

# Near/Far Comparison at CaldeT 2003: Muons\* & Pions\*

## Overview:

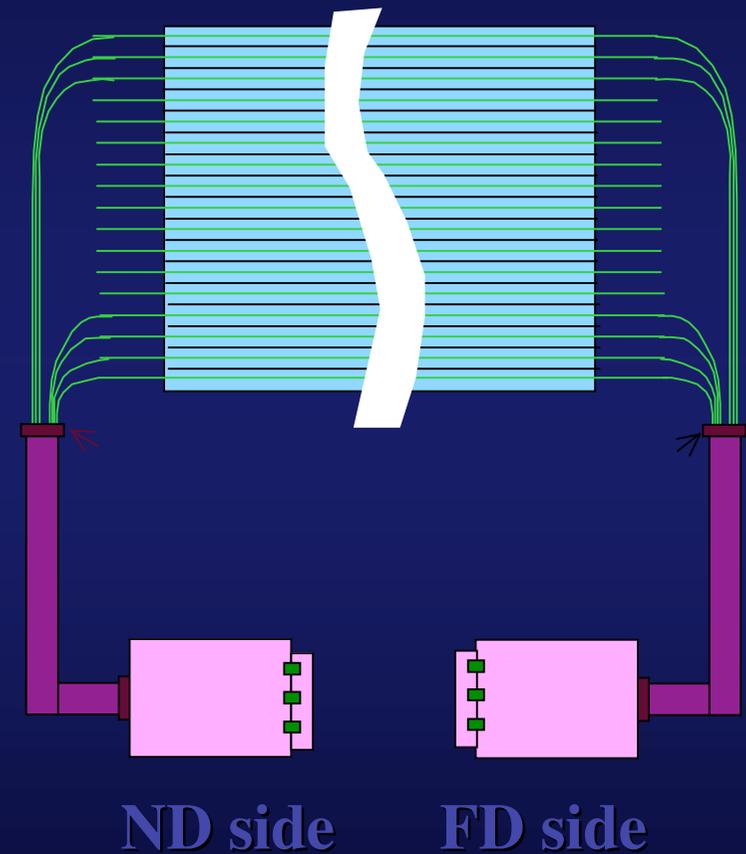
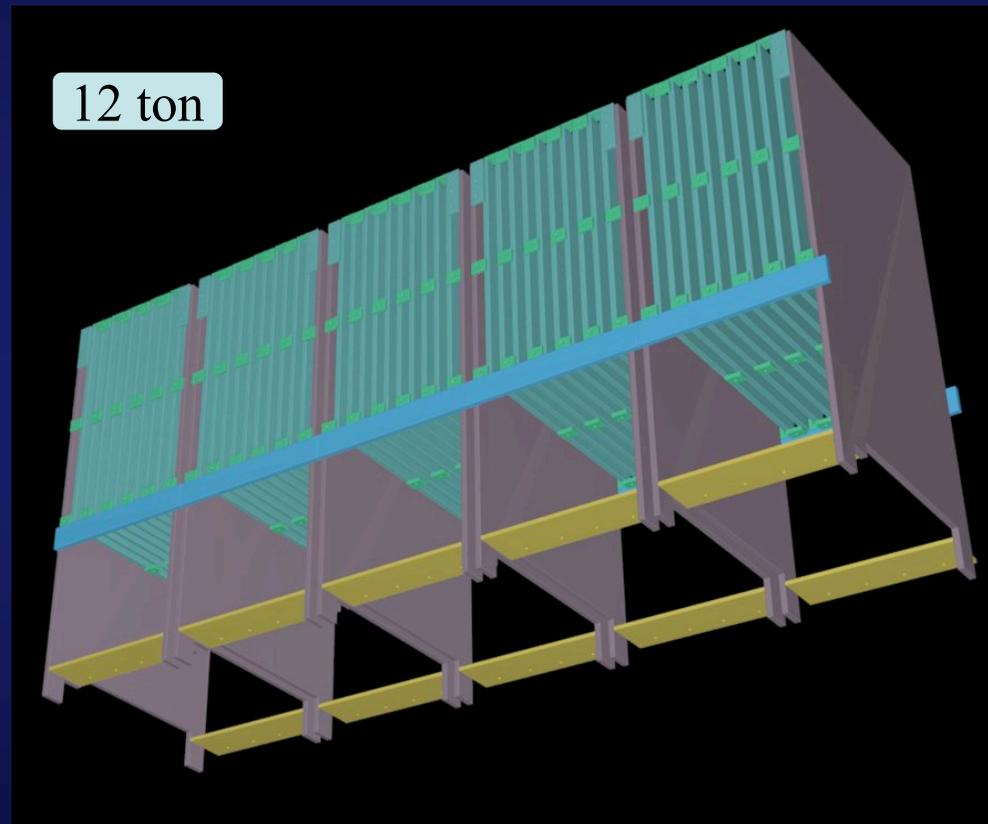
- Brief introduction to CaldeT.
- N/F Comparison with muons and pions.
- Response & Topology.
- Conclusions.

MINOS Collaboration Meeting -28-3-2004

*Anatael Cabrera - Oxford University*

## *N/F Calibration at Caldet 2003:*

Calibration Detector (Caldet) equipped with ND and FD electronics in either side:



CERN Test beams (PS complex) -> samples of  $e$ ,  $p$ ,  $\pi$ ,  $\mu$  at energies from 600MeV to 10GeV.

