EFDA
EUROPEAN FUSION DEVELOPMENT AGREEMENT
Task Force
INTEGRATED TOKAMAK MODELLING

Remote meeting, 9 February 2011

INTEGRATED SCENARIO MODELLING, Introduction meeting 9 February 2011

Presented by X LITAUDON & I VOITSEKHOVITCH

TF Leader : G. Falchetto
Deputies: R. Coelho, D. Coster

EFDA CSU Contact Person: D. Kalupin

Agenda

- **Introduction**
  - Meeting announcement
  - Association replies to 2011 call for participation and Welcome to new participants
- **I. Voitsekhovitch Report from the last European Transport Solver code camp**
- **I. Voitsekhovitch , X. Litaudon, D. Coster, V. Basiuk, D. Kalupin Proposal for ETS validation on JET hybrid discharges**

Remote meeting

Regular remote meeting on Wednesday morning 10h30-12h00 CET (09h30-11h00 GMT) :

- **Wed 09 Feb 10h30-12h00 CET**
- **Tuesday 15th, 9:00-10:30 CET (17:00-18:30 Naka time): Status of JT60SA modelling and possible EU contributions**
- **Wed 16 Feb 10h30-12h00 CET**
  - **P. Belo, I. Ivanova-Stanik « benchmark the ETS/impurity code against SANCO »**
  - **D. Harting "Overview of EMC3-EIRENE code"**
  - **J. Garcia Update on the ITER hybrid scenario modelling**
- **Wed 02 March 10h30-12h00 CET**
  - **Preparation Working session**
- **Wed 23 March**
  - **Wrap-up ISM working sessions**
- **Wed 6 April**
  - **IOS/ITPA rehearsals and discussion of the benchmarking of GLF23 for rotation + ….**
- **Wed 20 April**
  - **overview of IOS meeting in Culham +….**
- **Wed 11 May**
- **Wed 8 June**
  - **EPS rehearsals + ?**
- **Wed 22 June**
  - **preparation of ISM WS july 4-8**

ISM Working session & related meeting [1/2]

- **First ISM working session 07 March 13h - 11 March 18h , at Cadarache, possibility to stay 14-18 March**
  - Joint session with IMP#3 "WP11-ITM-ISM-ACT1 Support Validation of the ETS " + ACT 2 & ACT3
  - CCFE: I. Voitsekhovitch, V. Parail, Luca Garzotti, …
  - TEKES: J Lonnroth
  - IPP: J Hobirk, E FABLE
  - FOM: J Citrin, D Hogeweij
  - FZJ: D. Harting, S Wiesen
- **Logistic e-mail has been sent by G. Falchetto to all ITM members**
- **LOC : V. Basiuk & V. Icard**

ISM Working session & related meeting [2/2]

- **ITPA-IOS : JET culham 11-15 April**
- **Second ISM 04-08 July FOM ? TbC**
- **ITM general meeting 12-16 sept**
- **Third ISM Nov- Dec. Culham ? TbC**

2011 -Participation to conferences, Workshop , ITPA

- **EPS: Strasbourg du 27 june to 1 july 2011 : http://www-fusion-magnetique.cea.fr/eps2011/index.html**
  - **EPS Deadline abstract: 28 feb. Internal JET deadline: 11 feb.**
  - **ISM : send your proposal 14 feb**
  - **Invited talk: integrated modelling G. Giruzzi**
  - **Determination of the requirements for the sustainment of hybrid scenarios on JET : J. Garcia et al**
  - **JET / ASDEX hybrid transport modelling: J. Citrin**
  - **ITER Hybrid current ramp up: D. Hogeweij**
  - **JET ramp-down modelling ?**
- **EFTC & APS**
  - **Core/Edge ITER modelling (baseline) S. Wiesen**
- **ITPA – IOS April**
  - **DIII-D modelling Irina Voitsekhovitch**
  - **J. Garcia tbc**

