

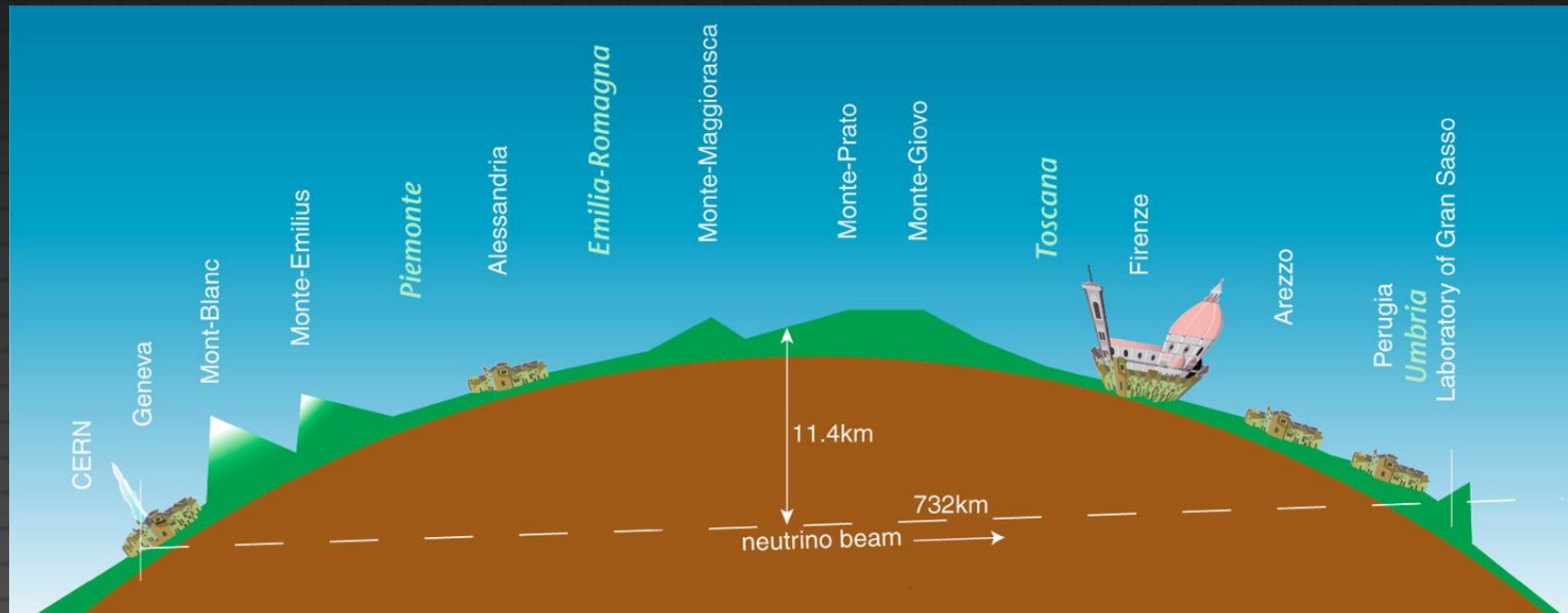
COMCHA ML Challenge

Introduction

1st COMCHA School

Barcelona, October 4th, 2019

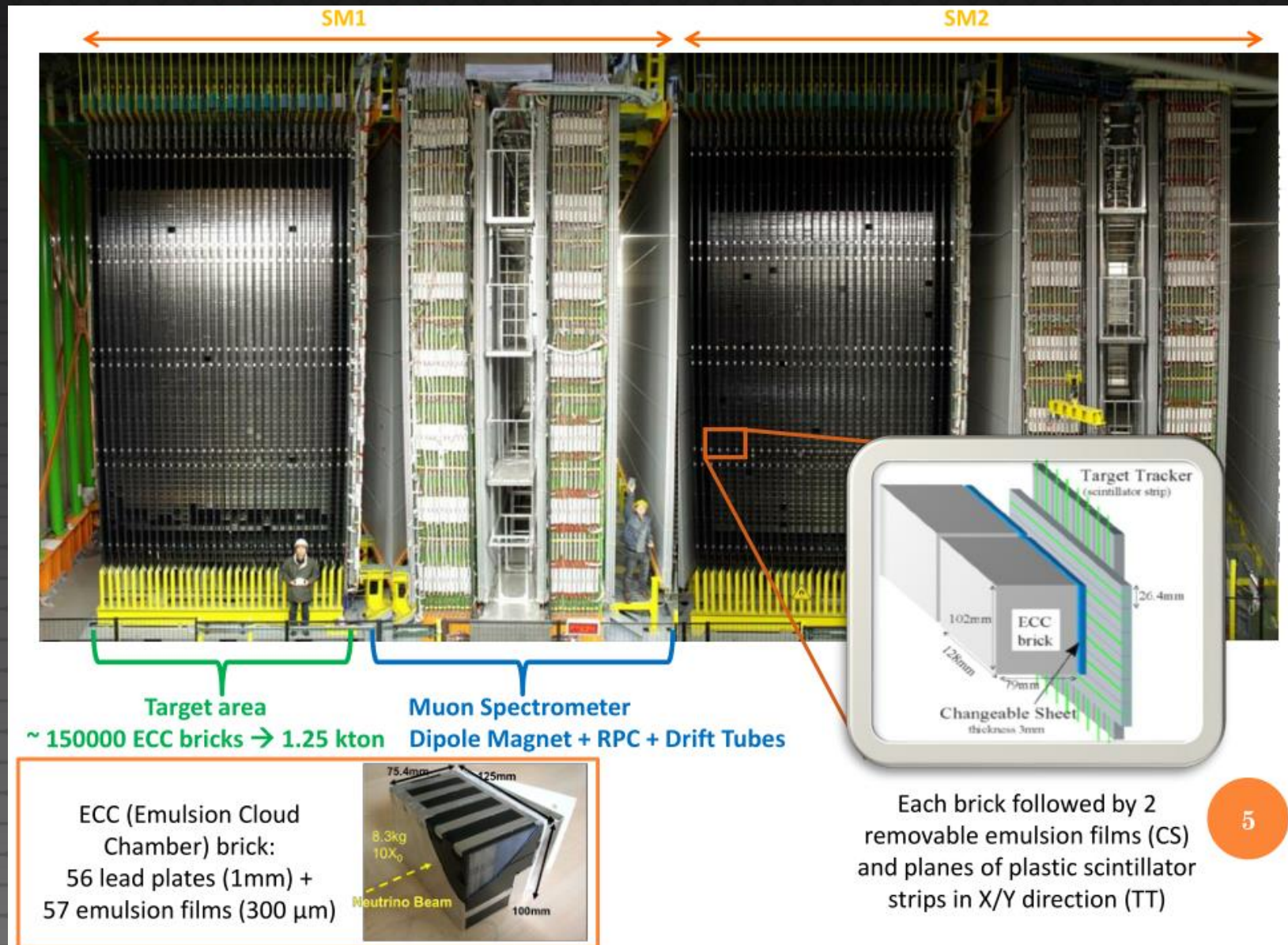
Overview



- Goal: find neutrino oscillation
- Detector: photo emulsion
- Data taking: 2008-2012
- Results: 5 $\nu_{\mu} \rightarrow \nu_{\tau}$ observed