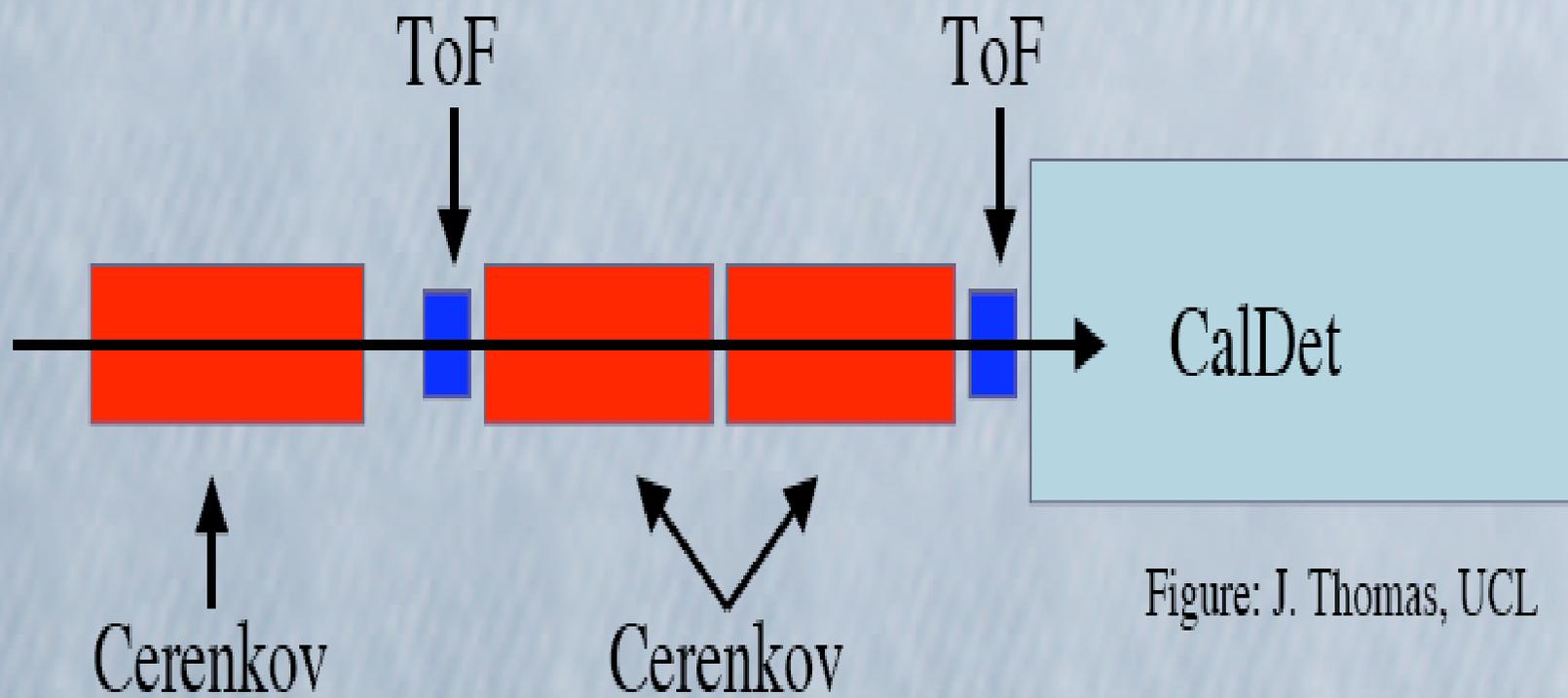


Figure: J. Thomas, UCL

## *N/F Comparison focused on muons and pions:*

N/F Comparison at Caldet:

Using electrons (very easy to select) would test...

- Response comparison over a large electronics dynamic range.
- Use EM showers to test topology comparison between the N/F.

*(I will discuss all this in Caldet session)*

But, for  $\nu_\mu$  CC appearance, we care the most about responses and topology differences of muons and pions (perhaps also p for QE events)...

I will show N/F comparison for +1.8GeV muons and pions.

## *My muons and pions selection: NO reconstruction.*

Run 71266 - +1.8GeV with at least US Cherenkov pumped up to trigger on e and  $\mu$ .

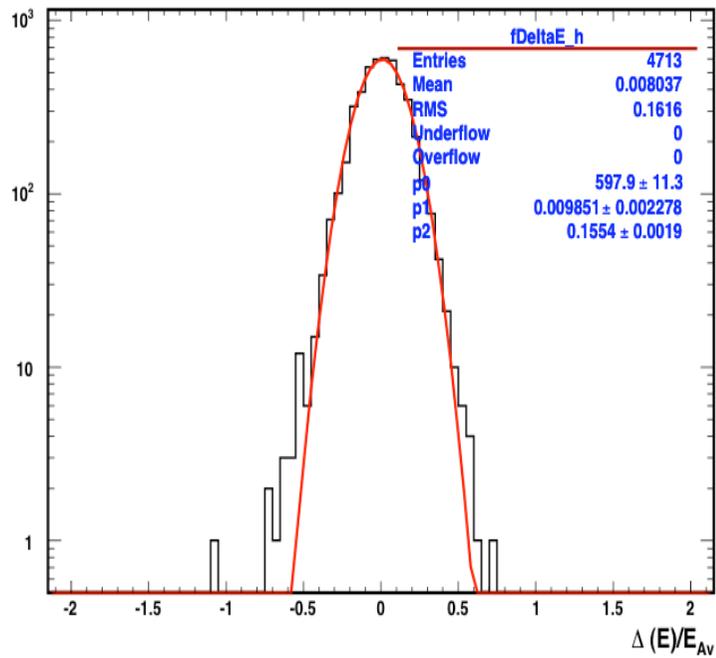
### Pions-like snarls:

- $\Delta$ TDC for TOF  $\rightarrow \pi$  peak.
- No hit on either Cherenkov.
- No multiple events snarl.
- Within fiducial time.
- Range  $< 35$  planes.

