

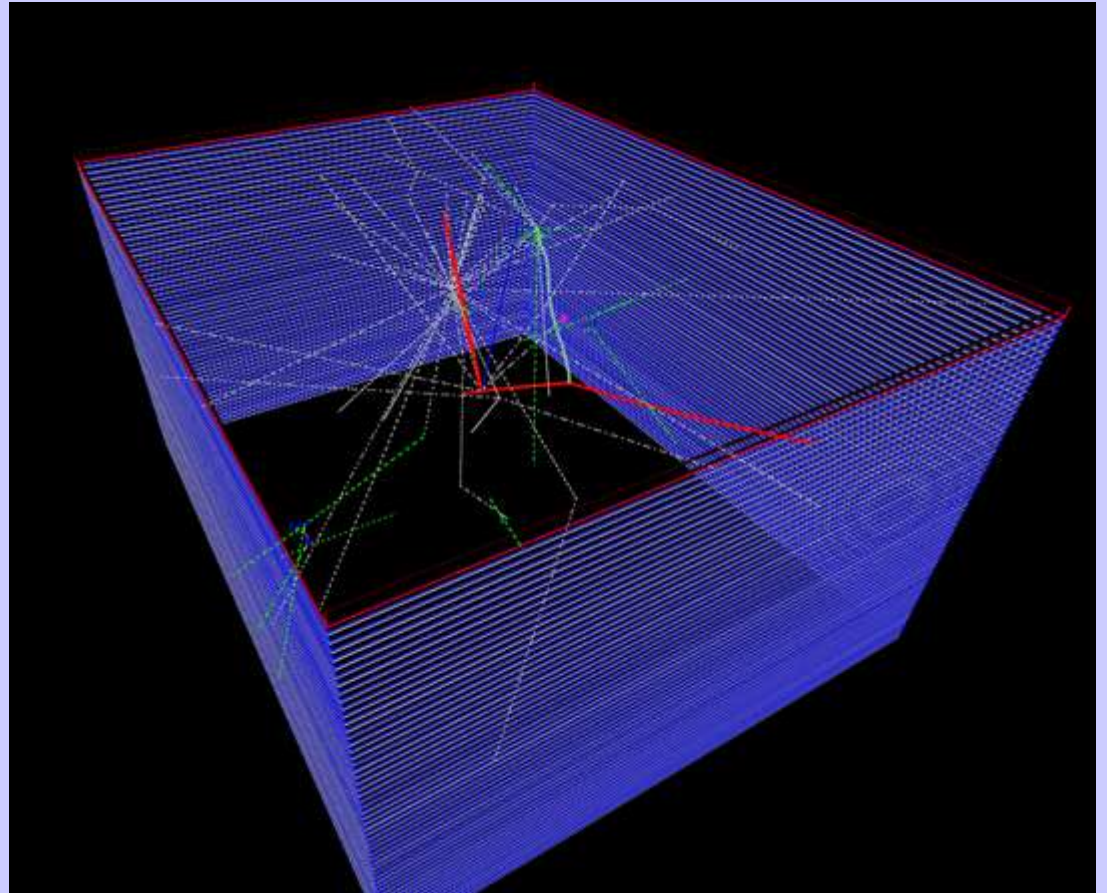
***Track finding algorithms in  
emulsions of the  
OPERA experiment***

