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Calculating the channelling efficiency of bent silicon crystals using two particle simulation programs: SixTrack and Xsuite

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A novel double-crystal experiment is being considered for installation in CERN's Large Hadron Collider (LHC) to measure precession properties of short-lived baryons such as Λ_c^+ . The experiment utilizes a first bent silicon crystal to deflect halo particles away from the circulating proton beam by $50 \mu\text{rad}$. Further downstream, a second crystal is installed, which produces a significantly greater bending angle of 7 mrad . While the former is well established for operations in the LHC, the latter presents a new challenge for existing simulation tools. Using particle tracking programs, SixTrack and the newly developed Xsuite, we simulate a single pass experiment to calculate the expected channelling efficiency of these crystals. The results serve as a prediction for the performance of prototype crystals recently tested in CERN's North Area at $180 \text{ GeV}/c$, that are planned to be installed in the LHC in 2025 for use in the multi-TeV energy range.

Footnotes

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