nuclear reactions**
- **ICRF wave deposition codes**
- **LH and EC ray/beam tracing codes**
- **Fokker-Planck codes dealing with fast particles generated by either NBI, nuclear reactions, ICRF, LH, EC or a combination of these.**
- **Codes for analysis of fast particle driven instabilities.**
- **Mappers of IMP5 CPOs (e.g. codes for generating test particles from continuous source distribution in the distsource-CPO, or vice versa).**
- **Orbit tracing codes**
- **Other codes needed for IMP5 as, e.g., antenna codes.**

Note that not all steps in Phases II and III may be applicable in case of libraries operating on IMP5 CPOs.

A specific objective is to provide the European Transport Solver (ETS) of modules that can deliver sources due to auxiliary heating and current drive.

In 2011 the work breakdown in this activity foresees :

1. **The adaptation of IMP5 codes already ported to the Gateway that have not reached the end of Phase II of the release cycle (see Appendix A), to be carried out under Baseline Support.**
2. **Adaptation and integration of new codes or codes under development in the Associations during 2010 in the above areas, to be carried out under Priority Support.**
3. **Generation of Kepler actors and test workflows for all IMP5 codes that participated to code integration in 2010 (in WP10-ITM-IMP5-ACT1) and have reached at least the end of Phase II of the release cycle (see Appendix A). Code documentation should be generated in a quality compatible to a public release and the test procedures and test cases should be standardised. These activities will be carried out under Priority Support.**

In addition to the above points, adaptation to version 4.08c of the datastructure should be completed within 3 months from its release (foreseen in the first half of 2011). This is to ensure that work on code cross-verification (see WP11-ITM-IMP5-ACT3) can be performed with codes communicating with CPOs updated to the most recent version.
Codes applying to this activity are expected to apply also to the following activities inside IMP5:

- **WP11-ITM-IMP5-ACT2**
- **WP11-ITM-IMP5-ACT3**

Implementation Method:

Baseline Support and Priority Support

Requested manpower/skills:

Code developers able to adapt IMP5 codes to ITM standards. The manpower allocated for this activity is

- **Subtask 1: indicative 1.5 ppy under Baseline Support**
- **Subtask 2: 0.2 ppy per code maximum under Priority Support**
- **Subtask 3: 0.15 ppy per code maximum under Priority Support**

The total manpower allocated for this activity is 3.8 ppy under Priority Support and 1.5 ppy under Baseline Support. Minimal participation to Code Camp is required for sub-tasks 2 and 3, in case integration support is needed.

Existing Commitments: In 2010, work on code adaptation has been initiated and performed up to Phase II for a number of H&CD Fast Particles codes, and to Phase III for a few of them.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Subtask 1	01/01/11	30/06/11	· Code adaptation up to creation of a Kepler actor	Subtask 3; WP11-ITM-IMP5-ACT6

Subtask 2	01/01/11	31/12/11	· Code adaptation up to creation of a Kepler actor	Subtask 3; WP11-ITM-IMP5-ACT5 WP11-ITM-IMP5-ACT6
Subtask 3	01/01/11	31/12/11	· Kepler actor and test workflow · Code documentation for developers and maintainers, and User documentation (Phase IV) · Adaptation to version 4.08c of the data structures; to be completed within 3 months from the release of version 4.08c of the data structures	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session	Feb/Mar 2011	1 week	Share experience and discuss IMP5 related problems and solutions.
Code Camp	Feb/Mar 2011	1 week	Assistance on the kepler actor/workflow build
Code Camp	July 2011	1 week	Assistance on the kepler actor/workflow build

WP11-ITM-IMP5-ACT2

Integration of IMP5 modules with the European transport Solver ETS

Description

This activity concerns mainly integration of IMP5 modules in the European Transport Solver (ETS). The work consists of four subtasks:

1. **Development of Composite Actors for coupling IMP5 codes to the ETS.**

2. **Development of datajoiners, i.e. modules merging the information in IMP5 related CPOs.**

3. **Development of modules for workflow orchestration. The IMP5 composite actor should look the same for many types of scenarios. This means that for many ETS simulations not all codes should be run. These routines should provide decision on what codes need running in a specific ETS simulations, i.e. they should take CPO and Kepler parameters as input and output Kepler parameters. Note that these modules are only needed when they cannot be replaced by a simple KEPLER composite actor.**

4. **Application, adaptation and development of the composite actors in 1. for integrated workflows suitable to cross-project integration efforts, e.g. coupling equilibrium reconstruction (from remote data via exp2itm) and H&CD chain.**

Implementation Method:

Priority Support

Requested manpower/skills:

Code developers able to work in Kepler. The manpower allocated for this activity is 0.6 ppy under Priority Support. Participation to Code Camps is required.

Existing Commitments: Many modules in WP10-ITM-IMP5-ACT1 providing sources in the field of ECRH&CD, ICRH, and NBI are under test as Kepler actors, and are ready to be integrated in ETS. Involved contributors are invited to apply.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Composite actors	01/01/11	31/12/11	· Develop composite actors for the ETS; · Develop workflows for testing the composite actors; · Develop standard test cases for the composite actors.	WP11-ITM-IMP5-ACT1
Datajoiner	01/01/11	31/12/11	Develop datajoiners of two types to: · merge two CPOS of the same kind, e.g. from two wave codes writing the waves-CPO for EC and LH waves; · generate the coresource-CPO by merging the CPOs distribution, distsource and waves.	WP11-ITM-IMP5-ACT1
Modules for workflow orchestration	01/01/11	31/12/11	· Develop workflow orchestration within IMP5 composite actors.	
Extended	01/01/11	31/12/11	· Develop composite actors and	WP11-ITM-

applications of composite actors			workflows for integration of ITM codes and testing. · Reports on testing of the composite actors and workflows.	ISIP-ACT2 WP11-ITM-EDRG-ACT1 WP11-ITM-IMP12-ACT

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Feb/Mar 2011	1 week	Coupling/integration of source modules in ETS
Code Camp	July 2011	1 week	Coupling/integration of source modules in ETS

WP11-ITM-IMP5-ACT3

Benchmarking and validation of codes

Description

This activity concerns both

1. **extensive benchmarking, i.e. cross verification of codes solving similar equations and adapted to ITM standards**

2. **validation of codes against experiments (with input from WP11-ITM-EDRG-ACT1).**

Both these exercises should be performed using ITM tools, i.e.,

- **all codes should run within Kepler workflows,**
- **all inputs should be provided as CPOs or XML-files with code specific parameter,**
- **all validated data should be stored in CPOs.**

This would ensure that the codes read the same inputs and produce similar outputs via CPOs. Linear stability codes will perform verification also for ITPA-Energetic Particle Physics Topical Group benchmark cases.

