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4.34 DIII-D Faraday-Effect Polarimeter for Fast Magnetic Dynamics Measurement

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A Radial-Interferometer-Polarimeter (RIP) diagnostic has been developed to explore fast magnetic dynamics in high-performance DIII-D plasmas by measuring radial magnetic field perturbations using three chords positioned near the magnetic axis. Newly developed solid-state sources operated at 650 GHz are used and provide phase noise down to 0.01 degree/sqrt(kHz) and tunable bandwidth up to 10 MHz. Various systematic errors, which can contaminate the Faraday-effect polarimetric measurement, have been investigated in detail. The impact of the perpendicular magnetic field (Cotton-Mouton Effect) is evaluated and found negligible. Distortion of circular polarization due to non-ideal optical components is calibrated by using a rotating quarter wave-plate technique. Optical feedback, due to multiple reflections induced by the double-pass configuration, is reduced by increasing the damping of stray light. Error due to non-collinearity is minimized to less than 0.5 degree for electron density up to 1x1020m-3 by optimizing the alignment. Measurement of coherent and broadband high-frequency magnetic fluctuation for DIII-D H-mode plasmas is presented. This material is based upon work supported by the Department of Energy under Award Numbers DE-FG03-01ER54615 and DE-FC02-04ER54698.

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