<http://opraweb.lngs.infn.it>

The OPERA detector



OPERA ECC brick

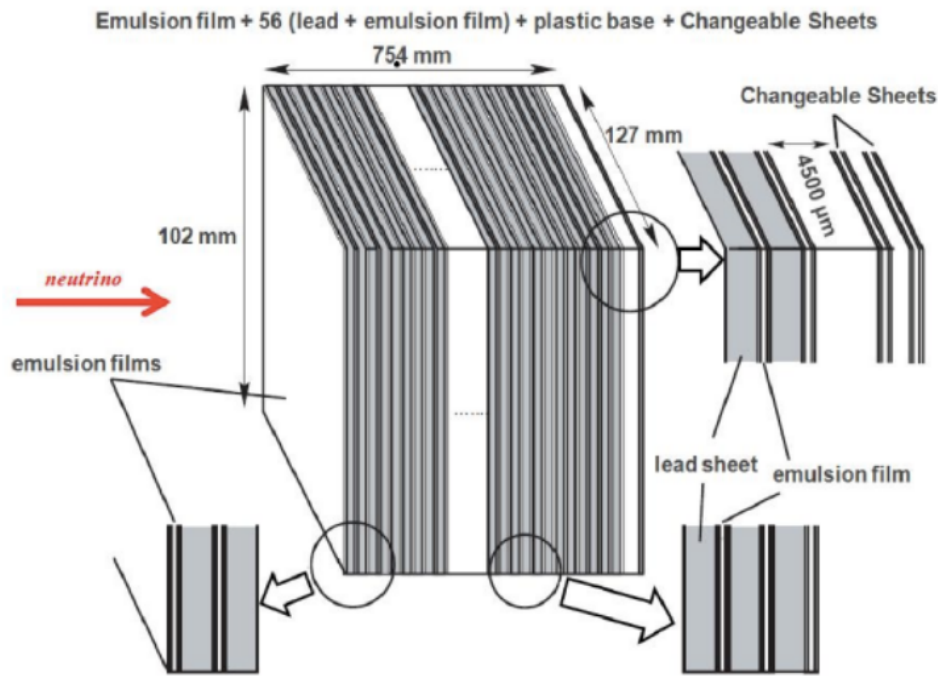
