EFDA Task Force
Integrated Tokamak Modelling
EUROPEAN FUSION DEVELOPMENT AGREEMENT

Call for Participation

2010 Work Programme

INTEGRATED TOKAMAK MODELLING TASK FORCE

Deadline for Responses: December 22, 2009

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This Call for Participation aims to implement the Integrated Tokamak Modelling Work Programme for 2010 under Task Agreements as foreseen in the new EFDA Art. 5

Introduction

ITM-TF goals

The longer term goal of the ITM-TF is to provide the European fusion community with a validated suite of simulation tools for ITER exploitation and to provide the basis for a complete simulation environment for fusion plasmas generally available for use also for modelling on current devices and in support of theory and modelling in general. IMPs have dual responsibilities in that they should continue to develop and manifest the physics foundations for Integrated Modelling in standalone packages targeting the code platform environment while they are also supporting the integration efforts towards scenario modelling tools

Scientific rationale and main objectives of the ITM task force

The EFDA-Steering Committee set up a long-term European Task force (TF) on Integrated Tokamak Modelling (ITM) in 2003. The TF is in charge of "co-ordinating the development of a coherent set of validated simulation tools for the purpose of benchmarking on existing tokamak experiments, with the ultimate aim of providing a comprehensive simulation package for ITER plasmas". The continuity of the ITM-TF is inscribed within the provisions of the new EFDA and the role of the TF leadership is detailed in EFDA (07) 33/4.4.1. "The Scientific Leader of the Integrated Modelling TF (*TF Leader*) will ensure that the overall EFDA Work Plan and Work Programme objectives are adequately translated into specific / detailed scientific and technical objectives in the development, validation and application of computational models and their integration and that these objectives 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."

Programmatic Background

At its meeting in Prague on 24 March 2009, the EFDA Steering Committee approved elements of the EFDA 2010 Work Programme, among which the Task Force on Integrated Tokamak Modelling programme. This includes the code adaptation and modelling developments within the five different Integrated Modelling Projects and the activities of the Infrastructure and Software Integration Project (ISIP) which is 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 implementation results from calls for proposals. The outcome of the calls is assessed by the ITM-TF leadership and the EFDA-CSU and implemented under the following list of Task Agreements. They are summarized in table 1.

Table 1: Summary of Task Agreements proposed for 2010

Proposed Task Agreement for 2010	**Activity**
TFL	TF leadership
IMP12	MHD equilibrium, stability and disruptions
IMP3	Transport Code and Discharge Evolution
IMP4	Transport Processes and Micro stability
IMP5	Heating, Current Drive and Fast Particle Physics
ISIP	Infrastructure and Software Integration Project
AMNS	Atomic, Molecular, Nuclear and Surface Physics Data (*Task under Task Force Leadership*)
EDRG	Experimentalists and Diagnosticians Resource Group (*Task under Task Force Leadership*)

The activities under Priority Support in these Task Agreements were recommended by the EFDA Steering Committee at its meeting of 24th March 2008 in Prague (EFDA (09) 40/4.1.3) and endorsed by the CCE-FU at its meeting of 31st March 2009 (EUR (09) CCE-FU 45/7.5). This pertains to well identified actions, including:

- TF and project leadership (0.75 ppy for TF leader, 0.5 ppy for TF deputies, 0.25 ppy for project leaders and leaders deputy)
- maintenance, development and verification of the European Transport Solver
- development of free boundary equilibrium code
- work on machine descriptions
- work on the code platform and data base tools

Exchange of scientists between the involved Associations is planned covering:

- participation in code camps
- attendance at the TF meetings

For all these exchanges, the use of the mobility agreement is foreseen.
For 2010, a total of 30.75 ppy and 738 kEuro under Priority Support, as well as 930 kEuro under mobility is foreseen.

Task Agreement WP10-ITM-TFL:

Project Leadership

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Project Leadership

The ITM-TF Project leadership runs on a two –year appointment schedule, customary practice is that this is renewable. The current project leaders will reach end of term December 31 2009. Hence, an integral part of this call for participation is the appointment of Project Leaders for the coming two year period. The ITM-TF activities are planned on a longer time period and a longer reach than the appointment period for any of its leadership functions. The appointed Project Leaders will take active part in the establishment of Task Agreement and will be given the opportunity in negotiation with Associations to impact the final Task Agreements.

Negotiation

The Call for Participation is taken as the basis for the Task Agreement. In most cases there is a straightforward procedure to incorporate work commitments into Task Agreements. In a few cases, previous experiences show that it has been advantageous to re-engage in a discussion of scope and commitment levels for individuals or tasks. Exceptionally, new tasks could be introduced also at this stage to further streamline or promote the ITM-TF mission. With potentially new set of project leaders entering the project this year it could also serve to bridge interest areas and balance the need to maintain the work programme direction with new ideas and requirements.

Required Resources

The Implementation of the ITM-TF Projects for the work programme for 2010 is estimated to require a minimum of 3.75 ppy under Priority Support in order to be able to provide a minimum level of project guidance and leadership. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The Leadership together with inter-project coordinating activities within the project are eligible for Priority Support.

The project leadership are considered for Priority Support:

- **WP10-ITM-TFL-PL-ISIP**: Coordination of ISIP – Infrastructure and Software Integration is formed under Priority Support with a ceiling of 9 pm.
- **WP10-ITM-TFL-PL-IMP12**: Coordination of IMP12 – Equilibrium, MHD and disruptions is formed under Priority Support with a ceiling of 9 pm.
- **WP10-ITM-TFL-PL-IMP3**: Coordination of IMP3 - Transport Code and Discharge Evolution is formed under Priority Support with a ceiling of 12 pm.
- **WP10-ITM-TFL-PL-IMP4**: Coordination of IMP4 - Transport Process and Microturbulence is formed under Priority Support with a ceiling of 6 pm.
- **WP10-ITM-TFL-PL-IMP5**: Coordination of IMP5 – Heating, Current Drive and Fast Particles is formed under Priority Support with a ceiling of 9 pm.

A total of 45 pm has been assigned to Project leadership activity (excluding the ITM-TF leadership) in addition some related activities, Gateway User Board and activities.

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities, tentative time and duration are specified in relevant Task Agreements.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license.
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.

Project Background

Introduction

The EFDA-Steering Committee set up a long-term European Task force (TF) on Integrated Tokamak Modelling (ITM) in 2003. The TF is in charge of "co-ordinating the development of a coherent set of validated simulation tools for the purpose of benchmarking on existing tokamak experiments, with the ultimate aim of providing a comprehensive simulation package for ITER plasmas". The continuity of the ITM-TF is inscribed within the provisions of the new EFDA and the role of the TF leadership is detailed in EFDA (07)-33/4/4/1. "The Scientific Leader of the Integrated Modelling TF (*TF Leader*) will ensure that the overall EFDA Work Plan and Work Programme objectives are adequately translated into specific / detailed scientific and technical objectives in the development, validation and application of computational models and their integration and that these objectives 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."

The 2010 activities are aimed in providing the European fusion community with the complete simulation environment for fusion plasmas and supply a set of state of the art tools running on the Getaway and to pursue the validation and exploitation of these tools to the broader EFDA environment.

The ITM-TF is lead by a Task Force leader and three deputies. These are appointed by the EFDA-SC and reports to the EFDA leader. Activities within the ITM-TF are divided into Tasks which each belong to a project or for Tasks under the TF leader which are directly led by a TF leader or a specifically assigned Task coordinator. The ITM maintains in 2010 five projects, the Infrastructure and Software Integration project (ISIP) supports the underlying technology of the modelling Platform. In addition 4 physics related Integrated Modelling Projects are maintained. These are Equilibrium, MHD and disruptions (created by merging IMP1 and IMP2 and relabeled IMP12), Transport code and discharge evolution (IMP3 Transport Processes and Micro stability (IMP4) and Heating, Current Drive and Fast Particles (IMP5). Project leaders and Task Coordinators are appointed by the TF-leadership, in consultation with the EFDA leader, for a two year period following a Call for Participation. As all

Project leaders have their end of term December 2010 a full Call for Participation to appoint the ITM project leadership is opened.

Short name	Project Name	No of PL leaders	# Deputy leaders
ISIP	Infrastructure and Software Integration project	1	2
IMP12	Equilibrium, MHD and disruptions	1	1 (2)
IMP3	Transport code and discharge evolution	1	2 (or 3 – one taken the role as ISM leader)
IMP4	Transport Processes and Micro stability	1	1
IMP5	Heating, Current Drive and Fast Particle Physics	1	2

The exact number and distribution of deputies will be defined based on the qualifications and area of expertise of the applicants. A minimal work commitment of 0.25ppy is assumed for Project leaders (PL's) and deputies.

Relation to Experiments

Collaborative activities on data structure, machine descriptions and access to experimental data for code validation purposes are foreseen. Project leaders need to interact with a number of capacities both within IMT-TF (in particular EDRG) and directly with experimental facilities. Relations with JET is organised on the TF leader level with input from the projects.

Overall Milestone

Performance of the project leadership is judged by the progress of the project as a whole. Hence the delivery of deliverables and progress towards project milestones are essential monitoring tools.

Continuity

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		**Status in 2010**
ITM-09-TFL1	→	Restaffed but continued in WP10-ITM-TFL

Coordinated activities

Type of activity	Topic	Tentative Date	Length	Tasks involved
WS	PL+TFL meeting	2010-01-25	2 days	All projects
WS	PL+TFL meeting	2010-03-25	2 days	All projects
WS	PL+TFL meeting	2010-06-17	2 days	All project
WS	PL+TFLmeeting	2010-09-20	2 days	All projects (at the general meeting)

WP10-ITM-TFL-PL-ISIP: Coordination of ISIP – Infrastructure and Software Integration
WP10-ITM-TFL-PL-IMP12: Coordination of IMP12 – Equilibrium, MHD and disruptions
WP10-ITM-TFL-PL-IMP3: Coordination of IMP3 - Transport Code and Discharge Evolution
WP10-ITM-TFL-PL-IMP4: Coordination of IMP4 - Transport Process and Microturbulence
WP10-ITM-TFL-PL-IMP5: Coordination of IMP5 – Heating, Current Drive and Fast Particles

Type of support available for the task: Priority Support

Description of work:

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

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

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

Deliverables:

Title	Start date	End Date	Deliverable (precise definition)
Work Plan	2010-01-01	2010-01-25	Document describing the activities in the project during the year – Maintained and published on the IM-TF portal site
Progress Report A	2010-01-01	2010-03-31	Progress Report detailing progress in all tasks and status towards all deliverables – submitted to TF leadership and published on ITM-TF portal
Progress Report B	2010-03-31	2010-06-30	Progress Report detailing progress in all tasks and status towards all deliverables
Progress Report C	2010-06-30	2010-09-30	Progress Report detailing progress in all tasks and status towards all deliverables
Project Report	2010-01-01	2010-12-30	A complete overview of project activities and achievements during the year
Annual report Contribution	2010-01-01	2010-12-30	A summary of the project activities and achievements during the year in a format suitable for inclusion in the annual progress report.

Dependencies:

The project leadership is per default a coordinating activity and should be fully integrated with the ITM as a whole.

Resources, skills and needs:

Requested manpower/skills: documented, leading, technical expertise in the different project areas. Experience of project management and leadership are meriting.

Short name	Project Name	No of PL leaders	# Deputy leaders
ISIP	Infrastructure and Software Integration project	1	2
IMP12	Equilibrium, MHD and disruptions	1	1 (2)
IMP3	Transport code and discharge evolution	1	2 (or 3 – one taken the role as ISM leader)
IMP4	Transport Processes and Micro stability	1	1
IMP5	Heating, Current Drive and Fast Particle Physics	1	2

Each project leader and deputy is expected to spend more than 0.25ppy in project leadership task.
Existing Commitments: The assignment as Project leader or Deputy project leader is a two year assignment and the commitment is until end 2011.

Code Camps or other coordinated activities:

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	2010-01-21	2 days	Work plan – project and TF coordination issues highlighted – development of project micro-milestones
WS	2010-03-25	2 days	Progress report – project and TF coordination issues highlighted – development of project micro-milestones Preparation of 2011 WP
WS	2010-06-17	2 days	Progress report – project and TF coordination issues highlighted – development of project micro-milestones
WS	2010-09-20 (?)	2 days	Progress report – project and TF coordination issues highlighted – path towards milestones WP11 detailed structure and formats

Task Agreement WP10-ITM-IMP12:

Integrated Modelling Project 12 (IMP12): Equilibrium, MHD and disruptions

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Project Leadership

The ITM-TF Project leadership runs on a two –year appointment schedule, customary practice is that this is renewable. The current project leaders will reach end of term December 31, 2009. Hence, an integral part of this Call for Participation is the appointment of Project Leaders for the coming two year period. The ITM-TF activities are planned on a longer time period and a longer reach than the appointment period for any of its leadership functions. The appointed Project Leaders will take active part in the establishment of Task Agreement and will be given the opportunity in negotiation with Associations to impact the final Task Agreements.

The call for new Project Leadership is given in the section CfP-WP10-ITM-TFL.

Negotiation

The Call for Participation is taken as the basis for the Task Agreement. In most cases there is a straightforward procedure to incorporate work commitments into Task Agreements. In a few cases, previous experiences show that it has been advantageous to re-engage in a discussion of scope and commitment levels for individuals or tasks. Exceptionally, new tasks could be introduced also at this stage to further streamline or promote the ITM-TF mission. With potentially new set of project leaders entering the project this year it could also serve to bridge interest areas and balance the need to maintain the work programme direction with new ideas and requirements.

Required Resources

The Implementation of the IMP12 work programme for 2010 is estimated to require a minimum of 7.42Ppy under Baseline support and 5.5 Ppy under Priority Support in order to be able to provide a minimum level of project fulfillment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be

preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The Leadership together with inter-project coordinating activities and support roles within the project are eligible for Priority Support. In addition, a few tasks and activities within the IMP12 work programme are considered to be essential for the consolidation of ITM-TF cross-project activities and are integral parts to project wide milestones. These tasks are considered for Priority Support:

- The task **WP10-ITM-IMP12-ACT2: Free boundary plasma equilibrium integration in a discharge evolution with advanced feedback control** is formed under Priority Support with a ceiling of 30 pm.
- The task **WP10-ITM-IMP12-ACT5: Validation of the equilibrium reconstruction codes available in Kepler** is formed under Priority Support with a ceiling of 12 pm.
- The task **WP10-ITM-IMP12-ACT11: 3D MHD code** is formed under Priority Support with a ceiling of 12 pm.
- The task **WP10-ITM-IMP12-ACT14: Disruptions workbench** is formed under Priority Support with a ceiling of 12 pm.

A total of 66pm (excluding project leadership) has been assigned to IMP12 activities.

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the IMP12 group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway,

www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license. A Rights of access form (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.

Project Background

Introduction to the MHD equilibrium and stability project

Objectives

This project aims at providing a comprehensive ITER relevant modelling capability covering essential areas in a MHD simulation chain, starting from equilibrium reconstruction and free boundary evolution under feedback control, linear and non-linear MHD stability and plasma disruptions.

Scope and long term perspective

The mature consolidation of a substantial part of the IMP1 developed tools, e.g. equilibrium reconstructions and MHD linear stability prompts for a maintenance and integration stage. A perceptible synergy between equilibrium/linear stability and non-linear MHD modelling integration and an overlap in manpower between IMP1 and IMP2 support the merge of the two activity branches.

Adopting a unifying strategy, the project will therefore consolidate the coverage of essential MHD numerical tools. Validation of the full chain of equilibrium reconstruction and linear stability codes, started during 2009, will proceed, in collaboration with the MHD Topical Group, addressing relevant experimental scenarios (disruptive limits, edge stability limits,…) and engagement with additional devices is envisaged. Extension of equilibrium and linear stability codes and datastructures to encompass plasma flow and 3D effects will consolidate the scope of the present tools. Validation of

the existing modules for modelling a free boundary equilibrium (and others to come) on experiments and integration with the ETS, mediated by feedback plasma position and control schemes, will enhance significantly the whole device modeling capabilities of ITM tools. Interfacing with proceeding non-linear stability modules dedicated to sawtooth, NTM, ELMs, error fields and beta limit pertinent modules, such as the RWM will be facilitated. Alongside such efforts, both 2D and 3D MHD non-linear stability modules will be integrated in the platform, with privileged application to further development for VDE/disruption capability, including work towards a "real time" disruption predictor.

Relation to Experiments

The IMP12 project has direct interfacing with all fusion experiments engaged with the ITM-TF effort on verification and validation of the developed tools. In coordination with the official Contact Persons assigned to each device, a roadmap for V&V activities to be carried out is anticipated. Coordination with JET is dealt jointly with the TFL.

Overall Milestone

To provide the ITM-TF with a comprehensive set of equilibrium, linear and non-linear MHD stability modelling tools and provision the fundamentals for a consistent free boundary equilibrium evolution with application to the study of plasma disruptions.

