

## **Leveraging NERSC computing to support DIII-D operations through profile analysis and kinetic magnetic equilibrium reconstruction**

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The OMFIT CAKE (Consistent Automatic Kinetic Equilibrium) workflow has been adapted and ported to NERSC's Perlmutter and Cori Supercomputers to provide profile analysis and kinetic magnetic equilibrium reconstruction for DIII-D control room use. The workflow has previously been implemented on DIII-D local clusters, but took long enough to be restricted to post experiment analysis. The new NERSC implementation uses between shot automatic triggering via the NERSC Superfacility API, runs on Perlmutter's realtime queue, and connects with DIII-D via ESnet for timely data retrieval and writing of results to DIII-D's MDSplus database. The workflow run time is reduced to 20 minutes by optimizations taking advantage of the greater opportunities for parallelization. Further improvements to usability include the addition of OMAS (Ordered Multidimensional Array Structure) based control room data visualization tools, improvements to profile fitting, and additional analysis. Work is continuing to integrate more advanced analysis post equilibrium reconstruction, including linking to TGLF and CGYRO gyrokinetic analysis as well as speed improvements to the internal high convergence workflow of the equilibrium reconstruction in order to accelerate production of low numerical error equilibria for MHD stability analysis.

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