Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Fast ion beta limit measurements by collimated neutron detection in MST plasmas[1] WILLIAM CAPECCHI, JAY ANDERSON, PHILLIP BONOFIGLO, JUNGHA KIM, STEPHANIE SEARS, Univ of Wisconsin, Madison
— Fast ion orbits in the reversed field pinch (RFP) are well ordered and classically confined despite magnetic field stochasticity generated by multiple tearing modes. Classical TRANSP modeling of a 1MW tangentially injected hydrogen neutral beam in MST deuterium plasmas predicts a core-localized fast ion density that can be up to 25% of the electron density and a fast ion beta of many times the local thermal beta. However, neutral particle analysis of an NBI-driven mode (presumably driven by a fast ion pressure gradient) shows mode-induced transport of core-localized fast ions and a saturated fast ion density. The TRANSP modeling is presumed valid until the onset of the beam-driven mode and gives an initial estimate of the volume-averaged fast ion beta of 1-2% (local core value up to 10%). A collimated neutron detector for fusion product profile measurements will be used to determine the spatial distribution of fast ions, allowing for a first measurement of the critical fast-ion pressure gradient required for mode destabilization. Testing/calibration data and initial fast-ion profiles will be presented. Characterization of both the local and global fast ion beta will be done for deuterium beam injection into deuterium plasmas for comparison to TRANSP predictions.

[1]Work supported by US DOE

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Date submitted: 23 Jul 2015 Electronic form version 1.4