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TIME-RESOLVED X-RAY RADIOGRAPHY AND PHASE CONTRAST IMAGING OF SHOCKS PROPAGATING IN FOAMS

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We performed an experiment at the Vulcan TAW laser (Rutherford Appleton Laboratory, England) to study the propagation of shock-waves using XPCI. As diagnostic, we used phase-contrast-enhanced time-resolved X-ray radiography. X-ray phase-contrast imaging (XPCI) is a technique which allows enhancing the visibility of discontinuities in the sample, like target edges and the shock front.

The 3 additional laser beams (with duration of 2 ns, average total energy 550 J) were used to launch the shock. The laser pulse (with duration of 1 ps, energy of 50 J) was used to irradiate a back-lighter Cu wire (with diameter of 10 μm) producing photons at energy $\approx$8 keV. These were equipped with Phase plates producing a Gaussian spatial intensity distribution with FWHM = 400 μm.

The shocked target was polymide tube (tube thickness 50 μm, inner diameter 1000 μm, length 1000 μm) filed with TMPTA foam (density 0.1 g/cm^3). As ablator we used 25 μm of parylene, while the pusher was 5 μm Ti.

The propagation of a shock with a Gaussian shape is clearly observed in the 7 performed shots. Images were obtained for different time delays 15 ns, 25 ns and 35 ns allowing to follow the dynamics of shock propagation in time. We observed that the FWHM of spatial shape of shock front remains constant in time (with FWHM ≈600-700 μm). This seems to show that 2D effects in shock propagation are negligible in our case.

Finally experimental results were compared to numerical results obtained from 1D and 2D hydro simulations performed using the code MULTI.