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Standing wave dielectric disk accelerating structure design and high power test results

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A Dielectric Disk Accelerator (DDA) is a metallic accelerating structure loaded with dielectric disks to increase coupling between cells and group velocity, while still maintaining a high shunt impedance. This is crucial for achieving high efficiency, high gradient acceleration in the short pulse acceleration regime. Recent research of these structures has produced traveling wave structures that are powered by very short (˜9 ns), very high power (400 MW) RF pulses using two beam acceleration at the Argonne Wakefield Accelerator. In testing, these structures have withstood more than 320 MW of power and produced accelerating gradients of over 100 MV/m. A new standing wave DDA structure was fabricated and high power tested on the Nextef2 test stand at KEK. This experiment tested how the structure behaves on a more conventional, klystron power source. Simulation results of this structure show that at 50 MW of input power, the DDA produces a 457 MV/m gradient. It also has a large shunt impedance of 160 MΩm with an r/Q of 21.6 kΩm. High power testing concluded November 2024 with data processing ongoing. During testing a peak power of > 20 MW was reached and a pulse length of 200 ns.

Footnotes

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