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Design of a rib stiffened, cryogenically cooled sagittal bender mechanism for use at CARS sector 13 beamline

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When using sagittally bent crystals as focusing monochromators, it is important to minimize or eliminate the anticlastic bending in order to prevent significant departure from the Bragg condition and resultant loss of monochromator performance. The traditional approach to this problem utilizes stiffening ribs in the tangential direction of the crystal. However, for large crystal sizes and/or small angles of incidence, stiffening ribs of sufficient rigidity inevitably distort the sagittal curvature of the crystal, thus limiting the focusing ability.

Recent calculations indicate, though, that the combination of rigid sidebars with a specific length/width ratio of the crystal suffices to eliminate, to first order, the anticlastic bending near the center. The residual tangential slope errors can be controlled with small size stiffening ribs, narrow enough so as not to have any measurable impact on the sagittal curvature within the vertical emittance of the storage ring.

We present a complete design of a crystal and sagittal bender utilizing these results. The design is compact and flexible and incorporates cryogenic cooling of the crystal, thus making it appropriate for APS insertion device (wiggler and undulator) applications.