Electromagnetic showers energy estimation

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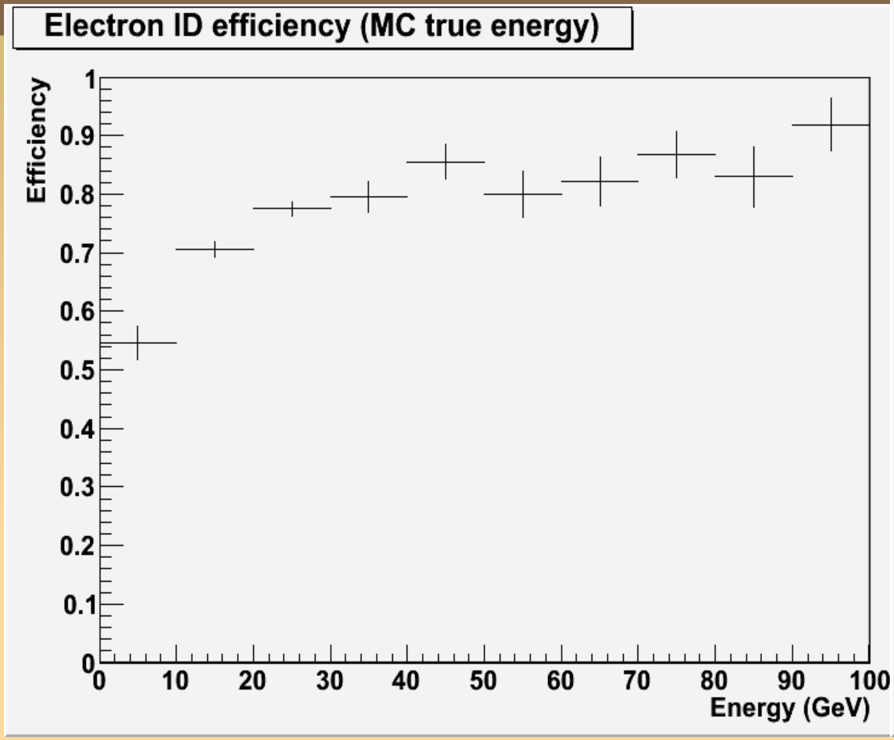
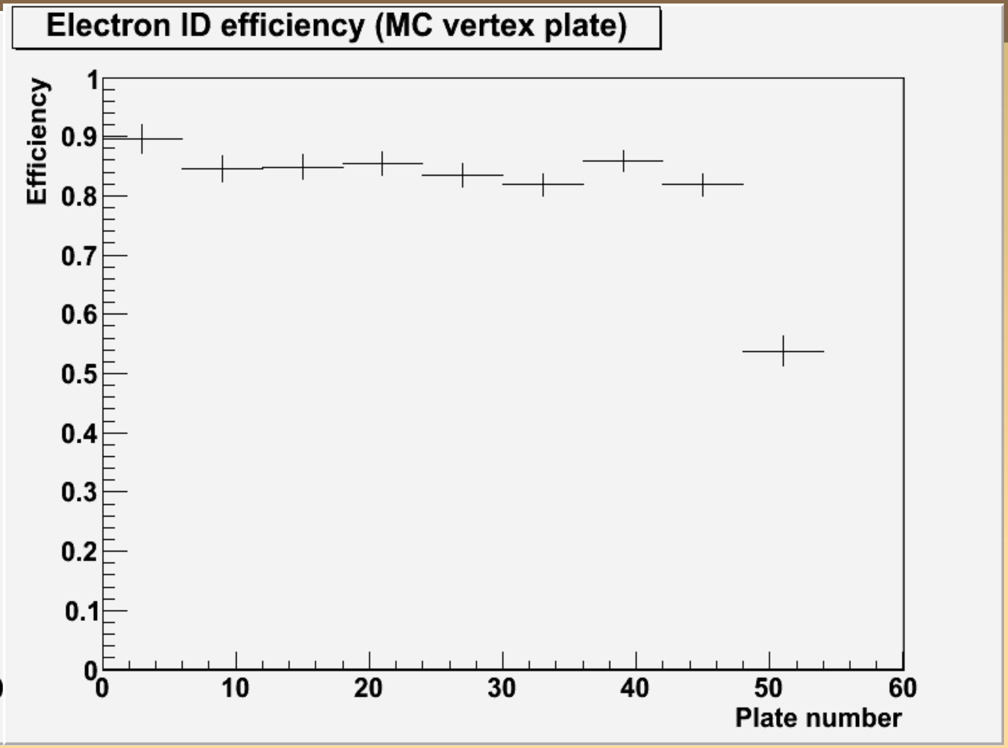
Outline

- Efficiency calculation : electron identification
- Energy estimation on MC sample : nue,taue
- Calibration of energy estimation on MC
- Testbeam data analysis