Implementation Method:

Priority Support

Requested manpower/skills:

Code developers and/or responsible officers of codes participating in WP11-ITM-IMP5-ACT1, able to work in Kepler. The manpower foreseen under Priority Support for this activity is 0.15 ppy per code maximum, with a minimal manpower required 1.5 ppy

Existing Commitments: This activity is a continuation of WP10-ITM-IMP5-ACT3. Code contributors already involved are invited to re-apply.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Detailed report	01/01/11	31/12/11	Deliver report including a detailed description of verification or validation procedure and results.	WP11-ITM-IMP5-ACT1 WP11-ITM-EDRG-ACT1
Publication	01/01/11	31/12/11	Publications, or conference contributions	

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session	Feb/Mar 2011	1 week	Progress on the benchmarking effort and associated problems emerging
Working Session	July 2011	1 week	Progress on the benchmarking effort and associated problems emerging

External connections / requirements

Validation activity is expected to be performed in collaboration with JET and eventually other machines.

WP11-ITM-IMP5-ACT4

Development and integration of models for synergies between heating schemes and self-consistent coupling of IMP5 heating codes

Description

This activity concerns the modeling of physics process involving synergies and self-consistent coupling between IMP5 codes. The main topics are:

1. **Synergies: Fokker-Planck modeling including both sources of beam ions and alpha particle and interactions with ICRF and LH wave fields.**

2. **Synergies: Fokker-Planck modeling including interactions with EC, LH and ICRF wave fields.**

3. **Quasilinear coupling of wave and kinetic plasma model by inclusion of a non-Maxwellian in the plasma susceptibility. This includes both the evaluation of the dielectric response from a general distribution function taken from the DISTIRIBUTION CPO and adaptation of wave codes to use this response.**

This activity should start from existing IMP5 codes.

Implementation Method:

Priority Support

Requested manpower/skills:

Expertise on the physics processes involved in relevant synergies and self-consistent coupling processes. In particular in area of self-consistent quasilinear coupling of wave and kinetic plasma models. Code developers with experience in both the relevant IMP5 codes and in the ITM framework.
The manpower allocated for this activity under Priority Support is 0.8 ppy.

Existing Commitments: This project is an evolution of WP10-ITM-IMP5-ACT4. After developing basic Fokker-Planck models during 2010, the next step is the integration of these models to include multiple heating schemes and facilitate self-consistent treatment of wave particle interaction.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Source	01/01/11	31/12/11	Actors and source code with documentation; all stored under Gforge-svn. Documentation of tests verifying the functionality of the source. Source code should follow good ITM practice.	WP11-ITM-IMP5-ACT1
Workflows	01/01/11	31/12/11	Workflows for performing modelling of synergies and self-consistent coupling between codes.	WP11-ITM-IMP5-ACT1

WP11-ITM-IMP5-ACT5

Code development and datastructure evaluation for global stability analyses of Alfvén Modes in realistic geometries and in the presence of non-perturbative fast ion excitations

Description

This activity concerns the development of a code for global stability analysis of Alfvén modes in realistic geometries and in the presence of non-perturbative fast ion excitation (HYMAGYC). Indeed, due to the high power density associated with charged fusion products in burning plasmas and/or fast ions produced by high power auxiliary heating systems, such codes must consider the possibility that energetic particles themselves can significantly contribute to the mode structure and its dynamic properties (under Baseline Support). Integration activity for this code will be performed under WP11-ITM-IMP5-ACT1. Issues concerning the interface between such codes and the Fast Particle datastructure should also be addressed (under Priority Support)

Implementation Method:

Baseline and Priority Support

Requested manpower/skills:

The activity is expected to require 1.0 ppy under Baseline Support of dedicated work in total (including porting and verification activities). The activity is suitable to be divided among different individuals.
Fast particle datastructure evaluation is eligible for Priority support with a maximum of 0.1 ppy.

Existing Commitments: In 2010 the writing of the code HYMAGYC has been completed and several activities regarding debugging, parallelization and interface of the MHD module with equilibrium CPOs has been carried on. In 2011 these activities are expected to be completed.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Debugging	01/01/11	31/12/11	Complete code debugging of numerics and physics	
Fast Particle datastructure evaluation	01/01/11	31/12/11	Evaluation of suitable datastructure for energetic particle distribution function, with reference to initial particle loading and after nonlinear saturation	

WP11-ITM-IMP5-ACT6

Development of codes calculating nuclear reaction rates

Description

The aim of this activity is to provide the fusion reaction rates on a given plasma scenario. It

involves developing tools that calculate nuclear reactions from both Maxwellian and non-Maxwellian distribution functions of the reactants.
The codes developed under this activity should be ported to the ITM under WP11-ITM-IMP5-ACT1. The tools should be adapted to the ITM, and write the IMP5 CPO distsource.

Implementation Method:

Baseline Support

Requested manpower/skills:

Expertise on nuclear physics.
The manpower allocated for this activity 0.4 ppy under Baseline Support. Those interested in this act should apply also to WP11-ITM-IMP5-ACT1 and consider participation in WP11-ITM-EDRG-ACT1 and WP11-ITM-AMNS-ACT1.

Existing Commitments: This is a new activity.

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Source	01/01/11	31/12/11	Source code with documentation; all stored under Gforge. Documentation of tests verifying the functionality of the source. Source code should follow good ITM practice.	WP11-ITM-EDRG-ACT1, WP11-ITM-AMNS-ACT1

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Feb/Mar 2011	1 week	Integration of data and modules for data delivery for Atomic and Nuclear data with the ETS and IMP5 codes

JET related activities

described at activity level

Resources

The Implementation of the IMP5 work programme for 2011 is estimated to require a minimum of 6.8 ppy under Priority Support and a minimum of 2.9 ppy under baseline support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones

6.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

The project will provide Kepler actors and test bench workflows covering the needs within the ETS for different source terms relating to heating and current drive. This includes codes dealing with Neutral Beam Injection, ICRF heating, LH current drive and EC heating and current drive. These modules should be documented and verified, and the validation process should be started.

