In a companion abstract we presented recent improvements in the start-up and efficiency of the A6 magnetron with radial extraction and axial extraction (MDO) [1]. Here we describe recent advances in mode switching and mode control.

RF mode switching from one shot to the next was demonstrated in particle-in-cell (PIC) simulations for the A6 MDO [2,3]. By operating the magnetron near the critical magnetic field that separates two modes of operation and introducing a relatively weak (~$10^5$ W) short input signal it is possible to switch the operating mode of a 1 GW-level magnetron from one mode to the other.

In PIC simulations of a 12-cavity variant of the A6 MDO we found a splitting of the radiation frequency for each eigenmode owing to its different longitudinal distribution. Since the splitting manifests as a bifurcation of frequency for definite values of the applied axial magnetic field, scenarios of frequency switching for this 12-cavity magnetron are considered as in our earlier work [2,3].

Finally, we have recently begun PIC simulations of the A6 magnetron with strapping. There is an intermediate range of $A$-$K$ gap over which the magnetron mainly oscillates in the $4 \pi /3$-mode. A slightly unconventional approach to strapping eliminates the $4 \pi /3$-mode mode and allows the magnetron to oscillate in a clear $\pi$- or $2 \pi$-mode mode for different cathode radii and magnetic field ranges. A maximum electronic efficiency of 43% was achieved. In addition, strapping the magnetron on the upstream side allows the implementation a simple mode converter for axial extraction of microwaves, as was described in [1].


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