Electronic supplementary information for: *In situ* speciation and spatial mapping of Zn products during pulsed laser ablation in liquids (PLAL) by combined synchrotron methods

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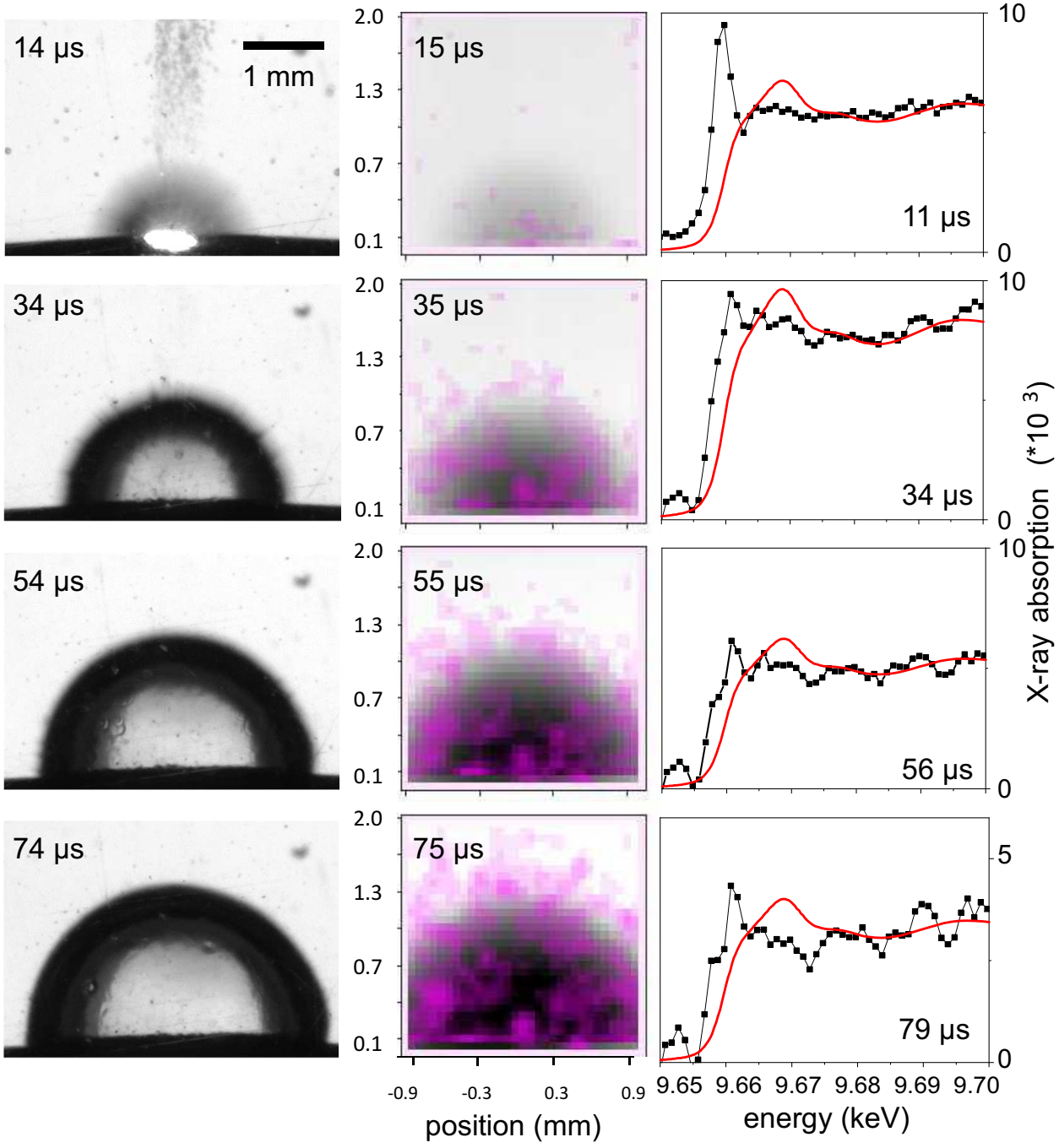

Figure 1: (Supplementary) Visible stroboscopic images (left), X-ray multicontrast images (center, pink: dark-field contrast, gray: absorption contrast) and X-ray absorption spectra (right) as function of delay in microseconds $< 80\ \mu s$ after laser irradiation. The measured absorption spectra (dots) are compared to a reference spectrum of a zinc foil (red lines).

