SCECAL progress report

Tohru Takeshita (Shinshu)

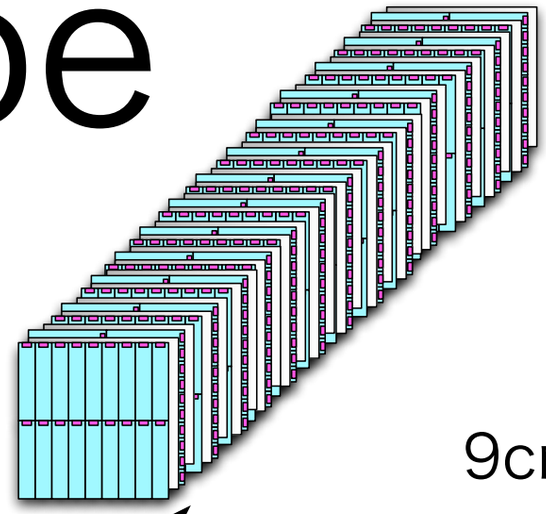
★DESY Beam Test summary

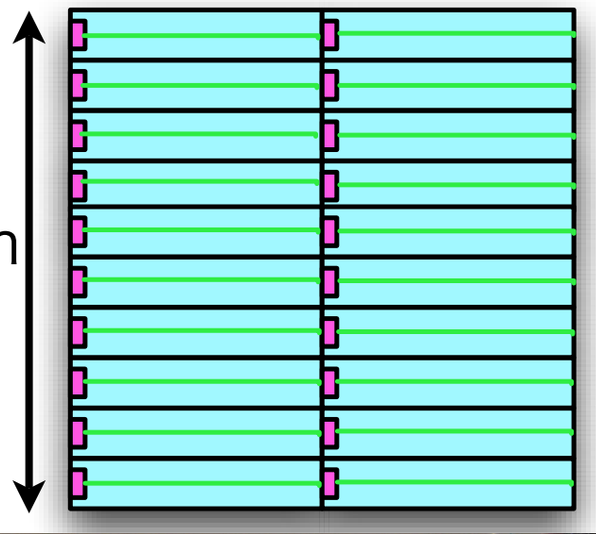
★improvements for FNAL BT

★FNAL module

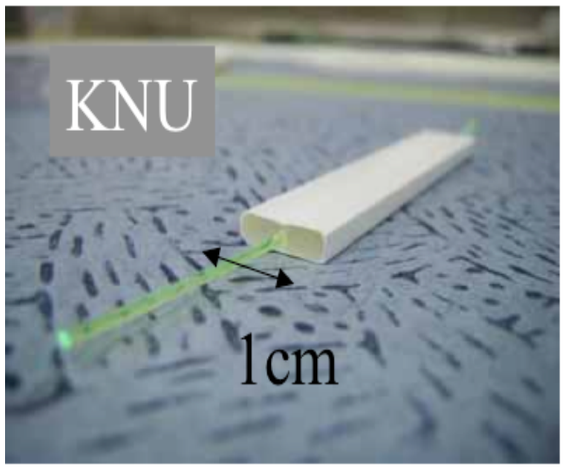
★current status at Fermilab

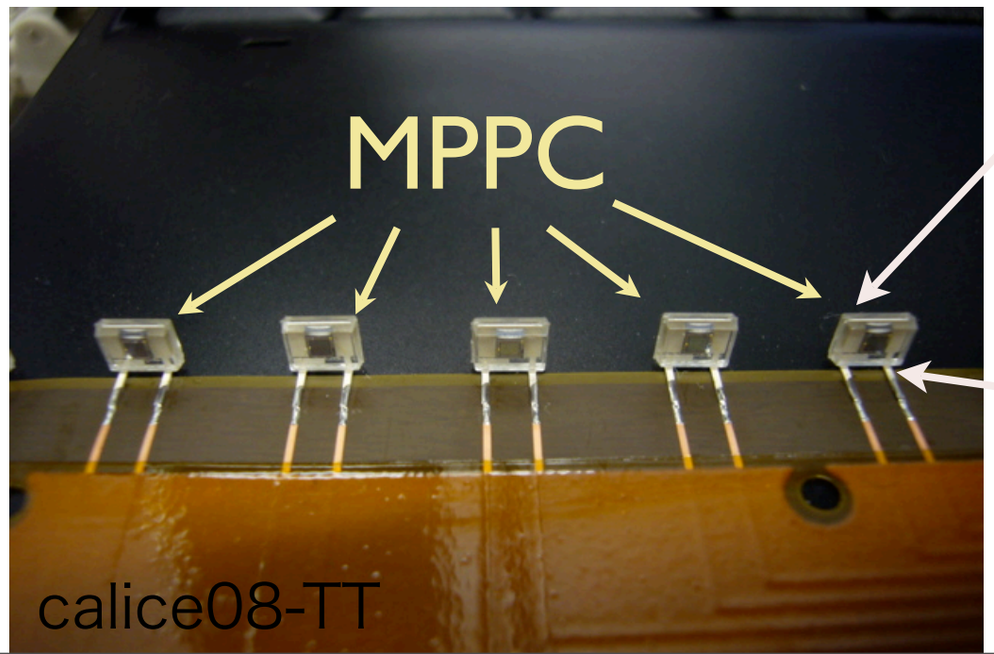
small prototype at DESY

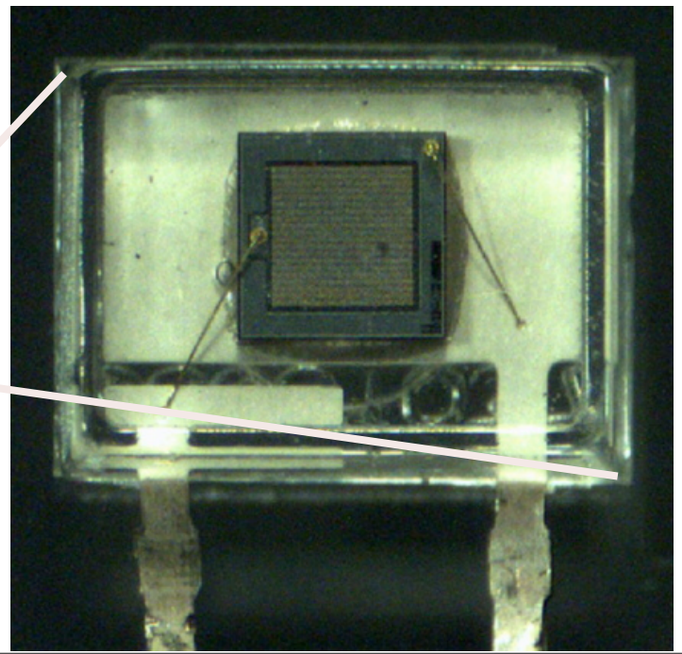


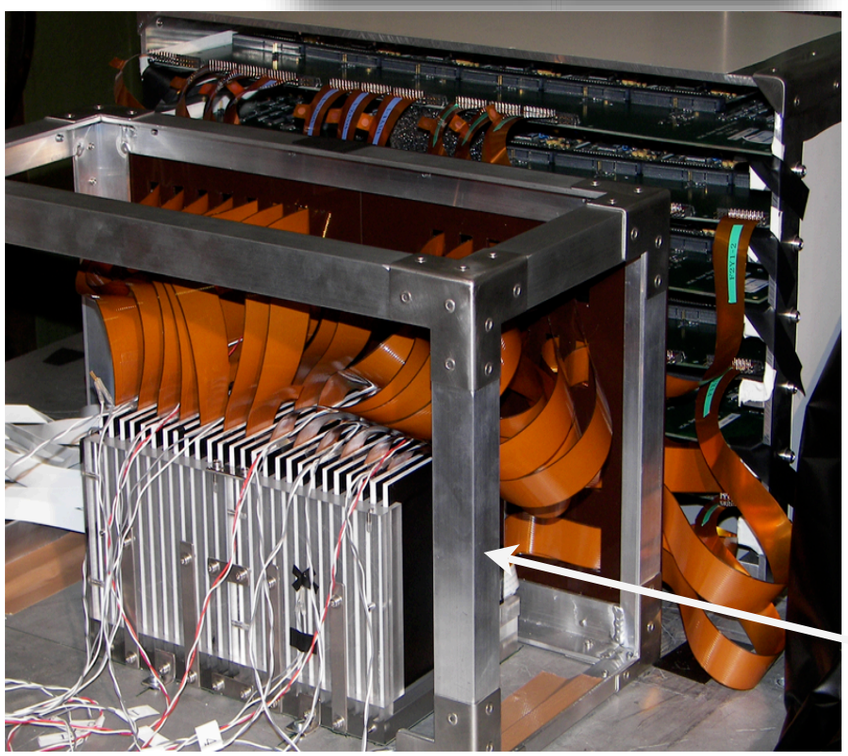


- 9x2 strips / layer x 26 (468ch)
- 1cm x 4.5cm x 0.3cm strip
- fibre in a hole
- without fibre
- MPPC read out





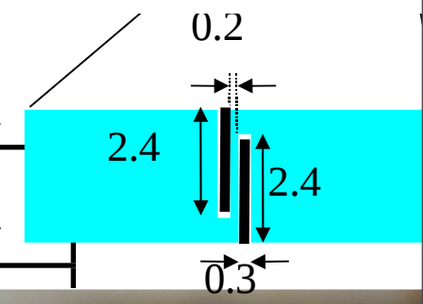


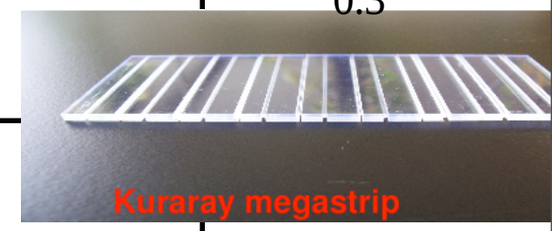


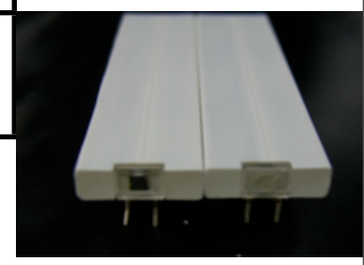
results at DESY

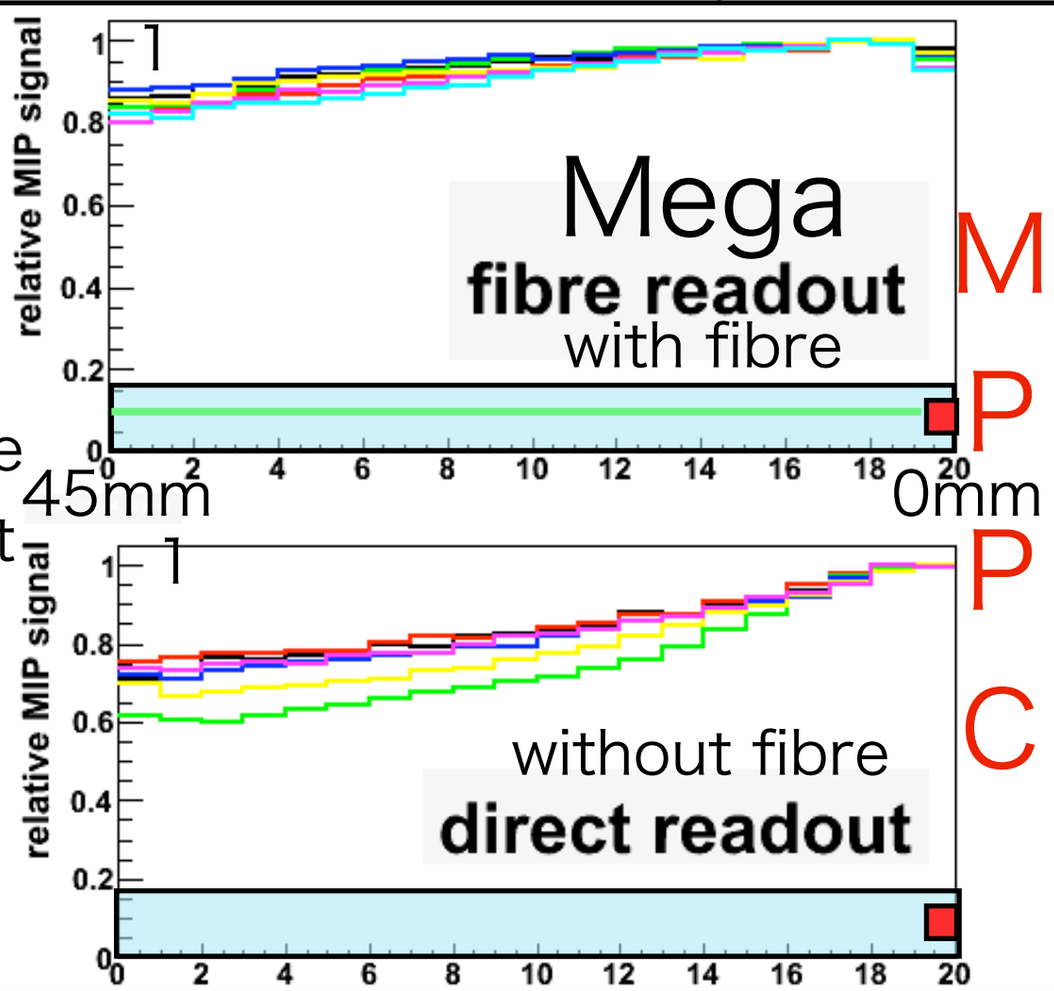
- 3 detector configurations

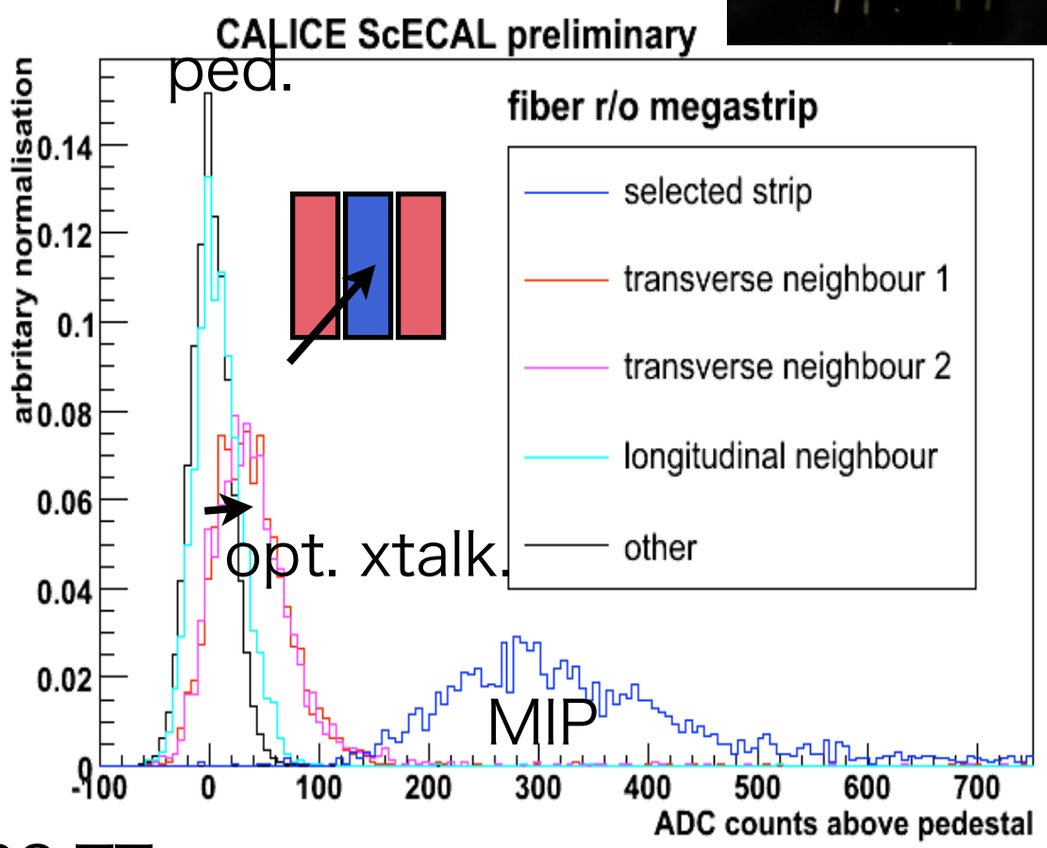
	strip	uniformity	light X-talk
Kuraray	Mega	good	× 10%
	direct r/o	△	
KNU	extruded	need study	good







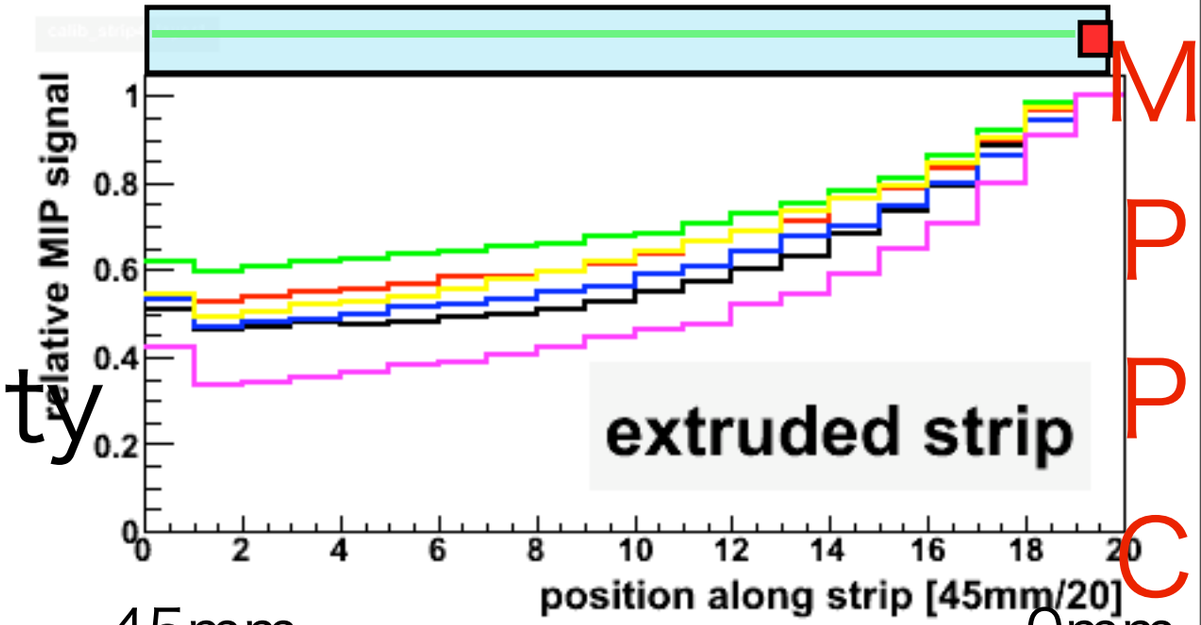




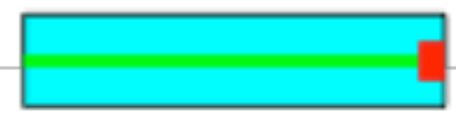
calice08-TT

extruded scintillator

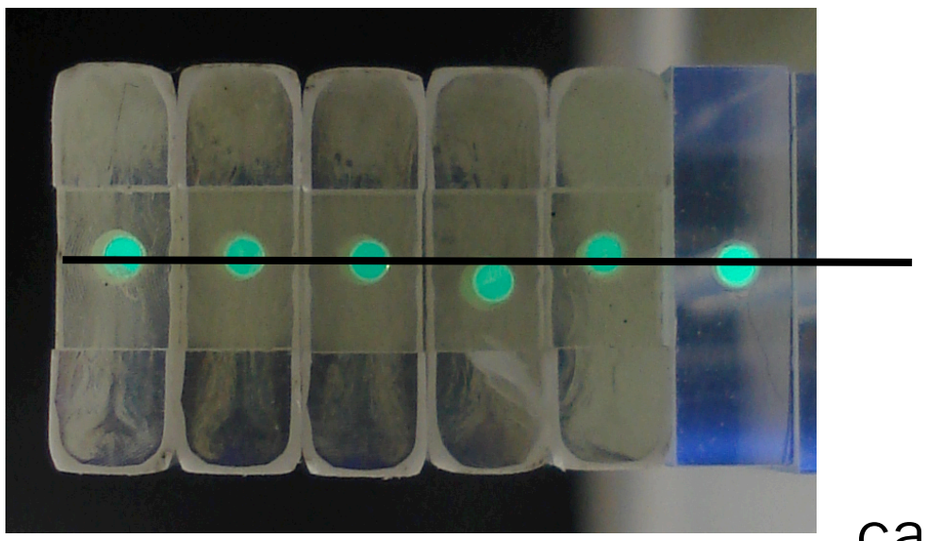
- one of the mysteries
- significant non-uniformity
- due to TiO2 shield
- and miss-alignment of fibre and MPPC

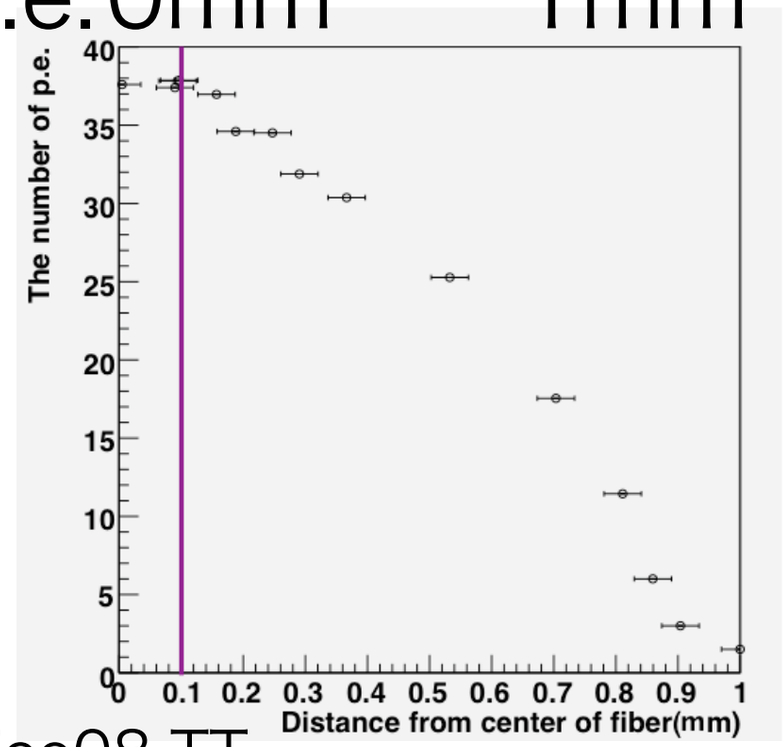


wrapped by reflector



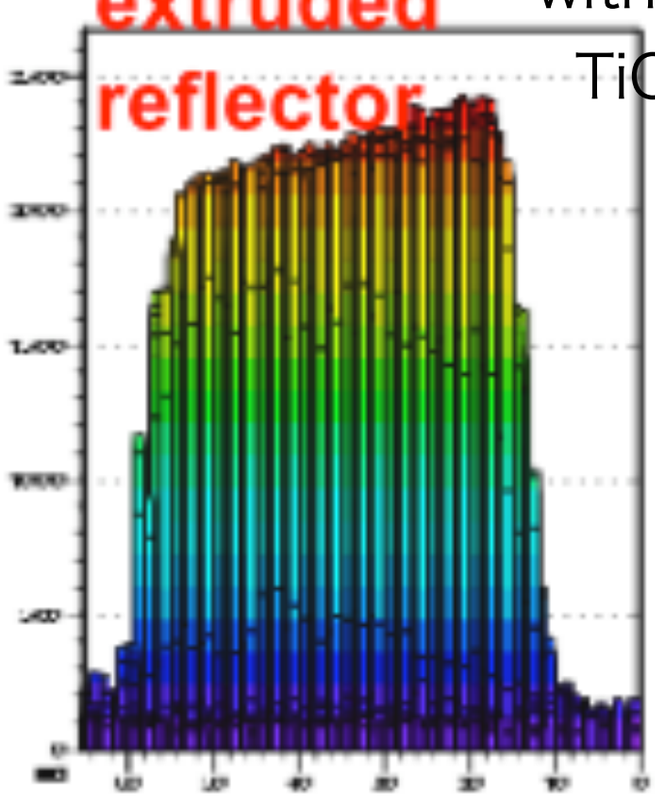
without TiO2





p.e.0mm 1mm

calice08-TT



uniform strip

modified ext. scint.

