Development of an apparatus for speckle image observations near the X-ray diffraction spots using focusing beam.

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We have developed a new apparatus for speckle image observations using high coherent beam from a synchrotron radiation beam. The experiment was carried out at the undulator beamline BL-20XU of SPring-8. Figure 1 shows optics layouts for speckle measurements. A cross-slit with opening size of 100 micron x 100 micron was used as a pseudo-point source, and a Fresnel zone plate (FZP) (diameter=100micron, focal distance=16cm at 8keV, diffraction limited focal spot size =0.25micron[(1)], fabricated at NTT-AT.) was set about 200m downstream from the cross-slit. Sample was set at the focal plane of the FZP. A visible-light converted type two-dimensional image detector coupled with a CCD camera (Hamamatsu. 1024x1024 pixels) was set at 1.2m downstream from sample. Temperature of the sample was controlled from the 473K to below 10 K with a Liquid He cooling system. Sample rotation range was $-3<2\theta<61^{o}$. We observed the diffraction spot speckle image of $NbSe_2$ single crystal (*006*). The difference of periodicity between the speckle pattern of $NbSe_2$ at the room temperature and that below the superconductive transition point was observed. We will show a possibility that this method reveals periodic and/or random structures which is difficult to be observed with the conventional diffraction methods.

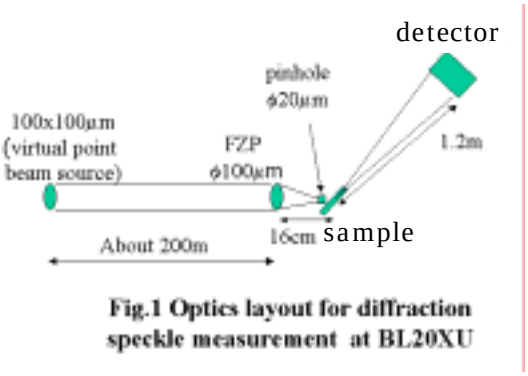

Fig.1 Optics layout for diffraction speckle measurement at BL20XU

(1). Suzuki, Y., Takeuchi, A., Takano, H., Ohigashi, T., and Takenaka, H., Jpn. J. Appl. Phys. 40 (2001), pp1508-1510.