IPP INSTITUTE OF PLASMA PHYSICS
OF THE CZECH ACADEMY OF SCIENCES

Modelling of the interaction of RE with PFC

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2022 Plan

- Workflow of particle tracing codes coupled to FLUKA
    - spatial distribution and energy levels of RE heat loads on the JT-60SA PFC
- Simulations with 2 particle tracing codes for selected scenarios - scans over RE energy and pitch angles
    - ORBIT
    - CODE - Full orbit particle tracing code developed at COMPASS
- Identification of areas where REs terminate with different energy and pitch angle
- FLUKA/FluDAG simulations with inputs from the particle codes - deposited energy density profiles in simplified and full CAD geometry

FluDAG progress

- RE Energy deposition in divertor CAD geometry by DAGMC [1]
- Validation of results with FLUKA simulations in simplified geometry
  - Energy deposition in the heatsink 2 orders of magnitude lower
- Possible to import results to a FEM solver (ANSYS) for modelling of temperature distribution - tested at COMPASS
- Requirements - CAD models of other PFC (inner and outer limiters)
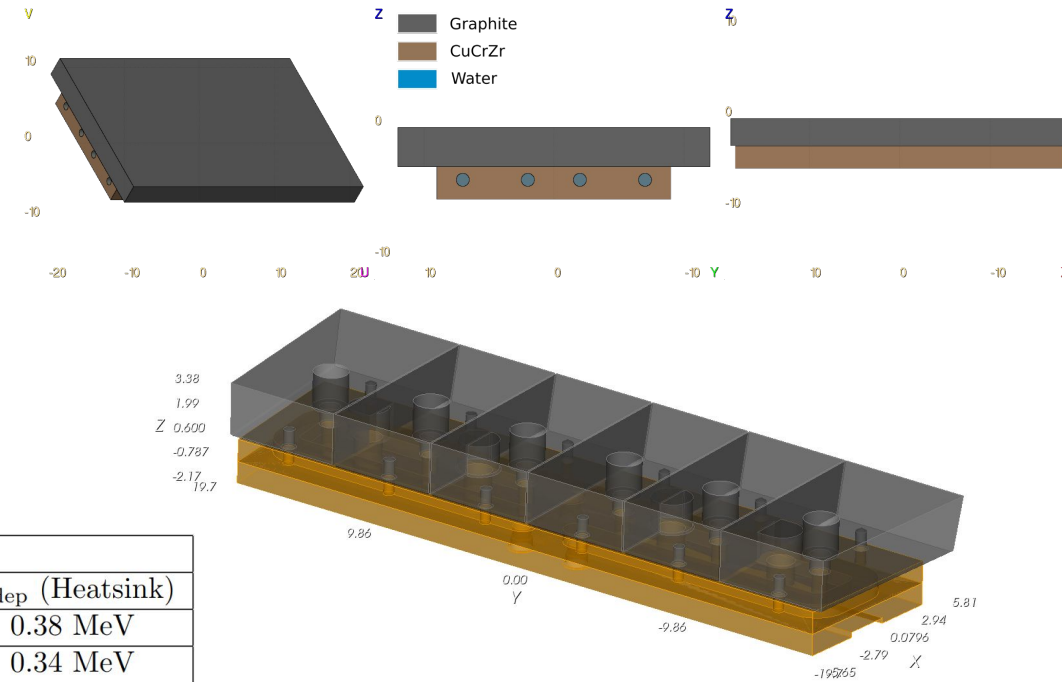

| $E_{\mathrm{RE}} = 20$ MeV, $\alpha = 10°$		
	E_{dep} (Graphite)	E_{dep} (Heatsink)
DIV (simplified)	18.77 MeV	0.38 MeV
DIV (CAD)	18.69 MeV	0.34 MeV
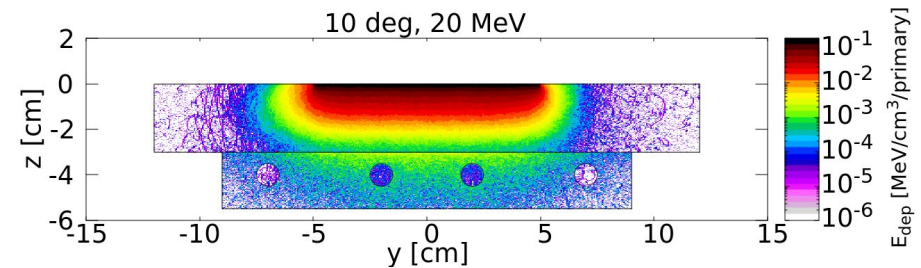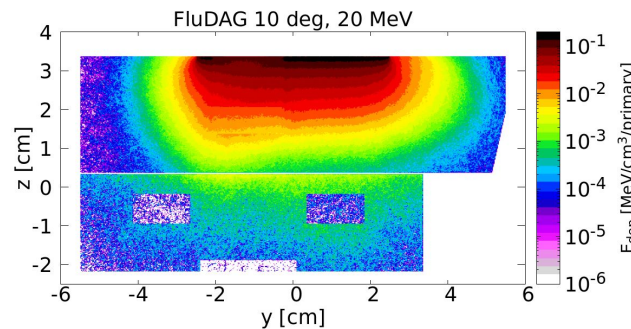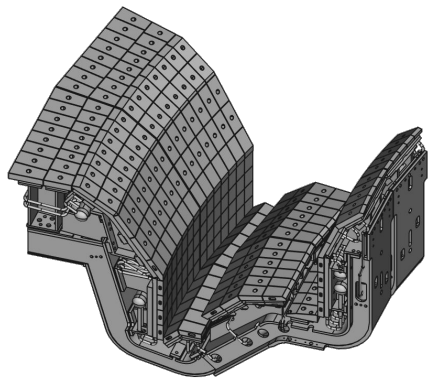
[1] A. Davis et al, Nucl. Instrum. Methods. Phys. Res. 915 (2019) 65-74

