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**Benchmarking the parallel FACETS core solver**[1] ALEXANDER PLETZER, AMMAR HAKIM, MAHMOOD MIAH, JOHN CARY, Tech-X Corp, SCOTT KRUGER, Tech-X, SRINATH VADLAMANI, Tech-X Corp, ALEXEI PANKIN, Lehigh U, TECH-X CORP TEAM, LEHIGH U TEAM — The Framework Architecture for Core-Edge Transport Simulations (FACETS) is a SciDAC project targeting whole-device plasma simulations in tokamaks such as ITER. A key component in the multi-physics FACETS effort has been the development of a core transport solver (FACETS::core) that is both robust and runs in parallel. FACETS::core can interface to any of the flux calculators available through the Framework for Modernization and Componentization Fusion Modules (FMCFM), including GLF23 and MMM95. Electron and ion temperatures are advanced implicitly using the nonlinear fluxes from GLF23 (or other model). Here, we present results comparing the stability and accuracy of FACETS::core with the ASTRA transport code. Although FACET::core is slower than ASTRA on a per time step basis, the multigrid algorithm and PETSc/SNES solver applied by FACETS::core allow the latter to take orders of magnitude larger time steps, conferring to FACETS::core a 5-10x overall performance improvement over ASTRA. This, combined with the capability of FACETS::core to scale to tens of processors, contributes towards a wall clock time reduction of the core transport computation by a factor 200-500x.

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