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EIC 197 MHz crab cavity HOM damping and tolerance analysis

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Crab cavities, operating at 197 MHz and 394 MHz respectively, will be used to compensate the loss of luminosity due to a 25 mrad crossing angle at the interaction point in the Electron Ion Collider (EIC). Both cavities are of the RF Dipole (RFD) type. To meet the stringent impedance requirements for beam stability and quality, the cavity design must incorporate strong Higher Order Mode (HOM) damping. A special type of HOM coupler has been developed (for both horizontal and vertical HOMs), which consisting of a waveguide stub that couples to the cavity and a waveguide-to-coaxial transition that extracts the HOM power to an external load. This design effectively damps HOMs up to a frequency of 2 GHz. Due to the wide range of frequencies that need to be damped, the damping of some of the HOMs may be sensitive to errors in the cavity and coupler geometry. Therefore, the tolerance of HOM damping with respect to cavity errors needs to be properly addressed in the mechanical design and fabrication process. In this paper, we will present the design of the HOM couplers and the damping tolerance analysis of the 197 MHz cavity.

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Author: LI, Zenghai (SLAC National Accelerator Laboratory)

Co-authors: XIAO, Binping (Brookhaven National Laboratory); DELAYEN, Jean (Thomas Jefferson National Accelerator Facility); WU, Qiong (Brookhaven National Laboratory); RIMMER, Robert (Thomas Jefferson National Accelerator Facility); DE SILVA, Subashini (Old Dominion University)

Presenter: LI, Zenghai (SLAC National Accelerator Laboratory)

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