B14

# Optimization of monochromator crystal bending using computer simulations

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Sagittal focusing of synchrotron beam is important for both bending magnet (BM) and insertion device beamlines as a means of increasing beam density at the sample position. Designs for the second crystal of a double-crystal monochromator share the goal of producing a uniform sagittal radius and minimizing anticlastic bending of the crystal. Most designs use crystals with parallel stiffening ribs or slots. In practice it has been found that these designs may have a sagittal radius that varies across the surface due to the ribs or slots and thus deteriorates the focus.

We describe results obtained by finite element analysis (using commercial software) of various optimized crystal shapes. Crystal geometry and material properties were used to calculate the crystal surface deflections and radii of curvature using different bending mechanisms simulated by the choice of appropriate boundary conditions. For the BM and wiggler sources, we analyzed ribbed crystals and found conditions at which the principal curvature is cylindrical and anticlastic effect is minimized. For the undulator-A source, we found that a single slot in the center of a thick Si (111) plate would be sufficient to eliminate anticlastic effects and ensure cylindrical sagittal bending.