Deliverables:

described at activity level

7. Infrastructure and Software Integration:

Task Agreement WP11-ITM-ISIP:

Infrastructure and Software Integration

7.1 Introduction

Project leadership 2011:

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Gabriele Manduchi, gabriele.manduchi@igi.cnr.it (deputy)

The Infrastructure and Software Integration Project (ISIP) provides the key technologies needed for supplying a broadly accessible framework tool for integrated simulation of magnetic confinement fusion devices. It develops a suitable environment for modellers and code developers to access input data (synthetic or experimental) and to allow dynamic creation of computational workflows. The framework targets various physical issues by coupling together different physics components and codes into user-defined applications. The platform is intended to communicate with a wide spectrum of computer resources, including grid enabled resources (e.g., EGEE and DEISA architectures) local clusters, HPC and single node machines. ISIP is working mainly on tools residing on the ITM platform (Gateway), however it will provide support to local installation of the Universal Access Layer (UAL) on some Association computer facilities for exceptional needs recognized as critical by the TF leadership. This main local installation would allow the remote access to ITM database from local experiments.

The ISIP provides the infrastructure for the ITM-TF programme and is fully covered by Priority Support. The project covers a number of activities: support for the hardware infrastructure (Gateway), the framework and its associated tools (code platform), the data communication system (UAL), the Web portal and several applications (ITM tools) and the data management (data structure and handling). The simulation framework and the GRID-HPC computing infrastructure are of even broader relevance than for the fusion community and could be used in many other domains.

The implementation of the 2011 work programme will be used to fulfil three main missions :

1. **Support the users of the ITM platform (Hotline, documentation, tutorials)**
2. **Maintain and update the existing platform tools**
3. **Identify missing functionalities in the platform and develop the required new functionalities**

7.2 Objectives

7.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-ISIP-ACT1

Support the users of the ITM platform

Description
This activity consists in three tasks:

WP11-ITM-ISIP-ACT1-T1: Hotline, documentation and support of the ITM software on the gateway is formed under Priority Support.Estimated minimal manpower required 4 pm.

WP11-ITM-ISIP-ACT1-T2: Support to workflow development is formed under Priority Support. Based on an expert knowledge of Kepler, this activity consists in exploring new ways of designing workflows in Kepler, for e.g. carrying out parametric scans in an automated way, usage of GRID and HPC resources in workflows, advanced combinations of directors, combination of multiple UALinit and UALcollector actors. This exploratory activity should liaise with the needs of the IMP, support users in designing workflows and deliver workflow examples. Estimated minimal manpower required 4 pm.

WP11-ITM-ISIP-ACT1-T3: Tutorials on the ITM software is formed under Priority Support, covers various tutorials that can be given on ITM tools along the year (code camps, General meeting). Estimated minimal manpower required 2 pm.

Implementation Method:

Priority Support

Requested manpower/skills:

Requested manpower is indicated above in the Task description / Skills : Good knowledge of ITM/ISIP software. Participation in Code Camps is required and shall be included in the commitments to Task activities.

Existing Commitments: T1 is covered significantly by the Core Programming Team, thus only 4 pm are open in this Call for Participation.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
T1	January	December	Hotline, documentation	IMPs
T2	January	December	Workflows	IMPs
T3	January	December	Tutorials	IMPs

WP11-ITM-ISIP-ACT2

Maintain and update the existing platform tools

Description

This activity consists in eleven tasks:

WP11-ITM-ISIP-ACT2-T1: Update of Kepler Platform is formed under Priority Support. The main item in 2011 is to install Kepler 2.0 in the ITM environment. Porting the various ITM tools to the new Kepler version is done under the other tasks of this activity. Estimated minimal manpower required 3 pm.

WP11-ITM-ISIP-ACT2-T2: Simulation catalogue is formed under Priority Support. The main item in 2011 is the upgrade of the existing functionalities and querying interface from the feedback of the users. Estimated minimal manpower required 4 pm.

WP11-ITM-ISIP-ACT2-T3: Maintenance and upgrades of the Integrated Simulation Editor is formed under Priority Support. Estimated minimal manpower required 6 pm.

WP11-ITM-ISIP-ACT2-T4: Data structure is formed under Priority Support. Estimated minimal manpower required 2 pm.

WP11-ITM-ISIP-ACT2-T5: Universal Access Layer is formed under Priority Support. Estimated minimal manpower required 6 pm.

WP11-ITM-ISIP-ACT2-T6: Actor generator is formed under Priority Support. This includes the maintenance and upgrades of FC2K, the finalisation and merging into a single version of HPC2K (GRID/HPC tools) and WS2K (Web Service actor generator). Moreover FC2K should be augmented to generate also CPO-formatted Matlab script (wrapper) to be pasted into the native Kepler Matlab actor. The tasks includes also the maintenance of GRID and HPC services (RAS, Unicorn, …) on the Gateway and the consistent evolution of HPC2K. Estimated minimal manpower required 10 pm.

WP11-ITM-ISIP-ACT2-T7: CPO management in workflows is formed under Priority Support. This includes the maintenance and upgrades of UALinit and UALcollector actors with a closer connection to the simulation catalogue, in particular the implementation of the CPO referencing system. Estimated minimal manpower required 5 pm.

WP11-ITM-ISIP-ACT2-T8: Administration of the collaborative software is formed under Priority Support. Estimated minimal manpower required 3 pm.

WP11-ITM-ISIP-ACT2-T9: Maintenance and upgrades of experimental data import tool (Exp2ITM) is formed under Priority Support. The main new feature to develop is an automated search of the machine description using the simulation catalogue and public database. Estimated minimal manpower required 3 pm.

WP11-ITM-ISIP-ACT2-T10: Maintenance and upgrades of the Control toolbox is formed under Priority Support. Estimated minimal manpower required 8 pm.

WP11-ITM-ISIP-ACT2-T11: Maintenance and upgrades of the advanced visualisation tools is formed under Priority Support. The main new feature to develop is the visualisation of time-dependent data in Visit. Estimated minimal manpower required 4 pm.

Implementation Method:

Priority Support

Requested manpower/skills:

Requested manpower is indicated above in the Task description / Skills : Good knowledge of ITM/ISIP software

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
T1-11	January 2011	December	Maintenance and updates	IMPs

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session	June 2011	1 week	Review progress of the Tasks, coordination.