Continuity – Task relations

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		**Status in 2010**
ITM-09-IMP1-T1: Maintenance of equilibrium and linear MHD codes	→	Continued in 2010 (WP10-ITM-IMP12-ACT1)
ITM-09-IMP1-T2a: Free boundary equilibrium codes	→	WP10-ITM-IMP12-ACT2: Continued in [Priority Support]
ITM-09-IMP1-T2b: Feedback control in free boundary equilibrium codes	→	Incorporated in WP10-ITM-IMP12-ACT2
ITM-09-IMP1-T3: development of equilibrium reconstruction codes	→	Continued : WP10-ITM-IMP12-ACT3 applied in WP10-ITM-IMP12-ACT5
ITM-9-IMP1-T4: flow extension of equilibrium and MHD stability codes	→	Continued WP10-ITM-IMP12-ACT4

ITM-9-IMP1-T5: validation of equilibrium reconstruction codes	→	Continued : WP10-ITM-IMP12-ACT5 [Priority support]
ITM-9-IMP1-T6: 3D data structures and equilibrium codes	→	Continued : WP10-ITM-IMP12-ACT6
ITM-09-IMP02-T1: Data Structures	C	Discontinued. From 2010 data structures are produced by each module developer, with overall coordination at the PL level.
ITM-09-IMP02-T2: Sawtooth crash module	→	WP10-ITM-IMP12-ACT7
ITM-09-IMP02-T3: ELM module	→	Re-called as WP10-ITM-IMP12-ACT8
ITM-09-IMP02-T4: RWM module	→	WP10-ITM-IMP12-ACT9
ITM-09-IMP02-T5: NTM module	→	WP10-ITM-IMP12-ACT10
ITM-09-IMP02-T6: Full MHD code	→	Re-proposed as WP10-ITM-IMP12-ACT11: 3D MHD code
ITM-09-IMP02-T7: Error field modes	→	WP10-ITM-IMP12-ACT12
ITM-09-IMP02-T8: 2D MHD code	→	WP10-ITM-IMP12-ACT13
ITM-09-IMP02-T9: Disruptions	→	WP10-ITM-IMP12-ACT14
ITM-09-IMP02-T10: Halo plasma model	→	merged into WP10-ITM-IMP12-ACT14

Some new tasks are planned for 2010

New Tasks in 2010	
WP10-ITM-IMP12-ACT15: Numerical Toolbox	Creation of a new task out of the FLUSH subtask of ITM-09-IMP1-T1

Coordinated activities

Type of activity[1]	Topic, aims and intended audience[2]	Participants[3]	Length[4]	Tentative Date[5]	Tasks involved[6]
PM	joint IMP12+ETS meeting to launch the new combined project	40	5	22-26 of February 2010	All IMP12, + selected ETS
CC	Assist CPO integration in IMP4 codes: deliver initial transport modules. IMP4 turbulence and neoclassical code developers + IMP3 + ISIP representatives	10	8	3-12 March 2010	IMP12, IMP3–ACT1+ ISIP tasks oriented to Kepler and cross-IMP interfaces (i.e., the the current version datastructure CPO and codeparam system)
WS	Developmenty of 3D machine description IMP12, IMP3, EDRG	20	3 days	April 2010	IMP12-ACT6 IMP3-ACT3 EDRG-ACT3
WS	get-together of specialists and developers working on magnetic islands and the like	20	5	3 May 2010	WP10-ITM-IMP12-ACT9, -ACT10, -AC T11, -AC T12, -AC T13
WS	Mid-term assessment of control activities status and roadmap evaluation. ITM associated task contributors and Feedback control experts + possible WG contributors.	15	2 days	28 June 2010	ISIP-ACT12 IMP12-ACT2 EDRG-ACT4
Code Camp	Hands-on session on how to integrate control schemas into	15	3 days	June, just after the WS	ISIP-ACT12 IMP12-ACT2 EDRG-ACT4

[1] Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.

[2] Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)

[3] Indicative number of participants expected to participate

[4] Length of the activity in calendar days

[5] Indicative starting date for activity

[6] A list of tasks within ITM that are directly linked to this activity.

	the ITM platform using SCICOS and Simulink; RT workshop C++ code generation from Simulink schema, CPO datastructure wrapping and FC2K actor generation. Very useful to stimulate contributions from WG and control experts.				
WS	Interfacing of equilibrium modules with the erc3D code package. Joint effort from ERCC team and IMP12	~6	2-3days	5-7 July	EDRG-ACT6, IMP12-ACT1
WS	Integration freeboundary equilibrium+feedback code in ETS IMP12 , ETS, EDRG	25	1 week	19-23 July	IMP12-ACT2 IMP3-ACT1 EDRG-ACT4 ISIP-ACT12

WP10-ITM-IMP12-ACT1: Maintenance of equilibrium and linear MHD stability

Type of support available for the task : Baseline Support

Description of work

In 2009, two equilibrium reconstruction codes, three high resolution equilibrium codes and two linear MHD stability codes have been made available as actors within the Kepler environment. A continuous effort is required to keep the codes up-to-date with respect to the requirements, the definition of the data structures and the correction of bugs.
Implementation of new features such as additional diagnostics in the equilibrium reconstruction codes, additional coordinate systems in the high-res equilibrium codes or new solvers in the linear MHD stability codes also fall under this task.
The task comprises 3 parts corresponding to the applications

1a) equilibrium reconstruction codes (EQUAL, EQUINOX)
1b) high-res equilibrium codes (CHEASE, HELENA, and CAXE)
1c) linear MHD stability codes (ILSA, KINX)

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[7]
codes maintenance and documentation	1-1-2010	31-12-2010	up-to-date version of the codes and documentation available under SVN on the gateway	none
verification test cases	1-1-2010	31-12-2010	definition of standardised test cases for code verification, publication of verification tests on the IMP12 web pages.	none

Resources, skills and needs

Requested manpower/skills:
People with expertise in the contributed IMP1 codes, the IMP1 data structures and the implementation in the Kepler environment are required. The estimated manpower is 10 pm.

Existing Commitments: This task is a continuation of the task in 2009. It is foreseen to be a permanent task (but likely with an decreasing amount of required manpower over the years)

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	5 July	3 days	Outline and preliminary testing of equilibrium code integration

[7] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) :
The codes maintained in this task can be used by external parties (JET, MHD-TG, …)

WP10-ITM-IMP12-ACT2: Free boundary equilibrium codes

Type of support available for the task : Priority support

Description of work

An important ingredient of the whole device modelling, one of the main objectives of the ITM taskforce, are free-boundary equilibrium codes. The plasma profiles are evolved within the separatrix using 1D transport codes but the plasma shape and the external poloidal flux is evolved quasi-statically driven by the currents in the poloidal field coils and possibly the induced currents in the conducting structures. In 2009 a first version of two freeboundary equilibrium codes have been made available.

In 2010 the development of the freeboundary codes should continue in the following directions:

- validation of the freeboundary codes on experiments
- Integration of the freeboundary codes in the transport solver
  - Adaptation of the freeboundary codes to the ETS requirements
- Self-consistent time evolution:
  - Development of a dynamic version to compute self-consistently the evolution in time of the free boundary equilibrium as a result of the voltages applied to the poloidal field coils. To perform plasma scenario simulations that are consistent with the PF coils system features and limitations.
  - Extend the dynamic evolution by coupling to feedback control schemes.

Given the central importance of the free-boundary equilibrium code(s) with respect to the community needs, the requirements on the next step developments of the European Transport solver (IMP3) and phasing with IMP1 general activities, the development of the ITM free-boundary equilibrium module will be undertaken with Priority Support with a ceiling of 30 pm (2.5 ppy) for 2010.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[8]
Report on the validation of freeboundary code	1-1-2010	1-8-2010	Report on the validation of freeboundary code(s)	EDRG-T1 (formal agreement with devices)
freeboundary code Kepler actor	1-1-2010	31-12-2010	Dynamic version of freeboundary code(s) available as Kepler actor (SVN, documentation)	IMP3-T1
Feedback control extension	1-6-2010	31-12-2010	Integrate feedback control schemes on the free boundary code	ISIP-T12
Kepler workflow	1-6-2010	31-12-2010	Provide a Kepler workflow for the dynamical free boundary evolution and for added feedback control.	ISIP-T12

Resources, skills and needs

Requested manpower/skills:

Experience with free boundary equilibrium codes, the ITM data structures and feedback control schemas. The estimated manpower is 24 pm for the free boundary validation, Kepler actor and workflow development and 6pm for the feedback

[8] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

control integration. Experts in applications for Kepler are essential for assisting the workflow development.
Existing Commitments: This task is a continuation of the task in 2009.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	19 July	1	Assist IMP3 on the Integration freeboundary equilibrium+feedback code in ETS

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP12-ACT3: Development of equilibrium reconstruction codes

Type of support available for the task: Baseline Support

Description of work

The adaptation of the equilibrium reconstruction codes to the ITM data structures needs to be continued and completed in 2010.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[9]
Equilibrium reconstruction code actor	1-1-2010	31-12-2010	Equilibrium reconstruction code available as an actor in the Kepler framework code and documentation available under SVN on the Gateway	none
Benchmark	1-1-2010	31-12-2010	Benchmark on standard test cases (to be defined)	none

Resources, skills and needs

Requested manpower/skills:

People with expertise in the contributed IMP1 codes, the IMP1 data structures and the implementation in the Kepler environment are required. It is estimated that the total manpower needed for the activities within this task is about 12pm.

Existing Commitments: This task is a continuation of the task in 2009.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
none			

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[9] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT4: Flow extension of equilibrium and MHD stability codes

Type of support available for the task: Baseline Support

Description of work

The existing ITM data structures describing the equilibrium and MHD stability will need to be extended to include toroidal and possibly poloidal flow.

Adaptation of existing equilibrium and linear MHD stability codes with flow to the extended ITM data structures.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[10]
Extended ITM datastructures for the equilibrium and MHD stability	1-1-2010	30-4-2010	Equilibrium CPO definition with toroidal (and possibly poloidal) flow	none
Adaptation of existing equilibrium and/or linear MHD stability codes with toroidal and/or poloidal flow to the ITM datastructures.	30-4-2010	31-12-2010	Equilibrium code with flow available as a Kepler actor. Source code and documentation available on the ITM subversion server Publication of standard test cases on the IMP1 website.	none

Resources, skills and needs

Requested manpower/skills:

People with expertise in the contributed codes, the former IMP1 data structures and the implementation in the Kepler environment are required. It is estimated that the total manpower needed for the activities within this task is about 8 pm.

Existing Commitments: This task is a continuation of the task in 2009 for which there was 0.18ppy available

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
none			

[10] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP12-ACT5: Validation of the equilibrium reconstruction codes available in Kepler

Type of support available for the task: Priority support

Description of work

Equilibrium reconstruction codes have been adapted to the ITM requirements and contributed to the ITM taskforce. The next step is the verification and validation of the equilibrium reconstruction codes following the V&V procedures as defined within the taskforce.

In 2009 a start has been made for the verification on JET and Tore Supra using magnetic data only. In 2010 the verification will need to be extended to include more diagnostics, notably MSE, polarimetry and pressure profile data. One of the objectives for 2010 is extension of the validation to additional machines (AUG, MAST, TCV etc.)

The end result will be a set of validated and documented codes that can be used on any tokamak for which a machine description is available.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[11]
Code Validation	1-1-2010	1-6-2010	Validation of the codes on additional machines (in addition to JET and TS) and diagnostic (in addition to the magnetics)	EDRG-T1 (formal agreement with devices) EDRG-T2
Report on the validation .	1-1-2010	31-12-2010	Report on the validation exercise	Additional diagnostics in the equilibrium reconstruction codes

Resources, skills and needs

Requested manpower/skills:
People with expertise in the use of equilibrium reconstruction codes. The estimated manpower is 12pm.

Existing Commitments: This task is a continuation of the task in 2009.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
none			

[11] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) Manpower availability from JET for assisting the validation

WP10-ITM-IMP12-ACT6: Definition of 3D data structures for the equilibrium and implementation in 3D equilibrium codes

Type of support available for the task: Baseline Support

Description of work

To prepare for the inclusion of stellarator codes and for the applications of 3D equilibria on tokamaks (like the effect of the ripple on the equilibrium reconstruction), the former IMP1 datastructures will need to be extended to 3D. This includes both the machine description and the equilibrium datastructures. The development of the 3D machine description will be in close collaboration with the EDRG and IMP3 which have related activities.

Adaptation of an existing 3D equilibrium code to the 3D ITM data structures.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[12]
Extension of the data structures to 3D machine geometries	1-1-2010	30-6-2010	3D machine descriptions (magnetics) 3D equilibrium data structure	EDRG-T3
Adaptation of existing equilibrium codes to the ITM data structures.	30-6-2010	31-12-2010	3D Equilibrium code available as a Kepler actor. Source code and documentation available on the ITM subversion server Publication of standard test cases on the IMP12 website.	none

Resources, skills and needs

Requested manpower/skills:

Expertise in 3D equilibrium codes is requested. Experience is ITM data structures would be very useful but support for the ITM data structures is available. It is estimated that the total manpower needed for the activities within this task is about 12 pm.

Existing Commitments: This task is a continuation of the task in 2009. Due to a lack of manpower this task has not started in 2009.Additional commitments are sought.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	April 2010	0.5	Joint assessment of the requirements of 3D datastructures in

[12] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

			equilibrium, stability, transport and machine geometry

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP12-ACT7: Sawtooth crash module

Type of support available for the task: Baseline Support

Description of work

The scope of this task agreement is to make available to ITM a validated computer software module to determine the effect of a sawtooth crash.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[13]
sawtooth crash module documentation	1/1/2010	28/2/2010	Full documentation of the module, including end user manual on the ITM-TF server, under Gforge	
sawtooth crash module validation	1/1/2010	31/10/2010	Validation exercise	EDRG-T1 (pending updated Agreement with devices)

Resources, skills and needs

Requested manpower/skills:.Sawtooth crash module developers.
a) 2 ppm for the documentation
b) 6 ppm for validation

Existing Commitments:
This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)
Experimental groups (JET, EFDA MHD TG) to contribute with manpower for validation.

[13] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT8: ELM module

Type of support available for the task: Baseline Support

Description of work

The scope of this task agreement is to provide the ITM task force with a computer software module to determine the effect of edge localised modes (ELMs). The module will be able to read from the plasma state variables (profiles), determine whether the trigger condition for ELMs occurs, and calculate the incremental transport coefficient due to ELMs for the duration of the ELM phenomenon. It will be based on existing ELM modules currently employed in certain codes and in particular in JETTO. It will be written in a way that would allow implementing foreseeable extensions.

The module will take the form of a callable routine whose parameters conform to the ITM data structure.

The module will be released with adequate technical documentation (the computer program), and with detailed information of the physics model on which it is based. This will include, in particular, a description of any approximation or possible ad hoc factors that were necessarily introduced in the model, its limitations of applicability, and an appreciation of directions of possible upgrading.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[14]
ELM module (code)	1/1/2010	30/6/2010	A software module for the ELM phenomenon, complying with ITM specifications	
ELM module documentation	1/1/2010	30/6/2010	a) technical documentation of the module for the end user b) A detailed description of the physics model including its limitations	
ELM module actor	1/7/2010	31/10/2010	Installation and tests of the ELM module on the ITM platform as a Kepler actor	

Resources, skills and needs

Requested manpower/skills: 0D/1D ELM modelling experts are envisaged; The estimated manpower is 6pm

Existing Commitments: This is a renewal of a task that did not receive adequate support in 2009.

Code Camps or other coordinated activities

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

[14] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP12-ACT9: Resistive wall modes

Type of support available for the task: Baseline Support

Description of work

Software module(s) for the stability analysis of resistive wall modes complying with ITM specifications.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[15]
RWM code documentation	1/1/2010	31/5/2010	technical documentation for the end user and description of the physics taken into account, including limitations	
RWM Kepler actor	1/1/2010	31/08/2010	Installation of the module on the Gateway in the ITM-TF framework as a Kepler actor.	EDRG-T3 (3D wall)

Resources, skills and needs

Requested manpower/skills: RWM modelling experts (some knowledge of the ITM datastructure is welcome) are requested for 9pm

Existing Commitments This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	April 2010	0.5	Joint assessment of the requirements of 3D datastructures in equilibrium, stability, transport and machine geometry
WS on islands	3 May	1	closer integration, better cooperation, cross-fertilisation

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[15] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT10: NTM module

Type of support available for the task: Baseline Support

Description of work

The scope of this task agreement is to provide the ITM task force with an updated computer software module to determine the effect of neoclassical tearing modes (NTMs). The updated module will have to include the effect of the island rotation and the effect of the island on transport.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[16]
NTM actor	1/1/2010	31/3/2010	Final steps to release the module to the task force as a Kepler actor	
NTM module upgrade	1/4/2010	31/8/2010	a) Explicit calculation of Δ' from the current profile b) Addition of terms in the Rutherford equation from recent tearing mode theory.	
NTM module documentation	31/8/2010	31/12/2010	Technical and physics documentation	

Resources, skills and needs

Requested manpower/skills : Experts on NTM 0D code development , requested for 9 ppm

Existing Commitments: This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS on islands	3 May	1	closer integration, better cooperation, cross-fertilisation

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[16] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT11: 3D MHD code

Type of support available for the task: Priority Support

Description of work

The scope of this task agreement is to provide the ITM task force with a three-dimensional, nonlinear MHD code in general toroidal geometry. The code can be either full or reduced MHD. The initial goal is to test its functioning on the ITM platform.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[17]
3D MHD code	1/1/2010	31/8/2010	installation and tests on the ITM Gateway	
Kepler actor	1/9/2010	31/12/2010	creation of a Kepler actor and evaluation tests	

Resources, skills and needs

Requested manpower/skills: Experts on 3D non linear MHD code development, envisaged for 12 pm

Existing Commitments: None

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS on islands	3 May	1	closer integration, better cooperation, cross-fertilisation

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[17] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT12: Error field modes

Type of support available for the task: Baseline Support

Description of work

The scope of this task agreement is to provide the ITM task force with a computer software module to determine the effect of error field modes. This is a multi-year effort. Work in 2010 will be directed to the development of a cylindrical code that computes the plasma response to an applied error field at the boundary.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[18]
Error field module	1/1/2010	31/12/2010	A cylindrical code that computes the plasma response to an applied error field perturbation	

Resources, skills and needs

Requested manpower/skills: Experts in 1D/2D error field modelling. Estimated 6 pm is requested

Existing Commitments: This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS on islands	3 May	1	closer integration, better cooperation, cross-fertilisation

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[18] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT13: 2D MHD code

Type of support available for the task: Baseline Support

Description of work

The scope of this task agreement is to provide the ITM task force with a non-linear two-fluid MHD code. The code must be able to solve the four field model with cold ions in cylindrical geometry. The code will be written in a way to accommodate foreseeable extensions of the model and it should conform to the ITM data structure.

This code aims to provide the ITM task force with a predictive tool of intermediate complexity between zero-dimensional modules and full MHD three-dimensional codes.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[19]
2D MHD code	1/1/2010	31/12/2010	2D MHD code as a Kepler actor	
2D MHD code documentation on physics	1/1/2010	30/6/2010	physics description	
2D MHD code technical documentation	1/7/2010	30/6/2010	technical documentation for the end user	

Resources, skills and needs

Requested manpower/skills: Experts on 2D MHD plasma modelling, estimated 12 pm required

Existing Commitments This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS on islands	3 May	1	closer integration, better cooperation, cross-fertilisation

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[19] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-IMP12-ACT14: Disruptions workbench

Type of support available for the task: Priority Support

Description of work

Addressing disruptions is both of strategic importance and a substantial integration exercise in itself, since it requires dealing with several aspects of tokamak modelling ranging from physics to engineering. This is a multi-year joint effort of the whole ITM task force. Coordination with other EFDA TGs and TFs will be implemented, with the involvement of various experiments for validation. A working session on disruptions under WP 2009 has defined a number of actions for modelling and experiments. For the WP 2010, the ITM-TF seeks support for the following priority actions:

1) Development of a 3D nonlinear MHD code into a disruptions code (a code to treat the evolution of MHD modes in the whole plasma volume during a disruptive event). Further development beyond 2010 will include the effect of external conductors and of a 3D wall.

