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Test beam of a cell prototype for a dual readout-calorimeter proposal at the Future Circular Collider FCC-ee

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The IDEA apparatus, a proposed experiment for the future FCC-ee accelerator, recently incorporated a novel electromagnetic calorimeter into its baseline design. This calorimeter aims to improve the energy reconstruction for neutral particles to 3 % at 1 GeV, while simultaneously enabling particle-flow algorithms through fine segmentation.

Designed to fit inside the magnet coil, the crystal calorimeter will be composed of two scintillating crystal layers with approximate thicknesses of 6 X_0 and 18 X_0. The required transverse cell size of 1-1.5 cm, requires a readout based on Silicon Photomultipliers. One the central features of such apparatus will be a simultaneous measurement of the Cherenkov and scintillation light fractions (dual-readout) in the shower for the back layer. This calorimeter will complement the sampling hadronic one located outside the magnet, and that is also designed for dual-readout.

INFN, in collaboration with the Calvision consortium in the USA, is actively involved in the proof of principle of such crystal calorimeter with the sections of Milano Bicocca, Napoli, and Perugia.

This contribution will presents results from a test beam conducted in 2024 at the CERN North Area H6 beamline. For this test, PWO, BGO, and BSO crystals were exposed to a 10-100 GeV electron beam. The primary objective was to demonstrate the double readout technique using Silicon Photomultipliers, crucial for a compact design of the apparatus and an overall versatility for the design of future applications.

The single crystal under test was mounted on a rotation stage to exploit the directionality of the Cherenkov photons; we explored both optical and waveform template techniques for the identification, finally proving we can separate such photons from the scintillation ones.

A larger prototype, capable of shower containment is currently under development within the MAXICC prin project as part of the DRD6 collaboration and will be tested on beam in the fall 2025.

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