

Development and commissioning of a novel C-band hybrid photoinjector at RadiaBeam

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RadiaBeam, in collaboration with UCLA, SLAC, and Amplitude Lasers, is developing a compact tunable ICS gamma ray source for industrial, medical, and security applications. The entire system is designed to be transportable in a standard cargo container, requiring minimizing longitudinal footprints of the individual components. To this end, a compact C-band hybrid photoinjector was developed, simultaneously enabling high brightness e-beam generation, acceleration, and longitudinal compression with only 80 cm of space, between the photocathode surface and the linac entrance plane. This novel photoinjector was designed, manufactured, and recently commissioned at the RadiaBeam gun test stand facility, achieving a micron-level emittance, and over 200 A peak current at the linac injection plane, and a reliable and reproducible operation. In this paper, the C-band hybrid design and features are discussed, and the commissioning results are presented. The unique hybrid dynamics is illuminated by the parametric phase scans. The near plans for completion of the ongoing 100 MeV beam energy upgrade, and ICS source commissioning are also presented. Finally, other applications of this novel photoinjector technology, relevant to AAC programs, will be summarized.

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