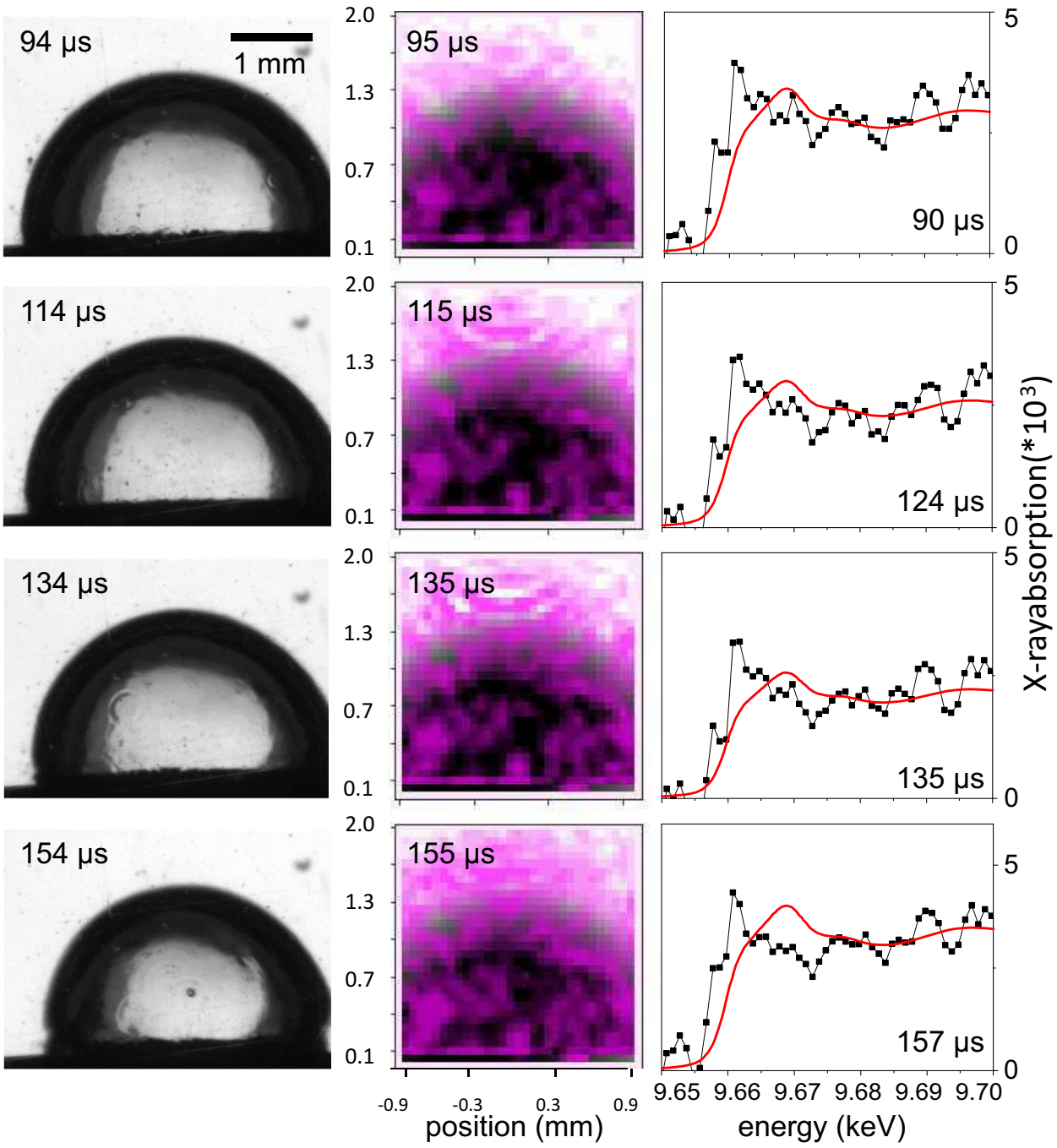

Figure 2: (Supplementary) Visible stroboscopic images (left), X-ray multicontrast images (center, pink: dark-field contrast, gray: absorption contrast) and X-ray absorption spectra (right) as function of delay in microseconds 95 - 160 μs after laser irradiation. The measured absorption spectra (dots) are compared to a reference spectrum of a zinc foil (red lines).