2) Extension of free-boundary equilibrium codes to incorporate the formation of a halo plasma during a symmetric VDE and the self-consistent evolution of halo currents (former task ITM-09-IMP2-T10)

This activity in performed in close collaboration with MHD topical group as specified in WP10-MHD-02

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[20]
3D MHD code for disruption simulations	1/1/2010	31/12/2010	A first version of a 3D MHD code capable of handling the evolution of MHD modes during the disruption phase. Installation on the Gateway and tests.	
2D code for VDEs	1/1/2010	31/12/2010	A code capable of treating VDEs including the halo plasma and the halo currents. Installation on the Gateway and tests.	

Resources, skills and needs

Requested manpower/skills: 3D MHD and disruptions experts are envisaged, estimated 12pm required
Existing Commitments: This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.

Code Camps or other coordinated activities

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

[20] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP12-ACT15: Numerical Tools

Type of support available for the task: Baseline Support

Description of work

The development of code interfaces within the ITM-TF requires the development and maintenance of standard tools for grid interpolations, mesh generation, and coordinate transformations as well as of other packages of general purpose character.

This task is intended to promote the installation, survey, and development of general purpose numerical tools, especially for:

- High order interpolation (1D, 2D, 3D) and contouring tools
- Coordinate transformation tools
- Mesh generation tools

Key requirements for the tools in this task are the conformance with the ITM-TF data structures (CPOs), the existence of complete and up-to-date documentations, and the development of clear and robust interfaces.

Since this task is a collective task, small contributions (even below 1pm) are welcome.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[21]
1D and 2D interpolation and contouring routines	1/1/2010	1/6/2010	Provision of a library and actor for 1D and 2D interpolations and contouring + documentation under Gforge	
3D interpolation routines	1/1/2010	31/12/2010	Assessment of the need of 3D interpolation routines plus provision of a library and actor + documentation under Gforge	
Coordinate transformations	1/1/2010	1/9/2010	Assessment of needed transformations and provision of a library and actor + documentation under Gforge	
Mesh generation tools	1/1/2010	31/12/2010	Provision of 2D and 3D mesh generation tools as a library and actor + documentation under Gforge	Depends on availability of the grid CPO

Resources, skills and needs

Requested manpower/skills: owners and users of existing tools as well as numerical experts, estimated 12pm required

Existing Commitments: Some work may be recycled from the former FLUSH task under task ITM-09-IMP1-T1. **This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply as well as new commitments.**

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

[21] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

Task Agreement **WP10-ITM-IMP3**:

Integrated Modelling Project 3 (IMP3):

Transport Code and Discharge Evolution

Contents

Project Leadership

The ITM-TF Project leadership runs on a two –year appointment schedule, customary practice is that this is renewable. The current project leaders will reach end of term December 31 2009. Hence, an integral part of this call for participation is the appointment of Project Leaders for the coming two year period. The ITM-TF activities are planned on a longer time period and a longer reach than the

appointment period for any of its leadership functions. The appointed Project Leaders will take active part in the establishment of Task Agreement and will be given the opportunity in negotiation with Associations to impact the final Task Agreements.

The call for new Project Leadership is given in the section CfP-WP10-ITM-TFL.

Negotiation

The Call for Participation is taken as the basis for the Task Agreement. In most cases there is a straightforward procedure to incorporate work commitments into Task Agreements. In a few cases, previous experiences show that it has been advantageous to re-engage in a discussion of scope and commitment levels for individuals or tasks. Exceptionally, new tasks could be introduced also at this stage to further streamline or promote the ITM-TF mission. With potentially new set of project leaders entering the project this year it could also serve to bridge interest areas and balance the need to maintain the work programme direction with new ideas and requirements.

Required Resources

The Implementation of the IMP3 work programme for 2010 is estimated to require a minimum of 5 ppy under Priority Support and 15 ppy under Baseline support, in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The Leadership together with inter-project coordinating activities within the project are eligible for Priority Support.

In addition, a few tasks and activities within the IMP3 work programme are considered to be on the critical path for ITM-TF to meet its mission and/or are integral parts to project wide milestones. These tasks are considered for Priority Support:

- The task **WP10-ITM-IMP3-ACT1: "Maintenance, continuing development, verification and validation of the ETS"** is partially formed under Priority Support with a ceiling of 60 pm.

A total of 60pm (excluding Project Leadership) has been assigned to IMP3 activities.

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the IMP3 group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license.
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.

Project Background

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 these modules require data from the other projects' modelling codes, e.g. auxiliary heating deposition profiles. The ultimate goal of the IMP3 activity, and the ITM-TF in general, is whole device modelling, i.e. integrating modelling of all the essential processes relevant for a fusion plasma. Within IMP3 itself the major challenge is to integrate modelling of different transport processes and regions of a fusion device. For instance the core transport needs to be coupled to the edge transport, which in its turn must be integrated with models for the thermal properties of targets etc. Moreover, the developed transport code interfaces must be adapted to incorporate the data structures that provide the necessary information, e.g. sources and sinks, simulated by codes from the other IMPs. In fact, models of different complexity and scope are needed for the ITM-TF, ranging from 0D modelling for fast routine assessments of various scenarios to 2D-3D models that integrate all the relevant regions of a fusion plasma.

The ITER Scenario Modelling Task is now an integral part of IMP3 and will continue modeling and benchmarking activities using existing transport codes (JETTO, CRONOS, ASTRA,…) integrating ITM_TF developments into to tool suite as they become available.

Relation to Experiments

IMP3 will rely on a certain level of data from a few experiments (AUG, JET,...) for testing and developments purposes. It is foreseen that the current (2009) development of the data structures (v4.07b) and planned installations of corresponding data mappings are sufficient for IMP3 needs. For continued modelling and benchmarking for ISM, the porting of the current ISM database to the gateway would need to be finalized. In coordination with the official Contact Persons assigned to each device, a roadmap for V&V activities to be carried out is anticipated. Coordination with JET is dealt jointly with the TFL.

Overall Milestone

Delivery of a workflow that couples the core and edge.

Continuity – Task relations

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		Status in 2010
WP09-ITM-IMP3-T1 Maintenance and continuing development of the ETS	→	**WP10-ITM-IMP3-ACT1 continued with extended scope including WP09-ITM-IMP3-T2** "Maintenance, continuing development, verification and validation of the ETS" Continued (under partial Preferential Support)
WP09-ITM-IMP3-T2 Use of the modules and interfaces, comparison with existing 1D codes and experiment (validation and verification)	→	**merged into WP10-ITM-IMP3-ACT1**
WP09-ITM-IMP3-T3 Continuation of edge code validation	→	**WP10-ITM-IMP3-ACT4** Continuation of edge code validation including codes added in 2009. Continued (Baseline Support)
WP09-ITM-IMP3-T4 Continuation of the development and implementation of edge CPOs (including core-edge coupling)	→	**WP10-ITM-IMP3-ACT3** Continuation of the development and implementation of edge CPOs (including core-edge coupling), continued development/implementation of edge codes. Continued (Baseline Support)
WP09-ITM-IMP3-T5 Extension of edge code simulations to the (real) wall	→	**merged into WP10-ITM-IMP3-ACT3** See above
WP09-ITM-IMP3-T6 Implementation of 3d edge code(s) on the Gateway Machine	→	**merged into WP10-ITM-IMP3-ACT3** See above
WP09-ITM-IMP3-T7 Implementation of kinetic edge codes on the Gateway machine	→	**merged into WP10-ITM-IMP3-ACT3** See above

Some new tasks are planned for 2010

New Tasks in 2010	
WP10-ITM-IMP3-ACT2: ITER Scenario Modelling (ISM)	Continuation of ISM activities, in close collaboration with WP10-ITM-IMP3-ACT1.

Coordinated activities

Type of activity[22]	Topic, aims and intended audience[23]	Participants[24]	Length [25]	Tentative Date[26]	Tasks involved[27]
Working Session/Code Camp	• All those involved in the ETS or ETS type workflows • ISM (Core&Edge)	20 - 30	2 weeks	Feb 2010	**WP10-ITM-IMP3-ACT1** **WP10-ITM-IMP3-ACT2**
CC	CPO integration in IMP4 codes: deliver initial transport modules. • IMP4 turbulence and neoclassical code developers + IMP3 + ISIP representatives	10	8 days	3-12 March	IMP12, IMP3–ACT1+ ISIP tasks oriented to Kepler and cross-IMP interfaces (i.e., the current version datastructure CPO and codeparam system)
Working Session/Code Camp	• Edge modellers • ISM (Edge)	10 - 20	2 weeks	Apr 2010	**WP10-ITM-IMP3-ACT2** **WP10-ITM-IMP3-ACT3** **WP10-ITM-IMP3-ACT4**
WS	• Developmenty of 3D machine description IMP12, IMP3, EDRG	20	3 days	April 2010	IMP12-ACT6 IMP3-ACT3 EDRG-ACT3
Working Session/Code Camp	• All those involved in the ETS or ETS type workflows • ISM (Core)	20 - 30	2 weeks	Jul 2010	**WP10-ITM-IMP3-ACT1** **WP10-ITM-IMP3-ACT2**
WS	Integration freeboundary equilibrium+feedback code in ETS • IMP12 , ETS, EDRG	25	1 week	19-23 July	IMP12-ACT2 IMP3-ACT1 EDRG-ACT4 ISIP-ACT12

[22] Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.
[23] Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)
[24] Indicative number of participants expected to participate
[25] Length of the activity in calendar days
[26] Indicative starting date for activity
[27] A list of tasks within ITM that are directly linked to this activity.

Working Session/Code Camp	• Edge modellers • ISM (Edge) • Key ETS members	10 - 20	2 weeks	Sep/Oct 2010	**WP10-ITM-IMP3-ACT2** **WP10-ITM-IMP3-ACT3** **WP10-ITM-IMP3-ACT4** **WP10-ITM-IMP3-ACT1**
Working Session/Code Camp	• All those involved in the ETS or ETS type workflows • ISM (Core&Edge) • Key Edge modellers	20 - 30	2 weeks	Oct/Nov 2010	**WP10-ITM-IMP3-ACT1** **WP10-ITM-IMP3-ACT2** **WP10-ITM-IMP3-ACT3** **WP10-ITM-IMP3-ACT4**

WP10-ITM-IMP3-ACT1: Maintenance, continuing development, verification and validation of the ETS

Type of support available for the task:

Priority Support for maintenance, critical continuing development and verification activities

Baseline Support for general continuing development and validation

Description of work

This should contain a brief and to the point description of what is expected to be done under this task. In particular no confusion over what the work consist of should be allowed.

(1) Maintenance support for the ETS including the addition of new modules within the Kepler workflows (ongoing: reports every 3 months – 2010-03, 2010-06, 2010-09, 2010-12 (PS, ~ 6 – 12 ppm)
(2) A number of standard workflows for inexperienced users (documented package of workflows 2010-06 & 2010-12) [in collaboration with the other IMPs] (PS, ~ 6 – 12 ppm)
(3) Physics modules whose development continues from 2009 (to be completed by 20010/06) (PS & BS, ~ 6 – 12 ppm)
(4) A free boundary version of the ETS (PS & BS, ~ 6 – 12 ppm)
(5) Reports on the experience of using the ETS with suggestions for improvements (2010-03, 2010-09) (BS, ~ 4 ppm)
(6) Verification reports describing the comparison of the ETS against and analytic results and existing 1d transport codes (2010-06, 2010-12) (PS, ~ 6 – 12 ppm)
(7) Validation reports (2010-06, 2010-12) (BS, ~ 6 – 12 ppm)
(8) Report on the use of the 0d code (2010/09) (BS, ~ 3 ppm)

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[28]
ETS maintenance	2010-01	2010-12	Reports on the status of the ETS, 2010-02, 2010-06, 2010-09 & 2020-12	
Development of standard workflows	2010-01	2010-12	Documented packages of workflows 2010-06 & 2010-12	
Finalization of IMP3 core modules	2010-01	2010-06	Delivery by 2010-06 of modules for 1. Neutrals 2. Impurities 3. Pellets	
Free boundary ETS	2010-01	2010-12	Free boundary version of the ETS	WP10- IMP12 – ACT2
Experience reports	2010-01	2010-12	Reports on the experience of using the ETS with suggestions for improvements (2010-03, 2010-09)	Requires the release of workflows form ITM-WP10-IMP3-ACT1
Verification reports	2010-01	2010-12	Verification reports describing the comparison of the ETS against analytic results and existing 1d transport codes (2010-06, 2010-12)	• Requires the release of workflows form ITM-WP10-IMP3-ACT1 • Timely finalization (and continued support) for WP09-ISM-ACT6
Validation reports	2010-01	2010-12	Validation reports describing the comparison of the ETS workflows against experiment or first principles based models	• Requires the release of workflows form WP10- ITM-IMP3-ACT1 • V&V activity with experiments – EDRG-ACT1 • Requires input from other IMPs
0d-code	2010-01	2010-09	Report on the use of the 0d code (2010/09)	

Resources, skills and needs

Requested manpower/skills: Please describe the required skills and competencies.

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

Existing Commitments: If this is a continued task please give a brief overview of 2009 activities and expected activity needs for 2010 and if appropriate indicative need for 2011.

[28] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session (joint with ETS)	Feb 2010	2 weeks	Core team session: Kick off/consolidation of remote activities. Towards general deliverables. Status Report required.
Working Session (joint with ETS)	Jul 2010	2 weeks	Core team session: consolidation of remote activities. Towards general deliverables. Status Report required.
WS	19 July	1	Assistance from IMP12 on the Integration free-boundary equilibrium+feedback code in ETS
Working Session (joint with ETS)	Oct/Nov 2010	2 weeks	Core team session: consolidation of remote activities. Towards general deliverables. Status Report required.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

Experimental data as identified by the validation task might be required.

WP10-ITM-IMP3-ACT2: ITER Scenario Modelling (ISM)

Type of support available for the task: Baseline Support

Description of work

The ITER Scenario Modelling Group was established under limited scope at April 2007. It started its work by using the existing major European Modelling codes (e.g. ASTRA, CRONOS and JETTO for core plasma modelling), and aims at integrating more and more ITM modules and codes as they become available. The modelling tasks are carried out by more than one code - when possible - and code-to-code comparison is an essential aspect of this work. This method of approach provides a better confidence in the results obtained as well as a continuous improvement of the European modelling tools. Moreover, the philosophy of this activity is to take into account existing experimental results, and the models used for extrapolation to ITER scenarios are systematically tested against existing experimental data.

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

In broad terms the activity will focus on

- Development of improved set of ITER reference scenarios
- Verification and Validation, Benchmarking of the ISM tool set
- Development and publication of the ITER scenario modelling database.

ISM activities should also provide a continuation/finalization effort of the 2009 activities as needed*

- Systematic modelling of current ramp up/down in all reference ITER scenarios.
- Density control by pellet injection and by gas puffing.
- Impurity control in the core and SOL.

*The team should be sufficiently flexible in the organisation of the work, in order to be able to address urgent ITER issues in a rapid timescale.

ISM coordination will be performed by one of the deputy leaders of IMP3

There is a good progress at present in our understanding of hybrid scenario, which will be exploited in first place. As the modified and improved scenarios develop they will be assessed and contrasted within the framework of the reference ITER scenarios and promoted within the framework of the

ITER collaborations with the aim of providing further insight and improvements to the baseline scenarios and proposal for experimental validation on current tokamaks.

The ISM group should continue to act as a resource and response group for ITER modelling needs.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[29]
Status Report A	2010-0101	2010-03-15	Status report on ISM core activities	IMP3-ACT1, ACT4
Status Report B		2010-05-15	Status Report on ISM edge activities	IMP3-ACT1, ACT4
Database release	2010-01-01	2010-06-31	ITM release of ISM database (documentation and data)	WP09- TFL2-ISM-T6 (2009)
Status Report C		2010-08-15	Status Report ISM activities (detailed plan for remainder of 2010)	IMP3-ACT1, ACT4
Status Report D		2010-10-31	Status Report for ISM edge activities	IMP3-ACT1, ACT4
Final report		2010-12-31	Detailed summary of ISM activities and results(	IMP3-ACT1, ACT4

Resources, skills and needs

Requested manpower/skills: Please describe the required skills and competencies.

A critical assessment of ITER scenarios requires a broad mix of skills and expertise cutting across the different Integrated Modelling Projects and should benefit strongly from the input of high level experimentalists as well. The activity will be led by a Task Coordinator who will also take a role as a deputy IMP3 project leader. (The Task Coordinator is called for separately)).

The call for participation will explicitly ask for participants with skills covering core and SOL modelling, MHD stability, simulation of evolving free boundary equilibrium and other aspects of integrated modelling. Moreover, high level experimentalists will be sought (on the session leader level or equivalent). This should ensure that the necessary mix of expertise needed to carry out the tasks can be gathered. It is essential that the group has expertise and knowledge covering both physics and technical issues for all three ITER reference scenarios.

Existing Commitments: If this is a continued task please give a brief overview of 2009 activities and expected activity needs for 2010 and if appropriate indicative need for 2011.

The ITER Scenario modelling task is a continuation of 2009 activities and has had a strong backing of ~4.5 ppy. The task is expected to be maintained at the same level of activity as in 2009 and existing

[29] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

contributors are strongly requested to provide continued support for the activity.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session (joint with ETS)	Feb 2010	2 weeks	ISM (core and edge) team session: Kick off/consolidation of remote activities. Towards general deliverables. Status Report required.
Working Session (joint with IMP3 edge tasks)	Apr 2010	2 weeks	Edge team Kick off with ISM core team/consolidation of remote activities. Towards general deliverables. Status Report required.
Working Session (joint with ETS)	Jul 2010	2 weeks	Core team session: consolidation of remote activities. Towards general deliverables. Status Report required.
Working Session (joint with IMP3 edge tasks)	Sep/Oct 2010	2 weeks	Edge team session: Towards general deliverables. Status Report required.
Working Session (joint with ETS)	Oct/Nov 2010	2 weeks	ISM core and edge team session: consolidation of remote activities. Towards general deliverables. Status Report required.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

ITM-IMP3-T2 activities relies on access to some experimental data and will in general involve modelling ITER relevant data and should interface with ITPA as well as other EU activites.