Sheshukov Andrey

Irkutsk State University  
LNP JINR

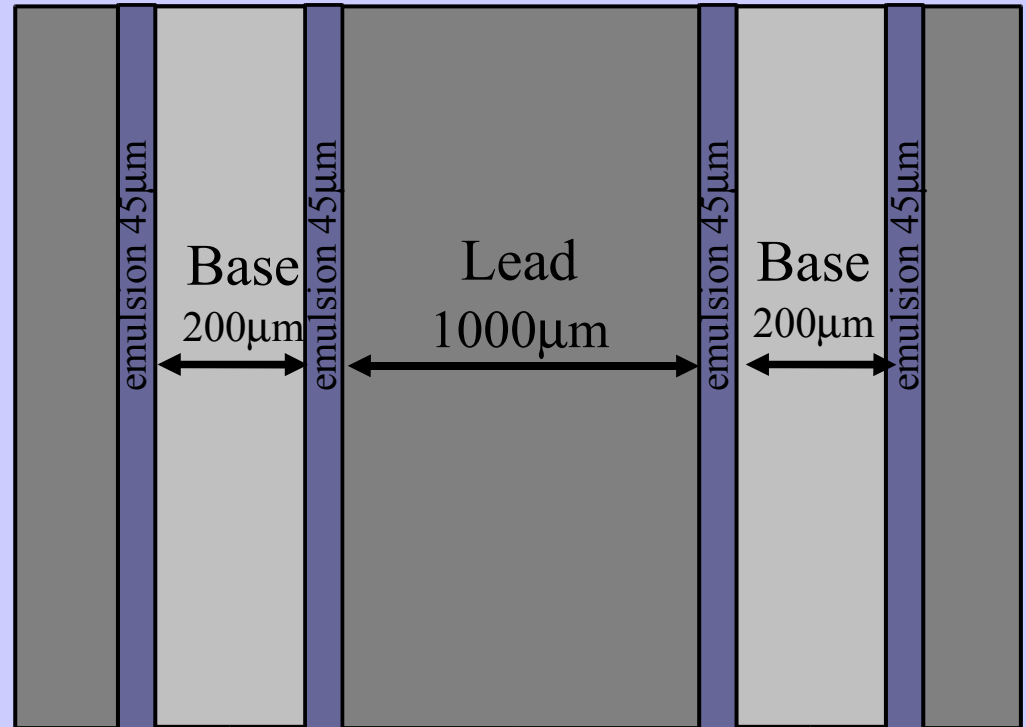
# *The OPERA experiment*

- Experiment studies  $\nu_{\mu} \rightarrow \nu_{\tau}$  oscillations
- The main goal of the experiment is to obtain  $\Delta m_{23}^2$
- Appearance of tau neutrinos in the muon neutrino beam is to be measured
- Photo emulsion is used to study the neutrino interaction vertex and tracks

