Call for Participation

2013 Work Programme

INTEGRATED TOKAMAK MODELLING TASK FORCE

Deadline for Responses: 14. Dec 2012

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This Call for Participation aims to implement the Integrated Tokamak Modelling Work Programme for 2013 under Task Agreements as foreseen in the new EFDA Art. 5

Introduction

At its 52nd meeting in Marseille, France, 3-4 October 2012, the EFDA Steering Committee approved elements of the EFDA 2013 Work Programme, including the programme on Integrated Tokamak Modelling programme (EFDA (12) 52/4.1.1). The ITM-TF Work Programme will be implemented through the Integrated Modelling Projects (IMPs), the ITER Scenario Modelling project (ISM) and the Infrastructure and Software Integration Project (ISIP).

IMPs have 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 and physics exploitation. ISIP is responsible for providing the technology backend and framework technology for the Task Force as a whole.

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.

Since the ITM budget 2013 has not yet been allocated the resources requested in the present Call for Participation are only indicative.

Table 1: Summary of Task Agreements for the 2013 Work Programme

Task Agreement	Activity
WP13-ITM-AMNS	Atomic, Molecular, Nuclear and Surface Physics Data (*Task under Task Force Leadership*)
WP13-ITM-EDRG	Experimentalists and Diagnosticians Resource Group (*Task under Task Force Leadership*)
WP13-ITM-IMP12	MHD equilibrium, stability and disruptions
WP13-ITM-IMP3	Transport Code and Discharge Evolution
WP13-ITM-IMP4	Transport Processes and Micro stability
WP13-ITM-IMP5	Heating, Current Drive and Fast Particle Physics
WP13-ITM-ISIP	Infrastructure and Software Integration Project
WP13-ITM-ISM	ITER scenario modelling
WP13-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 the end of their term on 31st December 2013.

Priority Support

In 2013, the minimum total commitment from an individual to priority support activities should be 0.15 ppy. Lower commitment might be accepted on an exceptional basis for specific tasks.

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

- TF and project leadership (0.5 ppy for TF leader and 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 2013

Task Agreement	**Activities under Priority Support**	**Specific Tasks under Priority Support**
WP13-ITM-AMNS	• ACT1 partial • ACT2	• Coordination of AMNS data • Maintenance of AMNS interfaces
WP13-ITM-EDRG	• ACT1 partial • ACT2 • ACT3 partial	• Provision of the Data Mapping for the “testbed" shots • Coordination of plasma control activities and support to control integration in workflows • Synthetic diagnostics integration; V&V of erc3d code
WP13-ITM-IMP12	• ACT1 • ACT2 partial • ACT3	• Integration of equilibrium and MHD modules into ITM Workflows and Maintenance of IMP12 codes • Adaptation of MHD codes of particular relevance for the ITM-TF (ELMs, error field, ab initio non linear 2D/3D MHD) • Verification and Validation
WP13-ITM-IMP3	• ACT1 partial • ACT2 partial	• Maintenance, continuing development, verification and validation of the ETS and other core components • Integration of edge codes and wall code Edge-

		core coupled Kepler workflow
WP13-ITM-IMP4	• ACT1 partial • ACT2 partial • ACT3 partial	• Porting of experimental data into the ITM database • Perform simulation on the Gateway, where the workflow submits the actor to HPC-FF/IFERC, collecting data on the Gateway. • Validation of SOL codes against Langmuir probe data Provision of actors for neoclassical and linear codes used in ISM-ACT2
WP13-ITM-IMP5	• ACT1 partial • ACT2 • ACT3	• Maintenance and V&V of H&CD actors • Development of ITM workflows based on IMP5 actors • Development and integration of models for synergies between heating schemes and self-consistent coupling of IMP5 heating codes
WP13-ITM-ISIP	• All (ACT1, ACT2, ACT3)	• Support the users (Hotline, documentation, tutorials) • Maintain and upgrade the existing functionalities of the framework • Identify and develop missing functionalities in the framework
WP13-ITM-ISM	• ACT1	• Support to the validation and physics application of the ETS and ITM tools

A significant part of the work of 2013 activities falling under Priority Support will be organised in coordinated working sessions and code camps.
Training on ITM tools will be offered in March 2013 and all who are not familiar with the latest version of the ITM tools are strongly encouraged to attend this event.

Table 3: ITM Trainings and Code Camps in 2013

ITM coordinated efforts	**Provisional dates / locations**
Code Camp	4-22 March / IPP-Garching
ITM Tools Training (in connection with the Code Camp)	4-22 March / IPP-Garching
Code Camp	15-26 April / CIEMAT
Code Camp	8-19 July / TEKES
Code Camp	9-20 September / MedC
Code Camp	November-December / Not yet decided

Attendance at 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 in Table 3 and the required participation 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 strengths and weaknesses of the model, possible limitations and identify, whenever possible, future model extensions.

Main programmatic priorities of the 2013 ITM Work Programme

In agreement with the remit of the ITM-TF and of EFDA ITER Physics as well as with the Horizon 2020 roadmap, the drive for the activity in 2013 should stem from a short-list of ITER and DEMO relevant physical problems requiring complex integrated modelling for which ITM will provide the capability by developing the necessary functionalities.

In 2012 ITM-TF is achieving the development of complex workflows allowing for the following capabilities:

- Linear MHD stability analysis chain for production use
- Free boundary plasma simulator coupled to transport solver with shape and position feedback control.
- Core transport simulator including Heating and Current Drive, impurities, pellets, sawteeth, NTM.
- First principle turbulence core simulations coupled to transport, using HPC resources.
- Direct core-edge coupling.

2013 should see the validation and application of the above workflows on physics problems of relevance to the ITER Scenario Modelling activity, ITPA and/or for regular interpretative/predictive modelling of experimental data from present devices by modellers/experimentalists in the Associations. As an added value to the modelling activities in the EFDA WP, the ITM-TF should liaise with other EU activities as well as ITPA to identify synergies between existing programs and gaps where tools required for their programs are not sufficient, or do not yet exist.

ITM-TF wide priority workflow development in 2013 and related project activities involved (Priority Support)

Physics milestones for 2013:

1. Integrated modelling of ITER scenario with ITM ETS workflows, based on the existing scenario developed with CRONOS, JETTO and ASTRA – Calculation of edge MHD stability and core turbulence.
2. Impurity modelling for JET and ASDEX Upgrade - address the core impurity transport (Be and W) in L mode and baseline ELMy scenario for JET with the new ILW and AUG with W wall. Comparison of simulated radiation profile with experiments.
3. VDEs in present experiments (e.g. JET, TCV) and ITER
4. First exploitation of a system code for DEMO reactor modelling, using ITM framework (in coordination with EFDA PPPT Work Programme)

Technical milestones for 2013 are the development of workflows providing for the following capabilities:

1. First principle based core/edge transport simulations using HPC resources.
2. Local analysis of the bulk plasma - interpretative simulations including equilibrium reconstruction, the use of measured profiles, calculation of H&CD deposition profiles (accounting for synergy effects) and calculation of transport coefficients (possibly including turbulence modules).
3. Full scale simulation involving feedback control and H&CD.
4. Workflow for reactor design, simulating self-consistently the Plasma, Divertor, Breeding Blanket and Bio-Shields, TF and CS coils.

Relation to Experiments

The validation and exploitation of the above workflows will strongly imply collaboration with the official Contact Persons assigned to each device experimental device (WP13-ITM-EDRG-ACT1) and ITER, in particular it is foreseen:

- Consolidation of the Machine Description and Data Mappings (MD&DM) of all participating devices and ITER in view of covering all subsequent needs of testbed data for V&V of ITM codes and workflows. It is anticipated that updates of the data mappings to comply with the current working version of the data structure (v4.10a), its future upgrades and corresponding planned installations will be needed.
- In collaboration with other activities under EFDA ITER Physics Work programme for 2013, bring further synthetic codes to the ITM and increase collaboration on workflow design for plasma control applications.
- In collaboration with ITER-IO and ITPA-IOS experts, develop ITER scenario modelling for current ramp down; real time model-based profile control; expansion of the operational domain of ITER hybrid scenario with q on-axis below one by controlling the sawtooth period.

Additional V&V efforts will be pursued within the specific integrated modelling projects on selected "testbed" shots (IMP4, ISM)

Benchmarking of the equilibrium and MHD stability modules against each other within the equilibrium and MHD stability chain and validation against experimental data will continue. Physical exploitations of selected ETS workflows on experimental data, coordinated under ISM-ACT1, is expected to involve all integrated modelling projects.

Interpretative and predictive modelling of scenarios for existing EU devices will be carried out by the ISM project as well as predictive modelling of ITER, JT60-SA (under input of the JT60 SA EFDA Work Programme implementation) and DEMO (under input of the EFDA PPPT Work Programme implementation) scenarios.

Implementation

All software integration and development is expected to be carried out 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 projects and at the same time ensure that Quality Assurance and traceability criteria for the ITM projects that adhered to.

Relation to HPC-FF, HLST and IFERC

The achievement of some of the above described ITM milestones will require the use of High Performance Computing systems. ITM has been allocated CPU time on IFERC for development purposes and submitted a proposal for an allocation dedicated to running workflows including large first-principle codes. Installation of the UAL on IFERC will largely be carried out by the ITM (and in particular by the CPT) – some support on the interoperability between the Gateway and the IFERC from the HLST might be necessary. The HLST provided support for applications requiring large data transfers (ADIOS) and is evaluating the US developed Integrated Plasma Simulator (IPS) framework which provides different nested levels of parallelization on an HPC.