WP10-ITM-IMP3-ACT3: Implementation and integration of edge codes

Type of support available for the task: Baseline Support

Description of work

This should contain a brief and to the point description of what is expected to be done under this task. In particular no confusion over what the work consist of should be allowed.

(1) Delivery by 2010-04 of (BS ~6 ppm):
   a. CPO for the edge plasma state
   b. CPO for the wall
   c. CPO for core-edge coupling
   d. CPO for edge-edge coupling
   e. CPO for edge plasma-neutral coupling
(2) Functioning core-edge coupling using CPOs (2010-09) (BS ~ 12 ppm)
(3) Functioning core-edge coupling using Kepler (2009-12) (BS ~ 12 ppm)
(4) Functioning edge codes on the Gateway using the wall CPOs (2010-09) (BS ~ 6 ppm)
(5) Functioning edge code on the Gateway using the plasma-neutral CPOs (2010-09) (BS ~ 6 ppm)
(6) Functioning edge code on the Gateway using the plasma-wall-neutral CPOs (2010-09) (BS ~ 6 ppm)
(7) Release of CPO'ified versions of edge codes (2010-09) (BS ~ 6 – 24 ppm)
(8) Release of coupled edge codes (2010-12) (BS ~ 12 ppm)
(9) Delivery of a report on approaches for evolving grids in the edge covering issues such as re-meshing, moving mesh, … (2010-12) (BS ~ 6 pm)

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[30]
Edge CPOs	2010-01	2010-04	a. CPO for the edge plasma state b. CPO for the wall c. CPO for core-edge coupling d. CPO for edge-edge coupling e. CPO for edge plasma-neutral coupling	Acceptance of the grid storage proposal (2009)
Core-edge	2010-05	2010-12	Functioning core-edge coupling using CPOs (2010-09) and using Kepler (2010-12)	Release of edge CPOs
Edge-neutral	2010-05	2010-09	Functioning edge code(s) on the Gateway using the plasma and wall CPOs (2010-09)	Release of edge CPOs
Edge-wall	2010-05	2010-09	Functioning edge code(s) on the Gateway using the plasma and wall CPOs (2010-09)	Release of edge CPOs
Edge-neutral-wall	2010-05	2010-12	Functioning edge code(s) on the Gateway using the plasma, neutral and wall CPOs (2010-12)	Release of edge CPOs
MC-plasma	2010-05	2010-09	Release of CPO'ified versions of edge codes	Release of edge CPOs

[30] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

			(2010-09)	
MC-edge	2010-09	2010-12	Release of coupled edge codes (2010-12)	Completion of MC-plasma
Moving-edge	2010-01	2010-12	Delivery of a report on approaches for evolving grids in the edge covering issues such as re-meshing, moving mesh, … (2009-12)	

Resources, skills and needs

Requested manpower/skills: Please describe the required skills and competencies.

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..

Existing Commitments: If this is a continued task please give a brief overview of 2009 activities and expected activity needs for 2010 and if appropriate indicative need for 2011.

This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session (joint with IMP3 edge tasks)	Apr 2010	2 weeks	Edge team Kick off with ISM core team/consolidation of remote activities. Towards general deliverables. Status Report required.
WS	April 2010	0.5	Joint assessment of the requirements of 3D datastructures in equilibrium, stability, transport and machine geometry
Working Session (joint with IMP3 edge tasks)	Sep/Oct 2010	2 weeks	Edge team session team/ Towards general deliverables. Status Report required.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP3-ACT4: Verification and validation of edge codes

Type of support available for the task: Baseline Support

Description of work

This should contain a brief and to the point description of what is expected to be done under this task. In particular no confusion over what the work consist of should be allowed.

A status report of the current status of the edge code comparisons, together with a plan for the continuation of the work, to be delivered by 2010-12. (BS ~ 6 – 12 ppm)

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[31]
Edge V&V	2010-01	2010-12	Report on edge code V&V (2010-12)	• EDRG-ACT1 (Formal agreement with devices) • EDRG-ACT2, ISIP-ACT11 • Code choices dependent on activities in WP10-ITM-IMP3-ACT4

Resources, skills and needs

Requested manpower/skills: Please describe the required skills and competencies.

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

Existing Commitments: If this is a continued task please give a brief overview of 2009 activities and expected activity needs for 2010 and if appropriate indicative need for 2011.

This is a continuation of the task from 2009 and all who participated in the task in 2009 are encouraged to reapply.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session (joint with IMP3 edge tasks)	Apr 2010	2 weeks	Edge team Kick off with ISM core team/consolidation of remote activities. Towards general deliverables. Status Report required.

[31] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

Working Session (joint with IMP3 edge tasks)	Sep/Oct 2010	2 weeks	Edge team session team/ Towards general deliverables. Status Report required.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

The task might identify the need for experimental data. There is also a synergy with the ITPA DivSOL working group.

Task Agreement **WP10-ITM-IMP4**:

Integrated Modelling Project 4 (IMP4):
Transport Processes and Micro stability

This Call for Participation aims to establish the IMP4 work programme for 2010 under EFDA Art.5 Task Agreement format.

Contents

Project Leadership

The ITM-TF Project leadership runs on a two –year appointment schedule, customary practice is that this is renewable. The current project leaders will reach end of term December 31 2009. Hence, an integral part of this call for participation is the appointment of Project Leaders for the coming two year period. The ITM-TF activities are planned on a longer time period and a longer reach than the appointment period for any of its leadership functions. The appointed Project Leaders will take active part in the establishment of Task Agreement and will be given the opportunity in negotiation with Associations to impact the final Task Agreements.

The call for new Project Leadership is given in the section CfP-WP10-ITM-TFL.

Negotiation

The Call for Participation is taken as the basis for the Task Agreement. In most cases there is a straightforward procedure to incorporate work commitments into Task Agreements. In a few cases, previous experiences show that it has been advantageous to re-engage in a discussion of scope and commitment levels for individuals or tasks. Exceptionally, new tasks could be introduced also at this stage to further streamline or promote the ITM-TF mission. With potentially new set of project leaders entering the project this year it could also serve to bridge interest areas and balance the need to maintain the work programme direction with new ideas and requirements.

Required Resources

The Implementation of the IMP4 work programme for 2010 is estimated to require a minimum of 0.3 Ppy under Priority Support and 6 Ppy under baseline support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal

peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The Leadership together with inter-project coordinating activities within the project are eligible for Priority Support.

In addition, a few tasks and activities within the IMP4 work programme are considered to be on the critical path for ITM-TF to meet its mission and/or are integral parts to project wide milestones. These tasks are considered for Priority Support:

- The task **WP10-ITM-IMP4-ACT3: Implementation of CPO/Kepler compatible interfaces into IMP4 codes** is partially formed under Priority Support with a ceiling of **3pm.**

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the IMP4 group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license.

A Rights 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.

Project Background

Introduction

The main objective of IMP4 is to develop physics-based models for neoclassical and turbulent transport coefficients in all three plasma regions (core, pedestal and scrape-off layer), including models for bifurcations. The physics challenges are outlined in the IMP4 section of the *EU-ITM-TF 2010 work programme.* The objectives are obviously long term aims. The standards of present computational models ("codes") in the turbulence area (by far the most important) are very uneven. The first stage of effort is mostly dedicated to benchmarking present codes on standard cases which are relevant to experiment. The cases involve physical processes which are not easy to capture; hence their usefulness as a standard. Neoclassical transport and linear instability models are also to be benchmarked on the same cases. This verification process "vis-à-vis" the equations the codes are solving is a prerequisite to the future validation of codes on standard experimental shots. The quality assurance standard is expected to be a continuously evolving process becoming more stringent with time. Only with documented knowledge of current status of code performance on these standard cases can the community be confident that the codes represent tools which are capable of modelling physical processes in ITER.

IMP4 is also concerned with the development of the knowledge base behind this rapidly evolving field. This necessarily involves the theory which underlines the codes. But since the responsibility for basic science properly resides with the individual experts within the associations, IMP4 responsibility is restricted to providing an open forum for continuous exchange of the expertise needed to develop succeeding generations of new codes, more than one level of which is surely prerequisite to the above stated Objectives of this Project.

IMP4 activities in 2010 continue with a sustained effort towards the cross verification of IMP4 codes on standard cases and the integration of those into workflows. The first stage of the cross-verification of turbulence codes was highlighted in an invited talk at EPS 2008 and published by end of 2008. The new benchmark effort started in late 2009 – partly owing to the availability of HPC-FF - and will continue in 2010. The cross-verification of linear and neoclassical codes was postponed due to the lack of participating codes. Inter-code integration has begun in 2009: the ability of a turbulence code to interface with an equilibrium code (IMP1) was demonstrated as well as the successful integration of simple transport modules with a transport modelling solver (IMP3).

Moreover IMP4 is charged with the maintenance of transport models which can be used in 1-D or 2-D/axisymmetric transport modelling. Import of those into IMP4 will start in 2010. Modules which are actually used in modelling will be collected and maintained according to ITM standards of interoperability/modularity and documentation. In addition to this are the modules based on codes. These are either wrapped codes (i.e., linear codes used in a mixing length model) or models which are based on code results. Ultimately, all anomalous transport models used in ITM transport codes should reside within and be maintained by IMP4. Intensively focussed work on the integration of turbulence and neoclassical transport modules to MHD equilibrium modules and to the ETS will be done in 2010, in parallel to the cross-verification campaign. The activities for assessing the physics needs to properly treat transport mechanisms under ITER conditions will continue and an evolving documentation of physics and numerical standards needed, will be maintained.

Relation to Experiments

The validation of IMP4 codes on standard experimental discharges will require an experimental database including profile diagnostics data (densities, temperatures, velocities, safety factor) and interfacing with synthetic diagnostics data structure.

Overall Milestone

In 2010 a working example of an integrated modelling case using a neoclassical transport module, a turbulence code-based module and the ETS, with a consistent equilibrium calculation (optionally source modules) will be available.

Continuity – Task relations

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		**Status in 2010**
ITM-09-IMP4-T2: Cross-verification of IMP4 turbulence codes on specified standard cases	→	Continued: WP10-ITM-IMP4-ACT1
ITM-09-IMP4-T3: Assess physics needs for IMP4 to treat transport mechanisms under ITER conditions	→	Presently on hold. WP10-ITM-IMP4-ACT2
ITM-09-IMP4-T4: Implementation of Phase IV Data Structure and HDF5 into IMP4 codes	→	Continued with expanded scope in 2010 WP10-ITM-IMP4-ACT3: Implementation of CPO/Kepler compatible interfaces into IMP4 codes
ITM-09-IMP4-T5: Cross-verification of linear stability and neoclassical transport codes on specified standard cases	→	Not done due to lack of responses. Re-called: WP10-ITM-IMP4-ACT4

Two new tasks are planned for 2010

New Tasks in 2010	
WP10-ITM-IMP4-ACT5	Maintenance and standards-keeping of commonly used transport model modules
WP10-ITM-IMP4-ACT6	Validation of neoclassical and turbulence codes against experimental data

Coordinated activities

Type of activity[32]	Topic, aims and intended audience[33]	Participants[34]	Length [35]	Tentative Date[36]	Tasks involved[37]
PM	kick-off meeting for on-hold tasks T2-T4 all IMP4	20	3	end-Feb	
CC	CPO integration in IMP4 codes: deliver initial transport modules. IMP4 turbulence and neoclassical code developers + IMP3 + ISIP representatives	10	8	3-12 March	IMP12, IMP3–ACT1+ ISIP tasks oriented to Kepler and cross-IMP interfaces (i.e., the the current version datastructure CPO and codeparam system)
WS	EM benchmark of linear and turbulence codes; neoclassical codes benchmark: cross-verification data IMP4-T1 + T4 EM + neoclassical code developers	10	8	3-12 May	
CC	integration of IMP4 data to ERCC codes IMP4 selected + ERCC	6	5	6-10 Dec	WP10-ITM-EDRG-ACT6

[32]Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.
[33]Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)
[34]Indicative number of participants expected to participate
[35]Length of the activity in calendar days
[36] Indicative starting date for activity
[37] A list of tasks within ITM that are directly linked to this activity.

WP10-ITM-IMP4-ACT1: Cross verification of IMP4 turbulence codes on specified standard cases

Type of support available for the task: Baseline Support

Description of work

This constitutes the main code benchmarking effort within IMP4. In 2010 the benchmark over the new electromagnetic case defined in 2009 will be continued both for the core turbulence codes, including gyrokinetic codes and for the edge turbulence codes.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
report on cross-verification		Dec 2010	publication on the cross-verification of turbulence codes on an electromagnetic case	availability of HPC-FF and its connection to the ITM-Gateway.

Resources, skills and needs

Requested manpower/skills: Skills are the ability to create and maintain IMP4 codes at the level of programming and algorithmic details. Since the activity will be carried out on the ITM Gateway, codes should comply with ITM data structure and Gateway User Agreement. New codes/participants are welcome to the activity. For the benchmarking efforts we require at least 1pm per participant and the participation in the related working session.

Existing Commitments

The activity of turbulence code benchmark in 2009 was delayed due to limited availability of HPC-FF. A simple module with a fluid description of transport has been delivered.

There are about 15 central participants, the estimated total for the benchmarking effort is at least 15 pm. Indicative need for 2011: similar commitment, increased if more edge turbulence codes with temperature physics, and/or electromagnetic global codes join the activity.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working session	3-12 May	1.5	Assignments whose execution will lead to the report on cross-verification

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

none

WP10-ITM-IMP4-ACT2: Assess physics needs for IMP4 to treat transport mechanisms under ITER conditions

Type of support available for the task: Baseline Support

Description of work

This effort aims to expand and guide the development of the IMP4 codes towards both the ITM needs for anomalous and neoclassical transport estimates and the detailed physics and implementation requirements for ITER relevant plasmas. The discussion effort supports the continued evolution of IMP4 codes.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
documentation		end-Dec 2010	An evolving documentation of physics and numerical standards. Posted on the IMP4 website.	

Resources, skills and needs

Requested manpower/skills: Skills are the understanding of the theory behind IMP4 code model equations including the ability to prove their properties, and the ability to communicate with code authors at the level of algorithmic development. For this effort we require 1 pm per participant.

Existing Commitments: Activity was on hold in 2009 due to unavailability of the major contributors to participate in a working session. About 20 participants committed in 2009, considering the central active ones the estimated effort for 2010 is 10 pm. Indicative need for 2011: we expect to roll the task over in light of physics developments in the gyrokinetic and gyrofluid areas.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

EFDA-TG Transport

WP10-ITM-IMP4-ACT3: Implementation of CPO/Kepler compatible interfaces into IMP4 codes

Type of support available for the task: Baseline Support and Partial Priority Support

Description of work

Integrate codes into the IMP4 data structure and in the ITM workflows through CPOs, including Kepler-compatible interfaces. This effort will continue with the new codes participating to WP10-ITM-IMP4-ACT1, ACT4 and ACT5. A code camp is foreseen, with members from IMP12/IMP3 and ISIP as well as from IMP4 present. The demonstrated workflow may be within Kepler if developments in the latter allow.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
integration of IMP4 modules in an ITM workflow		end-Oct 2010	Continued integration of CPOs in IMP4 turbulence codes. Delivery of at least one each of the three IMP4 code types integrated to the ITM workflow. Extension to Kepler possible.	Kepler extended functionality IMP4 codes participating in WP10-ITM-IMP4-ACT1 and -ACT4

Resources, skills and needs

Requested manpower/skills: Necessary skills are the same as for Task 1: the ability to create and maintain IMP4 codes at the level of programming and algorithmic details. Mainly code authors will be involved. We expect 1pm for each code (author) as a minimum commitment and participation to the related code-camp. Maintenance of the FUTILS package is in addition to this estimate.

Existing Commitments: An initial workflow involving one code/module each from IMP1/IMP4, was demonstrated and integrated to the transport solver. 13 participants have committed to this task for a total of 12 pm (BS) plus 2 pm (PS) in 2009 and are expected to disseminate the results of this task to the rest of IMP4 in 2010. At least 1 pm is required per participant a similar commitment is expected therefore of about 15pm.
Indicative need for 2011: similar commitment, depending on new codes participating in IMP4 and Kepler evolution

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
CC	3 March	1.5	Demonstration of workflow functionality, dissemination of workflow and Kepler concepts

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) none

WP10-ITM-IMP4-ACT4: Cross verification of linear and neoclassical codes on specified standard cases

Type of support available for the task: Baseline Support

Description of work

This task includes the part of the benchmarking effort specifically dedicated to neoclassical and linear codes, which are most directly suited to self-act as modules describing the underlying model and its description of transport. Linear codes will also produce a transport model based on either mixing length or weak turbulence or other model of similar scope.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
report on cross-verification		end Dec 2010	report on the cross-verification of linear and neoclassical codes	commitment of more than one linear / neoclassical code for each part of the report

Resources, skills and needs

Requested manpower/skills: Skills are the ability to create and maintain IMP4 codes at the level of programming and algorithmic details. Since the activity will be carried out on the ITM Gateway, codes should comply with ITM data structure and Gateway User Agreement. New codes/participants are welcome to the activity. For the benchmarking efforts we require at least 1pm per participant and participation in the related working session. The participation of NCLASS code is desired. A representative with the approval of its author (W Houlberg, ITER) is appropriate.

Existing Commitments This Task was Called in 2008. Little commitment has been reached for linear codes. No commitments have been obtained for neoclassical codes in 2009.
A simple neoclassical transport module has been delivered in 2009. Only 3 participants committed for a total of 2pm in 2009. The commitment will have to be extended with new codes and participants and will be established by the call for participation in 2010.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS same as for Task IMP4-ACT1	3-12 May	1.5	Assignments to authors whose execution will lead to the report on cross-verification

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)
EFDA -TG Transport (Rotation) ITER (for NCLASS)

WP10-ITM-IMP4-ACT5: Maintenance and standards-keeping of commonly used transport model modules

Type of support available for the task: Baseline Support

Description of work

IMP4 is also charged with the maintenance of transport models which can be used in 1-D or 2-D/axisymmetric transport modelling (i.e., IMP3 codes). One module exists as a Gforge project on the ITM-Gateway, intended for testing purposes (ETAIGB). Modules which are actually used in modelling will be collected and maintained according to ITM standards of interoperability/modularity and documentation. In addition to this are the modules based on codes. These are either wrapped codes (i.e., linear codes used in a mixing length model) or models which are based on code results. Ultimately, all anomalous transport models used in ITM transport codes should reside within and be maintained by IMP4.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
turbulence module		end-Oct 2010	At least one code-based module, with a kinetic or fluid description of turbulent transport integrated to the transport solver and appropriately documented.	Engagement with authors or maintainers of existing transport models.

