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Comprehensive approach to fast ion measurements in the beam-driven FRC RICHARD MAGEE, ARTEM SMIRNOV, MARCO ONOFRI, SEAN DETTRICK, SERGEY KOREPANOV, KURT KNAPP, Tri Alpha Energy, Inc., AND THE TAE TEAM — The C-2U experiment [1] combines tangential neutral beam injection, edge biasing, and advanced recycling control to explore the sustainment of field-reversed configuration (FRC) plasmas. To study fast ion confinement in such advanced, beam-driven FRCs, a synergetic technique was developed that relies on the measurements of the DD fusion reaction products and the hybrid code Q2D, which treats the plasma as a fluid and the fast ions kinetically. Data from calibrated neutron and proton detectors are used in a complementary fashion to constrain the simulations: neutron detectors measure the volume integrated fusion rate to constrain the total number of fast ions, while proton detectors with multiple lines of sight through the plasma constrain the axial profile of fast ions. One application of this technique is the diagnosis of fast ion energy transfer and pitch angle scattering. A parametric numerical study was conducted, in which additional *ad hoc* loss and scattering terms of varying strengths were introduced in the code and constrained with measurement. Initial results indicate that the energy transfer is predominantly classical, while, in some cases, non-classical pitch angle scattering can be observed.

[1] M. Binderbauer et al., Physics of Plasmas **22**, 056110 (2015).

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