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Development of Poloidal Magnetic Flux Measurements and Ion Beam Velocity Detectors P.J. FIMOGNARI, T.P. CROWLEY, D.R. DEMERS, T.D. KILE, Xantho Technologies, LLC, Madison, WI — Local, non-perturbative measurements of the current density profile and magnetic fluctuations in fusion plasmas will provide information capable of advancing equilibrium, transport, and stability studies. We are developing beam-based measurement techniques and a detector to determine the poloidal flux function, poloidal magnetic field, current density profile, and poloidal flux fluctuations in axisymmetric toroidal plasmas. We have injected a K^+ beam into the MST reversed field pinch plasma and successfully measured the intensity and toroidal velocity of K^{2+} ions created at a sample location along its trajectory. Because angular momentum of ions is conserved in an axisymmetric system, the toroidal velocity of the K^+ and K^{2+} beams can be used to determine the poloidal flux function $\psi = RA_\varphi$ at the sample location. We have begun developing simulation tools needed to unfold the poloidal flux from the beam velocity measurement and confirm accuracy of this diagnostic technique. Variations with time and initial injection angle of measured signals are consistent with simulations of the experiment. The detectors are operated with a direct view of the plasma and therefore subject to much higher photon-induced and plasma particle noise currents than a traditional heavy ion beam probe (HIBP) detector. The detector has features that reduce this noise and facilitate the broader goal of developing diagnostic tools that have HIBP attributes, but use a lower energy beam and a much smaller detector. This work is supported by US DoE award DE-SC0006077.

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