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Next-generation ultra-compact calorimeters based on oriented crystals

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Scintillating crystal calorimeters provide unparalleled resolution in measuring the energy of electromagnetic particles. Recent experiments performed at CERN and DESY beamlines by the AXIAL/ELIOT collaboration demonstrated a significant reduction in the radiation length inside $PbWO_4$, the material used for the CMS ECAL, observed when the incident particle trajectory is aligned with a crystal axis within $\sim 0.1^\circ$. This remarkable effect, being observed over the wide energy range from a few GeV to 1 TeV or higher, paves the way for the development of an innovative calorimeter based on oriented crystals, featuring a design significantly more compact than currently achievable while rivaling the current state of the art in terms of energy resolution in the range of interest for present and future forward detectors (such as the KLEVER Small Angle Calorimeter at CERN SPS), beam dumps for light dark matter search and source-pointing space-borne γ-ray telescopes.

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Secondary track (number)

12

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