



EFDA

EUROPEAN FUSION DEVELOPMENT AGREEMENT

Task Force
INTEGRATED TOKAMAK MODELLING

Remote meeting February 8 2012

INTEGRATED SCENARIO MODELLING

ACT1 restart

I VOITSEKHOVITCH and ISM/ACT1 team

TF Leader : G. Falchetto
Deputies: R. Coelho, D. Coster
EFDA CSU Contact Person: D. Kalupin

a. Benchmarking of new modules in ETS (V. Basiuk (CRONOS, ETS), J. Garcia (CRONOS), J. Urban (FBE/CRONOS), L. Figini (ETS/EC), E. Westerhof and R. Bilato (ETS/ICRH), J. Ferreira (ETS, JETTO), J. Bizarro (GLF23&NCLASS/JETTO), I. Voitsekhovitch (ASTRA, TRANSP, ETS), F. Koechl (JETTO), D. Hogeweij (CRONOS), D. Kalupin (ETS), D. Coster (ETS)

- **NCLASS: transport coefficients still need to be compared.**

→ main ion D&V

→ thermal diffusivities

→ impurity D and V. Should we take carbon?

Same test case: JET 77922, stand alone NCLASS with extra output for main species (Vincent/ETS, Irina/ASTRA) + run with prescribed impurity

- **GLF23 benchmark:**

→ numerically stable solution if possible (far from the threshold)

→ two test cases: ITG dominant (1) and TEM dominant (2)

transport (Irina to prepare the test cases)

→ input data: #77922, Gaussian heating, analytical n_e , T_e & T_i profiles. ETS simulations (Denis)

a. Benchmarking of new modules in ETS (V. Basiuk (CRONOS, ETS), **J. Garcia** (CRONOS), **J. Urban** (FBE/CRONOS), **L. Figini** (ETS/EC), **E. Westerhof** (ETS/EC), **R. Bilato** (ETS/ICRH), **J. Ferreira** (ETS, JETTO), **J. Bizarro** (GLF23&NCLASS/JETTO), I. Voitsekhovitch (ASTRA, TRANSP, ETS), **F. Koechl** (JETTO), **D. Hogeweij** (CRONOS), **D. Kalupin** (ETS), **D. Coster** (ETS))

- **BgB/particle transport: Luca to send the model to Denis**
- **ECCD (GRAY): Asdex-Upgrade or Tore Supra discharge? Data?**
- **NBI under 4.09: status?**
- **TRANSP for α heating and neutrons?**

b. Impurity transport for Be and W (ETS–SANCO):

I. Ivanova-Stanik (ETS), **F. Nave** (SANCO), **P. Belo** (SANCO)

c. Core neutral module: ASTRA & JETTO for main species (#77922, 7.7 s). SANCO for impurity

I.Ivanova-Stanik (ETS), F. Nave (JETTO), I. Voitsekhovitch (ASTRA), S. Moradi (RITM), R. Stankiewicz (ETS)

Core neutrals:

JETTO (FRANTIC, EIRENE): FRANTIC [S.Tamor, J. Comput. Phys. 40 (1981) 104]: *1D model, simplified geometry, multiple ion and neutral species, interaction with fast ions, recombination, volume neutral sources from beam deposition; computes the effect of neutral transport on momentum balance. Energy, momentum, and particles are strictly conserved within the FRANTIC geometry and when data is transferred to a generalized flux surface geometry*

ASTRA (kinetic equation for distribution function f_N),

$$v \frac{\partial f_N}{\partial x} + \left(s_{ion}^{(e)} n_e + s_{ion}^{(i)} n_i + s_{cx} n_i \right) f_N = \frac{\sqrt{3}}{2} n_i (s_{cx} N + s_{rec} n_e) \delta \left(v \pm \frac{v_{Ti}}{\sqrt{3}} \right),$$

Questions to Irena and Roman:

ETS neutral module?

ETS input/output parameters to be distributed before the CC?