RE Particle tracing

- RE tracing in 3D perturbed magnetic field by ORBIT [1] and CODE [2]
- Output: spatial and pitch-angle distribution of REs as a function of electron energy
- Spatial distribution of RE impact to be used for FLUKA simulations
- Requirements:
  - Magnetic equilibrium
  - Estimated guess on spectrum and amplitude of MHD perturbations
  - Estimates on the RE energy and pitch angle ranges
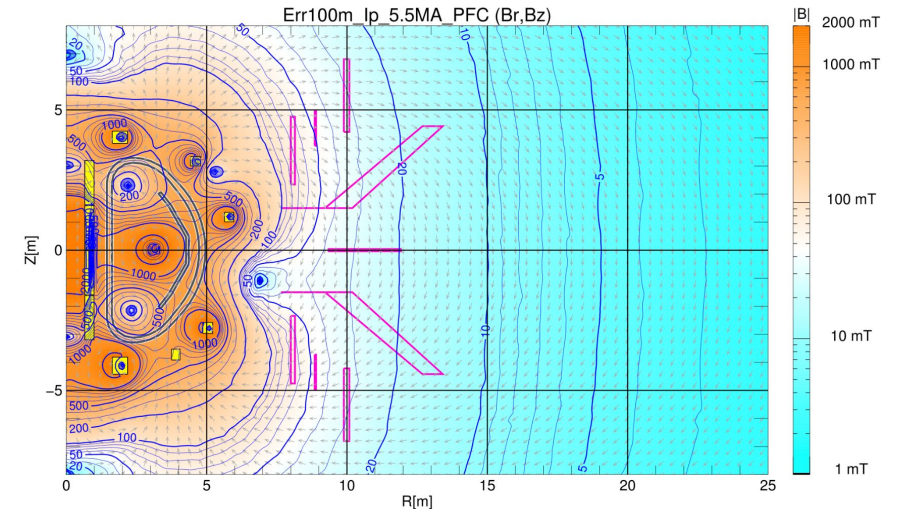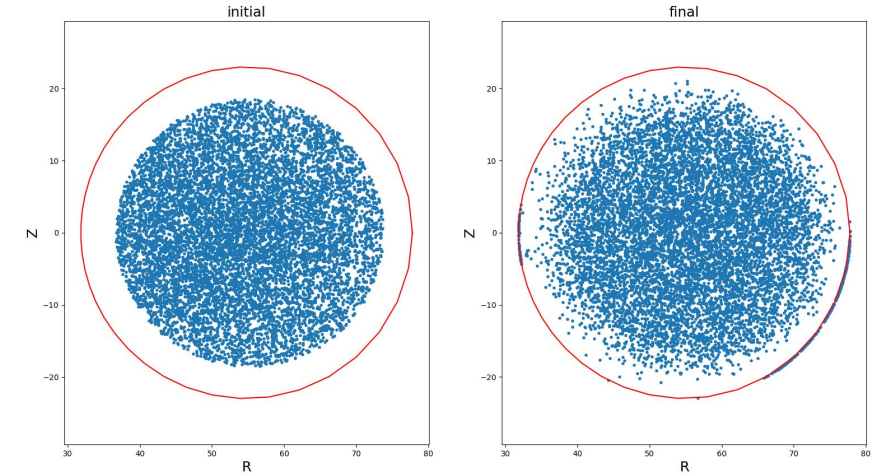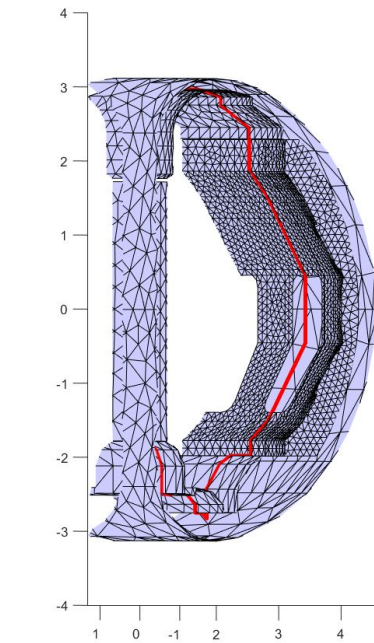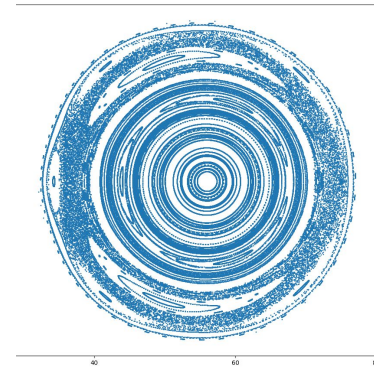
[1] R.B. White et al, Phys. Fluids 27.10 (1984) 2455-2469
[2] M. Hron et al, Nucl. Fusion 62 (2022) 042021