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Diffraction optics for focusing and characterization of hard X-ray free electron laser radiation

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The unique characteristics of the hard XFEL radiation impose new requirements for the focusing optics used when compared to hard synchrotron radiation. For example the heat loads caused by the extremely high photon flux quickly damage conventional optics such as Fresnel zone plates (FZPs) or diffraction gratings. Here we present results obtained using nanostructures based on diamond at Linac Coherent Light Source (LCLS). The focusing properties of diamond FZPs were measured using the imprint technique. The spot size was observed to be limited by the spectral bandwidth of the source to 320 nm FWHM. Also, a spectrometer setup based on a focusing diamond grating is presented with measured shot-to-shot spectra of LCLS beam.

Primary authors: KARVINEN, Petri (Paul Scherrer Institut); RUTISHAUSER, Simon (Paul Scherrer Institut)

Co-authors: MOZZANICA, Aldo (Paul Scherrer Institut); DAVID, Christian (Paul Scherrer Institut); FRITZ, David (SLAC National Accelerator Laboratory); GREIFFENBERG, Dominic (Paul Scherrer Institut); LEMKE, Henrik (SLAC National Accelerator Laboratory); JACEK, Krzywinski (SLAC National Accelerator Laboratory); CAMMARATA, Marco (SLAC National Accelerator Laboratory); GORELICK, Sergey (Paul Scherrer Institut)

Presenter: KARVINEN, Petri (Paul Scherrer Institut)

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