Contribution ID: **68** Type: **not specified**

High power test of mm-wave accelerators

Tuesday, 20 April 2021 10:45 (30 minutes)

GeV/m acceleration may be achieved at mm-wave and sub-Terahertz (THz) frequencies, thanks to the high shunt impedance. One of the main goals of this research is to study the physics of high gradient acceleration and rf breakdown at mm-wave frequencies. Previously, the only measurements of high gradients and rf breakdowns at mm-wave frequencies were performed in beam-driven accelerating structures at SLAC's FACET. These beam-driven structures sustained low gradients and high surface electric fields, and experienced damage from the beam halo. In this talk, the measurements of high gradient and rf breakdown rates (BDRs) in a 110 GHz accelerating cavity externally-driven by an rf source are reported. The accelerating structure has a unique quasi-optical coupling scheme and was fabricated and assembled with a very high precision. The cavity is powered by 10 nanoseconds rf pulses, chopped from 3 microsecond megawatt pulses from a gyrotron using a laser-driven silicon switch. The highest achieved accelerating gradient was 230 MV/m at 570 kW of peak input power, corresponding to a peak surface electric field of 520 MV/m after rapid processing of the cavity with more than 105 pulses. Initial breakdown rates are also reported and the BDR is expected to further decrease after extended running time. Building on the success of this experimental demonstration, we are developing a high-gradient field emission electron gun toward significantly compact, bright, and efficient particle sources. These results open up many frontiers for applications not only limited to the next generation particle accelerators but also x-ray generation, probing material dynamics, and nonlinear light-matter interactions at mm-wave and THz frequency.

Presenter: OTHMAN, Mohamed (SLAC)

Session Classification: Session 3