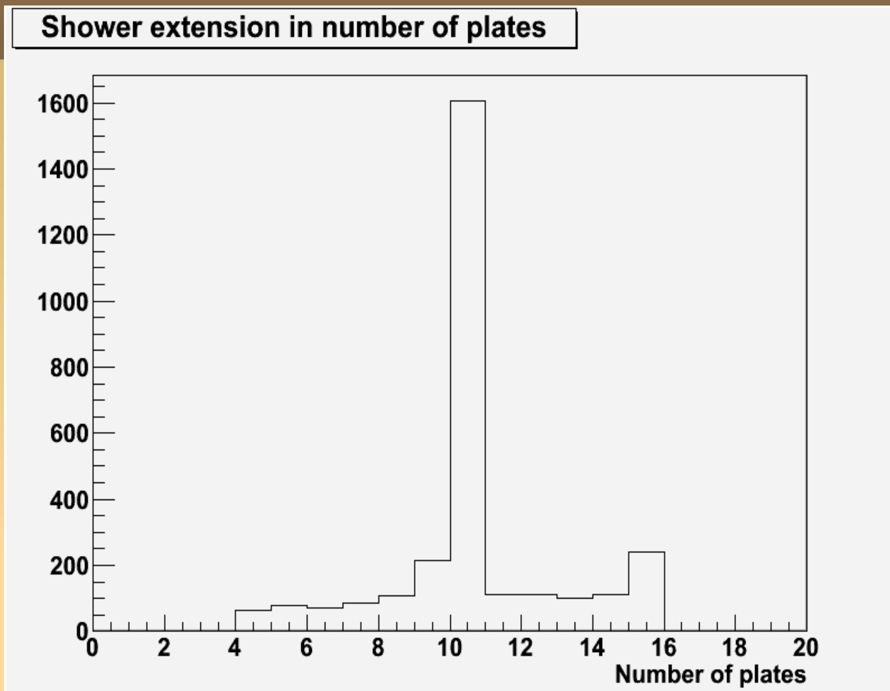
NUE 5k : Electron ID Efficiency

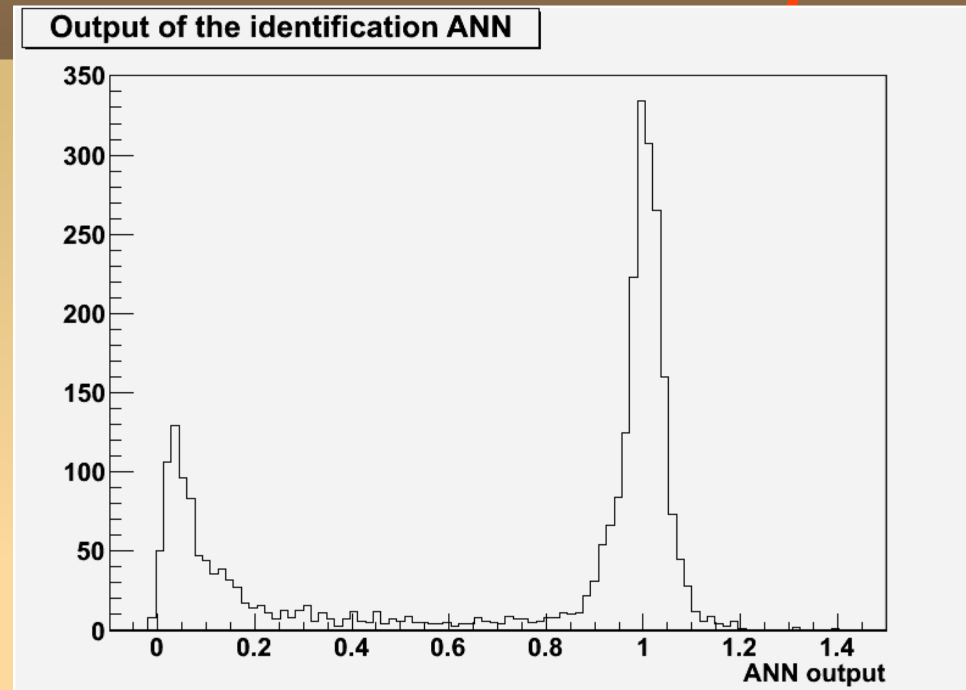


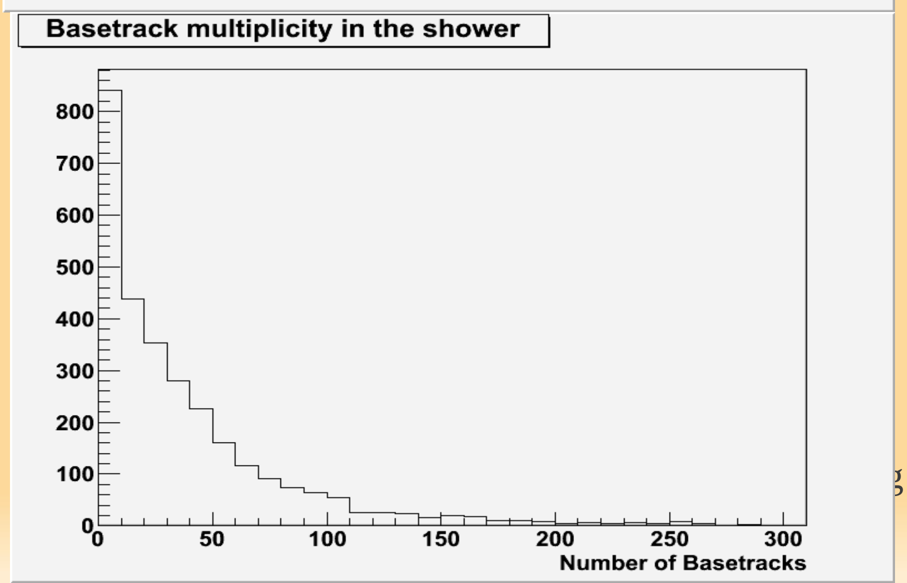


- Mean efficiency about 74%
- Statistical error less than 10%
- Electron ID efficiency is stable as far as the number of plate is sufficient
- Electron ID efficiency increases with the energy up to 30 GeV and reaches a plateau

NUE 5k : Electron ID Efficiency

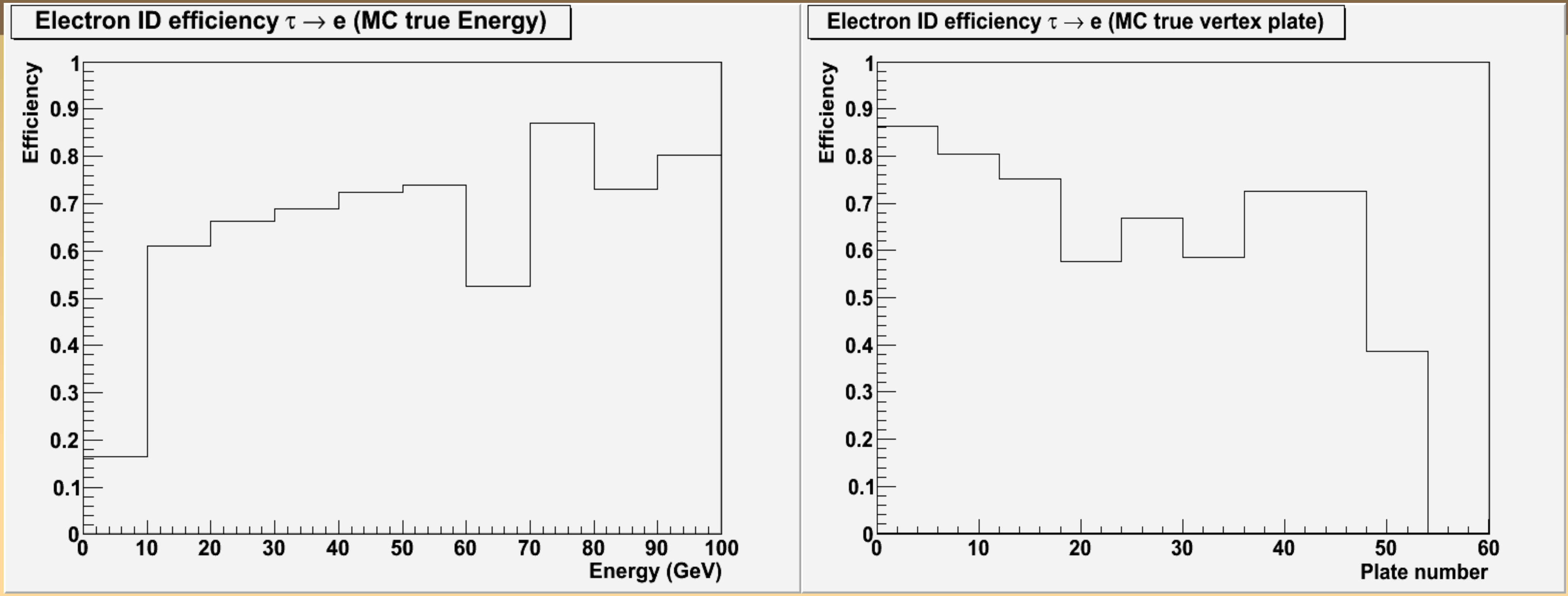






- ANN output <0.2 → pion track in the shower
- Most of showers extend within 10 plates
- BT Multiplicity in agreement with past electron study in Bern

TAUE 3k : Electron ID Efficiency



- Mean efficiency about 67%
- No error computed → to be done
- Electron ID efficiency decreases downstream in the brick
- Electron ID efficiency increases with the energy and reach a plateau

