ELECTRON DYNAMICS AND STARTUP IN CROSSED FIELD MICROWAVE DEVICES*

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Recently there has been a renewed interest in the inverted magnetron because of its larger cathode area, reduction of electron end-loss, and substantially faster startup in comparison with the conventional magnetron. A recently conceived embodiment of the magnetron, called the recirculating planar magnetron, RPM [1], incorporates these attractive features. The electron dynamics for the various magnetron configurations has been re-examined with the Particle-In-Cell code MAGIC.

It has been shown [2] that an electron rotating under a combination of axial magnetic field B_0 and a radial electric field E_0 has an effective mass in the *azimuthal* direction, which can be either positive or negative depending on the magnitude and sign of E_0. For inverted magnetron, this effective mass is negative, therefore an azimuthal electron density bunching (a spoke) has a tendency to build up. For conventional magnetrons, this effective mass is positive, and the tendency toward azimuthal bunching disappears, at least during startup.

We believe that this negative-mass property in the inverted magnetron leads to its substantially faster startup than the conventional magnetron. The results of simulations showing the initiation of bunching in several different magnetron configurations, including the RPM will be presented.

1. R. M. Gilgenbach et al., "Recirculating-Planar-Magnetron for High Power, High-frequency Raddiation Generation," in this conference.

2. D. Chernin and Y. Y. Lau, Phys. Fluids 27, 2319 (1984); Y. Y. Lau, Phys. Rev. Lett. 53, 395 (1984); and in Ch. 9 in High Power Microwave Sources, Eds. V. L. Granatstein and I. Alexeff (Artech House, 1987).

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