Resources, skills and needs

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

Existing Commitments: None. This is a new task.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)
ITER (for Coppi-Tang and NCLASS, see also Task ACT4)
EFDA TG Transport (for commonly used transport modules)

WP10-ITM-IMP4-ACT6: Validation of neoclassical and turbulence codes against experimental data

Type of support available for the task: Baseline Support

Description of work

The IMP4 codes and modules will eventually be validated against experimental data. It is important to note that "matching to experiment" is neither expected nor desired, rather, that the outcome of a comparison done with documented standards be made available in a standard way. This activity depends on the availability of experimental tokamak discharge data becoming established within the ITM system. Nevertheless, initial attempts which among other things will expose shortcomings in existing documentation standards should be started in 2010.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
code validation documentation		end-2010	One well documented attempt to compare any single IMP4 code against an experimental data set	EDRG Existence of complete experimental discharge data including profiles in ITM database

Resources, skills and needs

Requested manpower/skills: Familiarity with the handling of experimental data for modelling. Familiarity with the use of any of the IMP4 code types in experimentally oriented modelling. We require at least 1pm per participant.

Existing Commitments: None. This is a new Task.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

EFDA TGs Transport and Diagnostics

Task Agreement WP10-ITM-IMP5:

Integrated Modelling Project 5 (IMP5):

Heating, Current Drive and Fast Particle Physics

Contents

Project Leadership

The ITM-TF Project leadership runs on a two –year appointment schedule, customary practice is that this is renewable. The current project leaders will reach end of term December 31 2009. Hence, an

integral part of this call for participation is the appointment of Project Leaders for the coming two year period. The ITM-TF activities are planned on a longer time period and a longer reach than the appointment period for any of its leadership functions. The appointed Project Leaders will take active part in the establishment of Task Agreement and will be given the opportunity in negotiation with Associations to impact the final Task Agreements.

The call for new Project Leadership is given in the section CfP-WP10-ITM-TFL.

Negotiation

The Call for Participation is taken as the basis for the Task Agreement. In most cases there is a straightforward procedure to incorporate work commitments into Task Agreements. In a few cases, previous experiences show that it has been advantageous to re-engage in a discussion of scope and commitment levels for individuals or tasks. Exceptionally, new tasks could be introduced also at this stage to further streamline or promote the ITM-TF mission. With potentially new set of project leaders entering the project this year it could also serve to bridge interest areas and balance the need to maintain the work programme direction with new ideas and requirements.

Required Resources

The Implementation of the IMP5 work programme for 2010 is estimated to require a minimum of 2 Ppy under Priority Support and 5Ppy under baseline support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The Leadership together with inter-project coordinating activities within the project are eligible for Priority Support.

In addition, a few tasks and activities within the IMP5 work programme are considered to be on the critical path for ITM-TF to meet its mission and/or are integral parts to project wide milestones.

The tasks:

- WP10-ITM-IMP5-ACT4: Development of an advanced 3D ion Fokker-Planck solver for ions.
- WP10-ITM-IMP5-ACT6: Data joiners for output from Heating and Current Drive codes

are therefore partly formed under priority support.

A total of 24pm of Priority Support has been assigned to IMP5 activities.

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the IMP5 group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license. A Rights of access form (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.

Project Background

Overview: Heating, Current Drive and Fast Particles

The aim of IMP5 is to develop the computational basis for a modular package of codes simulating heating, current drive and fast particle effects. The areas to be covered include, ECRH, ICRH, NBI, LH, alpha particles and fast particle interaction with instabilities. The ultimate goal is to enable self-consistent simulation of heating and current drive in the presence of fast particle instabilities, especially for ITER. Priority will be given to modelling applicable to ITER standard and advanced scenarios.

Scope and longer term perspective

The work carried out within the framework of IMP5 should be concentrated on developing a package of codes for prediction and interpretation of heating, current drives and fast particles instabilities. Modelling of antennas should be included in the work, aiming to couple antenna codes and wave propagation code for analysis of, for example, RF-sheath effects. Modelling of heating and current drive is a complex problem, often requiring self-consistent computations of the wave propagation and the evolution of the distribution functions of resonating particle species. Owing to the vastly different time scales for wave propagation and the evolution of distribution functions, self-consistent computations can, in general, be obtained by combining codes solving the wave fields at time slices with codes evolving the distribution functions between the time slices. Even though the frequencies of the waves are well separated, synergetic effects, not always desirable, appear in general through coupling via distribution functions of resonating particle species. Since the distribution functions are in general affected by more than one heating method, the wave propagation of one wave might influence that of another. For instance, the electron distribution function is determined by the loop voltage, electron cyclotron heating, lower hybrid heating and ICRF waves, all of which deposit energy on electrons; the ion distribution functions are determined by neutral beam, fusion reactions, ion cyclotron heating, lower hybrid heating and a plethora of MHD modes. A self-consistent treatment of all possible heating scenarios taking into account finite orbit width effects of a distribution function (requiring at least the solution of a three dimensional orbit averaged Fokker-Planck equation), is a very challenging problem with current modelling capabilities. Consequently, priority should initially be given to simulating ITER standard and advanced scenarios taking into account the most important effects. The goal is to have at least one module for each physics area at two levels: one basic enabling fast computations but less detailed and one advanced, but computationally expensive, enabling detailed computations of the distribution functions of electrons and ions during heating and current drive, ultimately incorporating non-linear effects of instabilities and their redistribution fast ions. A modular approach should be taken, enabling an interchange of codes (“plug in” and “plug out”). This should facilitate the comparison of various wave field, Fokker Planck and beam deposition solvers. Owing to the different levels of details of the basic and advanced codes, it is not an absolute

requirement that codes at the advanced levels should be interchangeable with codes at the basic level and vice versa. In the period covered by the present call, the work on adapting code modules to ITM requirements should be consolidated such that essential modules are available for providing the necessary input to the transport solver (ETS). Furthermore, continued improvements to the data structures relating to the physics of Heating & Current drive and fast particle physics is foreseen. It is also desirable to bring in new modules and adapt them to the ITM standards. When more than one module of a certain type is available, work on cross verification should start. Furthermore, effort should be devoted towards more self consistent treatments of the relevant physics. An important area where a new development is foreseen is a general Fokker-Planck solver for ions. The formation of a consortium of associations to develop such a code is encouraged. The model development will be performed in collaboration with the teams working in the other Integrated Modelling Projects (IMPs).

Overall Milestone

The project should make available codes covering the needs within the ETS for different source terms relating to heating and current drive, this should include codes dealing with Neutral Beam Injection, ICRF heating, LH current drive and EC heating and current drive. These modules should be documented and verified, and the validation process should be started.

Continuity – Task relations

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		Status in 2010
The part of ITM-09-IMP5-T1 relating porting of codes. ITM-09-IMP5-T3: Fast ICRH code for Routine analysis ITM-09-IMP5-T6: Installation of an orbit following Monte Carlo code for simulation of fusion products and fast ions due to NBI ITM-09-IMP5-T7: Development of a NBI source module ITM-09-IMP5-T8: Development of an ECRH ray tracing code for rapid calculations ITM-09-IMP5-T9: Adaptation/development of a thin banana width Fokker-Planck solver	→	WP10-ITM-IMP5-ACT1:

for fast electrons. The part of ITM-09-IMP5-T12 relating to porting codes to the ITM Gateway.		
ITM-09-IMP5-T2: Evaluation of data structures for IMP5 specific codes	→	WP10-ITM-IMP5-ACT2: Continued in Baseline Support
The part of ITM-09-IMP5-T1 relating to comparison, verification and validation of IMP5 relevant codes on the gateway using ITM tools of ITM-09-IMP5-T4: Verification of simple models for calculating fast wave current drive on full wave codes ITM-09-IMP5-T12: Benchmarking of linear MHD codes to assess Alfvén Eigenmode (AE) and Energetic Particle Mode (EPM) stability thresholds (note porting to gateway etc. will be done under WP10-ITM-IMP5-ACT1)	→	WP10-ITM-IMP5-ACT3: Baseline Support
ITM-09-IMP5-T5: Development of an advanced 3d Fokker-Planck solver for ions	→	WP10-ITM-IMP5-ACT4: Partly under priority Support
ITM-09-IMP5-T11: Code development for global stability analyses of Alfvén Modes in realistic geometries and in the presence of non-perturbative fast ion excitations	→	WP10-ITM-IMP5-ACT5: Continued under baseline support

A new task is planned for 2010

New Task in 2010	
WP10-ITM-IMP5-ACT6: Data joiners for output from Heating and Current Drive codes	Development of data joiners for IMP5 codes: (i) joiner of data from wave deposition codes for output to Fokker-Planck codes; (ii) joiner of data from Heating and Current Drive codes for output to transport solver.

Coordinated activities

Type of activity[38]	Topic, aims and intended audience[39]	Participants[40]	Length [41]	Tentative Date[42]	Tasks involved[43]
WS	Cross verification of a number of codes for NBI, ICRF, LH and EC heating and current drive.	~10	1 week	May 2010	WP10-ITM-IMP5-ACT3
WS	Identification of reference scenarios for fast ion driven instabilities analyses	~5	2 days	May-June 2010	WP10-ITM-IMP5-ACT3
WS	General ion Fokker-Planck solver, decision on solution method, work plan etc.	~6	1 week	April 2010	WP10-ITM-IMP5-ACT4
Code Camp	ICRF, NBI, LH, EC and fast particle physics codes adapted to communicate via CPOs	~10	1-2 Weeks	March 2010	WP10-ITM-IMP5-ACT 1

[38] Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.
[39] Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)
[40] Indicative number of participants expected to participate
[41] Length of the activity in calendar days
[42] Indicative starting date for activity
[43] A list of tasks within ITM that are directly linked to this activity.

WP10-ITM-IMP5-ACT1: Adaptation of codes for Heating, Current Drive and Fast Particle Physics for use with ITM tools

Type of support available for the task: Baseline Support

Description of work

A key activity for the 2010 programme will be to integrate existing codes into the ITM structure. In particular, it is essential to provide codes that can deliver sources due to auxiliary heating and current drive for the new European Transport Solver (ETS). For the individual code contributor there are benefits in terms of getting access to a system where contributed codes can be integrated with other ITM codes, which should lead to new opportunities for physics exploration. To have such an extended capability is also often crucial for the validation of codes (see task T3 below), which is the best way of building trust in a code and making it accepted by the wider community.

The task concerns existing codes in the following areas are covered by this task:

1. NBI source codes
2. ICRF wave deposition codes
3. LH and EC ray/beam tracing codes
4. Fokker-Planck codes dealing with fast particles generated by either NBI, ICRF, LH, EC or a combination of these.
5. Codes for analysis of fast particle driven instabilities.
6. Other modules needed for IMP5 (e.g. orbit tracing codes).

In order to provide codes to ITM-TF, it is necessary to adapt them to run on the ITM Gateway and to make them conform to ITM standards, especially in terms of communication via ITM data structures, i.e CPOs (Consistent Physical Objects). Significant work on this was carried out in 2009 on several codes. It is necessary to consolidate this work and bring new codes into the system.

The work on adapting a code to ITM standards consists of ensuring that the codes run with the compilers installed on the gateway and, if necessary, replace any commercial subroutine libraries. Once codes run on the gateway and are adapted to communicating via CPOs they can made into actors and run in the ITM simulation platform (Kepler). This will facilitate code benchmarking and validation (it ensures that exactly same data is used in different codes, traceability etc.). Codes running in Kepler are also ready to be tested in more complex work flows and should be available for workflows involving transport simulations.

It should be emphasised that very little investment in time is needed to learn to handle CPOs. Furthermore, support will be available regarding issues of code integration in the form of code camps, see blow.

Once codes have been adapted to ITM data structures and made into Kepler actors work on studying how to best integrate them into workflows will be required. In particular, this should start with more simplified solutions for routine analysis and then be expanded to increasingly self-consistent treatments of processes involving more than one code.

Deliverables:

For each code included in the present task the deliverables are as follows

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Inventory and release schedule of IMP5 codes	01.01/10	28/02/10	The codes that will part of the IMP5 set during 2010 should be identified. For each code a schedule for release and other milestones associated with it should specified.	
Code for H&CD	01/01/10	31/12/10	A code under the ITM svn server adapted to ITM standards, i.e. communicating data via CPOs.	
Documentation H&CD code	01/01/10	31/12/10	Documentation of the code including information on verification or references to work where verification has been demonstrated.	
Porting on the Gateway of FP stability codes	01/2010	06/2010	The codes participating in the benchmarking task will be adapted to the ITM data structures and ported on the ITM code platform	
Porting on the Gateway of the codes to assess Alfvén Eigenmode (AE) and Energetic Particle Mode (EPM) linear stability thresholds	01/2010	06/2010	The codes participating in the benchmarking task will be adapted to the ITM data structures and ported on the ITM code platform	

Resources, skills and needs

Requested manpower/skills: Developers or responsible officers for codes able to adapt them to ITM standards. The task is expected to require 2 pm per code contributed

Existing Commitments: Renewal of commitments made in 2009 is encouraged. Work has started on the ICRF Full wave codes TORIC (IPP) and EVE (CEA), simplified ICRF Fokker-Planck code ; NBI injection and Fokker-Planck codes (TEKES, ÖAW and CEA); LH/EC ray tracing and 3D electron Fokker-Planck solver (nearly complete, CEA)

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Code camp	March 2010	1-2	ICRF, NBI, LH, EC and fast particle physics codes adapted to communicate via CPOs

External connections/requirements

Discussions with IMP3 to understand their detailed needs in terms of output from IMP5 codes.

WP10-ITM-IMP5-ACT2: Evaluation of data structures for IMP5 specific codes

Type of support available for the task: Baseline Support

Description of work

An essential aspect of codes running in the ITM framework is that they should communicate via so called CPOs, Consistent Physical Objects. The ITM data structures define how the data in a CPO are organised. It is thus necessary to define data structures for all the relevant physics models incorporated in the ITM.

There are several areas where IMP5 specific data structures are needed:

1. Antenna codes
2. Wave codes
3. Fokker-Planck codes
4. NBI deposition codes
5. Fast particle instability codes

In each of these groups one or more CPOs are needed (e.g. self-consistent coupling between wave codes and Fokker-Planck codes might need a special CPO of its own).

Since the ITM aims at having available as complete as possible models as well as more simplified ones, it is important to define the data structures in a way flexible enough to cover booth needs. To be able to evaluate and define data structures such that they can allow coupling between different wave codes, NBI deposition codes and different Fokker-Planck solvers in a flexible way (e.g. to also accommodate sophisticated antenna models) requires specialised skills, suited to researchers who are intimately involved in such modelling.

A number of CPOs were developed in 2009, but more progress is needed. In particular, experience from using the IMP5 related CPOs is required, so as to improve them. It is important to reach stable versions of the CPOs as quickly as possible and most major ones (NBI deposition, waves and Fokker-Planck) should have their basic form defined early in 2010 (if not before). From then on only minor modifications and additions should take place.

In other cases, e.g. ICRF antennas and fast particle instabilities, new or further developments of CPOs is needed. In this case contributors should take part in essentially the initial design of the CPOs.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
NBI input CPO	01/01/10	31/01/10	Stabilised version of CPO for input to Neutral Beam deposition codes	
NBI output CPO	01/01/10	31/01/10	Stabilised CPO for input to Neutral Beam deposition codes	
Waves CPO	01/01/10	31/01/10	Stabilised CPO for output of wave deposition codes	
F-P CPO	01/01/10	31/01/10	Stabilised CPO for kinetic codes (Fokker-Planck) calculating non-thermal distribution functions.	
ICRF antenna CPO	01/01/10	28/02/10	Stabilised CPO for simplified description of ICRF antennas	
CPO for linear stability fast	01/01/10	31/07/10	First version of CPO for output from codes analysing linear stability of fast particle	

particle codes			driven modes	

Resources, skills and needs

Requested manpower/skills: The task is directed towards code developers with a good overview of the physics involved such as to ensure that the CPOs represents the physics correctly. The task is expected to require 1pm per contributor.
Existing Commitments: Renewal of commitments made in 2009 is encouraged.

Code Camps or other coordinated activities

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

External connections/requirements

WP10-ITM-IMP5-ACT3: Benchmarking and validation of codes

Type of support available for the task: Baseline Support

Description of work

For this activity it is required to do cross verification of codes solving similar equations (e.g. two LH ray tracing codes). Two types of efforts are envisaged: (i) Heating and Current Drive codes; (ii) codes for analysing fast particle instabilities.

This should be done with versions of the codes adapted to the ITM tools, especially the data structures to ensure that the codes are using exactly the same input data. Consequently, this is a step following on from the work carried out in task T1. This work should increase the confidence in that the codes solve the actual equations and should also serve to explore under which circumstances simplified codes can be utilised by comparing them to more complete models. In a second step the physics fidelity of the codes should be assessed by validating them against experimental measurements. This latter step is involved a procedure for each type of code and needs to be worked out.

Reliable extrapolations to ITER impose to assess Alfvén Eigenmode (AE) and Energetic Particle Mode (EPM) stability thresholds. Mode dynamics and structures (wave propagation properties) are important for both drive as well as damping mechanisms, e.g., for characterizing eigenmode vs. resonant mode behaviours and for investigating the role of mode conversion to Kinetic Alfvén Wave (KAW). In order to clarify the role of the various physical phenomena that determine the stability thresholds for both AE and EPM and to successfully benchmark codes, this task will imply detailed comparisons of simulation results by various codes in a limited number (to be determined) of reference scenarios.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Report	01/01/10	31/12/10	Report on cross verification of two or more codes solving similar equations relating to Heating and Current Drive	Adaptation of codes under task ACT1 above.
Identification of benchmark cases for fast particle instabilities	03/2010	09/2010	Identification of reference scenarios for fast ion driven instabilities analyses in realistic equilibria/geometries and consistent with ITM data structures	Collaborative effort with IMP1 tasks for preparing high-resolution equilibrium CPOs.
Benchmarking activity	09/2010	12/2010	A written report on the results of the benchmark activities should be produced by December 2010	

Resources, skills and needs

Requested manpower/skills: The task is expected to require 1-2 pm per participating code. It is intended for developers and/or responsible officers for codes.