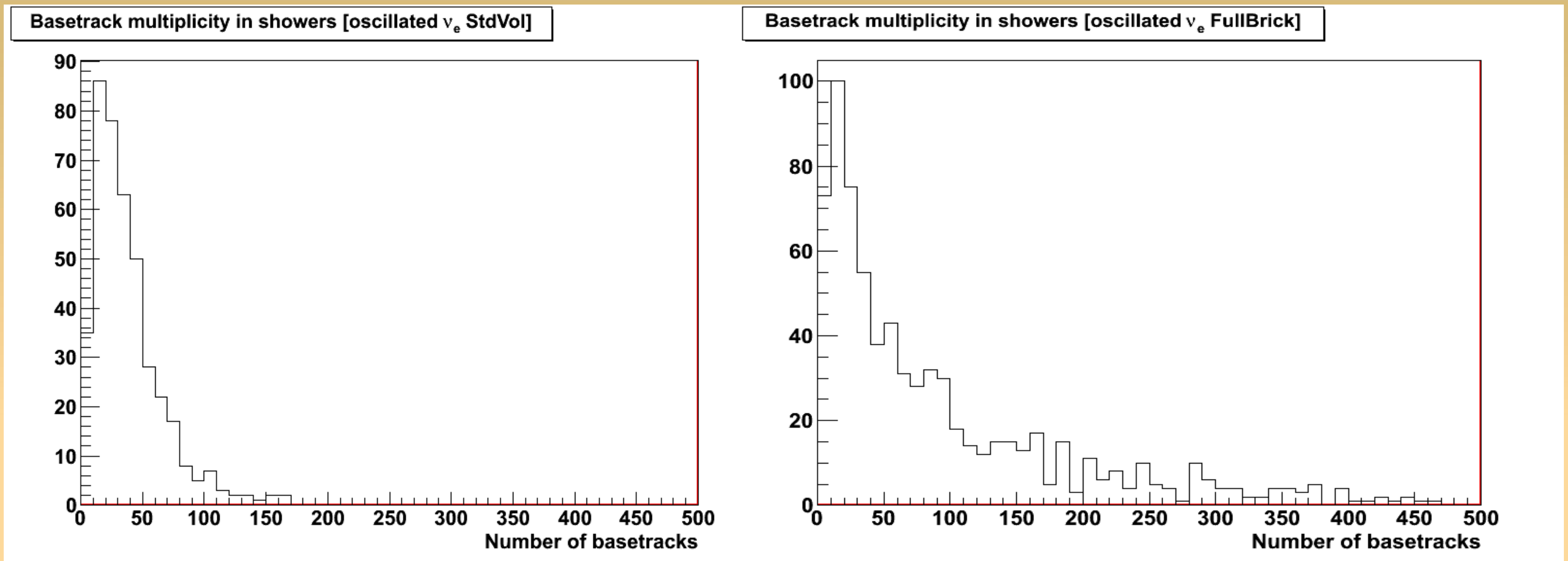
Electron ID Efficiency

- List of events which pass the electron identification is available in the rms document webpage http://rms.in2p3.fr/spaceConfLogin.php?conference=77632
- To be done : « efficiency » to identify an electron in numunc events

Energy estimation on MC

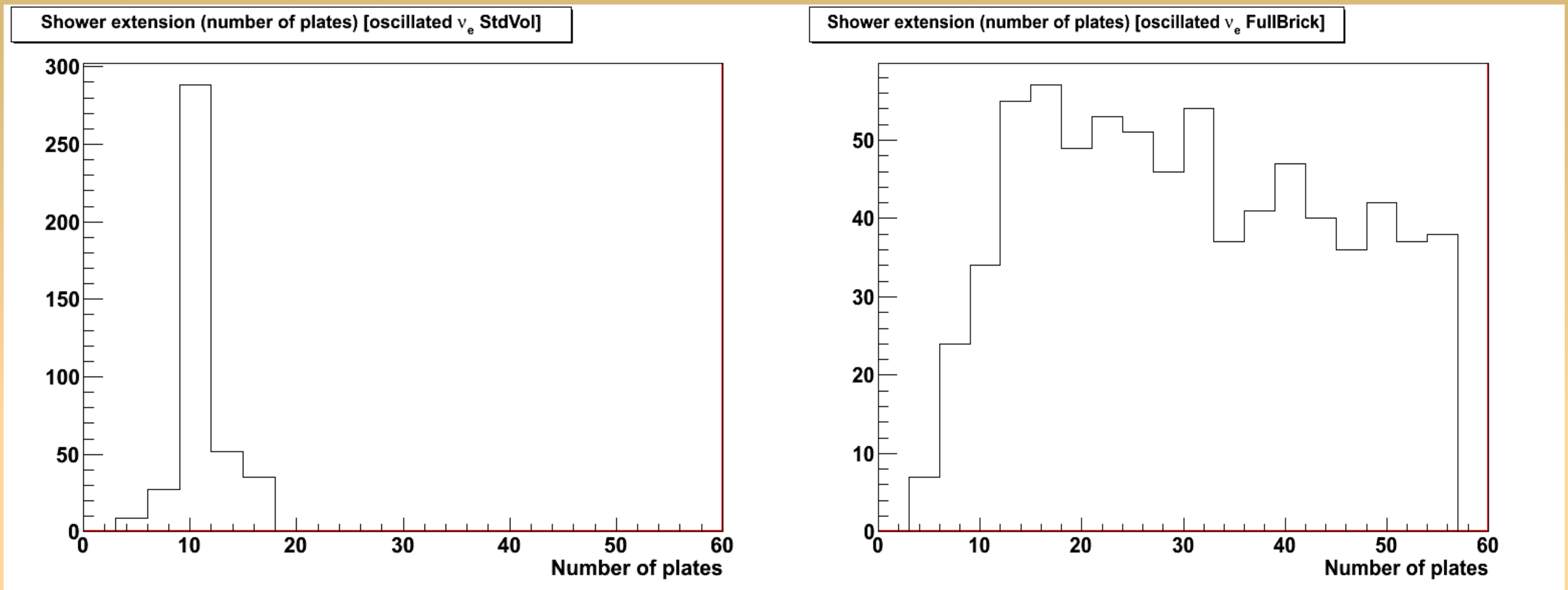
- Reconstruct shower on MC samples : 1000 oscillated nue & 1000 tau→e within a standard volume (5 plates up & 10 plates downstream) then within a Full brick volume
  - Check shower reconstruction : BT multiplicity & shower extension
  - Result of the electron-ID algo
  - Finally the reco'ed energy, residuals and REC/MC ratio

NUE 1k«OSC»:shower rec check



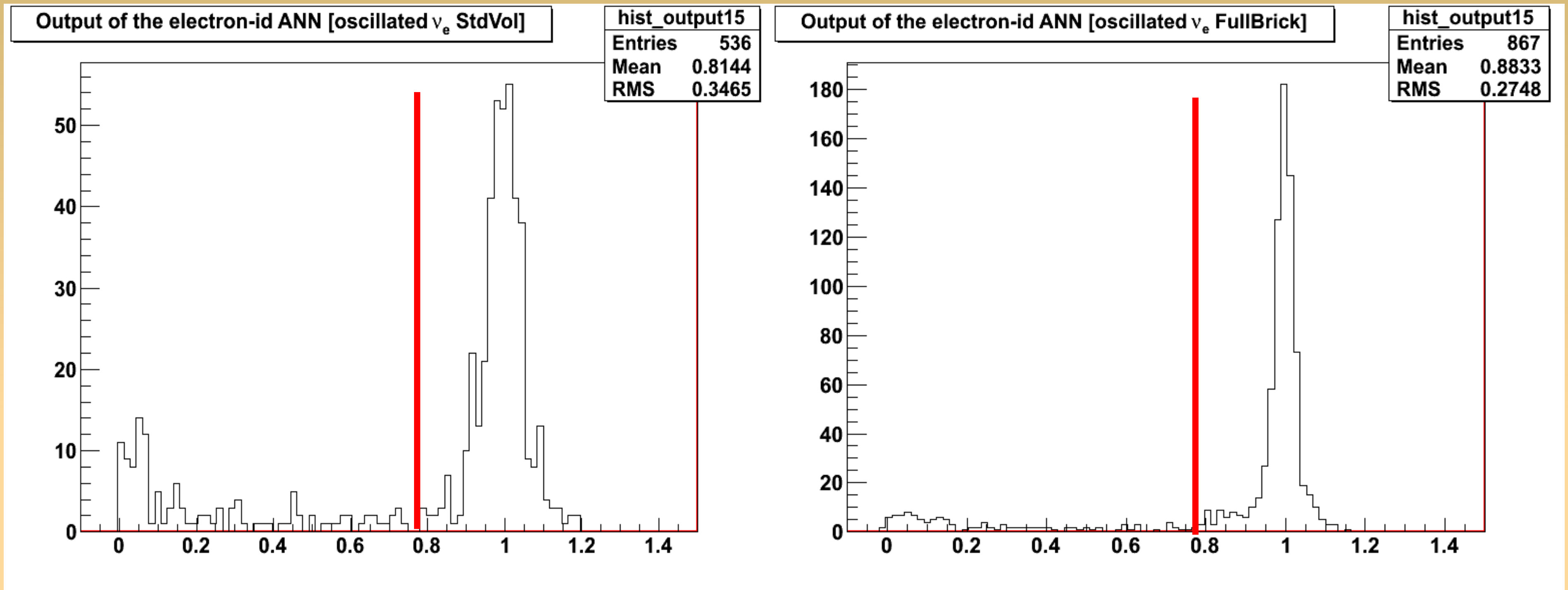
- The basetrack multiplicity in showers
  - Less BT in Standard volume than in Full brick