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.

1. AMNS:

Task Agreement WP13-ITM-AMNS:
Atomic, Molecular, Nuclear and Surface Physics Data (Task under Task Force Leadership)

1.1 Introduction

The ITM has a broad need for data relating to atomic, molecular, nuclear and surface data (AMNS). In particular, AMNS data are needed in several of the ITM modelling projects. A consistent approach, taking into account the specific requirements of the ITM while maintaining the work aligned with other European efforts in this area, is therefore required. The 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 codes

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 • Bundeled charge state descriptions
Surface data	• Sputtering/Reflection coefficients • Chemical sputtering • Mixed materials effects
Nuclear data	• Nuclear reactions for: D-D, D-T • Cross sections for diagnostics

The data will be needed by codes that have plasma temperatures/energies in the range of 0.1eV to 100 keV; for CX cross section data energies up to 5 MeV are wanted; the electron density should be between 1018 to 1022 m-3. The ITM has standardised on S.I. units but with temperatures in eV. There is a desire for cross-section data to be available as a function of angle as well as energy.

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 interface. The work on providing the AMNS data can be split into two parts:

(i) contact with different databases, including recommendation of the best data to be used/stamp of approval; transfer of appropriate data to the ITM-TF data repository;

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

In 2013 the emphasis will be on adding more data (in particular, a complete set of surface data, atomic cross sections for key elements, and the start for molecular data) and implementing the AMNS interface in more codes.

1.2 Objectives

The purpose is to supply AMNS data to ITM codes including

- a full set of rate coefficients for atomic processes
- a set of cross sections for atomic processes
- a full set of sputtering and reflection data for surface processes
- an initial set of data for molecular processes
- a full set of cross sections for the basic thermo-nuclear processes
- data for bulk materials

1.3 Work Breakdown

WP13-ITM-AMNS-ACT1

Coordination and Provision of AMNS data

Description
The following tasks are foreseen:

1. coordination of data for Atomic data
2. coordination of data for Molecular data
3. coordination of data for Nuclear data
4. coordination of data for Surface data
5. coordination of data for Bulk materials
6. the provision of AMNS data to the ITM

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- Tasks 1-5 will be covered by Priority Support with indicative manpower of 0.25 ppy for each of the areas (atomic, molecular, nuclear, surface) Participation in at least two of the relevant code camps is required.
- Task 6 is under Baseline Support with total manpower required of 2 ppy.

Existing Commitments: This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Integration of AMNS data for delivery to ITM codes.
Code Camp	April	**2**	Integration of AMNS data for delivery to ITM codes.
Code Camp	September	**2**	Integration of AMNS data for delivery to ITM codes.
Code Camp	Nov/Dec	**2**	Integration of AMNS data for delivery to ITM codes.

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

WP13-ITM-AMNS-ACT2

Further development, maintenance and documentation of modules to provide AMNS data to ITM-TF codes as well as support for the use of the modules

Description
The following tasks are foreseen:

1. further development, maintenance and documentation of the user callable interface to the AMNS library
2. support for the implementation of the AMNS interface in ITM codes

Implementation Method:
Priority support

Requested manpower/skills (indicative):

- Task 1 will be covered by Priority Support with indicative manpower of 0.25 ppy
- Task 2 will be covered by Priority Support with indicative manpower required of 0.25 ppy.

Participation in at least two of the relevant code camps is required.

Existing Commitments: This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Integration of AMNS modules for ITM codes.
Code Camp	April	**2**	Integration of AMNS modules for ITM codes.
Code Camp	September	**2**	Integration of AMNS modules for ITM codes.
Code Camp	Nov/Dec	**2**	Integration of AMNS modules for ITM codes.

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

1.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-AMNS-ACT1	• Documentation of data transfers to the ITM-TF, including software used for this purpose, and other activities carried out for the task. • Documentation of modules used for taking data from external databases and to store them in the ITM database via the AMNS data structure.	31. Dec 2013
WP13-ITM-AMNS-ACT2	• Interface updates (T1). Updates to the AMNS interface modules as needed by new data and new capabilities; documentation of the updates • Implementation report (T2). Report of codes converted to use the AMNS interface	31. Dec 2013

2. EDRG:

Task Agreement WP13-ITM-EDRG:
Experimentalists and Diagnosticians Resource Group (Task under Task Force Leadership)

2.1 Introduction

The Experimentalist and Diagnosticians Resource Group (EDRG) promotes and coordinates the validation and consolidation of the simulation tools that the ITM-TF aims to provide for ITER and existing experiments, interacting with the experimentalists and diagnosticians fusion community. The EDRG group is in charge of 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, the support to the integration of control elements in TF-wide Kepler workflows, and the development and integration of synthetic diagnostic modules, covering as broad range of European fusion devices as possible. All the before mentioned activities address both present devices and ITER and can seamlessly be extended to include JT-60SA and DEMO.

In line with the EFDA 2013 Workprogramme, the activities of EDRG on 2013 will address the revision and consolidation of the MD and DM of present devices and of ITER. This will cover adaptation to new releases of the ITM datastructure, the development of new diagnostic CPOs when needed, revisions to the 3D first wall rasterization models for the devices and all subsequent needs of testbed data for V&V of ITM codes and workflows. The integration of machine descriptions for JT60-SA and DEMO is planned. Coordination of the plasma control activities will be pursued, with special emphasis on the support to other IMPs to encompass control related actors in their workflows and to integrate actuator circuiting from particular devices as support to feedback control workflow design and testing. In the area of synthetic diagnostics, the verification of the several kernel implementations for the European Reflectometer 3d code (erc3d) including the coupling to turbulence spectra and code validation against experimental data will proceed. Integration of other synthetic diagnostic efforts of interest as called out by the user community is also foreseen. Further testing, validation and use for interpretative experimental data analysis on present devices of the synthetic diagnostics integrated during 2012 will be carried out in collaboration with relevant IMPs, e.g. neutron diagnostic modelling predictions for ITER, building on ETS+H&CD runs.

2.2 Objectives

Revise and consolidate the machine descriptions, data mappings and experimental data from the tokamak devices involved in the ITM-TF modelling activities, including ITER. Maintain and further develop, where needed, the synthetic diagnostics integrated during 2012 and proceed to their validation, supported by ETS and H&CD runs, against experimental data.

2.3 Work Breakdown

WP13-ITM-EDRG-ACT1

Machine Descriptions, data mappings and experimental data

Description

1. Maintenance and support on the Machine descriptions and Data mapping for each of the participating devices (includes provision of STL files for the first wall when required). (BS)
2. Consolidation of H&CD elements, 2D vessel qualifying for discontinuous elements, pfsystems CPO and upcoming diagnostic CPOs as requested by the IMPs (e.g. Strike point, Bremsstrahlung, LIDAR, neutral particle analyser, X-ray diagnostics).
3. Contact person for each of the participating devices, assisting and coordinating ITM-TF V&V activities by delivering data mappings of "testbed" shots (coherent and reasonably complete set of plasma profiles of representative scenarios as well as fluctuation diagnostics data as requested for IMPs validation tasks). ***Priority support will be given to devices for which V&V activity on given codes/workflows is agreed.***
4. Whole device wall surface mesh for representative tokamak devices with different physics requirements (gas-tight vs ports), relevant for edge code boundary conditions.

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- T1 –T2 Experimentalists from each of the participating experiments are requested. Estimated 0.15ppy per device for MD and DM maintenance. (BS)
- T3 For providing the DM for the "testbed", experimentalists/database experts with experience in data validation and, desirably, good understanding of the ITM datastructure are requested, 1pm commitment per device is required. Minimal total manpower required is estimated to 0.25 ppy (under Priority Support) For the coordination of the overall effort and V&V roadmap agreement, a high level representative of the associated laboratory is called for (under baseline support with estimated 0.1ppy).
- T4 Experts on the rasterization method used in ITM and the grid element structure; Experts on first wall meshing for RWM modelling (2pm estimate needed, under Priority Support).Participation at Edge Code Camps is encouraged

Existing Commitments:

- This is a continuation of the task from 2012 and all who participated in the task in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	April	**2**	provisioning of testbed data during code camp

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/JT60-SA to provide support for upgrade/maintenance of the official machine description file is also encouraged in liaison with ISM activities.
- Collaboration with PPPT is sought for in case preliminary designs for DEMO device are proposed.
- Drawing offices from participating experiments to provide CAD files of the device.

WP13-ITM-EDRG-ACT2

Coordination of plasma control activities and support to control integration in workflows

Description
This activity focuses on the coordination and support of all control related activities in the ITM-TF. Considering the TF-wide scope of such activities, the following assignments are requested :

1. A coordinator for plasma control activities is requested, taking the responsibilities to:

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

- Plasma position & shape feedback control (IMP12-ACT1-T3)
- MHD plasma control (RWM and NTM) (IMP12-ACT1-T4)
- Control toolbox and Simulink integration via RT Workshop/C++ wrappers (ISIP-ACT2-T10)
- Tokamak simulator layout in Kepler with Plasma model, actuators and diagnostic elements (IMP3-ACT1-T8).

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

2. Support and expertise for the development of control schemas to be used in the ITM Kepler workflows that require control (e.g. IMP12-ACT1-T3-T4).