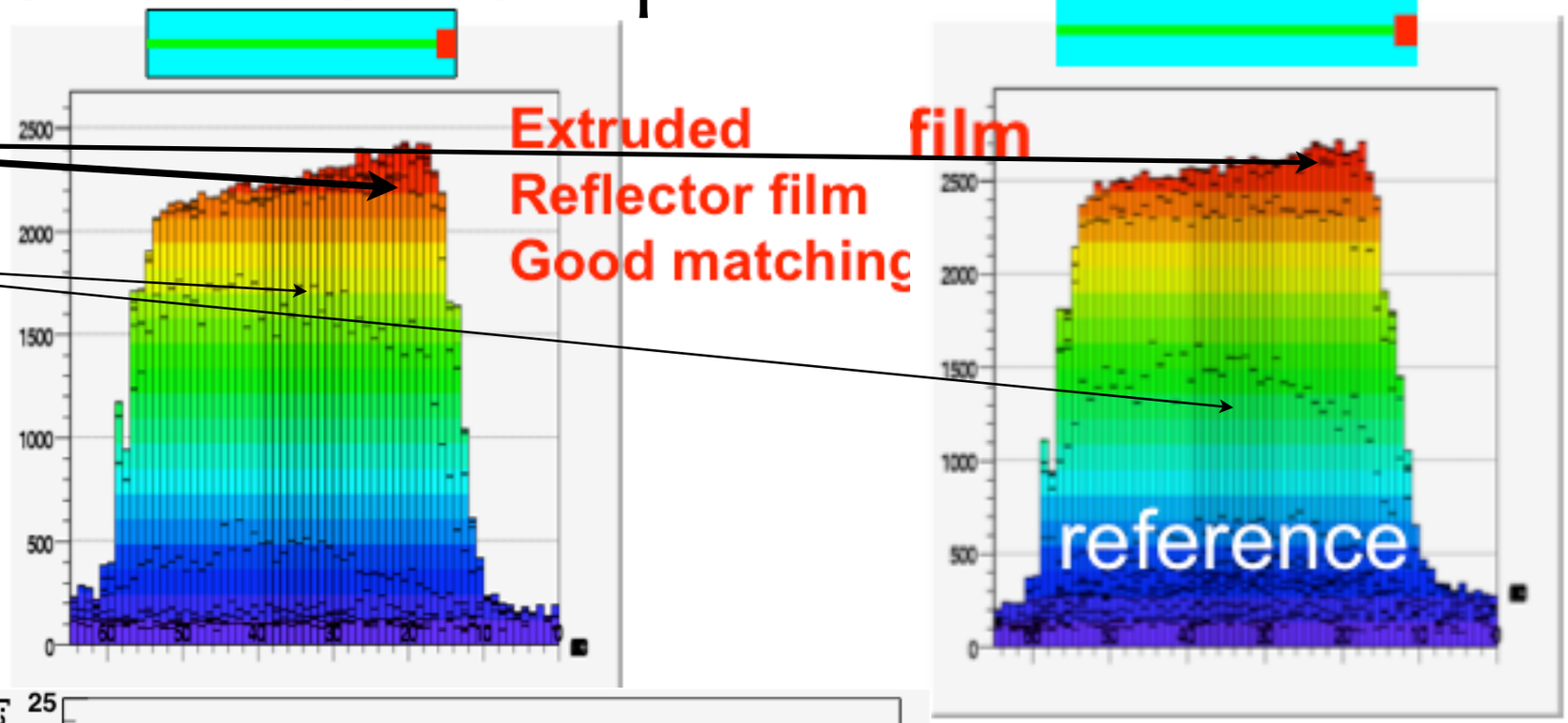
- without TiO2 shield

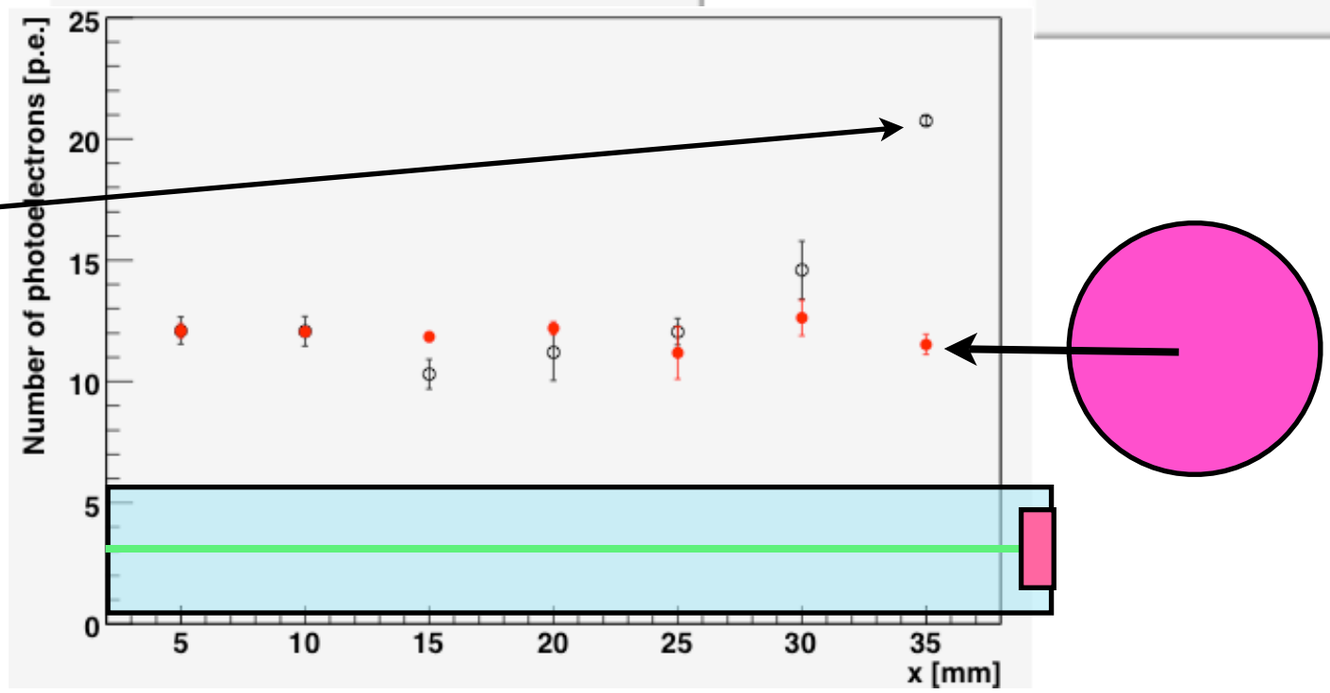
MPPC
1x1 mm²

fibre
1 mmϕ

extruded-strip

mega-strip



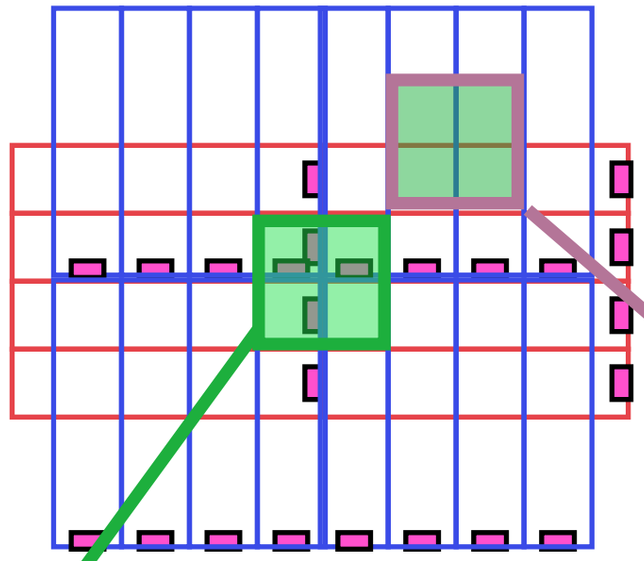


calice08-TT

energy resolution

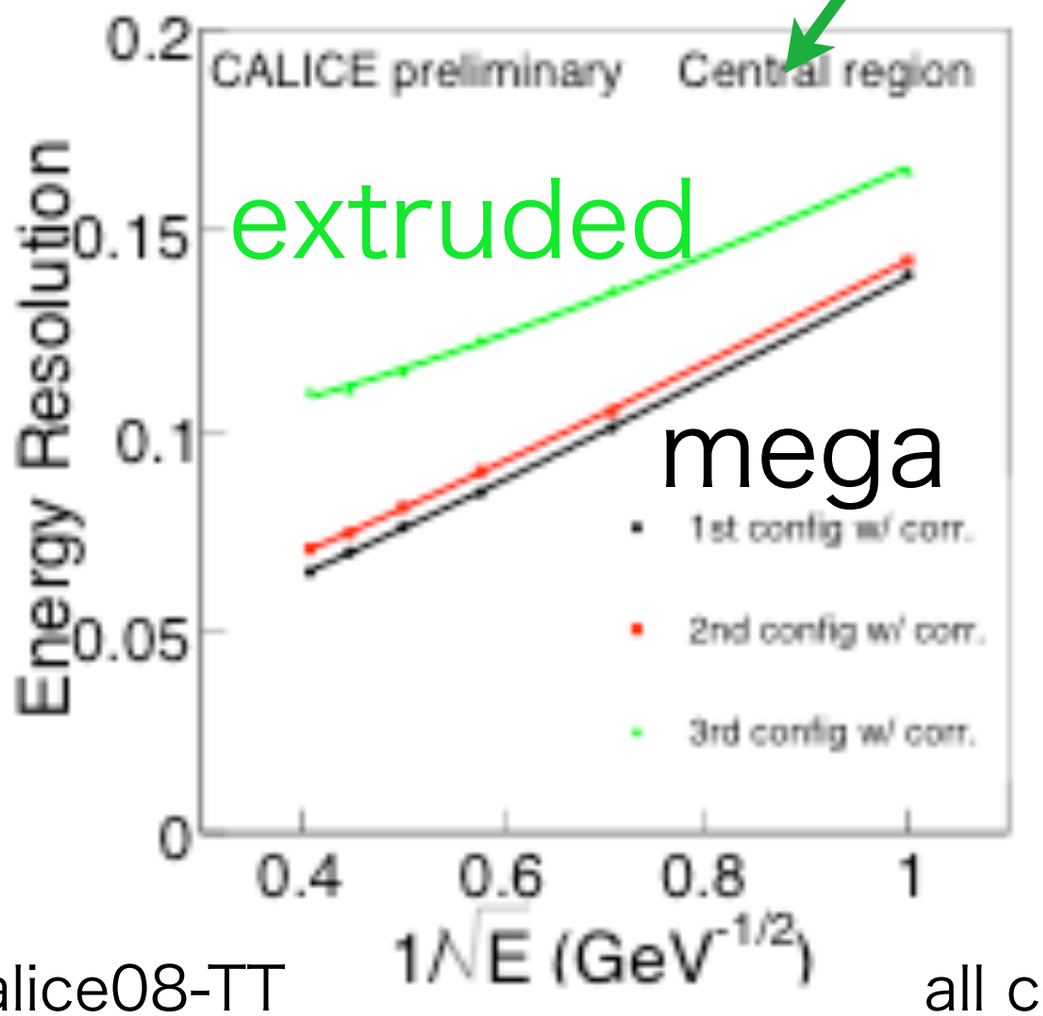
detector center is a singular point

without saturation correction

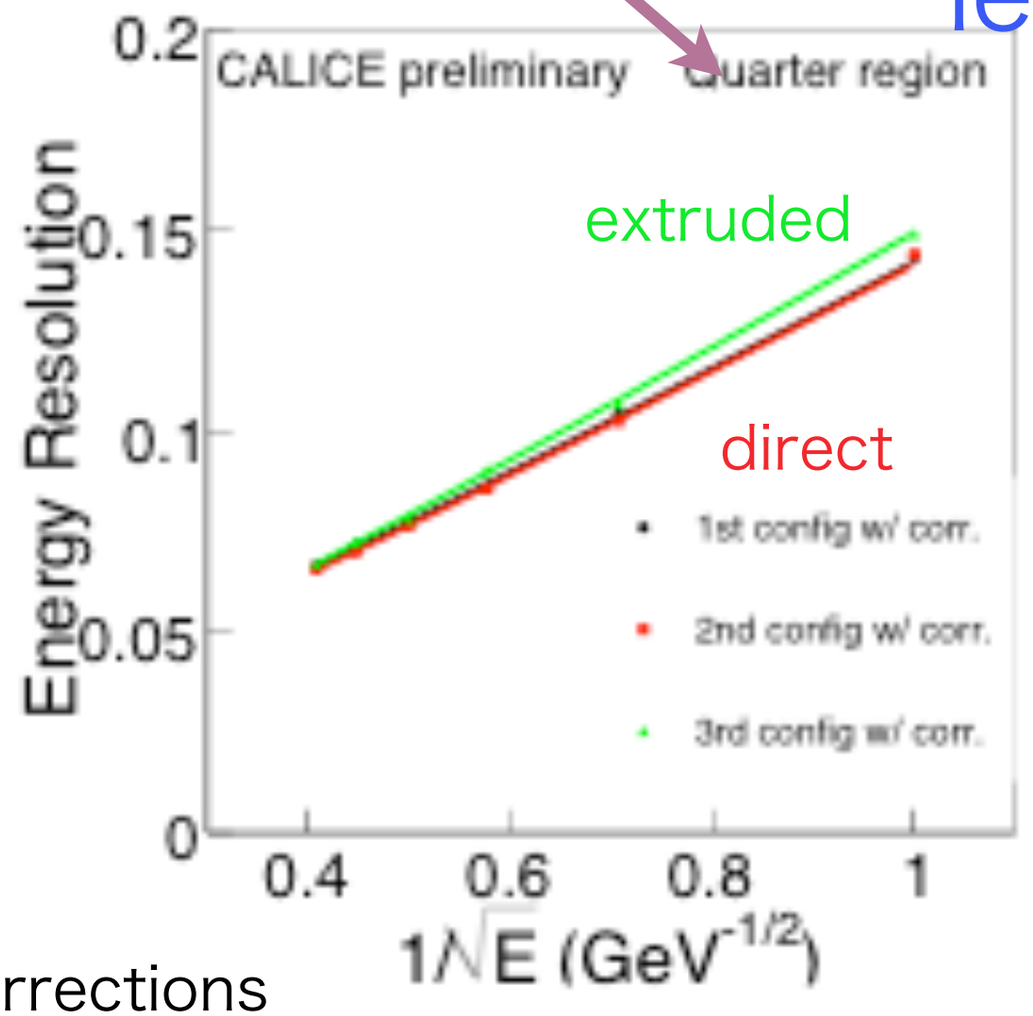


$$\frac{13\%}{\sqrt{E(GeV)}} \oplus 3\%$$

shower leakage



calice08-TT

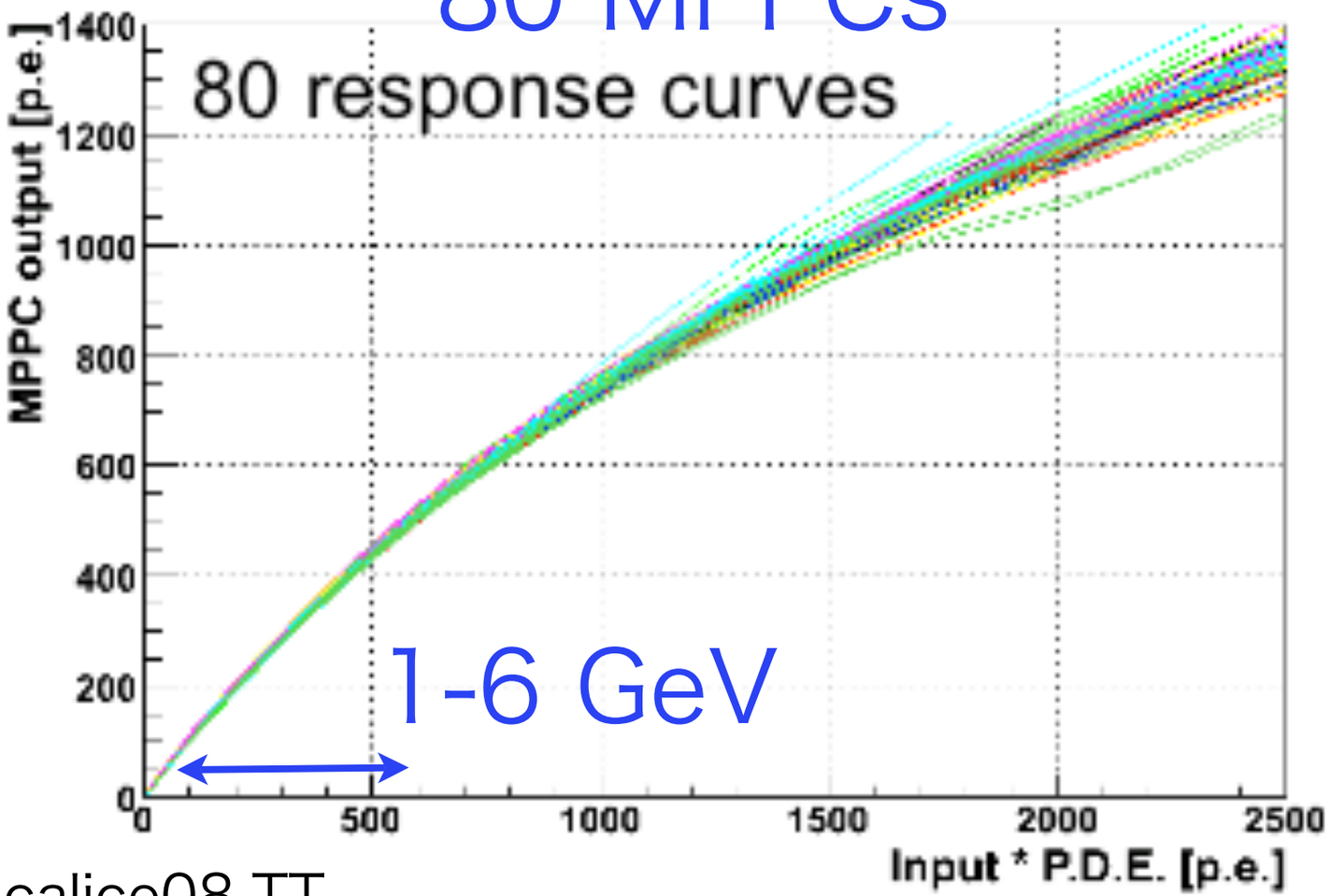


all corrections

MPPC saturation

- MPPC response saturates by big amount of light input
- it exceeds the number of MPPC pixels =1600 due to quick recovery

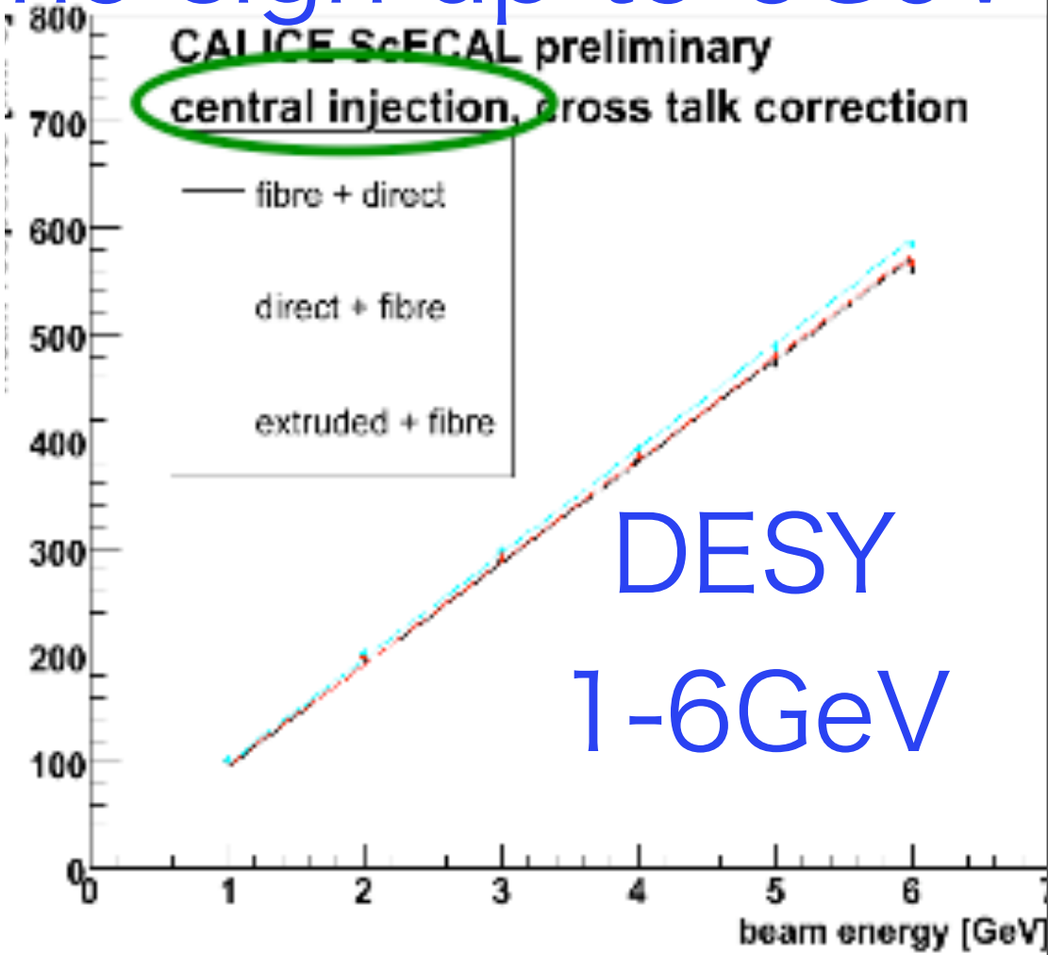
80 MPPCs



calice08-TT

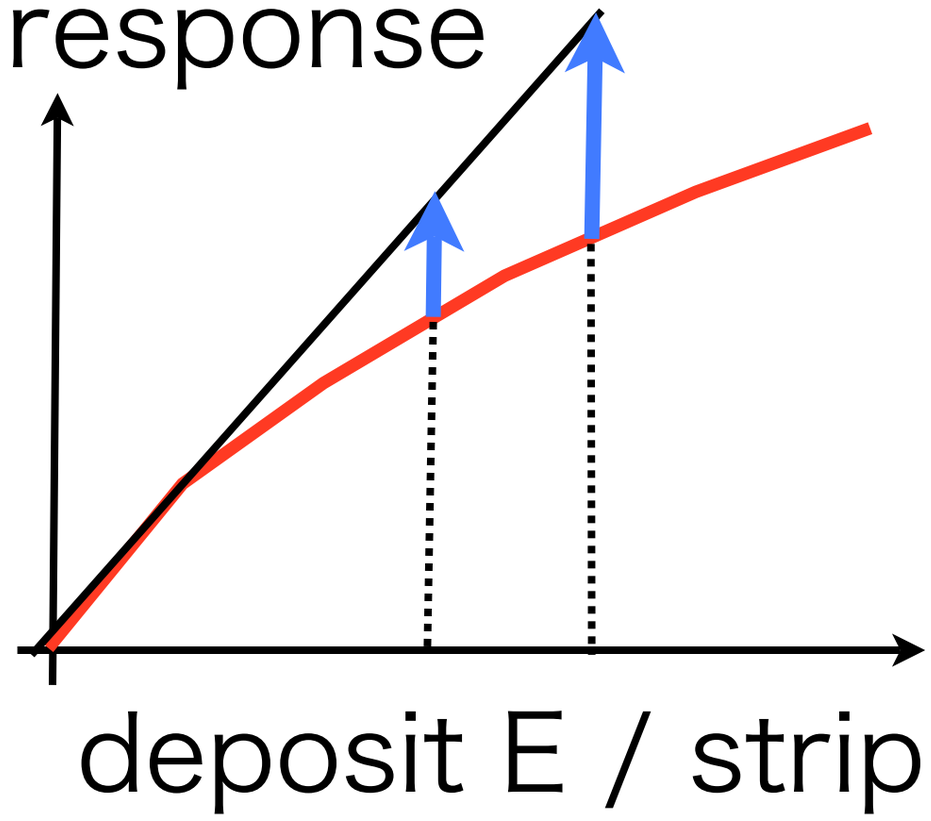
linearity

no sign up to 6GeV



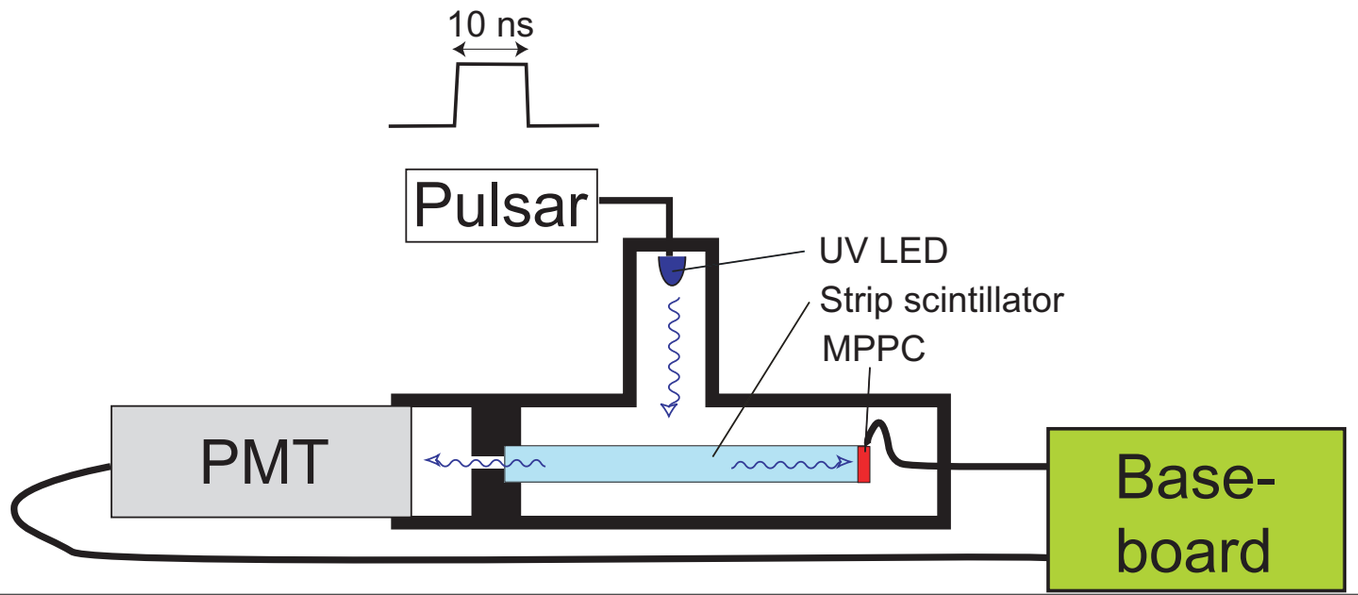
MPPC saturation

- saturation correction



-bigger at EM shower central
-energy distribution will be wider than that measured (central part will shift, howeve others remain)

shape of the curve depends on the electronics (integration time,,,)



