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Measurements of ion energies during plasma heating of the Proto-MPEX High Intensity Plasma Source[1] J.B.O. CAUGHMAN, R.H. GOULDING, T.M. BIEWER, T.S. BIGELOW, J. CANESES, S.J. DIEM, D.L. GREEN, R.C. ISLER, J. RAPP, Oak Ridge National Laboratory, P. PIOTROWICZ, University of Illinois, C.J. BEERS, N. KAFLE, M.A. SHOWERS, University of Tennessee
— The Prototype Materials Plasma Exposure eXperiment (Proto-MPEX) is a linear high-intensity RF plasma source that combines a high-density helicon plasma generator with ion and electron heating sections. It is being used to study the physics of heating over-dense plasmas in a linear configuration with the goal of delivering a plasma heat flux of ˜10 MW/m^2 at a target. The helicon plasma is produced by coupling 13.56 MHz RF power at levels >100 kW. Additional heating is provided by ion cyclotron heating (ICH) (˜25 kW) and electron Bernstein wave (EBW) heating (˜25 kW) at 28 GHz. Measurements of the ion energy distribution with a retarding field energy analyzer (RFEA) show an increase in ion energies in the edge of the plasma when ICH is applied, which is consistent with COMSOL modeling of the power deposition from the antenna. Views of the target plate with an infrared camera show an increase in the surface temperature at large radii during ICH, and these areas map back to magnetic field lines near the antenna. The change in the power deposition at the target during ICH is compared with Thomson Scattering and RFEA measurements near the target.

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