NUE 1k«OSC»:shower rec check



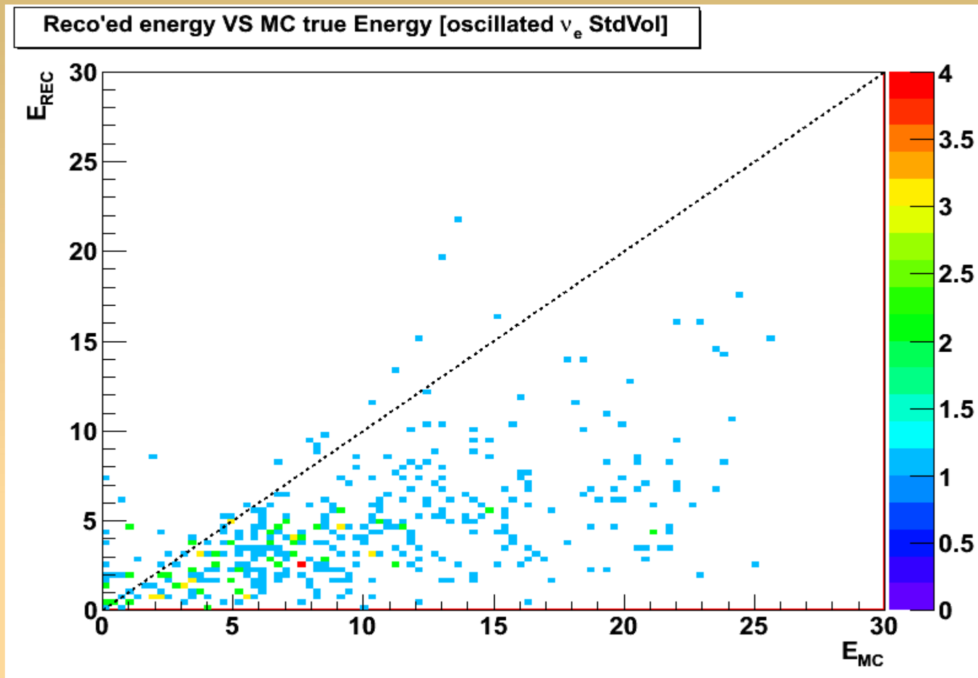
- Shower extension
  - Max 15 plates in Standard volume
  - Up to 57 in Full brick volume

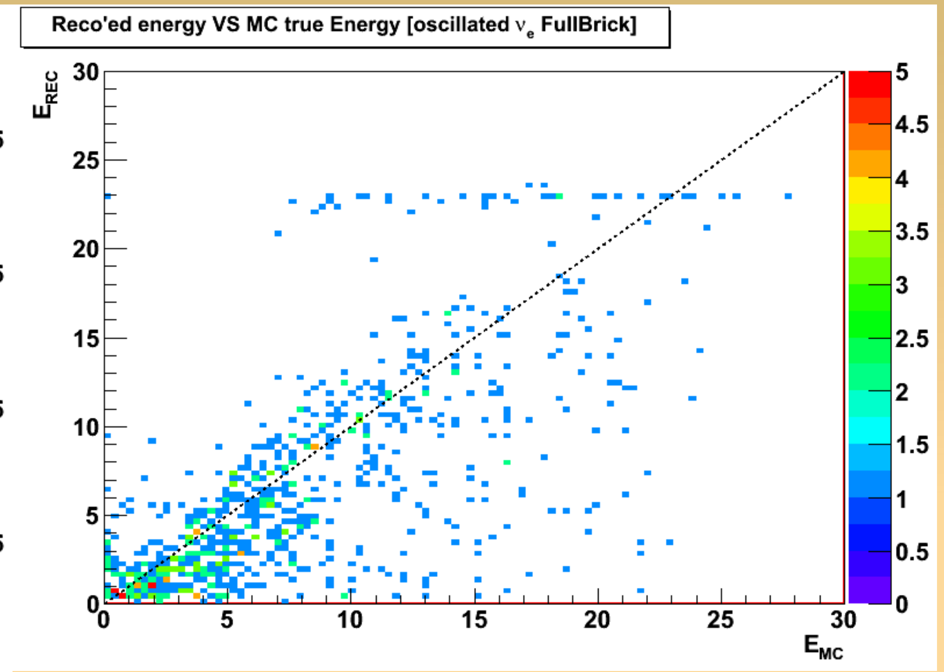
NUE 1k«OSC»: electron-ID algo



- We have a contamination of electron showers by pion
  - With larger number of plates electron-id is better