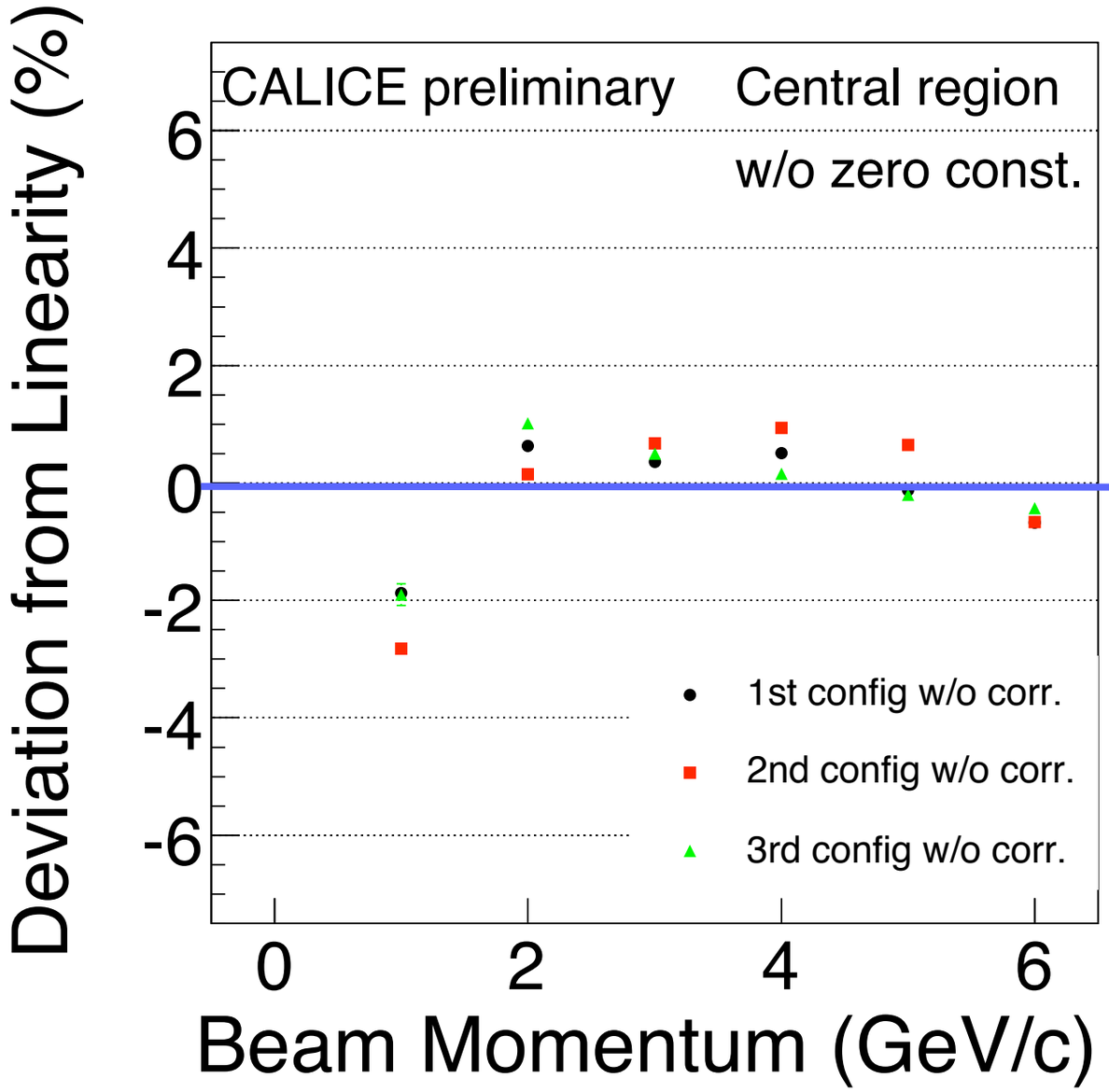
calice08-TT

linearity

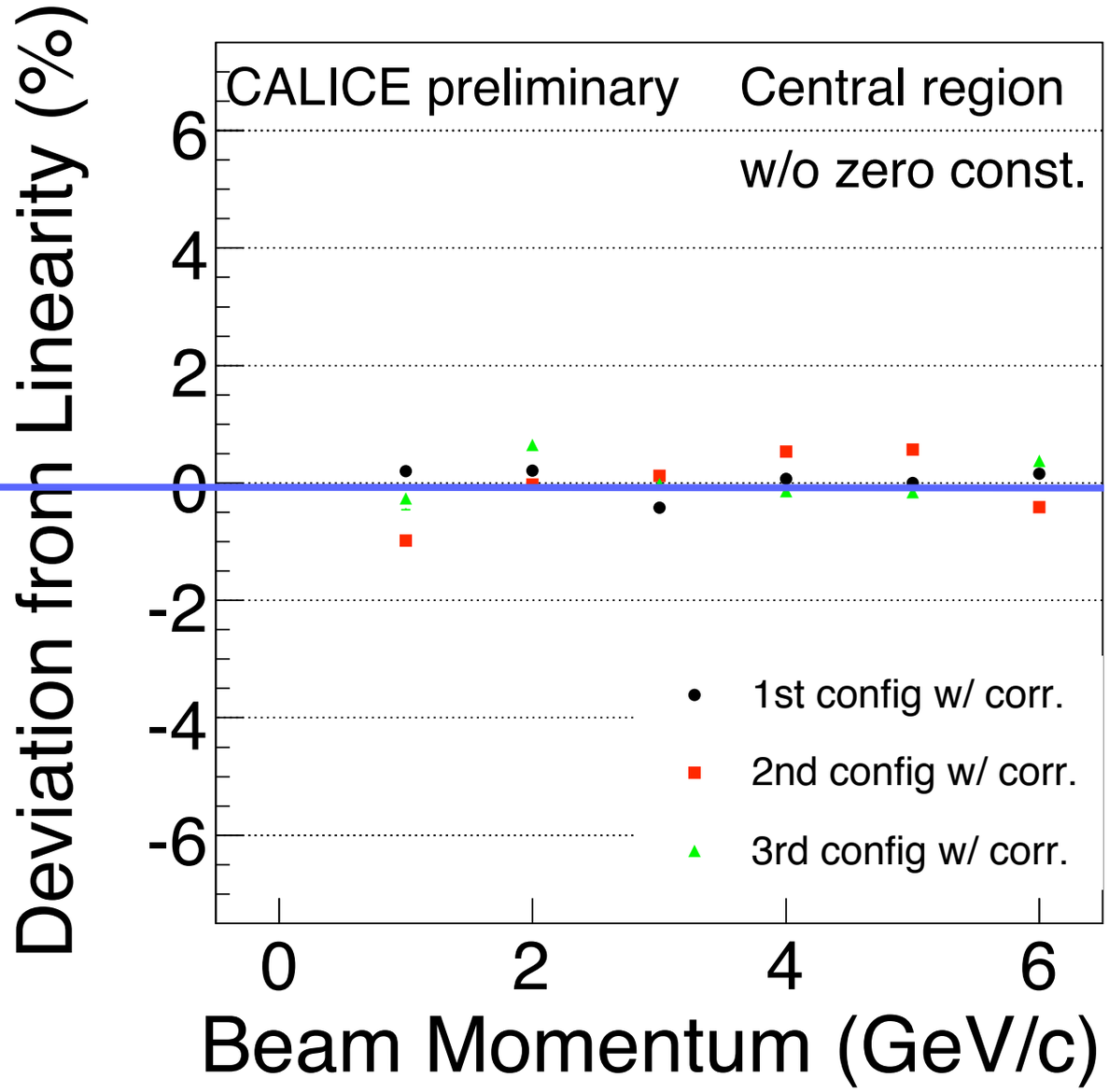
without/with saturation correction

- saturation correction
- improves linearity

before correction



saturation corrected

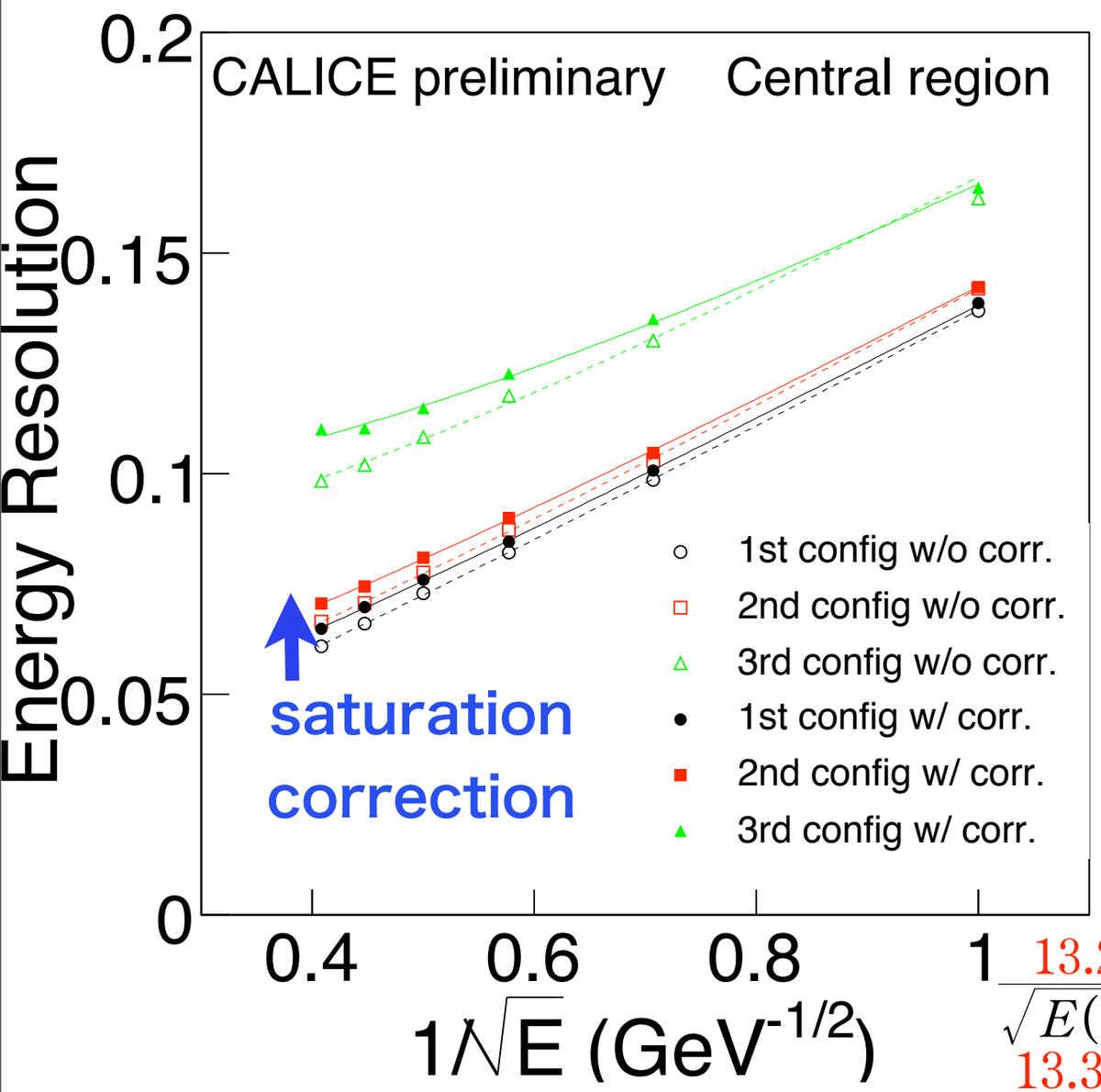


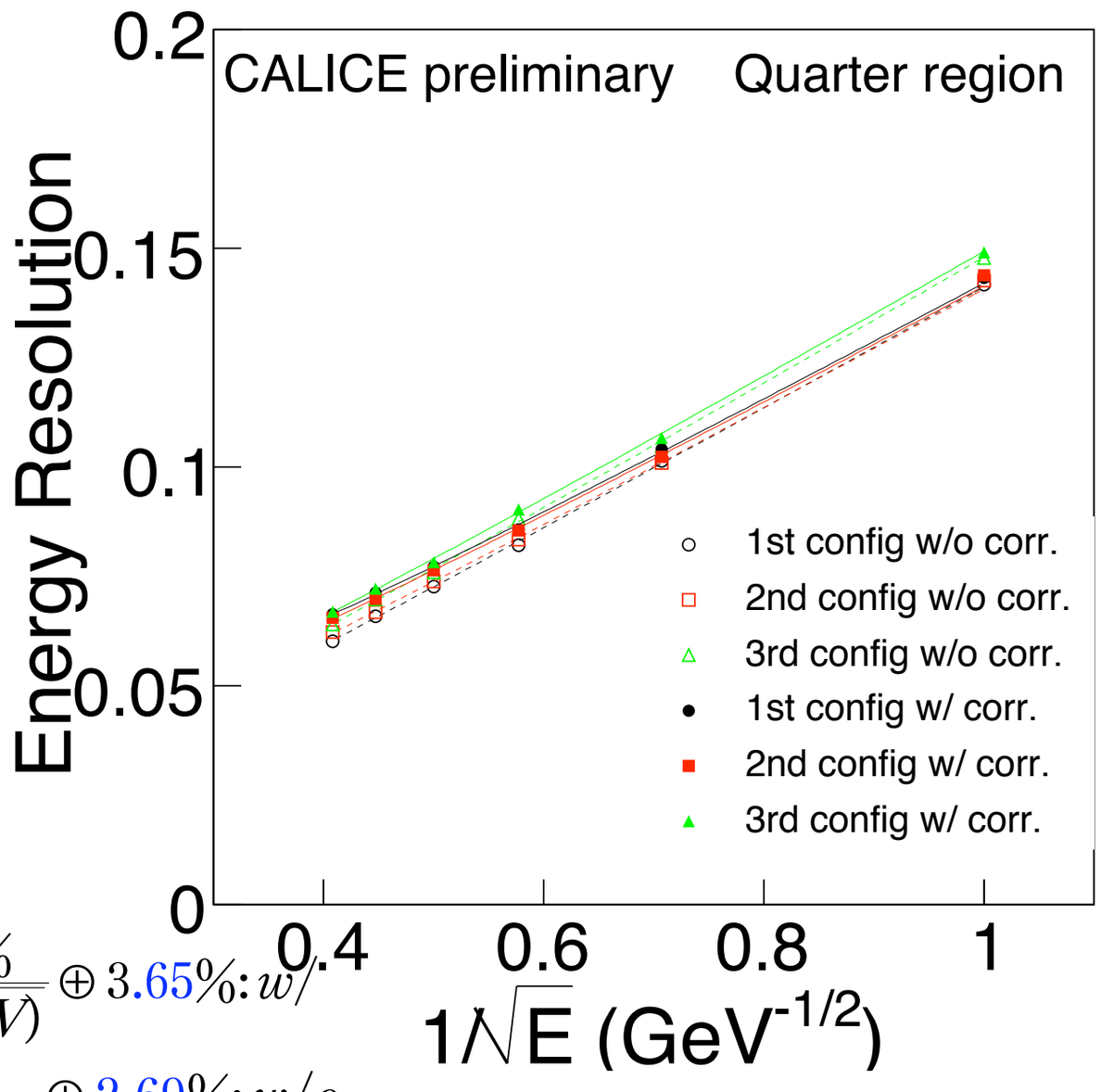
energy resolution

with/without saturation correction

saturation correction makes it worse,

because of broadening the distribution





$\frac{13.24\%}{\sqrt{E(GeV)}} \oplus 3.65\%: w/$

$\frac{13.38\%}{\sqrt{E(GeV)}} \oplus 2.69\%: w/o$

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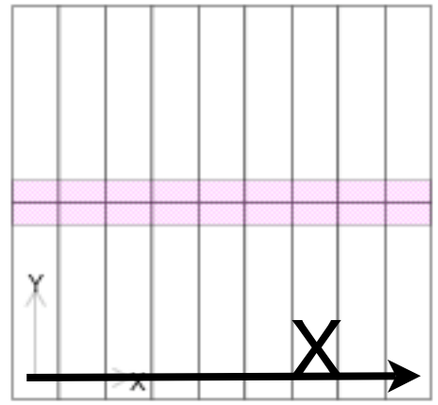
saturation correction

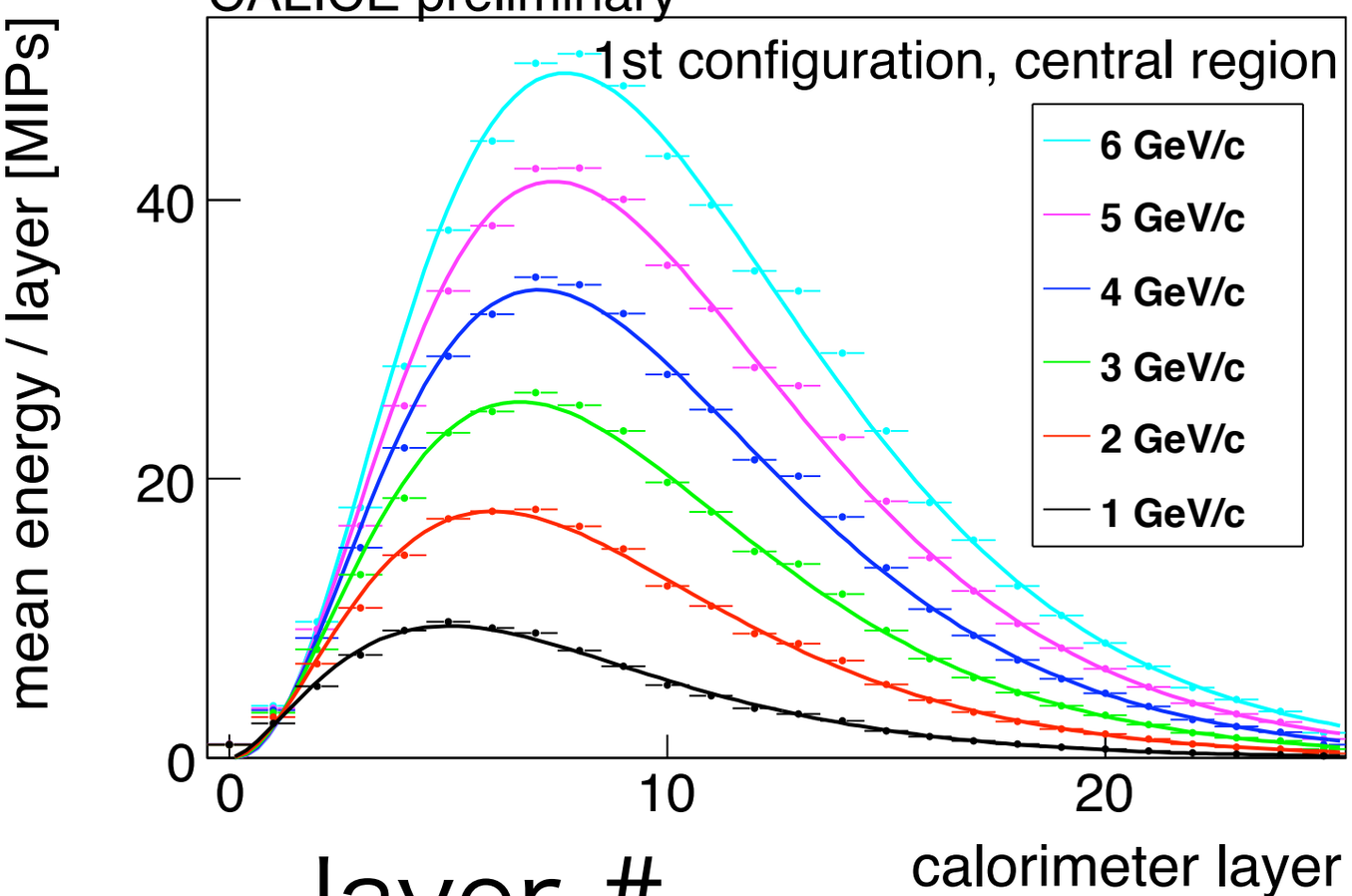
EM shower shape

- longitudinal and lateral
- EM shower shape

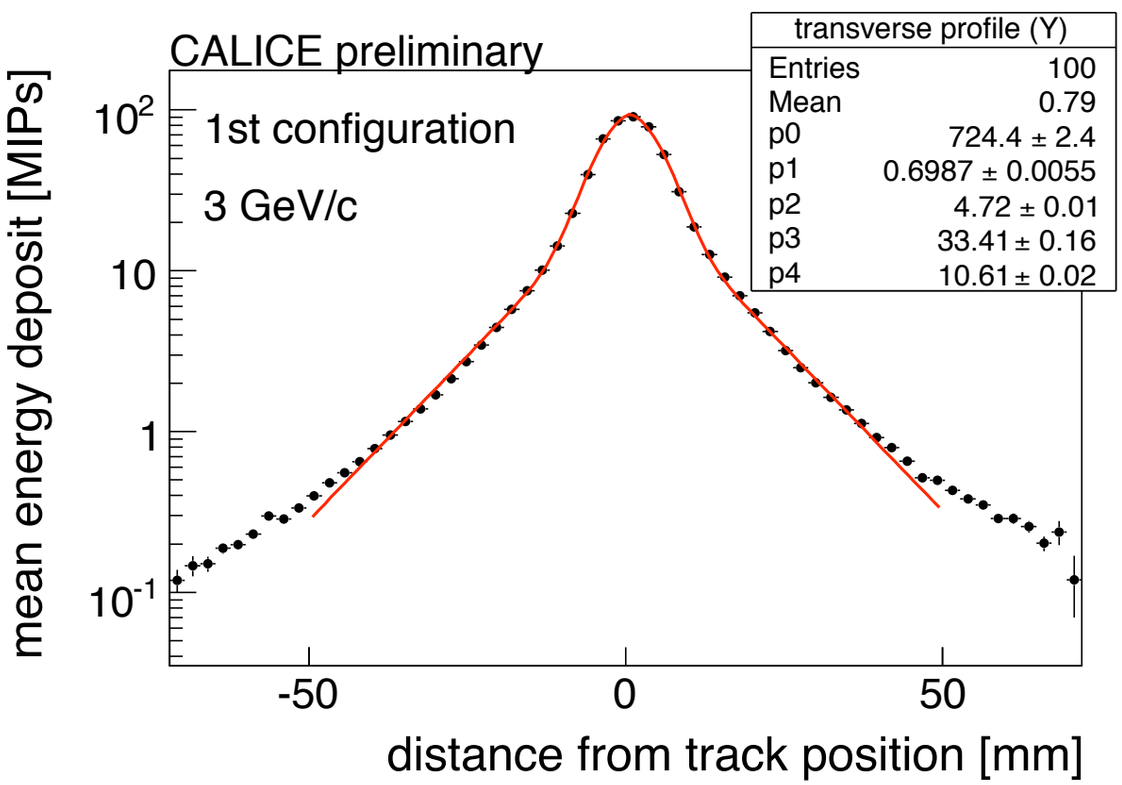


longitudinal

lateral



layer #



x (cm)

