

# scecal status for scintillator W ECAL DBD

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for CALICE-Asia

DBD : Detailed Baseline Document

scecal status review  
performance results  
understandings by simulation  
open issues

# issues by Felix

Established **performance**: energy resolution, linearity, uniformity, two particle separation

- Validated simulation: **longitudinal and transverse shower profiles**, response, linearity and resolution, for electrons and hadrons
- Operational **experience**: dead channels, noise, stability, monitoring and calibration
- Scalable technology solutions: power and heat reduction, low volume interfaces, data reduction, mechanical structures, dead spaces, services and supplies
- **Open R&D issues**: analysis and R&D to be completed before a first pre/production prototype can be built, cost reduction and industrialization issues

# road to DBD

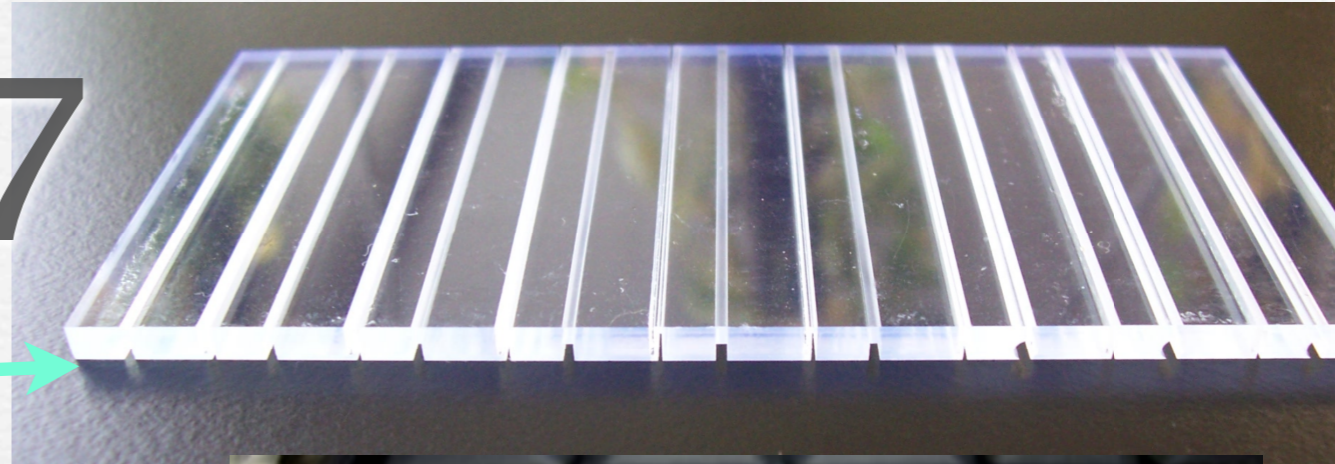
hardware historical summary

we're DBD

	phase I 2007	phase II 2008/9	Technological prototype 2012	ILC 201?
scintillator	molded & machined w WLSF	extruded strip 1cm	0.5cm no fiber	
MPPC	1600pix 1mmx1mm	N=x4	SMD	
electronics	separated SPIROC	N=x4	onboard EBU spiroc2	
calibration		fiber & LED	LED?	

