In Situ Characterization of XFEL Beam Intensity Distribution and Focusability by High Resolution LiF Crystal X-Ray Detector

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Abstracts: *We present here a new X-rays diagnostic based on using LiF X-ray crystal detectors that is able to perform in situ measurements the intensity distribution of X-rays beams with diameters ranging from some microns up to some centimeters with high spatial resolution (~ 1μm.) We demonstrated also, that by means of the LiF crystal submicron spatial resolution X-ray detector, in situ 3D visualization of SACLA XFEL focused beam profile along propagation, including propagation inside photoluminescence solid materials*

At coherent X-ray radiation facilities there is an urgent need for simple and efficient methods for *in situ* beamline metrology. Additionally, measurements of energy distribution of XFEL beams in the caustic of focusing system are very important both for correct evaluation of X-ray fluence in the different cross-sections of such beams and for future improving different focusing systems, which are now typically applied for such purposes. We present here a new X-rays diagnostic based on using LiF X-ray crystal detectors that is able to perform *in situ* measurements the intensity distribution of X-rays beams with diameters ranging from some microns up to some centimeters with high spatial resolution (~ 1μm). This diagnostic have an extremely limited cost and is relatively easy to set up. A first observation using this diagnostic at EH5 in SACLA shows that the presence of a slit in the XFEL beam highly structured it by generating diffraction patterns (Fig.1). An optimization of the distance between the slit and the sample position is presented to minimize the effect of the diffraction pattern induced by the slit. We demonstrated also, that by means of the LiF crystal submicron spatial resolution X-ray detector, *in situ* 3D visualization of SACLA XFEL focused beam profile along propagation, including propagation inside photoluminescence solid materials (See Fig.2), is possible [1].

[1] Pikuz, T. *et al.* Sci. Rep. **5**, 17713 (2015).