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Investigation of the fast ion beta limit in MST[1] WILLIAM CAPECCHI, SCOTT EILERMAN, JOSHUA REUSCH, JONATHAN KOLINER, JAY ANDERSON, University of Wisconsin, LIANG LIN, UCLA, JERRY CLARK, Florida A&M University, DEYONG LIU, UC Irvine — Fast ion orbits in the reversed field pinch (RFP) magnetic configuration are well ordered and have low orbit loss, even considering the stochasticity of the magnetic field generated by multiple tearing modes. Purely 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 (NPA) of an NBI-driven mode (presumably driven by a fast ion pressure gradient) clearly shows 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 in the range of 1-2% (local core value up to 10%). Distinguishing between an experimental fast ion number limit or fast ion beta limit is performed by scanning both the magnetic field strength and the NBI energy while observing conditions at the onset of the beam driven mode. Upcoming experiments will further investigate the empirical fast ion beta limit through the use of a deuterium beam into deuterium plasma which will allow for the NPA and neutron flux signals to provide a local and global fast ion beta measurement respectively.

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