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Use of tapered glass capillaries for producing microbeams

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Pacific Northwest Consortium CAT is developing tapered glass capillaries using fiber optics techniques. They will be used to produce x-ray microbeams at its Undulator-A insertion device beamline, and later, at the bending magnet beamline. Previous calculations showed that, under ideal conditions, glass capillaries can produce intensity gains of several thousand times that of a pinhole. Recently, we fabricated several capillaries and tested three of them with outlet diameters of 1.3, 1.4 and 12.4 micrometer and lengths of about 35-90 cm. We obtained intensity gains over a pin hole of about 270, 240, and 30, respectively. They are about half of the calculated values expected from an ideal linear profile. We plan to measure the profile of the capillaries more accurately and use this actual profile in our calculations to compare with the experimental performance. The goal is to investigate further the source of the differences between the calculated performance and the experimental performance obtained thus far, as part of our efforts to further improve the fabrication process. Efforts to produce capillaries with more optimum profiles, which are not linear, are in progress.