TSVV3 5/2/2025

GBS workplan for 2026/27

Swiss
Plasma
Center

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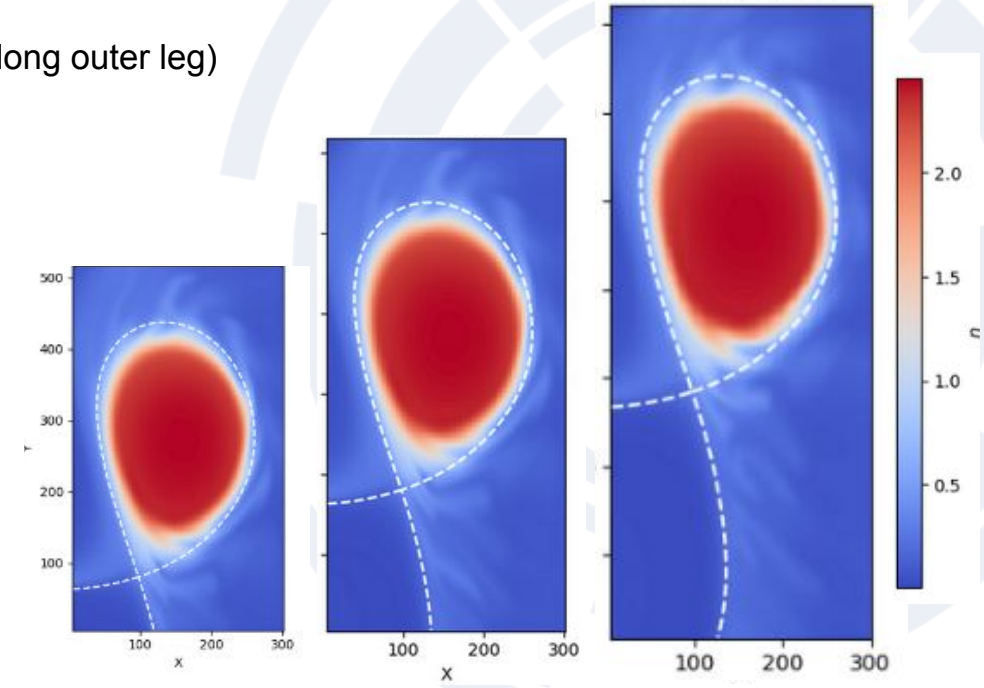
GBS toward realistic tokamak and stellarator simulations and their validation

- **Validation of tokamak simulations** with variable magnetic geometry:
  - Comparison with different leg lengths
  - Exploit results from TCV-X23 case (LSN with long outer leg)
  - Negative triangularity cases

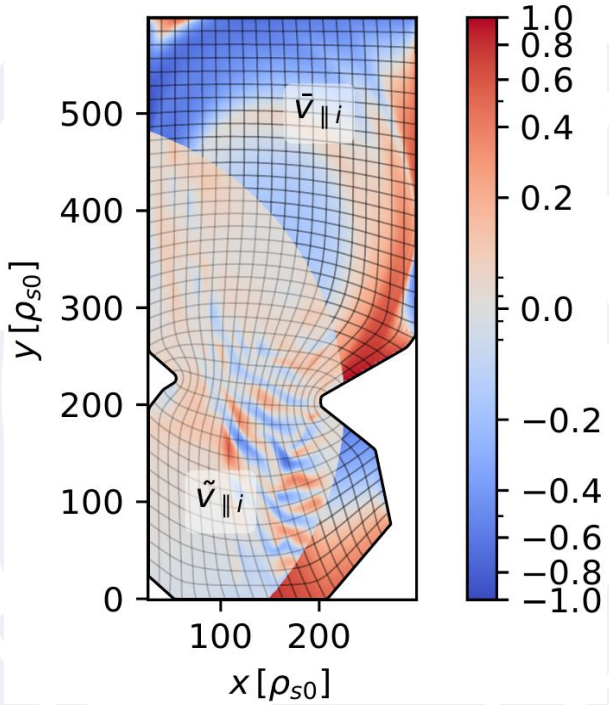
    (EUROfusion grant 2025/26 Mancini)
  - Simulations of larger devices (possibly JT60)



[courtesy of S.Garcia]

