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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  $\nu_\tau$ 's in the CERN to Gran Sasso (CNGS)  $\nu_\mu$  beam,

which is optimised for  $\nu_\tau$  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  $\mu\text{m}$  thick emulsion layers on either side of a 205  $\mu\text{m}$  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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