Implementation Method:
Priority support

Requested manpower/skills (indicative):
Experts in plasma position/shape and/or MHD feedback control and/or in modelling of whole plasma evolution are requested for the overall coordination (0.1ppy).

Experts in controller design/implementation in tokamaks (0.15ppy). Knowledge of the ITM infrastructure and toolset (e.g. Kepler) is recommended.

Existing Commitments:

Continued task from 2012 where 0.15ppy were allocated.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code camp	July	**1**	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.

WP13-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

I – Forward modelling integration

1. Integration and validation on the ITM platform of synthetic diagnostics based on the forward modelling concept that are appropriate for physics code validation (present effort focus on neutron cameras, NPA and MSE).

II – Synthetic 3D reflectometer (within ERCC)

1. Verification and validation of erc3d v1.1 code (including comparison with experimental data).
2. Improve the (fully integrated) time-frame parallelized code version.
3. Improvement of mixed-scheme EM propagation.
4. Continuing 2D cross-benchmarking and benchmarking to 3D code

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- Expert modellers of diagnostics to integrate synthetic diagnostic (2pm per diagnostic). (Priority support).
- The 3D full-wave reflectometry simulation code requires microwave reflectometry modellers and computer scientists specialized in parallel programming (1.5ppy) but the task can be split up between different individuals to cover the necessary areas of expertise and deliverables. (PS: task 1; BS: tasks 2,3 and 4)
- Participation at Working Sessions dedicated to synthetic diagnostics and/or edge/turbulence is mandatory.

Existing Commitments:

0.2ppy for synthetic MSE requirement analysis. 0.35 for NPA and 0.33 for the neutron camera.

3D Reflectometer is a continued task from 2012 where 1.35ppy was allocated.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	March	**0.5**	Open forum to promote adaptation/integration of synthetic diagnostics from outside the ITM.
Code camp	July	**1**	Cross-project outreach on the use of the synthetic diagnostic codes on data from relevant IMPs.

External connections / requirements
Evident synergies should be promoted between the ITM-TF workprogramme implementation and the rest of the EFDA ITER Physics Workprogramme implementation for 2012-2013 regarding the synthetic diagnostics integration (WP13-IPH-A05, WP13-IPH-A09).

JET related activities

The EDRG group has direct interfacing with all fusion experiments involved in the ITM-TF effort, assisted by a task assigned to Contact Persons. 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 2013.

2.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-EDRG-ACT1	• MD maintenance. Provide validated MD file for current and future ITM datastructure versions. • DM maintenance. Provide validated DM file for current version and future ITM datastructure versions. • DM for testbed data. Provide DM files for best fit data of plasma profiles as well as fluctuation diagnostics data for test bed shot selection. • Defeatured meshes. Defeatured first wall meshes of different type.	31. Dec 2013
WP13-ITM-EDRG-ACT2	• Final report on coordinated TF wide control activities • Implementation of Control elements on particular ITM workflows.	31. Dec 2013
WP13-ITM-EDRG-ACT3	• Integration and validation of synthetic diagnostic modules, driven by IMP needs, in the ITM platform. • V&V of erc3d v1.1 • Code parallelization • Mixed-scheme EM propagation • 2D cross-benchmarking and benchmarking to 3D code.	31. Dec 2013

3. IMP12:

Task Agreement WP13-ITM-IMP12:
MHD equilibrium, stability and disruptions

3.1 Introduction

The 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.

In 2013 the emphasis will be on

1. **Workflow Integration 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.
2. **Adaptation of standalone modules**. This activity accommodates all IMP12 relevant modules that are entering the adaptation 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).
3. **Verification & Validation**, targeting certain “mature” codes, already at the Kepler actor stage, employing Kepler workflows, e.g. equilibrium, MHD stability.

3.2 Objectives

To provide the ITM-TF with a comprehensive set of equilibrium, linear and non-linear MHD stability modelling tools and provision of the fundamentals for a consistent free boundary equilibrium evolution, a backbone for a full discharge simulator, including plasma transport, feedback control and plasma disruption modelling and prediction. To provide and maintain equilibrium reconstruction actors to be used in the analysis of experiments in existing machines.

3.3 Work Breakdown

WP13-ITM-IMP12-ACT1

Integration of equilibrium and MHD modules into ITM Workflows and Maintenance of IMP12 codes

Description

The following tasks are regrouped under this activity, which is covered by Priority Support :

1. Integration of MHD modules with the European Transport Solver Scope of this task is to integrate composite actors with the ETS workflows, in particular for the sawteeth, NTM, and ELM modules. The contributor(s) to this task shall liaise to IMP3-ACT1-T2 to cooperate in the construction of workflows able to simulate a plasma subject to MHD instabilities and the effect of these phenomena on transport.
2. Workflow coupling free boundary equilibrium codes with the European Transport Solver This task is a continuation of 2012 ongoing work jointly with the contributors of IMP3-ACT1-T3. The scope is to couple verified free boundary equilibrium Kepler actors to ETS workflows and proceed to the verification of the combined workflow, coordinated by IMP3. The integration of other free-boundary equilibrium actors under testing is also foreseen.
3. Coupling of free boundary equilibrium codes with a feedback controller The scope of this task is to collaborate with EDRG-ACT2 in developing a workflow coupling a free boundary equilibrium code with plasma shape and position controllers. The workflow should be able to simulate dynamic equilibrium, from the start to the end of the discharge. The contributor(s) to this task shall provide expertise on the equilibrium actors to integrate the controllers. TF wide coordination of control activities is done under EDRG-ACT2.
4. MHD control workflow The scope of this task is to develop workflows for MHD modules that can incorporate feedback control of MHD modes. Contributors to this task shall provide expertise on MHD, namely on NTMs and RWMs modules, in particular on the I/O interfacing to control systems based, respectively, on H&CD (in collaboration with IMP5-ACT2-T4) and external coils. The development of the workflows and signal input interfacing to the controllers is a charge of IMP12 while the support on the actuators is done under IMP5-ACT2 (H&CD) and IMP12 (external coils) in collaboration with EDRG-ACT1. Controller integration is done under EDRG-ACT2 (TF wide coordination of control activities also falls under EDRG-ACT2).
5. Maintenance of codes belonging to ITM workflows. This task covers maintenance work for existing IMP12 modules/actors/workflows requiring adaptation to the evolving ITM TF data-structures.

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- Priority Support will be provided for tasks T1-T4 with indicative manpower of 0.5 ppy per each task.
- Task T5 will be covered by Priority Support with indicative total manpower of 1 ppy. Participation in at least one relevant Code Camp is required.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Integration of new modules / Development of new workflows
Code Camp	April	**2**	Update of modules / Development of workflows
Code Camp	July	**2**	Integration of new modules / Development of new workflows
Code Camp	September	**2**	Update of modules / Development of workflows
Code Camp	Nov/Dec	**2**	Integration of new modules / Development of new workflows

WP13-ITM-IMP12-ACT2

Adaptation of standalone MHD modules and codes

Description
This activity concerns the adaptation of all the IMP12 codes/modules up to the level of tested Kepler actor. This activity is under baseline support. That level obtained, the IMP12 codes will be eligible for Priority Support under IMP12-ACT1. Contributors should consider such a breakdown when submitting one same code/module to both ACT1 and ACT2.

Priority Support will be attributed for the adaptation of new codes of particular relevance for the ITM-TF Work Programme remit, examples of the latter are highlighted below.

Examples of qualifying codes

- Conventional equilibrium and MHD stability codes of interest to IMP12 and not yet integrated in the ITM platform (BS)
- 3D equilibrium codes (PS).
- Equilibrium solvers with plasma flow (BS)

- Modules for MHD processes: RWMs, ELMs (PS), error field models (PS), etc.
- Ab initio” non-linear MHD codes (2D or 3D) (PS).

The work breakdown in this activity foresees :

1. Adaptation and integration of new codes in the above areas to the ITM infrastructure, porting on the Gateway and Gforge SVN, creation of a Kepler actor.
2. Adaptation of codes already ported to the Gateway during 2012, up to the stage of a tested Kepler actor.

Code documentation should be generated in a quality compatible to a public release and the test procedures and test cases should be standardised.

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- The adaptation of codes up to the level of tested Kepler actor is under baseline support (approx. total 1.5 ppy).
- Priority Support with a ceiling manpower of 1.0 ppy will be attributed for the adaptation of new codes of particular relevance. Participation in at least one Code Camp is required for the Priority Support accepted tasks.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar	**2**	Adaptation of modules/codes
Code Camp	July	**2**	Adaptation of modules/codes
Code Camp	Nov/Dec	**2**	Adaptation of modules/codes

WP13-ITM-IMP12-ACT3

Verification and Validation

Description
Verification and validation (V&V) is an essential part of the ITM TF code release cycle. The scope of this activity is to carry out validation of tested IMP12 actors within ITM workflows. This is a cross-project activity targeting code developers as well as experimentalists, liasing with EDRG-ACT1, to cooperate in the validation work.

The Task Force seeks commitments from the Associations to cover as a minimum the following tasks.