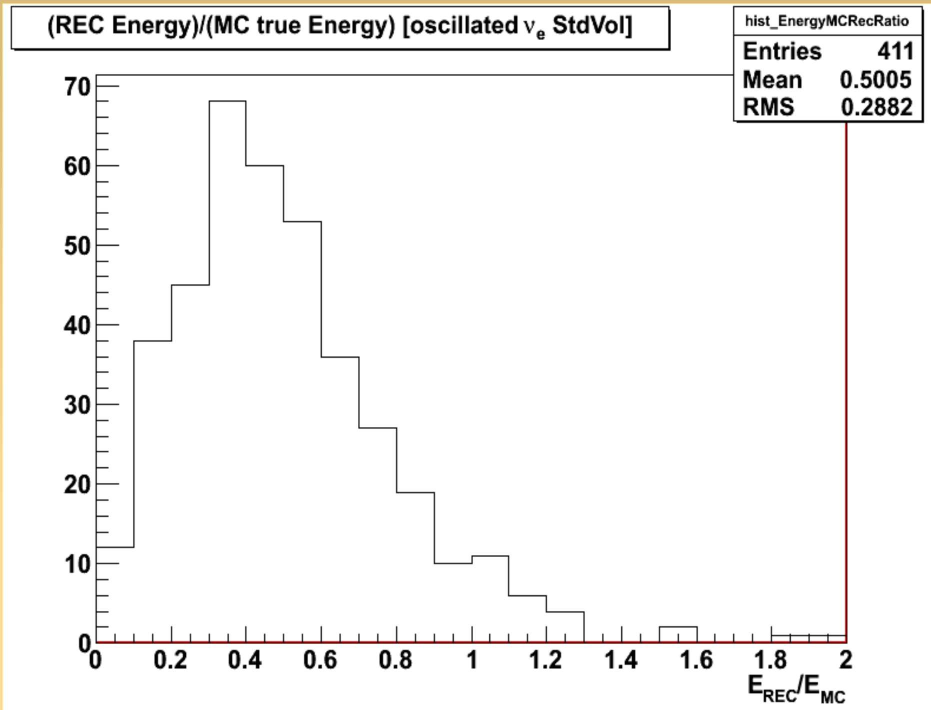
NUE 1k«OSC»: rec energy

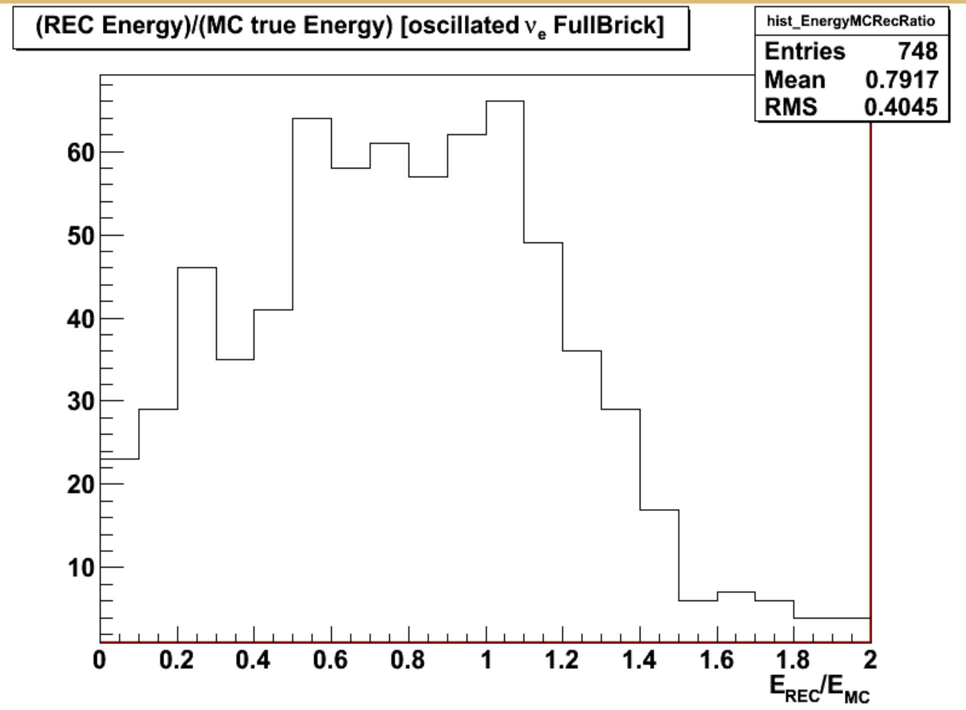




- In a standard volume, rec energy is underestimated
- Using a Full brick, rec energy is improved but see next slides

NUE 1k«OSC»: rec energy





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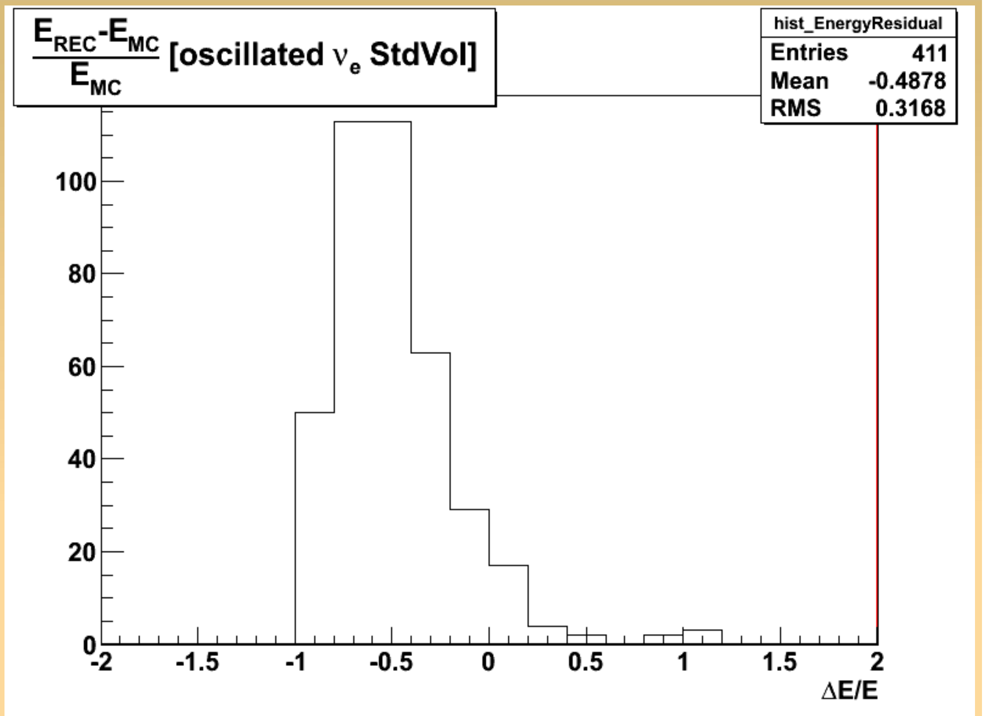