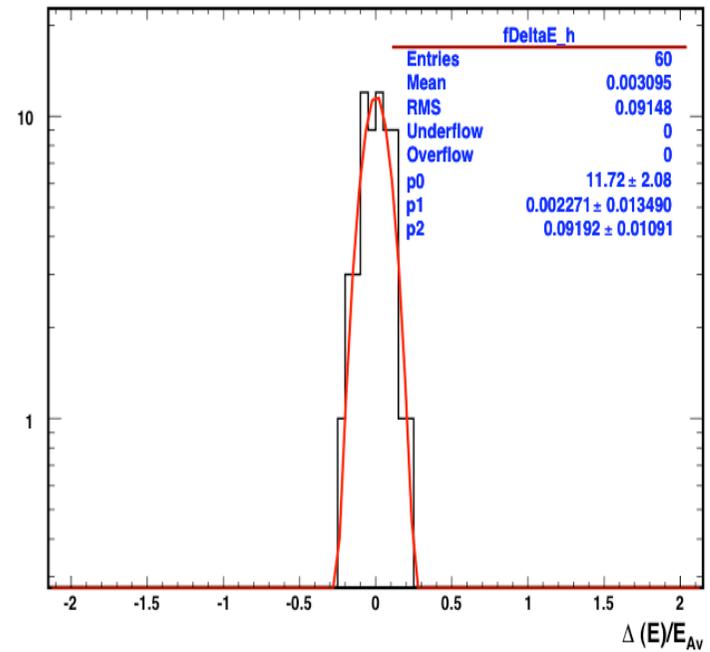
### Muons-like snarls:

- $\Delta$ TDC for TOF  $\rightarrow \pi$  peak.
- Hit on US Cherenkov  $Q > 0$  and  $Q < 1400$  ADCs.
- No multiple events snarl.
- Within fiducial time.
- Range  $> 35$  planes (muons stop at 1.8GeV).