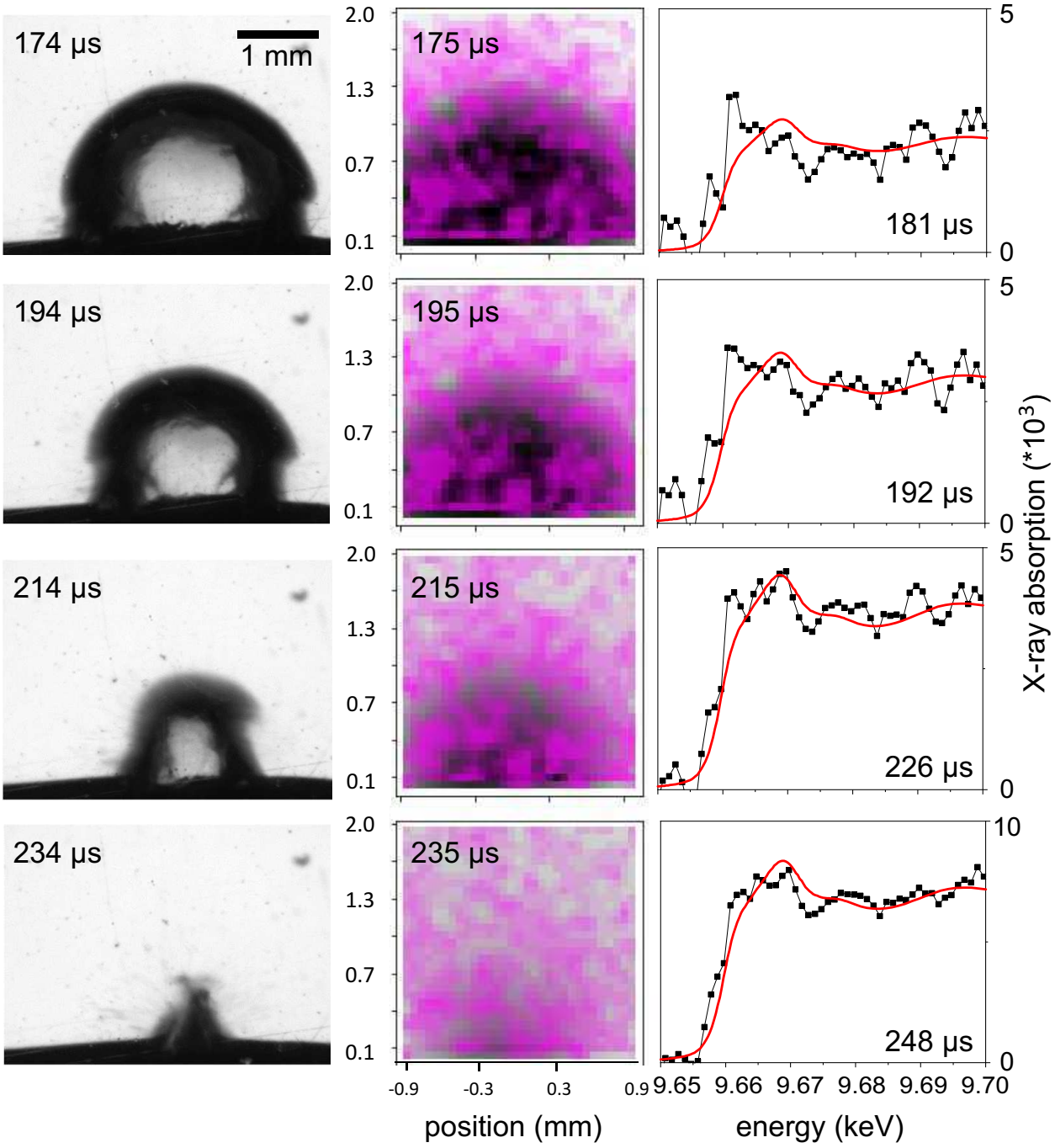

Figure 3: (Supplementary) Visible stroboscopic images (left), X-ray multicontrast images (center, pink: dark-field contrast, gray: absorption contrast) and X-ray absorption spectra (right) as function of delay in microseconds 175 - 240 μs after laser irradiation. The measured absorption spectra (dots) are compared to a reference spectrum of a zinc foil (red lines).