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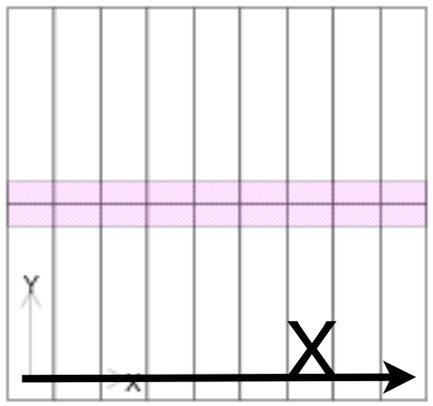
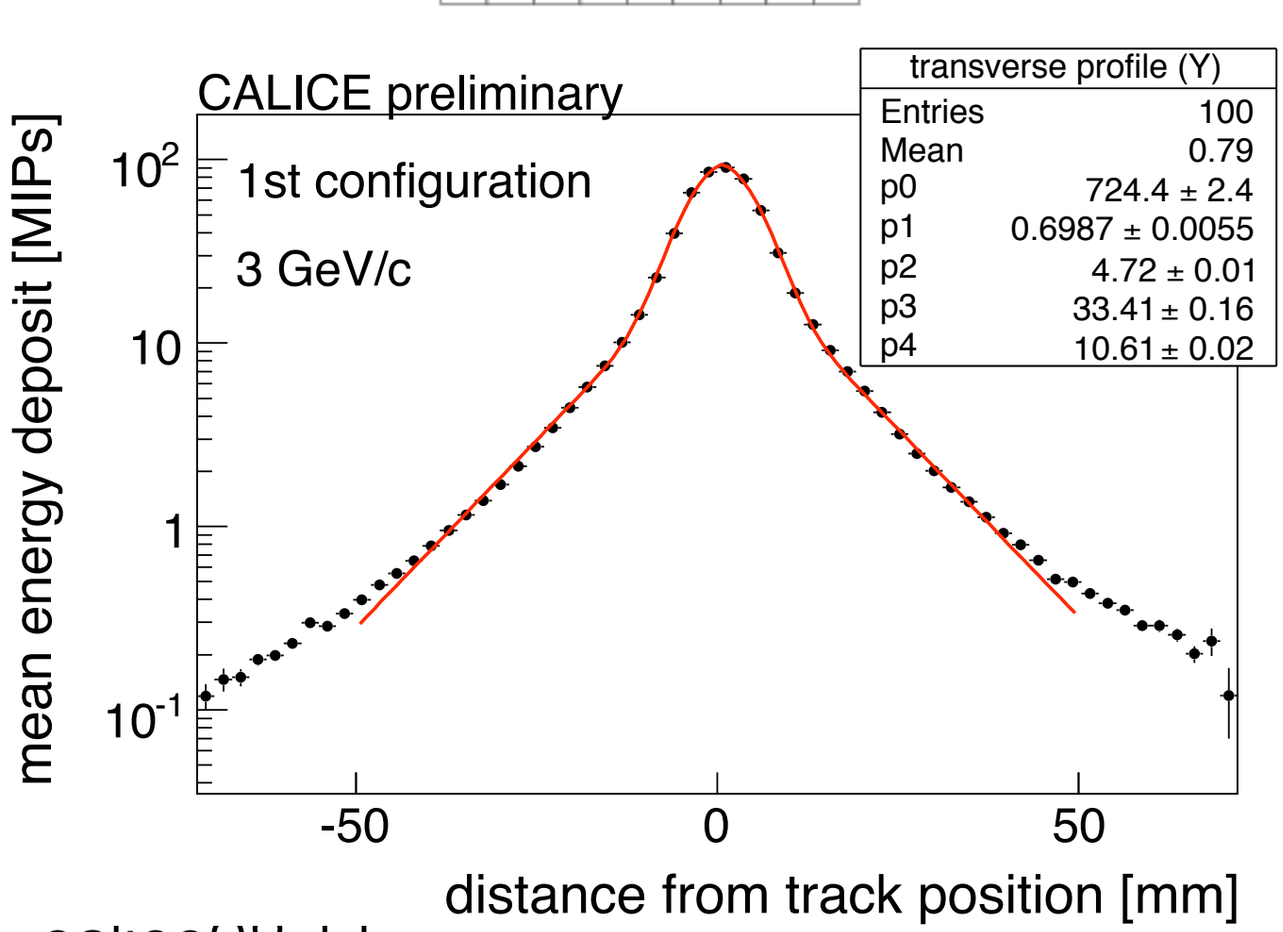
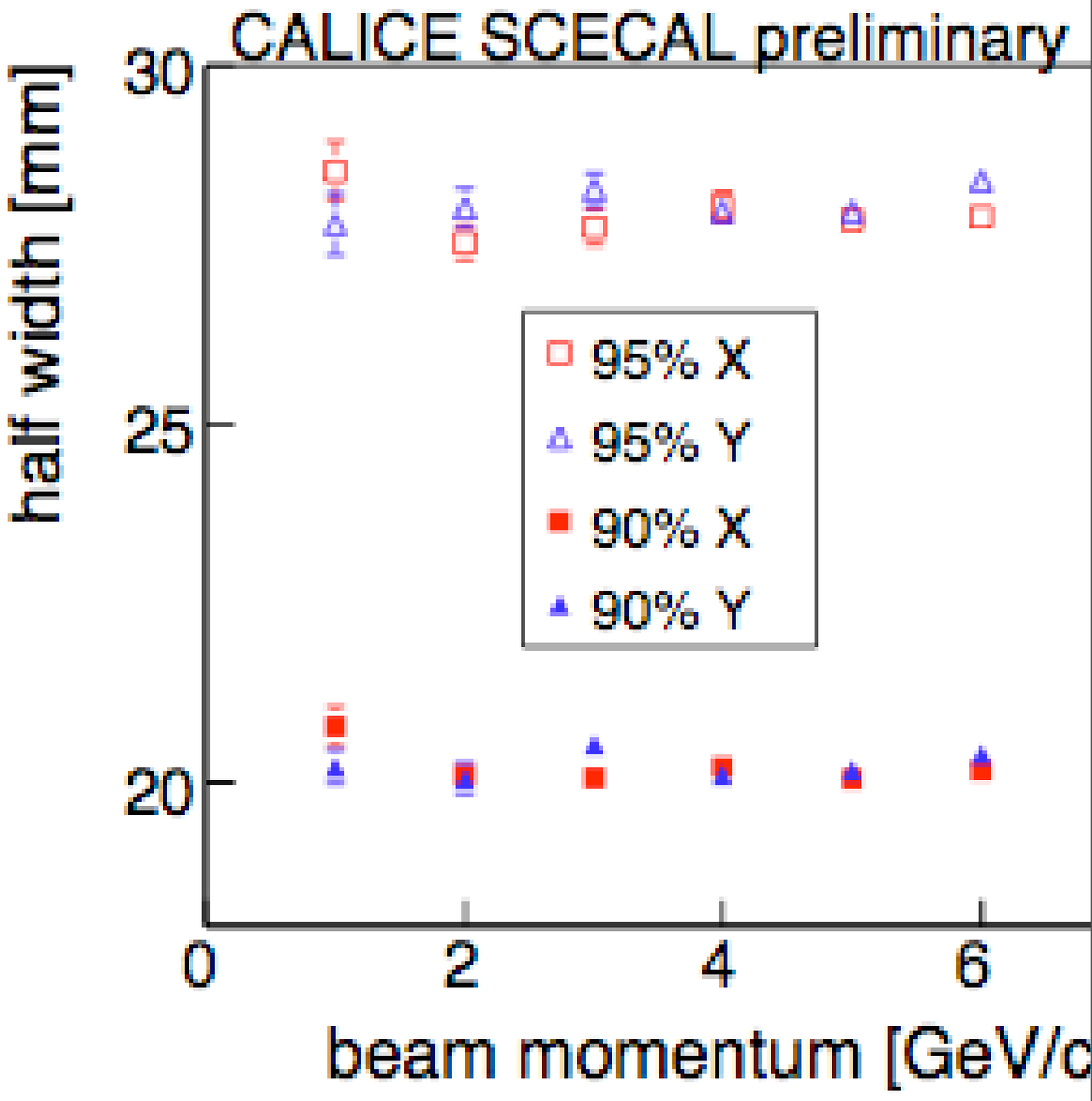
EM shower width

- in one dimension



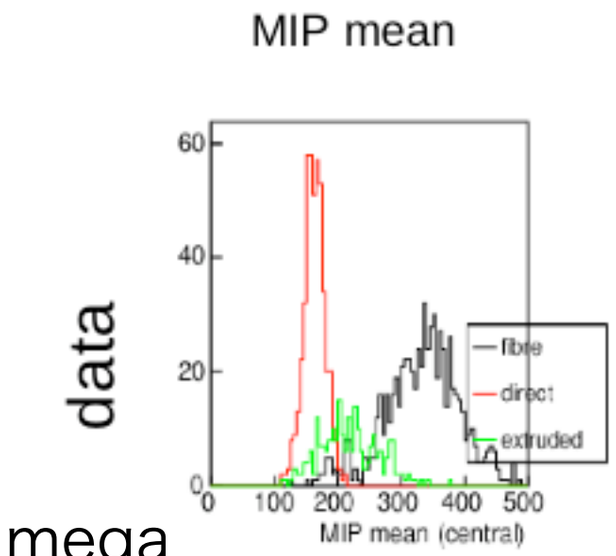


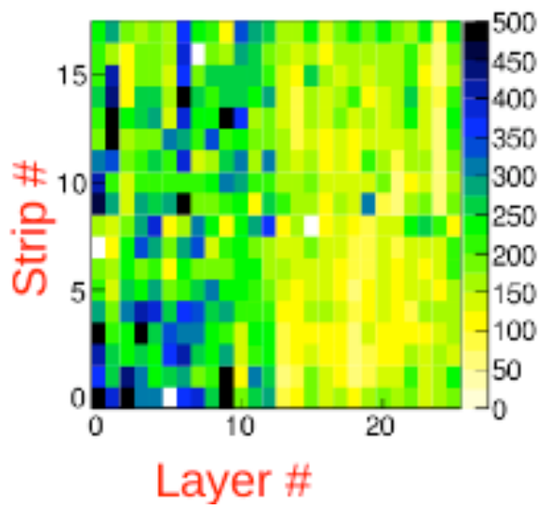


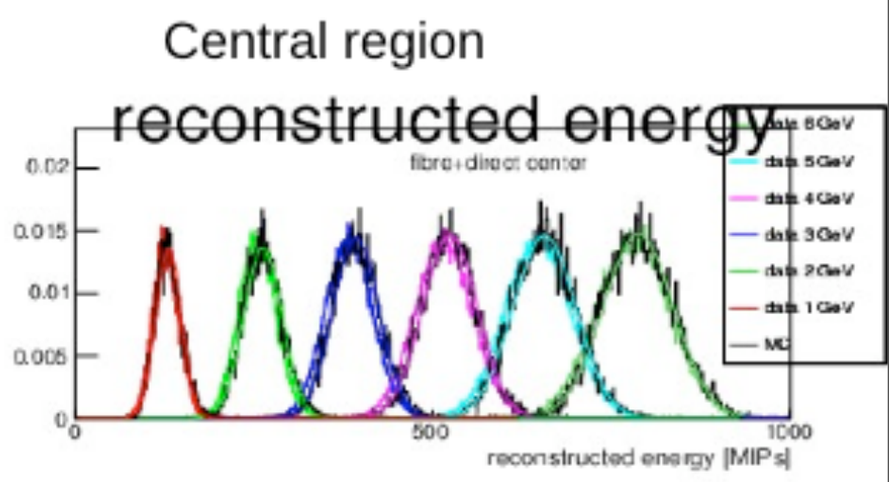
consisten and as expected

simulation

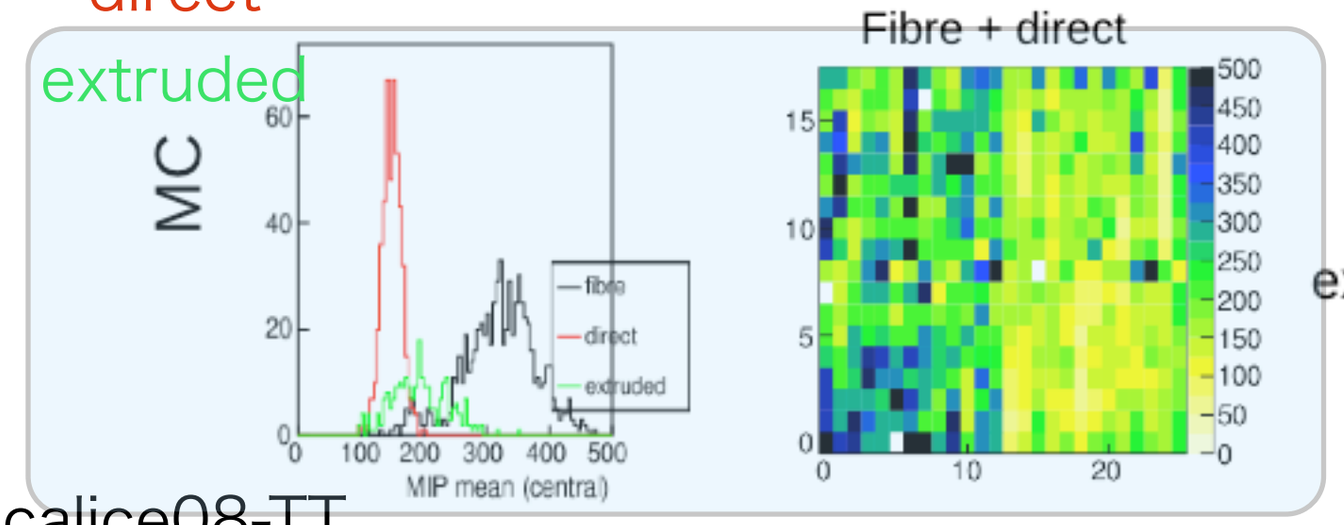
- non uniformity in a strip
- Xtalk between neighboring strips
- saturation effect

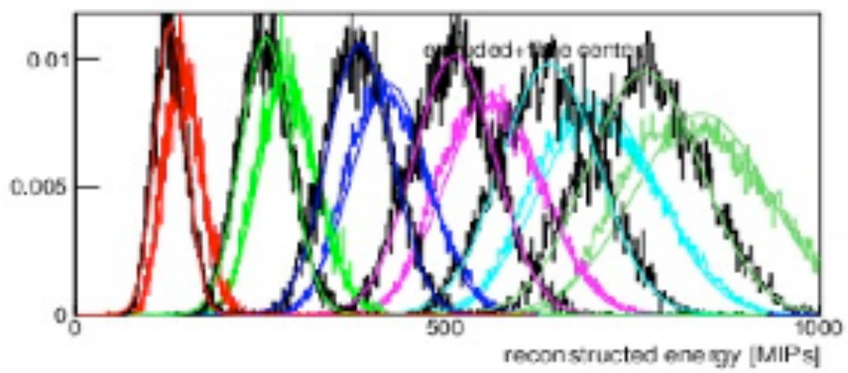






color : data, black : MC





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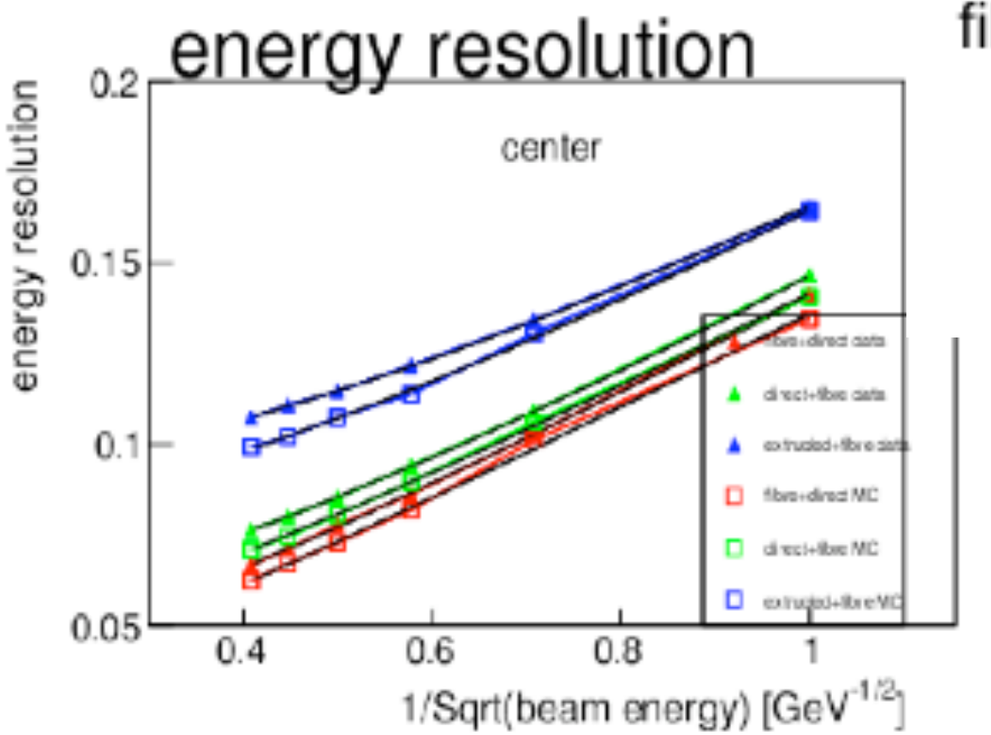
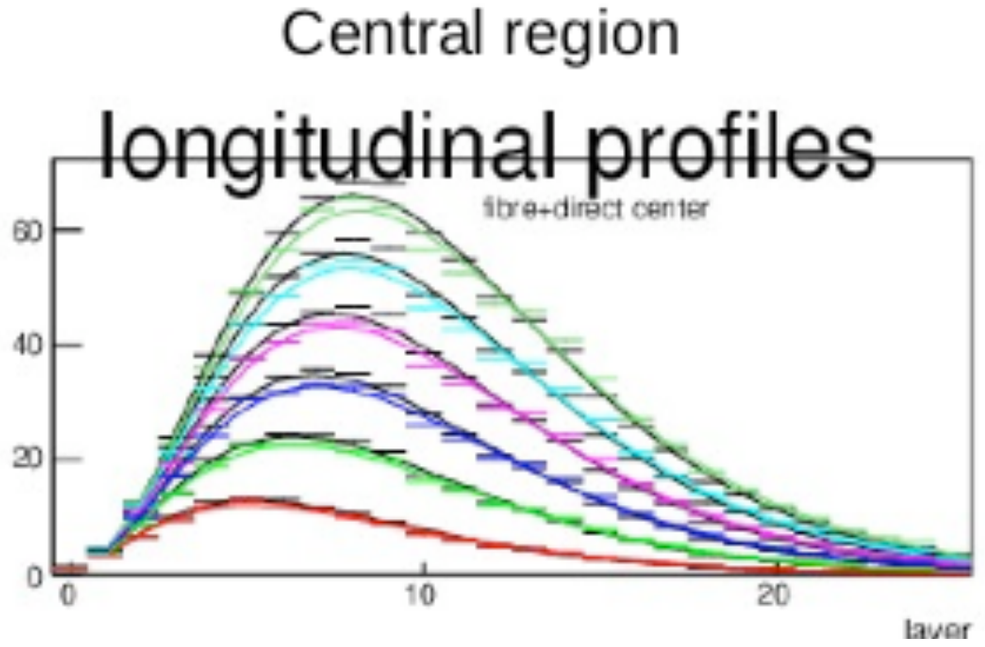
simulation (cont.)



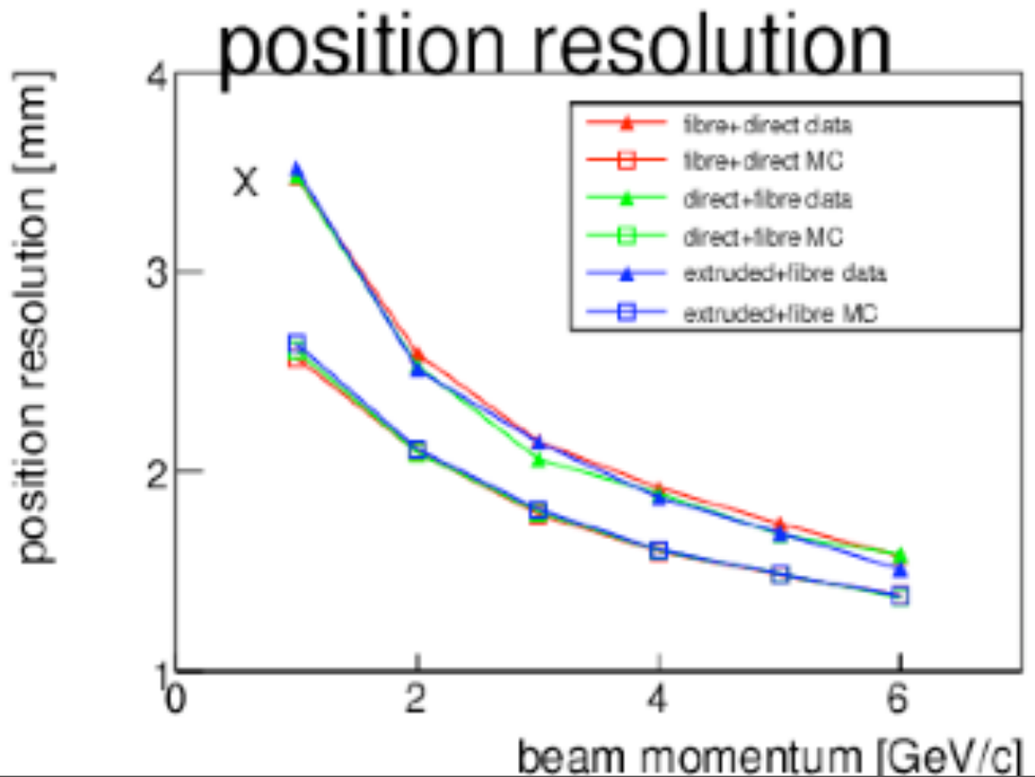
closed: data

open:MC

fibre+direct



X



calice08-TT

scecal FNAL BT

- x4 bigger ECAL than DESY : prototype
- 18cm x 18cm x 30 layers (2160ch)
- extruded scintillators w/o TiO2 shield
  - precise positioning of MPPC
- monitoring system
- moved mid August
- started DAQ