# Response Comparison: Good agreement between both sides.



Pions-like snarls



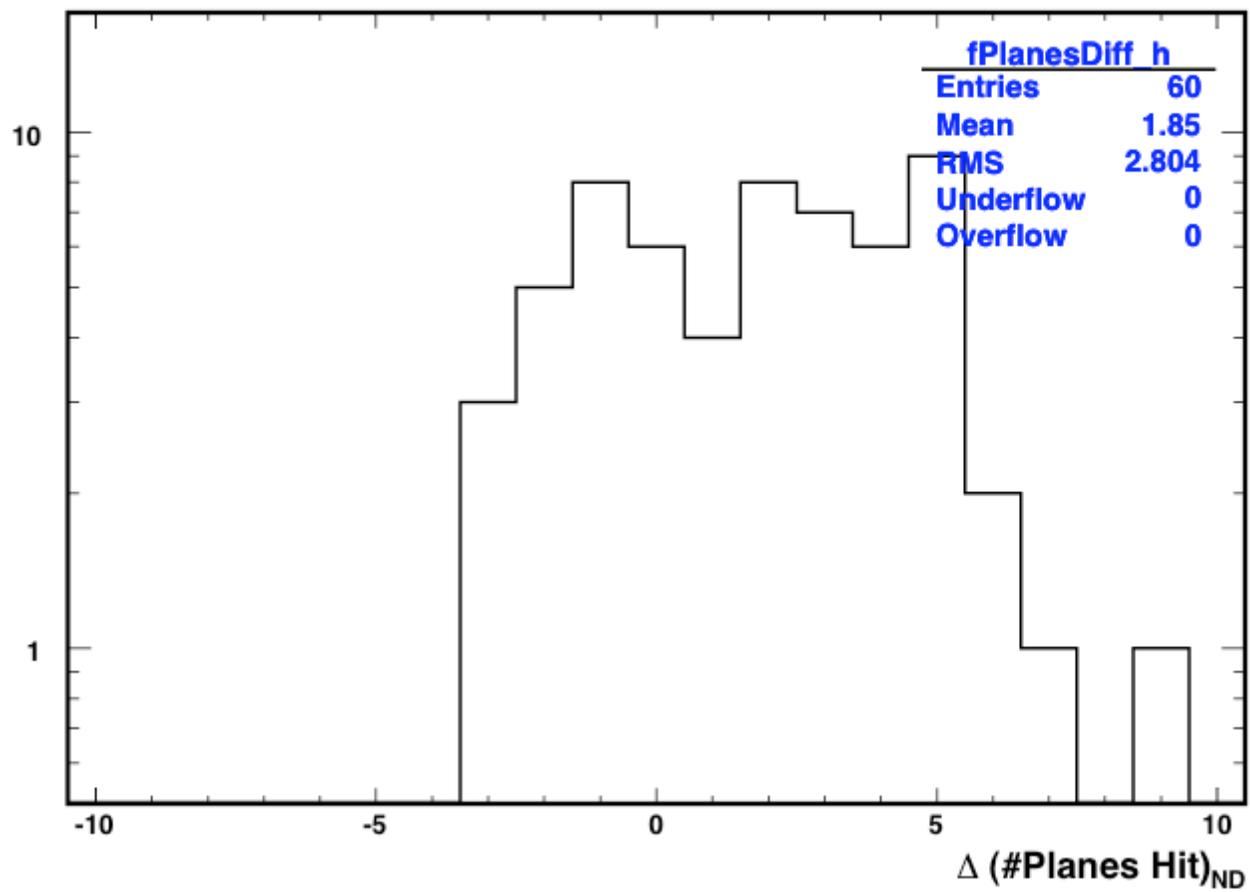
Muons-like Snarls

# Topology Comparison:

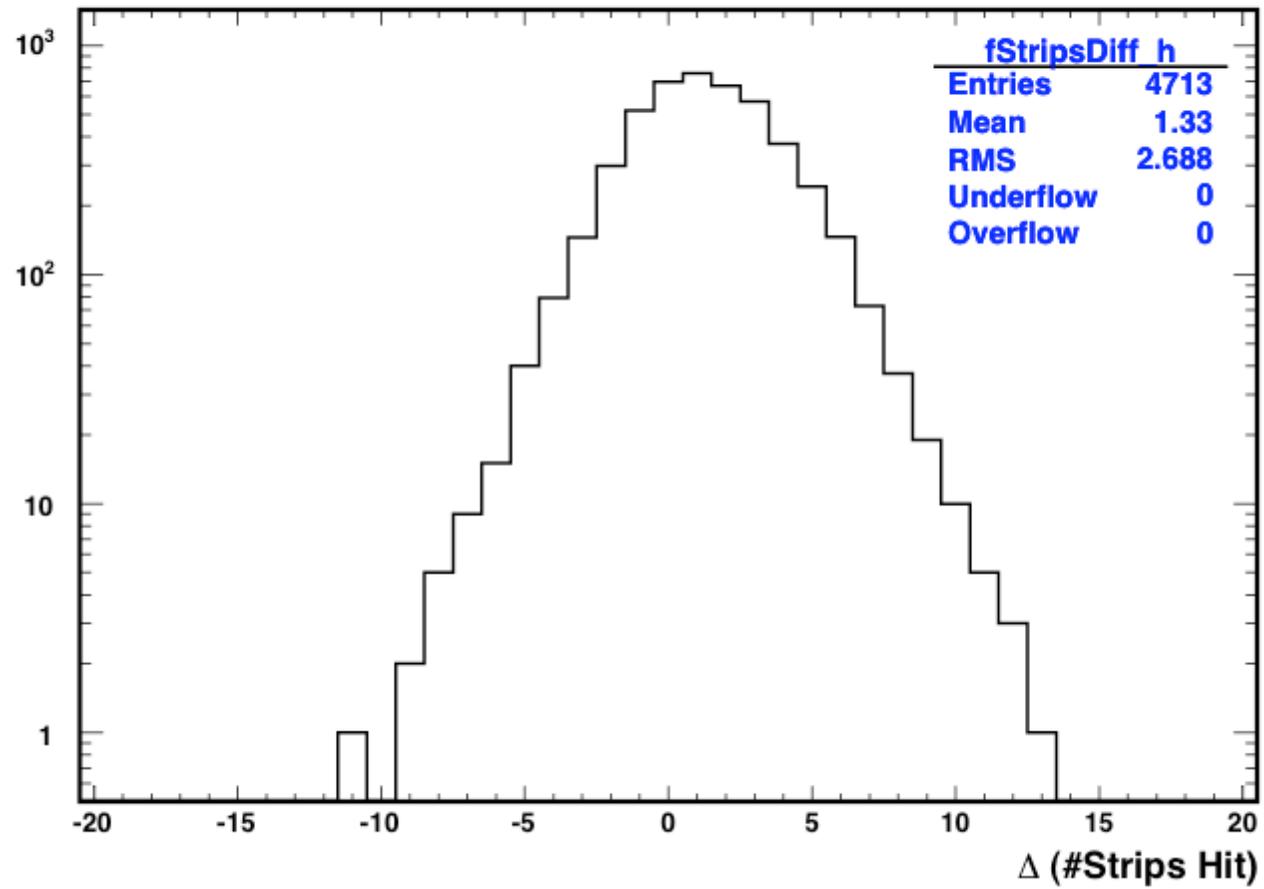
Topology Magnitude	$\pi^+ 1.8\text{GeV}/c$		$\mu^+ 1.8\text{GeV}/c$	
Entries	4713 (~70)		60 (~8)	
Charge(Event Max) H (%)	0.04	0.33	0.05	0.29
Strip(Event Max) H (strips)	-0.014	1.75	0.42	1.87
Plane(Event Max) H (planes)	0.00	0.00	0.00	0.00
Charge(Event Max) V (%)	0.02	0.32	0.03	0.29
Strip(Event Max) V (strips)	-0.03	1.81	-0.45	1.51
Plane(Event Max) V (planes)	0.00	0.00	0.00	0.00
Event Length [1.5PE Cut] (planes)	0.50	3.21	1.62	5.50
# Strips Hit [1.5PE Cut] (strips)	1.33	2.69	2.57	4.02
# Planes Hit [1.5PE Cut] (planes)	0.71	1.85	1.85	2.80
Last Plane Hit [1.5PE Cut] (planes)	0.48	2.11	0.12	0.66
First Plane Hit [1.5PE Cut] (strips)	-0.07	0.71	0.00	0.52
CM Strip H (strips)	-0.02	0.46	0.05	0.21
CM Plane H (planes)	-0.04	0.85	0.12	2.04
CM Strip V (strips)	0.00	0.42	-0.08	0.22
CM Plane V (planes)	0.04	0.90	-0.07	2.14
Charge Per Plane (%)	0.00	0.50	-0.02	0.56
Charge Per Strip V (%)	0.00	0.45	-0.04	0.43
Charge Per Strip H (%)	0.01	0.46	0.04	0.43
CM per Plane H (strips)	0.00	0.24	0.00	0.09
CM per Plane V (strips)	0.00	0.24	0.00	0.09
Direction: Slope H (%)	-0.02	0.73	-0.04	0.55
Direction: Slope V (%)	0.01	0.71	0.08	0.42
Direction: Interecept H (%)	0.00	0.23	0.00	0.50
Direction: Intercept V (%)	0.00	0.21	0.00	0.04
Direction: Offset H (%)	-0.02	0.52	0.09	0.43
Direction: Offset V (%)	0.00	0.51	-0.16	0.48
Charge (hit-by-hit) [paired] (%)	0.01	0.69	0.00	0.73
Charge (hit-by-hit) [all] (%)	-0.10	1.45	-0.15	1.24