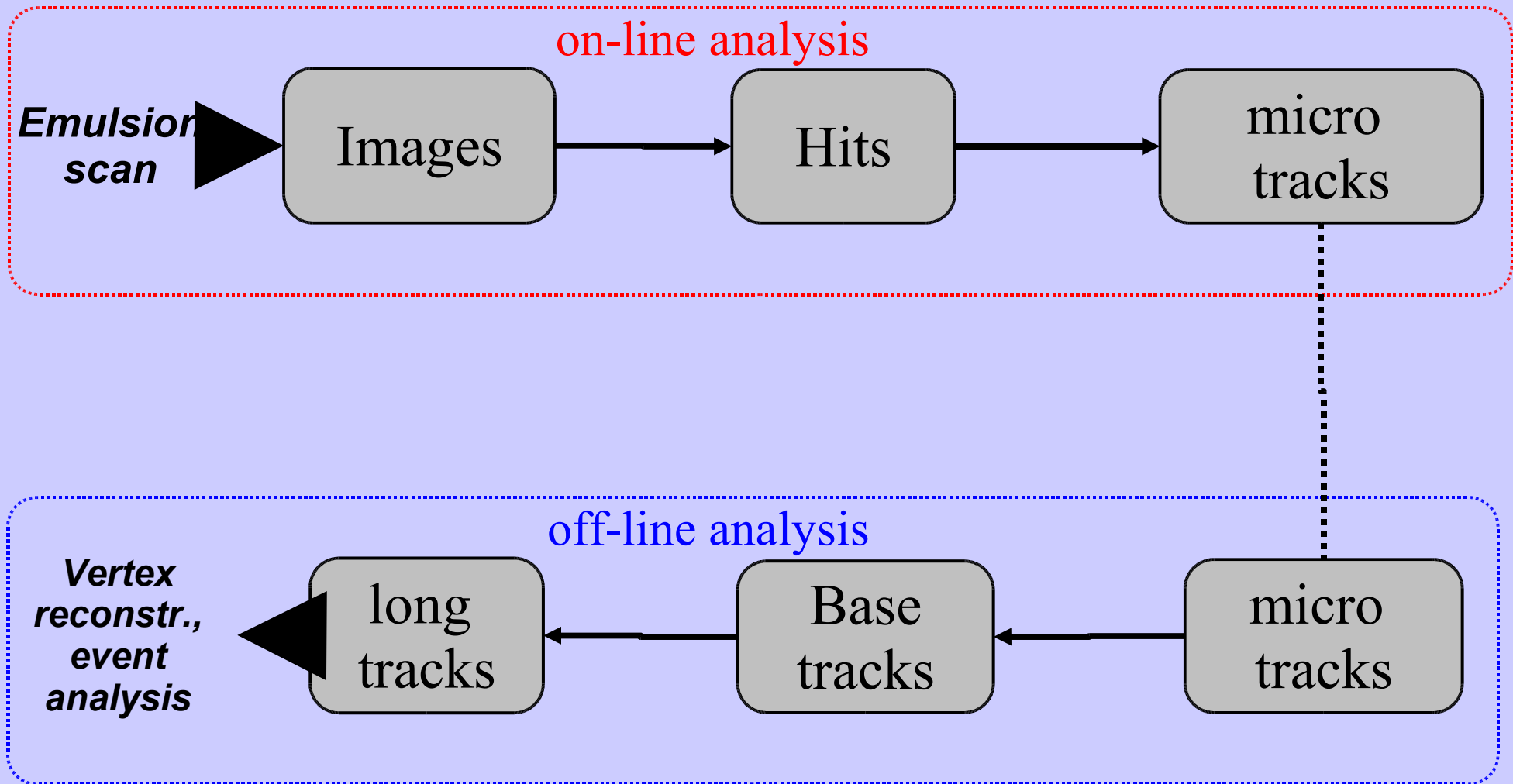


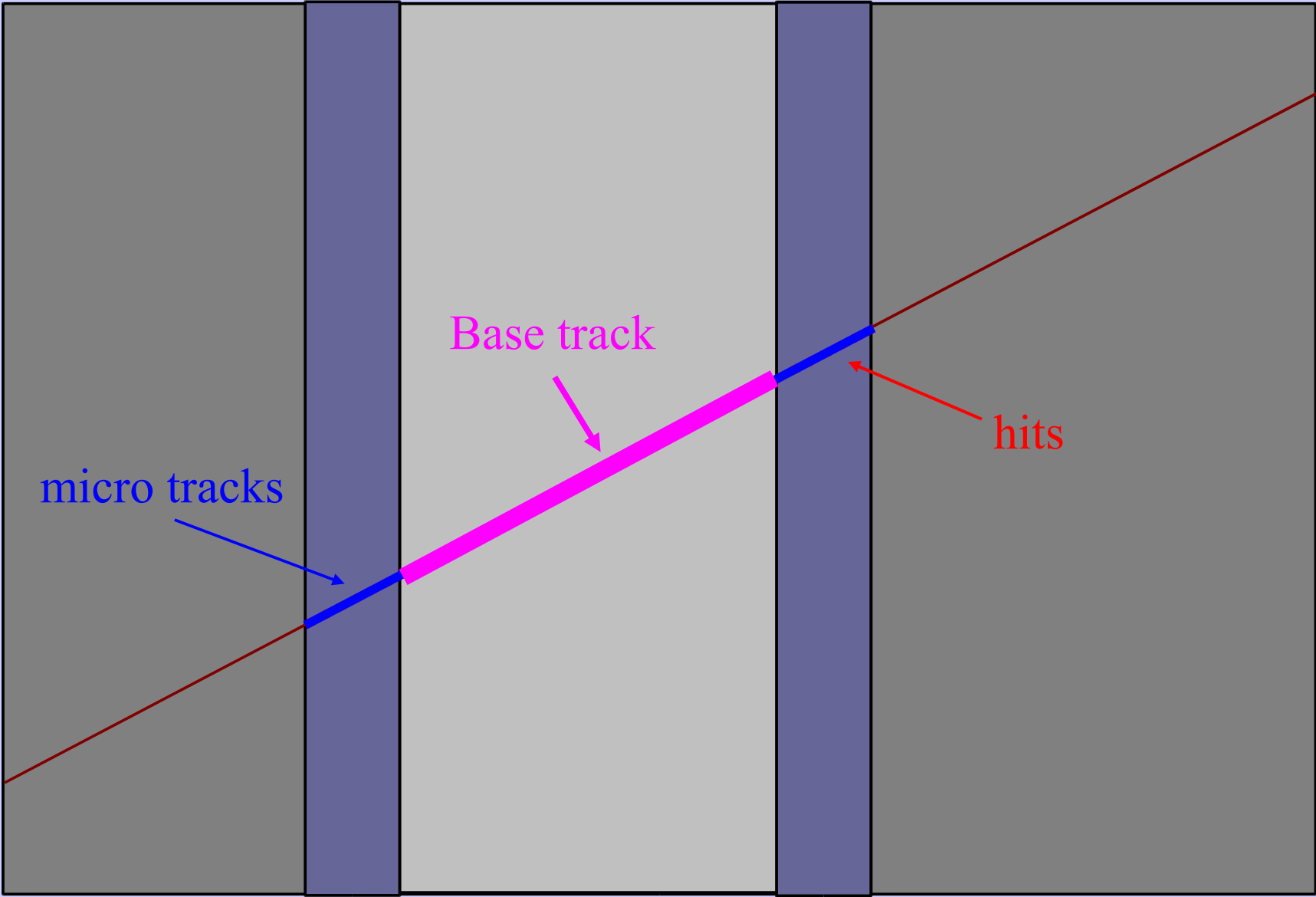
# OPERA Brick

- The OPERA Brick:  
102mm\*127mm\*75mm
- It contains 56 plates with  
2 emulsion layers each
- Each emulsion layer is  
scanned - 16 images

