Aalto TSVV5 KOM report

TSVV5 Kick-Off Meeting

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April 16th 2021

Future work will focus on better understanding and improving neutral physics models

- Create a set of simplified benchmark cases for code/physics testing

- Use well-defined L-mode JET pulses for code-verification

- Understand and develop physics models (A&M data, molecular CRM, photon tracing)

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Access to simplified benchmarking cases for quick and clear physics model verification

- 1D (flux-tube) simulations for EIRENE standalone simulations
  - → first-order verification against analytic models

- Coupled slab cases for representative plasma simulations
  - → AUG/ASDEX – JET – ITER/DEMO size slabs
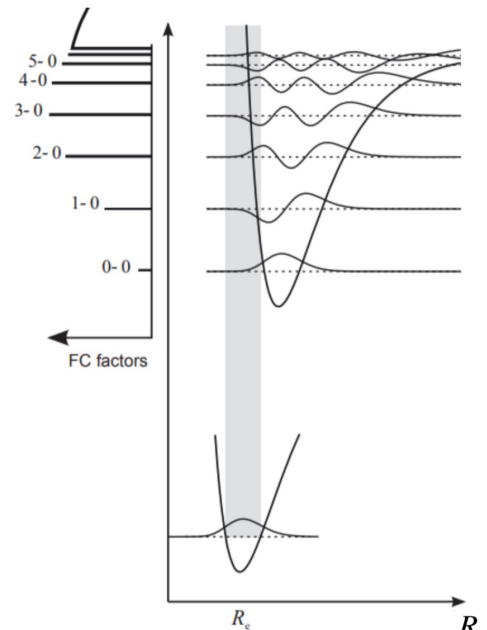
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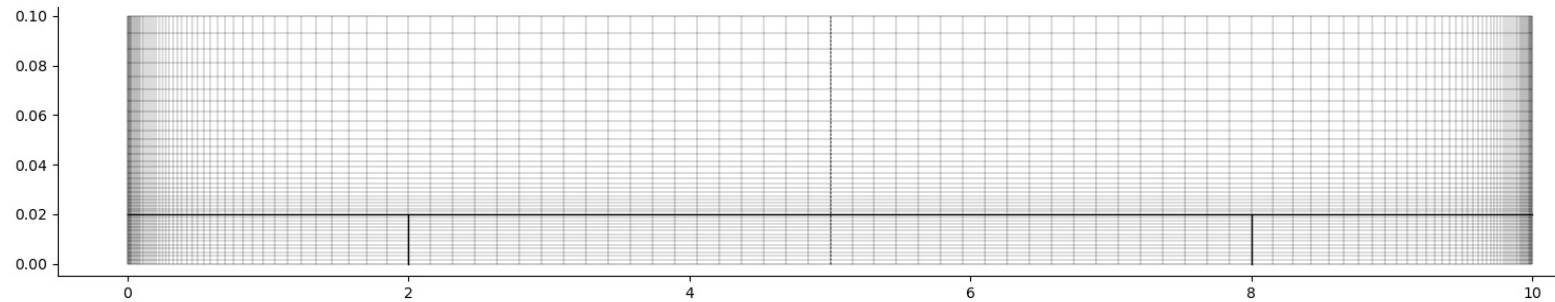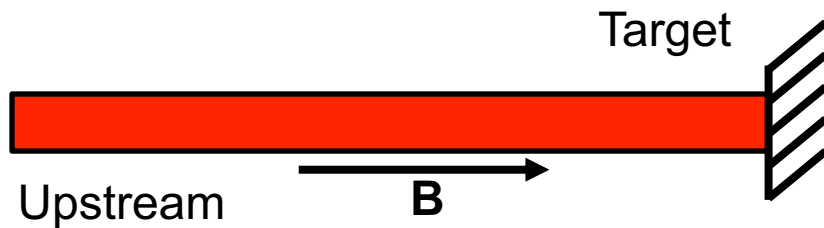
# Use well-defined JET L-mode pulses for code-experiment verification

