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# 8 μm よりも高い空間解像度を達成する X 線暗視野法光学系の開発

## Development of XDFI Optics to Achieve Spatial Resolution Higher than 8 μm


東理大 [1]，深圳大 [2]，MGH[3]，KEK[4]，総研大 [5]，九工大 [6]，群馬大 [7]，山形大 [8]，

○安藤正海 [1]，郭金川 [2]，Gupta R.[3]，平野馨一 [4]，兵藤一行 [4,5]，金歌 [6]，中尾悠基 [1]，岡村賢一 [6]，

砂口尚輝 [8]，성용진（成容璡）[3]，鈴木芳文 [6]，高橋敏男 [9]，呉彦霖 [5]，湯浅哲也 [8]

TUS[1], Shenzhen Univ.[2], MGH[3], KEK PF[4], GUAS[5], KIT[6], Gunma Univ.[7]，Yamagata Univ.[8],

○Ando M.[1]，Guo J.[2]，Gupta R.[3], Hirano K.[4], Hyodo K.[4,5], Jin G.[6], Nakao Y.[1], Okamura K.[6],

Sunaguchi N.[7], Sung Y.[3], Suzuki Y.[6], Takahashi T.[7], Wu Y.[5], Yuasa T.[8]

e-mail: msm-ando@rs.noda.tus.ac.jp



In order to establish signatures of diseases such as cancer and atherosclerosis via x-ray pathology, high spatial resolution imaging is required. In this presentation we discuss a way to achieve such high spatial resolution imaging at the beam lines BL14B and BL14C in the Photon Factory. In the orbit, the cross-section of the electron beam size for BL14B and BL14C is given by $2\sigma_x$ = 1160μm and $2\sigma_y$ = 72μm. Using this electron beam, a 5T superconducting wiggler produces vertically polarized synchrotron radiation. The apparent beam size on the orbit could be reduced by a factor b x c with the help of an asymmetric monochromator-collimator, where $b = \sin(\Theta_B-\alpha) / \sin(\Theta_B+\alpha) = 0.02$ is the asymmetric factor and c the correction factor; $\Theta_B$ is the Bragg angle and $\alpha$ the angle between the crystal surface and the diffracting planes. In order to analyze the refracted x-rays in the plane of incidence --- this plane is horizontal because of the vertical polarization of the X-ray beam --- we employed the optics for X-ray dark-field Imaging (XDFI). The upstream monochromators at BL14B and BL14C use 111 and 440 diffraction, respectively, while the XDFI optics in the hutch employs the 440 diffraction. In order to suppress image blur due to the beam divergence caused by the non-parallel optical arrangement at BL14B, the distance between sample and LAA was chosen as 2 cm. The imaging plate used had a spatial resolution better than 5 μm and the exposure time for each image was approximately 2 min. For this experiment, the stored current in the ring was 450 mA at 2.5 GEV. We used a 425 μm thick silicon sample with honeycombed holes with 8 μm spacing to measure the horizontal and vertical spatial resolution, and a 1 μm thick tungsten wire phantom by JIMA (Japan Inspection Instruments Manufacturers' Association) to measure the modulation transfer function (MTF). Our experiments reveal that a spatial resolution better than 10 μm is achievable using the setup described above. The presentation will describe the experimental setup and results in detail.