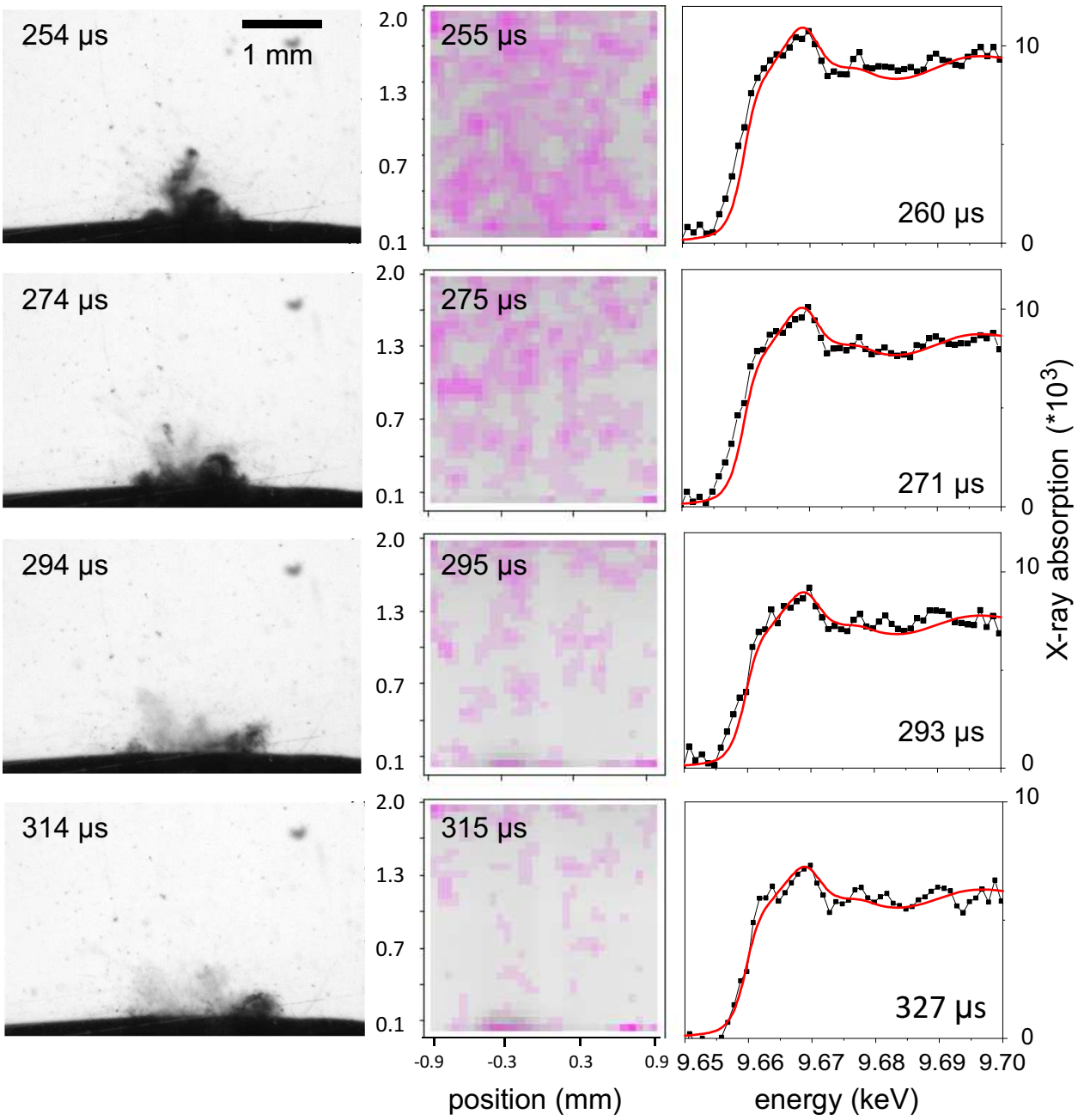

Figure 4: (Supplementary) Visible stroboscopic images (left), X-ray multicontrast images (center, pink: dark-field contrast, gray: absorption contrast) and X-ray absorption spectra (right) as function of delay in microseconds 255 - 315 μs after laser irradiation. The measured absorption spectra (dots) are compared to a reference spectrum of a zinc foil (red lines).

