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Measurements of Electron Diffusion via Hard X-ray Detection[1]

D.J. CLAYTON, R. O'CONNELL, D.R. BURKE, B.E. CHAPMAN, J.A. GOETZ, M.C. KAUFMAN, University of Wisconsin-Madison, M. GOBBIN, L. MARRELLI, P. MARTIN, P. PIOVESAN, Consorzio RFX, R.W. HARVEY, CompX — An upgraded array of hard x-ray (HXR) detectors has been implemented on MST to measure electron particle diffusion in globally improved confinement pulsed parallel current drive (PPCD) plasmas and locally improved confinement quasi-single- helicity (QSH) plasmas. Each of these plasmas confines runaway electrons that emit HXRs. The diagnostic is a multichord array of CdZnTe detectors sensitive to 10-300 keV x-rays. Recently added lead shielding blocks x-rays from outside collimated lines of sight. The Fokker-Planck code CQL3D, now with HXR flux from the entire array as a constraint, is used to compute the diffusion coefficient as a function of radius during PPCD. In QSH plasmas, where one mode dominates the core tearing mode spectrum, HXRs are observed when a dominant island emerges, and the HXR flux oscillates in phase with the rotation of this island. Modeling with the ORBIT code shows that runaway electrons are better confined inside the island than in the exterior stochastic region.

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