➤ **d. Pellet module (ETS/HYBRID / JETTO)**

F. Koechl (JETTO), L. Garzotti (JETTO), K. Gall (ETS)

- **pellet trajectory is not implemented yet, pellets along the central mid-plane**
- **Kinga is leaving. Continuation?**
- **Implementation of other pellet modules?**

ACT1/T2 application of ITM WFs for physics study

➤ a. Effect of NTM on transport & confinement in HS (JET and AUG): island width, transport simulations

O. Sauter, S. Nowak (NTM WF consultants), D. Yadykin, L. Frasinetti (JET shot selection), I. Voitsekhovitch (JET data preparation & running WF), J. Hobirk (AUG data), V. Basiuk (WF), E. Westerhof, J. Ferreira (exp2itm)

JET HS: high triangularity, I_{pl} overshoot

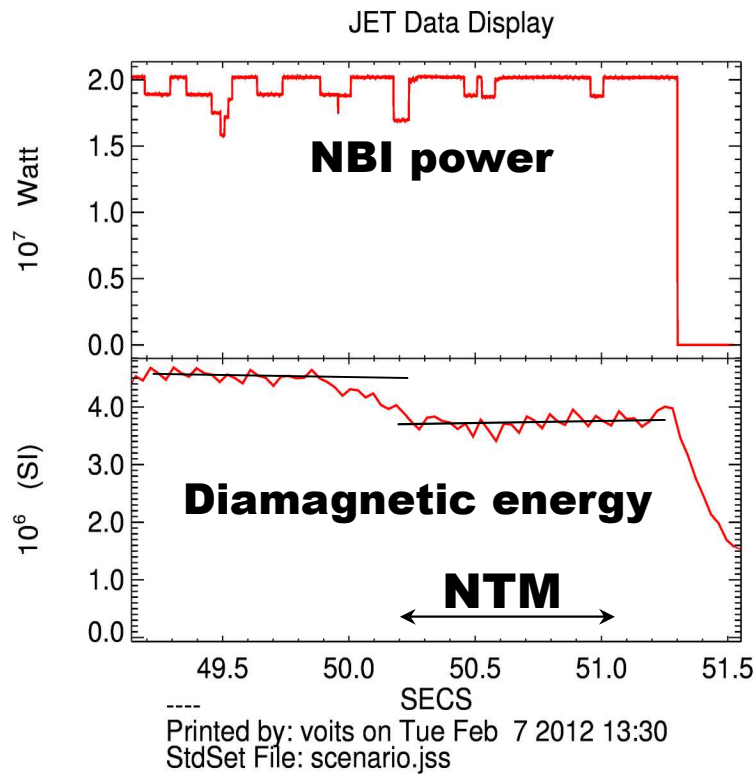
JET shot #	JET shot #	Island width	Time, s
76791	2T/1.6MA, NBI	11 cm	50.2017 - 51.1053,
77925	High δ , NBI+ICRH	7 cm	
76855	1.7T/1.4 MA, NBI	3 cm	48.8464 50.2738

Before the March CC:

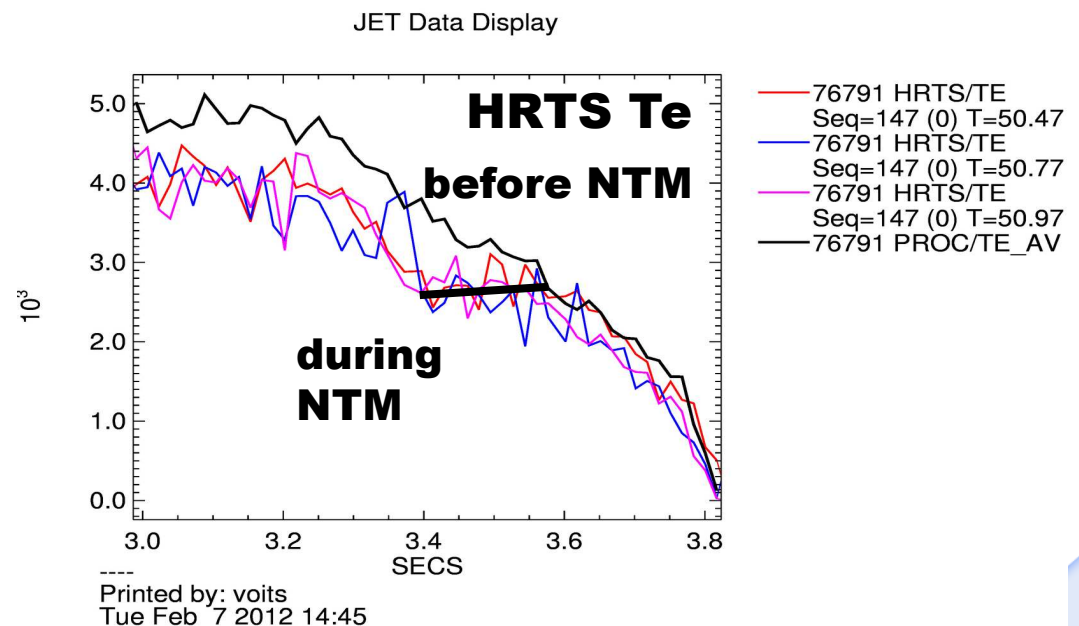
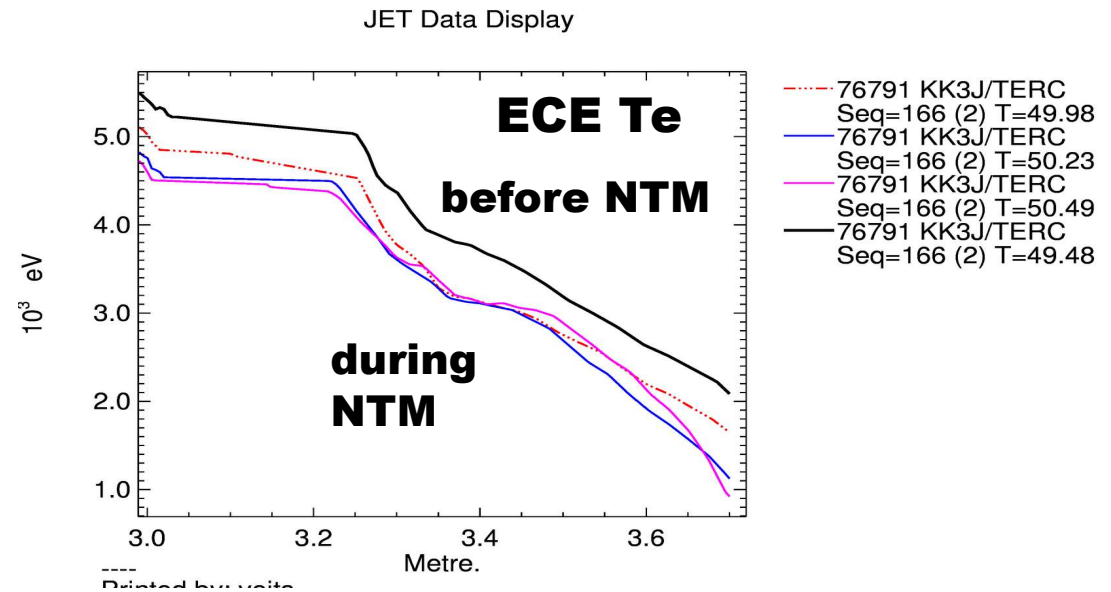
- TRANSP runs for 2 shots (Irina)
- TRANSP → CPO (Jorge)