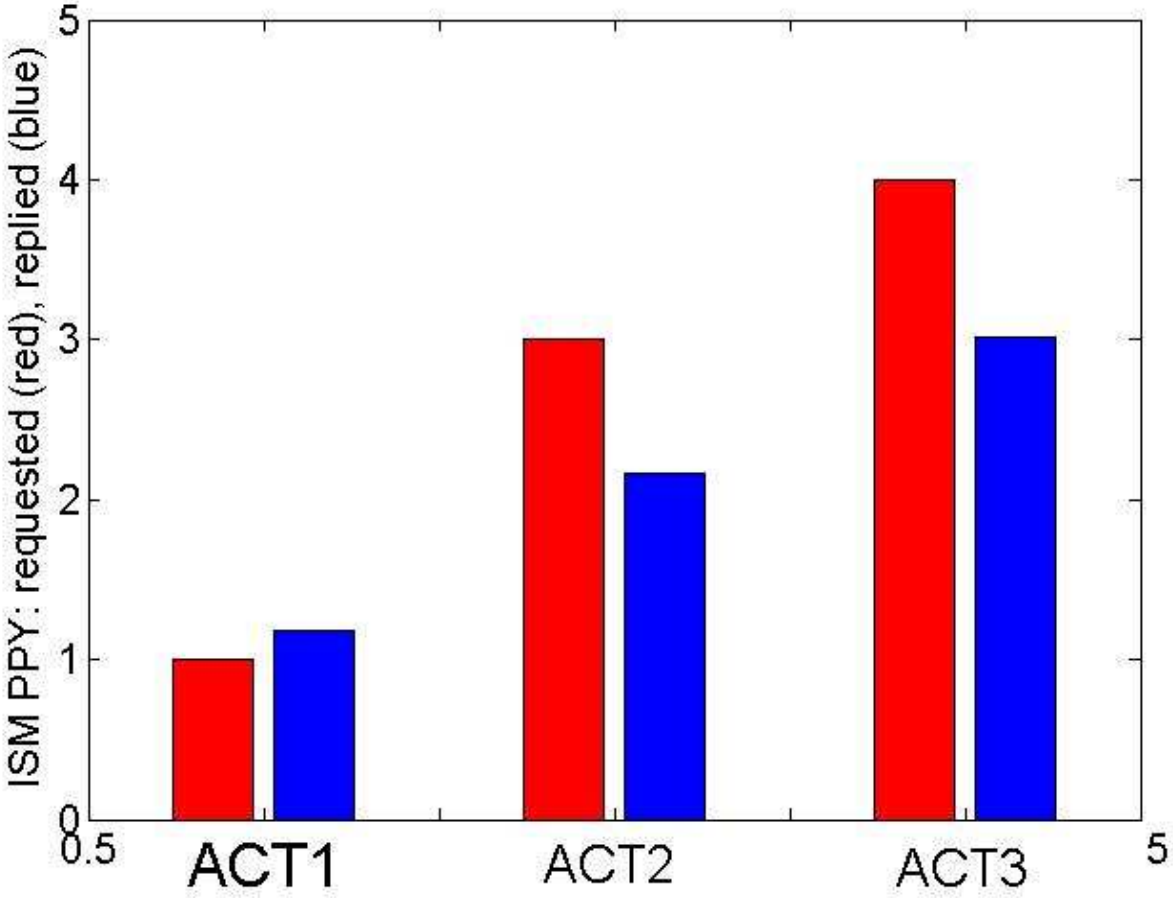
ITM/ISM reply to the Call 2011

- **Project leader meeting to analyse the response 26 -28 jan at Garching**
- **An significant increase in terms of participation with 47 ISM participants**
- **with 19 new ISM participants !**

2011 new participants

- **CEA**
  - F. Liu , Christophe GUILLEMAUT
- **CCFE**
  - Yuriy Baranov, David Keeling, Ian Jenkins, Michele Romanelli, Martin Valovic, Richard Kemp, Gerard Corrigan
- **IPP**
  - Clemente Angioni, Christian Konz, David Coster, Philipp Lauber
- **IPPLM, Warsaw**
  - Irena Ivanova-Stanik
- **VR**
  - Sara Moradi, Hans Nordman
- **ENEA-RFX**
  - Matteo Baruzzo, Tommaso Bolzonella

Reply to Call for Participation: ISM



ACT1: Support Validation of ETS (Priority support)

ACT2: Interpretative & predictive modelling of existing experiments (Baseline support)

ACT3: Predictive modelling of future projects (ITER, DEMO, JT60SA, etc.) (Baseline support)

This statistics does not include experimentalists (ACT2) and ITER IO (ACT3).

