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Target Development at ELI Beamlines - Two-Photon Polymerization

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Advances in high-energy-density physics increasingly require well-defined, targets that can shape the interaction of intense laser and ion beams. Traditional target fabrication methods, particularly for low-density foams, often produce stochastic microstructures with limited control over geometry, uniformity, and feature size.

In this work, we demonstrate the use of two-photon polymerization (2PP) as a flexible and precise technique for producing engineered micro- and nano-structured targets designed specifically for high-intensity laser experiments. Using a 2PP system, we fabricated solid foam targets with controlled internal architecture. This additive-manufacturing approach enables deterministic structuring in three dimensions, allowing not only tailored fabrication of targets but also functional geometries such as coils for magnetic field generation and composite assemblies that cannot be reliably produced using conventional methods. The ability to tailor the internal foam morphology and integrate custom-designed features offers new opportunities to systematically influence plasma formation and evolution during laser matter interaction.

These results highlight the potential of 2PP as a versatile platform for next-generation target development in experiments employing high-power laser or ion beams. In this poster, we present our current 3D-printing capabilities and workflow from target design through 2PP fabrication and post-processing to alignment and irradiation with high-power lasers.

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