Versatile Focusing Using a Combination of Toroidal and Kirkpatrick-Baez Mirrors

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Toroidal mirrors can be used to efficiently focus synchrotron radiation for magnifications near one. At the PNC-CAT insertion device beamline, a toroidal mirror is used to focus the entire undulator beam to a spot size of 450 x 150 microns. For large demagnifications, Kirkpatrick-Baez (K-B) mirrors are a good choice. Spot sizes down to one micron have been achieved at the PNC-CAT. However, these mirrors only collect a fraction of the undulator beam, and result in a highly divergent beam with a short working distance. To achieve intermediate beam size with less divergence, the toroidal and K-B mirrors can be combined. The toroidal mirror reduces the beam to match the entrance aperture of the K-B mirrors. This combination can provide beam sizes below 100 microns while collecting the entire undulator beam and providing a convenient working distance. Thus, the beam size, working distance, and divergence can be tailored to the needs of the experiment.

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