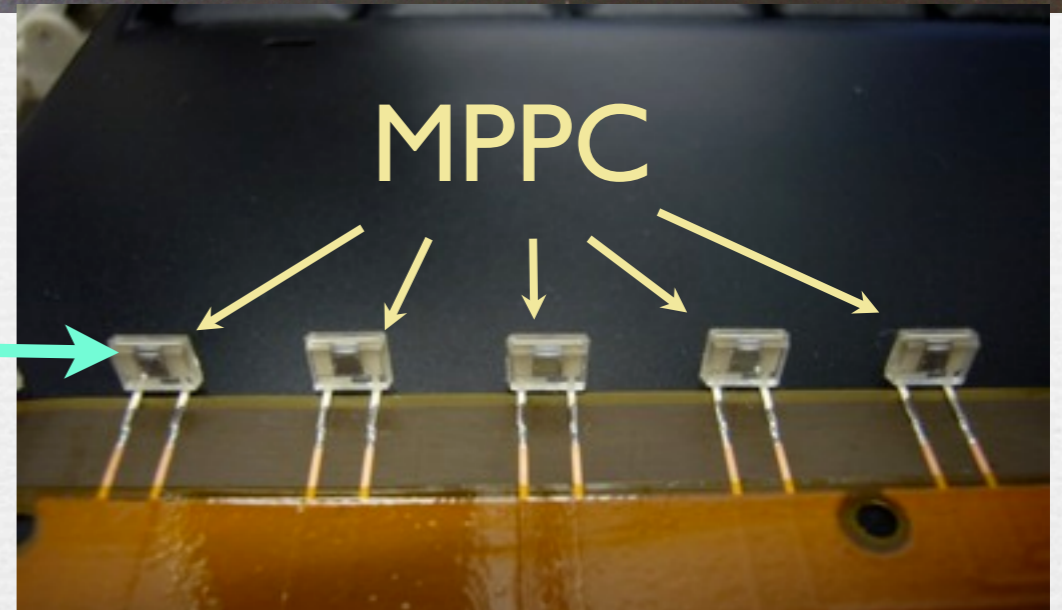
# phase I ~ 2007

- molded scintillator



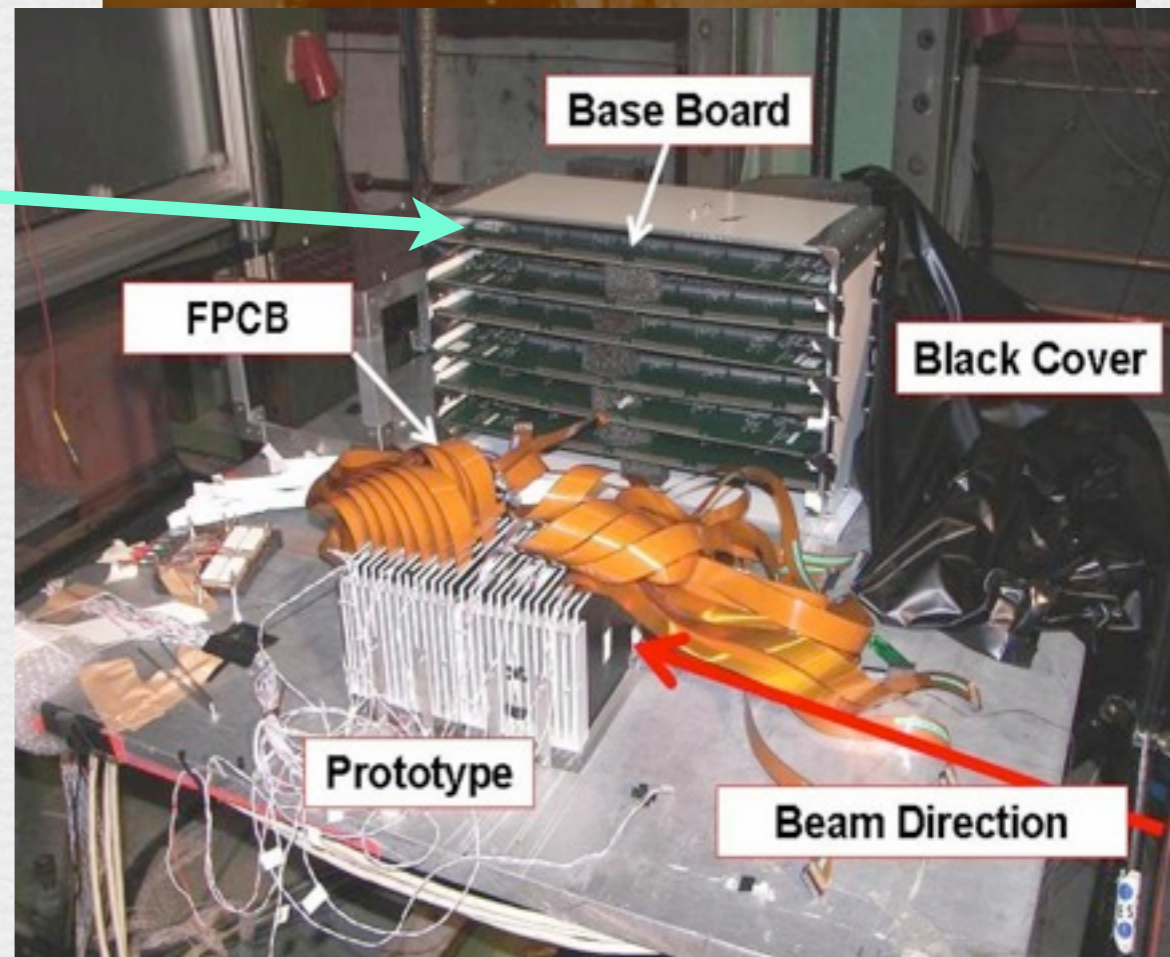
- costly

- MPPC 1600 pix.

