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Air Breakdown Dynamics with a 1.5-MW, 110 GHz Gyrotron[1]
JASON HUMMELT, MIT, ALAN COOK, MICHAEL SHAPIRO, RICK TEMKIN, MIT — We examine breakdown created by a 1.5 MW, 110 GHz 3 μs length pulsed quasioptical beam in atmospheric pressure air. The plasma formed exhibits a filamentary array of streamers for an incident linearly polarized beam and disc like structures for a circularly polarized beam. A fast gating camera is used to study the time evolution of the plasma structures and propagation of the plasma back towards the gyrotron source. We measure the speed at which the plasma propagates toward the gyrotron to initially be greater than 100 km/s. The plasma streamer expansion for the case of the linearly polarized beam is found to be 5-10 km/s and shows good agreement with what is predicted with the simple ionization-diffusion equation. In addition, microwave measurements show the scattering of incident microwaves by the plasma through an angular distribution. A fast gating, high-resolution spectrometer and a broadband spectrometer are used to study breakdown plasma temperatures. Results are compared with previous microwave breakdown experiments.

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