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Design and Initial Operation of a Tunable Compton-Scattering Based Gamma-Ray Source[1] DAVID GIBSON, SCOTT ANDERSON, SHAWN BETTS, MICAH JOHNSON, DENNIS MCNABB, MIKE MESSERLY, JASON PRUET, MIROSLAV SHVERDIN, AARON TREMAINE, FRED HARTEMANN, CRAIG SIDERS, CHRIS BARTY, Lawrence Livermore National Laboratory — Tunable, monochromatic gamma-ray sources are currently being developed at LLNL for nuclear photo-science and related applications. These novel systems are based on Compton scattering of laser photons by a high brightness relativistic electron beam produced by an rf photoinjector and offer a path to high-brightness high-energy (> 1 MeV) x-ray & gamma-rays due to their favorable scaling with electron energy. The current demonstration source, called the "Thomson-Radiated Extreme X-Ray" (T-REX) source, targets photon energies up to 1 MeV. With extensive modeling using PARMELA and well-benchmarked custom Compton-scattering simulation codes, the optimal design parameters for an interaction (including factors such as the collision angle, focal spot size, bunch charge, laser intensity, pulse duration, and laser beam path) can be determined. Here we present the results of this optimization, including early experimental results from the newly commissioned system.

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