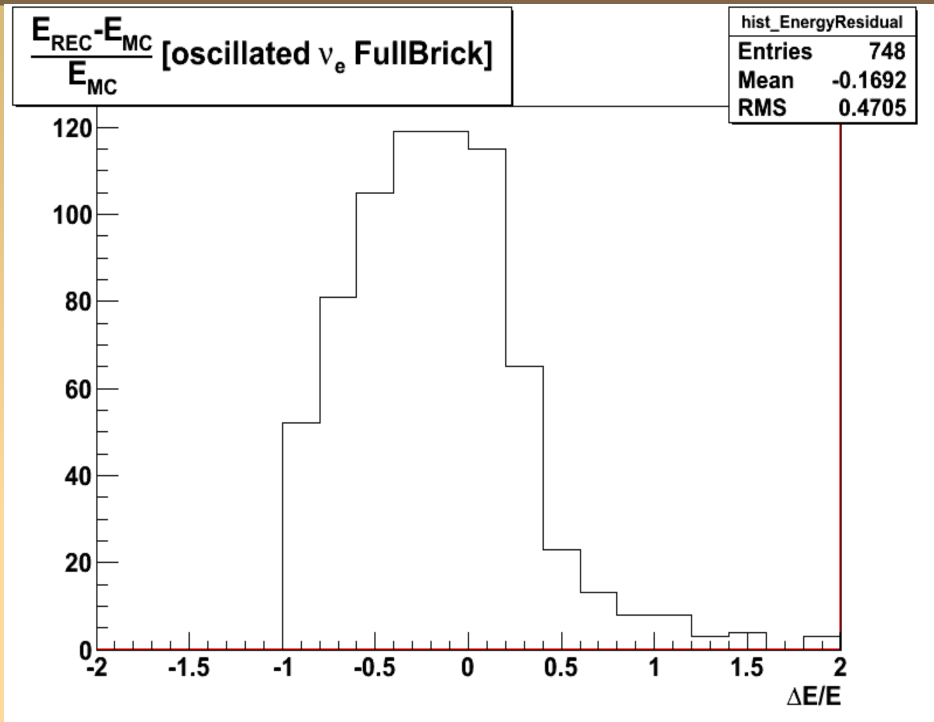

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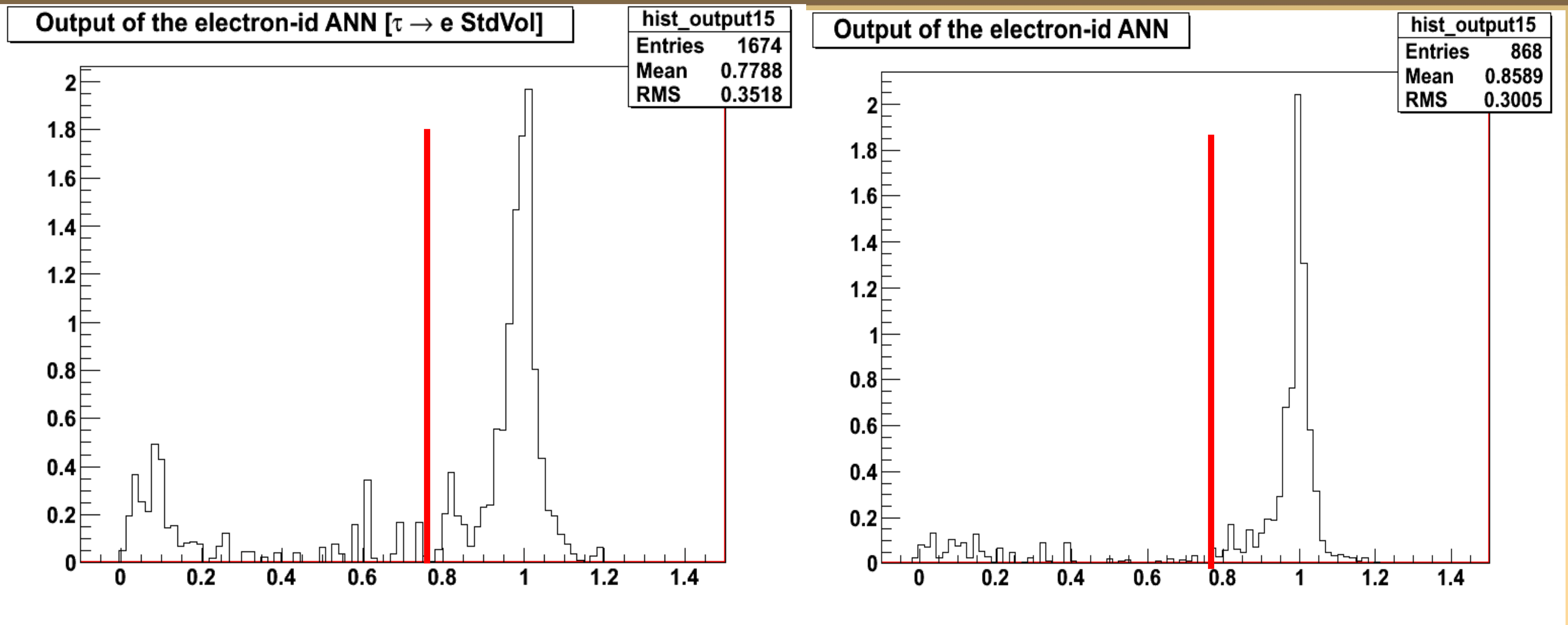
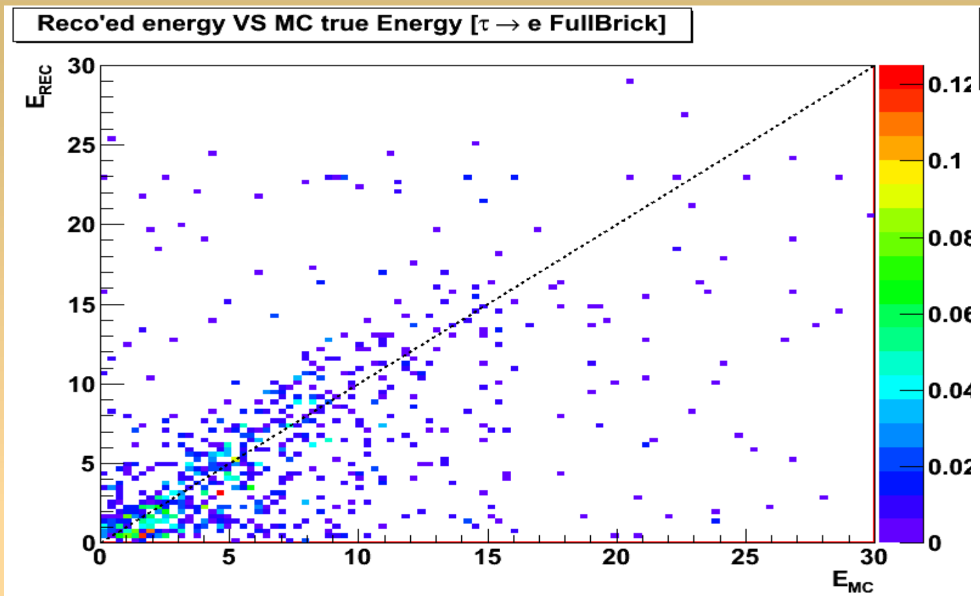
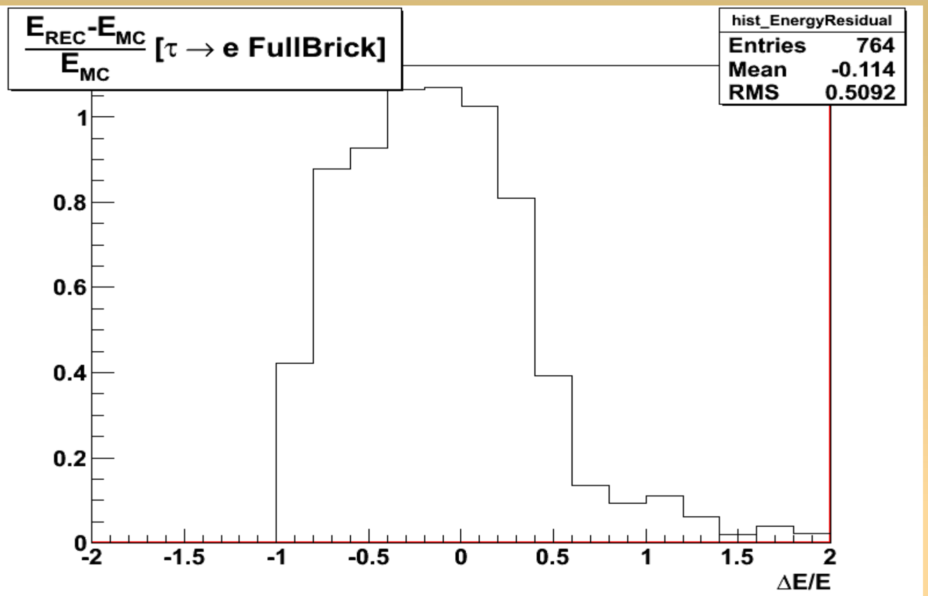
NUE 1k«OSC»: electron-ID algo

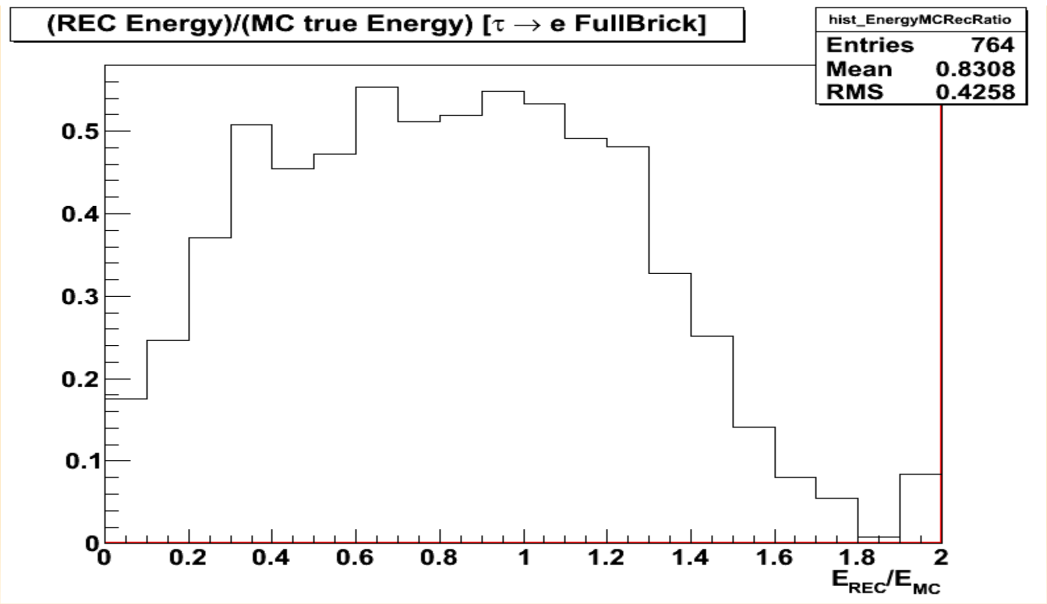


- We have a contamination of electron showers by pion
  - With larger number of plates electron-id is better

