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Interaction of Tearing Modes and Fast Ions in the MST RFP
J.A. REUSCH, J.K. ANDERSON, S. EILERMAN, J. FALK, J.J. KOLINER, M.D. NORNBERG, J. WAKSMAN, UW-Madison, L. LIN, UCLA, D. LIU, UC-Irvine, Y. TSIDULKO, BINP-Novosibirsk, Russia — Energetic ions sourced by a 1 MW, 25 keV, tangential neutral-beam injector (NBI) are well confined in RFP discharges in MST. In beam blip experiments, classical slowing and charge exchange loss can often account for the measured neutron flux decay. While these experiments give a sense of the global fast ion confinement, there are many important details that are lost in such an analysis. To gain insight into the effects of tearing modes on the fast ion distribution, a full orbit particle tracing code (RIO) has been used. RIO is capable of taking as input the 3D time varying electric and magnetic field output from the nonlinear resistive MHD code DEBS. While the tearing modes present in MST do not appear to cause significant direct loss of the highest energy ions due to drift orbit averaging, the ions do begin to interact with the tearing modes as they slow down, leading to a flattening of the ion density profile and an enhancement in the fast ion loss rate. While RIO allows the study of the effect of tearing modes on the fast ions we have also observed, in a separate set of long pulse NBI experiments, that the fast ions affect the tearing modes. Specifically, the core-most tearing mode amplitude is suppressed during NBI with the degree of suppression tracking directly with neutral particle analyzer measurements of the core localized circulating fast ions. The interaction of fast ions with the tearing modes in both beam blip and long pulse experiments will be presented. This work supported by the US DOE and NSF.

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