Core-edge-wall plasma transport simulations with FACETS

A. Pletzer, A. Hakim, M. Miah, S. Kruger, J. Carlsson, J. Cary (Tech-X), A. Pankin (Lehigh U), R. Cohen, T. Rognlien, T. Epperly (Lawrence Livermore National Lab), D. McCune, K. Indireshkumar Princeton Plasma Physics Lab), A. Pigarov, S. Krasheninnikov (U of California-San Diego), A. Malony (Paratools), J. Larson, L. McInnes (Argonne National Lab), D. Estep (Colorado State U), J. Kuehn (Oak Ridge National Lab)

The Framework Application for Core Edge Transport Simulation (FACETS) is a SciDAC project that started in 2007 with the aim of producing tokamak core-to-wall transport simulations on massively parallel architectures. FACETS integrates the best available software components from the fusion and applied mathematics communities. The framework presently incorporates the GLF23 turbulent transport models via the FMCFM generic interface for the computation of core thermal and particle fluxes, the UEDGE model for two-dimensional transport in the open field region, with the soon-to-be incorporated 1D WALLPSI model for plasma-wall interactions. Other components such as NUBEAM for ion heating will also come on line. Parallelism has been an integral part of FACETS since day one, with each component (core, edge, and wall) living on disjoint sets of processors. Coupling between components, which involves the exchange of fields or fluxes at the interfaces, can be implicit. A core solver using multigrid and based on the Petsc SNES library is available for the implicit time advance of core fields (ne, Te, Ti). Here, we will report on the progress of assembling FACETS, present some positive scaling results of the core solver on up to 64 cores as well as initial benchmark results against the ASTRA code.