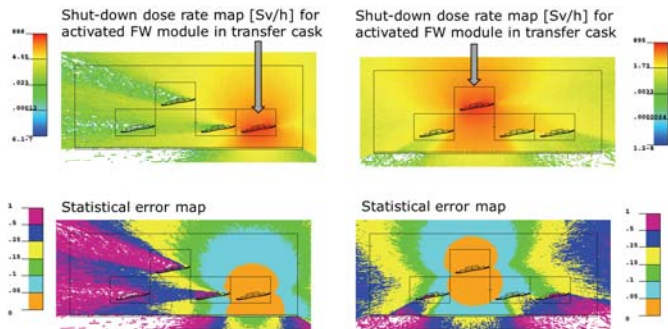


Advanced Computational Approaches and Tools for High-Fidelity Nuclear Analyses of Fusion Facilities

R2Smesh approach for calculations of dose rate distributions of activated components

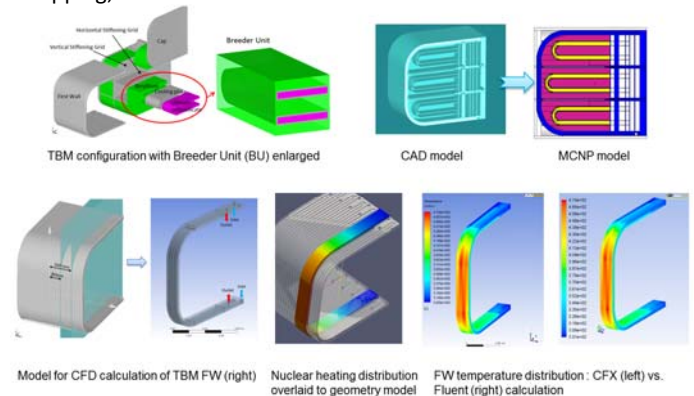
- **Rigorous 2-step (R2S)** approach: System of codes, data and interfaces for simulating neutron induced activation during operation and decay photon transport after shutdown.
- Utilizes **MCNP** for transport calculations (neutron and decay photons) and **FISPACT** for activation calculations with suitable coupling scheme.
- **R2Smesh** extension for calculation of shutdown dose rate distributions on superimposed mesh grid using MCNP's mesh tallies.
- **Portable decay gamma source** on high resolution mesh independent on geometry: irradiate components in ITER, remove and transfer them to external locations for calculation of radiation dose fields.

ITER transfer cask loaded with four FW modules, one activated



Multi-physics coupling approach for neutronics, thermal-hydraulic (TH) and structural mechanics (SM) analyses

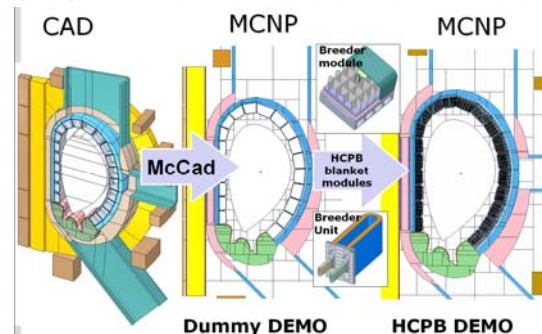
- Utilization of SALOME computation platform for integration of McCad and newly developed McMeshTran meshing tool.
- McMeshTran for processing of heating mesh tallies (e. g. from MCNP) for use with FE and CFD codes (translation and mapping).
- Interfaces to SALOME internal or adapted modules and external codes, e. g. MCNP, CFX, FLUENT, ANSYS.
- Entire analysis cycle can be performed: CAD geometry; neutronics, TH and SM calculations - all based on same underlying model; visualisation of results on same CAD geometry.
- Verification on TBM/FW case: McCad processing, McMeshTran mesh mapping, CFX and Fluent calculations and ParaView result visualisation.



McCad geometry conversion tool

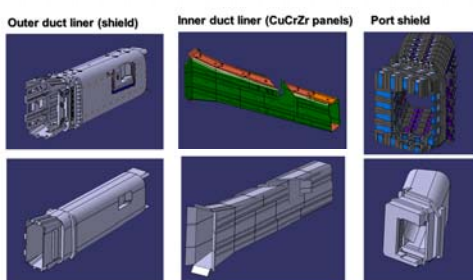
- Automatic conversion of CAD geometry data into semi-algebraic representation for Monte Carlo simulations with MCNP and Tripoli.
- Based entirely on open source software running under Linux Operating System, coded in C++.
- Related visualization capabilities of mesh tally results overlaid to CAD geometry through coupling with ParaView software.
- Improved algorithms for geometry decomposition and void generation implemented in the frame of EFDA PPPT programme.
- In routine use at KIT for conversion of (engineering) CAD geometry models for neutronics analyses of ITER, IFMIF, and DEMO using MCNP
- Available to external users as test version upon request.

DEMO model generation – EFDA PPPT programme (2013)

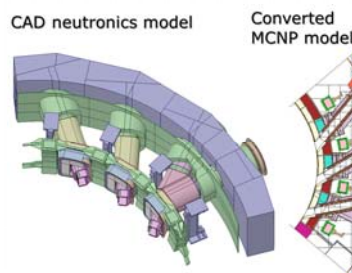


ITER – NBI port model generation

Generation of simplified CAD neutronics models from engineering CAD models using CATIA & SpaceClaim



Conversion of CAD neutronics model (NBI port segment) to MCNP model using McCad



Integration into 80° "A-lite" MCNP model of ITER

