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Two-dimensional electron beam size measurements with X-ray Heterodyne Near Field Speckles

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Measurements of the small beam sizes in current and future low-emittance light sources represent a serious challenge to the accelerator community due to the diffraction effects, and X-ray inteferometric techniques offer an interesting method to overcome this challenge. Here we report on 2D beam size measurements with a novel interferometric technique named Heterodyne Near Field Speckles (HNFS). It relies on the interference between the weak spherical waves scattered by nanospheres suspended in water and the intense transilluminating X-ray beam. Fourier analysis of the resulting speckles enables full 2D coherence mapping of the incoming radiation, from which the beam sizes along the two orthogonal directions are retrieved. We show experimental results obtained with 12.4 keV X-rays at the NCD-SWEET undulator beamline at ALBA, where the vertical beam size has been changed between 5 and 15 micrometers by varying the beam coupling. The results agree well with the estimated beam sizes from the pinhole calculations, proving that the HNFS method can resolve few-micrometer beam sizes.

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Footnotes

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