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Polarization measurement and vertical aperture optimization for obtaining circularly polarized bend-magnet radiation

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Using multilayer linear polarizers, we have characterized the polarization state of radiation from bend magnet beamline 9.3.2 at the Advanced Light Source as a function of vertical opening angle at photon energies of 97, 367 and 729 eV. Both a fine slit and a coarse semi-aperture were stepped across the beam to accept different portions of the vertical opening angle. Polarimetry data at each position yield the linear component of polarization directly and the circular component through reasonable assumptions about the amount of unpolarized radiation. The relative intensities for different vertical aperture positions were also measured. The results are in good agreement with theory, and demonstrate the importance of having such polarimetry data during the alignment and calibration of beamline optics. Such data make it possible to select radiation having a desired and known polarization state. For example, a degree of linear polarization in excess of 0.99 was measured with the fine slit in the orbit plane. Positioning the coarse semi-aperture to obscure a fraction of the beam enables optimization of the general figure of merit given by the square of the flux times the degree of circular polarization.