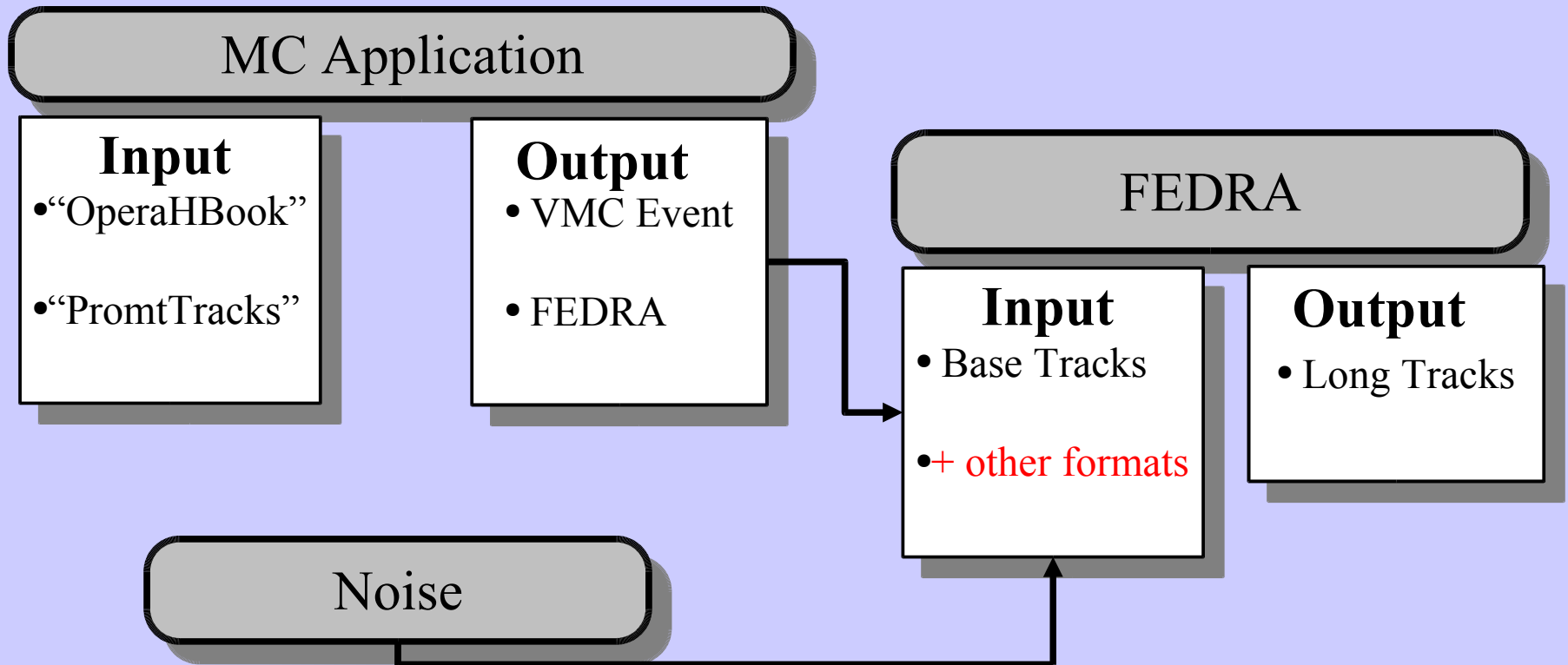


# *Emulsion analysis scheme*





# *Simulation scheme*



