

## Recent Investigations on Stable Operation of High-Power Gyrotrons

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### Abstract

Recent experimental investigations have shown that high-power gyrotrons (1-2 MW) show a strong tendency to develop parasitic oscillations, primarily in the beam tunnel region, prior to the interaction of the electron beam with the operating mode in the cavity. These oscillations may be in the high frequency regime (close to the design frequency) or at considerably lower frequency (MHz region). Both kinds of oscillations limit the possible operation range and strongly reduce the performance of the tubes.

Experiments with improved beam tunnel versions which are designed to suppress effectively the high frequency parasitic oscillations are reported. A step-frequency tunable gyrotron (105 – 143 GHz, 1 MW range) and a 170 GHz coaxial cavity gyrotron (European ITER pre-prototype gyrotron, 2 MW range) has been used to test different beam tunnels. The performance of the gyrotrons equipped with the original and modified beam tunnel is compared. The frequency spectrum of the parasitic oscillations and their dependence on operating parameters is presented. The design of the beam tunnel component is similar to the 140 GHz, 1 MW gyrotron for the stellarator W7-X.

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