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Visibility Measurements on a Fiber-Optic Probe Interferometer System[1] J.F. CAMACHO, NumerEx, LLC, A.G. LYNN, University of New Mexico, E.L. RUDEN, Air Force Research Laboratory, Directed Energy Directorate — A HeNe laser interferometer operating at 632.8 nm with several single-mode optical fiber probe beams has been assembled to measure the electron density of a field-reversed configuration for a magnetized target fusion experiment. Our system features probe beams whose path lengths are many times longer than the reference beam paths. We have generalized the condition for maximum interference visibility to the case of a heterodyned interferometer in which portions of the probe and reference beams propagate through different lengths of single-mode fiber. This analytic development also takes into account the effect of the line width of the individual modes of our multimode laser on mode coherence, which imposes an upper bound on the fiber length for which a good interference signal can be obtained. When this maximum fiber length is exceeded, an interference signal can still be observed, but the signal is amplitude modulated at frequencies much lower than the 80-MHz carrier signal. This modulation is likely due to "mode pulling" that occurs because of fluctuations in laser cavity length arising from acoustic modes of the laser tube. Visibility measurements establishing the viability of our design will be presented.

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