During the CC: ETS runs

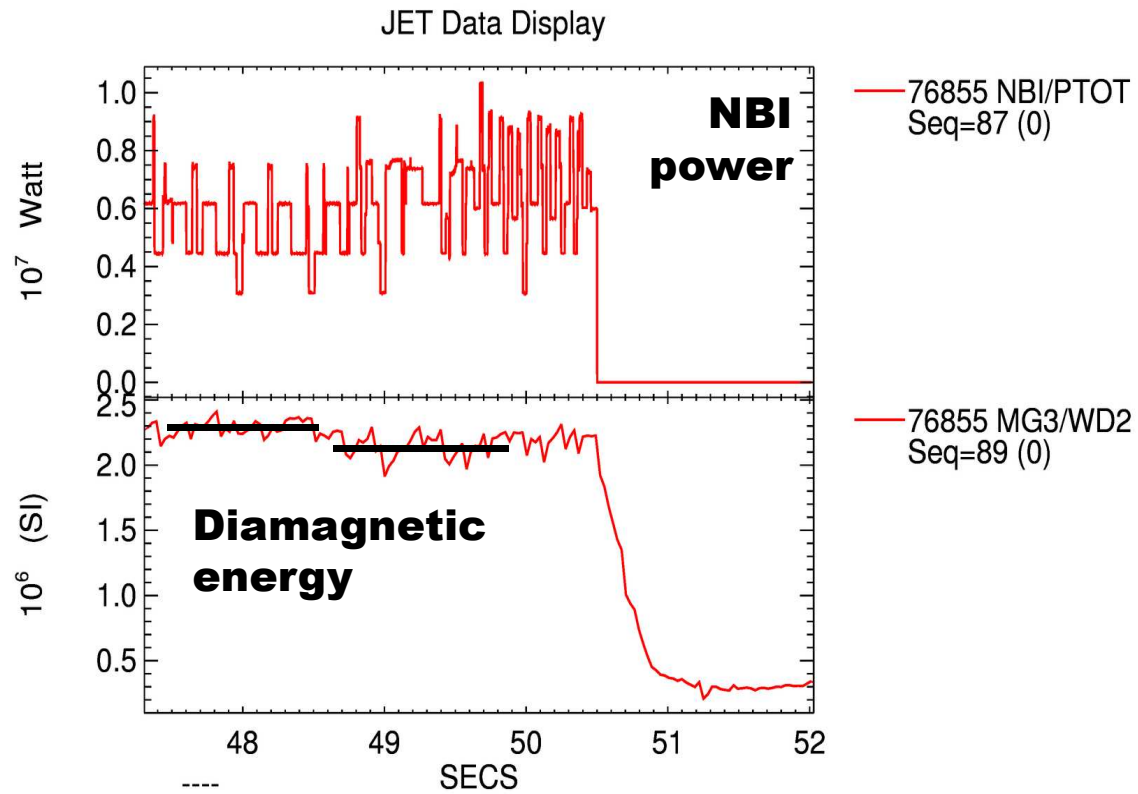
76791: plasma evolution with NTM onset



Wdia reduces by ~18%



76855 (small island)

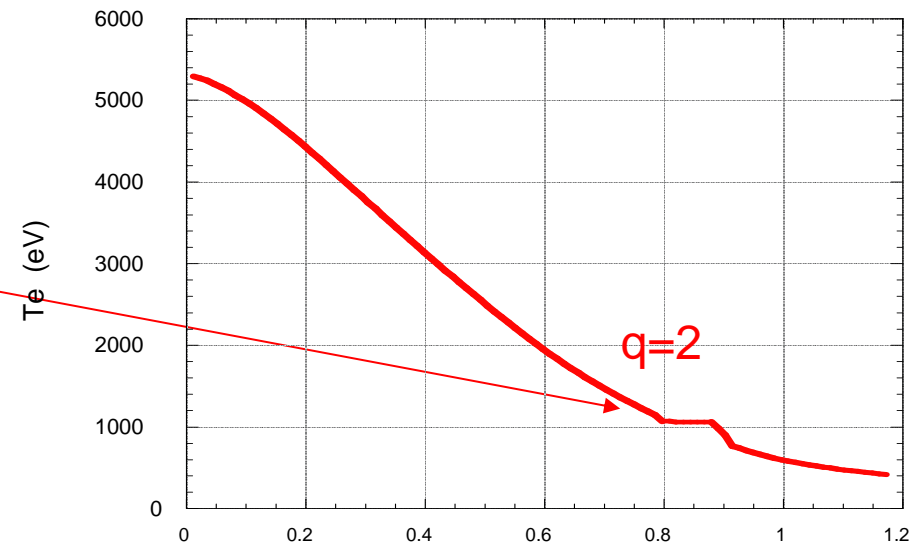
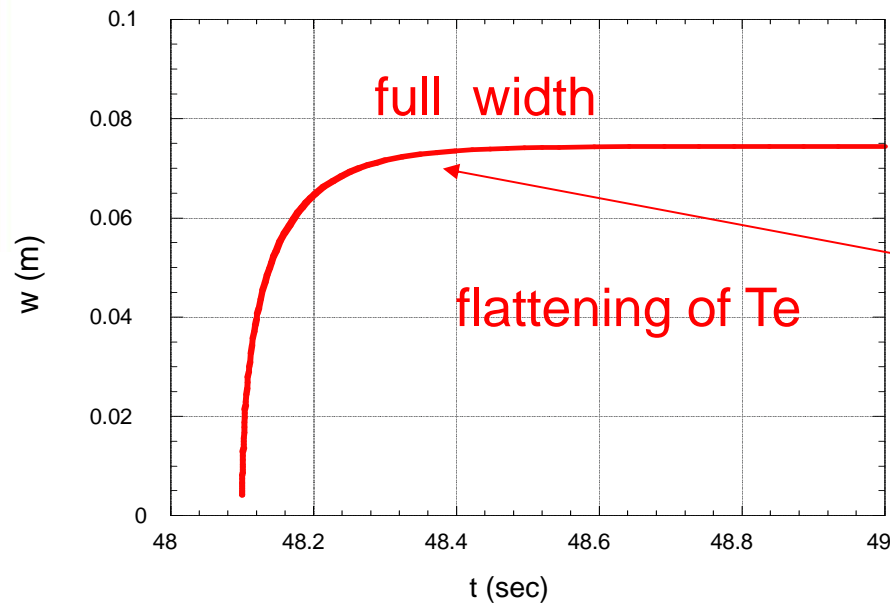


