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The OREO (ORiEnted calOrimeter) project

Inorganic scintillators are widely used to build compact and high-energy-resolution homogeneous electromagnetic calorimeters. Recent tests have shown that if the impinging angle of the particle relative to a lattice axis is smaller than one degree, the strong field experienced by electrons and photons with an energy larger than a few GeV increases the standard bremsstrahlung and pair-production cross-sections, leading to an acceleration of the electromagnetic shower.

The ORiEnted calOrimeter (OREO) collaboration (subtask 1.3.4 of the DRD6 collaboration) has assembled an electromagnetic calorimeter prototype based on oriented crystals, consisting of a 3×3 matrix of 5 radiation-length oriented PWO-UF (Ultra-Fast) crystals read out by SiPMs, followed by a layer of non-oriented crystals.

This contribution will present the results obtained during the OREO 2024 beam tests with 1–6 GeV/c electrons on the T9 beamline at the CERN PS and 40–200 GeV/c electrons on the H4 beamline at the CERN SPS. For the first time, we have demonstrated the possibility of aligning a layer of crystals along the same crystallographic direction, opening the way towards the development of a highly compact calorimeter.

In addition, we will show that this new type of calorimeter features a better energy resolution and improved $e^{\pm}$, γ/hadron discrimination capability. In fact, since the nuclear interaction length is unaffected by the lattice orientation, the oriented crystal layer of the calorimeter acts as an instrument that is sensitive to photons while being blind to hadrons.

These features make such a calorimeter highly attractive for high-energy physics experiments (e.g., forward calorimeters in colliders, fixed-target experiments) and for satellite-based γ-ray observatories.

Secondary track

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