COMPARISON OF SIMULATION AND EXPERIMENTAL RESULTS FOR A RADIALLY SYMMETRIC TRANSIT-TIME OSCILLATOR[1]

Robert L. Wright,[2] Edl Schamiloglu,[2] M. Joseph Arman,[3] Walter R. Fayne,[3] Kyle J. Hendricks,[3] Diana L. Loree,[3] John W. Luginsland,[3] Thomas C. Cavazos,[4] Kenneth E. Golby[4]

The transit-time effect in a coaxial structure has been proposed by Arman[5] as a mechanism to develop low impedance high power microwave devices using no externally-generated magnetic fields and having no confining foils. The major advantages seen for this type of device include: 1) a low device impedance due to the radial geometry; 2) reduced x-ray emission and associated shielding due to low operating voltage; 3) elimination of magnets normally used in RF oscillators to stabilize the electron beam; and 4) simplified coupling of the device output to the RF extraction structure (waveguide or antennas). The two-dimensional particle-in-cell code MAGIC has been used to design a prototype device: the radial acceletron. In the prototype device, an electron beam propagates radially within an annular anode-cathode (A-K) gap. Interaction between the electron beam self-generated electric and magnetic fields, non-linear (with gap voltage) cathode current emission, and electron transit time across the A-K gap generate a self-sustaining RF oscillation. Due to the complex internal geometry of the prototype device, simulation is not straightforward. The prototype design has been fabricated and tested; a comparison between simulation and initial experimental data is presented.

1. Research support in part by AFOSR/AASERT Grant No. F49620-96-1-0192
2. University of New Mexico, Dept. of Electrical and Computer Engineering, Albuquerque NM
3. Air Force Research Laboratory (Phillips Site); Kirtland AFB, NM
4. Maxwell Technologies, Inc.; Albuquerque, NM
5. M.J. Arman, “Radial acceletron, a new low-impedance HPM source,” IEEE Trans. Plasma Sci., Vol. 24, No. 3 (1996).