WP11-ITM-ISIP-ACT3

Identify missing functionalities in the platform and develop the required new functionalities
Description
This activity consists in seven tasks:

WP11-ITM-ISIP-ACT3-T1: Development of parallel I/O for the UAL is formed under Priority Support. It includes the development of parallel I/O capabilities for the UAL (in relation with ACT2-T5), the development of an additional parallel I/O mechanism for handling persistent data / initialisation data on the HPC, and the development of the procedures for data exchange with Kepler on the Gateway (in relation with ACT2-T6). Estimated minimal manpower required 8 pm.

WP11-ITM-ISIP-ACT3-T2: Development of the ITM Profile Maker is formed under Priority Support. It includes the collection of requirements from the IMPs and the implementation of new functionalities based on the prototype developed in 2010. Estimated minimal manpower required 4 pm.

WP11-ITM-ISIP-ACT3-T3: Advanced memory management in workflows is formed under Priority Support. It includes the collection of requirements from the IMPs and the implementation of new functionalities (in particular, keeping part of the CPOs in memory while others written to files). Estimated minimal manpower required 4 pm.

WP11-ITM-ISIP-ACT3-T4: Advanced workflow monitoring and interactivity in workflows is formed under Priority Support. It includes the collection of requirements from the IMPs and the implementation of new functionalities. Estimated minimal manpower required 6 pm.

WP11-ITM-ISIP-ACT3-T5: Collective workflow and actor development is formed under Priority Support. Design procedures and tools to facilitate the exchange of workflows and actors among ITM users. This includes the development of workflow and actor catalogues, as well as procedures and tools for enhanced traceability and reproducibility of simulations. Estimated minimal manpower required 4 pm.

WP11-ITM-ISIP-ACT3-T6: Advanced actor execution and monitoring on GRID/HPC is formed under Priority Support. It includes the development of procedures and tools for monitoring the execution of actors on GRID and HPC, booking resources on GRID/HPC in advance before the actors are actually run. Estimated minimal manpower required 3 pm.

WP11-ITM-ISIP-ACT3-T7: Secured Access to Gateway MDS+ server is formed under Priority Support. The purpose is to establish a secured access to the Gateway MDS+ server for remote connections. Estimated minimal manpower required 3 pm.

Implementation Method:

Priority Support

Requested manpower/skills:

Requested manpower is indicated above in the Task description / Skills : Good knowledge of ITM/ISIP software

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
T1	January	December	Parallel I/O feature in the UAL, with a demonstration workflow	IMP4, ISIP-ACT2-T5, ISIP-ACT2-T6
T2	January	December	ITM Profile Maker up and running	EDRG-ACT1, IMPs
T3	January	December	List of requirements, implementation within a demonstration workflow	IMPs, ISIP-ACT2-T5
T4	January	December	List of requirements, implementation within a demonstration workflow	IMPs
T5	January	December	List of requirements, implementation	IMPs
T6	January	December	List of requirements, implementation within a demonstration workflow	IMP4
T7	January	December	List of requirements, implementation	ISIP-ACT2-T5

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session	June 2011	1 week	Review progress of the Tasks, coordination.

JET related activities

ISIP is not directly interfacing any fusion experiments with one possible exception: the development of the exp2ITM tool which is using machine specific data mappings provided through EDRG may in exceptional circumstances need to address a specific device directly.

Resources

The Implementation of the ISIP work programme for 2011 is requires a minimum of 7.5 PPy under Priority Support in order to be able to provide a minimum level of fulfilment of the deliverables and milestones. Support participation in Code Camps shall be included in the commitments to Task activities.

7.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

Maintain - and upgrade when required - a stable and supported platform for ITM-TF modelling and exploitation needs, including the deployment of physics workflows making use of HPC and GRID resources.

Deliverables:

described at activity level

8. ISM:

Task Agreement WP11-ITM-ISM:

ITER scenario modelling (Task under Task Force Leadership)

8.1 Introduction

Task coordination:

ISM Group Leader: Xavier Litaudon, xavier.litaudon@cea.fr

Deputy Leader: Irina Voitsekhovitch irina.voitsekhovitch@ccfe.ac.uk

An increased need in integrated predictive modelling of plasma scenarios aimed at understanding the physics of fusion plasmas and optimisation of plasma performance in future experiments stimulates the development of the integrated modelling and analysis tools in Europe (JET suite of transport codes, EFDA-TF ITM and various efforts in the Associations (CRONOS, ASTRA, etc.))), USA (Fusion Simulation Project) and Japan (Burning Plasma Simulation Initiative). Due to a growing importance of interpretative and predictive modelling of operational scenarios, the ITER Scenario Modelling (ISM) group has been created within the ITM-TF to coordinate the European efforts in developing predictive modelling tools for operational scenarios in ITER and other new projects, to support the validation of ITM tools and to promote and deploy these tools towards integrated scenario modelling. To reach these long term objectives, ISM is involved in scenario modelling of present day devices since the accuracy of predictive modelling of future operations strongly relies on the systematic validation of the integrated models.

The ISM activities in 2011 will be coordinated around three large topics:

- **Support to the validation of the ETS and ITM tools;**
- **Developing and validating plasma scenarios simulations for existing devices;**
- **Support to predictive scenario modelling for future devices (e.g., ITER)**

The physics issues addressed within these integrated modelling tasks will include current profile diffusion, physics of thermal transport and validation of existing transport models, particle transport and density peaking, plasma fuelling with pellets injection, momentum transport and effect of rotation on plasma confinement, plasma control issues, impurity transport and effect of impurities on plasma performance, integrated core-edge-SOL simulations, MHD stability analysis with existing tools. The main effort will be focused on the complete modelling of the various phases of the Hybrid Scenario from the current ramp-up, flat-top and ramp down operational phases (to a lesser extend, other operational scenarios will be addressed as well). The long term objective is to provide comprehensive modelling of ITER hybrid scenario evolving simultaneously current, momentum, thermal and particle transport in view of defining/optimising the operational space (sensitivity studies).

Integrated scenario modelling requires a broad mix of skills and expertise cutting across the different IMPs and strongly benefits from the input of experimentalists (scenario experts). The required expertise includes core thermal, momentum and particle (including impurities) transport, fuelling, heating and current drive physics, edge and SOL physics, equilibrium, MHD stability.

The activity will progress mainly through remote collaboration supported by collaborative working sessions. Implied in the activity is the publication of and access to the detailed simulation data for the ITM-TF and in general adherence to the procedures of the ITM-TF and where applicable proper consideration of experimental access and clearance.