Existing Commitments: Renewal of commitments made in 2009 is encouraged. Commitments similar to those of T1

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working session	June 2010	1	Cross verification of a number of codes for NBI, ICRF, LH and EC heating and current drive
Working Session	spring-summer 2010	2 days	Identification of reference scenarios for fast ion driven instabilities analyses

External connections/requirements

The possibility to capitalize the experience of similar benchmark exercises performed in other international task groups (e.g., ITPA-Energetic Particle Topical Group) is highly desirable, in order not to duplicate efforts.

WP10-ITM-IMP5-ACT4: Development of an advanced 3D ion Fokker-Planck solver for ions

Type of support available for the task: Priority Support

Description of work

A general ion Fokker-Planck solver able to treat a variety of processes, including wave particle interactions due to auxiliary heating and neutral beam injected particles, should be developed. Such a solver must take finite orbit width effects into account and wave induced spatial transport of the ions. This is a significant undertaking, but preparatory work has already been started. The development of such a code will run over several years. In view of the importance of having this type of modelling available and the fact that there is very little on the market at present, it should be in the interest of two or more EFDA partners to form a consortium to develop and exploit this type of code. This should lead to a more rapid development than would otherwise be possible and should benefit from synergies due to different competencies within the associations.

There are different possibilities for the type of solution method. The findings of an earlier task ITM-05-IMP5-T5 indicated that a solver based of solving the orbit averaged Fokker-Planck equation with a Monte Carlo method is feasible. The first step of this task should be to hold a working session to decide on a solution method among the interested parties. A lead developer should be appointed and a work plan agreed such that the contributions from the different parties involved is well defined.

The task is a major undertaking. It is envisioned that the code can be extended later, which will be a separate task, to include: quasi-linear wave interactions with MHD waves, such as interactions with TAEs; effects of fast MHD events, such as energetic particle modes and sawteeth, by coupling the code to gyrokinetic codes or models; refuelling by recirculation of particles and pellets. Developments of the code are expected to continue after 2011, especially to adopt the code for self-consistent calculations of the distribution function and wave fields. Implementation of synthetic diagnostics is also expected to be an important part of the work.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Initiation of the task	01/01/10	31/03/10	A document defining the agenda for a Working Session on the Task, which also sets out the options to be discussed.	
Report	01/01/10	31/12/10	Progress report on the developments within the task.	

Resources, skills and needs

Requested manpower/skills: Researchers familiar with development Fokker-Planck codes and fast ion orbit effects are needed for this task; skills in modern programming techniques and upgrading of codes is also desirable since the work will most likely involve adoption of existing modules to some extent. The task is expected to require 20 pm of dedicated work under Priority Support in total during 2010.

Existing Commitments: Renewal of commitments made in 2009 is encouraged. Work on this task was ongoing in 2009, especially on finding suitable delta-f algorithms (VR).

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working session	April 2010	1-2	Decision on solution method; appointment of a lead developer and a work plan.

External connections/requirements

WP10-ITM-IMP5-ACT5: Code development for global stability analyses of Alfvén Modes in realistic geometries and in the presence of non-perturbative fast ion excitations

Type of support available for the task: Baseline Support

Description of work

Ultimately, the main goal of fast ion linear stability codes in the perspective of ITER is to develop a thorough understanding of drive and damping mechanisms for a realistic ITER scenario. Due to the high power density associated with charged fusion products in burning plasmas, such codes must consider the possibility that energetic particles themselves can significantly contribute to the mode structure and its dynamic properties, i.e. fast ions must be treated non perturbatively. The effect of complex geometries and boundary conditions, and realistic equilibrium plasma and fast ion profiles further complicates the stability analyses. This task should address the fundamental issues that must be considered for developing such codes, including those involved with the integration of a realistic plasma operation scenario in the reference equilibrium, the specification of quantities to be given and relative accuracy and nonlinear dynamics problems associated with fast ion transport and losses.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Debugging	01/2010	06/2010	Completing the debugging of the new hybrid MHD-Gyrokinetic code developed in 2009 under ITM-09-IMP5-T11 activity.	
Porting on the Gateway	01/2010	12/2010	The code developed for this task will be adapted to the ITM data structures and ported on the ITM code platform.	Collaborative effort with IMP1 tasks to interface the codes with the existing equilibrium CPOs (consider the possible addition of quantities required by the gyrokinetic module which describes the energetic particles)
Benchmarks with linear codes	06/2010	12/2010	The code developed for this task (which addresses non-linear fast ion dynamics and transport) will be benchmarked, in the linear phase, with the codes for the analysis of fast particle driven instabilities in WP10-ITM-IMP5-ACT3	WP10-ITM-IMP5-ACT1 and WP10-ITM-IMP5-ACT3 (availability of codes to assess Alfvén Eigenmode (AE) and Energetic Particle Mode (EPM) linear stability thresholds, definition of benchmark cases)

Resources, skills and needs

Requested manpower/skills: The task is expected to require 10pm of dedicated work in total during 2009. The task is suitable to be divided among different individuals or associations.

Existing Commitments: The task is a continuation of ITM-09-IMP5-T11 from 2009. Contributors in 2009 are

encouraged to express their ongoing interest. During 2009 a new Hybrid MHD-Gyrokinetic code in arbitrary geometry has been developed and is actually under testing. Because of the highly complex interplay between equilibrium, MHD and gyrokinetic modules, the activity will presumably continue also in 2011.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-IMP5-ACT6: Data joiners for output from Heating and Current Drive codes

Type of support available for the task: Priority Support

Description of work

Since Heating and Current Drive can involve different processes interacting with each other and/or several processes contributing to a certain quantity, it is necessary to join the data together from different codes and provide them in a consistent form to other codes. There are mainly two types of IMP5 joiners are envisaged at this stage: (i) joiner of results from wave deposition codes providing input to Fokker-Planck codes; (ii) joiner of data relating to sources due to auxiliary Heating and Current for providing data to a transport solver.

Code modules capable of performing the tasks described above should be developed. They should conform to ITM standards, i.e. use ITM data structures and should be made into Kepler actors. In principle this should be fairly straight forward, but some care needs to be taken to avoid that certain quantities are not double counted.

Deliverables:

For each code included in the present task the deliverables are as follows

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Joiner for wave deposition	01/01/10	31/07/10	A code under the ITM svn server adapted to ITM standards and running in Kepler, joining data from wave deposition codes for input to Fokker-Planck codes. The module should be documented.	IMP5 data structures
Joiner for H&CD codes	01/01/10	31/07/10	A code under the ITM svn server adapted to ITM standards and running in Kepler, joining data from Heating and Current Drive codes for input to transport solver. The module should be documented.	IMP5 data structures

Resources, skills and needs

Requested manpower/skills: The task is directed towards code developers with a good overview of the physics involved such as to ensure that data are joined in a correct way. The task is expected to require 4pm Under priority support.

Existing Commitments: it is a new task

Code Camps or other coordinated activities

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

External connections/requirements

Discussions with IMP3 to understand their detailed needs in terms of output from IMP5 codes.

Task Agreement **WP10-ITM-ISIP**:

Infrastructure and Software Integration Project (ISIP):

Contents

Project Leadership

The ITM-TF Project leadership runs on a two –year appointment schedule, customary practice is that this is renewable. The current project leaders will reach end of term December 31, 2009. Hence, an integral part of this Call for Participation is the appointment of Project Leaders for the coming two year period. The ITM-TF activities are planned on a longer time period and a longer reach than the appointment period for any of its leadership functions. The appointed Project Leaders will take active part in the establishment of Task Agreement and will be given the opportunity in negotiation with Associations to impact the final Task Agreements.

The call for new Project Leadership is given in the section CfP-WP10-ITM-TFL.

Negotiation

The Call for Participation is taken as the basis for the Task Agreement. In most cases there is a straightforward procedure to incorporate work commitments into Task Agreements. In a few cases, previous experiences show that it has been advantageous to re-engage in a discussion of scope and commitment levels for individuals or tasks. Exceptionally, new tasks could be introduced also at this stage to further streamline or promote the ITM-TF mission. With potentially new set of project leaders entering the project this year it could also serve to bridge interest areas and balance the need to maintain the work programme direction with new ideas and requirements.

Required Resources

The Implementation of the ISIP work programme for 2010 is estimated to require a minimum of 7.66PPy under Priority Support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The Leadership together with inter-project coordinating activities and support roles within the project are eligible for Priority Support. ISIP provides the infrastructure for the ITM-TF programme and is as of this year fully covered by priority support.

- The task **ITM WP10-ITM-ISIP-ACT1: Installation, hotline and support of the ITM software on the gateway** is formed under Priority Support with a ceiling of 15 pm.
- The task **WP10-ITM-ISIP-ACT2: Update of Kepler Platform** is formed under Priority Support with a ceiling of 5 pm.
- The task **WP10-ITM-ISIP-ACT3: Simulation catalogue querying tool** is formed under Priority Support with a ceiling of 5 pm.
- The task **WP10-ITM-ISIP-ACT4: Maintenance and upgrades of the Integrated Simulation Editor** is formed under Priority Support with a ceiling of 12 pm.
- The task **ITM WP10-ITM-ISIP-ACT5: Data structure** is formed under Priority Support with a ceiling of 2 pm.
- The task **ITM- WP10-ITM-ISIP-ACT6: Universal Access Layer** is formed under Priority Support with a ceiling of 12 pm.
- The task **ITM WP10-ITM-ISIP-ACT7: Actor generator and CPO management in workflows** is formed under Priority Support with a ceiling of 7 pm.
- The task **ITM WP10-ITM-ISIP-ACT8: Tools for the integration in KEPLER of GRID/HPC and gateway jobs** is formed under Priority Support with a ceiling of 5 pm.
- The task **WP10-ITM-ISIP-ACT9: Implement advanced / interactive workflow management** is formed under Priority Support with a ceiling of 8 pm.
- The task **ITM WP10-ITM-ISIP-ACT10: Administration of the collaborative software** is formed under Priority Support with a ceiling of 5 pm.
- The task **WP10-ITM-ISIP-ACT11: Maintenance and upgrades of experimental data import tool (Exp2ITM)** is formed under Priority Support with a ceiling of 3 pm.
- The task **ITM WP10-ITM-ISIP-ACT12: Control toolbox** is formed under Priority Support with a ceiling of 10 pm.
- The task **WP10-ITM-ISIP-ACT13: Advanced visualisation tools** is formed under Priority Support with a ceiling of 3 pm.

A total of 92 pm (excluding project leadership) has been assigned to ISIP activities.

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the ISIP group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license.
A Rights 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.

Project Background

Introduction to ISIP

Objectives

ISIP provides the key technologies needed in providing a broadly accessible framework tool for integrated simulation of magnetic confinement fusion devices. It develops a suitable environment for modellers and code developers to access input data (synthetic or taken from experiments) and to

allow dynamic creation of computational workflows. The framework targets different physics issues by coupling different physics components and codes together into user-defined applications. The platform will be able to communicate with a wide spectrum of computer resources, including grid enabled resources (e.g., EGEE and DEISA architectures) and local clusters and single node machines. ISIP is working mainly on tools residing on the ITM platform (Gateway), however ISIP will provide support to local installation of its tools on some experiments computer facilities for exceptional needs recognized as critical by the TF leadership. The main local installation foreseen is the one of the Universal Access Layer, allowing the access to ITM databases remotely from local experiments.

Scope and longer term perspective

The project covers a number of activities: support for the hardware infrastructure (gateway), the framework and its associated tools (code platform), the data communication system (Universal Access Layer - UAL), the Web portal and several applications (ITM tools) and the data management (data structure and handling). The fusion device description and the data access, which are developed in this project, are strongly relevant to ITER CODAC (Control and Data Acquisition). The simulation framework and the GRID-HPC computing infrastructure are even broader than the fusion community and could be used in many others domains. The implementation of the 2010 work programme will be used to consolidate the software and hardware architecture, to extend the simulations to the high performance resources and prepare the tools for the comprehensive fusion simulations. Part of the ISIP tasks is oriented towards support, help and training to the ITM users. On the longer term, the simulation of a comprehensive fusion device like ITER will require the use of material databases and the modelling of diagnostics and real-time control which are an essential part of real Tokamak.

Relation to Experiments

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

Overall Milestone

To provide a stable and supported platform for ITM-TF modelling and exploitation needs, including the simulation catalogue filled automatically by workflows with its querying tool.

Continuity – Task relations

Most tools constituting the ITM platform have been delivered last year in a first robust version. The ISIP Tasks are almost all continued for maintenance of the tools and addition of some new features. A few new tasks should start in 2010 to develop some missing features.

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		Status in 2010
ITM-09-ISIP-T1: Installation, hotline and support of the ITM software on the gateway	→	WP10-ITM-ISIP-ACT1: Continued in Priority Support (permanent exploitation task)
ITM-09-ISIP-T2: Updated version of the code platform, implementation of debugging facilities	→	WP10-ITM-ISIP-ACT2: Continued in Priority Support : update the ITM Kepler version with new features / versions provided by the Kepler development team
ITM-09-ISIP-T3: Database querying tools	→	WP10-ITM-ISIP-ACT3: Database querying tools (Task could not be done in 2009)
ITM-09-ISIP-T4: Upgrades to the Dedicated user interface (ISE)	→	WP10-ITM-ISIP-ACT4: Continued in Priority Support : Maintenance and upgrades to the Integrated Simulation Editor (ISE)
ITM-09-ISIP-T5: Data structures	→	WP10-ITM-ISIP-ACT5: Continued in Priority Support (permanent exploitation task)
ITM-09-ISIP-T6: Universal Access Layer	→	WP10-ITM-ISIP-ACT6: Continued in Priority Support (permanent exploitation task)
ITM-09-ISIP-T7: CPOs management in UAL actors and specialized actors	→	WP10-ITM-ISIP-ACT7: Actor generator and CPO management in workflows. Continued in Priority Support WP10-ITM-ISIP-ACT11: Maintenance and upgrades of experimental data import tool (Exp2ITM). Continued in Priority Support
ITM-09-ISIP-T8: Tool for the integration in KEPLER of GRID/HPC and gateway jobs	→	WP10-ITM-ISIP-ACT8: Continued in Priority Support
ITM-09-ISIP-T9: Managing large memory and long duration simulations	C	
ITM-09-ISIP-T10: Administration of the collaborative software	→	WP10-ITM-ISIP-ACT10: Continued in Priority Support (permanent exploitation task)
ITM-09-ISIP-T12: Control toolbox	→	WP10-ITM-ISIP-ACT 12: Control toolbox

Some new tasks are planned for 2010

New Tasks in 2010	
Name	Brief description
WP10-ITM-ISIP-ACT9: Implement advanced / interactive workflow management	Develop an advanced simulation monitor, allowing pause/restart of the simulation, visualisation of data and of the state of actors during the run.
WP10-ITM-ISIP-ACT13: Advanced Data visualisation	Finalise and maintain advanced data visualisation tools.

Coordinated activities

Type of activity[44]	Topic, aims and intended audience[45]	Participants[46]	Length[47]	Tentative Date[48]	Tasks involved[49]
Training session	Training on ISIP tools for IMP members	25	3 days	March 24th-26th	All
Working session	Specific developments requiring grouping ISIP members	10	5 days	April 12th-16th	Some ISIP tasks, not selected yet
Working session	Specific developments requiring grouping ISIP members	10	5 days	July 5th-9th	Some ISIP tasks, not selected yet
Working session	Interaction with the Kepler team	2	30 days	November	ISIP-T2

In addition to these specific ISIP code camps, selected ISIP members shall participate to code camps organised by the IMPs for support and training. These members may be taken preferentially from the support team (Task WP10-ITM-ISIP-ACT1) but not exclusively. This support effort will be decided at request of the IMPs as they organise the details of their code camps.

[44] Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.
[45] Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)
[46] Indicative number of participants expected to participate
[47] Length of the activity in calendar days
[48] Indicative starting date for activity
[49] A list of tasks within ITM that are directly linked to this activity.

