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Metamaterial Lens for Improved Transverse Resolution of mm-wave Diagnostics, applied to ECE at DIII-D SCOTT MASSIDDA, Columbia University, WILLIAM CAPECCHI, University of Wisconsin-Madison, KENNETH HAMMOND, FRANCESCO VOLPE, Columbia University — Millimeter wave diagnostics of plasmas typically cover bands of several GHz (reflectometry, scattering), tens of GHz (radiometry) or even hundreds of GHz (Michelson interferometry), but their focus is optimized for a single frequency. For other frequencies, the measuring volume is far from the beam waist. This results in a loss of resolution in the poloidal direction, especially at higher poloidal mode numbers (e.g., Alfvèn Eigenmodes). Ideally the beam should be focused at different locations for different frequencies. Our recent numerical study suggests that a zoned planar metamaterial lens can achieve this result in the 8-12GHz band [W.J. Capecchi *et al.*, *Optics Express* **20**, 8761 (2012)]. Here we present the design and full-wave simulations of a lens for possible use with Electron Cyclotron Emission (ECE) at DIII-D in the 80-130GHz band, discuss the fabrication challenges due to the required miniaturization, and present a system allowing the adjustment of the focal points to accommodate changes in the magnetic field. Because ECE at DIII-D undergoes one of the largest variations of optimal focal length, similar metamaterial lenses can more easily be designed for other mm-wave diagnostics and/or smaller devices.

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