H -> Horizontal V -> Vertical  
+ve -> ND side -ve -> FD side

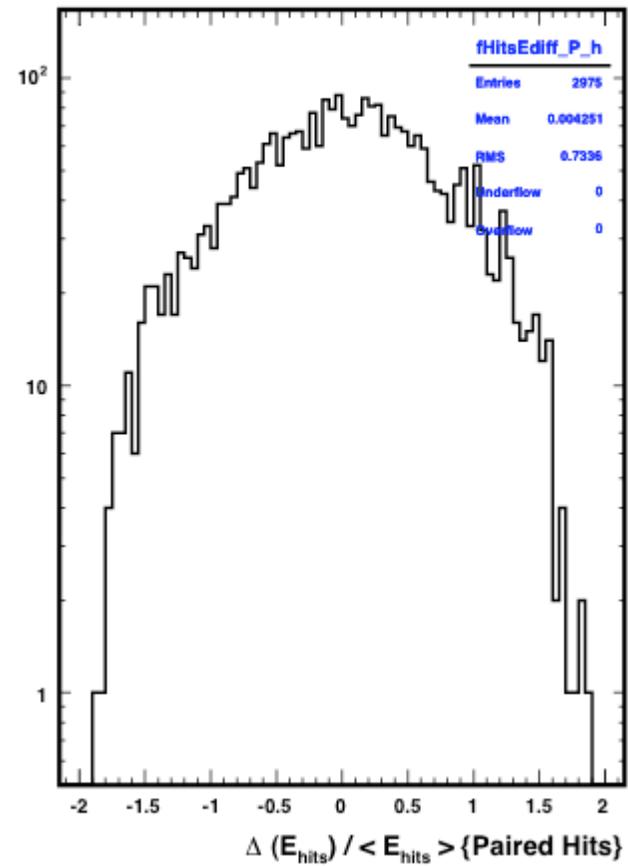
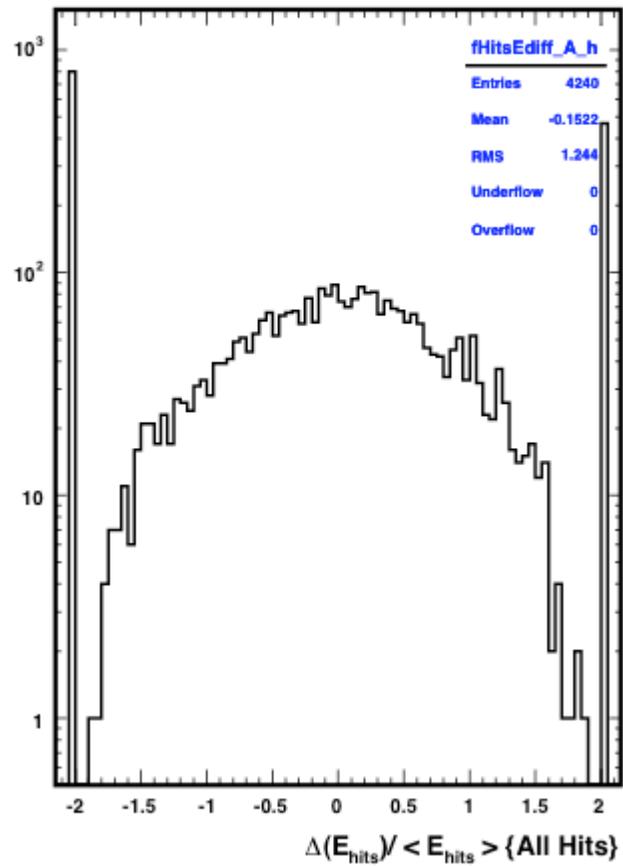
For muons....