8.2 Objectives

8.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-ISM-ACT1

Support Validation of the ETS
Description
Cross-project with corresponding V&V task of WP11-IMP3-ACT1 ASTRA, CRONOS, JETTO and TRANSP simulations for benchmarking of ETS modules including:

- **current diffusion with various models for bootstrap current and current conductivity,**
- **density and temperature evolution with various transport models,**
- **impurity evolution (SANCO runs)**

Sharing of Fortran routines for transport models.

Implementation Method:

Priority support

Requested manpower/skills:

ETS, ASTRA, CRONOS, JETTO/SANCO and TRANSP experts. The estimated total manpower is 1 ppy under PS. Participation to the Code Camps is required.

Deliverables

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Benchmarking of NCLASS	01/01/11	30/06/11	ASTRA, CRONOS, JETTO simulations	IMP3-ACT1, IMP4-ACT3 (NCLASS in ETS)
Benchmarking of Sauter neoclassical model	01/01/11	30/06/11	TRANSP runs for selected parametric domain	IMP3-ACT1, IMP4-ACT3
Benchmarking/sharing of transport models	01/01/11	31/08/11	New transport model in ETS. ASTRA, CRONOS, JETTO, simulations	IMP3-ACT1
Benchmarking of ETS impurity solver	01/01/11	28/02/11	JETTO/SANCO runs: benchmarking of reaction rates and radiated power	IMP3-ACT1,2

Code Camps or other coordinated efforts (preliminar)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Nov/Dec 2011	1	Comparison of ETS simulations with the one performed by ASTRA, CRONOS, JETTO. New transport modules in ETS

External connections / requirements

Limited and well diagnosed EFDA-JET discharges will be modelled for code validation.

WP11-ITM-ISM-ACT2

Developing and validating plasma scenarios simulations for existing devices

Description
1. Interpretative and predictive modelling of hybrid scenario for existing EU devices:

- **current ramps in hybrid scenario; validation of transport models**
- **current diffusion during main heating phase, effect of impurities on sawtooth-free operation**
- **first steps towards momentum transport in hybrid scenario: validation of existing transport models (GLF23, Weiland)**
- **edge MHD stability analysis**

2. Collaboration with T&C and IOS ITPA groups on current ramp-up simulations (e.g. DIII-D) and modelling of JET/JT-60U identity experiments

Implementation Method:

Baseline Support

Requested manpower/skills:

transport experts, heating, current drive and fuelling experts, EU ITPA members of T&C and IOS group, core, edge and SOL integrated modelling experts, EFDA transport topical group experts. The mimimal required manpower is 3.0 ppy under BS

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Current profile diffusion in hybrid scenario	04.01. 2011	31.12. 2011	Current diffusion simulations including ramp up, main heating and ramp down phases.	
Modelling of plasma rotation in hybrid scenario	04.01. 2011	31.12. 2011	Test of existing models for plasma rotation: GLF23, Weiland models.	
Modelling of current ramp-down	04.01. 2011	31.12. 2011	Validated transport models on existing dedicated ITER ramp-down experiments	
Modelling of DIII-D current ramp up discharges	04.01. 2011	ITPA T&C meeting, 2011	Current diffusion simulations and transport modelling: test of transport models	data from ITPA database
Validation and benchmarking of SOUL 1-D	01.06. 2011	31.12. 2011	Validation and benchmarking of SOUL 1-D: SOUL 1-D and EDGE2D runs for JET plasmas	-

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Intended audience**	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Working Session	ISM, IMP3	Feb-March	1	Review of activities since previous working session, agreement on the ITER parameters (shape, fuelling, heating and current drive actuators), first set of modelling with simple transport model, scan 0-D

				operational domain
Working Session	ISM, IMP3	May-June	1	Review of activities since previous working session, apply theory based transport modelling, prepare combined thermal and density modelling, Analysis MHD stability, coordinate ISM participation to EPS 2011
Working Session	ISM, IMP3	Nov	1	Review of activities since previous working session, finalise modelling for publication, first set of edge and core modelling, status of publications

External connections / requirements

Needs: Expertise from EFDA topical Transport and MHD groups is required
Limited and well diagnosed from different devices discharges will be modelled
Link with T &C and IOS ITPA groups

Participation in ISM working sessions of:

ITER-IO SOL experts on coordinated ITER-ISM core-SOL modelling;

EFDA TG on Transport;

EU ITPA members of IOS & T&C groups.

WP11-ITM-ISM-ACT3

Support to predictive scenario modelling for future devices (ITER , etc)
Description
1. Support to predictive modelling of hybrid scenario in future devices (ITER, etc)

- **repeat previous ITER modelling with the revised ECRH antenna configuration, assess the effect of ECRH on q-profile evolution**
- **study the pellet fuelling and effect of peaked density profile**
- **modelling of the current ramps including free-boundary equilibrium,**
- **scan the 0D operation space (Ti/Te, density, current, confinement factor etc)**
- **develop model based control matrices for real time profile control.**
- **assess MHD stability**

2. Integrated edge and core modelling of H-mode scenario including impurity seeding for radiative divertor

Implementation Method:

Baseline Support

Requested manpower/skills:

transport experts, heating, current drive and fuelling experts, core, edge and SOL integrated modelling experts, MHD and impurity experts, EFDA transport topical group experts. The total manpower required amounts to minimal 4.0 ppy under BS .