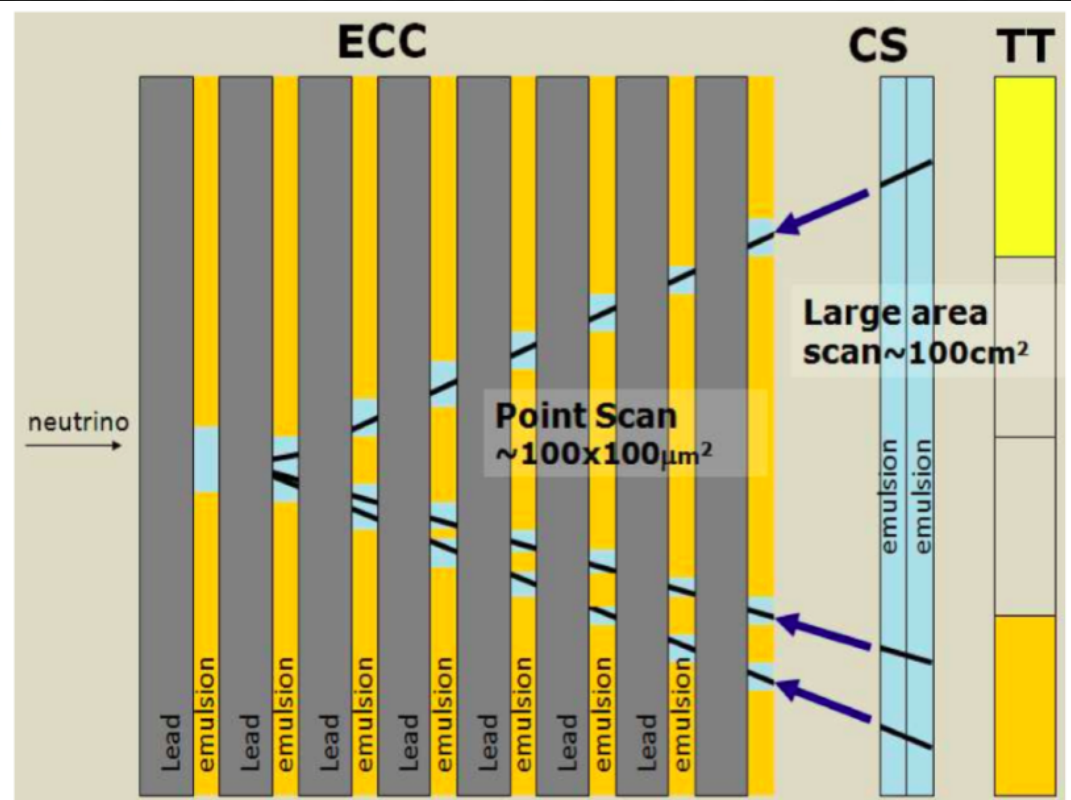
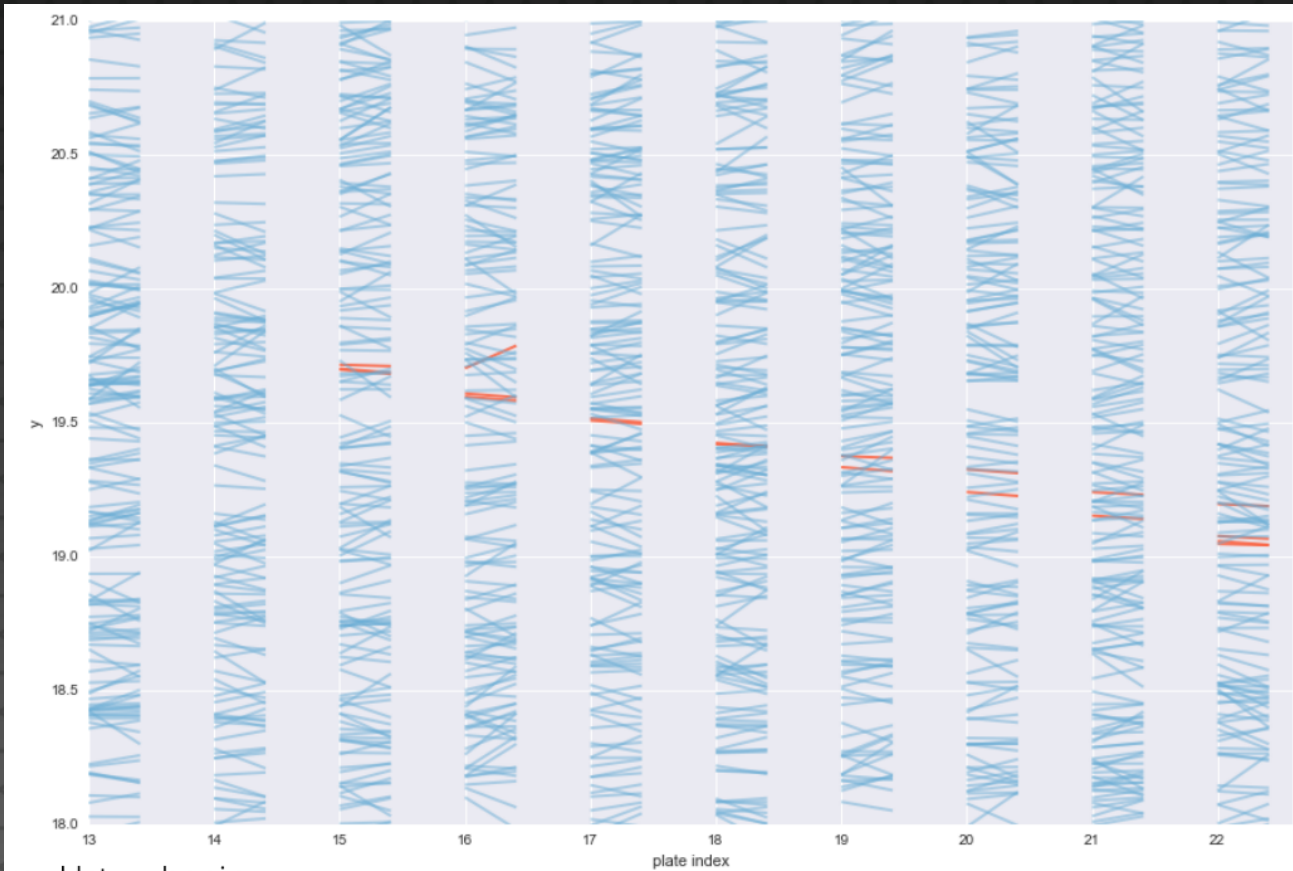


