Optical Spectroscopy of Plasma and Plasma Processing in High Power Microwave Pulse Shortening Experiments*

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Spectroscopic measurements have been performed to characterize the undesired plasma in a multi-megawatt coaxial gyrotron. This gyrotron is driven by the Michigan Electron Long Beam Accelerator (MELBA) at parameters: V= -800 kV, I_{tube}=0.3 kA, and pulselengths of 0.5-1 μs. Pulse shortening typically limits the highest (~40 MW) microwave power pulselength to 50-100 ns. Potential explanations of pulse shortening are being investigated, particularly plasma production inside the cavity and at the e-beam collector. The source of this plasma is believed to be due to water vapor. Plasma H-α line radiation has been characterized and correlated with microwave power and microwave cutoff. Experiments are underway to determine the effects of RF plasma processing of the coaxial cavity and collector. A collaborative effort is underway with the Stanford Linear Accelerator Center/ U.C. Davis to study RF cavity breakdown. A SEM is being used to examine the surface effects of RF processing cavity parts.

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