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Measurement of Z_{eff} and Particle Diffusion via X-ray Spectroscopy in MST D.J. CLAYTON, A.F. ALMAGRI, J.K. ANDERSON, D.R. BURKE, B.E. CHAPMAN, C.B. FOREST, R. O'CONNELL, UW-Madison, R.W. HARVEY, CompX — Measured x-ray spectra constrain Fokker-Planck modeling of MST discharges and provide a means to determine the effective ionic charge Z_{eff} and the radial particle diffusion coefficient D_r. A new radial array of Si photodiode detectors measures 2-10 keV x rays from thermal and runaway electrons in most plasma conditions. An array of CdZnTe detectors measures 10-150 keV x rays from high energy runaway electrons present only in plasmas with reduced stochasticity and improved particle confinement. The Fokker-Planck code CQL3D models the electron distribution function and predicts the resulting bremsstrahlung emission expected along each detector's line of sight. The code is run iteratively to find the $Z_{eff}(r)$ and $D_r(r)$ that produce the best fit to the data. Tests of this measurement technique with various plasma conditions will be presented, including largely stochastic plasmas with locally improved confinement within a magnetic island, and plasmas with reduced tearing modes and globally improved confinement. In the core of a typical high-temperture, low-density, improved-confinement plasma, $Z_{eff} = 4$-6 and $D_r = 1$ m^2/s. Work supported by the USDOE.

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