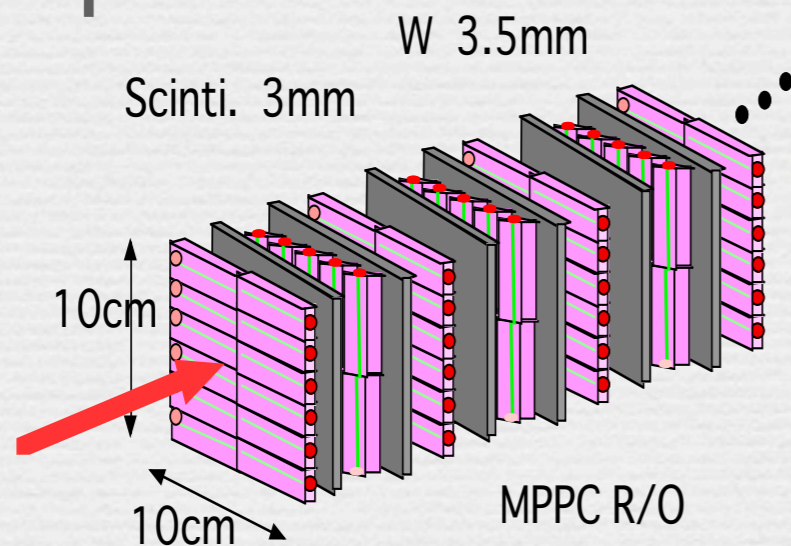


- developed with HPK

- AHCAL electronics



- spiroc and read board



# phase II ~2008/9

- extruded scintillator by KNU

- improved uniformity

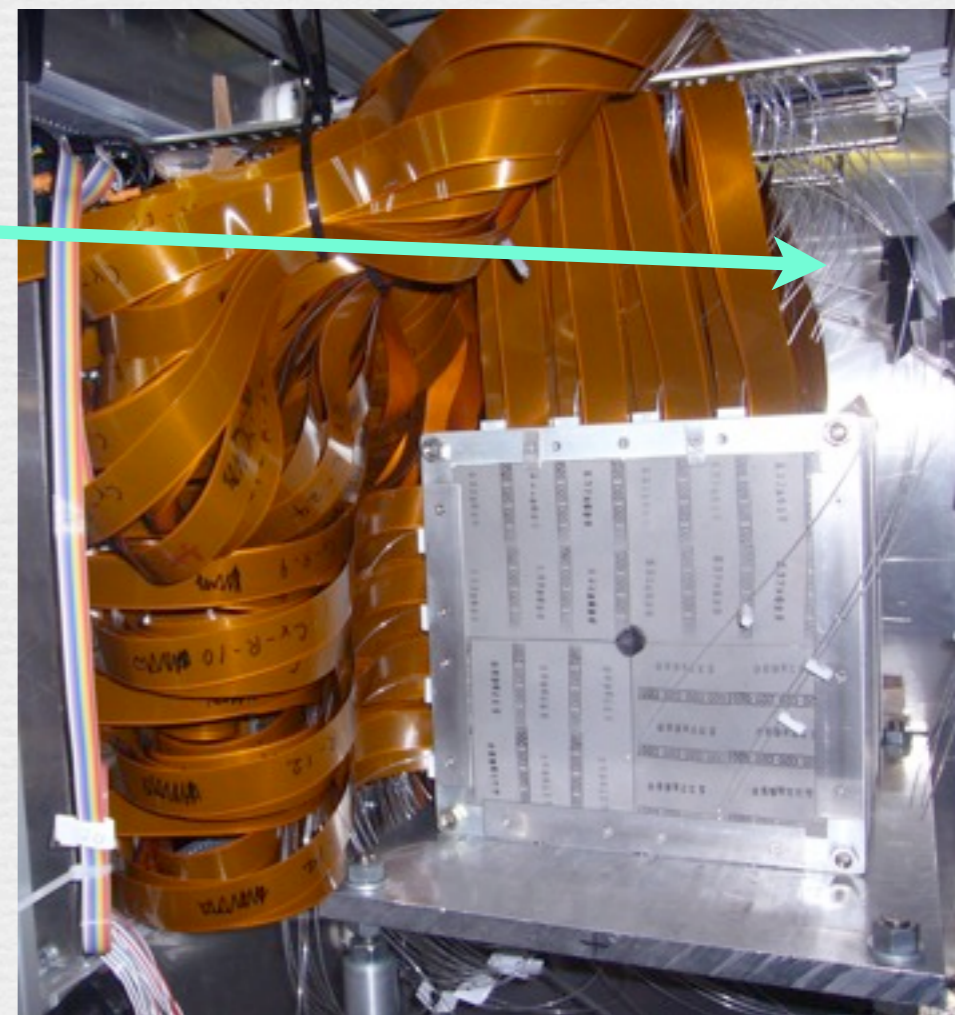
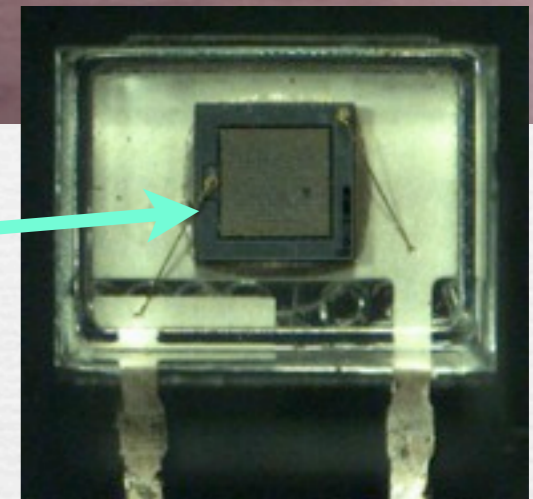
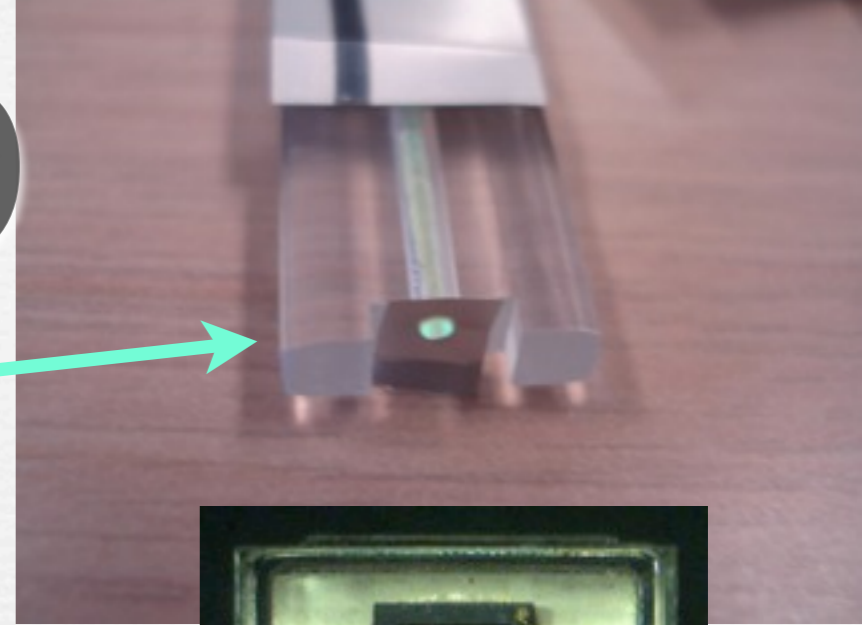
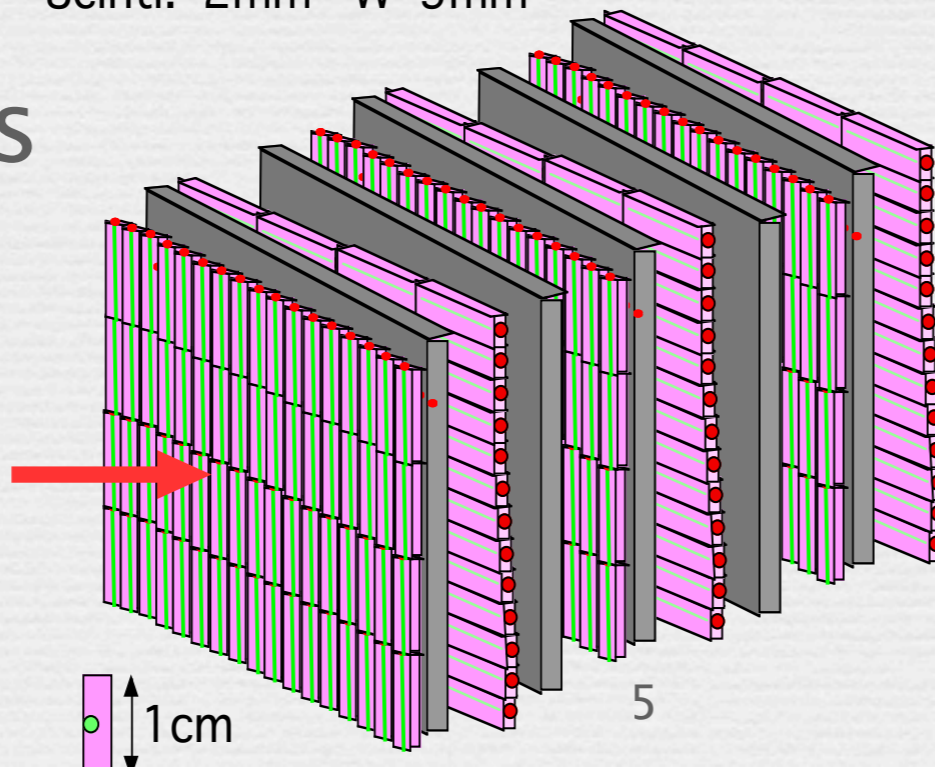
- MPPC 1600 pix