1. Validation of equilibrium reconstruction codes on existing Tokamaks. A selected list of shots/scenarios from all participating devices will be proposed by IMP12 and agreed with the contact persons for the devices (EDRG-ACT1). The validation exercise is intended to cover all tested equilibrium reconstruction actors and corresponding workflows, using varied reconstruction constraints where available. The exercise will document the comparison between the reconstructed equilibria data (on CPOs residing at the Gateway – liaison to EDRG-ACT1) using ITM codes and the main equilibrium reconstruction code used in each device.
2. Verification of equilibrium and MHD stability codes. Scope of this task is the verification of the ITM TF equilibrium and MHD stability codes by code-code comparison within the equilibrium and stability chain and assessment of code inter-operability. The specific task is to verify that the chain gives equivalent results upon interchanging equilibrium codes and stability codes. This task extends the 2012 task to other equilibrium and stability codes.

Implementation Method:
Priority support

Requested manpower/skills (indicative):

- Tasks T1 and T2 will be covered by Priority Support with indicative manpower of 0.5 ppy per each task.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Integration of new modules / Development of new workflows

Code Camp	April	**2**	Update of modules / Development of workflows
Code Camp	July	**2**	Integration of new modules / Development of new workflows
Code Camp	September	**2**	Update of modules / Development of workflows
Code Camp	Nov/Dec	**2**	Integration of new modules / Development of new workflows

External connections / requirements
JET experimental data as identified by the validation task might be required.

JET related activities

Resources

The Implementation of the IMP12 work programme for 2013 is estimated to require a minimum of 3 Ppy under Baseline support and 3.4 Ppy under Priority Support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones.

3.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-IMP12-ACT1	• T1 Integration of MHD modules with ETS. Release of tested kepler actor functioning within ETS workflows and documentation. • T2 Integration of a free boundary equilibrium code with ETS. Release of free boundary equilibrium actors functioning within ETS workflows and documentation. • T3 Coupling of free boundary equilibrium codes with a feedback controller. Provision of tested kepler actors functioning within feedback control workflows and documentation. • T4 MHD control workflow. Release of the workflows and documentation. • T5 Maintenance. Update of each single module/actor/workflow to the most recent datastructure and platform upgrades.	31. Dec 2013
WP13-ITM-IMP12-ACT2	• Code adaptation up to creation of a Kepler actor • Kepler actor and test workflow • Code documentation for developers and maintainers, and User documentation	31. Dec 2013
WP13-ITM-IMP12-ACT3	• Validation of equilibrium reconstruction codes. Documentation on the validation (including released actors/workflows, public available discharges, comparison between local/ITM modules). • Benchmarking of equilibrium codes (free and fixed) within the equilibrium and MHD stability chain. Report on the benchmarking exercise	31. Dec 2013

- Benchmarking of stability codes within the equilibrium and MHD stability chain. Report on the benchmarking exercise

4. IMP3:

Task Agreement WP13-ITM-IMP3:
Transport Code and Discharge Evolution

4.1 Introduction

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 2013 the emphasis will be on consolidating the achievements of 2012, as detailed above in the programmatic background.

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

Verification and Validation (V&V) of all components will also be an important part of the programme, in collaboration with ISM-ACT1.

4.2 Objectives

The purpose is to develop ETS workflows providing for the following capabilities:

1. Free boundary plasma simulator coupled to transport solver with shape and position feedback control.
2. Core transport simulator including Heating and Current Drive, impurities, pellets, sawteeth, NTM.
3. Direct core-edge coupling.
4. Full scale simulation involving feedback control and H&CD.
5. First principle based core/edge transport simulations using HPC resources.
6. Local analysis of the bulk plasma - interpretative simulations including equilibrium reconstruction, the use of measured profiles, calculation of H&CD deposition profiles (accounting for synergy effects) and calculation of transport coefficients (possibly including turbulence modules).

4.3 Work Breakdown

WP13-ITM-IMP3-ACT1

Maintenance, continuing development, verification and validation of the ETS and other core components

Description
Maintenance, continuing development, verification and validation of the ETS and other core components Description The following tasks are grouped under this activity, which is partly covered by Priority Support:

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] [PS]
2. Release of a number of standard Kepler workflows, including (but not limited to) workflows incorporating pellets, neutrals, impurities, heating and current drive modules, sawteeth, NTMs [in collaboration with other IMPs] [PS]
3. Verification of the free boundary version of the ETS [in strong collaboration with IMP12-ACT1-T2] [PS]
4. Verification of the ETS [in collaboration with ISM-ACT1] [PS]
5. Validation of the ETS [in collaboration with ISM-ACT1 and other IMPs] [PS]
6. Preparation of one or more interpretive runs of the ETS where experimental data is imported to CPOs; the ITM profile maker is used to generate the “coreprof” CPO; either the IMP12 equilibrium chain is used to prepare the equilibrium or it is read from the experiment; IMP5 heating and current drive modules are used if necessary to calculate the sources; and the ETS is used to calculate the transport coefficients. [BS]
7. Continuation of the development of the ETS workflow coupled with turbulence code [in strong collaboration with IMP4-ACT2 and ISIP] [PS]
8. A Kepler workflow that, in addition to having a model for the plasma, makes provision for actuators and signals derived from synthetic diagnostics. This would then form the basis of future work involving the emulation of plasma control systems. [in collaboration with EDRG-ACT2] [PS]
9. Adaptation of a “system code” to Kepler workflow [BS]
10. Implementation of the rotation equation into the ETS [PS]

Implementation Method:
Priority and Baseline support (as indicated above)

Requested manpower/skills (indicative):

- Task T6 and T9 are under Baseline Support. All other tasks will be covered by Priority Support with indicative total manpower of 4 ppy

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

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

WP13-ITM-IMP3-ACT2

Implementation, integration, verification and validation of edge codes

Description
In light of the limited progress in the task area in 2012, many of the activities are continuations:

1. Conversion of SOLPS-CARRE into a standalone ITM code with input and output to CPOs and XML for code specific parameters [BS]
2. Conversion of SOLPS-B2-b2mn into a Kepler module using XML for all code specific parameters, the AMNS routines for all A&S data, and the plasma state input and output via CPOs [BS]
3. Conversion of either EIRENE or SOLPS-EIRENE (or equivalent kinetic code) into a Kepler module using XML for all code specific parameters, the AMNS routines for all AM&S data, and the plasma/neutrals input and output via CPOs capable of being used for both the core and edge [PS]
4. Development of edge-core coupled Kepler workflow(s) including verification and the start of validation [PS]
5. Implementation and release (including verification and validation) of a number of edge codes using CPOs (Phase V of “ITM modules release cycle”) [BS]
6. Definition, implementation, verification and the start of validation of a number of edge only workflows using the edge codes [PS]
7. Further development of the Generalised Grid Description [PS]
8. Integration of a wall code, perhaps initially only solving for the wall temperature but later providing wall chemical composition and/or H inventory modules using the wall CPO to couple to other edge codes [PS]

Implementation Method:
Priority and Baseline support (as specified above)

Requested manpower/skills (indicative):
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.

- A minimum commitment of 2.25 ppy of PS is anticipated

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	April	**2**	Edge code implementation; Core-edge coupling; edge code workflows; edge code V&V
Code Camp	September	**2**	Edge code implementation; Core-edge coupling; edge code workflows; edge code V&V

External connections / requirements
JET experimental data as identified by the validation task might be required. Coordination with EFDA-TF-PWI, ITPA-DIVSOL, ITER

JET related activities

4.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-IMP3-ACT1	• T1. ETS Maintenance, Report on changes to ETS solver • T2. Release of Kepler workflows and report on workflows • T3. Free Boundary ETS, release as a workflow • T4. Verification reports • T5. Validation reports • T7. Release of workflows coupling the ETS to turbulence codes; report on the efforts. • T8. Release of workflows coupling the ETS to a basic Plant design with embedded control elements; report on the efforts. • T10. Report / working version of ETS with rotation	31. Dec 2013

WP13-ITM-IMP3-ACT2	• T3. Kepler actor of either EIRENE or SOLPS-EIRENE (or equivalent code) using XML for all code specific parameters, the AMNS routines for all AM&S data, and the plasma/neutrals input and output via CPOs, capable of being used for both the core and edge • T4. Release of of edge-core coupled Kepler workflow(s). Report on verification and the start of validation • T6. Release and Documentation of the implementation, testing, verification of workflows using multiple edge codes • T7. Report on the development of the Generalised Grid Description documenting enhancements • T8. Release of wall code module, using wall CPO.	31. Dec 2013

5. IMP4:

Task Agreement WP13-ITM-IMP4:
Transport Processes and Micro stability

5.1 Introduction

Integrated Modelling Project 4 maintains responsibility for turbulence codes as well as modules for neoclassical and diffusivity-based transport models, linear instability codes, and computational fluctuation diagnostics within the Integrated Tokamak Modelling Task Force (ITM-TF).

In 2013 the emphasis will be on HPC (high performance computing) workflows, by which demanding large-scale parallel computations can serve as elements in ITM workflows for modelling and validation exercises, moving towards comprehensive simulation of ITER-scale plasmas. Work on the IFERC platform will dominate the activities as the numerical codes under IMP4 should be ported to IFERC in early 2013 for participating in the benchmarks.

Benchmarking efforts will continue, both with new codes on the existing cases and with new and existing codes on new cases, specifically an edge benchmark using experimental data from JET and ASDEX Upgrade. Validation efforts using experimental/synthetic fluctuation diagnostics are expected to advance in tandem with availability of experimental fluctuation data (these are distinct from computational fluctuation diagnostics which are used to mathematically diagnose the codes).

5.2 Objectives

The purpose is as indicated above: development of necessary tools to enable modeling of ITER through first-principles based simulations. The workflows should be able to incorporate massively parallel turbulence codes along with simpler models as modules, in communication with a similar array of modules from the other projects. Standards-keeping is an integral part of this, to be implemented in the form of ongoing benchmarking.