- Multiple repeat experiments → good diagnostic coverage

- Measurements in all operating regimes
  - Attached → detachment onset → partial detachment → full detachment
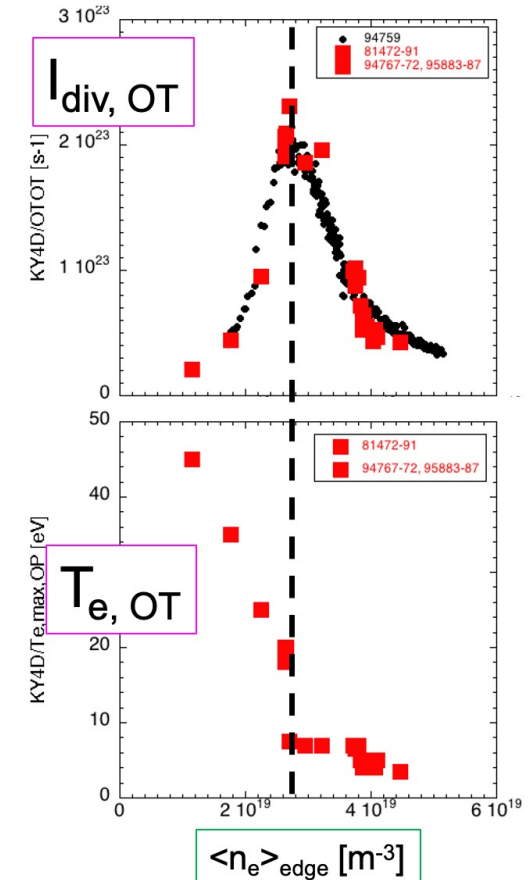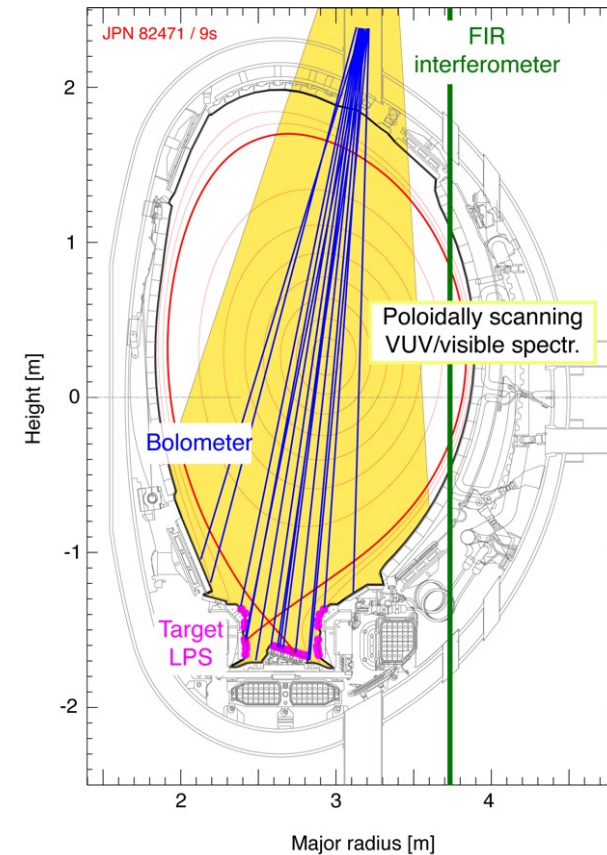
We need to understand where the EIRENE A&M data is from and how it is derived to assess its limitations

C. Hill (2019). *Molecular Spectroscopy* Lecture, Trieste, Italy.

U. Fantz, D. Wünderlich / Atomic Data and Nuclear Data Tables 92 (2006) 853–973
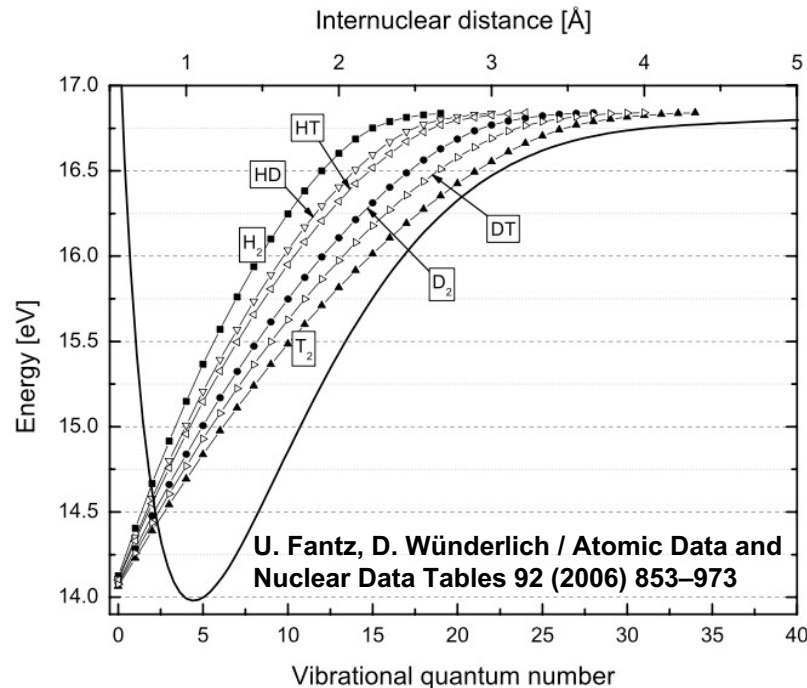
- Comparison of existing databases
  - AMJUEL/HYDHEL – ADAS – YACORA

- Treatment of isotopologues in EIRENE
  - Potential impact of simplified mass-scaling of reaction rates

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The set of molecular species time-dependently evaluated affects the model accuracy

B2-EIRENE: outer target density profile

midplane density:

without $H_2(\upsilon)$: — 5·10¹⁹ m⁻³
with $H_2(\upsilon)$: — 5·10¹⁹ m⁻³
— 6·10¹⁹ m⁻³
— 7·10¹⁹ m⁻³
— 8·10¹⁹ m⁻³
— 9·10¹⁹ m⁻³

