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Measurements of Laser Induced Ionizing Radiation Doses at SLAC

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Interaction of high intensity, short pulse laser beam on matter generates plasma in which electrons can be generated and accelerated to high energies (10s of keV to MeV) which in turn interact with target material generating ionizing radiation hazards. The radiation field and the dose level depend on the laser irradiance (laser energy, pulse length and spot size on target) and the target materials. The radiation field is primarily comprised of bremsstrahlung X-rays at lower irradiances, but will include neutrons at higher intensities.

With the rise in the number of high-intensity (multi-terawatt and petawatt) lasers in R&D facilities, for example in conjunction with both 3rd and 4th generation light sources, characterization of the radiation source terms, understanding of radiological hazards, and development of appropriate measures to ensure personnel safety are needed.

A systematic study of measurements of photon and neutron radiation doses generated from laser-plasma interaction has been underway at SLAC National Accelerator Laboratory using the the short pulse laser (800 nm, 40 fs, up to 1 J and 25 TW) at LCLS MEC. Results from the most recent measurements with the laser-optic-target system (peak intensity 2.4x10^18 W/cm^2) will be presented and compared with the calculations based on analytical models. Shielding and interlocked controls to mitigate the ionizing radiation hazards will also be discussed.

Summary

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