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Electromagnetic shower reconstruction with emulsion films in the OPERA experiment

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Summary

OPERA is a long-baseline neutrino oscillation appearance experiment designed to obtain an unambiguous signature of $\nu_\mu \rightarrow \nu_\tau$ oscillation. The detector, located in the underground Gran Sasso Laboratories, plans to detect ν_τ 's in the CERN to Gran Sasso (CNGS) ν_μ beam,

which is optimised for ν_τ appearance.

OPERA is an hybrid experiment with electronic detectors, iron magnets and Emulsion Cloud Chambers (ECC).

The ECC combines in one cell the high tracking precision of nuclear emulsions ($\sim 0.1 \mu\text{m}$) and the large target mass of the lead plates. The basic element, the "brick", has dimensions of $12.7 \times 10.2 \times 7.5 \text{ cm}^3$; it is a sequence of 56 lead (1 mm

thick) and 57 emulsion films

(44 μm thick emulsion layers on either side of a 205 μm plastic base). The total length of an OPERA ECC module is about $10 X_0$.

In addition of its very good tracking information capability, allowing for instance the detection of short-lived particles, the ECC can be used as a fine sampling

electromagnetic calorimeter. We will report the method developed to reconstruct the electromagnetic showers with ECC and the energy measurement in the 1-10 GeV range.

The achieved energy resolution is about $\frac{\sigma_E}{E} = \frac{40\%}{\sqrt{(E)}}$.

We will also

present the momentum measurement of the charged hadron using Multiple Coulomb Scattering used for the hadronic shower reconstruction.

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