Deliverables

Title	**Start date**	**End Date**	**Deliverable(s)** **(precise definition)**	**Dependent activities**
Hybrid scenario with revised ITER ECRH antenna configuration	04.01. 2011	04. 2011	scenario to be developed and passed for density modelling	ITER-IO provides the exact ECRH configuration
Hybrid scenario with revised ITER ECRH antenna and density modelling	04.01. 2011	31.12. 2011	scenario to be developed and passed for MHD analysis and impurity modelling	
Modelling of deep pellet fuelling in ITER hybrid regime	04.01. 2011	31.12. 2011	Assess the pellet penetration in ITER hybrid scenario	
Hybrid 0-D modelling	04.01. 2011	31.12. 2011	Estimation of operational space for hybrid scenario in future devices	
ITER hybrid current ramp-up and free boundary equilibria calculation	04.01. 2011	31.12. 2011	Optimised q-profile during ramp-up phase for Hybrid regime Scenario operational space constrained from PF limits)	
MHD stability of hybrid scenario	04.01. 2011	31.12. 2011	Stable MHD domain	
hybrid real time q profile control	04.01. 2011	31.12. 2011	Model based matrices for profile control	
Integrated modelling of ITER H-mode scenario including impurities	04.01. 2011	31.12. 2011	Core-edge-SOL simulations: temperatures, density, current diffusion, impurity	
JT-60SA modelling	04.01. 2011	31.12. 2011	Define operational space (0-D modelling)	

Code Camps or other coordinated efforts (preliminar)

Type of effort	**Intended audience**	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Working Session Joint meeting with ITER-IO SOL experts on coordinated ITER-ISM core-SOL modelling	ISM, IMP3	Feb-March	1	Review of activities since previous working session, agreement on the ITER parameters (shape, fuelling, heating and current drive actuators), first set of modelling with simple transport model, scan 0-D operational domain
Working Session	ISM, IMP3	May-June	1	Review of activities since previous working session, apply theory based transport modelling, prepare combined thermal and density modelling, Analysis MHD stability, coordinate ISM participation to EPS 2011
Working Session	ISM, IMP3	Nov	1	Review of activities since previous working session, finalise modelling for publication, first set of edge and core modelling, status of publications

External connections / requirements

Expertise from EFDA Topical Groups Transport and MHD is required.
Expertise from ITER-IO to precise the ITER modelling inputs (equilibrium, Heating & Current Drive, Edge conditions etc),
Expertise from EU members of T&C and IOS ITPA groups.

Participation in ISM working sessions of:

ITER-IO SOL experts on coordinated ITER-ISM core-SOL modelling;

EFDA TG on Transport;

EU ITPA members of IOS & T&C groups.

JET related activities

described at activity level

Resources

The completion of the ISM work programme for 2011 is estimated to require a minimum of 8 Ppy under Baseline Support and a minimum of 1 Ppy under Priority Support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestone.

8.4 Scientific and Technical Reports

described at activity level

Milestones and Deliverables

Milestones:

- **Integrated scenario modelling activities in line with the ITPA priorities and recommendations, including code benchmarking and validation.**

- **Promotion and deployment of ITM tools towards predictive scenario modeling of existing and future tokamaks**

Deliverables:

described at activity level

9. TFL:

Task Agreement WP11-ITM-TFL:

Task Force Leadership

9.1 Introduction

The ITM-TF is lead by a Task Force leader and two deputies. These are appointed by the EFDA-SC and reports to the EFDA leader.

The ITM maintains in 2011 five projects, the Infrastructure and Software Integration project (ISIP) supporting the underlying technology of the modelling Platform and four physics related Integrated Modelling Projects covering equilibrium, MHD and disruptions (IMP#12), transport code and discharge evolution (IMP#3), turbulence, micro-instabilities, and neoclassical transport (IMP#4) and heating, current drive and fast Particles (IMP#5). In addition three tasks are coordinated under the Task Force Leadership, AMNS (Atomic, Molecular, Nuclear and Surface Physics Data), EDRG (Experimentalists and Diagnosticians Resource Group) and the project on ITER Scenario Modelling (ISM.

As all Project leaders have their end of term in December 2011, present Call for Participation do not call for new project leaders.

Associations commiting their staff to this task in 2010 are asked to re-commit it fo 2011!

List of Task Force and Project Leaders in 2010

WP10-ITM-TFL-TFL	**CEA**	Gloria FALCHETTO	gloria.falchetto@cea.fr
	IST	Rui Coelho	Rui.Coelho@cfn.ist.utl.pt
	IPP	David Coster	David.Coster@ipp.mpg.de
WP10-ITM-TFL-PL-IMP12	**CEA**	Maurizio OTTAVIANI	maurizio.ottaviani@cea.fr
	ENEA_RFX	Roberto Paccagnella	roberto.paccagnella@igi.cnr.it
	IPP	Christian Konz	cjk@ipp.mpg.de
WP10-ITM-TFL-PL-IMP3	**IPP**	David Coster	David.Coster@ipp.mpg.de
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	IPP	Grigory Pereverzev	pereverzev@ipp.mpg.de
WP10-ITM-TFL-PL-IMP4	**IPP**	Bruce Scott	Bruce.Scott@ipp.mpg.de
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WP10-ITM-TFL-PL-IMP5	**ENEA_CNR**	Daniela Farina	farina@ifp.cnr.it
	ENEA_Frascati	Gregorio Vlad	gregorio.vlad@enea.it
	VR	Thomas Johnson	thomas.johnson@ee.kth.se

WP10-ITM-TFL-PL-ISIP	**CEA**	Frédéric Imbeaux	frederic.imbeaux@cea.fr
	ENEA_RFX	Gabriele Manduchi	gabriele.manduchi@igi.cnr.it
WP10-ITM-TFL-PL-ISM	**CEA**	Xavier Litaudon	xavier.litaudon@cea.fr
	CCFE	Irina Voitsekhovitch	irina.voitsekhovitch@ccfe.ac.uk

9.2 Objectives

9.3 Work Description and Breakdown

Work Breakdown

WP11-ITM-TFL-PL

Project Leadership

The Task Force on Integrated Tokamak modelling (ITM-TF) is mainly organized in *Projects*, covering major code package developments, and tasks addressing critical physics/technology issues. The latter will generally comprise joint efforts of theoreticians, experimentalists and engineers. Each project is coordinated by a *Project Leader* belonging to an Association. Project Leaders will be proposed by the Task Force Leader to the EFDA Leader on the basis of their scientific competence and of the scientific support which can be provided by their Association. The Project leaders are responsible for the day to day management of their projects and report to the Task Force leader.

In addition to leading, monitoring and developing the detailed work programme for the projects , to be endorsed by the Task Force leader, the project leaders have additional responsibilities:

- **Maintaining up to date project information (external and internal) on the ITM website.**
- **Enforcing the publication policies of the ITM within their projects.**
- **Representing the Task Force in scientific areas.**
- **Advising the Task Force leader on issues relating to their project and task force strategies.**
- **Provide Periodic reports to the TF leadership.**
- **Contribute the Annual Progress Report.**
- **Provide representation in the Gateway User Board**

WP11-ITM-TFL-TFL

Task Force Leadership

The TF leadership is providing the Scientific Leadership of the Integrated Modelling TF. They will ensure that the overall EFDA Work Plan and Work Programme objectives are adequately translated into specific / detailed scientific and technical objectives. Furthermore, they shall make sure that the work within the TF on development, validation and application of computational models, including their integration, is consistent with the objectives and that they are met. The TF leader can also propose activities within international collaborations and implement approved activities. The Integrated Modelling TF Leader shall report to the EFDA Leader.