- 2000 pieces handled

- calibration with clear fiber

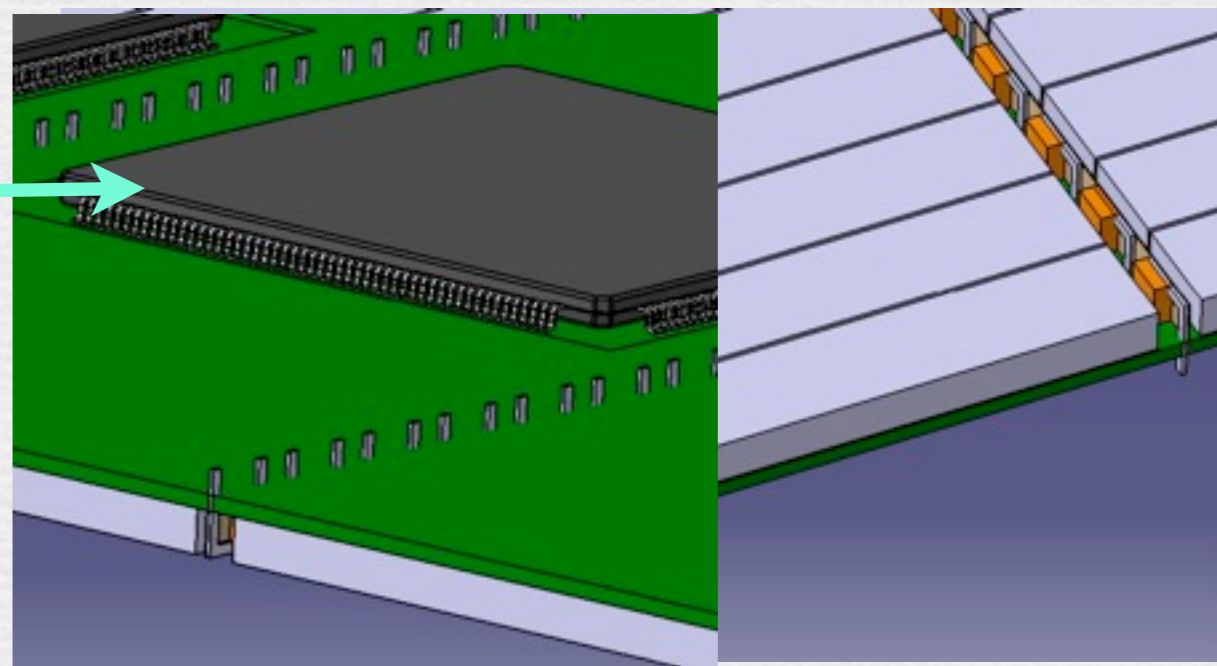
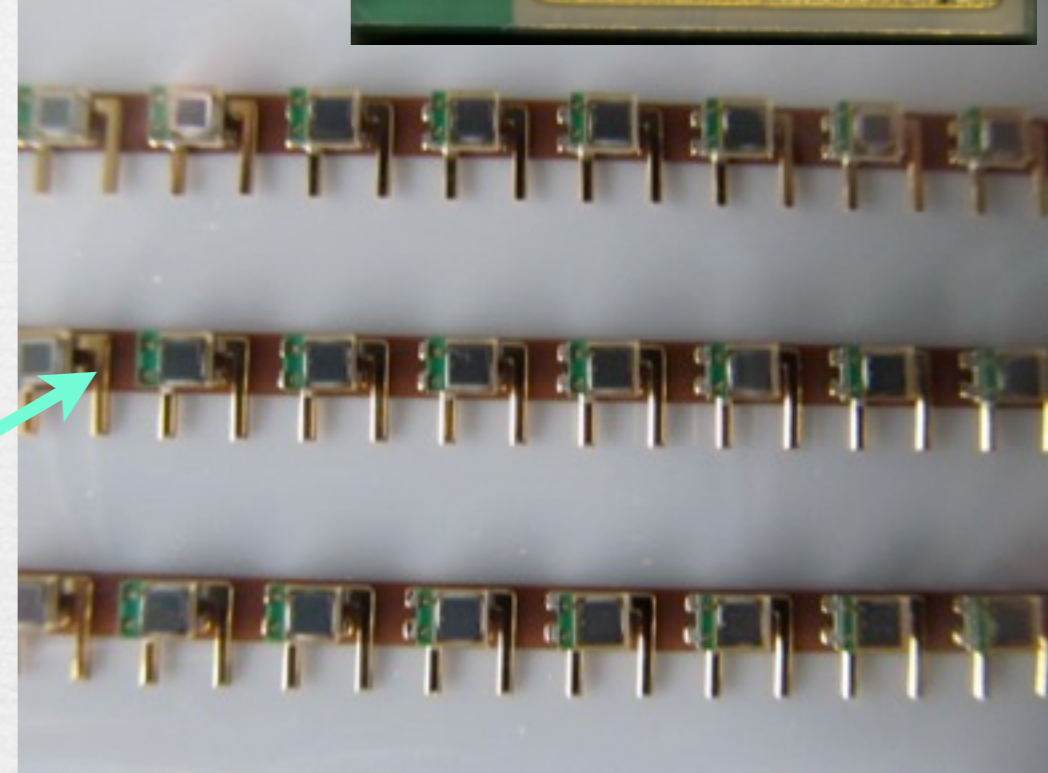
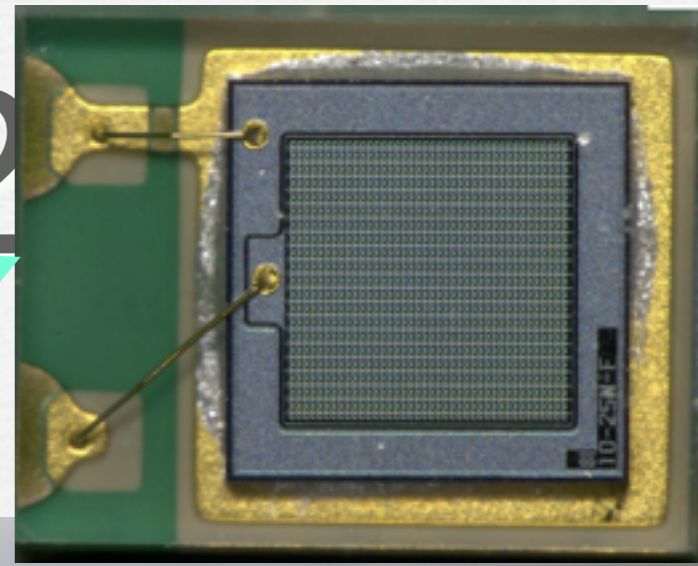
Scinti. 2mm W 3mm