TAUE 1k : rec energy



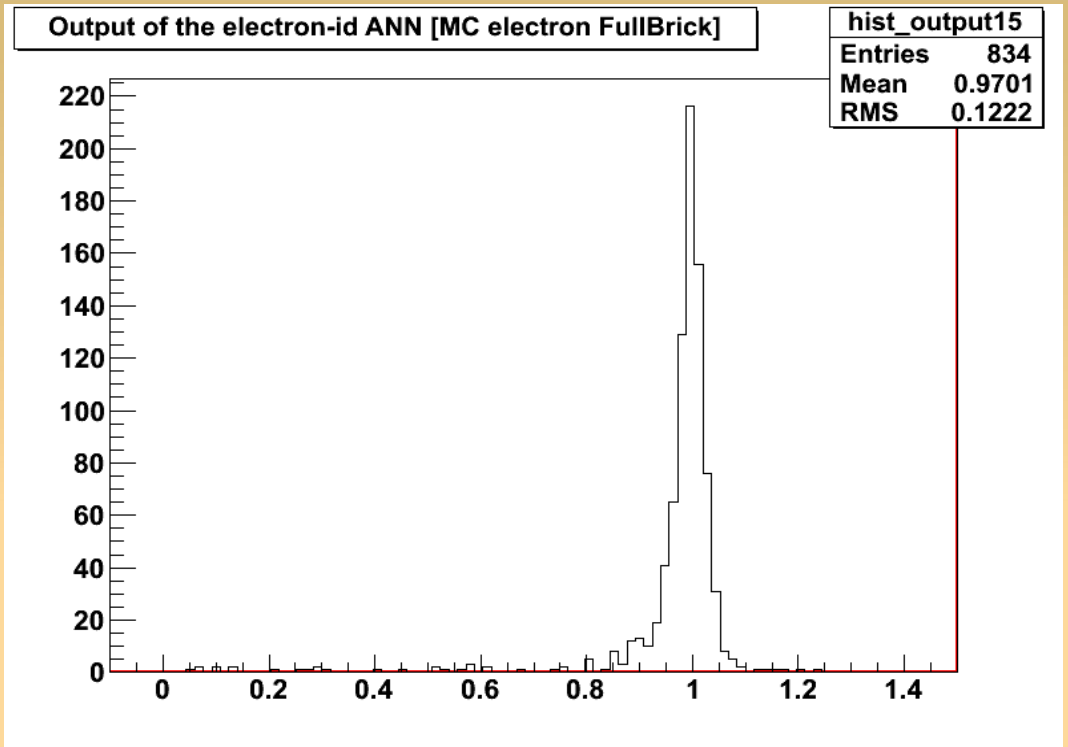




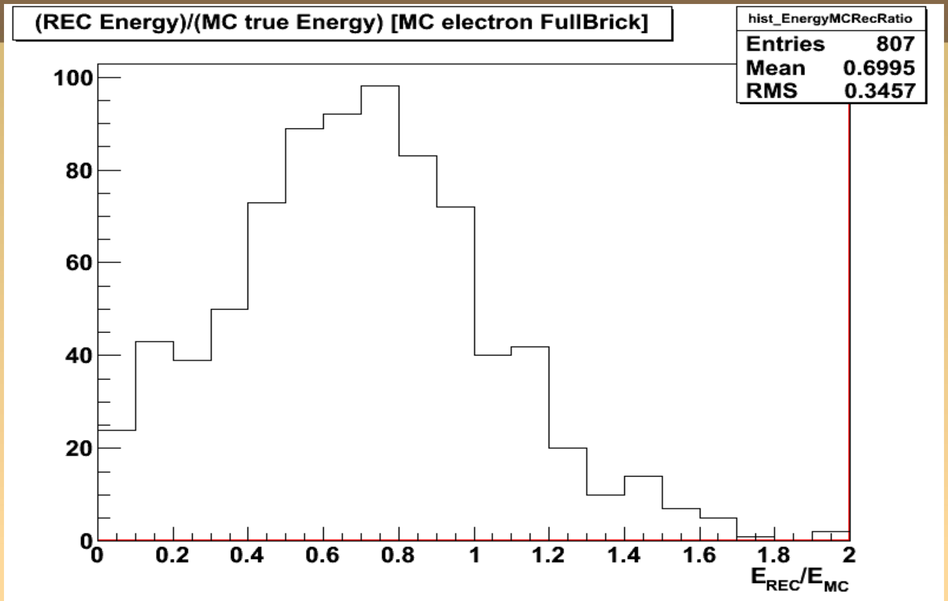
Reminder : physics performance of current tool to estimate shower energy

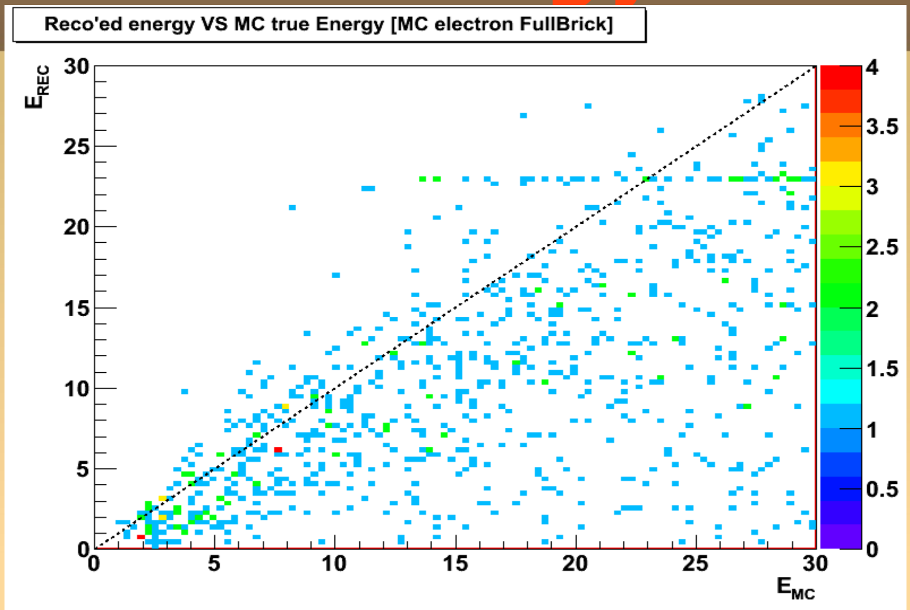
- New electron MC sample (10k)
  - Reconstruction with the stable framework is on going
  - Then define a correction as a function of the energy (maybe vertex depth, angle?) if necessary