5.3 Work Breakdown

WP13-ITM-IMP4-ACT1

Cross verification of IMP4 turbulence codes on specified standard cases

Description
This task is a continuation of WP11-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 (IMP4 shot 1 and shot 2) on HPC-FF in 2012.

The core benchmark effort will this year be extended by an edge benchmark. Experimental data from both JET and ASDEX-Upgrade will be ported into the ITM database in the form of coreprof and equilibrium data, in cooperation with EDRG-ACT1. Also Langmuir probe data will be included in at least 1 shot, to be used under ACT 2. The porting is foreseen to happen no later than during March Code Camp. Running the benchmark is foreseen to take place in between code camps. The IMP4 working session in May and September code camp will be the place to discuss and evaluate the results of the benchmark(s).

The participants of this ACT are :

1. Code developers. Those are expected to port their code to the IFERC system during 2013. They should also join the discussion for the definition of the experimental data to be included in the edge benchmark, prior to March Code Camp. (Baseline Support)
2. For the porting of experimental data into the ITM database, in cooperation with EDRG, we are seeking an anchor person, which besides being a code developer also have experience in handling experimental data from either JET and/or ASDEX-Upgrade. This task will be under Priority Support.

Fluid and kinetic simulations of standard ITER scenarios are also foreseen in 2013, as soon as the necessary input is provided via ISM.

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):
Participants are expected to be code authors who individually port their codes to IFERC in addition to participating to the benchmarks

- 0.1-0.2 ppy per code developer (BS)

For porting experimental data experience in handling experimental data are required

- 0.3 ppy (PS) for porting JET and ASDEX Upgrade experimental data to the ITM database

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Experimental data and first test
Working session	May	**1**	Running benchmark and evaluating results
Code Camp	September	**2**	Evaluating the benchmark results
Code Camp	Nov/Dec	**2**	Evaluating the benchmark results

External connections / requirements
The description from ITER of a standard case mediated via ISM

Cooperation with JET in porting experimental data to the ITM database. IFERC.

WP13-ITM-IMP4-ACT2

IMP4 HPC workflows and interfacing with IFERC

Description
From the start of 2013 it is expected that all IMP4 codes exist as Kepler actors and can run the IMP4 test workflow and have thus reached phase III (K) in ITM code status. The aim of this task is to evolve the individual codes at least one phase forward and thus complete one or all of level 1-4 described below. For any turbulence code this requires all of these levels to involve parallel jobs, at minimum, MPI. Parallel I/O is a target. High priority is placed on obtaining a working Kepler/HPC2K case with the turbulence code running on a HPC (HPC-FF or IFERC). A commitment for frequent, ongoing tests will be considered for Priority Support.

1. The FORTRAN workflow reads experimental data from the 2010 and 2013 benchmarks on the Gateway (requires profile/equilibrium data) and extracts plasma parameters and geometry from the CPOs. At the end of the simulation the turbulence CPO are populated and stored in HDF5 file whereas coretransp is written to the database.
2. As in level 1 but using a Kepler workflow.
3. As in level 1 but implemented on HPC-FF/IFERC. Level 1 and 2 can be considered as testing whereas this step will generate benchmark data to be evaluated with other codes.
4. Generate a Kepler actor on Gateway using HPC2K and perform simulation on the Gateway, where the workflow submits the actor to HPC-FF/IFERC, collecting data on the Gateway.
5. SOL-capable codes are validated against experimental Langmuir probe data. This is an extension of 2012 Task, where the basic infrastructure was built and tested. Based on this experience the process of extracting basic Last-Closed-Flux-Surface value will be made more standard, herein using the EDGE CPO to obtained this data. Experimental data from JET and ASDEX-Upgrade (see ACT 1) are expected to include Langmuir probe data and are thus subject to this study.

Tasks 4 and 5 are covered under Priority Support.

During the Code Camps and working session codes new in IMP4 will be given sufficient time to catch up.

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- Minimum commitment required 0.1-0.2 PPY (BS) for each code/author
- Level 4 requires 0.15 to 0.3 PPY under Priority Support (PS)
- Level 5 requires a 0.3 PPY under Priority Support (PS)
- Participation in at least two code camps is mandatory for PS.
- HPC/MPP capability needed

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Porting new codes
Code Camp	April	**2**	
Working session	May	**1**	Langmuir probe, task 5: Implementing code and making workflow
Code Camp	July	**2**	
Code Camp	September	**2**	Langmuir probe Task 5: Evaluation of the validation exercise
Code Camp	Nov/Dec	**2**	

External connections / requirements

- JET experimental data as identified by the validation task IMP4-ACT1 might be required.
- IFERC
- HLST grid computing, parallel I/O, and library expertise.

WP13-ITM-IMP4-ACT3

Cross verification of linear and neoclassical codes on specified standard cases

Description

This activity is specific to neoclassical and linear codes, distinct from versions of turbulence codes. Authors of neoclassical codes who are also neoclassical theory experts are especially encouraged to apply. Additionally there is increasing demand for impurity modelling so the neoclassical codes are required to treat the coreimpur CPO.
Linear codes will have to be able to translate their results into the coretransp CPO elements (flux/diff/vconv) for each transport channel (especially including the subdominant ones).

The work consists of establishment/maintenance of the CPO interface and Kepler actor version for the given code. Demonstration of performance on the benchmark case under Kepler is sufficient to enable use of the actor in ITM-wide workflows.

Developers responsible for codes used within the ISM activities (i.e. NCLASS and QualiKiZ) are especially encouraged to apply to IMP4-ACT3. Actual benchmarking can be done collectively (project leadership plus others in standard test workflows). The stamp of responsibility and knowledge of the model are what is especially needed as well as a long-term commitment for assuming responsibility for this class of codes.

Participants are encouraged to interact with ACT2 on Kepler workflow generation.

Implementation Method:

Priority and Baseline support

Requested manpower/skills (indicative):

- minimum 1 Ppm (BS) for each code/author
- Priority Support (PS) will be attributed for the participation of developers responsible for the codes used under WP12-ITM-ISM-ACT1 and WP13-ITM-ISM
- Participation in at least one of the two code camps is mandatory for PS

Existing Commitments:

This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Running benchmark
Code Camp	September	**2**	Running benchmark and evaluating results
Code Camp	Nov/Dec	**2**	Evaluating benchmark results

WP13-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 (IMP3 codes and ITM-wide workflows). Several modules exist under the MODTRANSP Gforge project on the ITM-portal. We wish to have all of these "small modules" currently in use by ITM or ISM (and ITER in general) maintained under this activity. ITM standards of interoperability and V&V are required.

1. Each module has to be incorporated into ITM as a subroutine taking CPOs as inputs and yielding the coretransp as output as in the case of other IMP4 codes. An auxiliary module IMP4imp is already available for simple treatment of impurities (coreimpur CPO) but modules which treat these are also sought.
2. Each module should be benchmarked against other IMP4 codes under IMP4-ACT1. Actual benchmarking can be done collectively (project leadership plus others in standard test workflows). The stamp of responsibility and knowledge of the model are what is especially needed. The status of ongoing comparisons with actual turbulence codes is to be reported by any use of the module.

Implementation Method:
Baseline support

Requested manpower/skills (indicative):
0.1 ppy by each module responsible / developer

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	Actor updating and testing
Code Camp	April	**2**	Actor updating and testing
Code Camp	July	**2**	Actor updating and testing
Code Camp	September	**2**	Actor updating and testing
Code Camp	Nov/Dec	**2**	Actor updating and testing

5.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-IMP4-ACT1	• ITM database entries: Database entries of JET and ASDEX-Upgrade shots which will be used for an edge benchmark at working session in May • Porting to IFERC: Porting IMP4 codes to IFERC and run the benchmarks using FORTRAN workflow • Kepler workflows : Kepler actors capable of running the IMP4 cases on IFERC under HPC2K and ETS looping workflows	31. Dec 2013
WP13-ITM-IMP4-ACT2	• Kepler and FORTRAN workflows: IMP4 code performing step 1-3 • HPC2K/HPC workflows: HPC2K/HPC workflow using IMP4 code performing step 4 • Validation with Langmuir probes: A Kepler workflow comparing data from an IMP4 turbulence code and experimental Langmuir probe data	31. Dec 2013
WP13-ITM-IMP4-ACT3	• NCLASS (Actor, documentation of model and tests) • NEOART (Actor, documentation of model and tests) • Any linear codes (Actor, documentation of model and tests)	31. Dec 2013
WP13-ITM-IMP4-ACT4	• MODTRANSP: Actors, documentation of models and tests	31. Dec 2013

6. IMP5:

Task Agreement WP13-ITM-IMP5:
Heating, Current Drive and Fast Particle Physics

6.1 Introduction

Integrated Modelling Project #5 on “Heating, Current Drive and Fast Particle Physics” aims to integrate codes simulating heating, current drive and fast particle effects into ITM, covering ECRH, ICRH, NBI, LH, alpha particles and fast particle interaction with instabilities. Following the same guidelines for this project as in previous years, we shall focus both on basic and advanced physics modules, to provide the capability to perform rough fast computations as well as more detailed but more expensive computations. Adaptation, integration and assembly of dedicated workflows as well as V&V for all major codes in IMP5 are foreseen to continue. The largest emphasis will be on maintenance, testing and benchmarking of IMP5 codes and workflows. In addition, focus on self-consistency and synergy will continue.