- notches



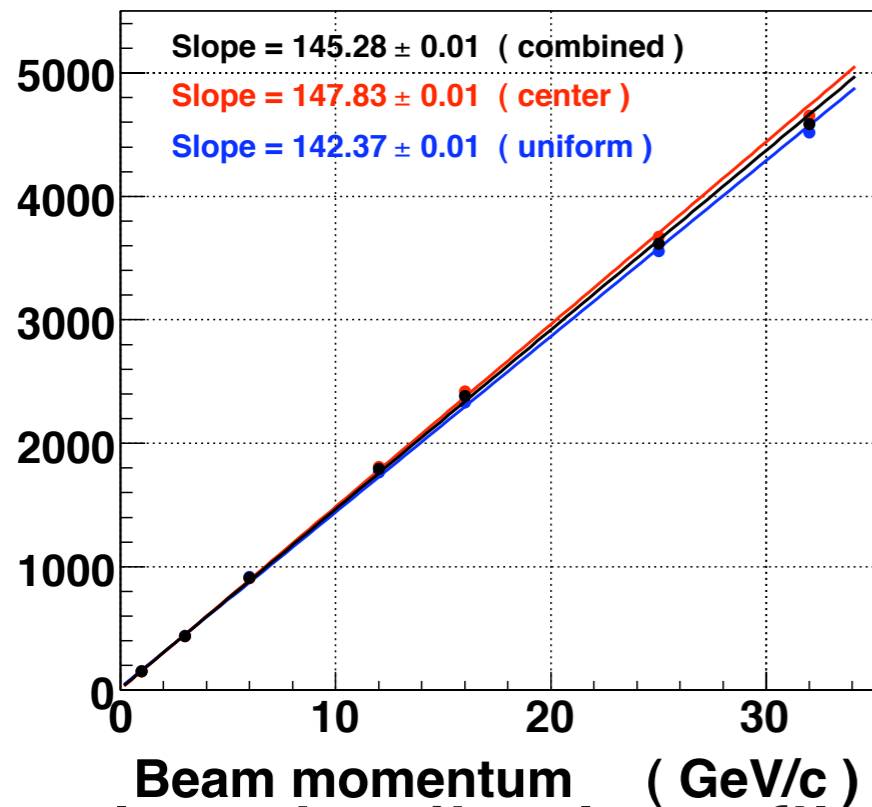
# Tech. Proto. ~2012

- ☛ 5mm scintillator
  - ☛ no WLSF
- ☛ MPPC
  - ☛ SMD: soldered on FPC
- ☛ EBU electronics
  - ☛ everything on board

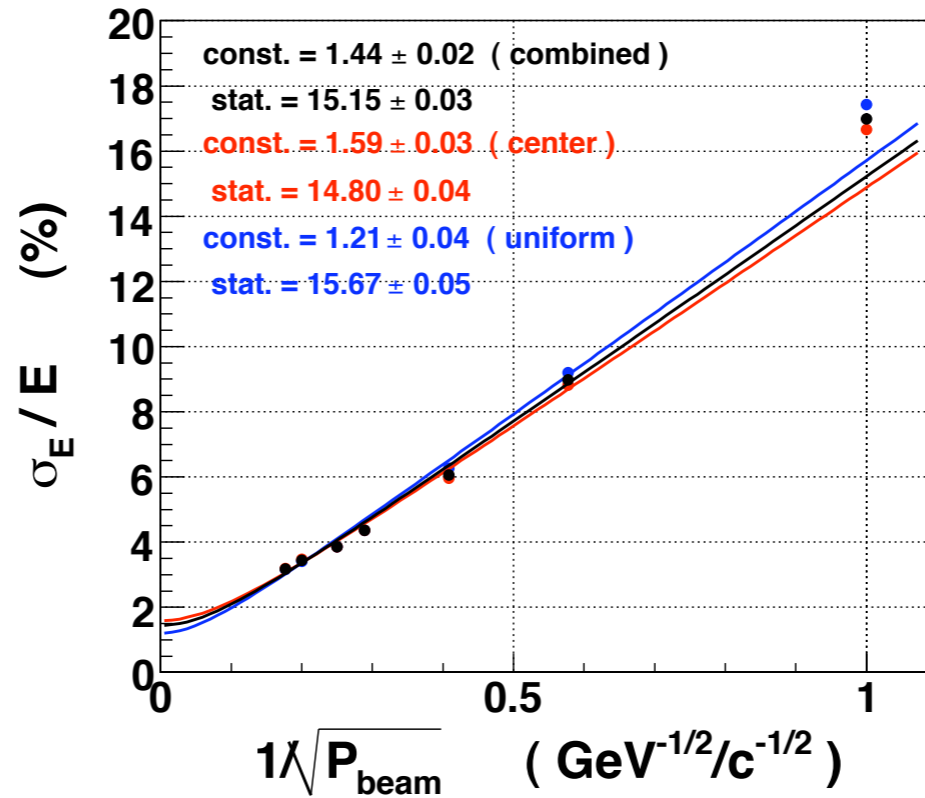


# performance: energy resolution, linearity, uniformity, two particle separation

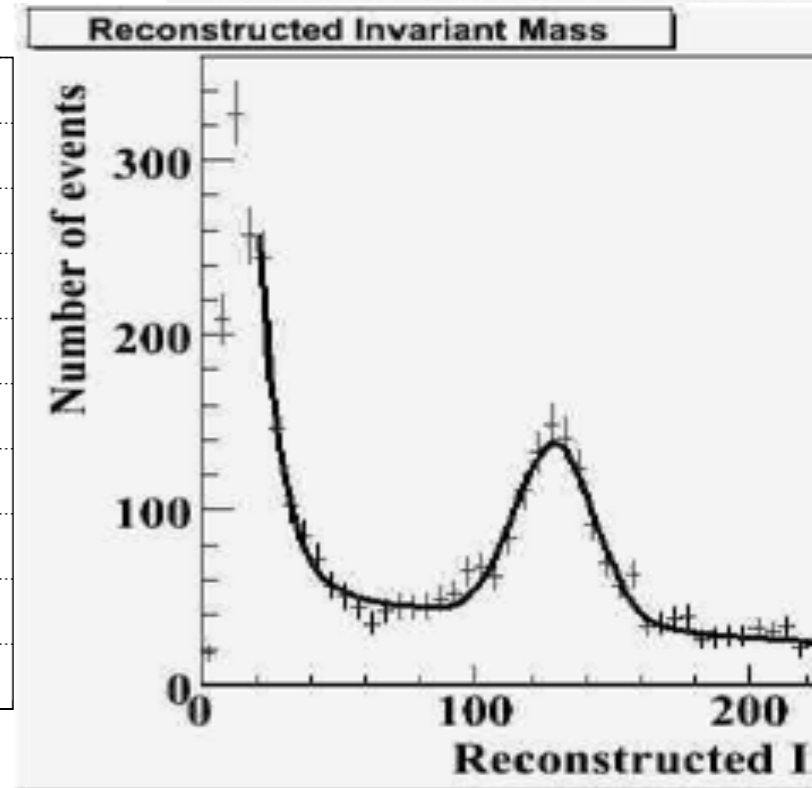
Deposit energy in ECAL (MIP)