GBS toward realistic tokamak and stellarator simulations and their validation

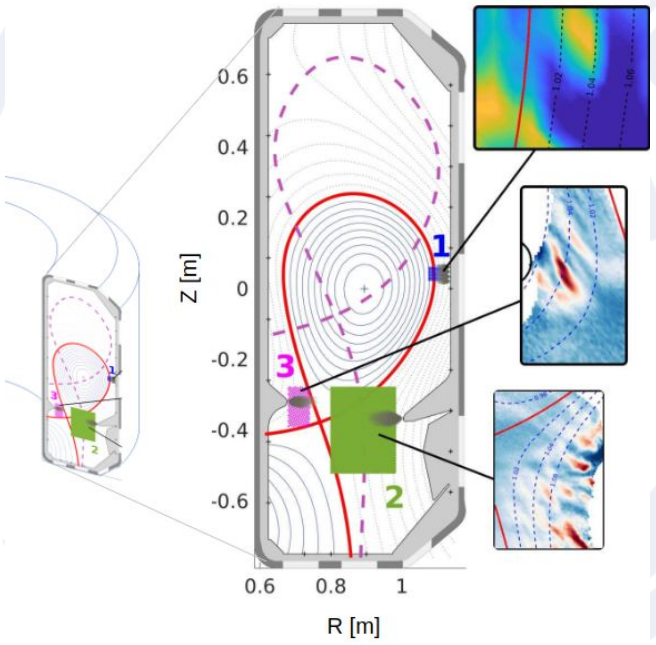
- Validation of tokamak simulations with variable magnetic geometry
- **Realistic wall geometry** impact on turbulence and neutral dynamics:
  - Simulations with TCV-like baffles
  - Simulations with closed divertor



[L. Stenger et al, poster Varenna (2024)]

GBS toward realistic tokamak and stellarator simulations and their validation

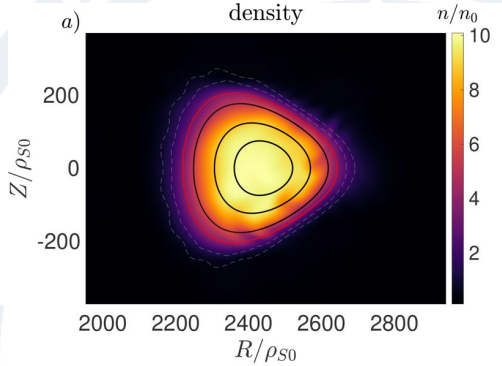
- Validation of tokamak simulations with variable magnetic geometry
- Realistic wall geometry impact on turbulence and neutral dynamics
- Interplay between **low-Z impurities** and turbulence:
  - Analyse impact of carbon wall in tokamaks
  - Analyse impact of active diagnostic on performance (e.g., GPI, He thermal beam)

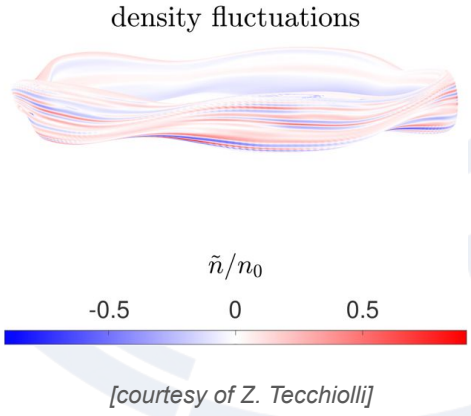


[courtesy of Y.Wang]

GBS toward realistic tokamak and stellarator simulations and their validation

- Validation of tokamak simulations with variable magnetic geometry
- Realistic wall geometry impact on turbulence and neutral dynamics
- Interplay between low-Z impurities and turbulence
- **Stellarator turbulence** studies:
  - Validation against experimental data
    (e.g. W7-AS, W7-X, HSX, LHD)
  - Study neutrals impact on turbulence in stellarators





[courtesy of Z. Tecchiolli]

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GBS toward realistic tokamak and stellarator simulations and their validation

GBS code improvements:

- **Validation of tokamak simulations**→
  - Improve efficiency of plasma model (e.g., energy conserving operators, IMEX time integration)
  - Port neutrals solver to GPU
  - Improve comparison methods with other codes and experiments (e.g., exploit IMASification)
  - Implementation of synthetic diagnostics collecting data on the fly
- **Realistic wall geometry** → Improve efficiency of neutral model (e.g., hierarchical-method with multi-species)
- **Low-Z impurities** → Expand multi-species framework to include easily any species on GPU
- **Stellarator turbulence** → Neutral model for stellarator simulations