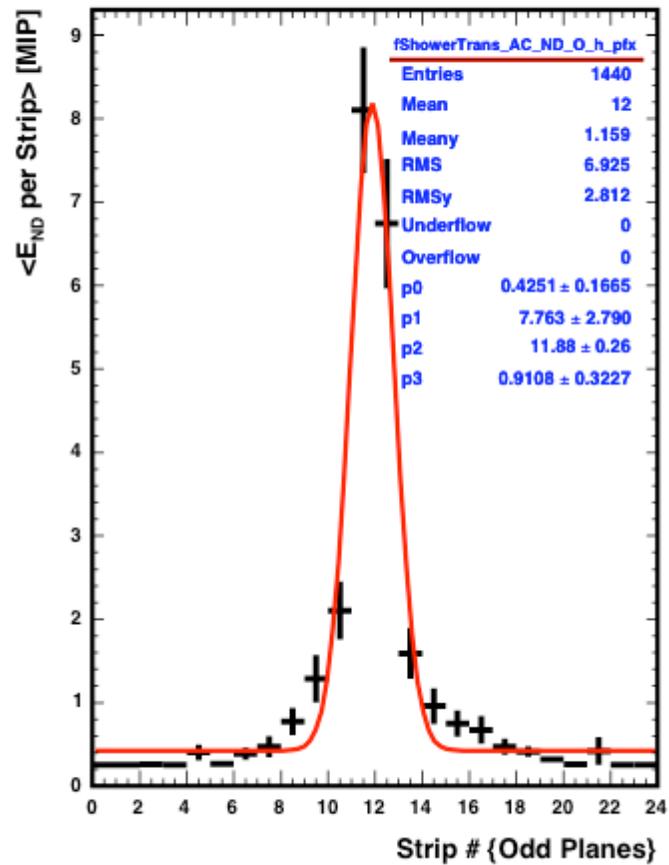
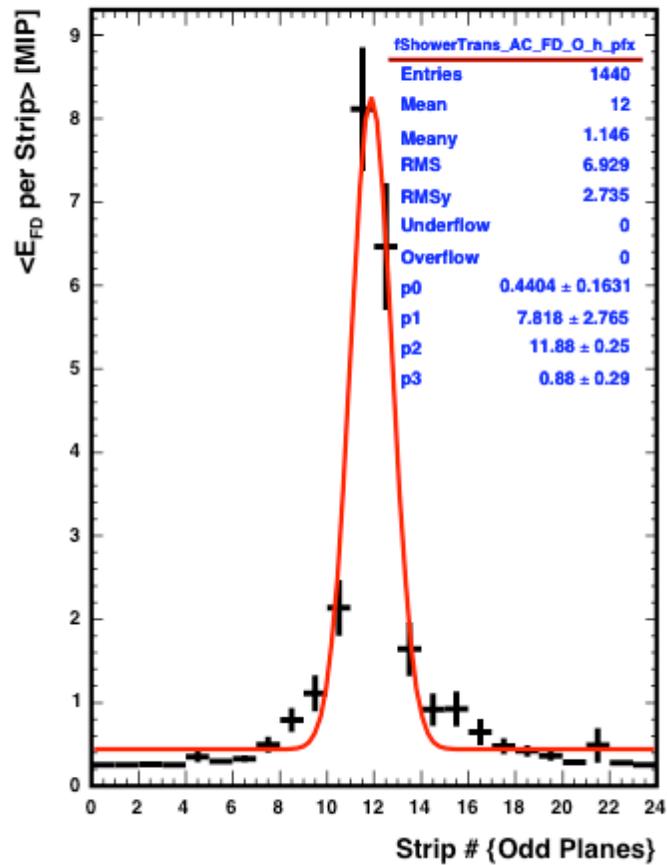


