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Development of a multi-channel scintillator array for improved reconstruction of high-energy photon spectra in laser-plasma experiments

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The generation of high-energy photons is a useful diagnostic tool in many different contexts. In laser-solid target experiments, the total yield and energy distribution can be compared for different target types to determine the optimal set-up for photon generation, to be used in radiography and computed tomography of dense objects. In colliding experiments between a laser pulse and an electron beam, the change of the photon yield with different experimental parameters can help differentiate between various radiation sources. In addition, the spectral data can help benchmark particle-in-cell (PIC) simulation codes that describe quantum electrodynamic (QED) processes. As higher-power laser facilities are opening, these types of experiments will be able to explore new regimes of physics and generate photon spectra extending to higher energies. Therefore, it's important to develop diagnostic tools capable of making these measurements. Spectrometers such as the filter stack spectrometer (FSS), the scintillator attenuation spectrometer (SAS), and the gamma stack spectrometer (GSS) have been used in several experiments at the Texas Petawatt Laser facility (TPW) and ELI-NP, providing valuable data about photon production at different laser energies. By using knowledge of the strengths and weaknesses of these spectrometers, we are developing a novel multi-channel scintillator array to work at a high repetition rate that improves our ability to unfold the spectrum from the measured signal. Its modular design will allow it to be utilized in a range of experiments at ZEUS and other laser facilities.

Working group

WG6 : Radiation generation, medical and industrial applications

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