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Broadband MeV to multi-GeV 10 PW laser-driven gamma-rays generation, characterization and possible applications

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Recent advancements in high intensity laser technology, with the advent of multi-PW facilities around the world [1], is allowing the investigation of multiple regimes to produce various compact high intensity particle sources [2,3,4,5]. Among the most promising techniques, the use of a multi-GeV electron beam accelerated through Laser WakeField Acceleration (LWFA) [6] to produce a secondary photon beam through a variety of processes (Bremsstrahlung [7], reverse Compton scattering [8], betatron radiation [9]) has been investigated during several experimental campaigns in the 10 PW long focal experimental area of ELI-NP. Due to the bunched nature of those photon beams, classical germanium or scintillator-based photon by photon detectors cannot be used, rendering the beam characterization in itself challenging. To circumvent this difficulty, diagnostics using scintillator stacks have been developed [10]. We will report here on the effort done at ELI-NP to develop a reliable gamma spectrometer adapted to this high intensity laser environment as well as the results it obtained during the commissioning campaigns of the 10 PW long focal experimental area.

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