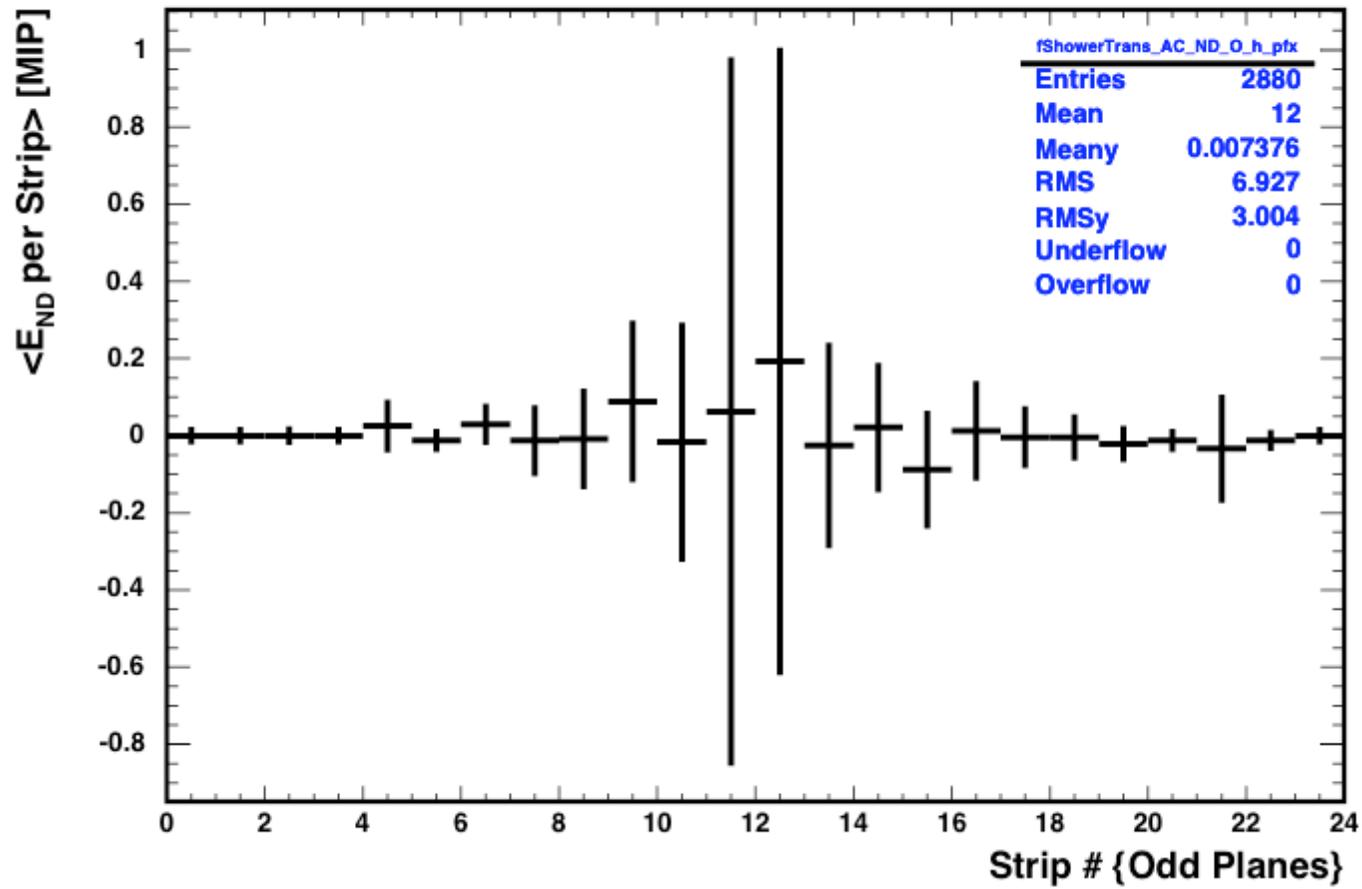
For pions...

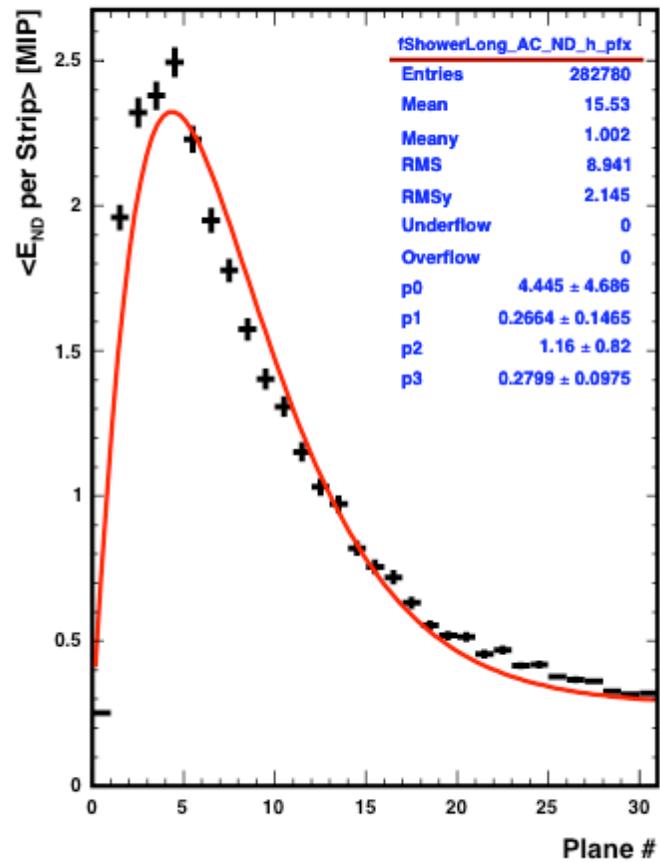
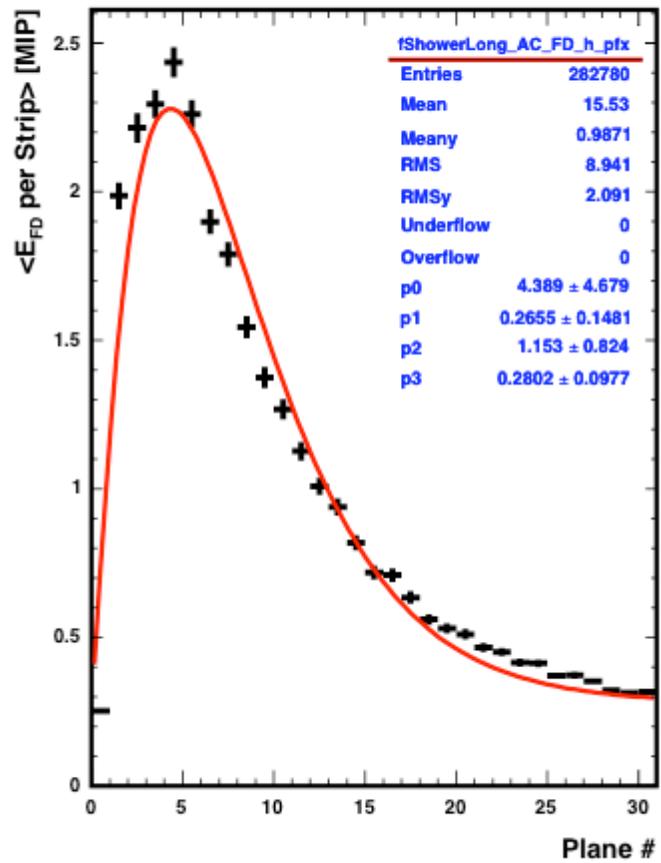


