**Abstract Submitted for the** 59th **Annual Meeting**
**of the APS Division of Plasma Physics**
**October 23-27, 2017 • Milwaukee, Wisconsin**

**Category Number and Subject:**

**Optimization of 3D Field Design, *** N.C. Logan (PPPL), Caoxiang Zhu (USTC), – Recent progress in 3D tokamak modeling is now leveraged to create a conceptual design of external 3D field coils for the DIII-D tokamak. Using the IPEC dominant mode as a target spectrum, a code for Finding Optimized Coils Using Space-curves (FOCUS) optimizes the currents and 3D geometry of many coils to maximize the total set's resonant coupling. By isolating and targeting the core/edge resonant coupling in IPEC, coil designs are optimized for error field correction/suppression of edge localized modes (ELMs). The generalized perturbed equilibrium code (GPEC) is used to determine optimally efficient spectra for driving total, core, and edge neoclassical toroidal viscosity (NTV) torque and these too provide targets for the optimization of 3D coil designs. These conceptual designs represent a fundamentally new approach to 3D coil design for tokamaks targeting desired plasma physics phenomena. Optimized coil sets based on plasma response theory will be relevant to designs for future reactors or on any active machine. External coils, in particular, must be optimized for safe and efficient fusion reactor designs.

*Work supported by the US Department of Energy under DE-AC02-09CH11466.

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