

# Study of Neutrino Interactions Using the Electronic Detectors and Emulsion-Lead Targets of the OPERA Experiment

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The OPERA experiment is based on a hybrid technology combining electronic detectors and nuclear emulsions.

OPERA collected muon-neutrino interactions during the 2008, 2009 and 2010 physics runs of the CNGS neutrino beam, produced at CERN with an energy range of about 5-35 GeV. A total of 5.3 10<sup>19</sup> protons on target equivalent luminosity from the 2008-2009 sample has been analysed using the measurements in the electronic detectors. Charged Current (CC) and Neutral Current (NC) interactions are identified and the NC/CC ratio is computed. The momentum distribution and the charge of the muon tracks produced in CC interactions are analysed. For CC events the Bjorken- $y$  distribution is also measured. Measurements are compared to Monte-Carlo expectations.

The OPERA neutrino target brick, based on the so-called Emulsion Cloud Chamber (ECC) technique, of dimensions 12.7x10.2x7.5 cm<sup>3</sup>, is composed by a sequence of 56 lead plates (1 mm thick) and 57 emulsion films (44 $\mu$ m thick emulsion layers on either side of a 205 $\mu$ m thick plastic base). The total length of a brick corresponds to about 10 X<sub>0</sub> where X<sub>0</sub> is the radiation length in lead. The angular resolution of the emulsions allows, using the multiple Coulomb scattering of the tracks in the lead plates, the determination of charged particle momentum from several hundreds of MeV/c to a few GeV/c. This range corresponds to the momentum range of secondary hadrons produced in neutrino interactions in the OPERA experiment. Momentum measurements performed by the electronic detectors on soft muon tracks are also compared to the measurement performed in the OPERA emulsion films.

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