FABRICATION AND TESTING OF A W-BAND SHEET BEAM EXTENDED INTERACTION KLYSTRON (EIK)

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A W-band extended interaction klystron (EIK) driven by a 19.5-kV, 3.5-A sheet beam is being developed. Simulations using the 3-D particle-in-cell codes MAGIC¹ and ICEPIC² predict saturated output power levels of 8-10 kW with a saturated gain >30 dB and small signal gain >40 dB. A beamstick has been successfully fabricated and tested, transporting 98% of the emitted current through a 0.4-mm x 5-mm x 20-mm-long beam tunnel.³ Performance of the beamstick was in excellent agreement with MICHELLE⁴ simulations.

The circuit consists of three 5-gap cavities operated in the 2π mode.⁵ Final design of the circuit was based on simulations that addressed issues such as cavity spacing, coupling iris size and shape, and choke configuration. Results of these simulations will be summarized. The cavities have relatively high $R/Q$ values of ~50 $\Omega$, so care has to be taken to avoid oscillation when small perturbations are introduced (e.g., beam and/or beam tunnel displacement relative to the cavity structure, cavity fabrication errors, etc.). The circuit incorporates features that help mitigate such problems. A diaphragm tuner is provided on each cavity to allow fine frequency adjustments. Quarter wavelength chokes are also incorporated between cavities to help prevent excitation of a beam tunnel mode.

The circuit has been fabricated and cold tested, and its performance agrees very well with ANALYST⁶ electromagnetic simulations. Fabrication of the complete amplifier is scheduled for completion in early spring of 2012. Test results will be presented and program status discussed.

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