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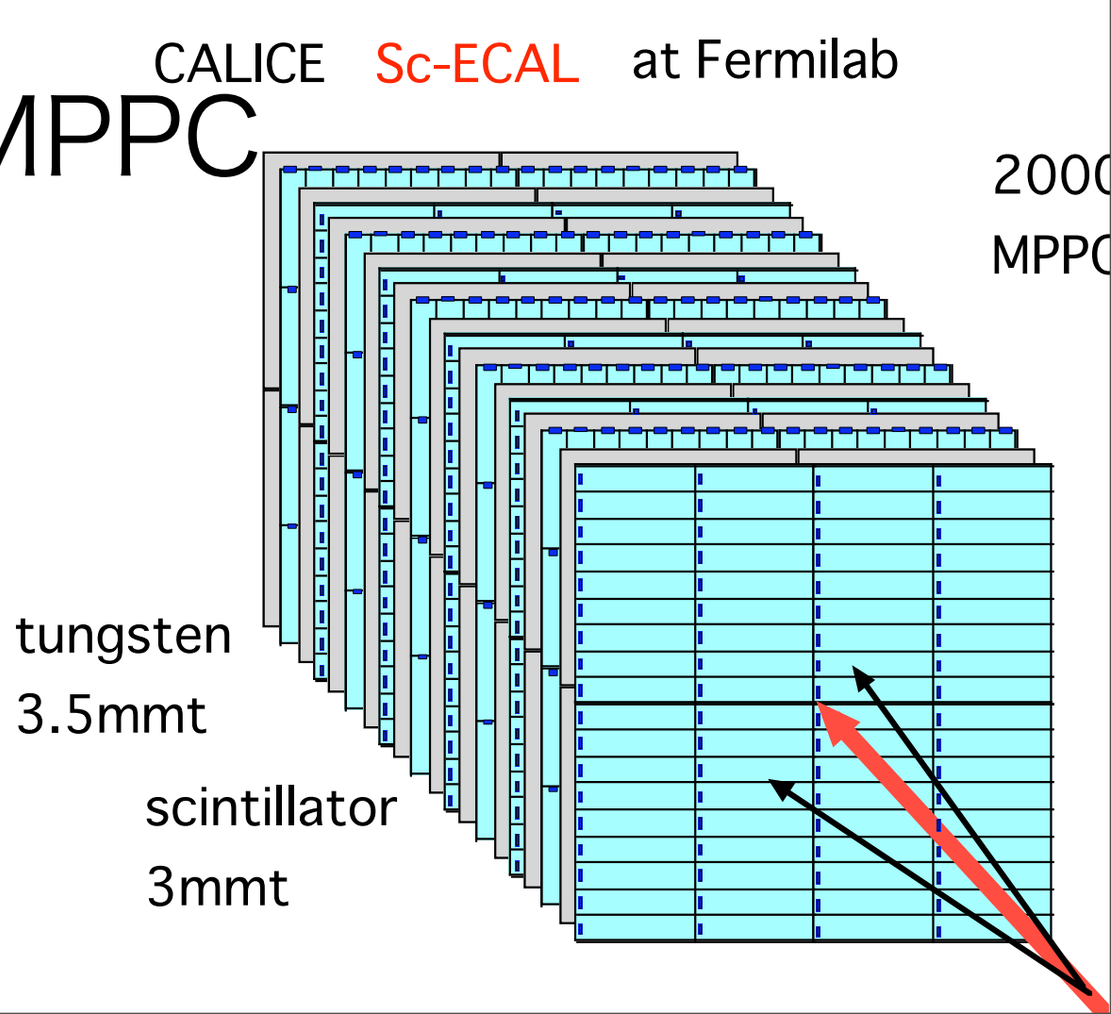
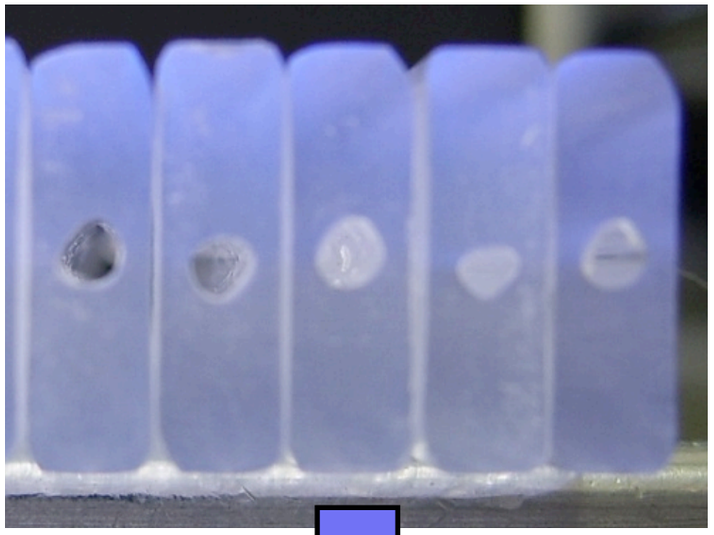
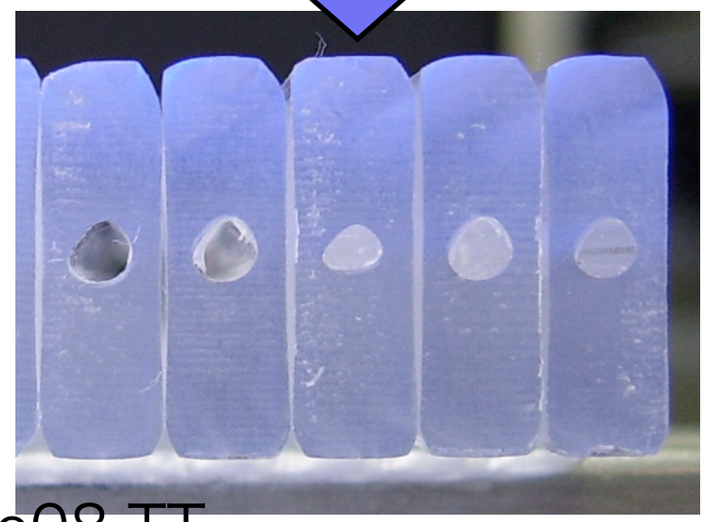


extruded scintillator

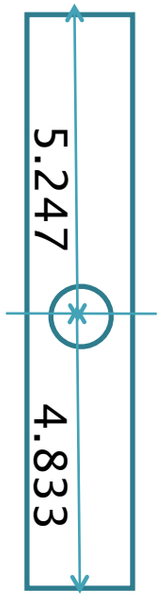
hole size and location > precise positioning