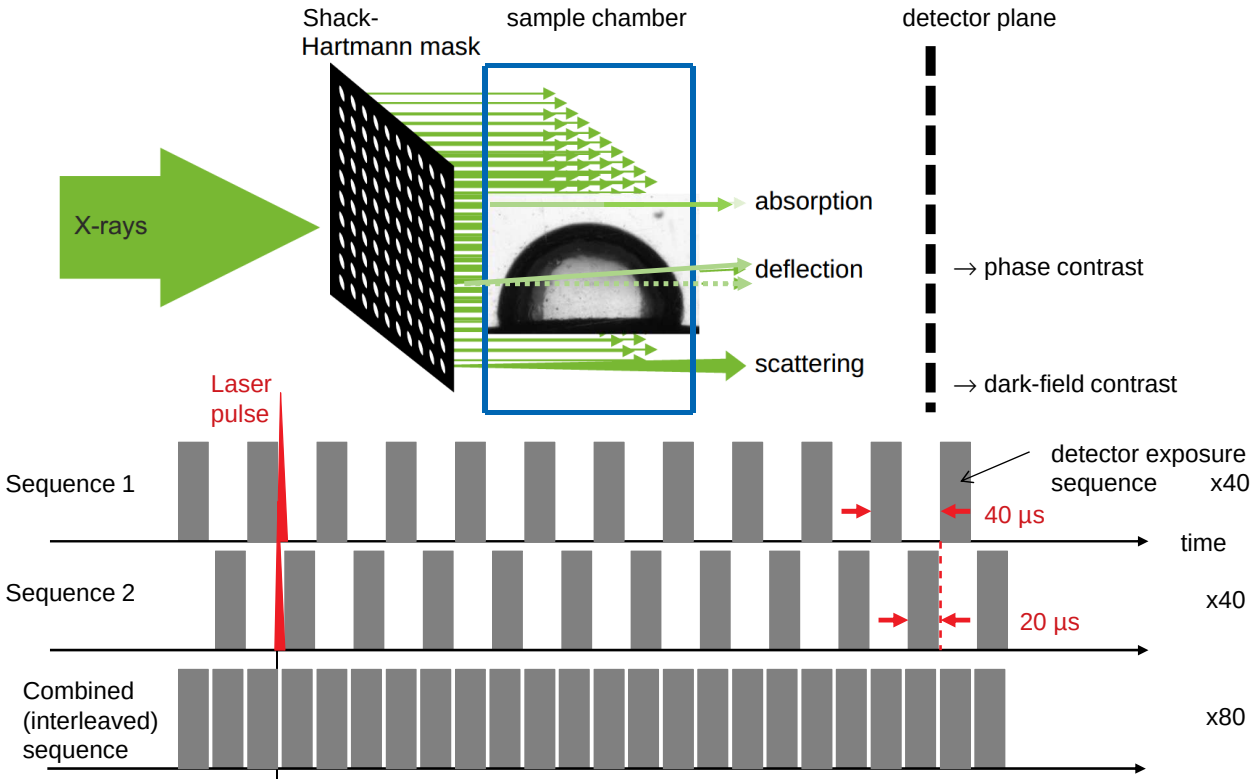

Figure 5: (Supplementary) Acquisition scheme for time-resolved X-ray Hartmann imaging (XHI): A wide X-ray beam is split into an array of isolated beamlets by a 2D arrangement of X-ray lenses.[1] The array of beamlets passes the sample. After interacting with the sample structure, each beamlet can be reduced in intensity through absorption, deflected by a transversal phase gradient or broadened by scattering on nano- to micrometer inhomogeneities. These beamlet deviations are registered by an area detector (scintillator-coupled CMOS camera). A Fourier analysis decomposes the changes into absorption, differential phase and dark-field contrast.[2] The temporal acquisition protocol is shown below: At each laser pulse on the target a fast sequence of images is recorded, such that images before the laser pulse serve as flat-field correction data, images after the laser pulse contain the time-dependent