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StdSet File: scenario.jss

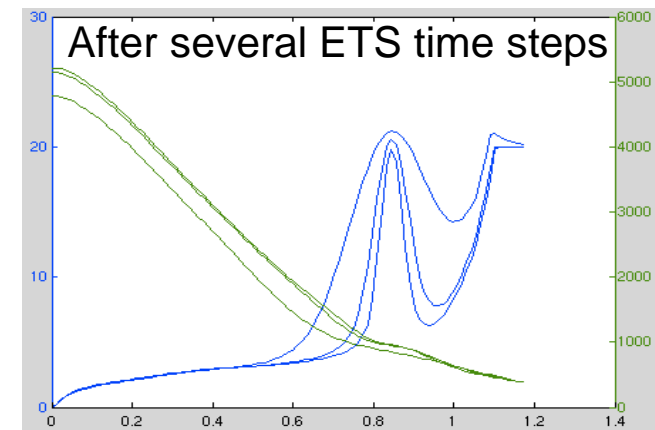
IMP12-IMP3: EFFECT OF NTM on TRANSPORT

S. Nowak, O. Sauter, P. Huynh

NTM workflow in ETS demonstrates the modification of temperature profile as a consequence of increased radial transport due to the magnetic island



$$\chi_{m,Te} = \chi_{Te} \left[1 + \text{coeff} \cdot \exp\left\{-4 (\rho - \rho_s)^2 / (\alpha w)^2\right\} \right]$$



➤ **b. Exploitation of the Equilibrium & MHD stability chain in two or more experiments. Pedestal MHD analysis for JET and ASDEX-U Hybrid Scenarios.**

J. Lönnroth, F. Nabais (edge stability analysis for JET with MISHKA/CASTOR), E. Joffrin & J. Hobirk (data), I. Voitsekhoitch, F. Koechl (JET data preparation), D. Yadykin (IMP12, ETS), J. Ferreira (exp2itm), W. Zwingmann (HELENA), C. Von Thun (ILSA)

Actions:

- *JET discharges for pedestal stability analysis: H-mode with kicks (73244 and 73247). First TRANSP runs are done, but may be improved, JETTO runs are in progress (Florian, Irina)*
- *exp2itm → CPO (Jorge)*
- *next step: run IMP12 WF with HELENA-ILSA for these shots.*

Problems:

- *HELENA-ILSA workflow does not work under 4.09a*
- *not possible to switch back to 4.08: HELENA is not working under 4.08 since it has been already modified for 4.09a*
- *IMP3 support actions?*

➤ **d. Predictive (Te, Ti, j, NBI) modelling of HS (JET, AUG) & comparison to experimental data.**

A. Figueiredo, V. Basiuk, M. Schneider, J. Bizarro

- What WF to be used? ETS/CRONOS needs to be coupled to CPO database; ETS/DK – needs NCLASS

- NBI module: fast solution for 77922 is the TRANSP NBI deposition until the ETS NBI module is working

- AUG discharge?

- **T3. Provision of ITER HS for IMP4 codes**
 - J. Garcia (providing CRONOS run for HS) , V. Basiuk (help with CPO preparation), B. Scott (IMP4)

- **T4. Provision of the ISM simulations & mapping tool for importing eqdsk/matlab simulation data to the ITM database**
 - J.-F. Artaud, R. Coehlo
 - Start during the coming CC?