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2P12 - The Influence of Magnetic Field Profile on the Downstream Electrons and the Output Mode of MDO

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Magnetron with Diffraction Output (MDO) possesses advantages like direct couple to axial output waveguide; hence it has higher output extraction efficiency. Like traditional magnetron, MDO also requires an axial magnetic field to force the explosive field emitted electrons to go into a spiral motion and form resonant fork, and unlike low power traditional magnetron where the B field is formed by permanent magnet, in high power pulsed relativistic magnetron the B field is usually formed by a pair of Helmholtz Coils that provides near constant Z axis B field if the radius and distance between the coils are large enough. Due to the nature of the pulsed power system that drives such high power MDO, the electrons tends to drift towards the output horn and the magnetic field profile in the horn region affects how the electrons propagate in this region. Using Particle-In-Cell (PIC) simulation, we found if the magnetic field is setup as a unit function, then the downstream electrons continue to drift in a straight line. If the magnetic field gradually decreases as in a real Helmholtz Coil, then the downstream electrons drift outwards in the vanes of the MDO. Due to the influence of the downstream electron positions, the output mode is slightly changed at the output horn end.

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