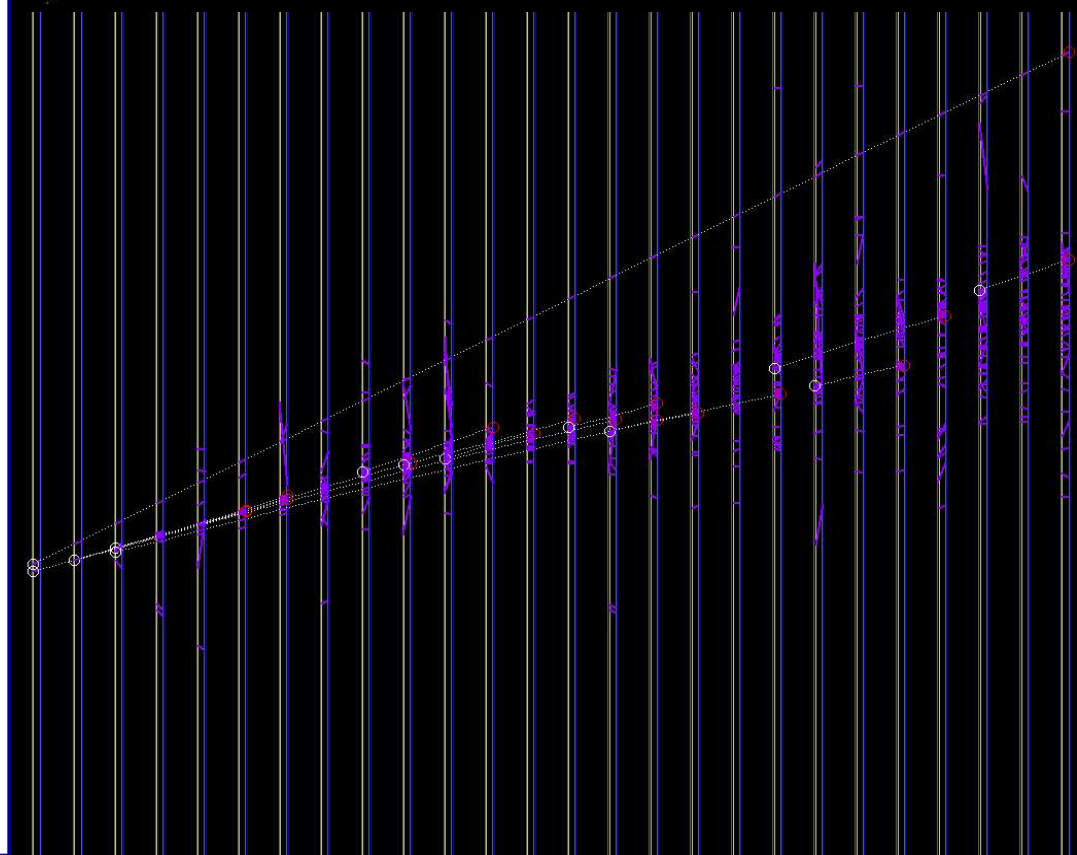
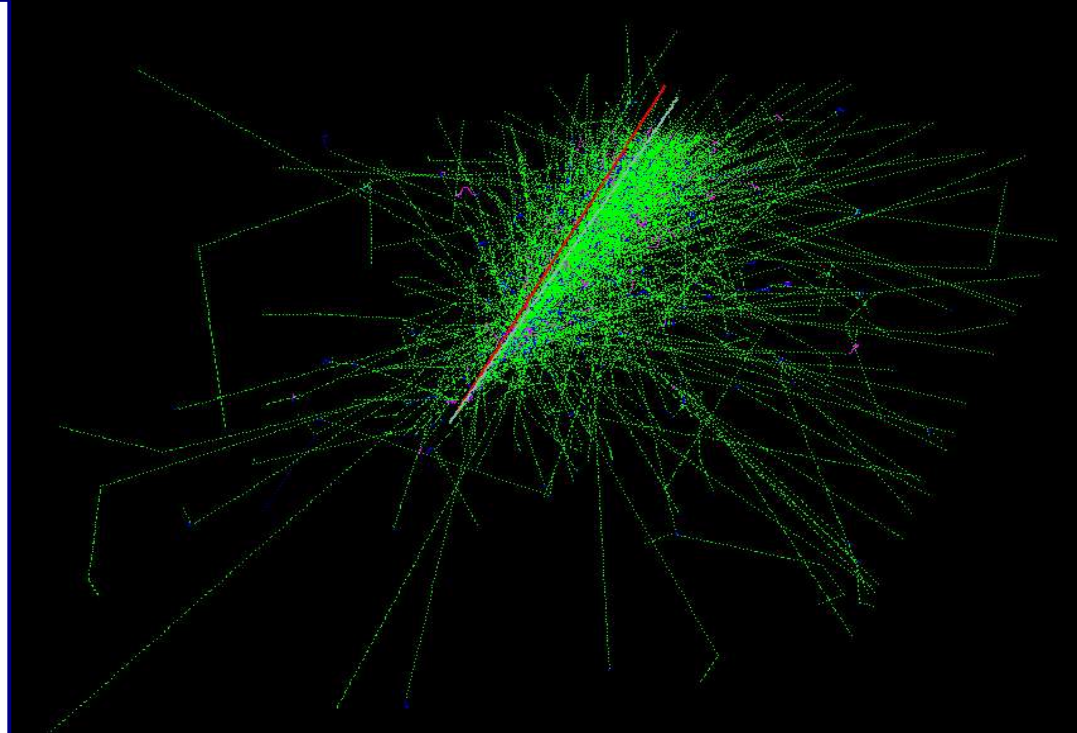
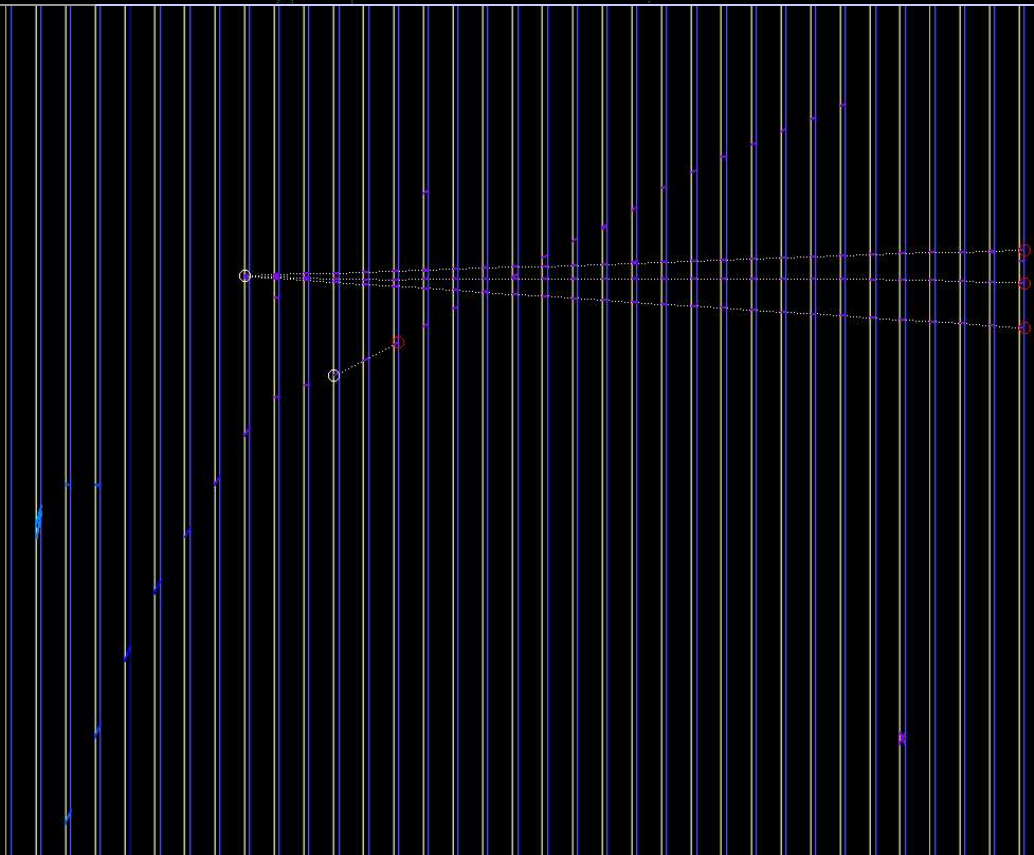