In 2013 the emphasis will be on the following activities:

1. Maintenance, testing, benchmarking of Kepler Actors and adaptation of new codes for Heating, Current Drive and Fast Particle Physics for use in ITM workflows. The evolution of the ITM data structures and of the new developed workflows requires an ongoing effort to maintain, test and benchmark the already integrated codes in this field. This activity takes the priority over development and porting of new codes.
2. Development of ITM workflows based on IMP5 actors. This activity, essential for integrated modelling of H&CD under the ITM-TF platform, should be supported by contributors of already available Kepler actors and foreseen ones.
3. Self-consistent coupling of IMP5 codes and synergies effect. Development and integration of ITM compatible models for synergies between heating schemes and self-consistent coupling of codes will continue aiming to describe more complex and realistic situations occurring in experiments dealing with more than one heating method and address case of deviations from Maxwellian equilibrium.
4. Fast particle codes. The development of various fast particle codes will continue in order to integrate them in the ITM for realistic plasma operation scenario simulations and investigate the nonlinear dynamics problems associated with fast ion transport and losses. Tools to calculate various local nuclear reactions and modelling fast particle redistribution during sawtooth events will be further developed.

6.2 Objectives

The purpose is to provide Kepler actors and test bench workflows covering the needs within the ETS for different source terms related to heating and current drive, including Neutral Beam Injection, alpha particle, ICRF heating, LH current drive and EC heating and current drive, as well as for other ITM integrated workflows with heating and current drive acting as sources and/or actuators.

6.3 Work Breakdown

WP13-ITM-IMP5-ACT1

Maintenance, testing, benchmarking of Kepler Actors from HCD and fast particle codes and adaptation of new codes.

Description
In IMP5 a large number of codes have been ported up to now covering almost all critical areas in the field of Heating, Current Drive and fast particles, therefore in 2013 the largest emphasis will be on the maintenance, testing and benchmarking of actors from these codes.

This activity concerns codes in the 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 NBI, nuclear reactions, ICRF, LH, EC or a combination of these.
- Codes for analysis of fast particle driven instabilities.
- Orbit tracing codes
- Codes for calculation of various local nuclear reaction rates
- Other codes needed for IMP5 as, e.g., antenna codes
- Mappers of IMP5 CPOs (e.g. codes for generating test particles from continuous source distribution in the distsource-CPO, or vice versa).

In 2013 the work breakdown will be covered by either Priority or Baseline Support.

The following tasks are foreseen under Priority Support:
1. maintenance, i.e., upgrading actors to the latest releases of the ITM data structure and ITM workflows;
2. verification and validation of Kepler actors performed in Kepler workflows

The following tasks are foreseen to be covered by Baseline Support:
3. adaptation of new heating, current drive and fast particle code codes to the ITM
4. creation of Kepler actors

Implementation Method:
Priority and Baseline support

Requested manpower/skills (indicative):

- Tasks 1 and 2 will be covered by Priority Support with indicative manpower of 3 ppy per each task.

- Tasks 3 and 4 are under Baseline Support with total manpower required of 2.5 ppy.
- Participation in at least one Code Camp is mandatory for Priority Support Tasks.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar	**2**	Integration of modules into IMP5HCD and ETS; code adaptation and validation
Code Camp	April	**2**	Integration of modules into IMP5HCD and ETS; code adaptation and validation
Code Camp	July	**2**	Integration of modules into IMP5HCD and ETS; code adaptation and validation
Code Camp	September	**2**	Integration of modules into IMP5HCD and ETS; code adaptation and validation
Code Camp	Nov/Dec	**2**	Integration of modules into IMP5HCD and ETS; code adaptation and validation

External connections / requirements
JET experimental data as identified by the validation task might be required, as well as experimental data from other machine

WP13-ITM-IMP5-ACT2

Development of ITM workflows based on IMP5 actors

Description
This activity continues WP12-ITM-IMP5-ACT2 and concerns the development of workflows based on IMP5 actors.

1. Maintenance of the IMP5HCD composite actor (the heating and current drive actor in the European Transport Solver, ETS)
2. Testing of actors in IMP5 workflows
3. Development of tools controlling these workflows (e.g. datajoiners)
4. Development of workflows including IMP5 actors for e.g. plasma control using heating and current drive, equilibrium reconstruction, workflows integrating heating and current drive codes with fast particle codes

Implementation Method:
Priority support

Requested manpower/skills (indicative):

- Code developers able to work in Kepler.
- Tasks will be covered by Priority Support with indicative manpower of 1.2 ppy for the whole activity
- Participation in at least one Code Camp is mandatory for Priority Support Tasks.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar	**2**	Development / maintenance of workflows and support to the ETS and V&V in ACT1
Code Camp	April	**2**	Development / maintenance of workflows and support to the ETS and V&V in ACT1
Code Camp	July	**2**	Development / maintenance of workflows and support to the ETS and V&V in ACT1
Code Camp	September	**2**	Development / maintenance of workflows and support to the ETS and V&V in ACT1
Code Camp	Nov/Dec	**2**	Development / maintenance of workflows and support to the ETS and V&V in ACT1

WP13-ITM-IMP5-ACT3

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

Description
This activity is a continuation of WP12-ITM-IMP5-ACT3 and concerns the modeling of physics processes 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 wave fields.
2. Synergies: Fokker-Planck modeling including interactions with EC, LH and ICRF wave fields.
3. Self-consistent quasilinear coupling of wave and kinetic plasma model by inclusion of a non-Maxwellian distribution in the plasma susceptibility. This includes both the evaluation of the dielectric response from a general distribution function taken from the DISTRIBUTION CPO and adaptation of wave codes to use this response. Note that clear documentation of the self-consistent model is mandatory.

This activity should start from existing IMP5 codes.

Implementation Method:
Priority support

Requested manpower/skills (indicative):
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 required manpower estimated for this activity under Priority Support is 0.8 ppy. Participation in at least one Code Camp is mandatory.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	development /integration of models including synergies and self-consistency
Code Camp	July	**2**	development /integration of models including synergies and self-consistency
Code Camp	Nov/Dec	**2**	development /integration of models including synergies and self-consistency

WP13-ITM-IMP5-ACT4

Fast particle codes

Description
This activity is partly a continuation of WP12-ITM-IMP5-ACT4. The main topics are:

1. Code development for global stability analyses of Alfvén Modes in realistic geometries and in the presence of nonperturbative fast ion excitations
2. Development of codes that calculate local nuclear reaction rates
3. Development of codes for the fast ion redistribution during sawtooth events

The codes developed under this activity should be ported to the ITM under WP13-ITM-IMP5-ACT1.

Implementation Method:
Baseline support

Requested manpower/skills (indicative):
The activity is expected to require 1.0 ppy under Baseline Support of dedicated work in total

Existing Commitments:

- This is a continuation of a task from 2012 (WP12-ITM-IMP5-ACT4) and all who participated in the task in 2012 are encouraged to reapply.
- People working in this activity should apply also to WP12-ITM-IMP5-ACT1 to perform the ITM integration work.

Code Camps or other coordinated efforts (preliminary)

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code Camp	Mar	**2**	development /integration of models
Code Camp	September	**2**	development /integration of models
Code Camp	Nov/Dec	**2**	development /integration of models

6.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-IMP5-ACT1	• Re-release of actors in the latest version of the ITM datastructures and workflows. The new release should be made available on the Gforge in the /kepleractors repository. Changes should be documented and the documentation should be available on either webpages or under svn. • Documentation of verification and validation. The documentation should be available on either webpages or under svn. • Release the code under Gforge SVN and completion of all the steps up to kepler actor creation	31. Dec 2013
WP13-ITM-IMP5-ACT2	• Documentation of adaptation/maintenance of IMP5HCD workflow • Documentation of tests of actors in IMP5 workflows • For all datajoiners and other codes used to control IMP5 workflows the source code should be stored in the imp5tool repository and the actor should be released in the kepleractors repository • Release of the workflows in the keplerworkflows repository • Documentation of the workflow; should be available on the ITM webpages.	31. Dec 2013
WP13-ITM-IMP5-ACT3	• Actor that can treat synergies between heating systems. Actor should be released in the kepleractors repository. • Library for self-consistent coupling between wave and Fokker-Planck solvers. • Actor for self-consistent modelling that couples wave and Fokker-Planck solvers	31. Dec 2013
WP13-ITM-IMP5-ACT4	• Code for Alfvén modes: Deliver module under SVN; including test cases and documentation • Codes for nuclear reaction rates: Deliver module under SVN; including test cases and documentation • Codes for fast ion redistribution: Deliver module under SVN; including test cases and documentation	31. Dec 2013

7. ISIP:

Task Agreement WP13-ITM-ISIP:
Infrastructure and Software Integration Project

7.1 Introduction

The Infrastructure and Software Integration Project (ISIP) develops and maintains the ITM-TF framework, a broadly accessible framework for integrated simulation of magnetic confinement fusion devices. The ITM-TF framework is 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 (provided by the IMPs) in a fully flexible way, allowing addressing a wide range of user-defined fusion applications. The framework 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.

The implementation of the 2013 work programme will be used to fulfil three main missions :

- ACT1 Support the users of the framework (Hotline, documentation, tutorials)
- ACT2 Maintain and upgrade the existing functionalities of the framework
- ACT3 Identify and develop missing functionalities in the framework

In 2013 the emphasis will be on i) performance optimization, ii) improving pause/restart mechanisms and iii) extending the distributed computing functionalities (HPC and GRID).

