TSVV-5: DIFFER 2021 report

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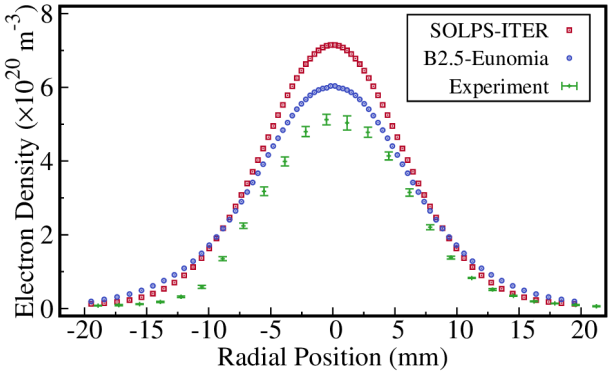
NWO

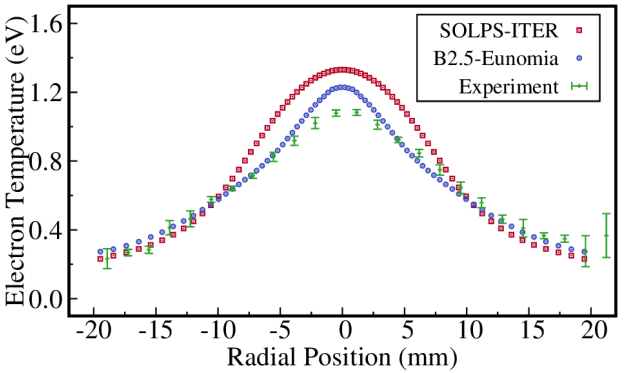
Reference cases of Magnum-PSI solved with SOLPS-ITER

Similar plasma solutions in low and high density cases

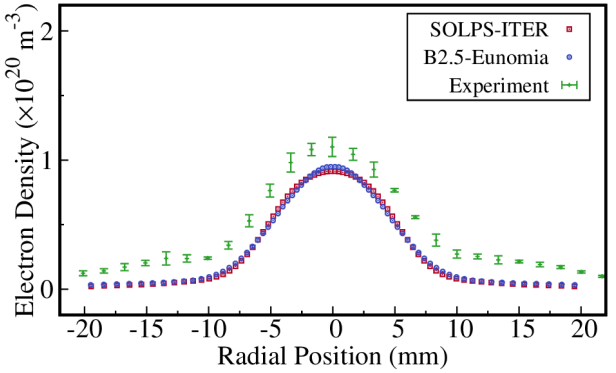
- SOLPS-ITER can produce results close to experimental data (and previous B2.5-Eunomia simulations) in high a low density Magnum-PSI cases.

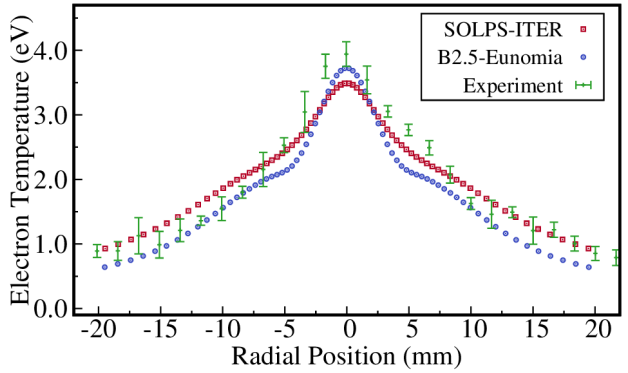
High Density Case
Comparison with TS profiles near the target





Low Density Case
Comparison with TS profiles near the target





Difference in implementation of processes

- A significant number of differences between Eunomia and Eirene regarding the implementation of collision processes have been identified.
- These include EI, MAR and plasma-neutral elastic interaction.
- These results in completely different neutral distribution between the two codes.