Beam momentum (GeV/c)  
longitudinal profile

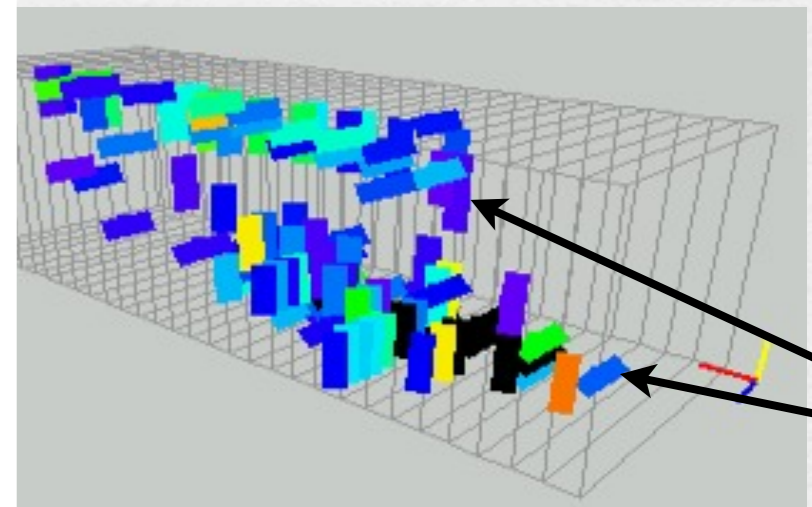
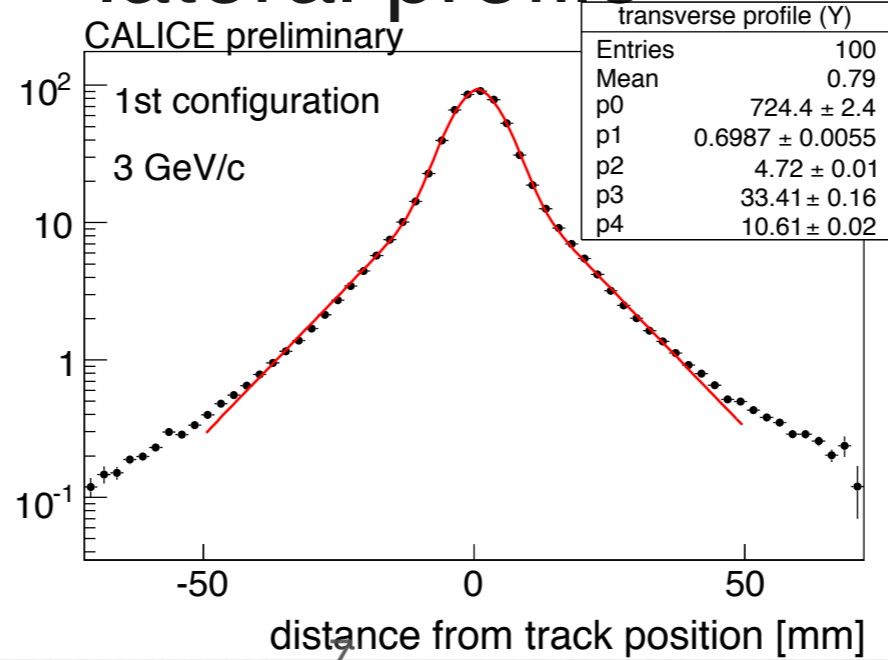
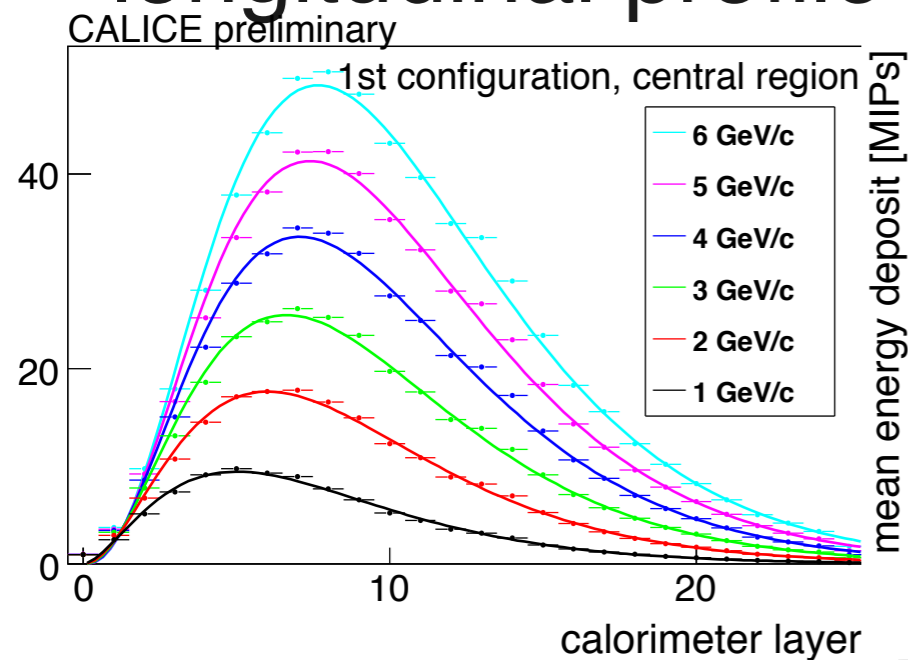


lateral profile



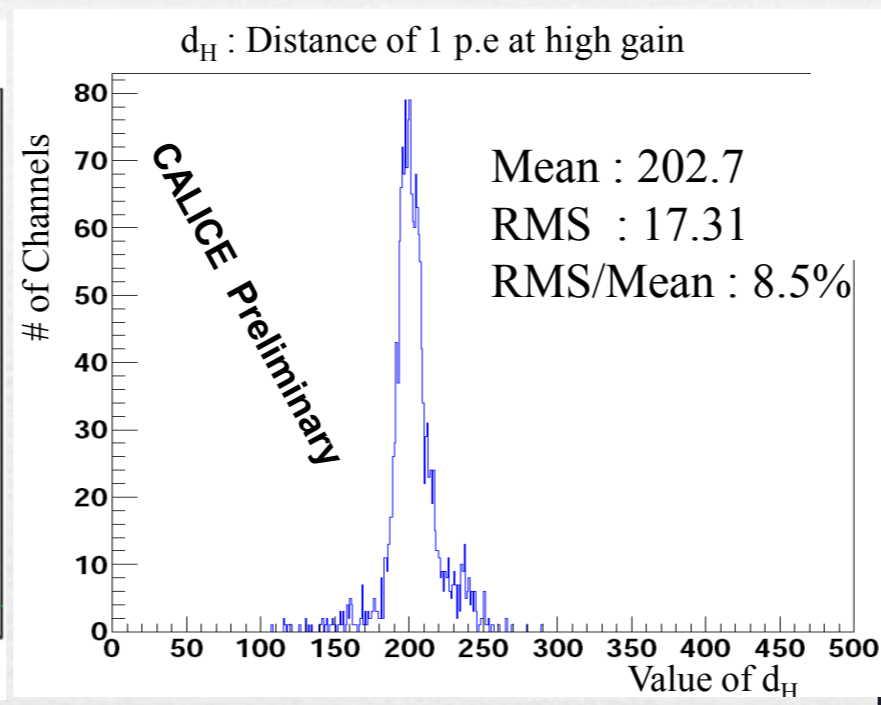
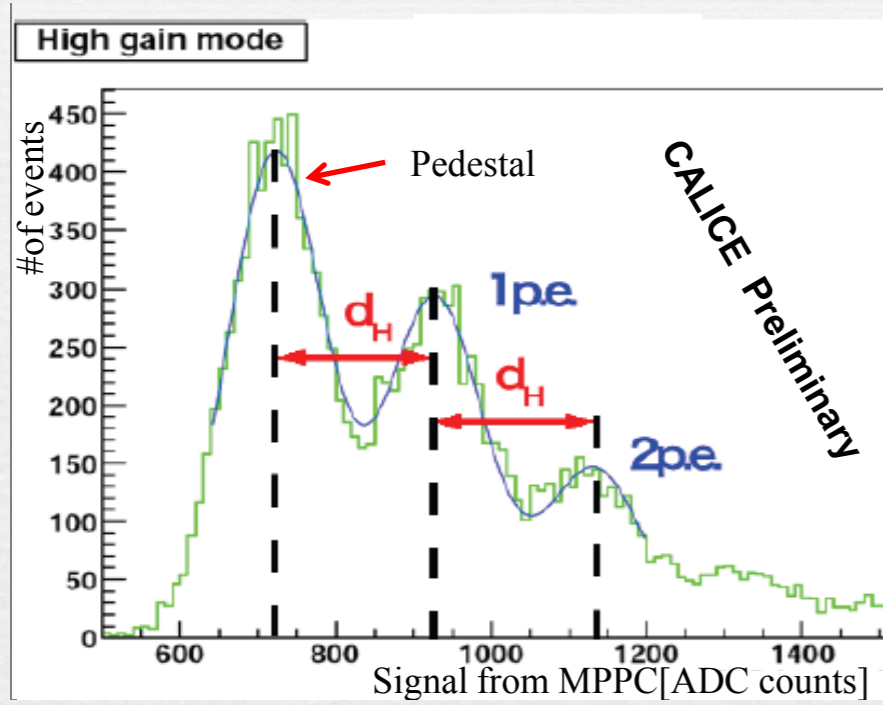
two particle separation