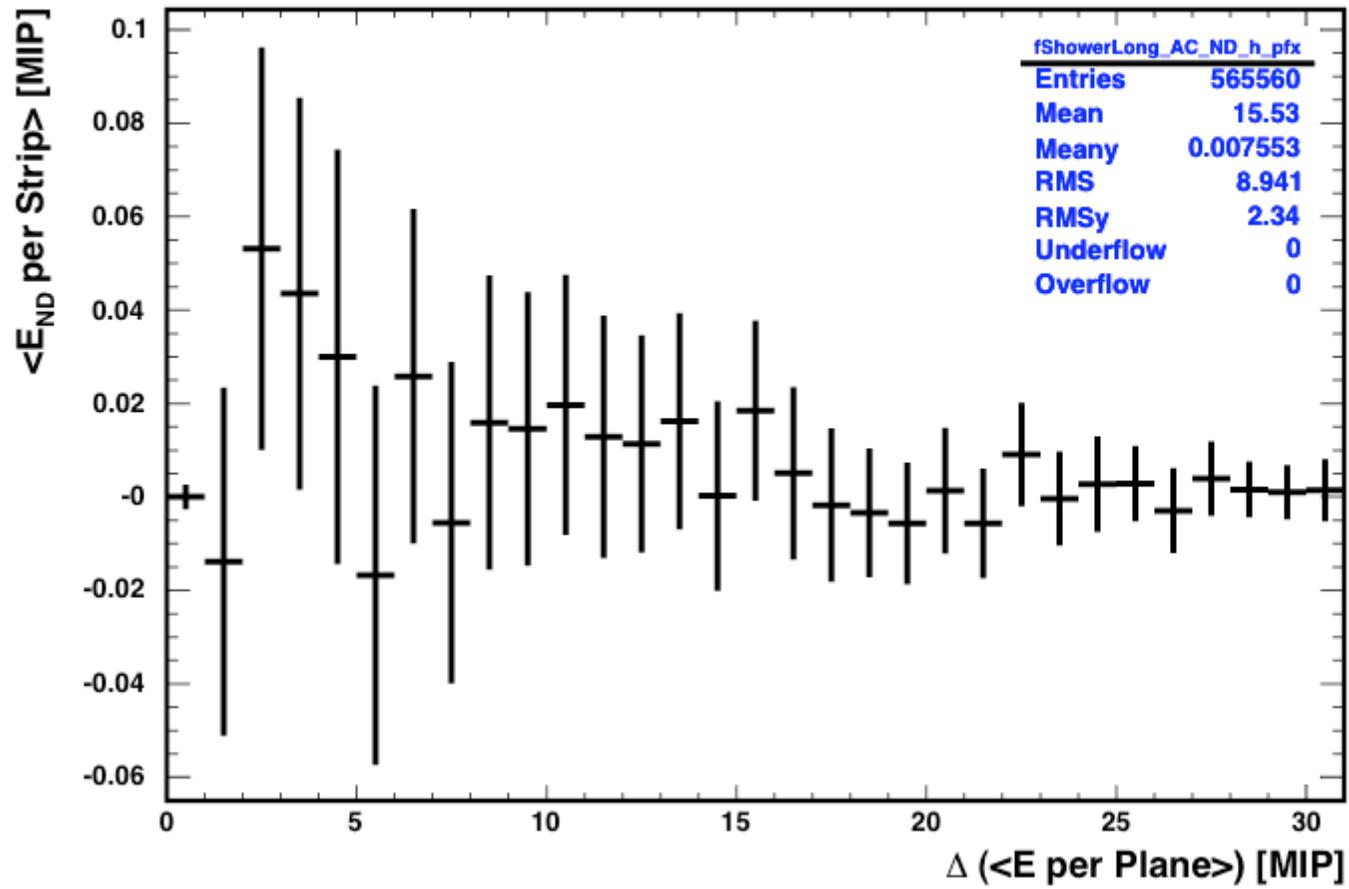
For muons...











## *Conclusion and Outlook:*

1. N/F detector show exceptional agreement on response and on topology description on muons and pions.
2. My sample of muons-like snarls is very small (60) -> repeat the exercise with more.
3. A few topological magnitudes seem to show some degree of disagreement between N/F sides -> MC would help us to understand their nature.