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Forward Modeling of Fast Ion Diagnostic Signals in C-2W with Monte Carlo Simulations GABRIEL PLAYER, SEAN DETTRICK, RICHARD MAGEE, LUCAS MORTON, SCOTT NICKS, TOSHIKI TAJIMA, THE TAE TEAM, TAE Technologies — In TAE Technologies' current experimental device, C-2W, beam-driven field reversed configuration (FRC) plasmas are produced and sustained in steady state utilizing variable energy neutral beams, advanced divertors, end bias electrodes, and an active plasma control system. Diagnosis of fast ions, which are born from neutral beam injection and responsible for heating, current drive, and stabilization, is critical for understanding the FRC behavior. Interpreting fast ion diagnostics in an FRC provides unique challenges, driven by the non-local nature of fast ion orbits. We present Monte Carlo methods for the forward modeling of measured fast ion signals, including the energy spectrum of charge exchange neutrals, heat flux to the wall, fast ion pressure, Doppler-shifted line emission and neutron production. These modeled signals are used to investigate fast ion physics topics, including fast ion transport and ion acceleration. Collaborations with Google AI have yielded high-fidelity Bayesian reconstructions of plasma mode activity, which have been used to model mode-induced fast ion transport. Theoretical and experimental evidence for thermal ion acceleration due to fast ion driven waves, as seen in C-2U, is also presented. This includes comparisons to alternative accelerating mechanisms, including collisional effects and inductive electric fields.

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