7.2 Objectives

The main ISIP purpose is to maintain - and upgrade when required - a stable and supported platform for ITM-TF modelling and exploitation needs, including the development of new functionalities and the support to Users.

7.3 Work Breakdown

WP13-ITM-ISIP-ACT1

Support the users of the framework

Description

This activity consists of two tasks:

T1: Hotline, documentation and support of the ITM software on the gateway.

T2: Tutorials on the ITM software, covers various tutorials that can be given on ITM tools along the year (code camps, General meeting).

Implementation Method:
Priority support

Requested manpower/skills (indicative):
Requested manpower is indicated above in the Task description / Skills : Good knowledge of ITM/ISIP software. Indicative requested manpower is 4 pm for T1 and 1 pm for T2. 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.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	All ITM Code Camps	**10**	User support, Tutorials

WP13-ITM-ISIP-ACT2

Maintain and upgrade the existing functionalities of the framework

Description
This activity consists of twelve tasks:

- T1: Maintenance and upgrades of the Kepler workflow tool (indicative 2 pm). The task consists in keeping contact with the Kepler core team in San Diego and updating the ITM-TF installation with new features developed by the Kepler team.
- T2: Simulation catalogue (indicative 6 pm). The main item in 2013 is the implementation of the functionalities from the 2012 conceptual design.
- T3: Maintenance and upgrades of the Integrated Simulation Editor (indicative 6 pm). The main items are the upgrade of the existing functionalities from the feedback of the users and in general improve the workflow preparation and monitoring features in ISE.
- T4: Data structure (indicative 2 pm). Continuous maintenance and upgrades of the data structure following the needs of the IMPs.
- T5: Universal Access Layer (indicative 7 pm). The main items are the continuous profiling and performance optimization of the UAL.

- T6: Actor generator (indicative 5 pm). 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.
- T7: ITM Profile Maker (indicative 2 pm). It consists in upgrading the prototype as more experimental data becomes available in the ITM-TF database.
- T8: Administration of the collaborative software (indicative 3 pm). This is the administration of the ITM-TF Portal, including Gforge, SVN, Jboss and documentation websites.
- T9: Maintenance and upgrades of experimental data import tool (Exp2ITM) (indicative 2 pm).
- T10: Maintenance and upgrades of the Control toolbox (indicative 2 pm).
- T11: Maintenance and upgrades of the advanced visualisation tools (indicative 6 pm).

Implementation Method:
Priority support

Requested manpower/skills (indicative):

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

Code Camps or other coordinated efforts (preliminary)

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

WP13-ITM-ISIP-ACT3

Identify and develop missing functionalities in the framework

Description
This activity consists of six tasks:

- T1: Deploy strategies for HPC and GRID execution of components and workflows (indicative of 4 pm). It includes the deployment of the procedures and tools prepared in past years for executing components of advanced physics workflows on HPC and GRID facilities. It includes also the evaluation of the proposed strategies and the design of new ones when needed depending on the Use Case. The task includes also the maintenance of

GRID and HPC services (Unicore, …) on the Gateway and the consistent evolution of HPC2K.

- T2: Advanced workflow monitoring and Checkpoint/restart in workflows (indicative of 5 pm). A first requirement capture has been done in 2011 and needs to be implemented.
- T3: Maintain local deployment package of the ITM-TF infrastructure (indicative of 3 pm). The deliverable is a packaged version of the ITM-TF platform independent of the Gateway in view of a possible local deployment in Associations.
- T4: Contact person for local deployment of the ITM-TF infrastructure in Associations (indicative of 2 pm) per contact person/Association. The contact persons shall install the package delivered in T3, provide feedback on this installation and report on the use of existing or the design of new integrated modelling workflows with the platform, possibly showing physical applications with data of their local tokamak experiment.
- T5: Implementation of profiling framework (indicative of 4 pm). The profiling framework will allow to track execution time of the workflow consisting of various elements: Kepler workflow, Fortran/C++/Java/Matlab codes, UAL low level components, hardware. It is assumed that profiling framework should allow to identify all the bottlenecks with ease. Profiler framework should provide users with the ability to easily inject profiling code into their application.
- T6: Development of client-server operation of an ITM workflow (indicative of 4 pm). The purpose of this task is to demonstrate the remote triggering and collection of results from an ITM workflow via a client-based GUI.

Implementation Method:
Priority support

Requested manpower/skills (indicative):

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

Code Camps or other coordinated efforts (preliminary)

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

7.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-ISIP-ACT1	• T1. Hotline, documentation • T2. Tutorials	31. Dec 2013
WP13-ITM-ISIP-ACT2	• Maintenance and updates	31. Dec 2013
WP13-ITM-ISIP-ACT3	• T1. Implement demonstration workflows for various Use Cases. • T2. Implementation of workflow profiling and checkpoint/restart functionalities, including handling of the code-specific internal variables • T3. Packaged version of the ITM-TF platform independent of the Gateway in view of local deployment in Associations • T4: Report on the usage of the ITM-TF platform locally deployed in Associations • T5: Implementation of profiling framework • T6: Development of client-server operation of an ITM workflow	31. Dec 2013

8. ISM:

Task Agreement WP13-ITM-ISM:
ITER scenario modelling

8.1 Introduction

The ITER Scenario Modelling (ISM) group within the ITM-TF coordinates the European efforts in developing interpretative and predictive modelling tools for operational scenarios in ITER and other new projects (e.g. JT-60SA), supports the validation of ITM tools and promotes and deploys 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 2013 will be coordinated around three large topics:

- Support to the validation and physics application 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. JT-60SA, ITER and DEMO, in collaboration with EFDA PPPT)

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.

In 2013, the main effort will be focused on

1. systematic use of the ETS workflows in view of reproducing the ITER scenarios developed with the existing integrated modeling codes (CRONOS, ASTRA, JETTO) and complement those studies with the calculation of edge MHD stability and core turbulence.
2. modelling of physics issues relevant towards the extrapolation of the scenarios with a metallic walls, using the ITM workflows (e.g. such as impurity transport, coupled core and edge transport, edge stability, vertical stability). This activity will require to validate the integrated modelling against experimental data from European tokamaks.

The long term objective is to provide comprehensive modelling of ITER scenarios evolving simultaneously current, momentum, thermal and particle transport in view of defining/optimising the operational space (sensitivity studies) including edge constraints imposed by the Be/W metallic walls.

8.2 Objectives

The main objectives of the ISM group within ITM-TF are to provide support to:

- interpretative and predictive integrated scenario modelling on existing EU experiments addressing the physics and operational issues
- scenario modelling activities to cover the preparation of operational scenario for ITER, JT60-SA, DEMO.

8.3 Work Breakdown

WP13-ITM-ISM-ACT1

Support to the validation and physics application of the ETS and ITM workflows

Description
T1. Benchmarking of new modules integrated within ETS workflows, following the ETS development (in collaboration with EDRG, IMP3, IMP4-ACT4 and IMP5-ACT1).

T2. ETS validation and application of ITM workflows to physics studies:
a. Integrated modelling of ITER scenarios with ETS workflows, based on the existing scenario developed with CRONOS, JETTO and ASTRA – Calculation of MHD stability, and core turbulence with dedicated ITM workflows (in collaboration with IMP12, IMP3, IMP4 and IMP5).
b. Effect of NTM on transport and confinement in Hybrid Scenarios. Application of the ETS workflows incuding the NTM module to either JET, ASDEX-Upgrade or ITER discharges: estimation of island width (in collaboration with IMP12-ACT1, IMP3-ACT1)
c. Core impurity transport in JET and ASDEX-Upgrade in L mode aas well as baseline ELMy discharges for JET with the new Be/W Iter like wall and ASDEX-Upgrade with W wall (in collaboration with IMP3-ACT1). Comparison of simulated radiation profile with experiments.
d. Self-consistent (Te, Ti, ne, j) predictive modelling for JET L-mode plasmas with the ETS.

Implementation Method:
Baseline and Priority support

Requested manpower/skills (indicative):

- ETS, ASTRA, CRONOS, JETTO, SANCO and TRANSP experts, Equilibrium, MHD stability, transport and H&CD experts. JET and ASDEX-Upgrade database expert (in liaison with EDRG-ACT1).
- All tasks will be covered by Priority Support with total indicative manpower of 1.5 ppy.
- Participation in at least one relevant Code Camp is mandatory.

Existing Commitments:
This is a continuation of the activity from 2012 and all who participated in 2012 are encouraged to reapply.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar	**2**	ETS benchmarking and application- Set up the ETS workflow for running ITER scenario
Code Camp	July	**2**	ETS benchmarking and application
Code Camp	Nov/Dec	**2**	Finalisation of benchmarking exercises and physics studies, comparison to experimental data. Reference ITER scenario with ETS workflow. Calculation of MHD stability with dedicated ITM workflow.

External connections / requirements
Experimental data for limited JET and ASDEX-Upgrade discharges as identified by the validation task will be required. One reference ITER scenario already modelled by CRONOS, JETTO, ASTRA.

