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10.42 Correlation polarimetry for broadband fluctuation measurements

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Correlation techniques have been successfully utilized for plasma diagnostics like electron cyclotron emission to reduce measurement noise. We present the first application of such a technique to interferometer-polarimeter operation on the Madison Symmetric Torus. The MST FIR interferometer-polarimeter diagnostic utilizes 11 vertical chords with a spatial resolution of 7-8 cm and a heterodyne detection system for fluctuation measurements up to several hundred kHz. The planar-diode mixers viewing each chord represent independent noise sources; modifying the optical setup so that two different mixers view the same chord allows cross-correlation between the two independent signals to reduce the noise floor in fluctuation measurements. In this manner, the noise floor in both interferometry and polarimetry measurements in reversed-field pinch discharges has been reduced by a factor of 20-30. The correlation polarimeter provides a sensitive measurement of broadband fluctuations. For chords near the magnetic axis, measured Faraday rotation fluctuations are dominated by the radial magnetic field component. Radial magnetic fluctuations measured with correlation polarimetry have been obtained in standard RFP discharges and discharges with suppressed tearing mode activity.

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