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Design of a Permanent Magnet Based Focusing Lens for a Miniature Klystron

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Abstract : Application of Permanent magnet technology to high frequency miniature klystron tubes to be utilized for space applications improves the efficiency and operational reliability of these tubes. But nevertheless the task of generating magnetic focusing forces to eliminate beam divergence once the beam crosses the electrostatic focusing regime and enters the drift region in the RF section of the tube throws several challenges. Building a high quality magnet focusing lens to meet beam optics requirement in cathode gun and RF interaction region is considered to be one of the critical issues for these high frequency miniature tubes. In this paper, electromagnetic design and particle trajectory studies in combined electric and magnetic field for optimizing the magnetic circuit using 3D finite element method (FEM) analysis software is presented. A rectangular configuration of the magnet was constructed to accommodate apertures for input and output waveguide sections and facilitate coupling of electromagnetic fields into the input klystron cavity and out from output klystron cavity through coupling loops. Prototype lenses have been built and have been tested after integration with the klystron tube. We discuss the design requirements and challenges, and the results from beam transmission of the prototype lens.

Keywords : beam transmission, Brillouin, confined flow, miniature klystron
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