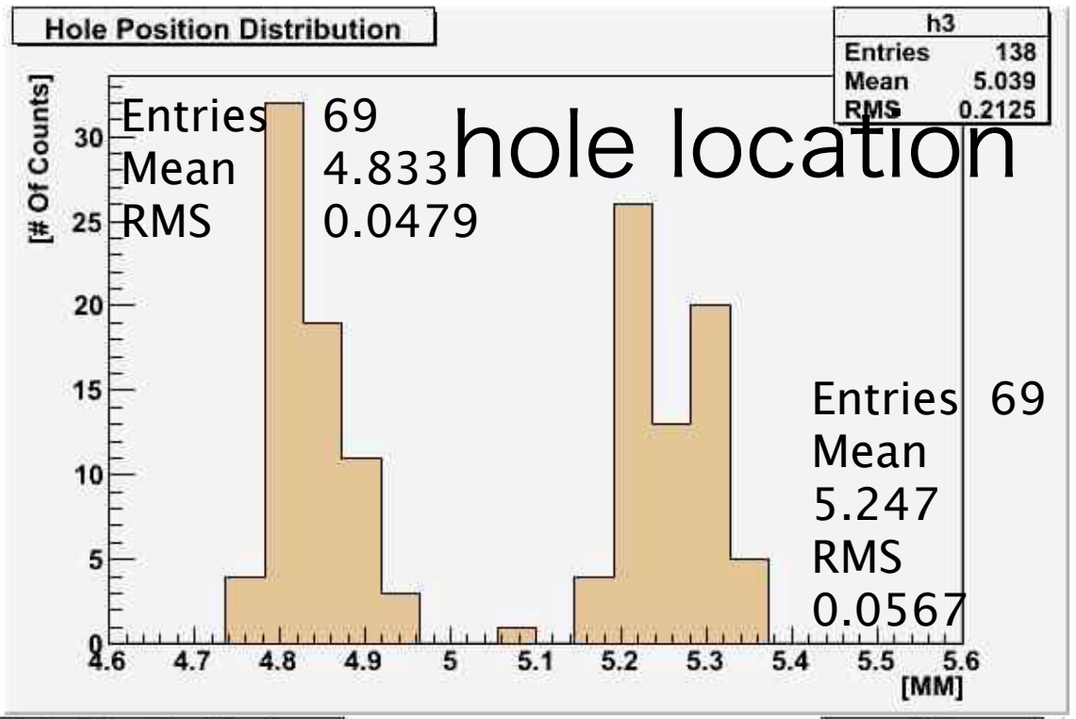
by selection

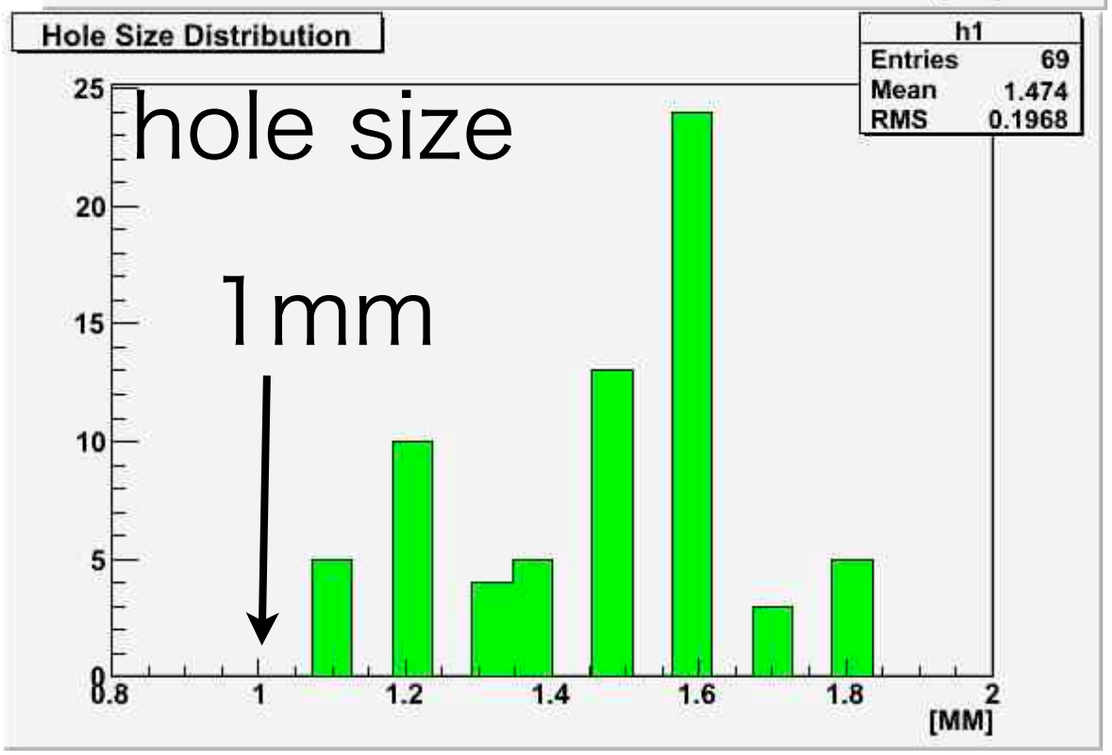




flip

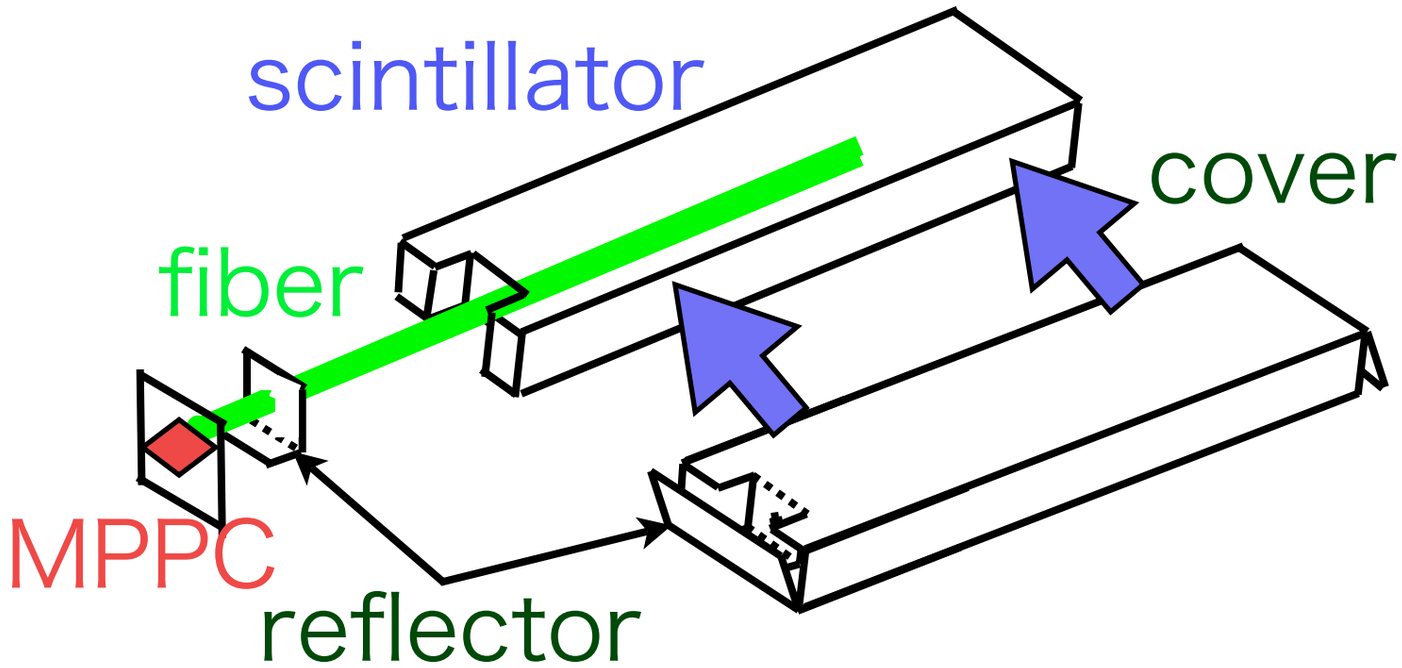


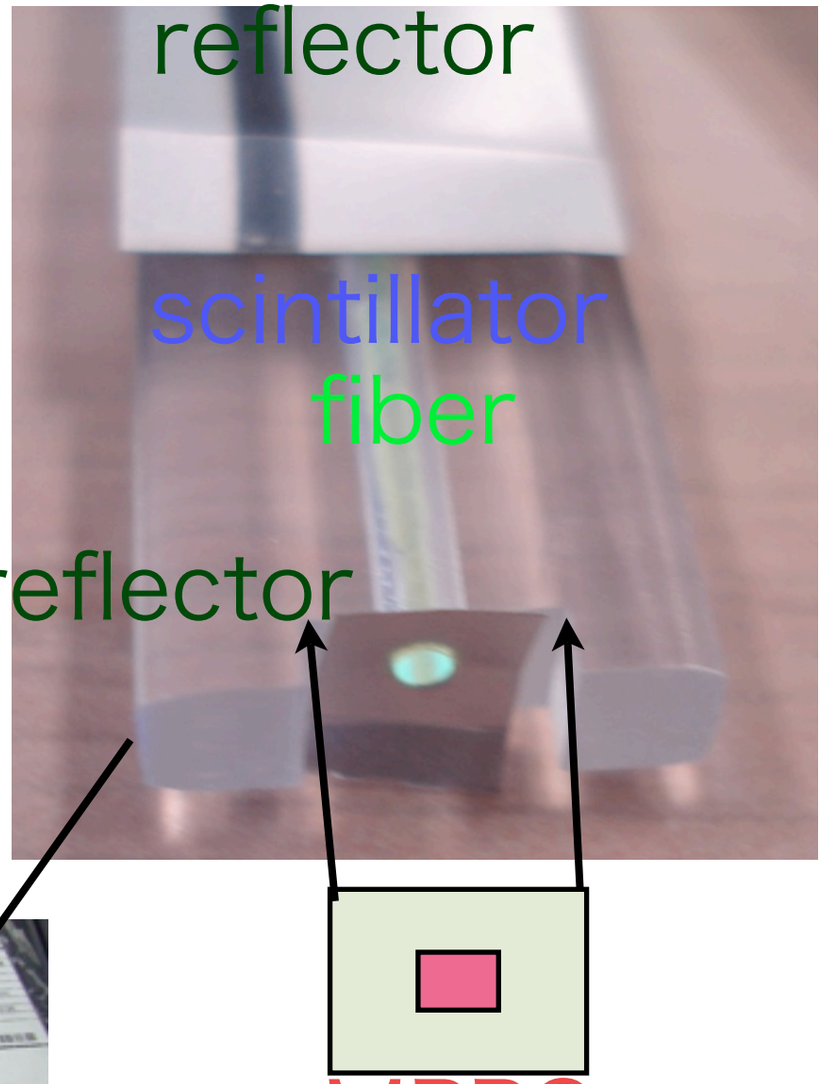




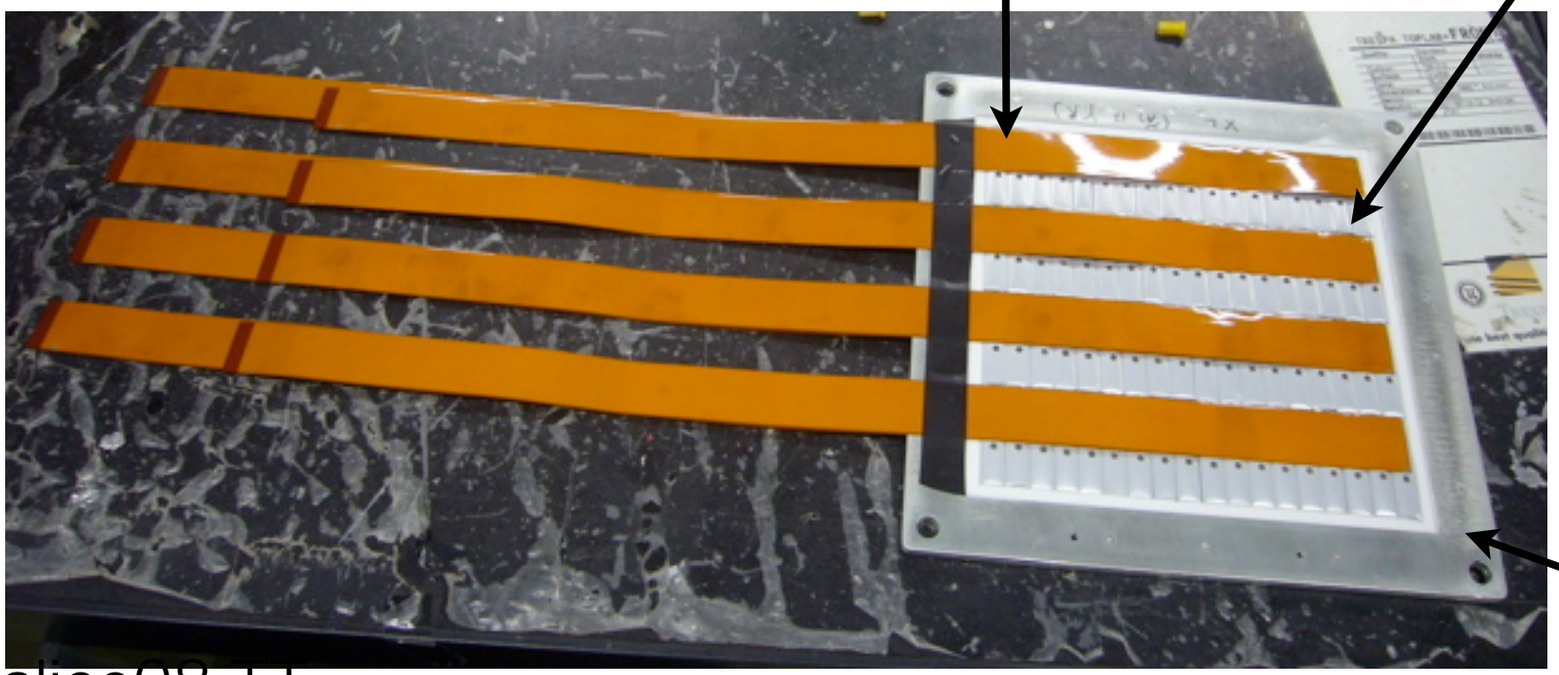
calice08-TT

construction of scecal



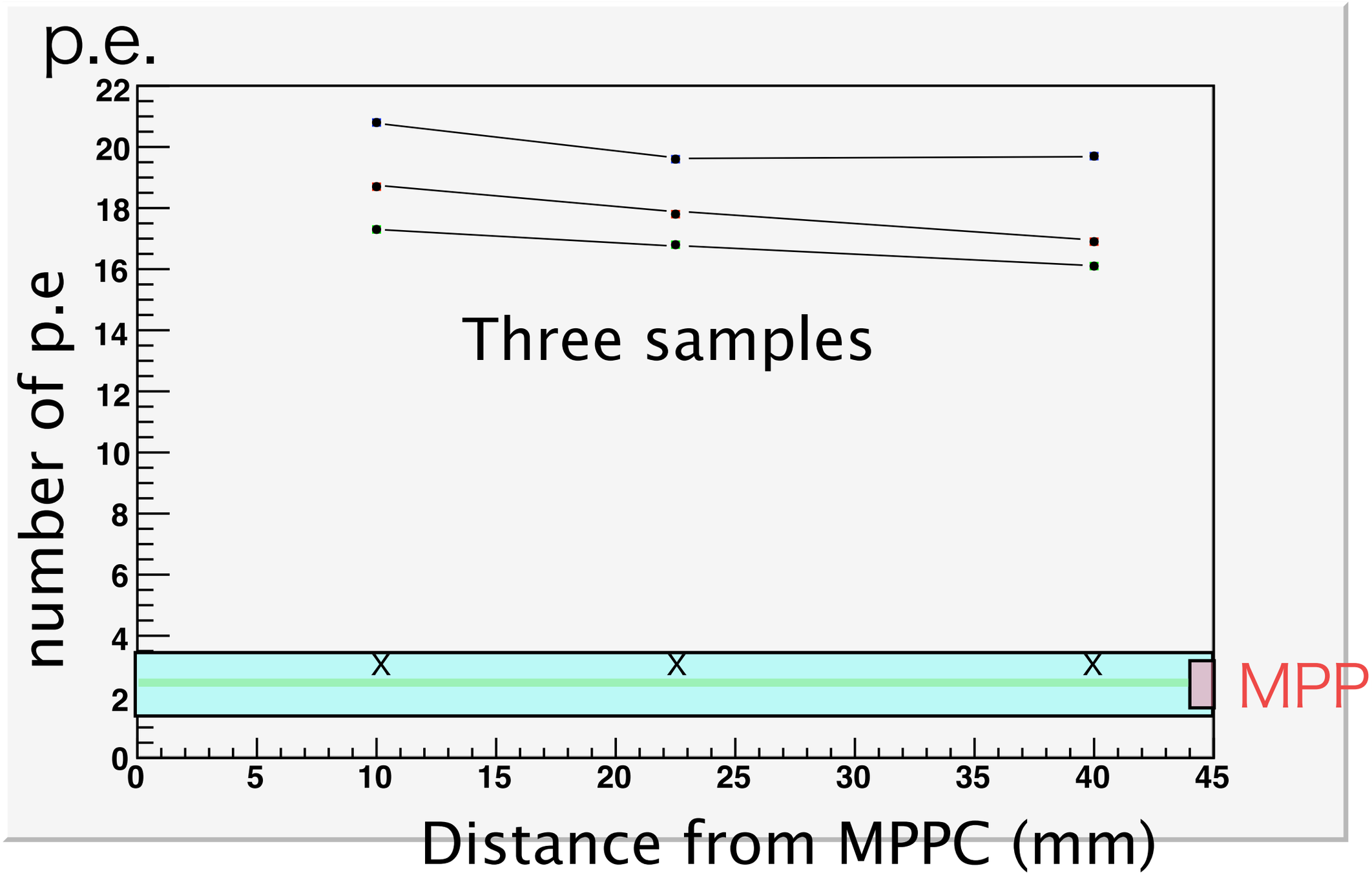


read out flat cable



pre-test results

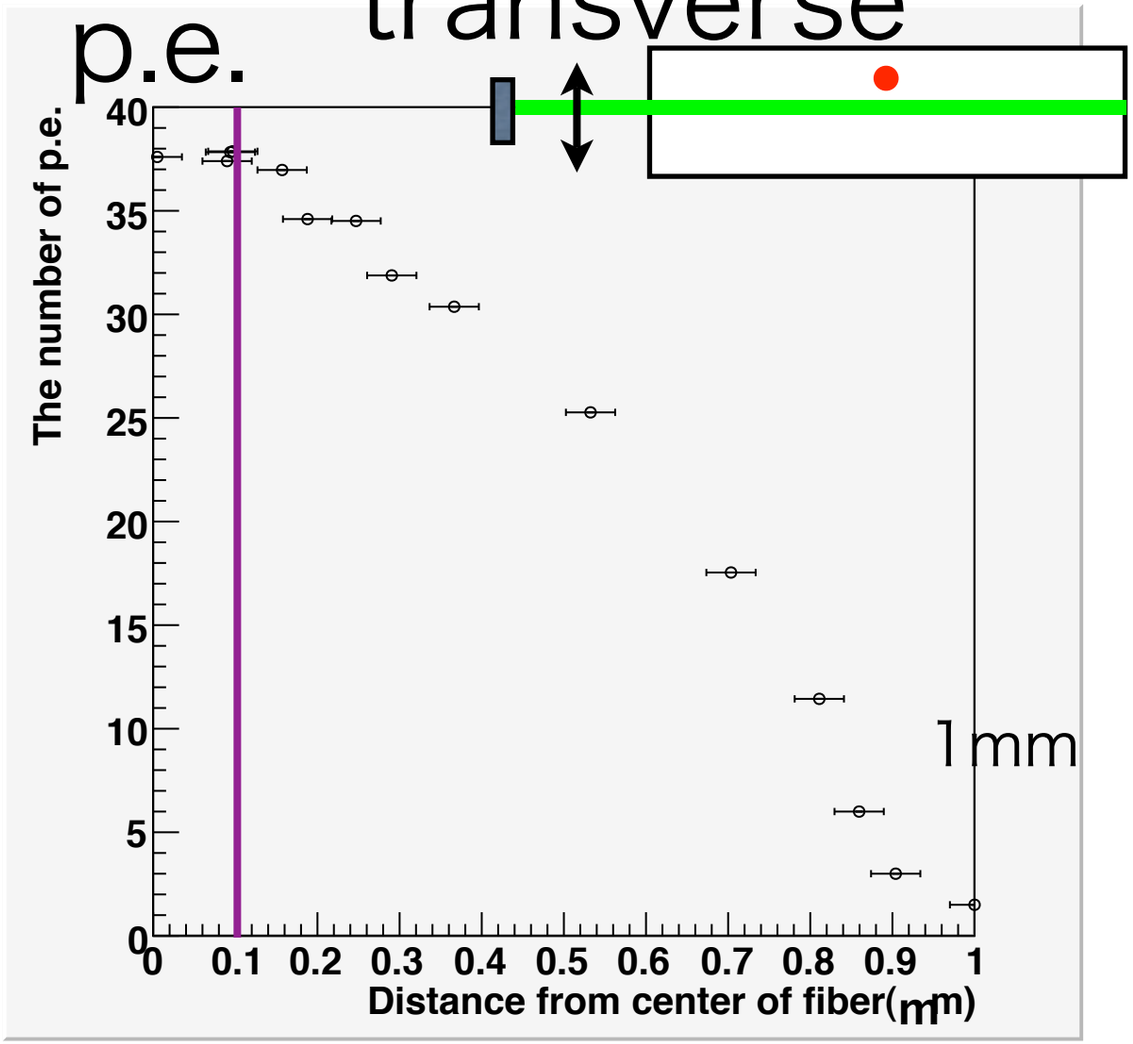
- light output by source



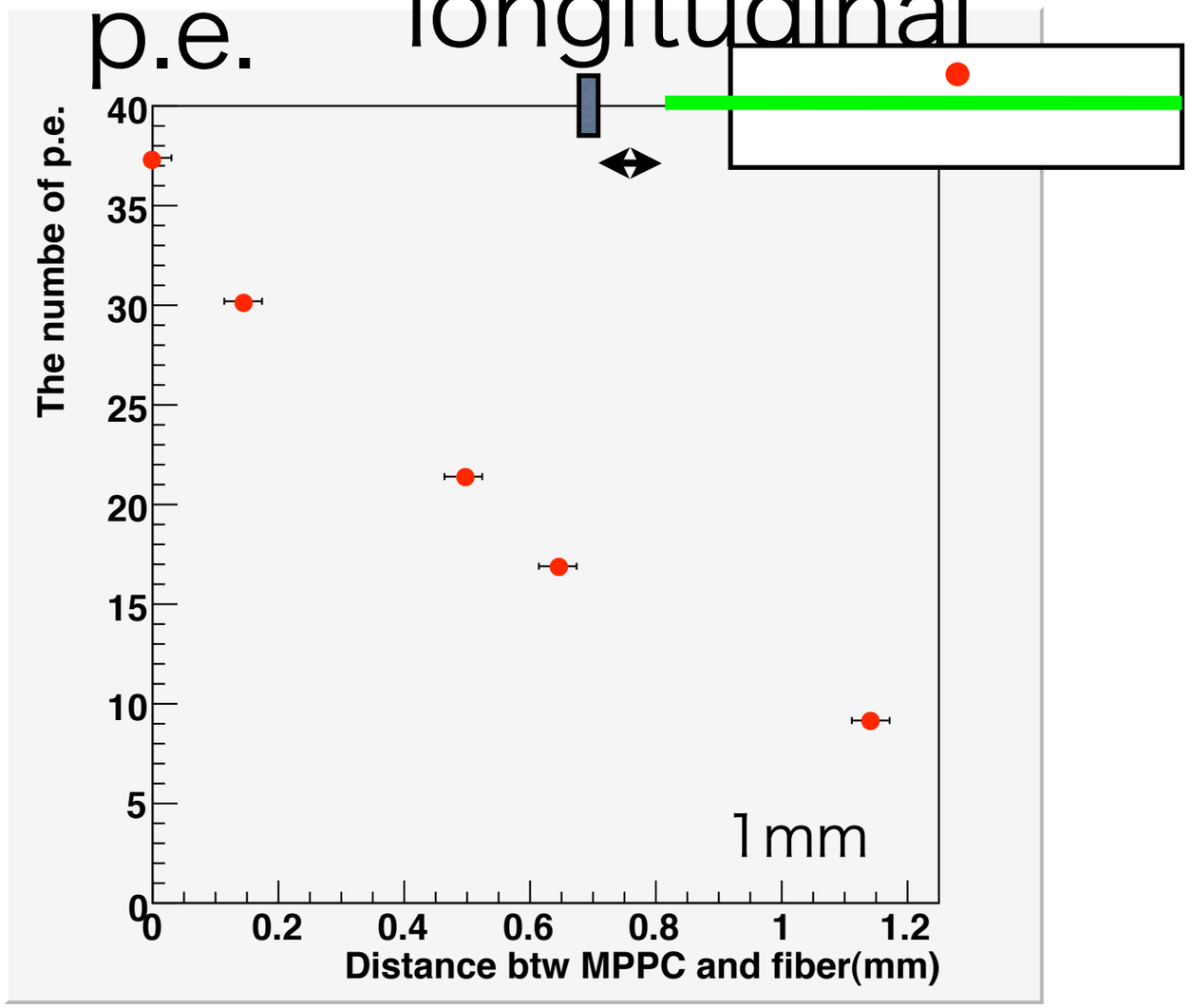
relative position

- MPPC and fibre
- required precision : within 0.1mm
- in transverse / longitudinal direction

transverse

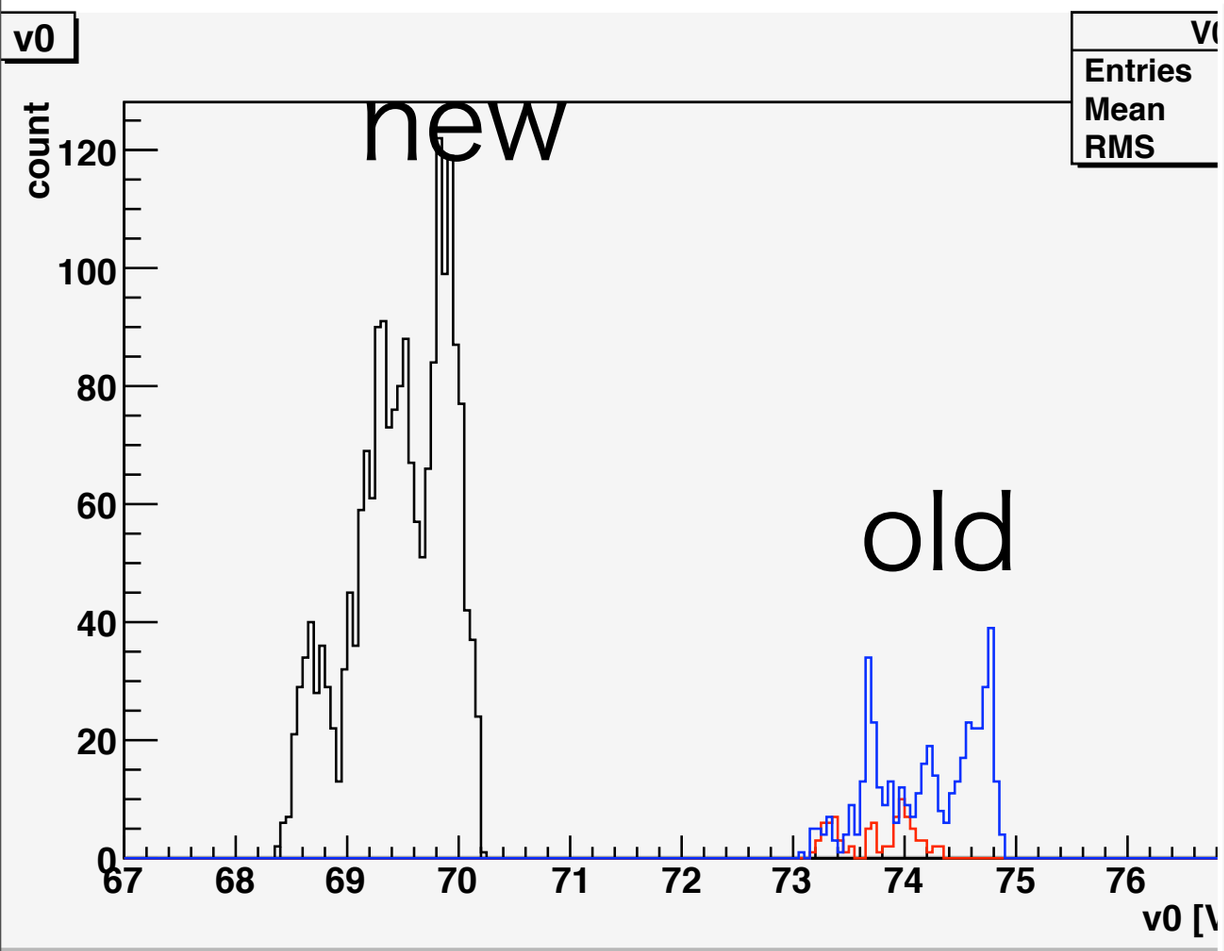


longitudinal

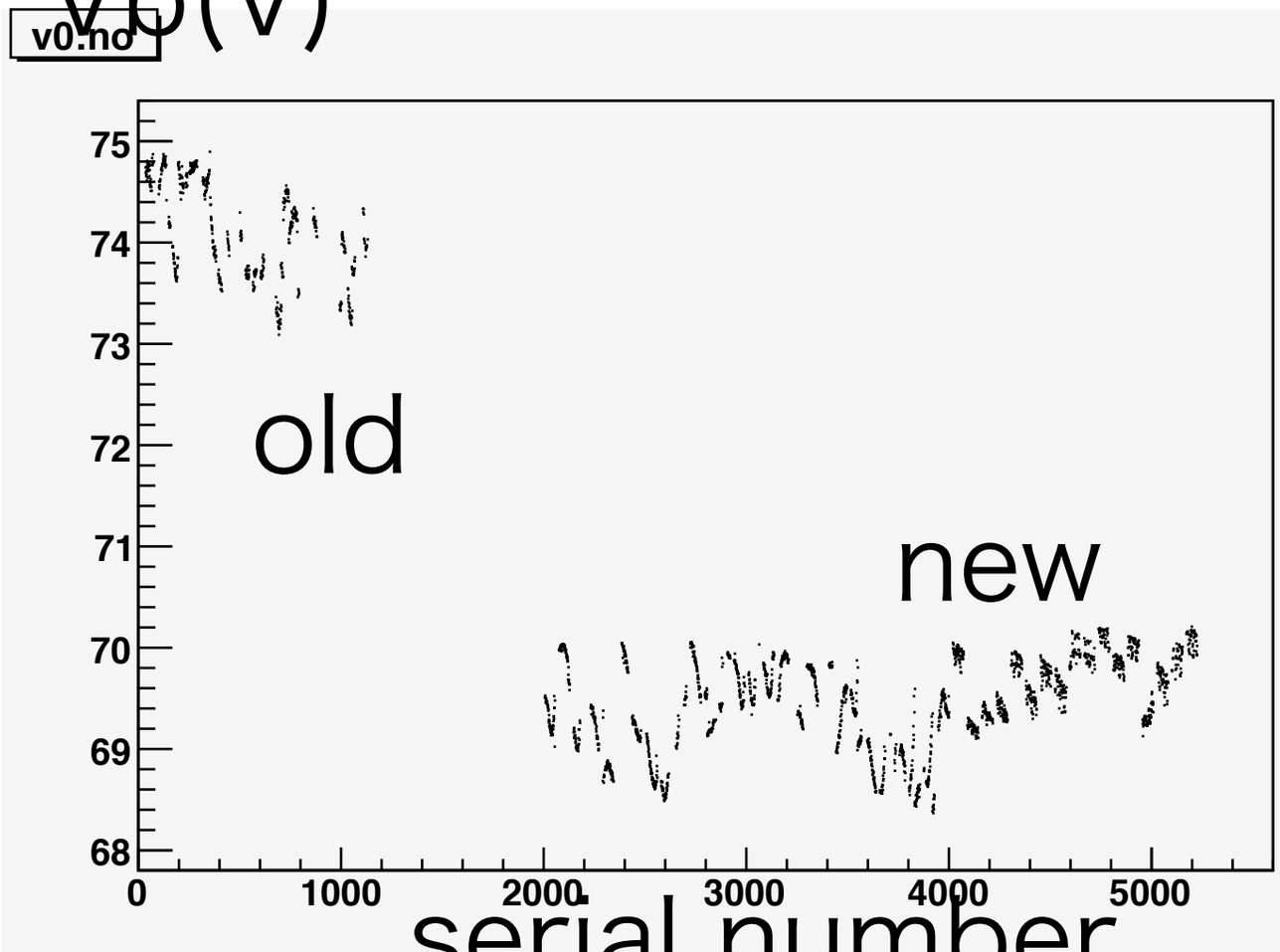


MPPC

- 2000 MPPC new : May 2008
- 160 old : Dec 2006
- tested , they all Ok for the detector



Vbreakdown (V)



Vb(V)

serial number

some are missing

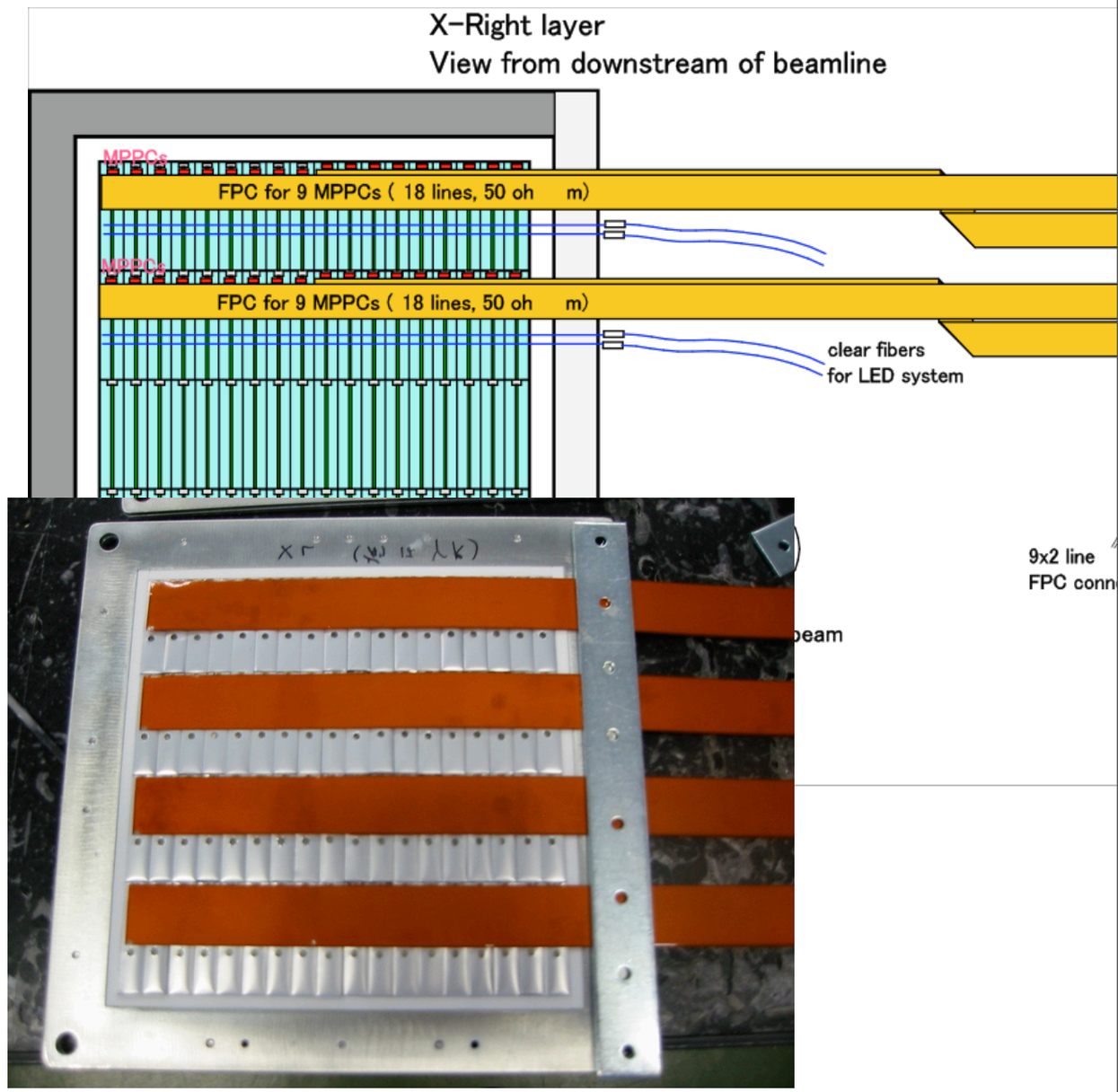
by Hamamatsu

prototype scecal

- structure

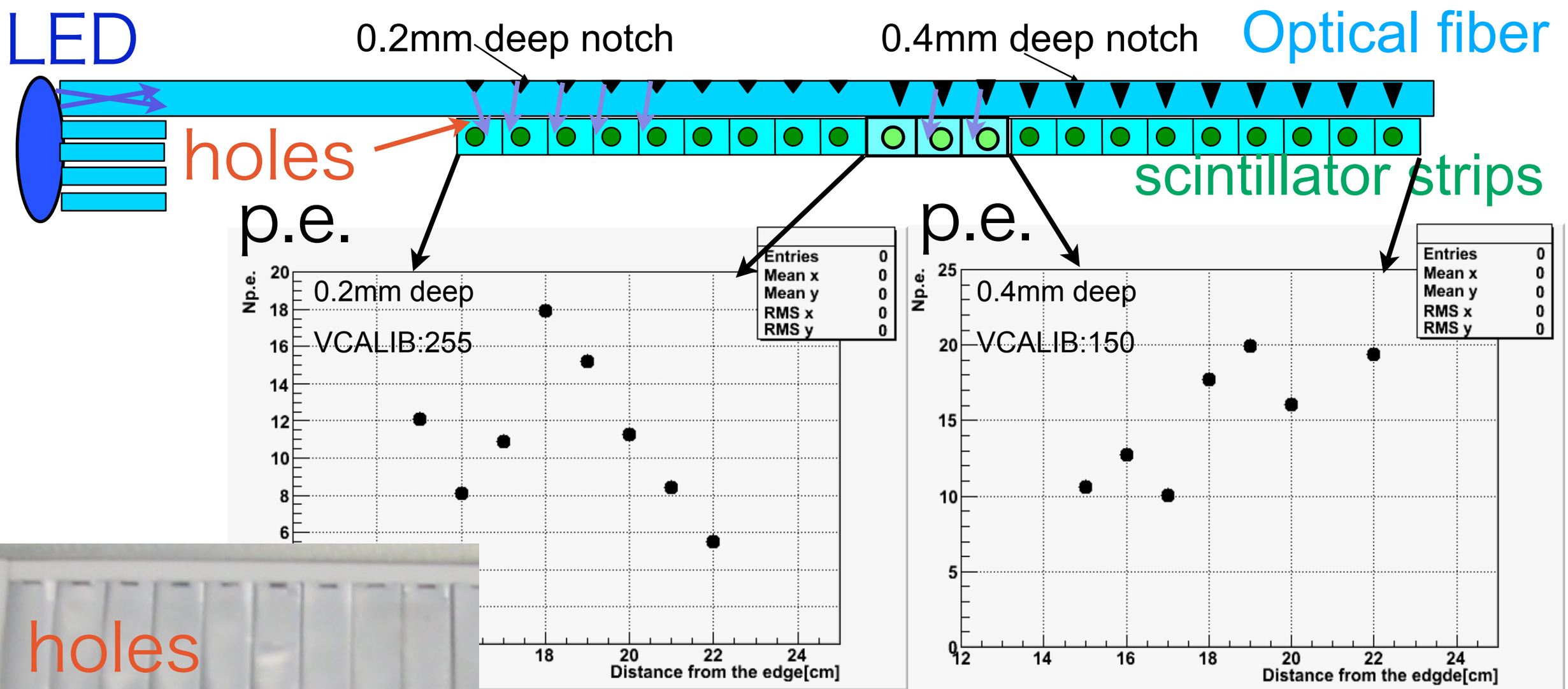
W 3.5mm scint. 3mm

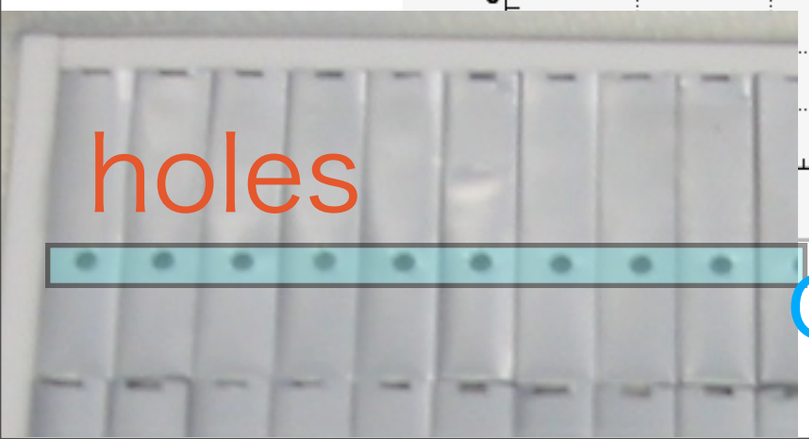
18 x 4 lows



monitoring system

light injection through clear fiber with notches

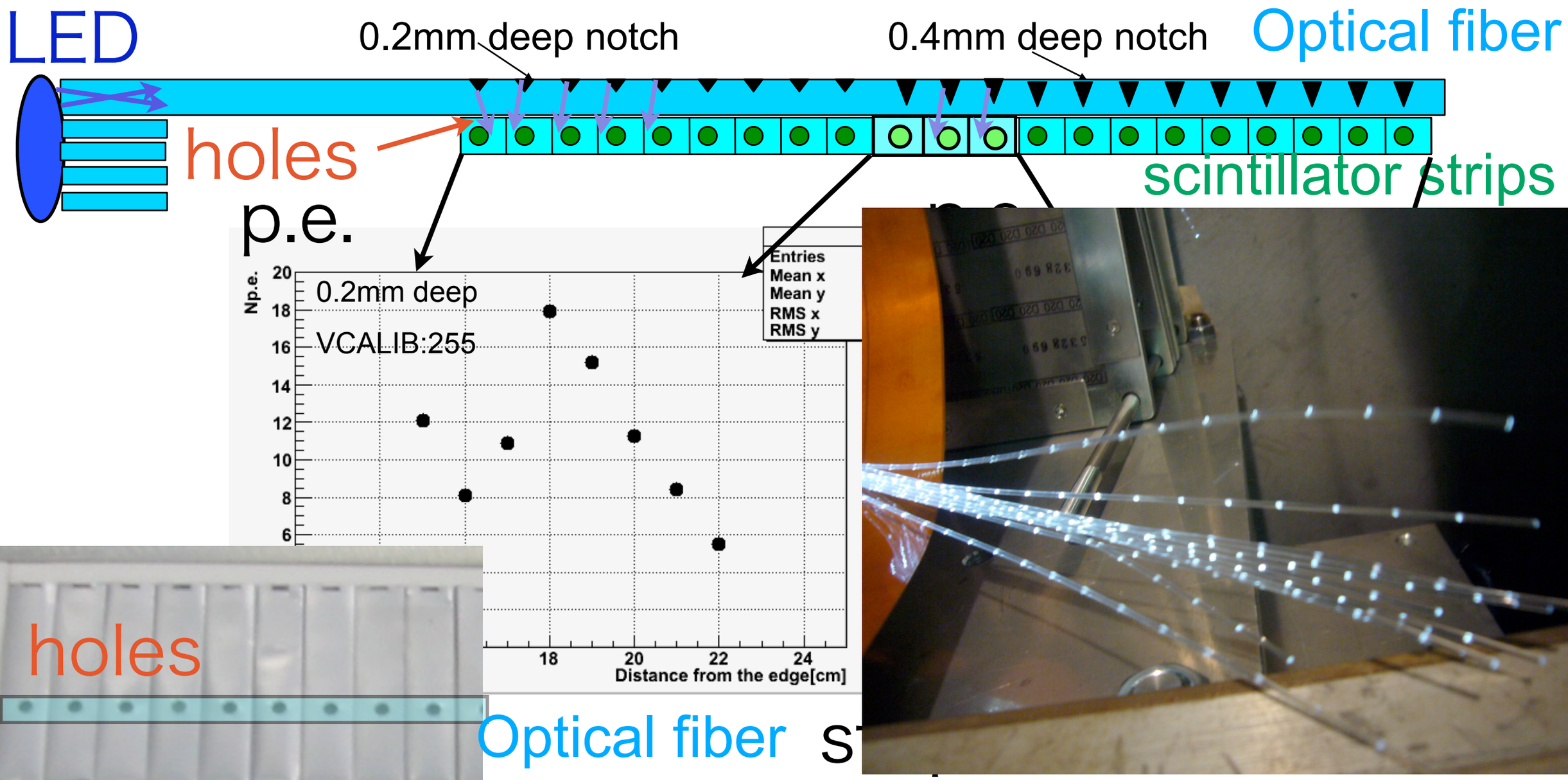




Optical fiber strip #

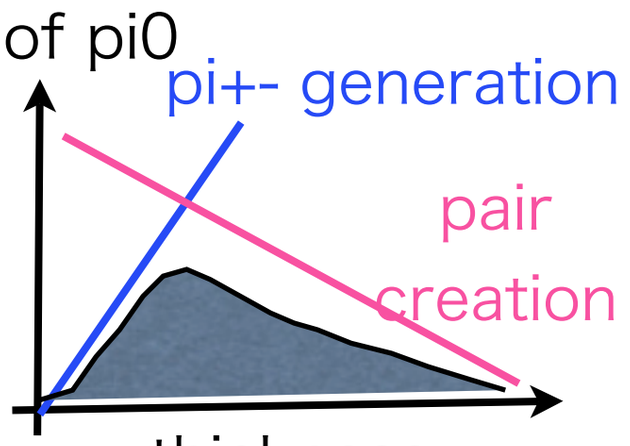
monitoring system

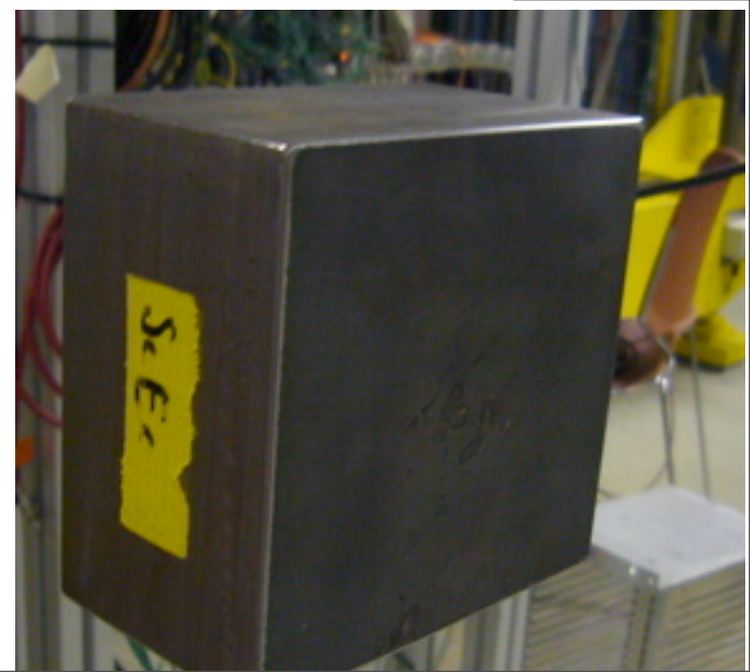
light injection through clear fiber with notches



