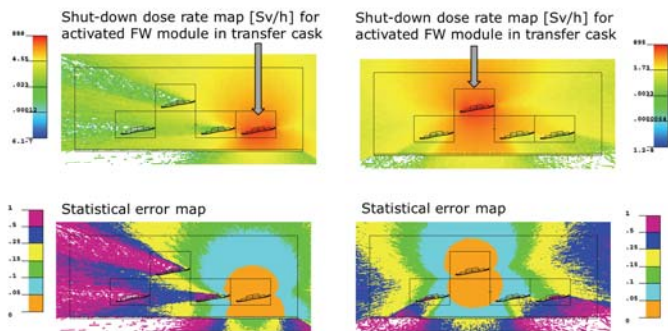


Advanced Computational Approaches and Tools for High-Fidelity Nuclear Analyses of Fusion Facilities

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

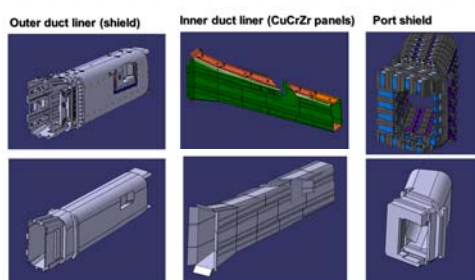


McCad geometry conversion tool

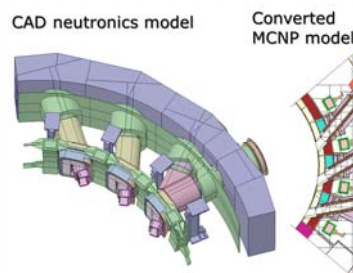
- Automatic conversion of CAD geometry data into semi-algebraic representation for Monte Carlo simulations with MCNP and Tripoli.
- Based entirely on open source software running under Linux Operating System, coded in C++.
- Related visualization capabilities of mesh tally results overlaid to CAD geometry 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.

ITER – NBI port model generation

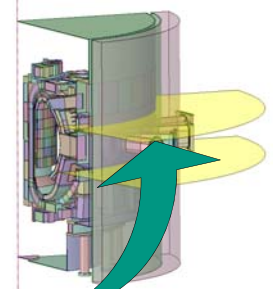
Generation of simplified CAD neutronics models from engineering CAD models using CATIA & SpaceClaim



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

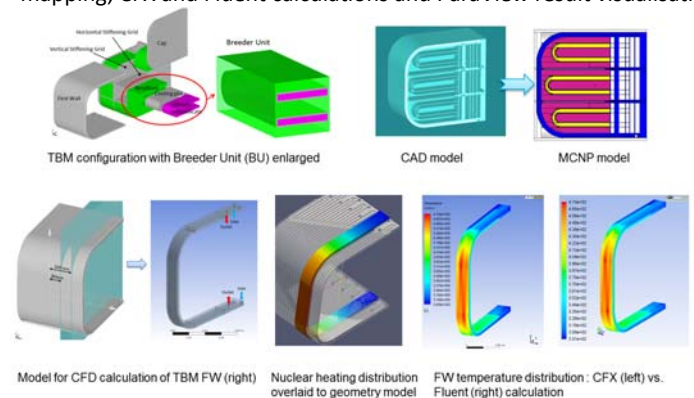


Integration into 80° "A-lite" MCNP model of ITER



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.



DEMO model generation – EFDA PPPT programme (2013)

