



# JT60-SA modelling with ETS: status and plans

Dmitriy Yadykin, Pär Strand, Emil Fransson, Luca Garzotti and ETS team



**CHALMERS**  
UNIVERSITY OF TECHNOLOGY



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- Integrated modelling workflow to model plasma evolution according to the specified transport and sources models
- Uses IMAS for data management
- Uses Kepler orchestration tool
- Several transport and heating models are available
- Channels that can be predicted: poloidal flux (current diffusion) electron thermal density/temperature, ion thermal density/temperature, impurity density
- Core/edge coupling (reduced models for pedestal/SOL)
- Documentation:
  - general: [https://iterphysicswiki.euro-fusion.org/index.php?title=ETS-6\\_Documentation](https://iterphysicswiki.euro-fusion.org/index.php?title=ETS-6_Documentation)
  - available models: [https://iterphysicswiki.euro-fusion.org/index.php?title=ETS-6\\_Actor\\_documentation](https://iterphysicswiki.euro-fusion.org/index.php?title=ETS-6_Actor_documentation)





- Verification of the scenario modelling done by ETS6 with JINTRAC results
- Modelling of the current ramp-up is started using Ohmic heating



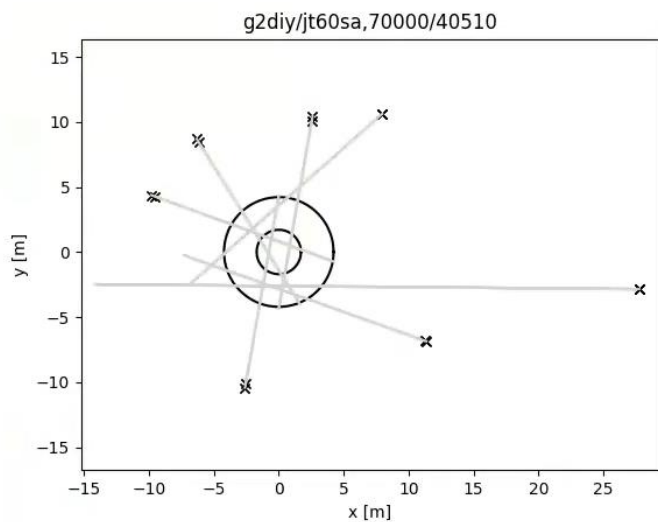
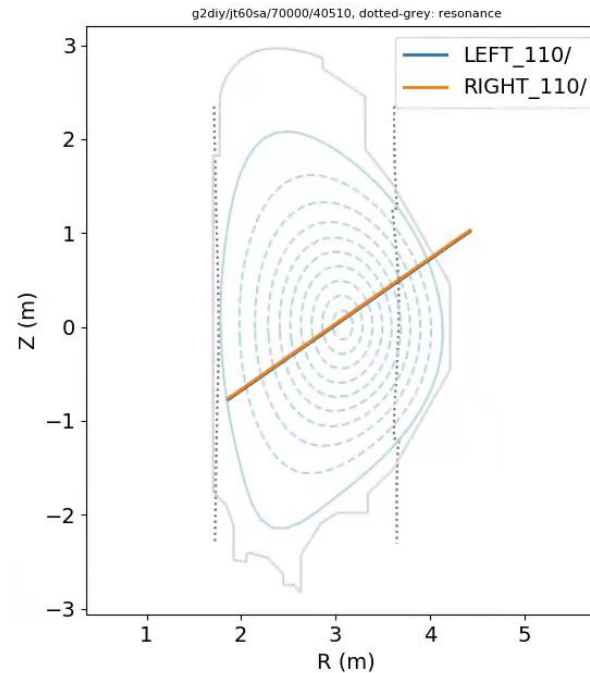
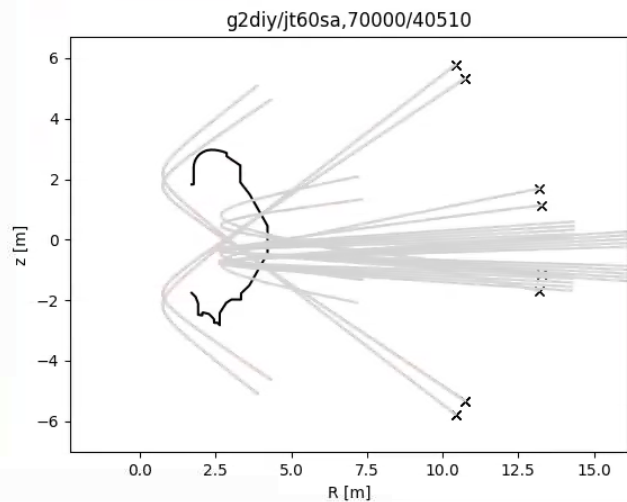
Scenario 2 is modelled with the following configuration of ETS:

- composition: e,D,C
- equilibrium: fixed boundary (CHEASE)
- transport: BGB+NCLASS
- heating: NBI(bbnbi+nbisim)+EC(Gray)

Simulation settings:

- Te,TD - predictive
- TC - from TD
- ne - interpretive,
- nC - concentration vs electrons (to have  $z_{eff}=1.8$ )
- nD - from quasineutrality
- Internal boundary at  $\rho_{tor\_norm}=0.85$

# Heating configuration



$f_{EC}=110$  GHz  
 $P_{EC}=7$  MW

PNBI=34 MW (10MW NNBI, 14 MW PNBI)

# Results: 0D parameters

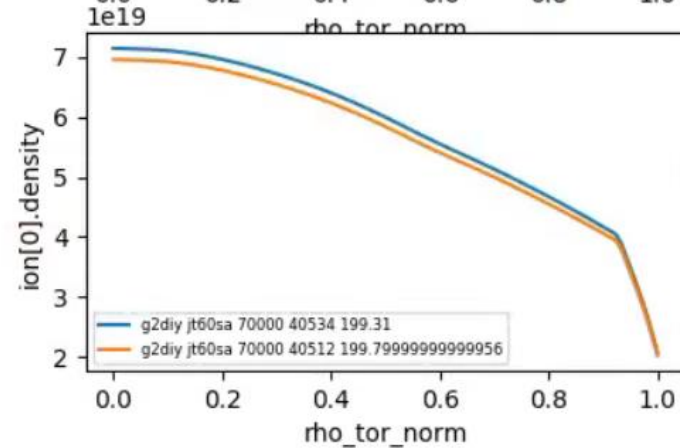
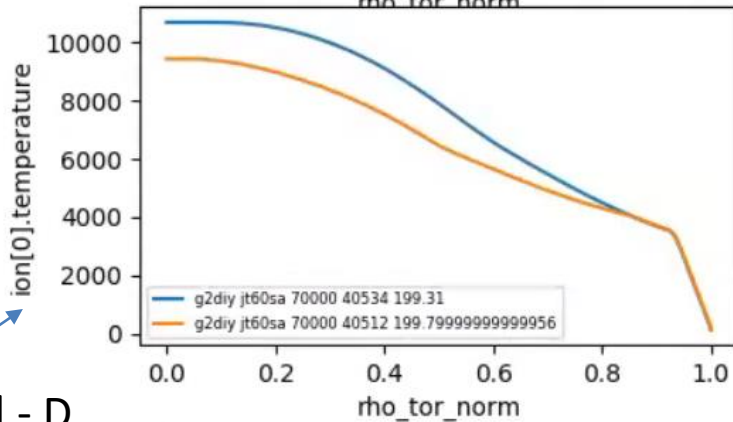
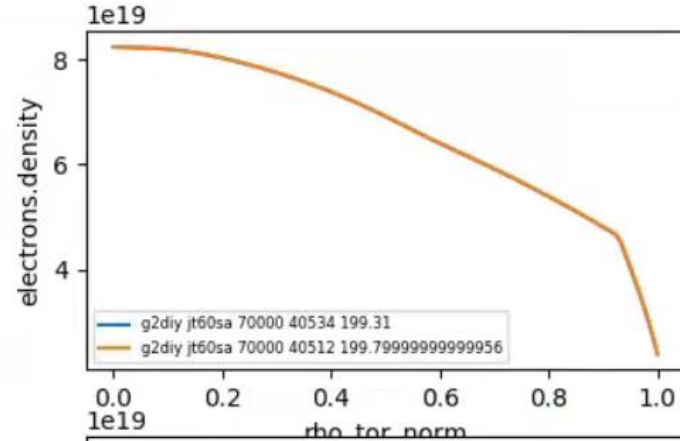
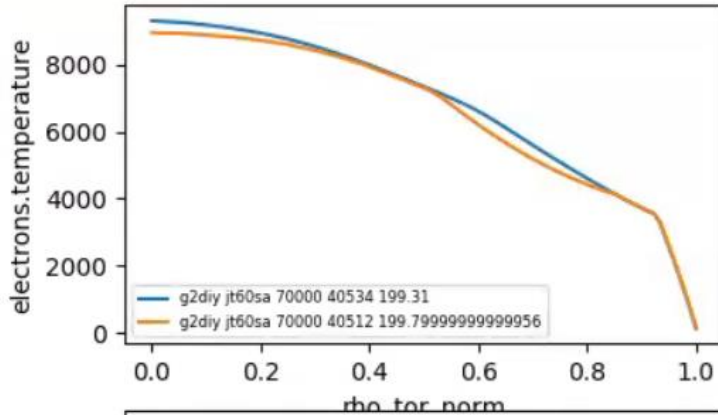


Parameters	Reference	JINTRAC	ETS
$B_t$ (T)	2.25	2.25	2.25
$I_p$ (MA)	5.5	5.5	5.4
q95	3.0	3.5	3.14
PNBI (MW)	34.0	33.0	34.0
PECRH (MW)	7.0	7.0	7.0
$n_{e0}$ ( $10^{19} \text{ m}^{-3}$ )	7.7	8.2	8.25
$\langle n_e \rangle$ ( $10^{19} \text{ m}^{-3}$ )	5.6	5.1	6.9
$T_{e0}$ keV	13.5	10.3	8.95
$\langle T_e \rangle$ keV	6.3	7.2	6.9
$T_{i0}$ keV	13.5	12.4	9.4
$\langle T_i \rangle$ keV	6.3	6.5	6.8