2011- ISM activities

- **Activity- 1: Support Validation of the ETS**
  - Under priority support
- **Activity-2 : Developing and validating plasma scenarios simulations for existing devices**
- **Activity-3 : Support to predictive scenario modelling for future devices (ITER , etc)**
- **General remarks: in addition to the working sessions, visits to work on specific ISM activities could be funded under EU mobility**

Activity- 1

- **ASTRA, CRONOS, JETTO and TRANSP simulations for benchmarking of ETS modules:**
  - current diffusion with various models for bootstrap current and current conductivity,
  - density and temperature evolution with various transport models,
  - impurity evolution (SANCO runs)
  - Sharing of Fortran routines for transport models.

- **Work has already started !!**
  - Euratom Mobility visit of Irena Ivanova-Stanik (Institute of Plasma Physics and Laser Microfusion, Warsaw, Polland) to CCFE to work with Paula Belo and Irina Voitsekovitch on benchmarking of impurity solver in ETS. The dates of this visit January 31 – February 4.

Activity- 1

2011-ACT1 team: V. Basiuk, E. Fable, I. Ivanova-Stanik, J. Ferreira, J. Bizarro, P. Strand, S. Moradi, I. Voitsekhovitch

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

Activity-1 during 2011 ISM working session 07 March -11 March

- **validate ETS keppler workflow using a high performance hybrid JET pulse #77922**
- **run JETTO /CRONOS/ASTRA #77922 with the same sources terms and transport model , Bohm/Gyro-Bohm**
- **ETS reads the heating source terms, share the transport model with CRONOS/JETTO /ASTRA**
- **ETS runs # 77922 and comparison with CRONOS/JETTO/ASTRA**
  - Benchmark transport model
  - Benchmark Spitzer and neoclassical resistivity /bootstrap
- **Irina will define the precise task but the work should start before the ISM working session**

Activity 2

- **Interpretative and predictive modelling of hybrid scenario for existing EU devices:**
  - current ramps in hybrid scenario; validation of transport models
  - current diffusion during main heating phase, effect of impurities on sawtooth-free operation
  - first steps towards momentum transport in hybrid scenario: validation of existing transport models (GLF23, Weiland)
  - edge MHD stability analysis
- **Collaboration with T&C and IOS ITPA groups on current ramp-up simulations (e.g. DIIID) and modelling of JET/JT-60U identity experiments**

Activity 2 team

Irina Voitsekhovitch, David Keeling, Ian Jenkins, Yuri Baranov, Luca Garzotti, Michele Romanelli, Martin Valovic

Jean-François Artaud, Jeronimo Garcia, Jerome Bucalossi, Christophe Guillemaut, X. Litaudon

Dick Hogeweij, Jonathan Citrin,

Joerg Hobirk, Emiliano Fable, Clemente Angioni, Marco Wischmeier, Philipp Lauber, Christian Konz, David Coster,

Hans Nordman,

Florian Koechl

Activity 2

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

Activity-3

- **Support to predictive modelling of hybrid scenario in future devices (ITER, JT60-SA)**
  - repeat previous ITER modelling with the revised ECRH antenna configuration, assess the effect of ECRH on q-profile evolution
  - study the pellet fuelling and effect of peaked density profile
  - modelling of the current ramps including free-boundary equilibrium,
  - scan the 0D operation space (Ti/Te, density, current, confinement factor etc)
  - develop model based control matrices for real time profile control
  - assess MHD stability
- **JT-60SA modelling**
  - Define operational space (0-D modelling)
- **Integrated edge and core modelling of H-mode scenario including impurity seeding for radiative divertor**

Activity-3 team

Irina Voitsekhovitch, Martin Valovic, Luca Garzotti, Richard Kemp, Gerard Corrigan, Vasili Parail,

Jean-François Artaud, Frédéric Imbeaux, Mireille SCHNEIDER, Rajiv Goswani, Gerardo Giruzzi, Jean Johner, Jerome Bucalossi, Bernard Pegourie, Patrick Maget, Eric Nardon, Didier Moreau, X. Litaudon

Tommaso Bolzonella, Matteo Baruzzo,

Dick Hogeweij, Jonathan Citrin,

Sven Wiesen, Derek Harting

Joerg Hobirk, Christian Konz, David Coster,

Johnny Lonnroth,

Florian Koechl

Activity-3

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