Experimental Results on a 1.5 MW, 110 GHz Gyrotron

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The gyrotron is a microwave source capable of emitting megawatts of power at millimeter wave frequencies, making it ideally suited for electron cyclotron heating (ECH) of fusion plasmas, including ITER. High efficiency operation of such high power gyrotrons is essential to ensure excellent reliability and to minimize the prime power required to operate the device. One important component for high gyrotron efficiency is the internal mode converter (IMC), which converts the electromagnetic cavity mode into a Gaussian beam. We recently tested a new IMC on our 1.5 MW, 110 GHz, 3 μs pulsed gyrotron operating in the $TE_{22,6}$ mode. We measured a Gaussian beam content of 95.8 ± 0.5 % in both hot and cold test [1]. Such a high quality Gaussian output beam is essential to ensure minimal losses in the subsequent ECH transmission lines and launchers [2]. Current research focuses on the start-up scenario for the gyrotron. As the modulator voltage rises, a series of different modes is excited in the cavity. We explore the nature of these start-up modes and their effect on the gyrotron's eventual operating mode power and stability at full voltage.

[1] D. S. Tax et al., *Journal of Infrared, Millimeter and Terahertz Waves*, **32(3)**, pp. 358-370 (2011).
[2] M.A. Shapiro et al., *Fusion Science and Technology*, **57(3)**, pp. 196-207 (2010).

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