WP13-ITM-ISM-ACT2

Interpretative and predictive integrated scenario modelling on existing devices

Description

1. Modelling of density evolution self-consistently with current diffusion and temperatures, validation of first principle transport models (TGLF, QualiKiz). Modelling of limited number of JET and ASDEX-Upgrade discharges using GLF23, TGLF and Bohm-gyroBohm models. Stability analysis and transport modelling with QualiKiz code. Current ramp down modelling including the H to L transition
2. Comparison and modelling of JT-60U and JET plasmas in typical operational domains (signed Proposal Document Sheet EU11-02). Compare performance and characteristics of the JET and JT-60U plasmas. Predictive and interpretative simulations of the same discharges
3. Comparison of current diffusion, transport and confinement in JET C and ILW discharges.
4. Impurity transport in JET ILW discharges, effect of impurity on plasma confinement.
5. Pedestal-SOL modeling for JET ILW discharges

Implementation Method:
Baseline support

Requested manpower/skills (indicative):

- transport experts, heating, current drive and fuelling experts, EU ITPA members of T&C and IOS group,
- EFDA Transport Topical group experts.
- All tasks are under Baseline Support with total manpower required of 3 ppy.

Existing Commitments:
collaboration within IEA Implementing Agreement for co-operation on tokamak programmes (JET and JT-60U). Existing commitments should be expanded to 2013

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar	**1**	Review of activities since previous working session, update on ITER needs and coordination of the ISM activity with ITER need. Modelling work within the above specified tasks
Code Camp	July	**1**	Review of activities since previous working session, status of the EPS presentations and publications. Modelling work within the above specified tasks
Code Camp	Nov/Dec	**1**	Review of activities since previous working session, finalise modelling for publication, discuss the status of publications.

External connections / requirements
Expertise from EFDA Transport and MHD Topical groups is required. Limited and well-diagnosed JET, ASDEX-U, JT-60U and Tore Supra discharges will be modelled. Link with the T&C and IOS ITPA groups.

WP13-ITM-ISM-ACT3

Support to predictive scenario modelling for future devices (e.g. JT-60SA, ITER, DEMO)

Description

1. Current diffusion and transport modelling for ITER hybrid current ramp down
2. Predictive density modelling with first principle models for ITER, addressing the density peaking effect.
3. ITER scenario modelling with METIS (operational domain …) including simulation of the real time control of the fusion burn.

4. Expansion of the operational domain of ITER hybrid scenario with q on-axis below one by controlling the sawtooth period
5. 1D JT-60SA scenario modelling: implementation of the JT-60SA H&CD configuration (NBI, ECRH) in EU transport codes. Predictive scenario modelling with transport models validated in ISM-ACT2.
6. DEMO modelling using ITM Kepler workflows, in coordination with EFDA PPPT Work Programme (in collaboration with IMP3-ACT1-T9]

Implementation Method:
Baseline support

Requested manpower/skills (indicative):

- Expertise from EFDA Transport and MHD Topical groups is required.
- Link with the T&C and IOS ITPA groups, ITER IO, F4E and ITER EFDA Department for JT-60SA, EFDA PPPT Department for DEMO modelling.
- All tasks are under Baseline Support with total manpower required of 3 ppy.

Code Camps or other coordinated efforts (preliminary)

Type of effort	**Start date**	**Length (in weeks)**	**Expected outcome/relation to deliverable(s)**
Code Camp	Mar	**1**	Review of activities since previous working session, update on ITER needs and coordination of the ISM activity with ITER need. Modelling work within the above specified tasks
Code Camp	July	**1**	Review of activities since previous working session, status of the EPS presentations and publications. Modelling work within the above specified tasks.
Code Camp	December	**1**	Review of activities since previous working session, finalise modelling for publication, discuss the status of publications.

External connections / requirements
EFDA Transport and MHD Topical groups, EFDA PPPT Department for DEMO modelling, T&C and IOS ITPA groups, ITER IO, F4E.

8.4 Deliverables

Activity	Priority Support Deliverables	Due Date
WP13-ITM-ISM-ACT1	• Benchmarking of new modules implemented in ETS. Provision of JET data for ETS: Report on the benchmark and port the data in ITM simulation catalogue. ETS simulation of JET L-mode plasmas. • Impurity simulations for JET and ASDEX-Upgrade discharges: Report on the benchmark and port the data in ITM simulation catalogue • Effect of NTM on transport and confinement in Hybrid Scenarios: Report on the work. • Integrated modelling of ITER scenarios with ETS workflows: Provision of one ITER reference scenario using ETS workflow.	31. Dec 2013
WP13-ITM-ISM-ACT2	• Modelling of density evolution self-consistently with current diffusion and temperatures, validation of first principle transport models (TGLF, QualiKiz): Report on simulation results. Prepare conference/journal publication. • Comparison and modelling of JT-60U and JET plasmas in typical operational domains (signed Proposal Document Sheet EU11-02): Report on simulation results. Prepare or contribute to conference/journal publication. • Current diffusion, transport and confinement with ILW at JET: Report on simulation results. Prepare conference/journal publication. • Impurity simulations for JET: Report on simulation results. Prepare conference presentation. • Pedestal-SOL modeling for JET ILW discharges: Report on simulation results. Prepare conference presentation.	31. Dec 2013
WP13-ITM-ISM-ACT3	• ITER hybrid scenario modelling: Report on simulation results. Preparation of conference/journal publication. • 1-D JT-60SA scenario modelling: Report on simulation results. • Modelling for DEMO: Report on simulation results.	31. Dec 2013

9. TFL:

Task Agreement WP13-ITM-TFL:
TF 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 report to the EFDA leader.

The ITM maintains in 2013 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).

The appointment of Project Leaders was set under WP12-ITM-TFL-PL for two years. Task Force and Deputy Task Force Leaders appointments have been renewed until December 2013.

Associations are asked to confirm their staff commitment for Task Force and Project Leader positions until December 2013.

List of Task Force and Project Leaders at the end of 2012

WP11-ITM-TFL-TFL	CEA	Gloria FALCHETTO	gloria.falchetto@cea.fr
	IST	Rui Coelho	Rui.Coelho@ipfn.ist.utl.pt
	IPP	David Coster	David.Coster@ipp.mpg.de
WP11-ITM-TFL-PL-IMP12	ENEA_Frascati	Edmondo Giovannozzi	edmondo.giovannozzi@enea.it
	VR	Dimitriy Yadykin	dimitriy@chalmers.se
WP11-ITM-TFL-PL-IMP3	IPP	David Coster	David.Coster@ipp.mpg.de
	CEA	Vincent Basiuk	vincent.basiuk@cea.fr
	OAW	David Tskhakaya	David.Tskhakaya@uibk.ac.at
WP11-ITM-TFL-PL-IMP4	IPP	Bruce Scott	Bruce.Scott@ipp.mpg.de
	RISØ	Anders Henry Nielsen	ahnie@risoe.dtu.dk
WP11-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
WP11-ITM-TFL-PL-ISIP	CEA	Frédéric Imbeaux	frederic.imbeaux@cea.fr
	ENEA-RFX	Gabriele Manduchi	gabriele.manduchi@igi.cnr.it
	IPP	Hans-Joachim Klingshirn	hmk@ipp.mpg.de
WP11-ITM-TFL-PL-ISM	CEA	Xavier Litaudon	xavier.litaudon@cea.fr
	CCFE	Irina Voitsekhovitch	irina.voitsekhovitch@ccfe.ac.uk

9.2 Objectives

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.

9.3 Work Breakdown

WP13-ITM-TFL-PL

Project Leadership

The Task Force on Integrated Tokamak modelling (ITM-TF) is mainly organized in Projects, covering specific physics modelling and addressing critical physics/technology issues and activities covering specific code development, integration and V&V efforts. The latter will generally comprise joint efforts of theoreticians, experimentalists and engineers. Each project is coordinated by a Project Leader and one or two deputies leaders coordinating some specific tasks.

Project Leaders will be selected 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.

- WP13-ITM-TFL-PL-ISIP: Coordination of ISIP – Infrastructure and Software Integration
- WP13-ITM-TFL-PL-IMP12: Coordination of IMP12 – Equilibrium, MHD and disruptions
- WP13-ITM-TFL-PL-IMP3: Coordination of IMP3 - Transport Code and Discharge Evolution
- WP13-ITM-TFL-PL-IMP4: Coordination of IMP4 - Transport Processes and Microturbulence
- WP13-ITM-TFL-PL-IMP5: Coordination of IMP5 – Heating, Current Drive and Fast Particles
- WP13-ITM-TFL-PL-ISM: Coordination of ISM – ITER Scenario Modelling

WP13-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 through the Head of the ITER Physics Department.

Resources

- 0.5 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 / Project Leader Deputy / ISM Task Coordinator / ISM Task Coordinator Deputy

9.4 Deliverables

Activity	Priority Support Deliverables	Due Date
	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 through the Head of the ITER Physics Department:	
WP13-ITM-TFL-TFL	• Lead and organize the overall ITM –TF activities • Monitor progress in the TF and seek to secure the needed resources • Assist the EFDA Leadership in the definition of the annual Work Programme • Provide Annual report of ITM activities • Support the EFDA Leader on International Collaborations and outreach activities.	31. Dec 2013
	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.	
WP13-ITM-TFL-PL	• Document describing the activities in the project during the incoming year – including timelines. Maintained and published on the ITM-TF website • Bi-monthly progress reports detailing progress in all tasks and status towards all deliverables – submitted to TF leadership, discussed in monthly PL meetings and published on ITM-TF portal • A summary of the project activities and achievements during the year in a format suitable for inclusion in the annual progress report.	31. Dec 2013