XHI signal to be analysed. The detector (Dimax, Photron) speed is given by the electronics hardware and limited to 25 000 frames per second for the given field of view. By recording two sequences, which differ only by the absolute delay between the laser pulse and an individual frame a composite sequence at the doubled frequency can be composed by interleaving the images from each individual sequence.

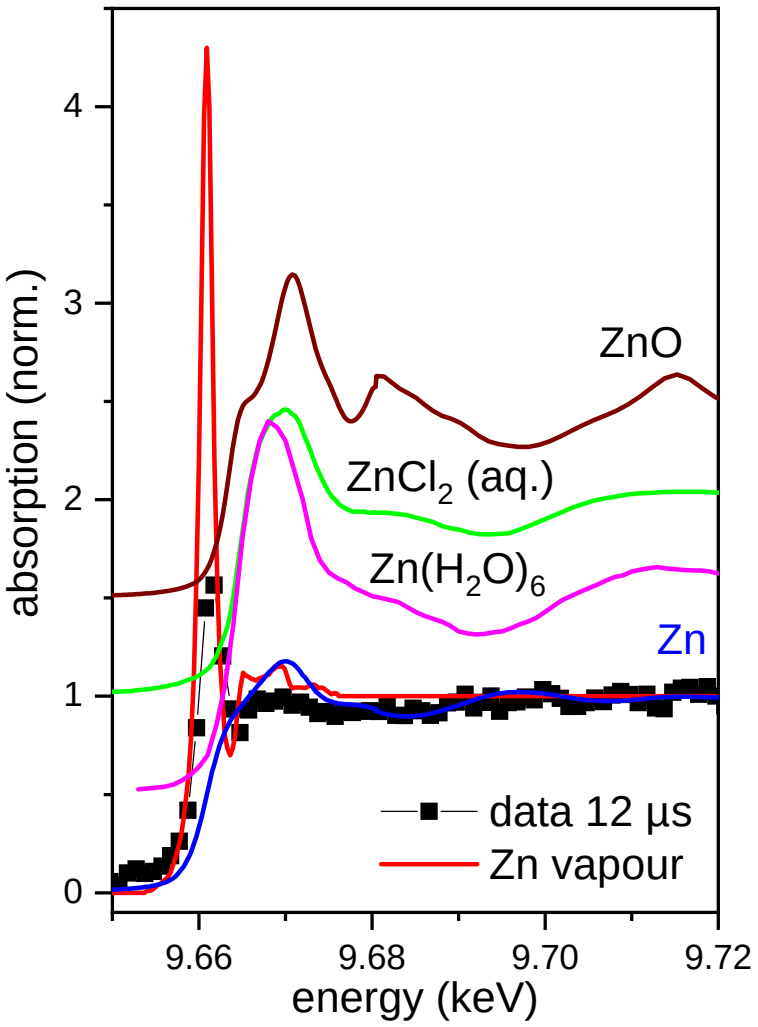

Figure 6: (Supplementary) Comparison of selected reference spectra to the XANES spectrum at 12 μs at 0.1 mm distance from the target. Spectra of a zinc foil, $ZnCl_2$ in water and ZnO in a cellulose pellet are measured at the beamline SUL-X at KARA, Karlsruhe. The reference spectra for zinc vapour and $Zn(H_2O)_6$ are taken from references[3] and,[4] respectively. Spectra are shifted in steps of 0.5 in absorption for clarity.

References

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