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Advanced utilization of a single laser source for an inverse Compton scattering system

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An Yb:YAG laser has been used to generate both the electron emission from a photocathode and act as the interaction laser on a 100 MeV inverse Compton scattering experiment. The laser generates 25 mJ pulses at 1030 nm, 1.5 ps long, up to 120 Hz. 10% of the energy is sent into a Fourth Harmonic Generation (FHG) module where frequency doubling happens twice. Up to 200 μ J of adjustable Ultra-Violet (UV) laser can be exploited and sent towards the photocathode. The rest of the energy, 90% of the initial IR beam, is propagated to the interaction region. The goal is to match 1mm beam on the photocathode and 40 μ m at the interaction region with high stability. To reach it, significant effort was put into optimization using state of the art laser propagation software. We used a set of tools like low aberrations lenses, truncated Gaussian beam, vacuum transport, relay of images, and closed loop stabilization system. In the end, this project pairs strong optical and mechanical constraints. A large part of it was built and tested, showing exciting results.

Footnotes

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North America

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