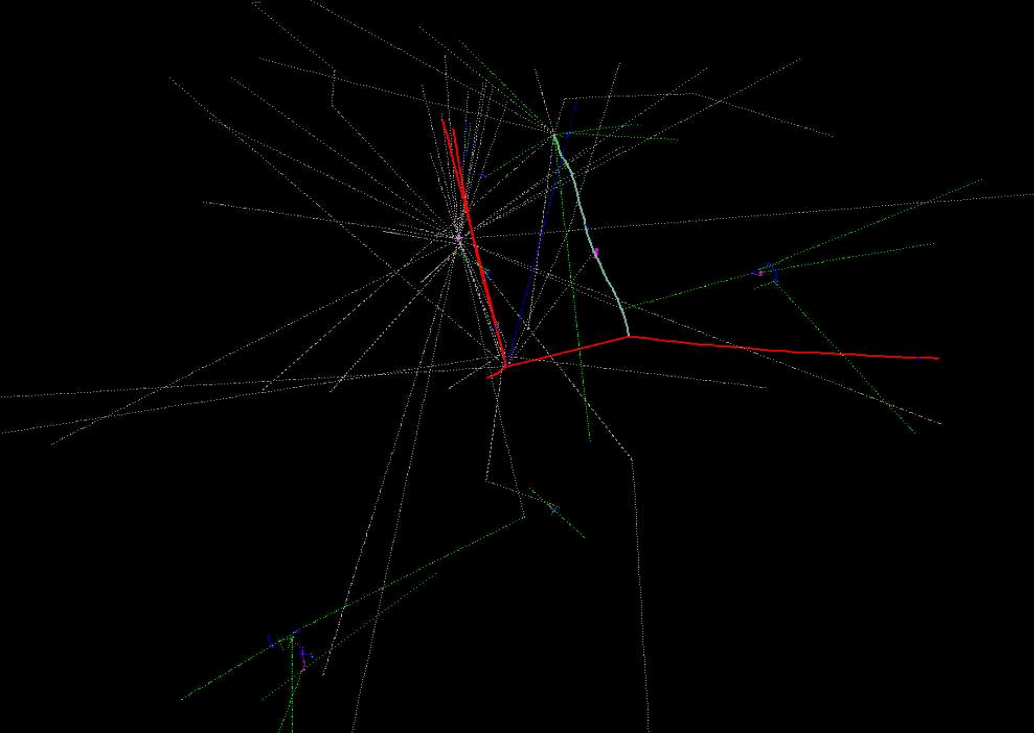
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# *Efficiencies definitions*

