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The OREO (ORiented calOrimeter) project

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Inorganic scintillators are widely used to build compact and high energy resolution homogeneous electromagnetic calorimeters. In recent years, several studies have been performed on the fact that their crystalline nature can heavily affect the Bremsstrahlung and Pair Production mechanisms. In fact, experimental tests have shown that when the incident beam is aligned with the crystal axes within some tenths of a degree, the electromagnetic shower development is accelerated. The ORiEnted calOrimeter (OREO) project intends to assemble and test an electromagnetic calorimeter prototype based on oriented crystals. The calorimeter will consist of a 3×3 matrix of 5 radiation length oriented PWO-UF (Ultra-Fast) crystals readout by SiPMs, followed by non oriented crystals. The most challenging aspect of the design is to keep the crystals aligned when arranged in a matrix structure. This contribution will present the results obtained with a 3 × 1 and a 2 × 2 matrix of PWO-UF oriented crystals during the Oreo 2023 beamtests with 6-15 GeV/c electrons on the T9 beamline at the CERN PS and with 20-150 GeV/c electrons on the H2 beamline at the CERN SPS. The results demonstrate for the first time ever the possibility to align a layer of crystals along the same crystallographic direction, opening a new technological path towards the development of a highly compact calorimeter. The contribution will explore also the particle identification capability of such a system: since the nuclear interaction length is unaffected by the lattice orientation, the calorimeter oriented crystal layer is an instrument that is sensitive to photons and blind to hadrons. These features make such a calorimeter of interest for high energy physics experiments (forward calorimeter in colliders such as in the CERN HIKE-KLEVER experiment, fixed target experiments) but also for space-borne γ ray telescopes.

Collaboration

Role of Submitter

I am the presenter

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