NEUTRINOS @ CERN

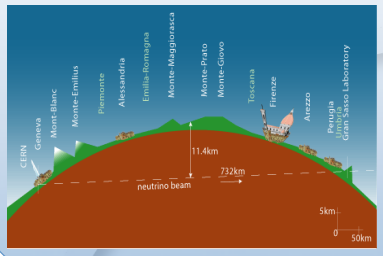
SINCE 2006

NEUTRINO OSCILLATIONS: THE OPERA EXPERIMENT

ANS / JAHRE / ANNI CERN

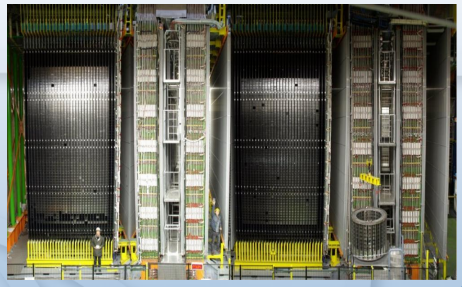
60 YEARS OF SWISS SCIENCE AT CERN

THE CERN/LNGS OPERA EXPERIMENT



OPERA is unique in studying $\nu_\mu \rightarrow \nu_\tau$ oscillations by searching for ν_τ appearance in the CERN Neutrino to Gran Sasso beam (CNGS). The hybrid detector has a 1250 ton target mass composed of emulsion film-lead sandwiches (bricks) complemented by electronic detectors.

http://operaweb.lngs.infn.it



First observation of ν_τ-ν_τ oscillation appearance

- ν_τ interactions in lead detected by observing *O*(100 μm) long τ tracks with high space resolution emulsion films (~1 μm accuracy).
- 150000 bricks including 10 million films constitute the neutrino target: the largest "photographic camera" ever built.
- Trackers and spectrometers allow to trigger, point to the interaction in the target, and perform BG reduction (from ν_μ CC interactions).
- The experiment took oscillation data from 2008 to 2012 (19505 events). 4 ν_τ events have been detected so far: 4.2σ observation of ν_τ oscillation appearance.
- Most sensitive limits on $\nu_\mu \rightarrow \nu_e$ oscillation appearance (high Δm^2)

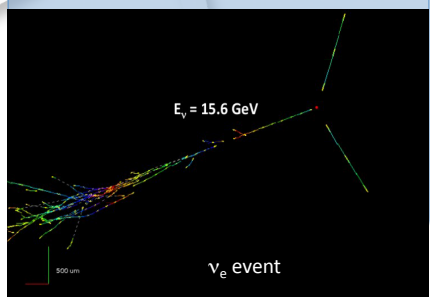
Swiss Emulsion Scanning Station

- The Swiss groups had a leading role in the realization of the emulsion European Scanning System based on automatic microscopes with CMOS camera readout and robotized handling of the emulsion films.
- Bern hosts the largest emulsion scanning station in Europe, with its 6 microscopes operating 24h/7d with high efficiency.
- 1430 events were scanned and analyzed at the Bern station (~25% of the total). Scanning is still in progress.

- list of publications in: http://operaweb.lngs.infn.it:2080/Opera/phpmyedit/articles.php

Main contributions of the Swiss groups: Bern – ETHZ – Neuchâtel

- Experiment proposal, design and construction (1998-2008)
- Management: Spokesperson
- Target tracker construction
- Lead for the target
- Development and realization of automatic microscopes
- Data taking and coordination
- Mass emulsion scanning
- Physics data analysis:
  - Decay search procedure
  - Muon ID & momentum measurement
  - Nuclear fragment identification
  - Charmed particle studies
  - Electron reconstruction and π^0 ID
  - Kinematics of neutrino events
  - Hadron re-interaction studies
  - $\nu_\mu \rightarrow \nu_\tau$ oscillation analysis
  - $\nu_\mu \rightarrow \nu_e$ oscillation analysis



Swiss Institute of Particle Physics

SPS/CHIPP ANNUAL MEETING 2014

Fribourg, 30 June– 2 July 2014

swiss physical society