JET related activities

Resources

- **0.75 ppy of Priority support is foreseen for the Task Force Leader**
- **0.5 ppy of Priority support is foreseen for the Task Force Leader Deputy**
- **0.25 ppy of Priority support is foreseen for the Project Leader / Projet Leader Deputy / ISM Task Coordinator / ISM Task Coordinator Deputy**

9.4 Scientific and Technical Reports

Milestones and Deliverables

Milestones:

Deliverables:

Activity	*Priority Support Deliverables*	*Due Date*
WP11-ITM-TFL-TFL	Task Force leadership is an ongoing activity and the main concern is to lead the project towards a successful and timely implementation of the work programme. The Task Force leaders have reporting obligations to the EFDA leader: · Lead and organize the overall ITM –TF activities · Monitor progress in the TF and seek to secure the needed resources · Define and implement the annual work programmes (to be endorsed by EFDA leader) · Provide Annual report of ITM activities · Support the interaction with TG and other EFDA, EU and ITER related organization The Task force leaders should actively support the EFDA leader in outreach and collaborative activities. The project leader will be supported by one or more deputy project leaders. The exact division of responsibilities between the project leader and his or her deputies within the project will be decided by the Project leader. The project leader maintains all responsibilities for the project towards the Task Force.	31. Dec 2011

Appendix: Gateway User Agreement

ITM SOFTWARE POLICIES AND GATEWAY USER AGREEMENT

Background and General information

The Integrated Tokamak Modelling Task Force (ITM-TF) is a Task Force defined under the European Fusion Development Agreement (EFDA). It has the long term aim of developing a validated suite of simulation codes for ITER exploitation and the remit extends to the benchmarking on existing devices.

The working format for the ITM-TF is collaborative activities between individual and Associations aimed towards the creation of a common simulation framework for fusion plasmas. Software within the ITM-TF is either original software developed fully within the ITM-TF or software contributed by the EFDA Associates and adapted to the ITM-TF framework, through ITM-TF. We take the ITM-TF framework to collectively mean the contributed and developed software together with compiled databases of experimental and simulation data.

ITM-TF undertakes to provide a record of the software being contributed to the ITM-TF in a registry and it will track the contributions made to the software within the ITM-TF activities. The initial data entry for the contributed software is provided by the Contributing Associate through information detailed in a separate Grant of Software Access agreement which also should appoint a Responsible Officer for the Software.

The ITM Gateway is a joint resource for contributors to the ITM-TF work programme and users of software developed within the framework of ITM-TF. The purpose of the Gateway is to provide a common development environment and access to contributed software. In addition, the Gateway should act as a user access point to relevant simulation and experimental data as well as the entry point to a wider range of computing resources. Only activities which are consistent with the ITM-TF Terms of reference can be supported on the ITM Gateway. The Gateway hosts the ITM-TF software repositories. Access to the repositories is structured according to the status of the software and the role of the users as described in the section on Quality Assurance.

All activities on the ITM Gateway need to be performed within one of the Integrated Modelling Projects (IMPs) or the Infrastructure and Software Integration Project (ISIP) or in collaboration with other EFDA entities.

The ITM GATEWAY USER BOARD (GUB) supports the development and maintenance of the contributed software and monitors the activities on the ITM Gateway. It consists of at least one representative from the TF leadership and one representative appointed by each of the Projects (IMPs and ISIP) and represents the unique management body and the main point of contact to users of the ITM Gateway. It grants access to the Gateway, to software releases and repositories, and the relevant data and data access tools based on the status of the user.

Two levels of Gateway user status are possible:

Active developers are individuals or groups of individuals contributing to an ITM Task formalized under a Task Agreement (TA) between their HRU and the EFDA Leader. These Tasks form the core of ITM work programme and are organized within the ITM project structure and coordinated by the

Project Leaders. Active developers are formal project members or collaborators agreed by the ITM task force leader and have access to the **project software development repositories** and the **ITM public release repository**. The appointment of active developers in a given task for development on a specific code should be agreed by the code responsible officer and the corresponding project leader.

Active users are individuals or groups of individuals that are not directly involved in the development of the ITM software suite but are actively using the ITM-TF tools for physics studies. This category of users will in general be supported though collaboration with the different Topical Groups, European Experiments or on an individual basis through work proposals supported by the GUB. This category of users has access to the ITM public release repository only. In general only binary versions of contributed software are available to this category of users. Exception to this rule can be granted by the ITM Gateway User Board in agreement with the Responsible Officer for the respective software.

Access rights to the ITM gateway may be revoked if a user is found to be in breach of the terms of the user agreement as set out in this document.

EFDA ITM-TF Software License Agreement

This ITM-TF Software License Agreement for ITM-TF Software (“License”) is an agreement between the undersigning party (“Licensee”) and the ITM-TF for the use of the ITM-TF Software (the "Software"), as defined below. If the undersigning party is obtaining access to the software for personal use, this agreement applies to and binds the undersigning party personally. If the undersigning party is obtaining access to the software as part of its work for an organization, this agreement applies to and binds such organization. In such a case the undersigning person must expressly declare that he/she acts on behalf and in the interest of the organisation.

The Software in this respect is any software contributed to the ITM-TF by an EFDA Associate through issuing of a Grant of Access form or any software developed solely within the ITM-TF in support of its work programme. The ITM-TF Software is thus constituted by the ITM-TF software repositories.

License

This software has been contributed by an EFDA Associate within the framework of the EFDA Taskforce on Integrated Tokamak Modelling (ITM-TF). The software has either been developed directly within the ITM-TF work programme or the EFDA Associates have granted the ITM-TF right of managing and distributing the Software on their behalf under this ITM Software Licence Agreement

1. ITM-TF allows the undersigning party to use the ITM-TF computer software residing in ITM-TF managed software repositories provided that this software will be used exclusively for non-commercial research purposes.

2. The undersigning party agrees not to transfer the software to third parties and not to grant sublicenses. If the undersigning party receives a request for such transfer it should be referred to the ITM Gateway User Board that will decide on appropriate action in consultation with the involved Associates and EFDA.