mean energy / layer [MIPs]



# calibration

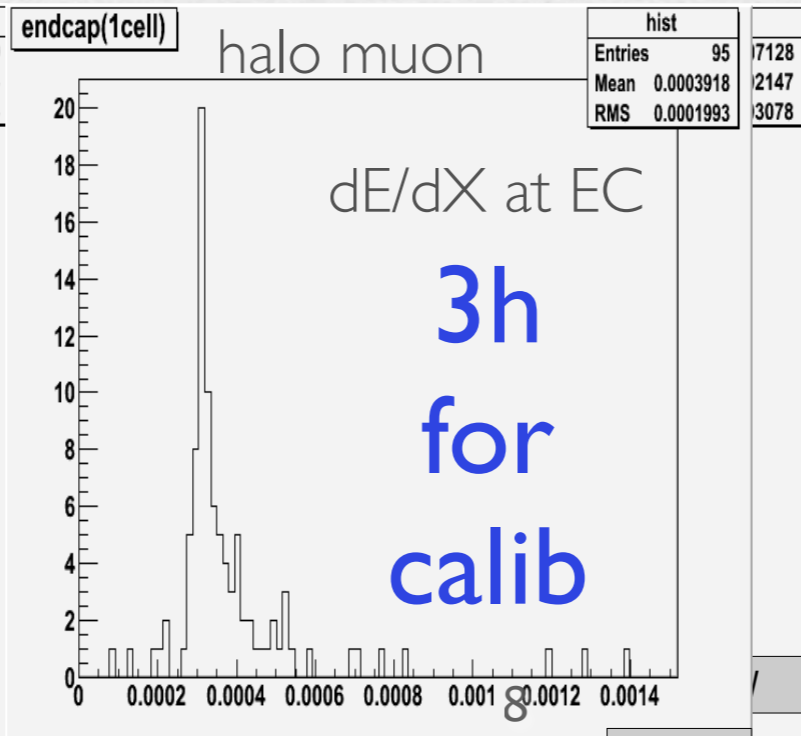
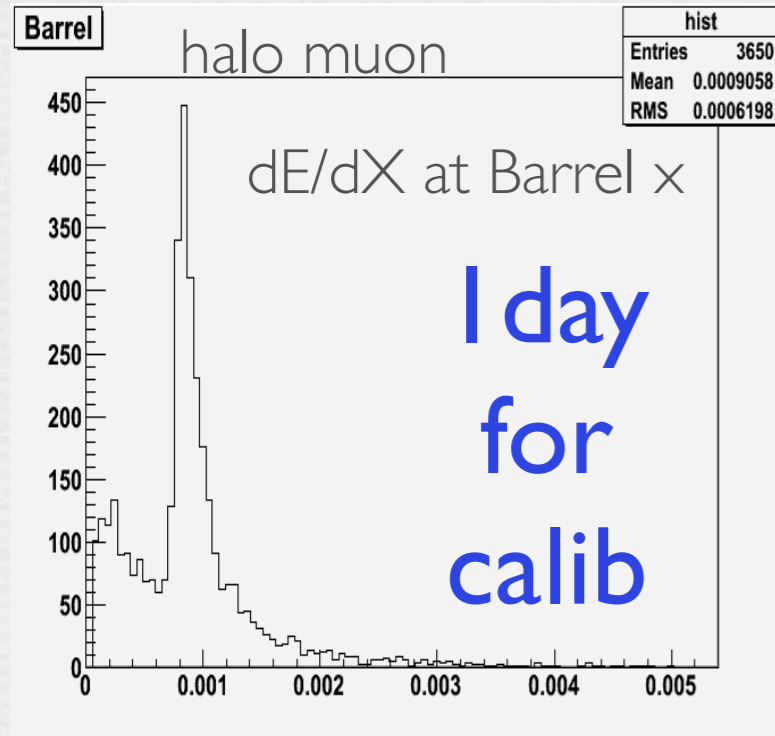
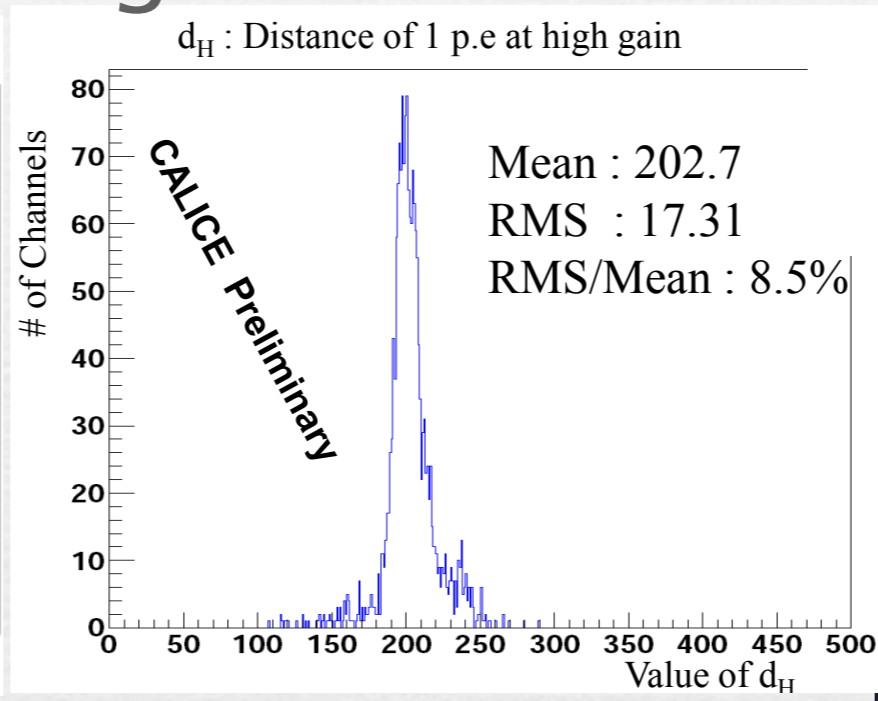
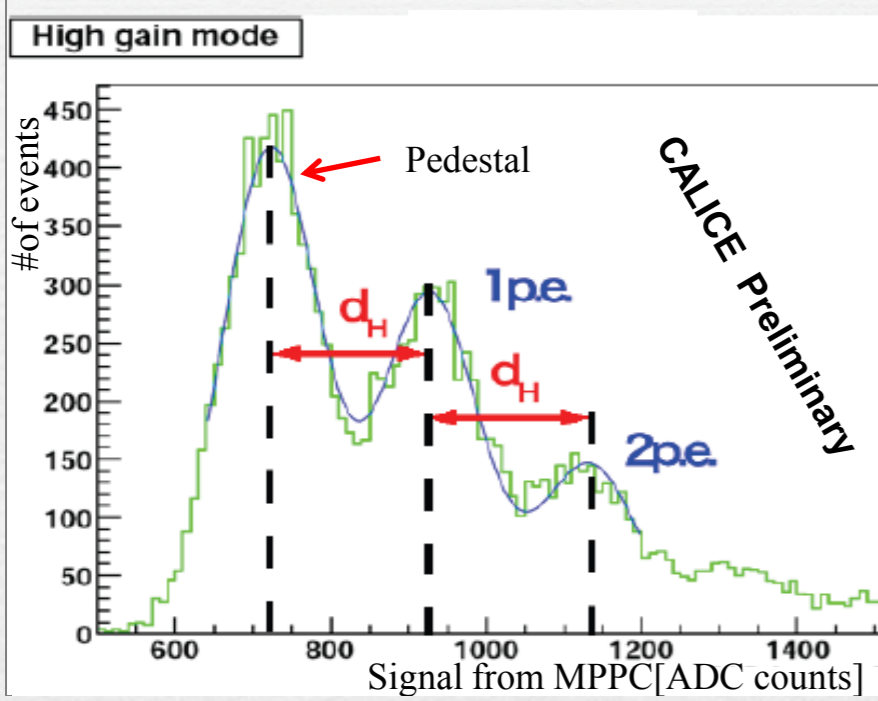
- notched clear fiber & LED