Parameters	Reference	JINTRAC	ETS
$W_{th}$ (MJ)	22.0	23.0	20.8
H98	1.3	1.2	1.18
$\beta_N$	3.1	3.1	3.19
$\tau_e$ (s)	0.64	0.6	0.52
$Z_{eff}$		1.8	1.78

Reference and JINTRAC values are taken from ***L. Garzotti et al, NF 58(2018)***

# Results: 1D profiles



ion[0] - D

Blue - JINTRAC

Yellow - ETS (BGB\*0.5)

Possible reason for under prediction of ion temperature - less NBI power to ions

	Power to e	Power to i
JINTRAC	10.8	22.8
ETS	10.4	19.8

to be investigated

# Current ramp-up modelling



ETS configuration:

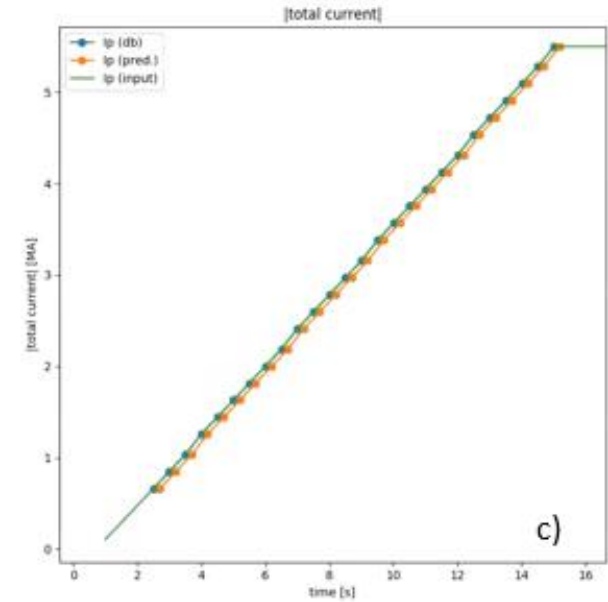
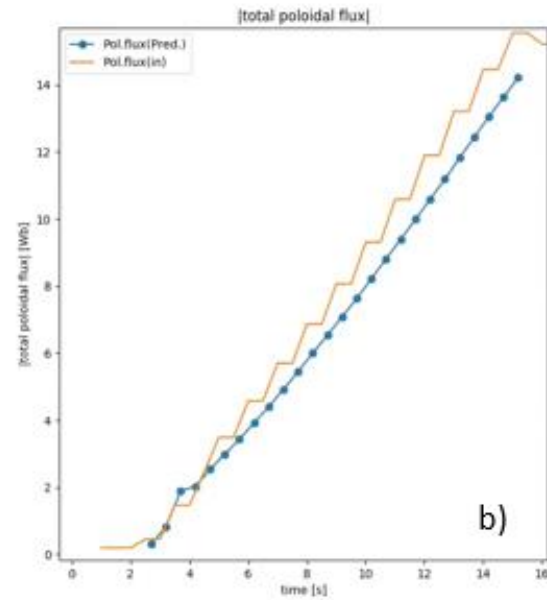
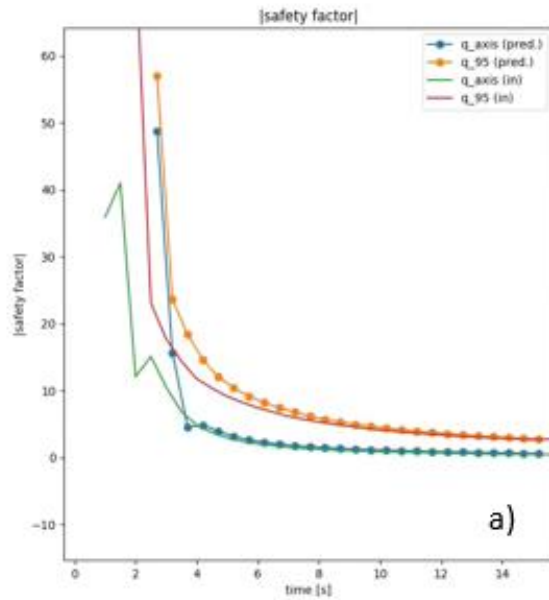
- composition - e,D
- equilibrium - CHEASE
- transport - NCLASS
- heating - Ohmic

Simulation settings:

- poloidal flux - predictive
- ne, Te, nD,TD - interpretive



# Comparison with JINTRAC



In - JINTRAC  
Pred - ETS



- Scenario modelling
  - Understand under prediction of the ion temperature
  - Include density prediction
  - Model different scenarios
- Ramp-up modelling
  - Consistent modelling (predict kinetic profiles)
  - Include impurities
  - Include EC

Comment:

Availability of the input data in IMAS format would be useful for the future simulations