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2P01 - Modeling a compact A6 relativistic magnetron operating with permanent magnets

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We present simulation results which demonstrate that a relativistic magnetron can be operated with permanent magnets. Using permanent magnets makes the magnetron a more compact device. In a recent paper (Leopold et al., IEEE-Trans. Plasma Sci., vol. 44, no. 8, pp 1375-85, 2016) we showed that the power balance in an A6 single radial output magnetron with its longitudinal slots covered by anode caps, is the result of a complex process involving the applied voltage and the distribution of the current between the axial leakage and magnetron currents. The axial magnetic field which is usually considered to be fixed and uniform in the interaction volume is an important parameter. The parameter space for pulse shortening and mode competition to occur has also been clarified. Replacing Helmholtz coils with permanent magnets is not though straightforward. It is possible to create sufficiently high axial magnetic fields by inserting magnets in the six vanes of an A6 magnetron, in the cathode or both. It is though difficult to use long enough permanent magnets for their edges to be far enough from the interaction region. On the other hand if the edges are too close, then the balance between the axial and magnetron currents is affected. Therefore it becomes more difficult to optimize the performance of such a magnetron.

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