U. Fantz et al. / Journal of Nuclear Materials 290–93 (2001) 367–373
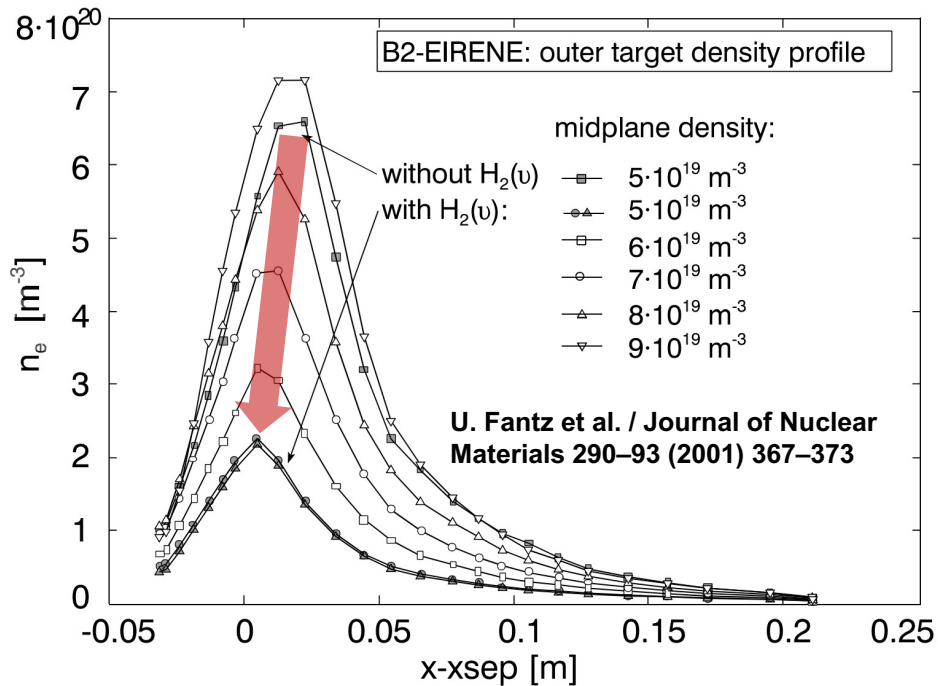
- Metastables necessary but not sufficient(!)
  →P.T. Greenland, *Proc. R. Soc. Lond.* (2001)

- Truncation of the A&M model
  - A&M data necessary for evaluation and creation
  - → CRM necessary (YACORA, CRUMPET,…)

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Ad-hoc inclusion of Ly opacity increases plasma ionization → pending activation of the EIRENE photon-tracing module
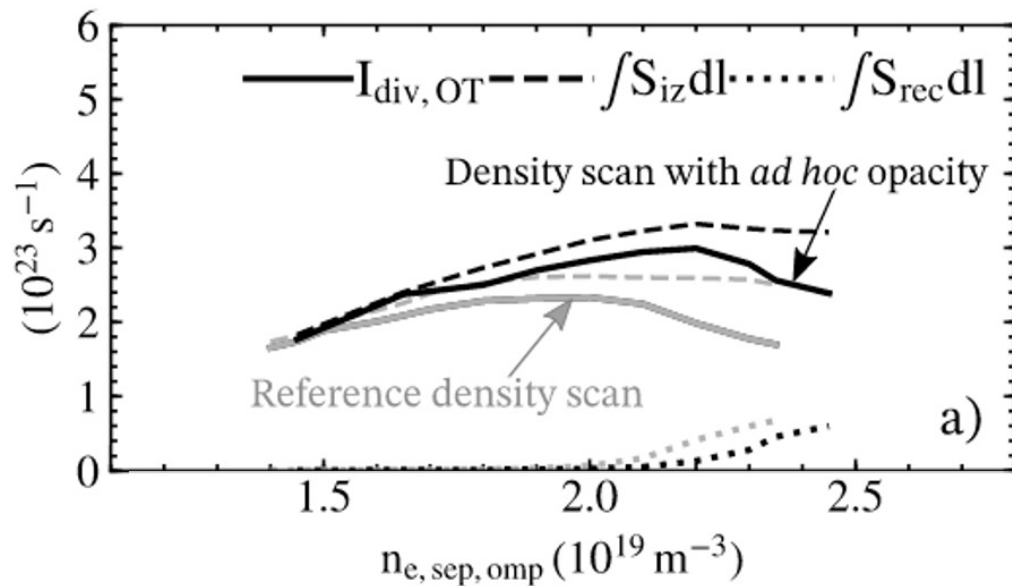
- Experimental Ly-β escape factor ~0.4 (rollover) to ~ 0.25 (full detachment)
→ Ly-α 90-98% re-absorbed along the vertical LOS
  – B. Lomanowski et al., PPCF 2020

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