FNAL BT purpose

- test at High energy : MPPC saturation effect
- verify monitoring system
- pi-zero reconstruction
  - put an Iron target of 6cm
  - eff~ 0.1% of triggers at high E π+ by MC
-





FNAL BT purpose

- test at High energy : MPPC saturation effect
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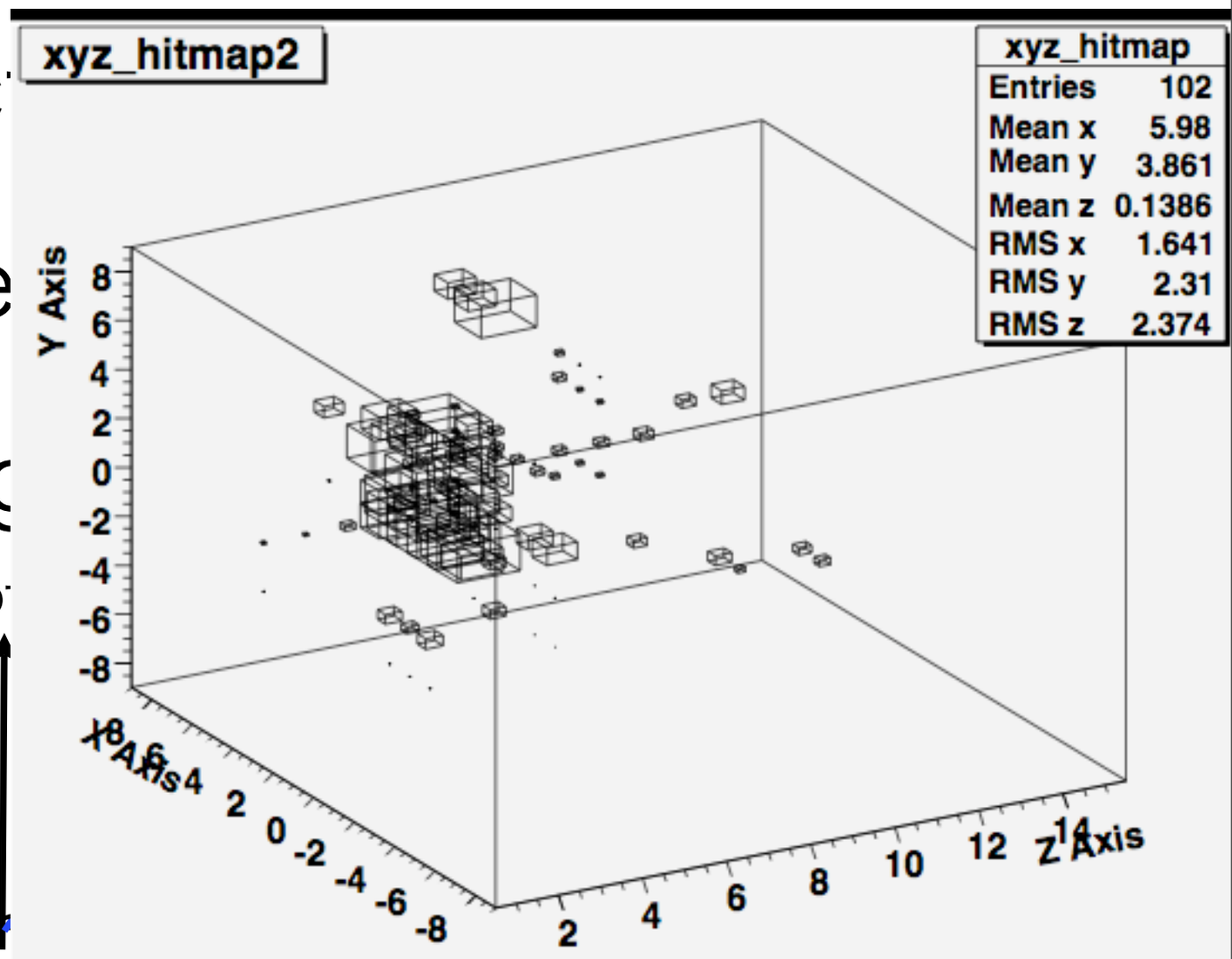
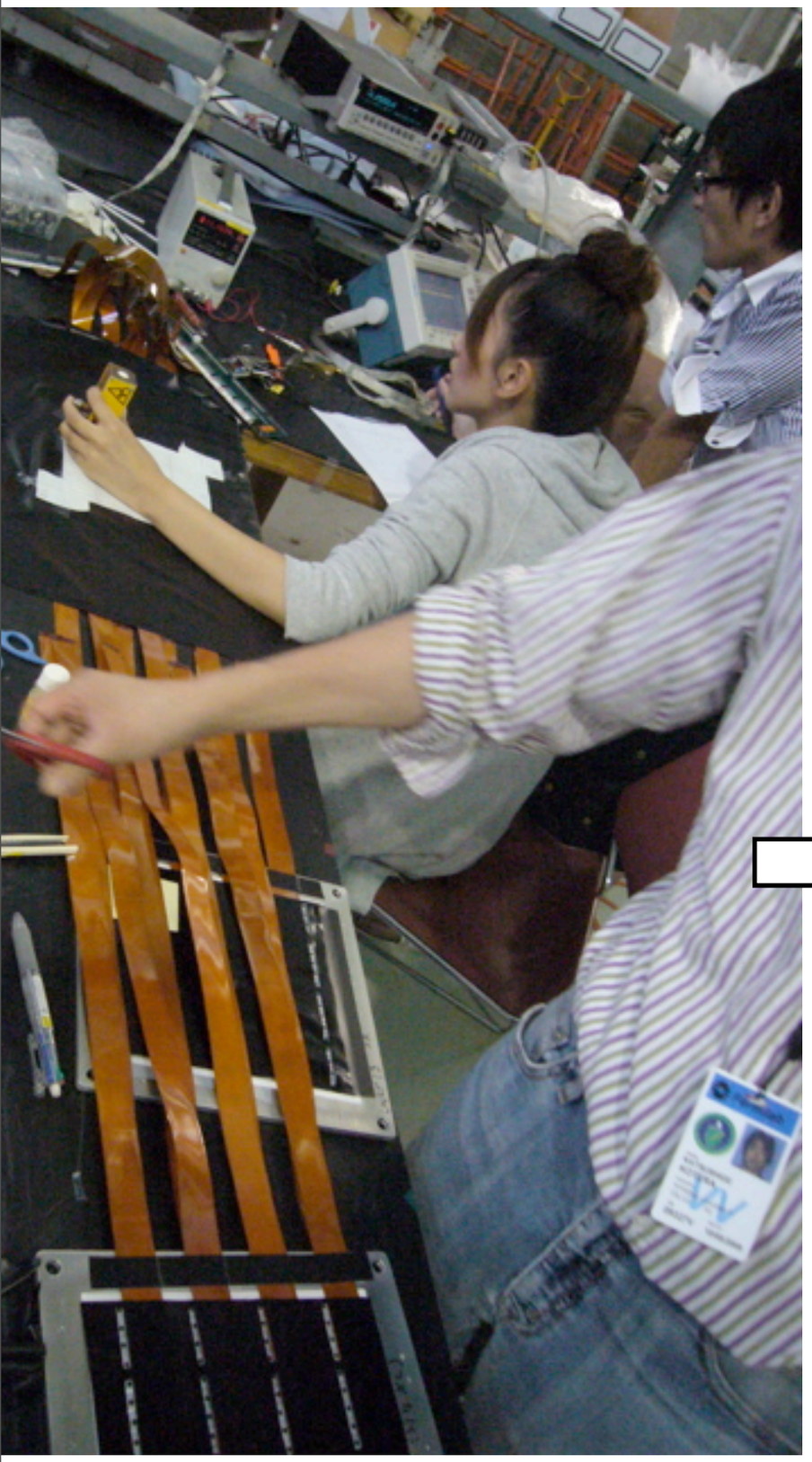
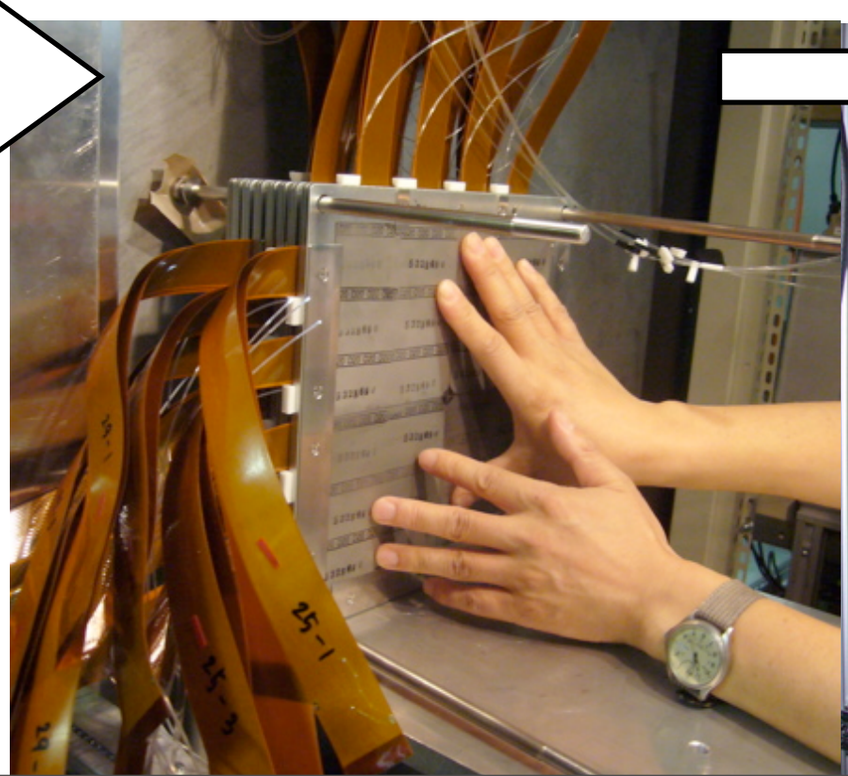
  - put an Iron targe
  - eff~ 0.1% of trigg
    E π+ by MC
-

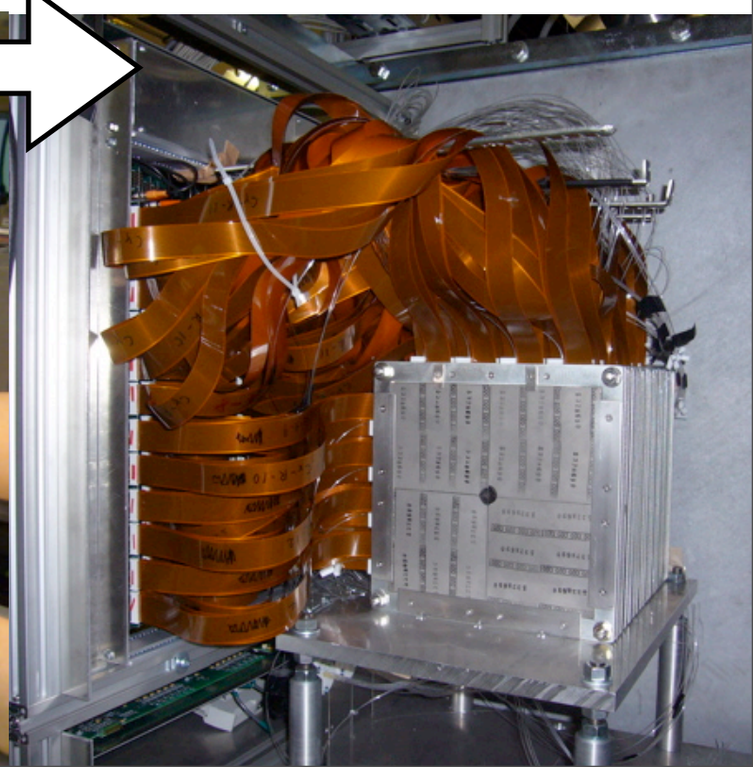


at FNAL



- construction
- test
- assembly

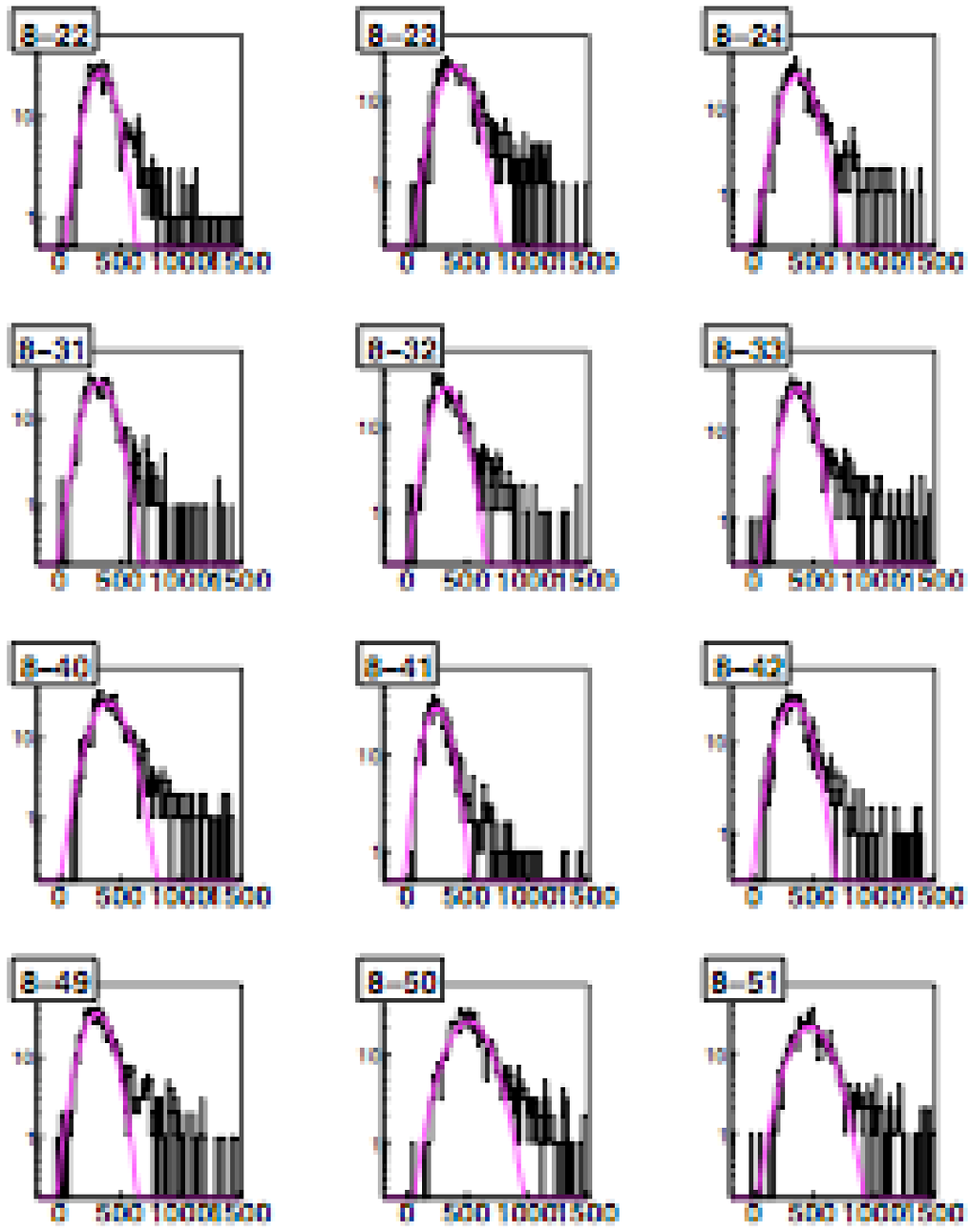




at FNAL (cont.)

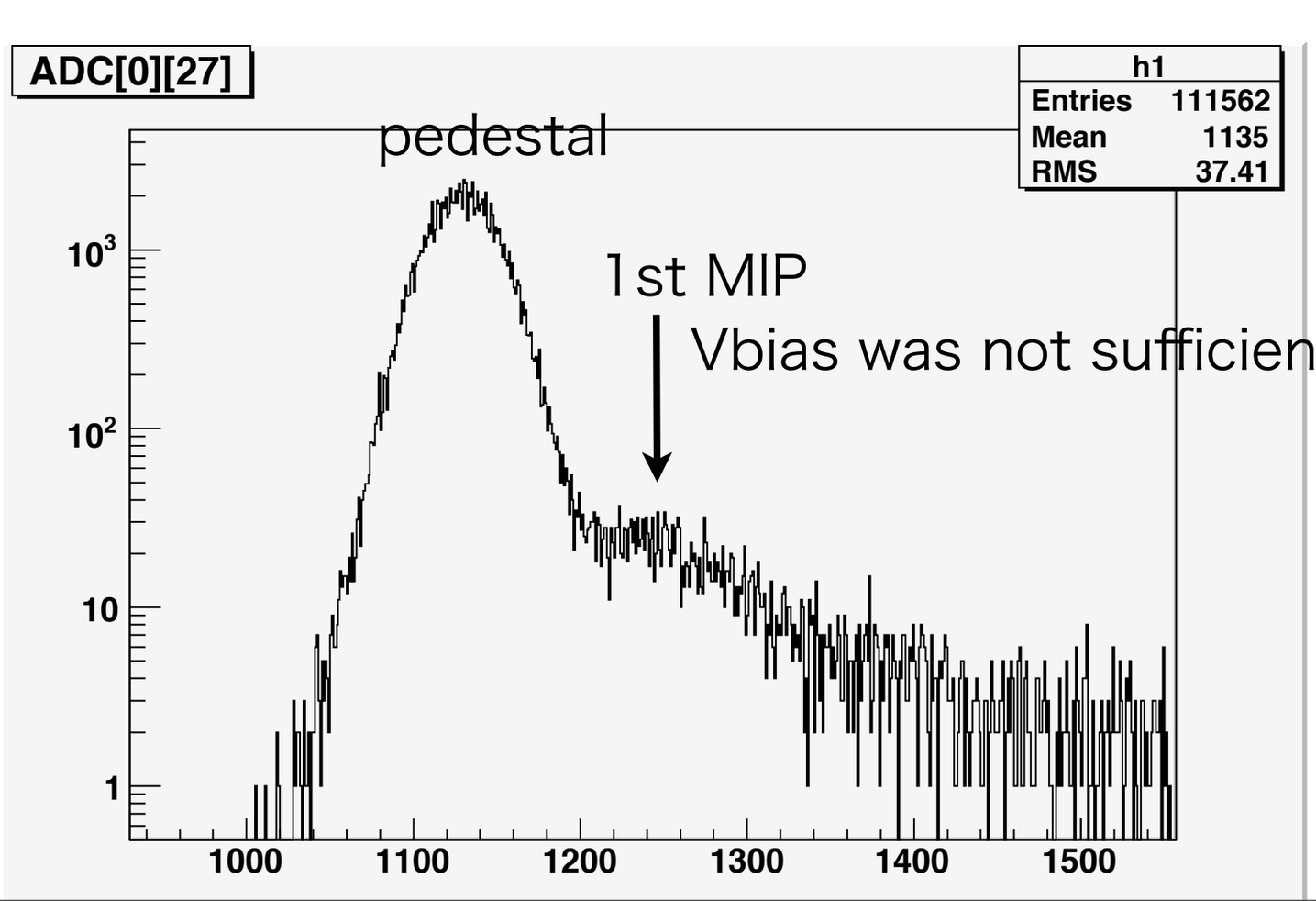
- pedestals
- LED run
- MIP calibration by muon
- electron
- pion / proton

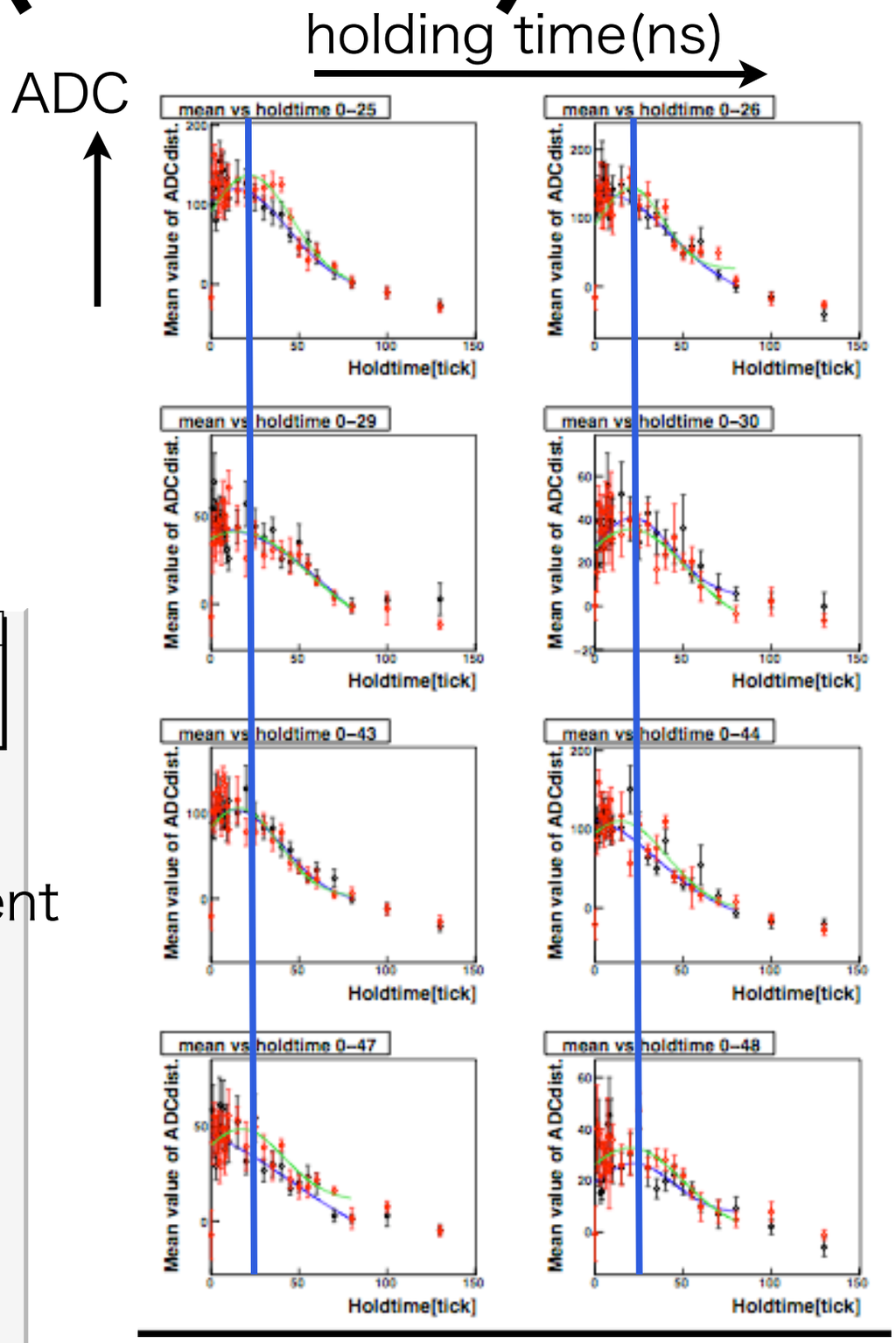
rms~20ch



at FNAL (cont.)

