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Full Wave Modeling of Helicon Operation in Proto-MPEX[1]
PAWEL PIOTROWICZ, University of Illinois Urbana-Champaign, JUAN CANESES, GREEN DAVID, CORNWALL LAU, JOHN CAUGHMAN, RICHARD GOULDING, Oak Ridge National Laboratory, DAVID RUZIC, University of Illinois Urbana-Champaign, PROTO-MPEX TEAM — An improved "high density mode" of operation of the helicon plasma source on Proto-MPEX has been observed recently. The high density mode is characterized by an increase in on-axis electron density (>5e19 m^{-3}) and a flat electron temperature (2 - 3 eV) profile during a helicon pulse. Presently, this transition has only been observed when deuterium gas is puffed downstream of the helicon antenna and the delivered RF power exceeds 110 kW. Establishing plasma densities and magnetic field strengths under the antenna that support a stable resonant helicon mode are believed to be the reason for the improved mode of operation. A full wave model of the helicon antenna has been made using finite element analysis software, COMSOL Multiphysics. This model is used to investigate the wave fields produced by the helicon antenna before and after the high density transition occurs. The investigation of the wave fields will be used in identifying the experimental conditions that are necessary for the high density mode transition and the resonant helicon mode responsible for the transition. Simulation results will be compared to radial B-dot probe measurements at multiple axial locations.

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