MULTIMODE CALCULATION OF FREQUENCY TUNABLE GYROTRONS FOR DYNAMIC NUCLEAR POLARIZATION APPLICATIONS

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Multimode calculations of a low-power (above 10W) high-frequency (200 GHz -300 GHz) gyrotron for NMR (nuclear magnetic resonance) spectroscopy applications have been performed. Six transverse modes ($TE_{-7, 2}$; $TE_{7, 2}$; $TE_{-4, 3}$; $TE_{4, 3}$; $TE_{-2, 4}$; $TE_{2, 4}$) whose coupling factors are above 30% and most probably excited in the cavity were included into the calculation. The frequency fine tuning was obtained via the excitation of a sequence of longitudinal modes of $TE_{-7, 2, q}$ by varying the beam voltage from 15kV upward and the magnetic field from 9.6T to 9.77T. The diffractive quality factor of the cavity equals to 9965 and the ohmic quality factor of the cavity equals to 6414. The results show that the main mode $TE_{-7, 2}$ is quite stable against the possible transverse mode competitors within this magnetic field range and a continuous frequency tuning range more than 800MHz (263.43 GHz - 264.28 GHz) has been achieved with alpha equaling 1.3, the beam radius and current being 1.33 and 100mA respectively.

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