Plasma diagnostics

Development of an Imaging Spectrometer for High-Repetition Rate Proton Measurement

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As laser-driven proton sources increase in repetition-rate to match upcoming laser facilities, new and improved diagnostics will be required to measure the spatial and spectral profiles of laser-driven proton beams.

Current proton measurements are incompatible with high-repetition rate operation, or are unable to capture spatial and spectral information simultaneously. In this report we present development of an imaging spectrometer using Lanex as an active detector, to simultaneously measure the spatial and spectral profile of laser-driven proton beams.

In collaboration with the CLF's Target Fabrication group, we have utilised 3D printed step filters to uniformly sample the spatial profile of proton beams at fixed proton energies, using automated analysis to interpolate the full profile of the proton beam.

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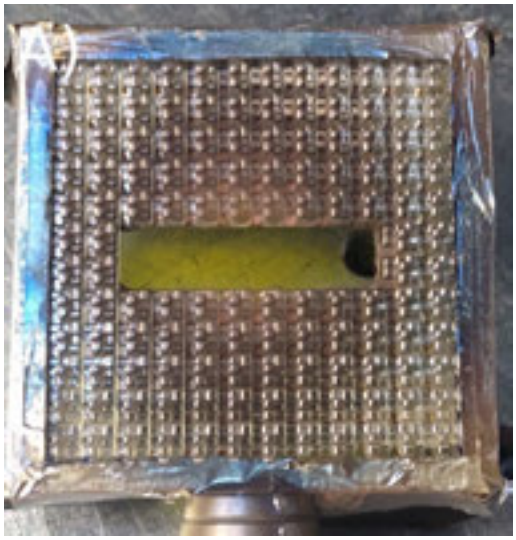

Figure 1: The 3D printed PROBIES mask front surface. The device contains an active surface of 36 mm, with the Lanex scintillator attached to the rear of the mask.

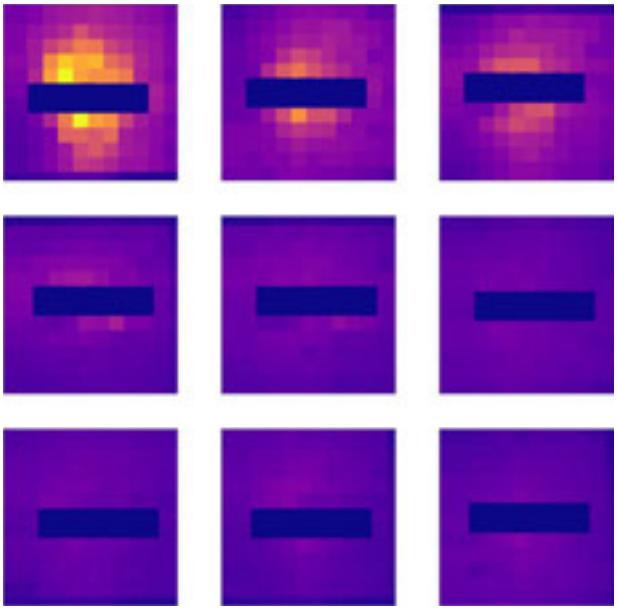

Figure 2: Interpolation of the spatial profiles of each peak in the mask design. Peak breakthrough energy increases from left to right.