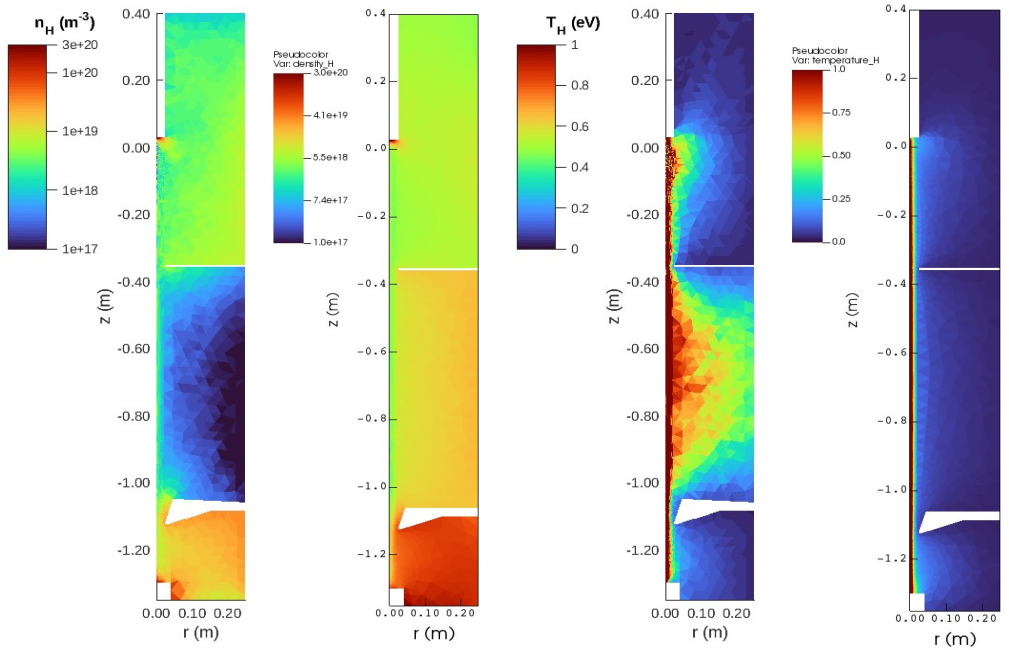


Fig. 3: H density for Eirene (left) and Eunomia (right).

Fig. 4: H temperature for Eirene (left) and Eunomia (right).

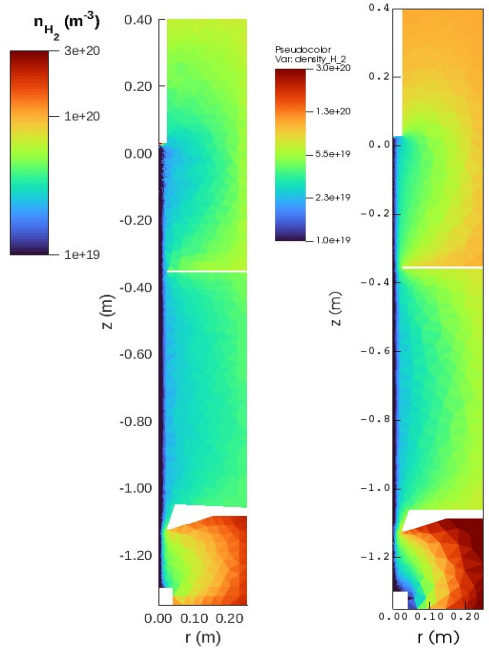


Fig. 5: H_2 density for Eirene (left) and Eunomia (right).

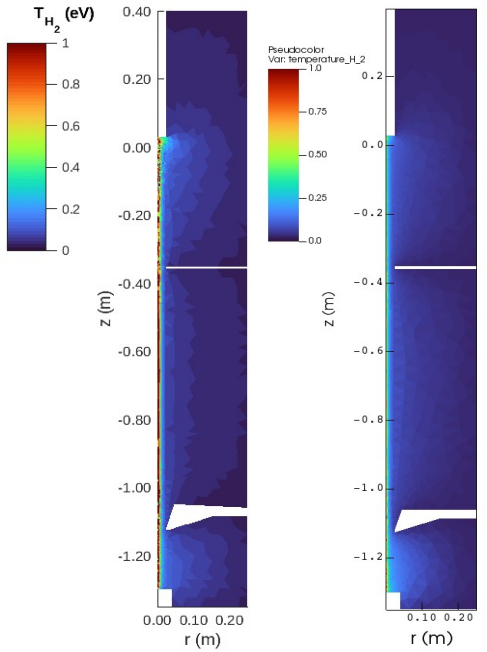


Fig. 6: H_2 density for Eirene (left) and Eunomia (right).

Future works

- Analyse the relevance of collision process in high target pressure (detachment).
- Reduce the free parameters to simulate Magnum-PSI:
  - Potential boundary condition at the source (experiments)
  - Transport coefficients for low density cases (kinetic simulations)
  - Distribution of neutrals (experiments)
  - Axial plasma profiles (experiments)
- Time-dependent simulations.

Coupling SOLPS-ITER with Finite Element Wall Model

Developing of new Finite Element Wall model coupled with SOLPS-ITER

- Currently being developed with the collaboration of Giuseppe Nallo (Politecnico di Torino).
- Only takes into account B2.5 fluxes, but extension to Eirene neutral fluxes is in development.
- This will self-consistently solve the target temperature and overwrite Eirene input parameters for recycling, evaporation, surface temperature…
- Currently the exchange of information is being done in plain text files. Plans to move towards IMAS structure and (possibly) HDF5.
- First steps to make the FEW model to communicate with B2.5 and Eirene.
- Iterative coupling in the next months.

Planning for FEW model

1)Extract relevant neutral fluxes from Eirene and pass them to the wall model.

2)Use a tungsten simplified 2D axial-symmetrical model to check that plasma and neutral fluxes are being correctly read.

3)Check overwriting of Eirene/B.25 parameters.

4)Simple coupled run with Magnum-PSI based on ITER's Monoblock:

1)Self-consistent temperature and sputtering.

2)Implement absorption and outgassing.

3)Involved recycling could be implemented too.

Thank you for your attention

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