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Development of new bent crystal assemblies for SPS and LHC accelerators

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Bent crystal assemblies developed at CERN allow high-energy particles to be channeled in its accelerators (SPS, LHC). This channeling of particles using crystals enables either to minimize losses (SPS) or to replace of primary collimators (LHC). Crystals may also be expected to be used in electron machines (eg. FCC-ee). The performance of such single bent crystals depends on the ability to precisely position a crystal onto a supporting assembly while minimizing crystal torsion. In the case of multiple crystals mounted on the same assembly, the relative positioning of each crystal becomes crucial, as particles must interact precisely with the successive lattice structures of distinct crystals. In this study, different materials are considered for the precision manufacturing of crystal benders, and an analysis of crystal torsion is provided. Simulations of crystal anticlastic deformation and torsion as a function of clamping surface tolerances are presented. The sensitivity of bent crystal assemblies to high-temperature cycles is also analyzed. Finally, the manual assembly process, including the clamping of the crystals onto the supporting benders, is discussed.

Footnotes

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