TSVV4 Status & Outlook

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DSD Jour Fixe 12-2024

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

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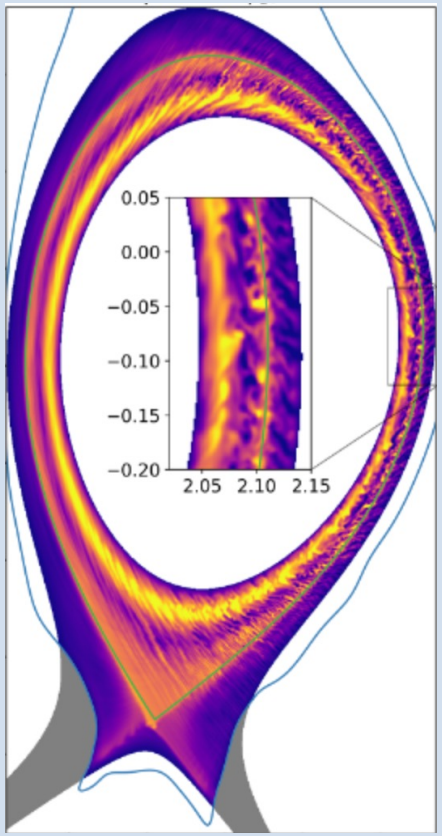
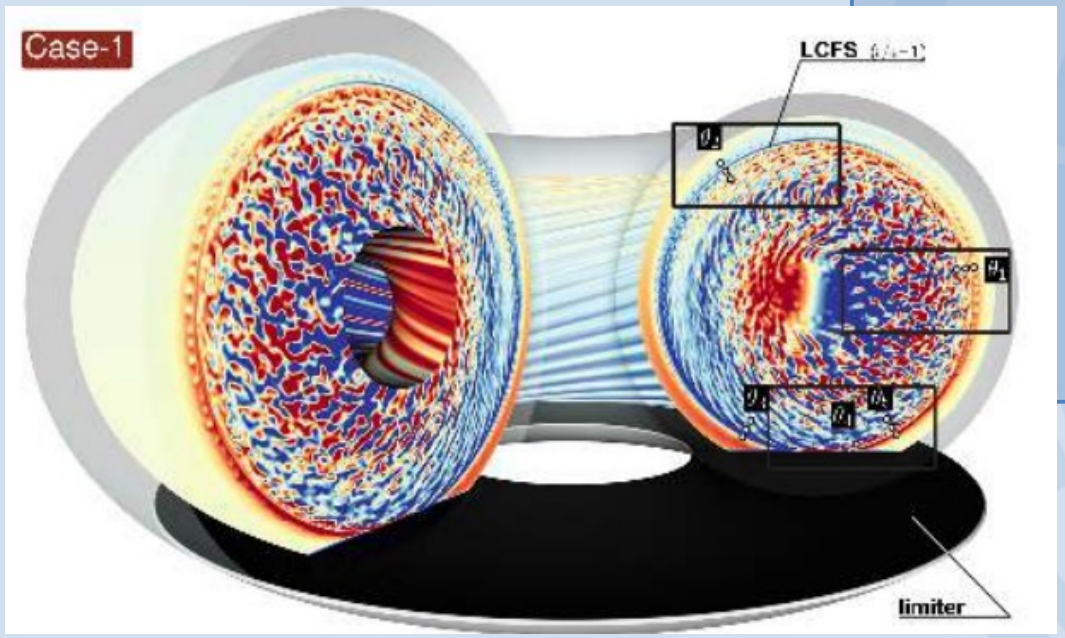
Setup of TSVV Task 4

Key deliverables	Our work
Kinetic codes for the plasma edge ▸ TSVV T1	GENE-X (IPP) PICLS (IPP/SPC) GyselaX (CEA)
Deal with open field lines	BIT1 VOICE semi-analytical methods
Limitations of Gyrokinetics	ssV (hybrid) GempicX Moment-based edge GK
Coupling methods	Neutrals Impurities Fluid-kinetic coupling

Aim: GK codes for Edge + SOL

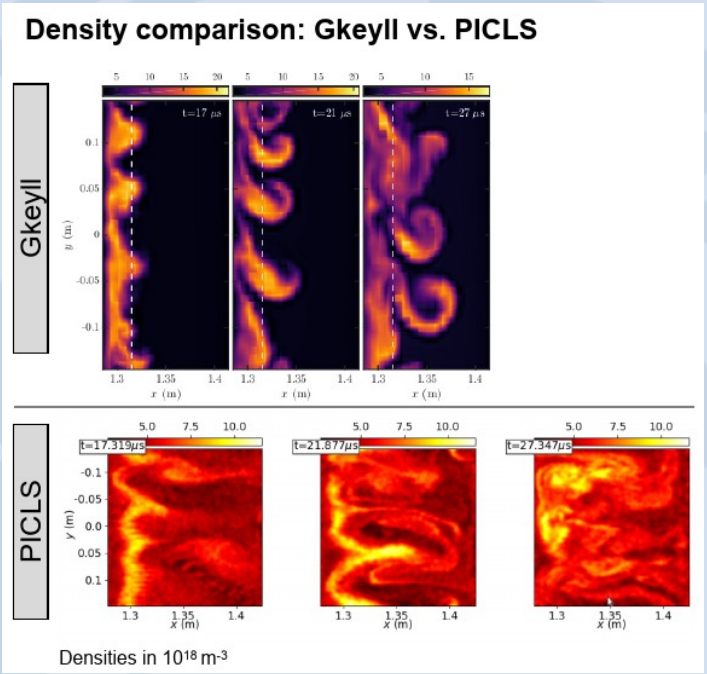


GENE-X /
D. Michels et al.,
Phys. Plasmas 2022



GyselaX /
G. Dif-Pradalier et al.,
Commun. Phys. 2022

PICLS /
A. Bottino
2021



Work plan for 2025

- **GENE-X**: Inclusion of **neutral and impurity physics**
- **GyselaX**: Inclusion of **neutral physics**, testing of **immersed boundary implementation** with kinetic ions and electrons
- **PICLS**: **Coupling with core codes** for limiter simulations, **finalizing the EM implementation**
- **BIT-1**: Continuation of **DEMO divertor** and **ITER SOL simulations**.
- **Semi-analytical sheath model**: Development of **coupling schemes** with gyrokinetic code(s)
- **Hybrid code ssV**: Continued characterization of **fully kinetic ITG physics**
- **GEMPICX**: Implementation of **cylindrical coordinates**
- **Gyro-moment approach**: Further development of **full-f moment approach**

Ideas for 2026/27

- Further improve **neutral models** for all GK codes:
  - Moving to higher moments
  - Eventually explore coupling to EIRENE
- **Further improve sheath** boundary conditions for all codes
- Develop **benchmark cases** tractable by all our GK codes (e.g. LAPD + sheath + neutrals)
- **Implement $B_{\parallel}$** magnetic fluctuations for all GK codes
- Develop methods to **deal with large temperature disparities** core ⇔ edge
- Explore efficient ways to treat **impurities + radiation**
- **Further develop fully kinetic/hybrid codes** ssV / GEMPICX
- **Further development of gyro-moment approach**

- **Explore RMP physics in GK SOL codes?**