We compute reconstruction efficiency for a chosen simulated track as:

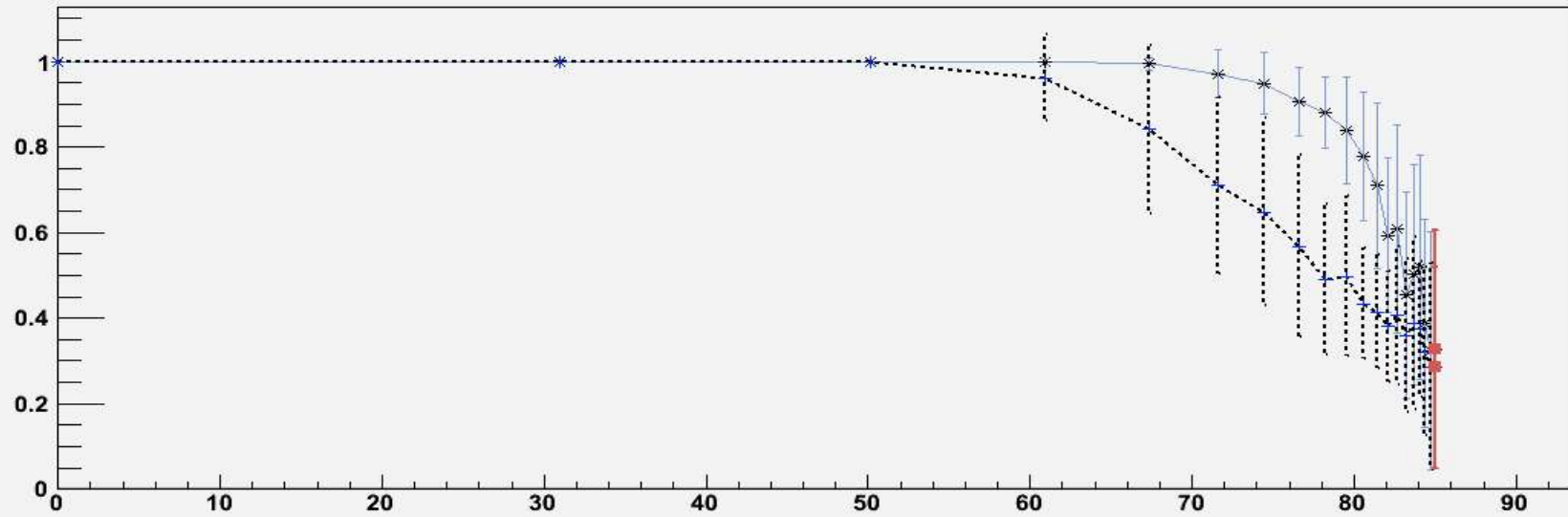
- $\text{Eff1} = n1/N$ , where  $n1$  is the number of simulated base segments associated to any reconstructed track.
- $\text{Eff2} = n2/N$ , where  $n2$  is the maximal number of base segments which belong to the same reconstructed track.

$N$  is the total number of simulated base segments.

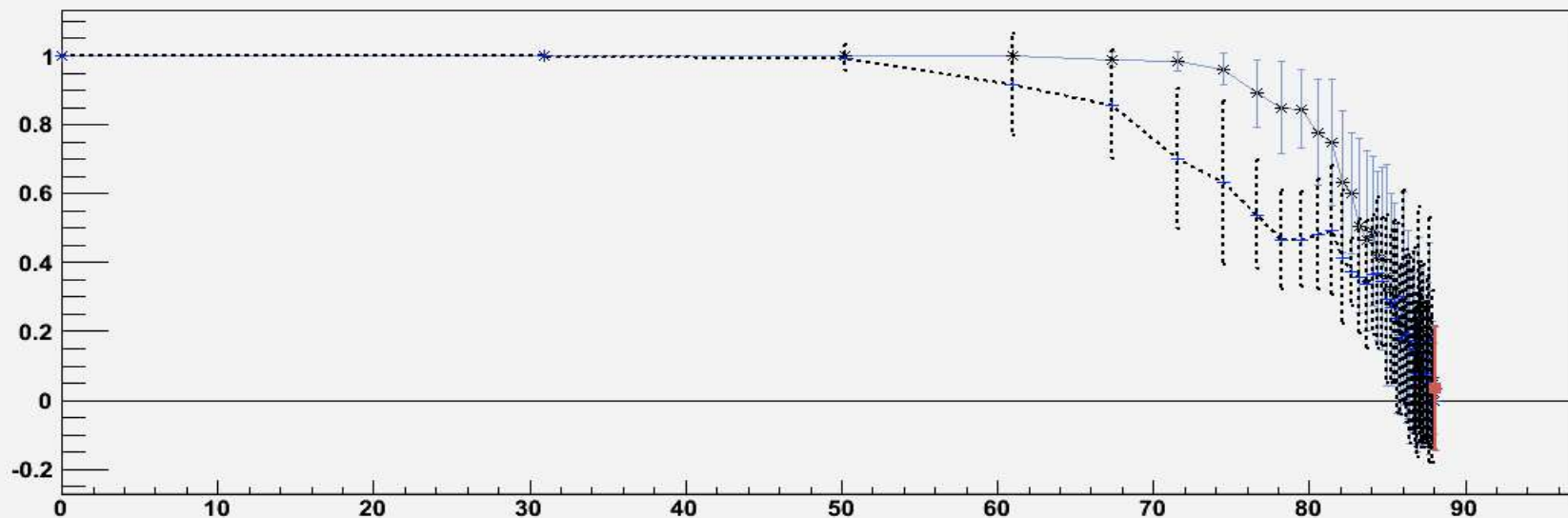
In this analysis we do not consider tracking accuracy

