NSTX-U Weekly Report (March 3, 2017)

FY 2017 status: NSTX-U is in a maintenance and repair outage.

NSTX-U Research (J. Menard)

Nick Lopez (Princeton University graduate student) gave an NSTX-U Physics Meeting talk on 2/27 on the feasibility of using O-mode ECH for non-inductive startup on NSTX-U. The 28 GHz system would be a key component in this startup scheme, which would prepare plasmas for HHFW and NBI. To perform this study, TRANSP simulations were used to self-consistently evolve plasma parameters in response to injected EC power, as calculated by GENRAY and CQL3D. Simulations were based on plasmas, one with a fast and one with a slow density ramp up rate, performing angular scans in EC deposition location in both scans. The simulation results indicate that the waves should be launched in the upper half plane. At the optimum injection angle, determined by a metric that accounts for first pass absorption and driven current, up to 95 kA could be driven by the ECH. These scenarios are stable to kink and ballooning modes. The shape of the density profile has a significant effect, however, especially on the poloidal injection angle. Future work will involve developing simple control equations for adjusting poloidal injection angle based on observations of the density profile, as well as modeling EBW startup scenarios.

The paper "A reduced resistive wall mode kinetic stability model for disruption forecasting" by Jack Berkery, Steve Sabbagh, and others has been published in the journal Physics of Plasmas (http://aip.scitation.org/doi/abs/10.1063/1.4977464). In recent years, analysis with the authors' MISK code has shown the importance of kinetic effects, such as resonances between plasma rotation and bounce and precession particle motions, as well as the effects of collisions, on resistive wall mode stability in tokamaks. The paper describes efforts to take this physics and incorporate it in a "reduced" kinetic model streamlined for fast computation in DECAF, the new Disruption Event Characterization and Forecasting code, also developed by the authors. The reduced model performed well in its first iteration on NSTX data, finding instability 84% of the time for experimentally unstable cases, and stability in 77% of experimentally stable cases. The paper is associated with Dr. Berkery's invited talk at the 2016 APS Division of Plasma Physics meeting in San Jose, CA.

Rory Perkins visited the Basic Plasma Science Facility at UCLA to prepare for an upcoming experiment on RF rectification. The experiment will be performed on the Large Plasma Device using a recently constructed single-strap antenna and will focus on measuring rectified currents, rectified voltages, and heat fluxes on different field lines connecting various plasma-facing components. Discussions focused on instrumentation, and the experiment will likely be conducted in early May.

NSTX-U Recovery Project (R. Hawryluk)

The seventh of the twelve planned Design Verification and Validation Reviews (DVVR), this one reviewing the NSTX-U power systems, was held this week, and observation/ suggestions (chits) are now being organized into corrective actions. John Dellas, the responsible engineer for the power systems, was the main presenter at the DVVR. External reviewers attending the meeting at PPPL included Dave Terry, of MIT and Heinrich Boenig, a retired engineer from the Los Alamos National Laboratory and National High Magnetic Field Laboratory. Jim Irby, of MIT, and Tom Todd, the chair of the external review committee, participated by video conference.

The NSTX-U Extent of Condition (EoC) meeting will be held over four days starting March 6th. Presentations were posted on Friday afternoon, and drafts of Corrective Actions have been forwarded to the NSTX-U Recovery EoC Committee.

Individual off-line flow tests of the PF1C upper and lower coils were performed this past week, and results were nominal to original design criteria and manufacturer test results.

Regarding test cell work, installation of waveguides and the configuration of electrical systems for the FIReTIP diagnostic continues, and preparations to install the Poloidal-CHERS passive plates in-vessel have started. Recommissioning of the coil winding facility also continued with the mounting of a copper coil to the tension skid brake system for winding tests where the tensioning skid will accept and pull copper.

Maintenance (Voith Hydro) of the Motor Generator (MG#1) Thrust Bearing resumed this week with the completion of the rebuilding of the four heat exchangers (Fluidics Inc.), and the re-assembly and successful testing of the oil pressure and temperature monitoring systems.

Ion Source work continues in the Neutral Beam (NB) shop with the successful assembly and alignment of an ion source accelerator grid module. The full assembly of the arc/accelerator modules will be completed this coming week, which will then be brought to the clean room mezzanine to be prepared for hydrostatic and electrical testing.