# Implementation of and first results from FACETS embedded core turbulence transport solver

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We present progress in implementation of a time-dependent solver designed for core transport equations with fluxes computed from gyrofluid/gyrokinetic calculations. The gyrofluid fluxes are computed using the theory based Trapped Gyro-Landau Fluid (TGLF) flux model while the gyrokinetic fluxes are computed from the continuum code GYRO. The solver itself is implemented in the FACETS whole-device modeling framework. Our solver uses a matrix-free Newton solver from the PetSC library, a hypersecant Jacobian evaluation and a novel grid sequencing strategy to accelerate the convergence of the nonlinear iterations, keeping the flux evaluations to the minimum. In addition, we have implemented a load balancing scheme using mixed integer linear programming techniques allowing us to achieve near-optimal parallel scaling while using GYRO.

We present results of evolving temperature profiles of electrons and ions from DIII-D shot 118897. The initial profiles are taken 1355 ms into the discharge and are evolved for about 100 ms. Time dependent boundary conditions are applied at the core-edge boundary and are taken from experimental measurements. Core heating profiles are held fixed during the evolution and are taken from an interpretive ONETWO simulation. Neoclassical fluxes are computed using a Chang-Hinton model. We compare the evolution with embedded turbulence fluxes to that obtained from the GLF23 model and discuss plans to validate the solver with experimental data.