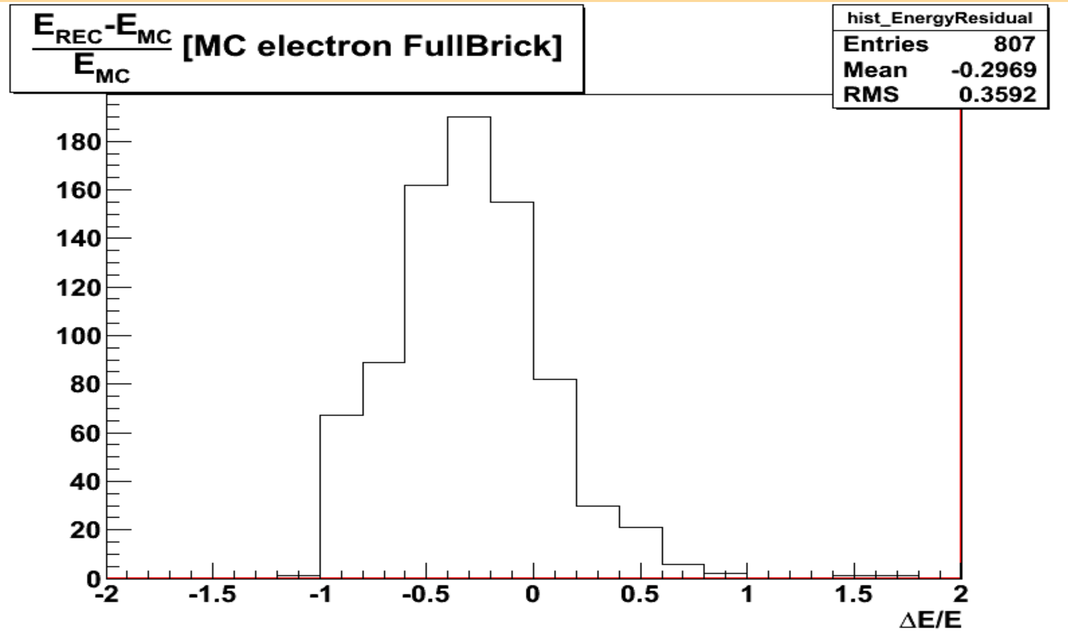
MC electron 1k : electron-id



MC electron 1k : rec energy



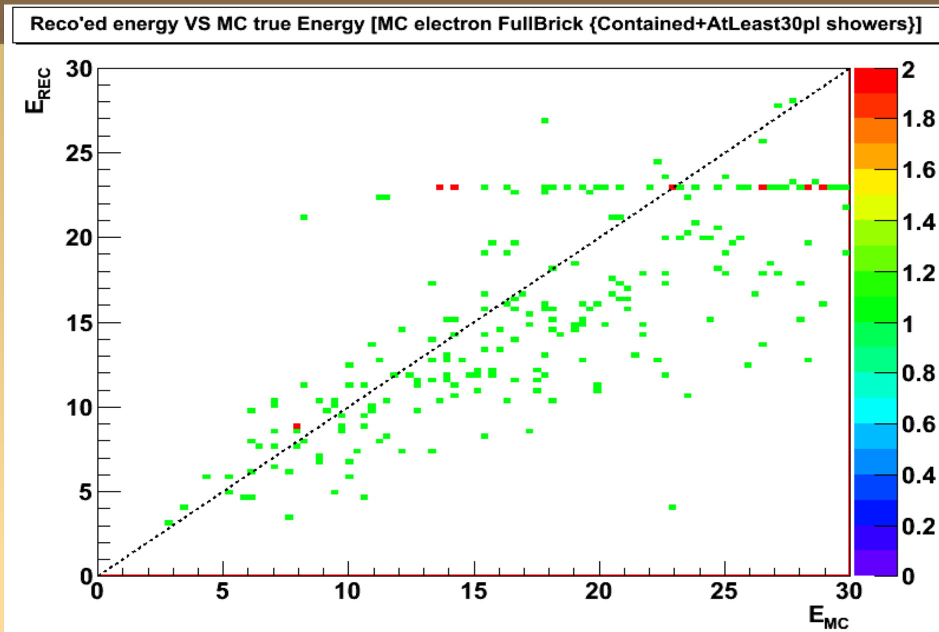


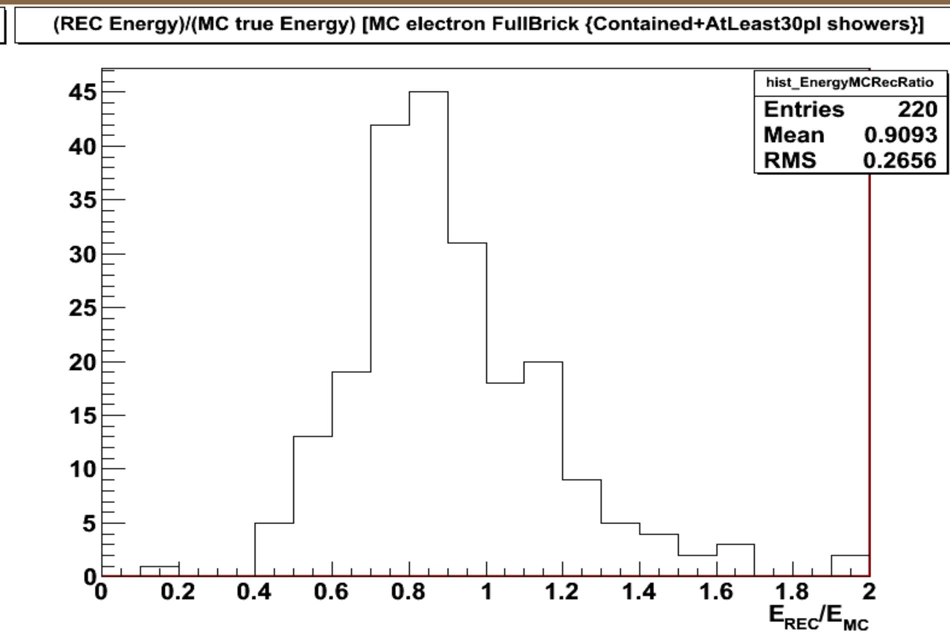


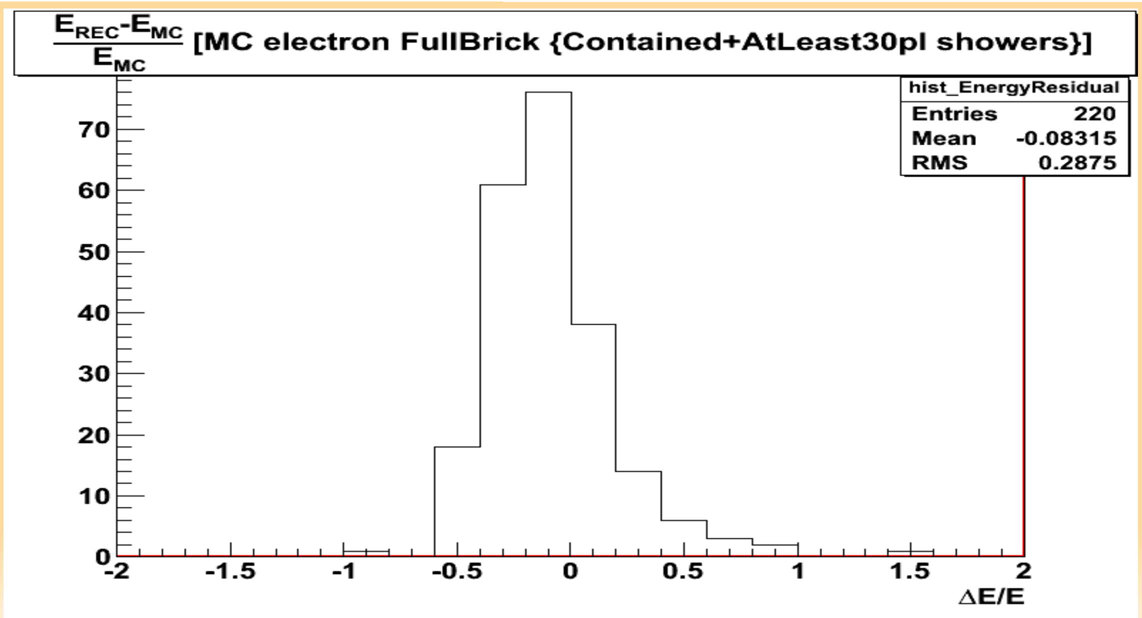
Reminder : physics performance of current tool to estimate shower energy

- New electron MC sample (10k)
  - Define a good sample for energy estimation
    - At least 30 plates for shower extension + Contained showers (cf. past presentation)
  - Then define a correction parametrized as a function of the energy, number of plates and shower axis angle

MC electron 1k : rec energy «control sample »







Ariga

Calibration Data Energy estimation

- Idea : produce a small sample of electron in the same reconstruction conditions as TB data & estimate the energy

→ MC samples have been processed

→ being checked electron-pion separation

→ energy estimation before/after correction

→ understand a possible discrepancy with the MC electron sample

Energy estimation

- On the new MC production 10k electrons [0,30] GeV [-0.5,0.5] rad, parametrize a correction of the rec energy and enhance the stat. to 10k electrons.
- Apply correction on the rec energy within a full brick for nue and taue samples and investigate the contamination of showers by tracking MC information of BT
- Electron-ID & Energy for testbeam-like MC samples

Outlook

1/ Electron Energy estimation

a/ investigate the energy estimation of the new MC sample

b/ Calibration of shower tool with electron data

c/ production of new MC sample for building a new energy tool → 40k remaing events

2/ Efficiency of electron identification in nue channel and taue by applying decay search first

3/ Possibility to find a tau→e events in the inefficiency of the DS with the electron shower rec & id on MC.

Backup slides

New Shower Tool : Status of « Frank tool » strategy

- Select Contained showers + Adding variables (angular) + weighting events (Energy) improve the rec energy
- But it is still unstable
- New idea : use a fitted longitudinal profile

→ being optimized the two selected functions to fit single shower

→ estimated efficiency of fitting on the MC sample