- ADC timing tuning
  - holding time scan
- muon calibration



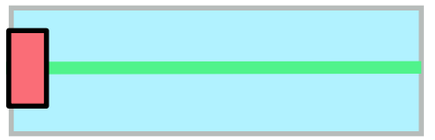


summary

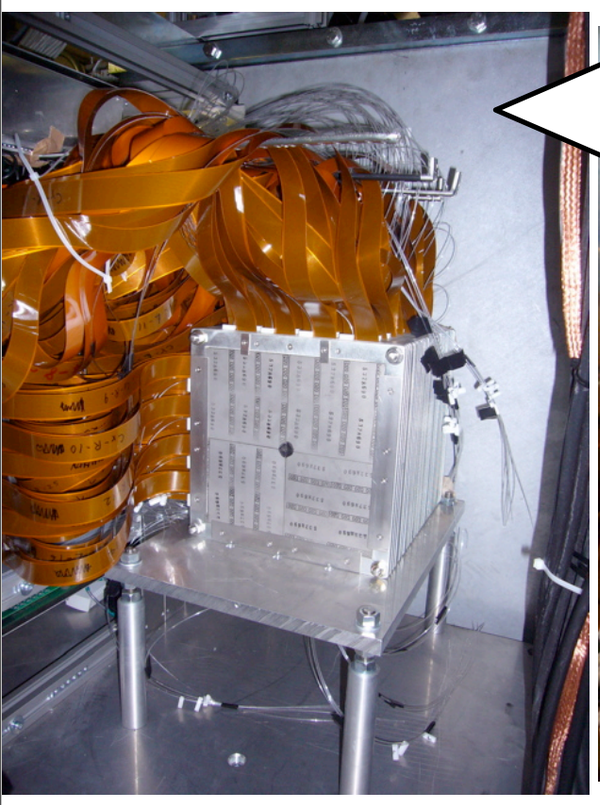
- DESY small prototype understood
  - saturation correction
  - simulation agrees
- FNAL improved prototype
  - extruded scintillator without Ti02
  - LED monitoring system installed
- current status at Fermilab
  - by the end of September

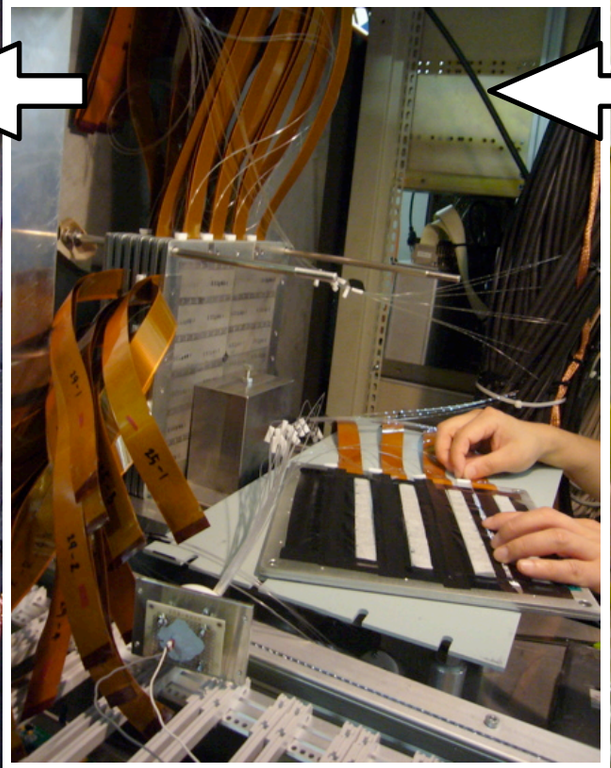
installation at MT6

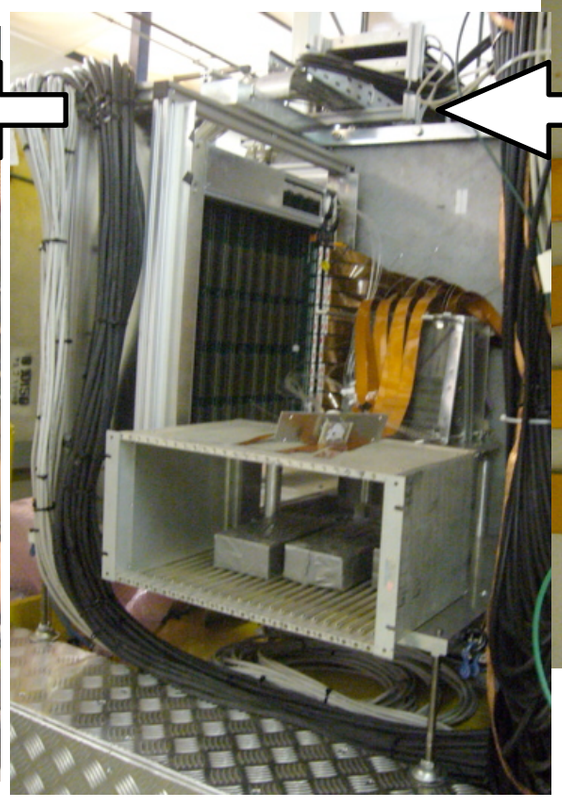
- scecal : 18 x 4 strips / layer
- 30 layers : ~22cm
- 2160 ch MPPC/strip

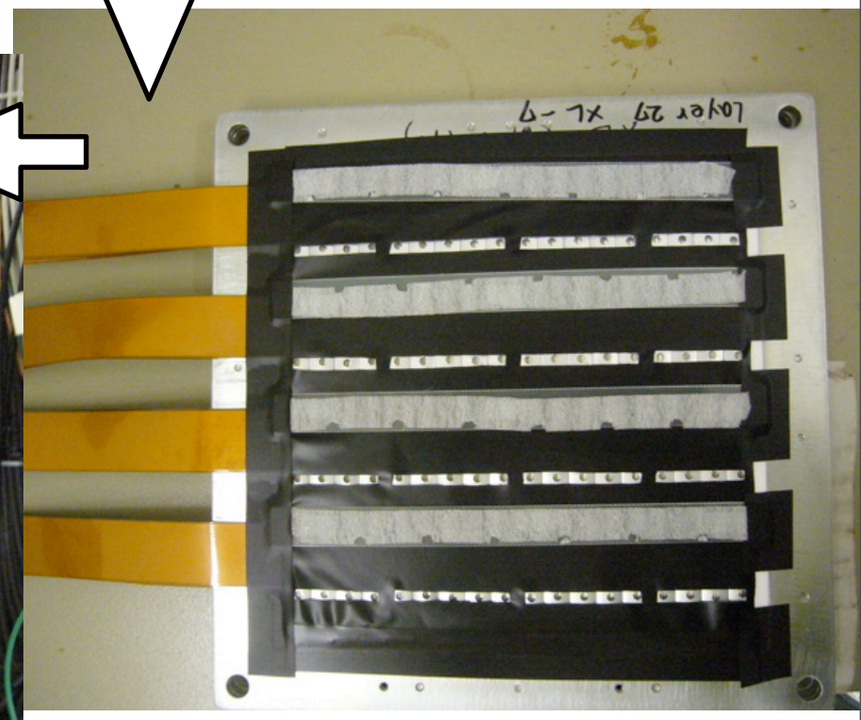


18cm x 18cm





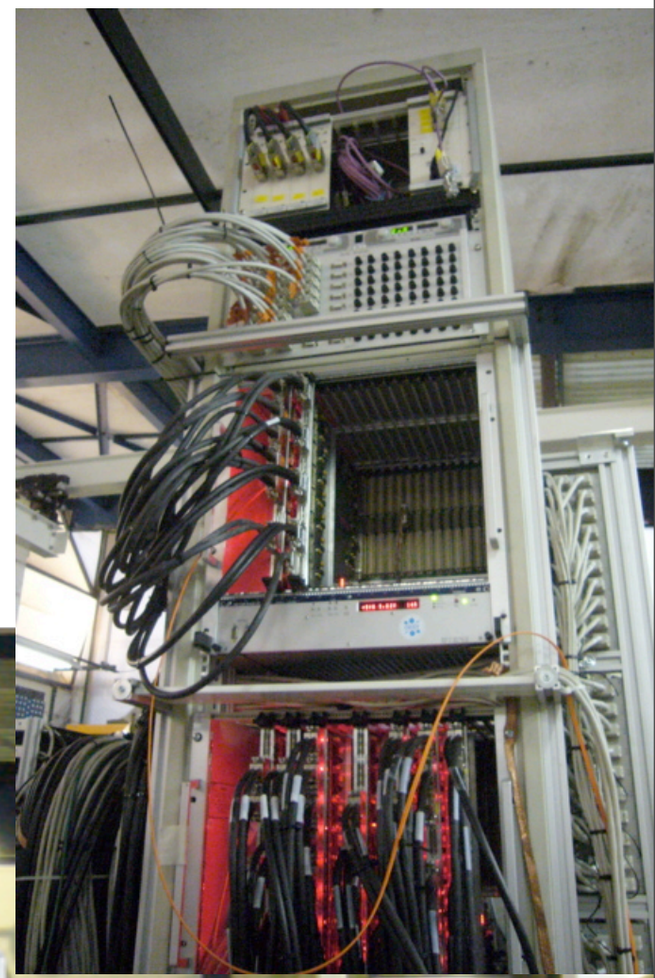




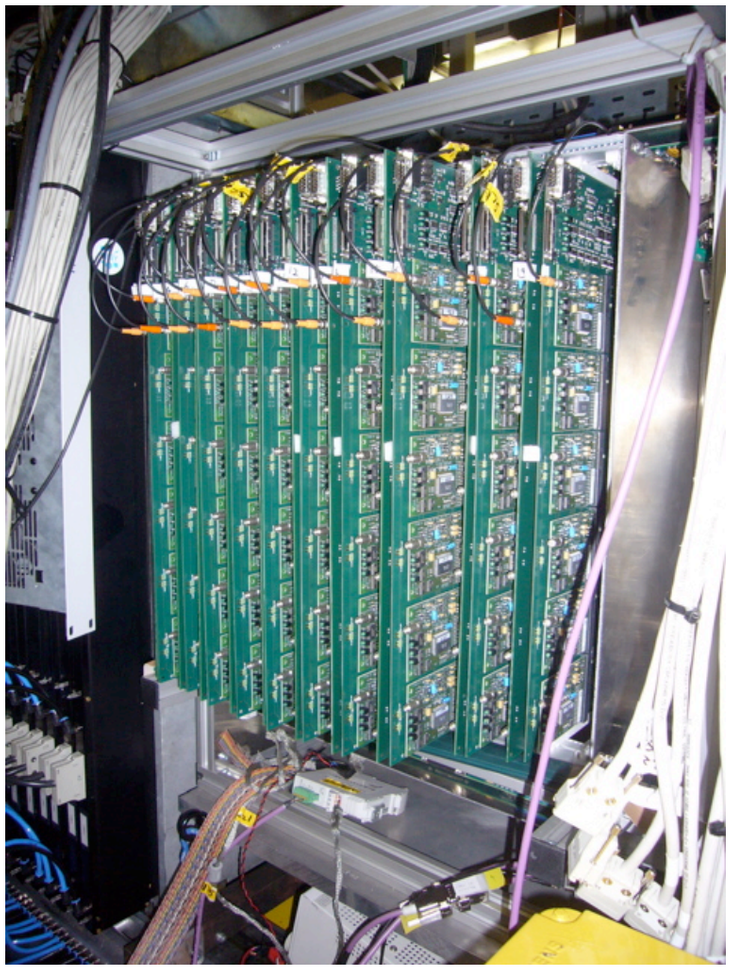
MT6/ Fermilab

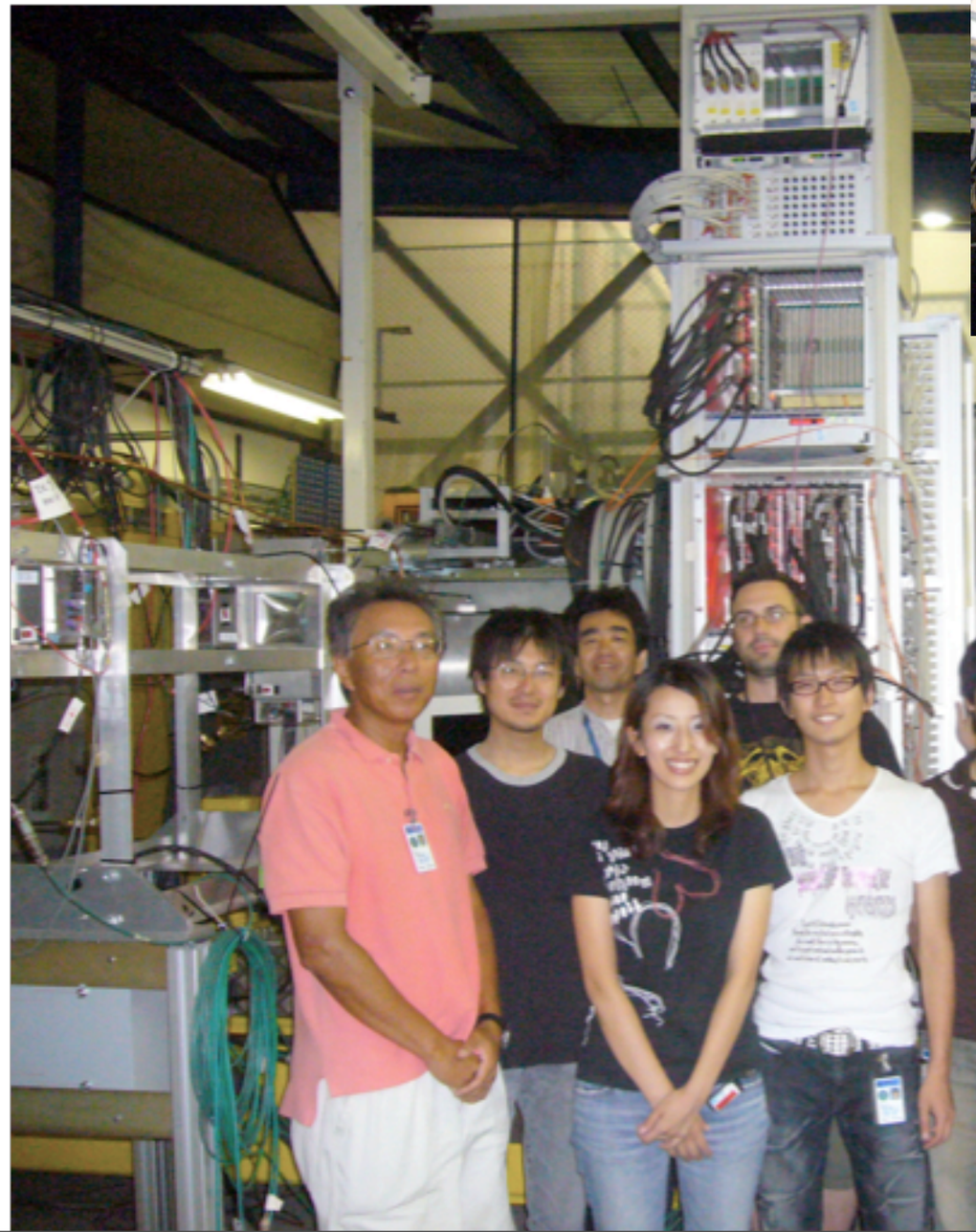
- with electronics

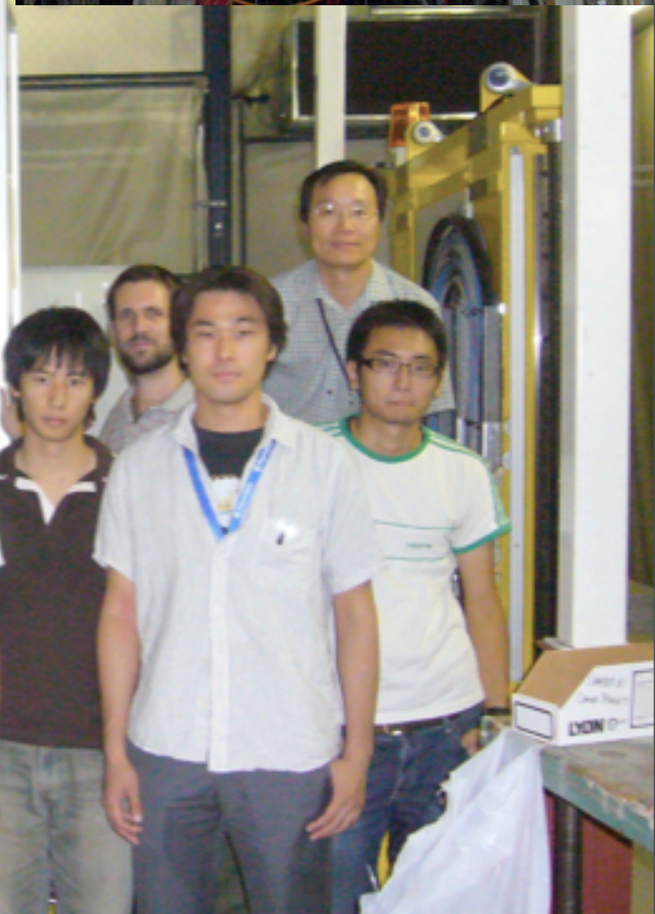
bias and ADC
on top of it



FE (=AHCAL)



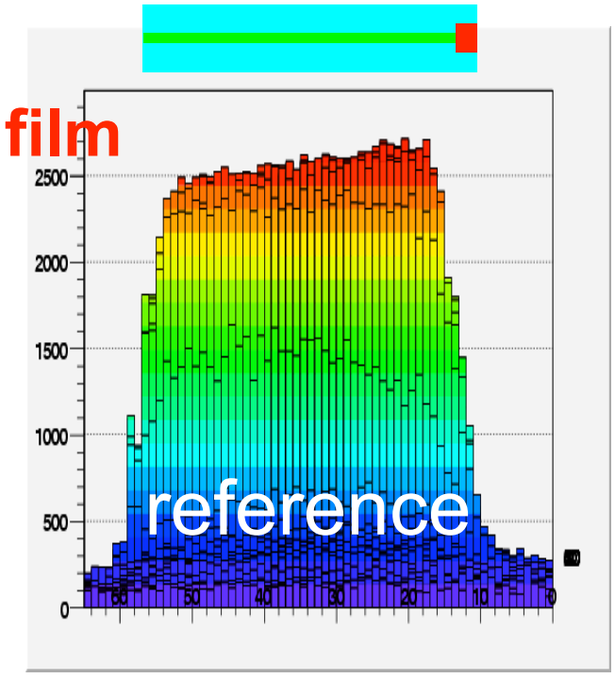




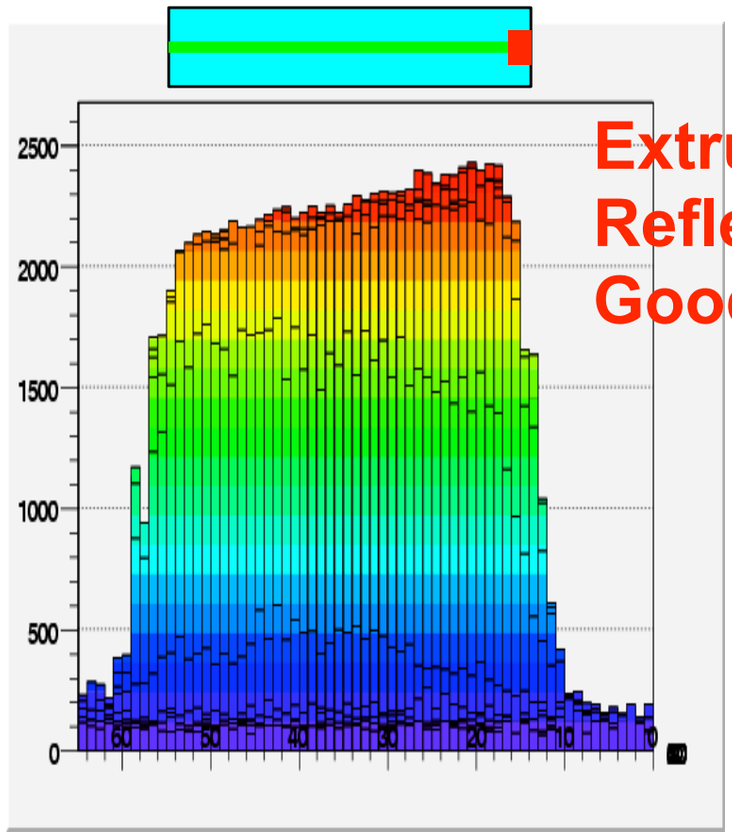
Uniformity

Signal (ADC counts)

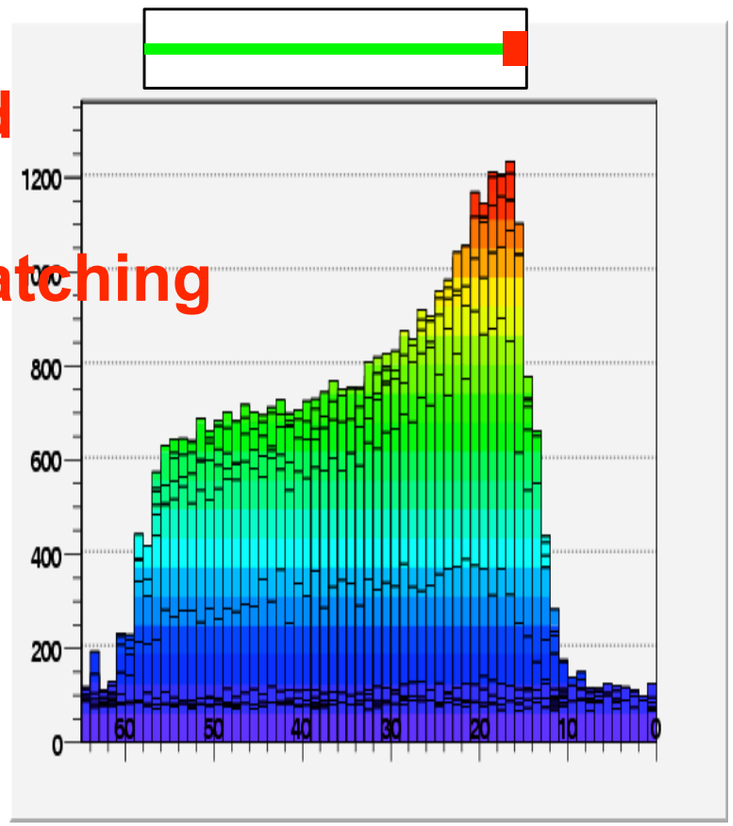
Kuraray Reflector film



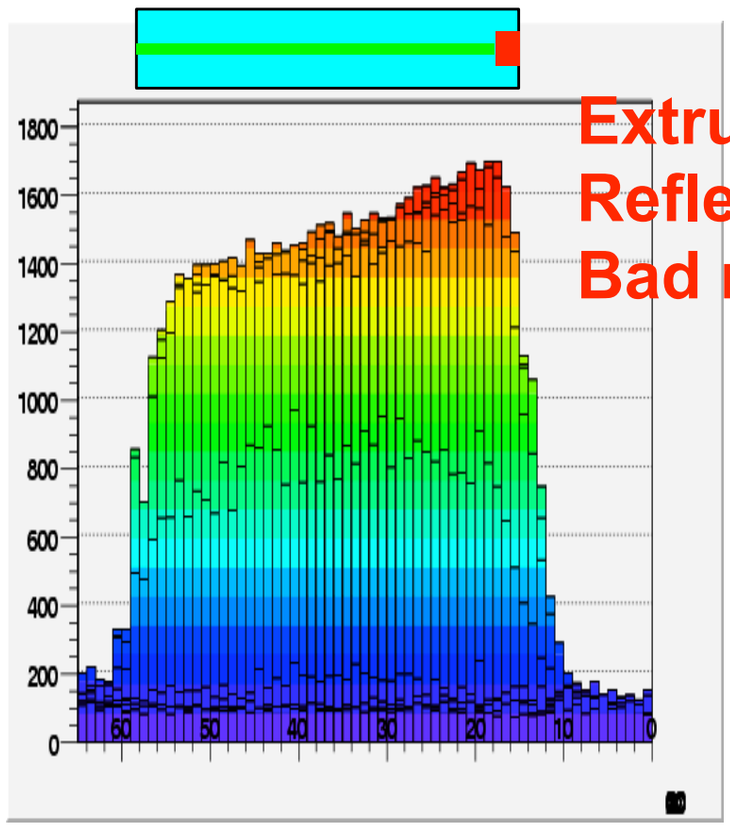
Extruded Reflector film Good matching



Extruded TiO_2 Good matching



Extruded Reflector film Bad matching



calice08-TT

calice08-TT

Beam position (mm)