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Characterizing optical synchrotron radiation in the geometric optical phase space and optimizing the energy transport to a photo detector

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At the Karlsruhe Research Accelerator (KARA) facility, an electron beam is generated by a thermionic electron gun, pre-accelerated to 53 MeV by a microtron and then ramped up to 500 MeV in a booster synchrotron before being injected into the storage ring, where a final electron energy of 2.5 GeV is reached. Compared to a 2D camera, when using 1D photodetectors either directly at the synchrotron light port or after a fiber optics segment, the optic design goal is to maximize the optical intensity at the photo detector, rather than to keep spacial coherence. In this field of non-imaging optics the emitter, optical setup and sink can be modeled in the optical phase space, with the etendue being the conserved quantity and position and angle the independent variables. In this contribution we describe the synchrotron radiation emitted at a dipole in the KARA booster synchrotron and the imaging setup into an optical multimode fiber with this formalism and compare the results with measurements at the synchrotron light port of the booster synchrotron.

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