Figure 2.4 – Schematic structure of an ECC brick.



- While passing through lead material neutrino can scatter
 - ➔ on atomic nuclei – known behaviour (hadronic showers)
 - ➔ on atomic electron resulting in electro-magnetic showers

Brick structure



Variables in data:

Id - ID of a track

X - X coordinate of the track start

Y - Y coordinate of the track start

Z - Z coordinate of the track start

TX - angle of the track in XZ plane

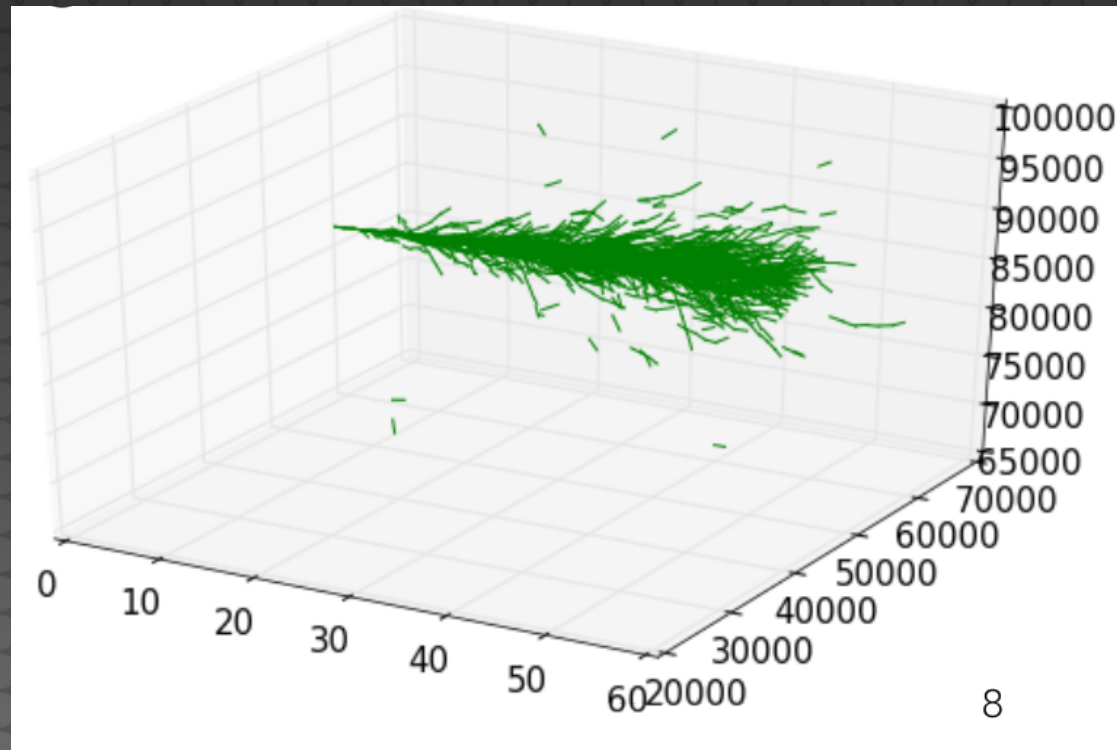
TY - angle of the track in YZ plane

chi2 - goodness of fit of the track line to the track hits

(See baseline classifier for more details on data structure)

The dataset

- Data Background: 1 brick, $\sim 10^6$ basetracks (signal=0)
- MC Signal: simulation of pure EM showers (100 events, $10^2 - 10^3$ basetracks per shower) (signal=1)
 - Origin of the mother-particle is known



(See baseline classifier for more details on data structure)

Challenge

- Detect basetracks coming from signal electromagnetic shower
- Figure of Merit: ROC AUC

October 7th, 11 a.m. : presentation of results

Hints

- Use information about origin
- Consider tracks within certain angle from every known origin
- Play with new features:
 - distance between tracks
 - \Alpha (see figure on the right)
 - \Theta (angle btw basetracks)
 - dTX, dTY (slope difference)
 - IP – Impact Parameter