WP10-ITM-ISIP-ACT1: Installation, hotline and support of the ITM software on the gateway

Type of support available for the task: Priority Support

Description of work

Support users from IMPs on the use of ISIP tools. In addition to the support activity, this Task includes a specific activity addressing the definition of standards for software documentation, test, coding practices and maintenance procedures, targeting all ITM software.
Provide up-to-date documentation on the website.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Support	Whole year		Support users from IMPs on the use of ISIP tools. Suggest and possibly implement improvements of the tools/documentation	All IMP users depend on this task for support. This task should use input from all ISIP tasks.
Review Gateway User's Guide and Guide for Beginners	January	March	Up-to-date documentation on the ISIP Portal	All ISIP tasks
Software Quality Plan	January	May	Establish standards for improved software quality (documentation, tests, coding practices, maintenance …), targeting all ITM software.	Close interaction with the IMPs is required

Resources, skills and needs

Requested manpower/skills: 15 pm / Knowledge of the ISIP tools (training available at the beginning of the year), skills in any of the following : Java / C++ / F90 / Matlab / Scilab / Python / SQL / MDS+

Existing Commitments: The support team was created in 2009 and uses a Bug Tracker system in Gforge. The activity of the support team should increase in 2010 with the number of users of the ITM platform, and will continue in 2011.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Participation to code camps organized by IMPs is foreseen			

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT2: Updates of Kepler

Type of support available for the task: Priority Support

Description of work

Update the ITM Kepler version with new features / versions provided by the Kepler development team and provide consistency with the other ISIP tools

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
2nd version of Kepler	January	February	Deliver the second version of Kepler (in ITM numbering) : new features : improved « expression » actors, semantic type checking, Matlab actor	All ITM activities relying on Kepler depend on this task
Interaction with Kepler team	Whole year		Interact with Kepler to get support and suggest new features for ITM applications	
Improve code parameter handling within Kepler	January	March	Investigate the possibility and implement improved code-specific parameter edition within Kepler (also : XML validation against schema)	All ITM activities relying on Kepler depend on this task
3rd version of Kepler	October	November	If significant improvements of Kepler are released by the Kepler development team, install a 3rd version on the ITM Gateway	All ITM activities relying on Kepler depend on this task

Resources, skills and needs

Requested manpower/skills: 5 pm / Kepler Expert

Existing Commitments: The commitments of 2009 are expected to be continued, additional commitments are welcome.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) Interaction with

the Kepler development team

WP10-ITM-ISIP-ACT3: Simulation catalogue querying tool

Type of support available for the task: Priority Support

Description of work

The ITM simulation catalogue (relational database) was designed in 2008 and functions have been added to the Java UAL in 2009 to GET/PUT information from/to the simulation catalogue. In 2010, the simulation catalogue should be populated automatically by specific actors (UALcollector). A querying tool with a User-Friendly interface is needed to search the simulations catalogue. The work consists in i) establishing the detailed requirements for the querying tool and User Interface, ii) implement them and ii) integrate them under the ITM Portal

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Detailed requirements	January	March	Detailed requirements	
Development	April	June	Development and implementation of the tools on the Gateway	Requires the update of UALcollector with link to the simulation catalogue (ISIP-T7)
Integration	June	July	Integration to the ITM Portal	Requires interaction with Portal administration (ISIP-T10)

Resources, skills and needs

Requested manpower/skills: 5 pm / SQL / PhP / Java

Existing Commitments: None

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT4: Maintenance and upgrades of the Integrated Simulation Editor

Type of support available for the task: Priority Support

Description of work

Maintenance and upgrade of the Integrated Simulation Editor, which allows visualising and editing data.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Optimisation of graphics	January	February	Faster data visualisation / edition + debug memory issues with large datasets	
Code parameters advanced interface	February	March	Provide a user-friendly edition interface for code specific parameters. Xforms is a possible solution.	Will depend on how the code specific parameters can be managed in Kepler directly (ISIP-ACT2)
Link to the simulation catalogue	March	April	Link ISE to the simulation catalogue, in particular for the reference system. Define detailed requirements, then implement	Requires the update of UALcollector with link to the simulation catalogue (ISIP-ACT7)
Profile fitting tool	March	September	Develop within ISE a mapping and profile fitting tool that would create core profiles (ne, Te, Ti, …) starting from raw diagnostic data	Requires the definition of relevant diagnostic CPOs (EDRG) and an equilibrium code. This deliverable is useful for all codes needing fitted profiles as input.
Simulation monitor interface	March	September	Implement in ISE the simulation monitor User interface	Close link to ISIP-ACT9 (simulation monitor)

Resources, skills and needs

Requested manpower/skills: 12 pm / Java, Kepler Expert

Existing Commitments: A first public version of ISE was delivered end of 2009. The commitments of 2009 are expected to be continued, additional commitments are welcome.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

EFDA Task Force
Integrated Tokamak Modelling
EUROPEAN FUSION DEVELOPMENT AGREEMENT

WP10-ITM-ISIP-ACT5: Data structure

Type of support available for the task: Priority Support

Description of work

Administration of the ITM data structure. Upgrades of data following the needs of IMPs. Upgrades of functionalities.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Update the data structure for arrays of structure	March	June	Updated data properties in the schemas allowing arrays of structures	The UAL must first be capable of handling arrays of structures (ISIP-ACT6)
Upgrades of data structure	Whole year		Following the evolution of IMP needs, expand the data structure and release new versions	Based on the request from the IMPs

Resources, skills and needs

Requested manpower/skills: 2 pm / Physics background + XML /XSLT skills

Existing Commitments: This is a continuous task. Existing commitments are expected to be continued with no need for additional ones.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT6: Universal Access Layer

Type of support available for the task: Priority Support

Description of work

Maintenance and upgrades of the Universal Access Layer in various languages

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Maintenance of the UAL	Whole year		Maintain the UAL in all languages, harmonise the functionalities for all languages (Java, C++, F90, Matlab, Python)	All ITM activities use the UAL
Test and upgrades of Memory caching	January	March (single node) July (multiple nodes)	Test the memory caching in Kepler (in-memory data storage, single node), propose and implement improvements (such as optional in-memory or disk for each CPO of the workflow). In a second stage, implement memory sharing in Kepler workflows using multiple nodes of the Gateway.	All workflows that need fast data exchange
Implement referencing system	January	April	Using the simulation catalogue, implement the referencing system, a method to allow implicit attachment of CPO data to an ITM catalogue entry.	Requires the update of UALcollector with link to the simulation catalogue (ISIP-ACT7)
Arrays of structure	March	June	Implement the possibility of storing arrays of structures with the UAL	Coding of arrays of structure in the data structure (ISIP-ACT5)

Resources, skills and needs

Requested manpower/skills: 12 pm. Skills in all UAL languages are sought (Java, C++, F90, Matlab, Python)

Existing Commitments: In 2009, the UAL has entered a production phase. The commitments of 2009 are expected to be continued, additional commitments are welcome.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT7: Actor generator and CPO management in workflows.

Type of support available for the task: Priority Support

Description of work

Maintenance and upgrades of actor generator and CPO management actors in Kepler workflow

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Link to catalogue and referencing system	January	March	UALcollector writes CPOs to the catalogue. UALinit and collector able to use the referencing system	All activities using Kepler workflows
Maintain FC2K (actor generator)	Whole year		Maintain and upgrade FC2K as new functionalities are requested by IMPs. For the moment, FC2K exists for F90 and C++, additional requirements may come for Matlab and Scilab	All IMPs producing Kepler actors. Control toolbox ISIP-ACT12
Web Service actor generator	January	September	Web service actors are executed on a different node than the main Kepler node, allowing solving some memory issues	UAL memory cache for multiple nodes (ISIP-ACT6)

Resources, skills and needs

Requested manpower/skills: 7 pm / skills in all ITM languages are sought

Existing Commitments: In 2009, the FC2K actor generator and UALinit/collector have entered a production phase. The commitments of 2009 are expected to be continued, additional commitments are welcome.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT8: Tools for the integration in KEPLER of GRID/HPC and gateway jobs

Type of support available for the task: Priority Support

Description of work

Specific actors allowing to send ITM actors for execution on GRID or HPC have been developed in the past years. The goal of the task this year is to integrate fully these tools to the public ITM Kepler version and enter production phase.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Actor execution on GRID/HPC	January	July	Launch actors from ITM standard workflows on GRID/HPC	Some codes in the IMPs need this feature
Workflow execution on GRID	July	November	Launch a whole ITM workflow on GRID	

Resources, skills and needs

Requested manpower/skills: 5 pm / knowledge of Kepler and distributed / parallel infrastructures are needed

Existing Commitments: The commitments of 2009 are expected to be continued, additional commitments are welcome.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT9: Implement advanced / interactive workflow management

Type of support available for the task: Priority Support

Description of work

Define functionalities of an advanced simulation monitor, allowing pause/restart of the simulation, visualisation of static data (persistent memory) and of the state of actors during the run.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Define requirements	January	May	Report on the detailed requirements for advanced / interactive simulation monitoring. Define the functionalities in agreement with IMP needs and establish the implementation strategy (Kepler / ISE, management of actor states).	The IMPs should express their needs as user of the system
Implement a first set of monitoring functionalities	June	September	Implement first functionalities : pause / restart of the workflow, visualisation of static data in actors and first version of actor state management. The exact list to be implemented may depend on the conclusions of the first deliverable.	The simulation monitor will be implemented within ISE, close interaction with ISIP-ACT4 is mandatory. Close interaction with ISIP-ACT7 is foreseen for developing actor state management

Resources, skills and needs

Requested manpower/skills: 8 pm / Good knowledge of Kepler and Java is required

Existing Commitments: In 2009, a report on the requirements for long duration simulations has been delivered. The detailed requirements for the advanced simulation monitor should be based on the recommendations of this report.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT10: Administration of the collaborative software

Type of support available for the task: Priority Support

Description of work

Maintain the Portal and the tools working under it. Support documentation efforts. Integrate new tools to the Portal (mainly ISE).

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Maintain Portal	January	December	Maintain the Portal and the tools working under it.	All ITM activities
Support documentation efforts	January	December	Help organising/coordinating the documentation on the Portal by administrating the Web site in close collaboration with ISIP-T1	ISIP-ACT1
Integrate ISE to the Portal	January	June	Users should be able to use ISE and run a Kepler simulation directly from the Portal, without having to connect to a Linux terminal	ISIP-ACT4

Resources, skills and needs

Requested manpower/skills: 5 pm / Jboss, Gforge technologies, Website administration

Existing Commitments: The Portal has been set-up in 2009 with all the main tools expected. The commitments of 2009 are expected to be continued, additional commitments are welcome in particular concerning the support of documentation efforts.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT11: Maintenance and upgrades of experimental data import tool (Exp2ITM)

Type of support available for the task: Priority Support

Description of work

The experimental data import tool exp2ITM must be maintained and upgraded according to the needs of the IMPs

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Maintenance and upgrade of exp2ITM	January	December	Through the whole year, receive input from IMPs on new features to add to exp2ITM, and implement them.	The work must be in close collaboration with ISIP-ACT5 and EDRG

Resources, skills and needs

Requested manpower/skills: 3 pm / Java

Existing Commitments: Existing commitments are expected to be continued with no need for additional ones.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT12: Control toolbox

Type of support available for the task: Priority Support

Description of work

Develop the control toolbox and additional actors required in agreement with the needs of the IMPs

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
First version of the control toolbox	January	March	Implement the fundamental tools needed for the control toolbox (SCICOS and Simulink schemas integration)	EDRG, all control activites in IMPs
First feedback controlled full discharge simulation	March	December	Implement a first example of a simulation with feedback control, using a quasi-0D full discharge simulator and a free boundary equilibrium	Actors from IMP3 and ex-IMP1 will be used
Actor support for controls schemas	March	July	Implement Kepler actor in support of integration of feedback control schemes	Actors from IMP3 and ex-IMP1 will be used

Resources, skills and needs

Requested manpower/skills: 10 pm / knowledge in plasma control and associated tools

Existing Commitments: In 2009, a report has been delivered on the strategy of implementation of the control toolbox. This year, the Task should implement the first set of dedicated control tools. The commitments of 2009 are expected to be continued, additional commitments are welcome.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

WP10-ITM-ISIP-ACT13: Advanced visualisation tools

Type of support available for the task: Priority Support

Description of work

Maintain and upgrade the capability to visualise ITM data with advanced tools such as Visit and Numpy

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities
Maintain and upgrade the functionalities for Visit and Numpy plug-in	January	December	Maintain and upgrade the functionalities for Visit and Numpy plug-in, depending on IMPs needs	The Python UAL is required ISIP-ACT6, coordination with ISIP-ACT5
Visualisation actors	February	May	Define detailed requirements and complete the development of visualisation actors for insertion in a Kepler workflow	

Resources, skills and needs

Requested manpower/skills: 3 pm / knowledge in Python, Visit, Numpy
Existing Commitments: In 2009, the data visualisation chain has been developed (as an Euforia activity). This year, last fixes should be made in order to enter production phase (utilisation by IMPs)

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....)

Task Agreement WP10-ITM-AMNS:

Atomic, Molecular, Nuclear and Surface Physics Data (AMNS)

Task under Task Force Leadership

Contents

Required Resources

The Implementation of the AMNS work programme for 2010 is estimated to require a minimum of 1.3 Ppy under Priority Support and 0.5Ppy under baseline support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations.

Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The tasks:

- **WP10-ITM-AMNS-ACT1 : Coordination of the data for each of the sub groups (Atomic, Molecular, Nuclear and Surface)**
- **WP10-ITM-AMNS-ACT3 : Further Development and maintenance of modules to provide AMNS data to ITM-TF codes**

are formed under priority support. **A total of 16pm has been assigned to AMNS activities.**

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the AMNS group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a

collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license. A Rights of access form (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.

Project Background

Atomic, Molecular, Nuclear and Surface Physics data in ITM

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. As a consequence the AMNS tasks are implemented as Tasks under the TF leadership and will have the following scope:

- Coordination of the work in the four different sub areas.
- Supply of data not presently residing in easily accessible data bases.
- 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. ▪ Line radiation ▪ Bundled charge state descriptions
Molecular Physics data	▪ H_2, D_2, T_2, HD, HT, DT

	▪ $C_w H_x D_y T_z$
Surface data	▪ Sputtering/Reflection coefficients ▪ Chemical sputtering ▪ Mixed materials effects
Nuclear	▪ Fusion cross sections ▪ Nuclear reactions ▪ Cross sections for diagnostics

The following should apply to AMNS data used by the ITM-TF

1. Version control of data imported to the ITM-TF data base is mandatory.
2. The provenance of the data must be accurate and stored in the ITM database
3. For "production" runs with ITM-TF codes using AMNS data it is important that the data have been given a stamp of approval by an expert.
4. The AMNS data must be communicated to ITM-TF codes via a standardised interface (this should also ensure coherence between different ITM-TF codes needing the same type of data)

The work on providing the AMNS data can be split in to three parts: (i) contact with different databases, including recommendation of the best data to be used/stamp of approval; (ii) transfer of appropriate data to the ITM-TF data repository; (iii) developments of modules that take AMNS data from the ITM-TF data repository and provide them in a standardized form to ITM-TF codes.

Three types of contributors to the AMSN work in the ITM-TF are envisaged: (i) coordinators, who should ensure that the ITM-TF is supplied with appropriate data in the different areas; (ii) data providers, e.g. researchers in possession of private data bases they are willing to share with the ITM-TF; and (iii) developers of modules for standardised delivery of AMNS data to the ITM-TF.

There is of course nothing to prevent somebody from being involved with more then one of the tasks above (it is encouraged).

Overall Milestone

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

Continuity – Task relations

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		Status in 2010
ITM-09-TFL2_AMNS-T1: Coordination of the data for each of the sub groups (Atomic, Molecular, Nuclear and Surface)	→	WP10-ITM-AMNS-ACT1: Continued in Priority Support
ITM-09-TFL_AMNS-T2: Contribution of data in each of the sub groups (Atomic, molecular, Nuclear and surface)	→	WP10-ITM-AMNS-ACT2: Continued in Baseline Support
ITM-09-TFL_AMNS-T3: Development of modules for delivering AMNS data to ITM-TF codes	→	WP10-ITM-AMNS-ACT3: Further development and maintenance of modules to provide AMNS data to ITM-TF codes, Continued Priority Support.

Coordinated activities

Type of activity[50]	Topic, aims and intended audience[51]	Participants[52]	Length[53]	Tentative Date[54]	Tasks involved[55]
Working Session/Code Camp	Atomic and Molecular data for the ETS; integrating AMNS modules and data with the ETS; AMNS coordinators and module developers.	~5	Up to 2 weeks	Feb. 2010	WP10-ITM-AMNS-ACT1 WP10-ITM-AMNS-ACT3

[50] Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.
[51] Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)
[52] Indicative number of participants expected to participate
[53] Length of the activity in calendar days
[54] Indicative starting date for activity
[55] A list of tasks within ITM that are directly linked to this activity.

	Note: this will be in conjunction with an IMP3 Working Session/Code Camp				
Working Session/Code Camp	Atomic, Molecular and Surface data for edge core modelling; integrating AMNS modules and data into edge modelling; AMNS coordinators and module developers. **Note:** this will be in conjunction with an IMP3 Working Session/Code Camp	~5	Up to 2 weeks	Apr. 2010	WP10-ITM-AMNS-ACT1 WP10-ITM-AMNS-ACT3

WP10-ITM-AMNS-ACT1: Coordination of the data for each of the sub groups (Atomic, Molecular, Nuclear and Surface)

Type of support available for the task: Priority Support

Description of work

Four coordinators are required to coordinate the data transfer for each of the sub group (Atomic, Molecular, Neutral and Surface)

The coordinator should ensure that appropriate data are transferred from existing data bases to the ITM-TF data repository. Moreover, he/she should notify concerned parties in the ITM-TF when an update of the ITM-TF database is necessary or has been effectuated.

In the case of data not residing in easily accessible databases (such as private ones), the coordinator should contact researchers who have access to such data and ensure, if possible, that the ITM-TF is allowed access to them.

The coordinator should give a stamp of approval of any AMNS data that are used in official production runs with ITM-TF tools.

Furthermore, the coordinator should identify any Intellectual Property Rights (IPR) protection issues associated with the data used by the ITM-TF.

Participation to relevant coordinated activities is required.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[56]
Report	01/01/10	31/12/10	Documentation of data transfers to the ITM-TF and other activities carried out for the task.	Transport modelling in IMP3 and NBI modelling in IMP5 needs AMNS data.

Resources, skills and needs

Requested manpower/skills: Experts in the areas of Atomic, Molecular, Nuclear and Surface physics are requested to respond. The coordination activity is expected to require up to 3 pm for each area and these will fall under priority support (a total of 12pm is requested).
The coordinator will report to the ITM leadership. Please indicate a willingness to take the coordinating responsibility for one of the areas.

Existing Commitments: Renewal of commitments made in 2009 is encouraged.

[56] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session/Code Camp in conjunction with IMP3	Feb 2010	Up to 2 weeks	Integration of data and modules for data delivery for Atomic and Molecular data with the ETS.

External connections/requirements

Require connections and collaboration with external AMNS data bases (ADAS, HYDKIN etc.)

WP10-ITM-AMNS-ACT2: Contribution of data in each of the sub groups (Atomic, molecular, surface and Nuclear)

Type of support available for the task: Baseline Support

Description of work

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

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[57]
Report	01/01/10	31/12/10	Report on data delivered to the ITM-TF database	Transport modelling in IMP3 and NBI modelling in IMP5 needs AMNS data.

Resources, skills and needs

Requested manpower/skills: Experts in the areas of Atomic, Molecular, Nuclear and Surface physics are requested to respond, especially those who have access to data not residing in easily accessible databases. The work involved in this task will vary with the amount of data that is delivered. As a guideline it would be reasonable to spend at least a 1 pm per contributor.

Existing Commitments: Renewal of commitments made in 2009 is encouraged.

Code Camps or other coordinated activities

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

External connections/requirements

Require collaboration with external data providers.

[57] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-AMNS-ACT3: Further development and maintenance of modules to provide AMNS data to ITM-TF codes.

