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SMITER: a field-line tracing environment for ITER

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The ITER plasma-facing components (PFC) are now fully designed and procurement is underway. A key utility in such design is field line tracing for different magnetic equilibria which allows the definition of component front surface shaping. On ITER, this design phase has deployed both analytic theory [1] and the tracing codes CASTEM and PFCFLUX [2]. Attention is now turning towards the critical issue of management and control of PFC heat fluxes, so important in an actively cooled device such as ITER. To facilitate the development of control algorithms, particularly for protection of the beryllium main chamber first wall panels [3], a new field line tracing environment, SMITER, has been developed, featuring a sophisticated Graphical User Interface (GUI) that uses the SMARDDA [4] kernel and has been thoroughly benchmarked against PFCFLUX for specific cases of first wall panel and divertor target loading. SMITER allows power deposition mapping in the full 3-D CAD geometry of the machine, taking as input a user-defined specifications for parallel heat flow in the scrape-off layer. In addition to its use as input for shape control algorithms [3], the tool will also be important for the production of synthetic surface temperatures using built in thermal models for input to diagnostic design.

The newly developed GUI framework provides CAD and IMAS integration, parametric CAD components catalogue, meshing, visualization, Python scripting, storage in hierarchical data files (HDF) with several simulation cases in one study running in parallel and using MPI for code speedup. Integrated ParaView module can augment CAD geometry, meshes and results.

[1] P. C. Stangeby, Nucl. Fusion 51 (2011) 103015; [2] M. Firdaouss et al., J. Nucl. Mat. 438 (2013) S536; [3] H. Anand et al., to be published at IAEA FEC 2018; [4] W. Arter et al., IEEE Tr. Plasma Sc. 42(7) 1932, arXiv:1403.7142

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