3. The undersigning party agrees, to use the software only for peaceful purposes and to avoid using the software for military purposes or any other purpose falling under the provisions for non-proliferation.

4. Except as specified in this license, all express or implied conditions, representations, and warranties including, without limitation, any implied warranty of fitness for a particular purpose, correctness of the mathematical and physical model, or error freeness of the numerical scheme, as well as non-infringement of copyrights, or arising from a course of dealing, usage, or trade practice, are hereby excluded to the extent allowed by applicable law. The undersigning party will notify ITM-TF if it discovers that the software contains any error or infringes any copyright.

5. Within the limits of the license granted to him, the undersigning party is required to make any modifications and improvements of the contributed software available to the ITM-TF under the same conditions.

6. The undersigning party agrees to acknowledge the name of the software, the author(s), the Associate(s), the ITM-TF, and cite the relevant technical reference(s) for the software package in any publication reporting results obtained with the aid of it. Any extensive support from an ITM-TF member to the undersigning party implies that the published work will include that ITM-TF member(s) as co-author.

7. Transfer of the software will involve no costs for EFDA ITM-TF.

ITM-TF SOFTWARE IS PROVIDED ON AN "AS IS" BASIS AND ANY EXPRESSED OR IMPLIED WARRANTIES (INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT AND FITNESS FOR A PARTICULAR PURPOSE) ARE DISCLAIMED. IN NO EVENT SHALL THE EFDA ASSOCIATES INVOLVED INT THE ITM-TF BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS ITM-TF SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Access to Source Code Repositories and basic Quality Assurance

ITM-TF is creating a collaborative research and software development environment for integrated modelling of ITER, DEMO and the current experimental devices. This requires joint adaptation and development of a range of software tools of different origins. It is foreseen that different levels of maturity will be exhibited during the lifetime of a code within the ITM-TF and a **layered set of access rights,** has been defined to reflect this:

Access to software is based on the ITM-TF project structure where

- Read access is granted for all active developers within a Task to all **source code development repositories** needed within the Task. Write access should be granted to the appointed Responsible Officer (RO) for each software code. Or, if so has been agreed between the ROs for the different software codes involved in the Task to a single person taking the coordinating responsibility for the software integrity in the Task. All active developers have write access to some parts of the relevant tree structure (development thread) so they can easily exchange files amongst themselves, make modifications and merge the versions

- Read access is granted for all active developers within a Project for all **Release Candidates** of the different software packages within a Project. A Release Candidate is a software or software component that is considered stable and fully adapted to the ITM-TF data structures and is currently being tested under the ITM-TF V&V procedures. Release Candidates are proposed by the Responsible Officers to the corresponding Project leader. Write access for Release Candidates is granted to Responsible officers OR the person taking the coordinating responsibility for the software integrity in the originating task. For each new version of the Release Candidate a renewed endorsement by the Project leader is needed.

- All ITM users have access to the public repositories. Public releases are proposed jointly by the Responsible Officer for each software and the corresponding Project leader to the ITM Gateway User Board. Only software that is deemed appropriate under ITM-TF V&V procedures can be proposed for Public Release. Write access for Public Releases is granted to Responsible officers OR the person taking the coordinating responsibility for the software integrity in the originating Task. For each new release of the software a renewed endorsement of the Gateway User Board is needed.

Any request falling outside of the above presented access hierarchy should be forwarded the ITM Gateway User Board. A permanent transfer of responsibility to the ITM-TF for software is possible through a separate written agreement between the involved HRU and the ITM-TF.

If a conflict arises in relation to software access or releases the first route for resolution is the ITM Gateway User Board. If that route fails to resolve the issue the TF Leader will move the complaint to the attention of the involved HRUs and the EFDA leader for further consideration.

ITM Publication Review Procedure

All activities in the ITM-TF are based on collaborative work involving, in most cases, several Associates providing resources and staffing to the ITM-TF through EFDA. The EFDA Publication Rules approved by the EFDA Steering Committee therefore apply to these activities.

Any manuscript intended for circulation outside the Task Force which is based on ITM related work has to be cleared by the Task Force Leader.

In line with the EFDA Publication Rules, the following procedure applies:

1. All proposed publications, conference contributions and abstracts need to be endorsed by the Project Leader(s) under whose project(s) the main part of the work to be reported was carried out. The manuscripts, abstracts, presentations and posters must then be submitted to the TF leadership at least 14 days prior to submission deadline for review.

2. The submitting author needs to have cleared any internal review and publication authorization required by his Association by the date of seeking review by the TF leadership. In the case of a manuscript or contribution deemed important to the ITM-TF where the author fails to clear an internal review or obtain travel authorization, the ITM-TF reserves the right to take appropriate measures to secure the publication or presentation of the material through other means.

3. No manuscript should be submitted without TF leadership approval. The submitting author should be prepared to iterate the manuscript until consensus has been reached. The TF leader communicates the final approval and submits the manuscript to EFDA for archiving.

4. EFDA leader can act as adjudicator on TF leader final decision if so requested by submitting Associate.

As a user (**active developer** or **user**) of the ITM Gateway I declare that

- I will abide by any software licenses covering contributed ITM gateway software tools. I have reviewed the general ITM software license as given here and agree to its contents. I am aware that for some software tools additional requirements may apply if so explicitly stated.
- In case I contribute software to the repository, I will take necessary measures in order to inform –other active developers or users as well as end users on any limitation of use due in particular to existing third parties' rights on the contributed software. I will also inform of the parts of software falling under Open Source Licenses.
- I agree to the ITM publications procedures for any work intended for dissemination outside of the ITM which depend in whole or in part on the use of the ITM gateway or any ITM software tool.
- I will not install or run any software on the ITM Gateway which cannot be directly attributed to my role as an **active developer** or **user**.
- I understand that User access to the Gateway is granted through individual accounts that cannot be transferred or shared.

Date and Place:

.....

Project (s)[ISIP or IMP#]

Associate

Name:

Signature:

.....

Full address:

e-mail:

phone:

fax:

For Non-EFDA collaborators only:

duly representative person of sponsoring Associate or organisation[1]

Name:

Organisation:

Signature:

[1]Members not directly employed by an Associate can be formal collaborators ITM and/or users of the Gateway. A co-signature is then required by a recognized official of the sponsoring party, usually an Associate, or as per collaborative agreement of the organization with ITM-TF and EFDA