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4.16 Novel quasi-optical front end for optimized cross-polarization scattering for magnetic turbulence measurements on the DIII-D tokamak#

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UCLA is continuing to develop a new generation diagnostic that utilizes cross-polarization scattering(1) (CPS) to measure the fluctuating internal magnetic fields in tokamaks. The CPS technique relies on magnetic turbulence to scatter EM radiation into the perpendicular polarization, enabling a local measurement of the magnetic fluctuations. This is a challenging measurement that addresses the contribution of magnetic turbulence to anomalous thermal transport in fusion relevant plasmas. The goal of the new quasi-optical design is to achieve the full spatial and wavenumber capabilities of the CPS diagnostic. The approach consists of independently controlled aiming systems for the probe and scattered EM beams (55-75 GHz). This is accomplished by internal focusing lenses and remotely controlled mirrors. This new quasi-optical front end was designed with the assistance of 3D plasma ray tracing and Gaussian beam propagation codes. The design of the lenses, mirrors, remote control components, vacuum interface, and testing will be presented. #Supported by US DOE under DE-FG02-08ER54984 and DE-FC02-04ER54698. (1)T. Lehner, et al., Europhys. Lett., 8 759 (1989), Linda Vahala, et al., Phys. Fluids B 4, 619 (1992), X.L. Zou, et al., Phys. Rev. Lettrs, 75, 1090 (1995)

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