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Millimeter Wave Interferometry and Fabry-Perot Spectroscopy on the Madison Plasma Dynamo Experiment[1] K. FLANAGAN, M. CLARK, C. COOPER, W. DING, J. MILHONE, W. PENG, F.L. ROESLER, J. WALLACE, D. WEISBERG, C.B. FOREST, University of Wisconsin-Madison — New non-invasive optical diagnostics for use on the Madison Plasma Dynamo Experiment (MPDX) allow for measurements of line-averaged density through interferometry and ion velocity and temperature through Fabry-Perot spectroscopy. Both the interferometer and the Fabry-Perot spectrometer are capable of scanning multiple chords through the plasma. Through inversion techniques, these chords can be used to construct profiles of electron density, ion temperature, and ion velocity. The interferometer consists of a millimeter wave source with two detunable outputs, two fundamental mixers with low-noise amplifiers, and an analog phase detector. A millimeter wave beam provides an easily measurable phase shift of approximately one fringe at typical MPDX densities of $10^{11} - 10^{12}$ cm^{-3}. The Fabry-Perot spectrometer collects light from a single chord through the plasma and passes it through an etalon, which images the typical ring structure onto a high performance CCD camera. Through a ring summing technique developed by Roesler et. al., we can determine the ion velocity and temperature on both MPDX and PCX. We will present detailed descriptions of both diagnostics and their implementation on MPDX in addition to preliminary density, ion temperature, and ion velocity measurements.

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