# Effectiveness for FakeTracks

Efficiency with  $D=0.500000$  1/cm<sup>2</sup>

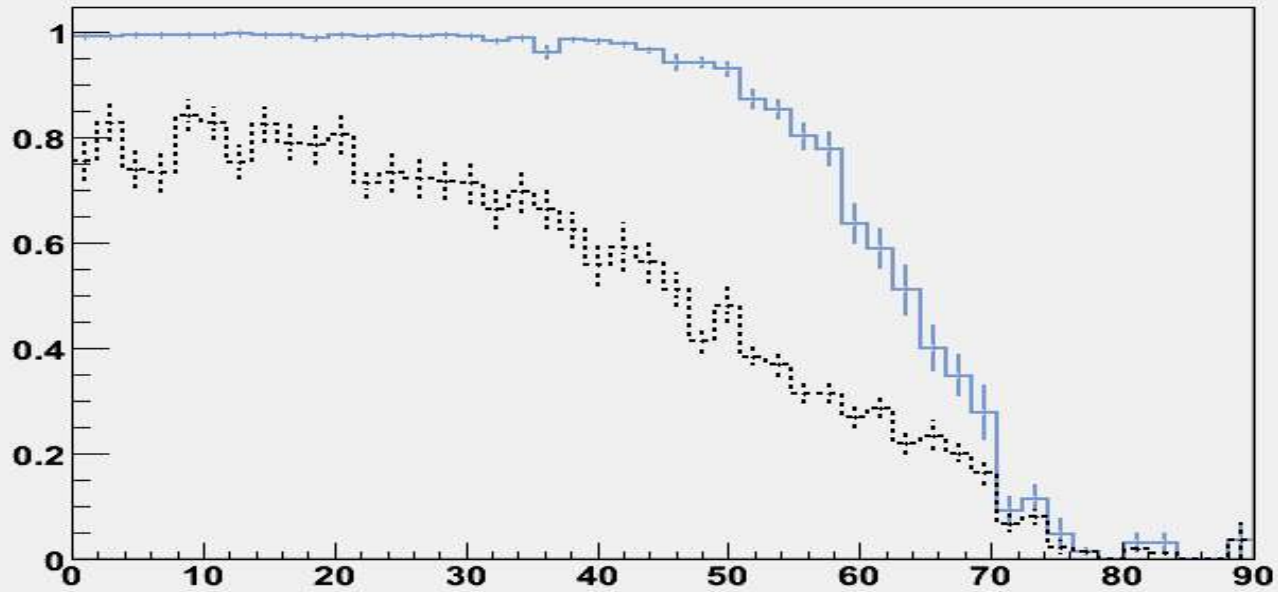


Efficiency with  $D=5.000000$  1/cm<sup>2</sup>

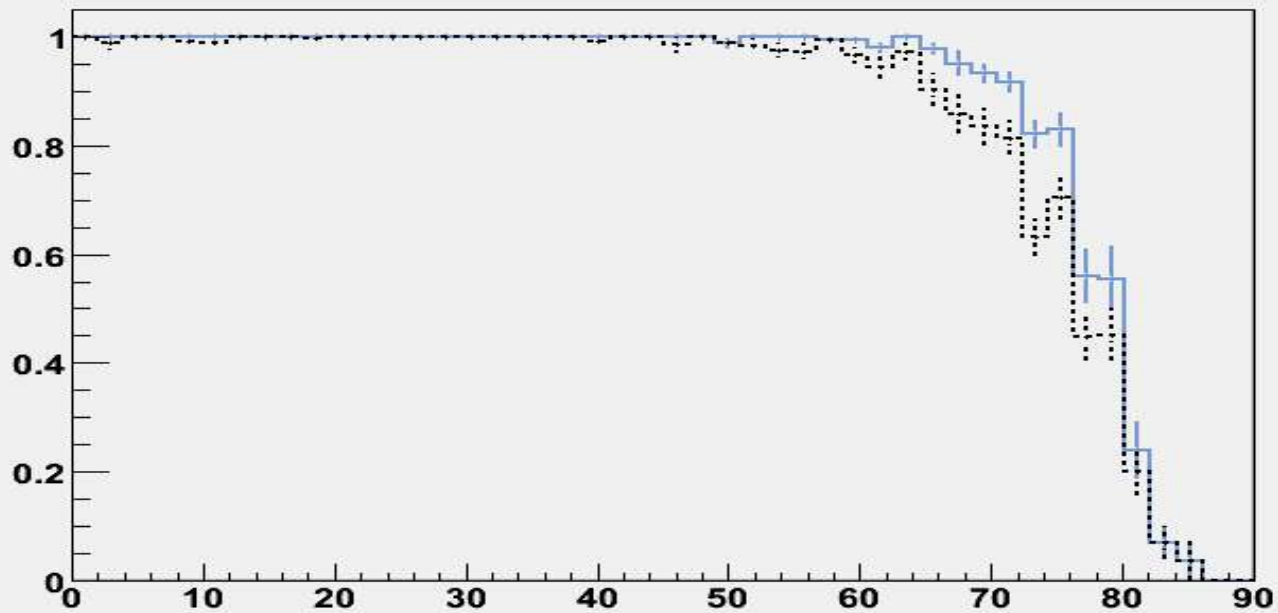


# *Effectiveness for muons*

**E=0.500000 GeV**



**E=5.000000 GeV**



# *Further work*

- Study FEDRA built-in reconstruction algorithms and define all relevant efficiencies (vs track length, noise level, energy, etc)
- Possible improvement of FEDRA algorithms
- Build end-to-end simulation-reconstruction-analysis chain and study OPERA sensitivity to neutrino mixing angle and mass squared difference.
  - study specific channels of tau decays (lepton + hadron [pion]) – part of my diploma work



THE END