TSVV TASK 7: PLASMA-WALL INTERACTION IN DEMO

Dmitry Matveev on behalf of TSVV-07 team

TSVV5 EIRENE Code Camp | DIFFER | 20.11.2024

TSVV-07 PLASMA-WALL INTERACTION IN DEMO

Objectives

Assessment of

- Steady-state W erosion rates

- Preferential W re-/co-deposition locations

- Dust mobilization, survival and accumulation

- PFC response to transients: melting, splashing

- W erosion for locations affected by transients

- Tritium inventory: co-deposition, bulk retention

Codes and interactions

ERO2.0
→ PWI & impurity tracing

MIGRAINe
→ dust transport

MEMENTO
→ transient melting

BIT1
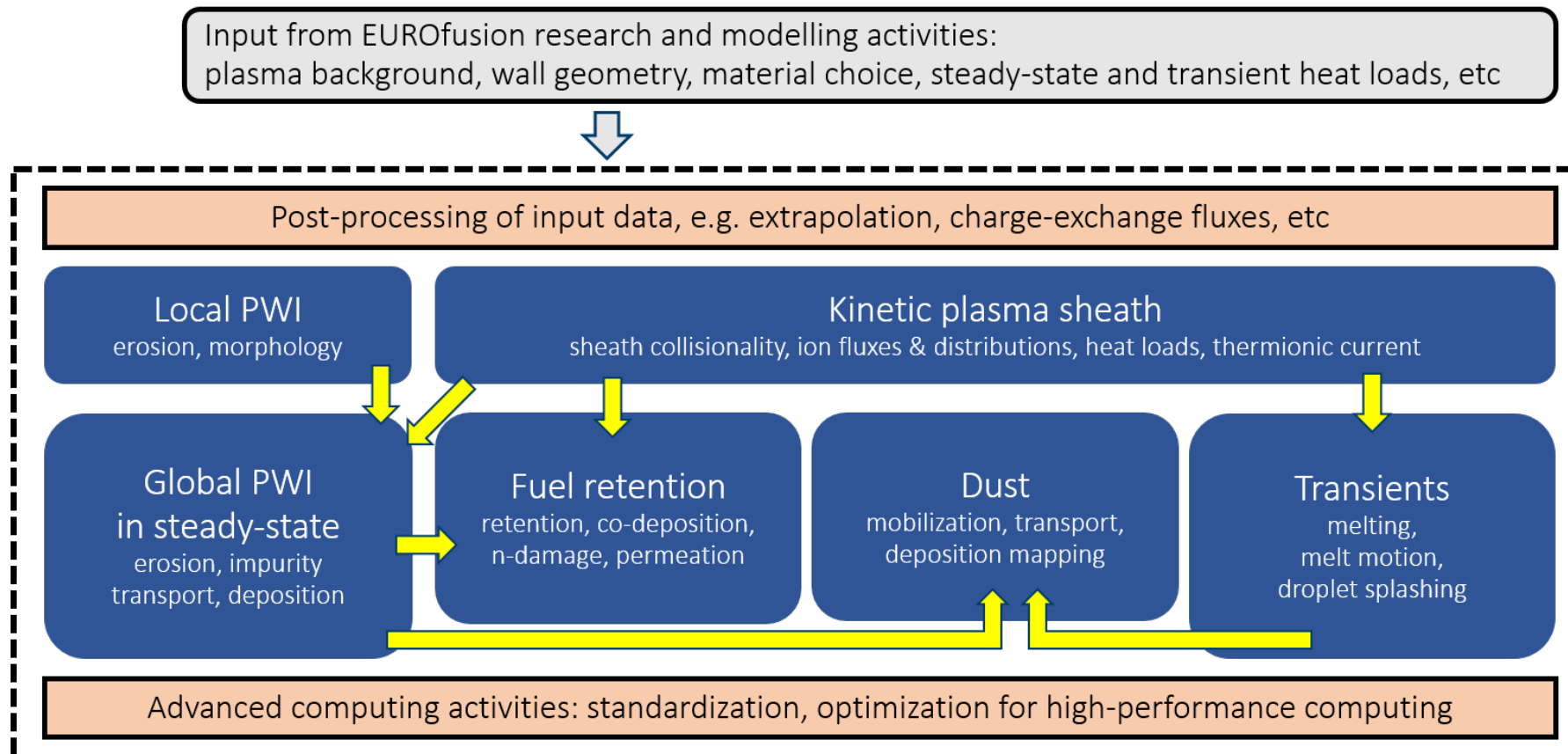→ high density sheath
→ dynamic sheath

SPICE
→ thermionic e- emission
→ fluxes to shaped PFC

SDTrimSP, MD
→ erosion yields

FESTIM, TESSIM, RAVETIME
→ T retention & permeation

Input from EUROfusion research and modelling activities:
plasma background, wall geometry, material choice, steady-state and transient heat loads, etc

Post-processing of input data, e.g. extrapolation, charge-exchange fluxes, etc

Local PWI
erosion, morphology

Kinetic plasma sheath
sheath collisionality, ion fluxes & distributions, heat loads, thermionic current

**Global PWI
in steady-state**
erosion, impurity
transport, deposition

Fuel retention
retention, co-deposition,
n-damage, permeation

Dust
mobilization, transport,
deposition mapping

Transients
melting,
melt motion,
droplet splashing

Advanced computing activities: standardization, optimization for high-performance computing

Project overview paper: *D. Matveev et al, Nucl. Fusion 64 (2024) 106043*

TSVV-07 PLASMA-WALL INTERACTION IN DEMO

Interaction with WPs

- WP-PWIE
  - W sputtering data from lab experiments and modelling (incl. supersaturated W)
  - Experiments in support of development and parameterization of models of tritium transport in materials

- WP-TE
  - Experimental programs at tokamaks (AUG, WEST) for validation of modelling tools (e.g. ERO2.0, MEMENTO)

- DEMO Central Team (DCT)
  - Geometry, equilibrium ad plasma background(s) for wall lifetime (ERO2.0) and dust inventory (MIGRAINe)
  - Transient heat loads for melting simulations (TQ, CQ)
  - Transient plasma profiles for start-up and VDEs for dust mobilization and transport

- TSVVs & Thrust 2
  - TSVV-05 – EIRENE as part of SOLPS-ITER etc for consistent plasma backgrounds and CX neutrals distributions
  - TSVV-06 – W impurity sources, screening, coupling to core plasma
  - Potential link to other TSVVs via the interest in plasma backgrounds and impurity sources (or other PWI data)