



TSVV5 – Neutral gas dynamics in the edge
KUL – workplan 2025

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FHK-modeling

- Further advance AFN models in SOLPS-ITER
 - Validation n-n collision effects with kinetic simulations
 - Extension to 'hydrodynamic' closure model for void regions w/o plasma
 - Development fluid model for molecules
- Hybrid modeling based on Hilbert expansion
 - Comparison of different options for boundary conditions
 - Implementation of an adaptive spatial hybrid method with error-based interface position
- Development KDMC model (fully particle based)
 - Extension to heterogeneous background, incl. unstructured mesh
 - Validation of source estimators
 - Integration with multi-level scheme

Error analysis, AD, and UQ

- Error analysis for multi-species cases
 - Understand origin of large bias (compared to D-only cases)
 - Provide recommendations for numerical parameters and simulation strategies
- Providing derivatives of EIRENE outputs through algorithmic differentiation (AD)
 - Analysis of AD derivative problems in high recycling
 - Analysis of impact estimators on accuracy of derivatives
 - *Implementation adjoint AD with TAPENANE*
 - *Forward (and adjoint) differentiation of coupled B2.5-EIRENE solver*
 - *Assess potential for building implicit coupling to plasma codes (B2.5, SOLEDGE3X) and providing sensitivities (ERO2.0)*
 - depending on outcome theoretical analysis –