Type of support available for the task: Priority Support

Description of work

Generic modules delivering AMNS data in a standardized form to ITM codes have been developed in Fortran90. Further development of these modules is needed, especially to make them communicate efficiently with the ITM-TF data base via ITM data structures is. Furthermore, the ITM-TF is committed to maintaining a multi-lingual approach in terms of programming languages (Fortran, C, etc.). Consequently, either the modules must be translated into different programming languages or "wrappers" must be written to make them callable from codes written in different languages.

Participation to relevant coordinated activities is required.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[58]
Module f90	01/01/10	28/02/10	Module in F90 for delivering AMNS data using ITM data structures to retrieve data from the ITM database.	Transport modelling in IMP3 and NBI modelling in IMP5 needs AMNS data.
Module c	01/01/10	31/03/10	Implementation of a module callable from a c program for delivering AMNS data using ITM data structures to retrieve data from the ITM database.	Transport modelling in IMP3 and NBI modelling in IMP5 needs AMNS data.
Documentation	01/01/10	30/04/10	Report documenting the Fortran and C modules mentioned above.	

Resources, skills and needs

Requested manpower/skills: Software/code developers, ideally with an ability to work with codes in different languages, are required. Some knowledge of AMNS data would be an advantage. The work is foreseen to be supported by priority support of 4pm during 2010.

Existing Commitments: Initially envisioned to be completed in the 2009 WP, but delays in agreeing on data structures for AMNS data means that some of the work spills over to 2010. Renewal of commitments made in 2009 is encouraged.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
Working Session/Code	Apr. 2010	Up to 2 weeks	Integration of data and modules for data delivery for Atomic, Molecular and Surface data with the

[58] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

Camp in conjunction with IMP3			ITM edge modelling.

External connections/requirements

Task Agreement WP10-ITM-EDRG:

Experimentalists and Diagnosticians Resource Group (EDRG)

Task under Task Force Leadership

Contents

Required Resources

The Implementation of the EDRG work programme for 2010 is estimated to require a minimum of 3.25 Ppy under Baseline support and 2.25 Ppy under Priority Support in order to be able to provide a minimum level of project fulfilment of the deliverables and milestones. The overall resources under priority support for the ITM Task Force are determined by the Work Programme, but the breakdown

between projects within ITM is left to be optimised by the Task Force Leader in order to satisfy project requirements while taking into account the resources made available by Associations. Furthermore the resources under baseline support shown in the Work Programme are meant to be preliminary. For these reasons, the manpower requirements stated in the project descriptions should be viewed as indicative. Tasks are generally collaborative in character or form parts of a larger structure where timely delivery and coordination is of importance. Support and training on the ITM framework and tools will be available and time for the participation shall be allocated in addition to Task activities.

In the analysis of the answers to the Call, the ITM-TF will do its best to promote collaborative efforts between associations as well as between individuals in the different tasks. This is to provide internal peer review, quality of work and to develop a stronger sense of community ownership for the developed tools. However, and in order to reduce fragmentation and related administrative burden, if smaller tasks are shared between Associations, care should be taken that no individual's total contribution to a project becomes too small.

Priority Support

The tasks:

- **WP10-ITM-EDRG-ACT3 : 3D machine description (12pm)**
- **WP10-ITM-EDRG-ACT4 : Coordination of plasma control activities (3pm)**
- **WP10-ITM-EDRG-ACT6 : Synthetic diagnostics – 3D reflectometry modelling framework (12pm)**

are formed under priority support. **A total of 27pm has been assigned to EDRG activities.**

A new feature of the 2010 implementation of the ITM-TF work programme is the focused use of coordinated joint activities as integral part of the work. These joint activities will be organised in working sessions and code camps (working sessions supported by the integration team) and supported under mobility. All contributors to the Task Force are strongly encouraged to participate in relevant working sessions and code camps. For activities falling under Priority Support, participation to these joint activities is obligatory. The list of coordinated activities for the EDRG group, tentative time and duration are provided in the table below.

Implementation

All software development is expected to be implemented on the ITM-TF gateway, www.efda-itm.eu, under the provisions of the Gateway User Agreement (attached). The latter was agreed to by the EFDA-SC in June 2008. The Gateway User Agreement details access and sharing mechanisms for the software developments within ITM-TF. Furthermore, the ITM-TF will provide a collaborative software development environment, based on Gforge, to support the development of individual programs and at the same time ensure that Quality Assurance and traceability criteria for the ITM project are adhered to.

Intellectual Property Rights Monitoring

In agreement with the EFDA-SC decision (June 2008), and as described in the Gateway User Agreement, the ITM-TF will monitor IPR relating to contributed codes. In particular, the ITM-TF will maintain a record of contributions made to any Software through collaborative Tasks within the ITM-TF. All such modifications remain fully available to the contributing Associate provided contributors are acknowledged though the principles stated in the ITM-TF license. A Rights of access form (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.

Project Background

Introduction to the Experimentalist and diagnosticians resource group

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

Relation to Experiments

The EDRG group has direct interfacing with all fusion experiments engaged with the ITM-TF effort, assisted by task assigned Contact Persons. Coordination with JET is dealt at the TFL level. The completion and extensions of the Machine Descriptions (a device descriptor) and Data Mappings (bridging experimental databases signals to the ITM-TF datastructure) are one essential aim in order to enable a comprehensive modelling building on a particular device. Plasma Control and Validation&Verification coordination activities also rely on the valuable contribution from the experiments.

Overall Milestone

To provide a privileged contact of the ITM-TF as a whole with experimental devices engaged with the ITM-TF, incorporate comprehensive machine descriptions and data mappings from these devices encompassing an increasing number of diagnostic data and integrate a suitable suite of synthetic diagnostics that assist the overall ITM code validation and "real-time" discharge evolution control.

Continuity – Task relations

The connection between 2009 tasks and those planned for 2010 are given in the following table.

2009 Task		Status in 2010
ITM-09-TFL2-EDRG-T1: Contact Person in Fusion experiments	→	WP10-ITM-EDRG-ACT1: Continued in Baseline Support
ITM-09-TFL2-EDRG-T2: Machine descriptions and data mapping	→	WP10-ITM-EDRG-ACT2: Continued in Baseline Support
ITM-09-TFL2-EDRG-T3: Coordination of plasma control activities	→	WP10-ITM-EDRG-ACT4: Coordination of plasma control activities
ITM-09-TFL2-EDRG-T4: Diagnostic related activities	→	WP10-ITM-EDRG-ACT5: Diagnostic related activities
ITM-09-TFL2-EDRG-T5: Synthetic diagnostics – 3D reflectometry modelling framework	→	WP10-ITM-EDRG-ACT6: Synthetic diagnostics – 3D reflectometry modelling framework

Some new tasks are planned for 2010

New Tasks in 2010	
ITM-09-TFL2-EDRG-T3: 3D Machine description	Implement a 3D description for the first wall of participating devices with adjustable detail level from master CAD drawings and including chemical, thermal, electrical and mechanical properties.

Coordinated activities

Type of activity[59]	Topic, aims and intended audience[60]	Participants[61]	Length[62]	Tentative Date[63]	Tasks involved[64]
WS	Developmenty of 3D machine description IMP12, IMP3, EDRG	20	3 days	April 2010	IMP12-ACT6 IMP3-ACT3 EDRG-T3
WS	Mid-term assessment of control activities status and roadmap evaluation. ITM associated task contributors and Feedback control experts + possible WG contributors.	15	2 days	28 June	ISIP-ACT12 IMP12-ACT2 EDRG-ACT4
Code Camp	Hands-on session on how to integrate control schemas into the ITM platform using SCICOS and Simulink; RT workshop C++ code generation from Simulink schema, CPO datastructure wrapping and FC2K actor generation. Very useful to stimulate contributions from WG and control experts.	15	3 days	June, just after the WS	ISIP-ACT12 IMP12-ACT2 EDRG-ACT4
WS	Interfacing of equilibrium modules with the erc3D code package. Joint effort from ERCC team and IMP12	~6	2-3days	5-7 July	EDRG-ACT6, IMP12-ACT1
WS	Integration freeboundary equilibrium+feedback	25	1 week	19-23 July	IMP12-ACT2 IMP3-ACT1 EDRG-ACT4

[59] Activity is either: Project Meeting, Working Session or Code Camp, or OTHER (need then further description). In this context a Code camp is a working session with ISIP support.
[60] Overview of the activity scope and aims (i.e., what should be achieved) and audience (i.e., who should participate and benefit)
[61] Indicative number of participants expected to participate
[62] Length of the activity in calendar days
[63] Indicative starting date for activity
[64] A list of tasks within ITM that are directly linked to this activity.

	code in ETS IMP12 , ETS, EDRG				ISIP-ACT12
WS	Code validation/benchmarking by interfacing with turbulence spectra	~6	5days	6-10 Dec.	EDRG-AT6 IMP4-ACT6

WP10-ITM-EDRG-ACT1: Contact Person in fusion experiments

Type of support available for the task: Baseline Support

Description of work

A local responsible officer from each of the participating major European experiments is envisaged. The called contact person will provide the liaison between the affiliated laboratory and the ITM and will be in charge of:

i) Coordinating the machine description (MD) and data mapping activities to be carried out in the affiliated laboratory by designated staff (see WP10-ITM-EDRG-ACT2,T3).

ii) Proposing verification and validation (V&V) activities to be carried on the experimental data of the affiliated laboratory, in collaboration with the relevant IMPs of ITM.

iii) Coordinate the development of ITM-TF tools within the Associations once workflows and tools are set for release.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[65]
Report	01/01/10	31/12/10	Report on V&V activities proposed and agreed to take place	
Report	01/01/10	31/12/10	Report on the progress made on the MD&DM	
Report	01/06/10	31/12/10	Report on the ITM-TF tools home development/integration.	

Resources, skills and needs

Requested manpower/skills: Close support representatives of each of the participating experiments are requested for this task.

Existing Commitments: Representatives from JET, TS, AUG, MAST, TCV, FTU, COMPASS committed for 2009. Renewal is envisaged with a stronger role expected namely on V&V activities as ITM-TF tools are maturing.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) : where appropriate, V&V activities should build on previous (or foreseen) related undertaking.

[65] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-EDRG-ACT2: Machine Descriptions and data mapping

Type of support available for the task: Baseline Support

Description of work

Machine descriptions and data mapping build the backbone of the ITM datastructure, enabling simulations on each device to be performed. Completion and revisions (if appropriate) of the machine description version 4.07a and coming developments, for all participating devices and new devices that haven't yet taken part, is asked for. Developments will include, among others, more complete antenna datastructure and other heating and current drive systems, 2D vessel qualifying for discontinuous elements, necessary adjustments to the pfsystems CPO and additional diagnostic CPOs to be developed (EDRG-T5).

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[66]
MD complete	01/01/10	31/03/10	Provide validated MD file for current version if unavailable/incomplete	Incomplete MD implies limited exploitation of ITM-TF tools
MD update	01/04/10	31/12/10	Provide validated MD file for new versions of the MD.	IMP3 2D codes for discontinuous wall elements.
DM complete	01/01/10	31/03/10	Provide validated DM file for current version if unavailable/incomplete	Incomplete DM implies limited exploitation of ITM-TF tools
DM update	01/04/10	31/12/10	Provide validated DM file for new versions of the DM.	

Resources, skills and needs

Requested manpower/skills: Experimentalists from each of the participating experiments are requested for this task. Estimated 3pm per device (30pm) is expected to be distributed throughout the year.

Existing Commitments: Representatives from TS, AUG, MAST, TCV committed for 2009 (uneven response) although a matching engagement up on renewal from all participating experiments is longed for.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....): collaboration from JET to be extended to 2010. Collaboration from ITER also encouraged.

[66] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-EDRG-ACT3: 3D Machine Description

Type of support available for the task: Priority Support

Description of work

Providing a full 3D description of a fusion device first wall is a major endeavour. The work to be carried out in this task should therefore follow the tentative breakdown:

a) Provision of a tool able to read a master CAD drawing and perform adjustable defeaturing on the output walls surface (STL format).
b) Report on acceptability of the defeatured surface mesh considering requirements of: MC codes, RWM codes, other.
c) Full scale mesh development for devices.
d) Adaptation of the 3D wall mesh to the GRID-CPO framework.

Participation to relevant coordinated activities is required.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[67]
Numerical tool	01/01/10	28/02/10	Provision numerical tool for reading/defeaturing	
First trials	01/03/10	30/04/10	First trial defeaturing reports reflecting on requirements	
Defeatured meshes	01/05/10	31/09/10	Defeatured meshes of pending type for some devices.	IMP3-ACT3
Mesh into GRID CPO	01/09/10	1/12/10	Adapt mesh to GRID-CPO structure.	

Resources, skills and needs

Requested manpower/skills: Experts on CAD file post-processing (expected 9pm); experts on ITM-TF datastructure (3pm expected)

Existing Commitments: Essentially a new task although initially envisioned in the 2009 WP but not carried out due to lack of manpower.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	April 2010	0.5	Joint assessment of the requirements of 3D datastructures in equilibrium, stability, transport and machine geometry

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) : Drawing offices from participating experiments to provide CAD files and collaborate on the validation of defeatured meshes.

[67] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-EDRG-ACT4: Plasma control activities

Type of support available for the task: Priority Support

Description of work

An integrated suite of modelling tools targeting the simulation of a magnetically confined plasma discharge, in realistic free boundary equilibrium experimental conditions, requires the integration of plasma feedback control elements. Specifically, plasma position and shape feedback controllers and actuators as well as active magnetic feedback systems for MHD control are foreseen in the ITM platform. A control expert is therefore called to coordinate the activities related to control within the ITM:,

- Feedback plasma position&shape control using Free-boundary equilibrium codes
- Extension to MHD plasma control
- SCICOS based Control toolbox deployment and integration of existing or newly developed control schemas based on Simulink.
- Paving layout for prospective PCS layout

Provide an external connection to other EFDA related control activities and coordinated the collaborative effort. Building on 2010 response from Associations on general information about feedback control schemes in use, plans for scheme integration in view of prototype KEPLER workflow development should be discussed.

Participation to relevant coordinated activities is required.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[68]
Control schemas	01/05/10	31/05/10	Preliminary roadmap for control schema integration	ISIP – Simulink integration trials + control toolbox progress (~June-10)
Report	1/07/10	15/07/10	Preliminary Progress Report on overall IMP activities + external connection + WS/code camp.	
Report	15/11/10	30/11/10	Final report + suggested roadmap for 2011.	

Resources, skills and needs

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

Existing Commitments: Continued task from 2009 where 0.33ppy were allocated.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS+Code camp	28th June	1	Mid-term assessment of control activities status and roadmap evaluation. Disseminate ITM-TF control effort to other EFDA WG contributors. Hands-on session on how to integrate control schemas into the ITM platform using SCICOS and Simulink. Stimulate contributions from WG and control experts.
WS	19 July	1	Assist IMP3 on the Integration freeboundary equilibrium+feedback code in ETS

[68] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) : 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.

WP10-ITM-EDRG-ACT5: Diagnostic related activities

Type of support available for the task: Task Agreement

Description of work

Extension of the present set of CPOs characterizing diagnostic data to provide the necessary coverage of coming V&V activities needs. In particular, *Strike point, Bremsstrahlung*, *LIDAR, neutral particle analyser, X-ray* and *fusion product* diagnostics are requested. In view of both the verification and validation of ITM-TF codes and preparing for real-time discharge evolution capabilities, the opportunity for the adaptation/integration on the ITM platform of the appropriate synthetic diagnostics will be explored.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[69]
Diagnostics datastructure	01/02/10	30/04/10	Develop datastructure for additional diagnostics	
Code inventory	1/01/10	15/03/10	Code Inventory on Synthetic diagnostics developed at each Association.	
Synthetic diagnostic integration	01/01/10	31/12/10	Adaptation/integration of synthetic diagnostic modules in the ITM platform (throughout the year).	

Resources, skills and needs

Requested manpower/skills: Expert diagnosticians to develop diagnostic CPOs (overall effort 3pm since filling the MD is carried out in EDRG-T2). Synthetic diagnostic integration (6pm)

Existing Commitments: Continued task from ITM-09-TFL2-EDRG-T4 where 1.05ppy were allocated.

Code Camps or other coordinated activities

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

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) : Evident synergies should be promoted between the Data Analysis and Calibration Techniques WG (auspices of the Diagnostic TG, see task **WP10-DIA-05-01**) and the ITM-TF regarding the synthetic diagnostics integration assistance in diagnostic datastructure development.

[69] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.

WP10-ITM-EDRG-ACT6: Synthetic diagnostics - 3D reflectometer modelling framework

Type of support available for the task: Priority Support

Description of work

Building on what was achieved during 2009, the following activities are planned : optimization of the finite difference kernel; Parallelization of the kernel code module; Continuation of the parallel effort of developing alternative solvers and, where appropriate, their implementation in the code; Extension of the interface module to allow integration with ITM equilibrium codes; Implementation of "realistic" numerical turbulence models; General integration of the code into the ITM framework; Development of the complementary code suite and post-processor tool-box.

In addition, a series of programmes will be undertaken, including: Extensive validation and verification of the code, including benchmarking activities; Simulation studies with ITER relevant geometries and parameters; Continue the programme of physics and fundamental issue studies.

Deliverables:

Title	Start date	End Date	Deliverable(s) (precise definition)	Dependent activities[70]
	01/01/10	01/07/10	Optimization/Paralellization	
	01/07/10	31/07/10	Interface module to integrate ITM eq. codes	
	01/08/10	31/10/10	General code Integration into the ITM	
	1/10/10	31/12/10	Code verification/validation and interfacing with turbulence models/spectra	

Resources, skills and needs

Requested manpower/skills: The 3D full-wave reflectometry simulation code requires a computer scientist specialized in parallel programming (1 ppy) but the task can be split up between different individuals to cover the necessary areas of expertise and deliverables.
Existing Commitments: Continued task from 2009 where 1.37ppy was allocated.

Code Camps or other coordinated activities

Type of effort	Start date	Length (in weeks)	Expected outcome/relation to deliverable(s)
WS	5 July	3 days	Outline and preliminary testing of equilibrium code integration
WS	6 Dec.	5 days	Testing interplay of erc3D code with turbulence codes and preliminary analysis of the effect of turbulence spectra

External connections/requirements

Please note any dependencies, needs or synergies with EFDA or other activities: (JET, TG, ITER....) : This task develops under the auspices of the European Reflectometry Code Consortium group.

[70] Please describe any tasks or activities that a) this deliverable needs as a prerequisite or b) depend on this deliverable being finalized.