

Detailed Modeling of Tokamak Antenna Modules Immersed in Edge Plasma

SciDAC Project: Center for Simulation of Wave-Particle Interactions (CSWPI)

David N. Smithe, Travis M. Austin (Tech-X Corporation), and the CSWPI Team

We use a large-scale 3D time-domain software package[1] to model the electromagnetic behavior of ICRH antenna modules in the large tokamaks, including the presence of edge plasma. In the case of an NSTX module, we have been able to import the complex 3D launcher geometry directly from CAD files. Our edge-plasma includes a sheath-potential model, to provide data for the investigation of this anomalous power absorption channel. The time-domain approach allows us to treat the non-linear evolution of the sheath self-consistently, based upon the local fields, and also mirrors our nascent efforts to model the core plasma with particle-based methods, which we will also highlight. The method has shown good scaling on NERSC supercomputers, with the practical benefit from using larger number of processors being a larger domain size, that includes more of the core-plasma and poloidal extent of the plasma in the simulation domain.

[1] Nieter and Cary, JCP 196 (2004) 448-473.