

The E332 experiment at FACET-II: Towards solid density beams and intense gamma-ray beams

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The passage of an electron bunch through a conducting foil has a focusing effect from the Near-Field Coherent Transition Radiation (NF-CTR) generated on the surfaces. Passing through multiple foils may allow to focus bunches down to solid densities and generate collimated gamma-rays with micrometer source sizes and conversion efficiencies exceeding 10%. The possibility offered by this scheme to self-focus high-energy beams and generate extremely dense gamma-ray beams calls for an experimental demonstration.

We present the E332 experiment at FACET-II (SLAC) where this mechanism can be studied with unprecedented electron beam parameters. Initial measurements were investigating the presence of NF-CTR focusing on single foils and the beam-induced heat damage, and are now followed by the first experimental tests with multiple foils. We furthermore report on simulations of realistic electron beam and target configurations for FACET-II that give rise to focusing of electron bunches from 5 μm down to 1.5 μm (rms) and conversion efficiencies from electron beam to gamma rays in the few-percent range. The relative simplicity, unique properties, and high efficiency of this gamma-ray source open up new opportunities for both applied and fundamental research including laserless investigations of strong-field QED processes with a single electron beam.

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