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Strong Reduction of the Effective Radiation Length in an Axially Oriented Scintillator Crystal

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We measured a considerable increase of the emitted radiation by 120 GeV/c electrons in an axially oriented lead tungstate scintillator crystal, if compared to the case in which the sample was not aligned with the beam direction. This enhancement resulted from the interaction of particles with the strong crystalline electromagnetic eld. The data collected at the external lines of CERN SPS were critically compared to Monte Carlo simulations based on the Baier Katkov quasiclassical method, highlighting a reduction of the scintillator radiation length by a factor of ve in case of beam alignment with the [001] crystal axes. The observed effect opens the way to the realization of compact electromagnetic calorimeters/detectors based on oriented scintillator crystals in which the amount of material can be strongly reduced with respect to the state of the art. These devices could have relevant applications in fixed-target experiments as well as in satellite-borne gamma-telescopes.

Reference

L. Bandiera et al., arXiv:1803.10005, accepted to be published on Phys. Rev. Lett.

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