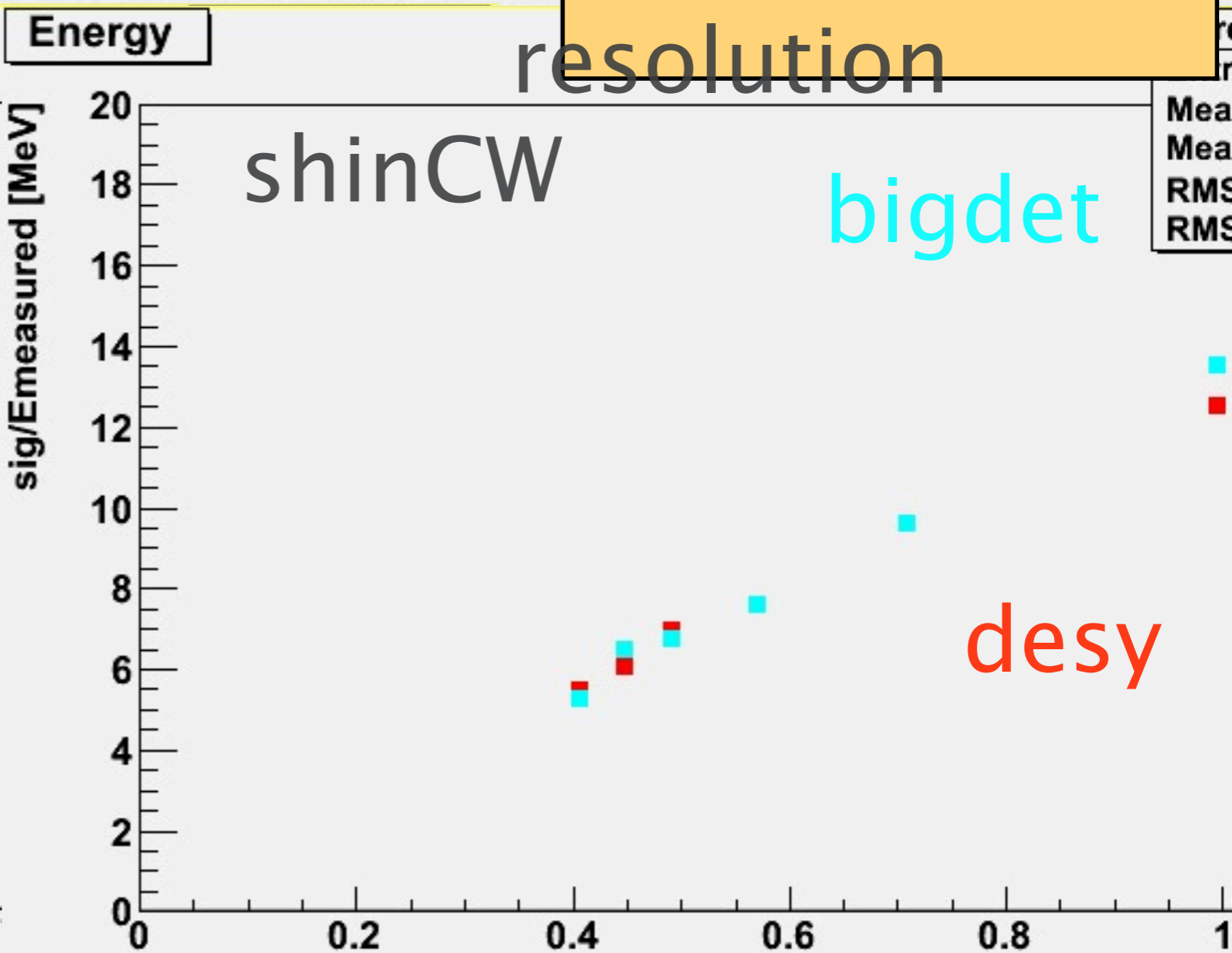
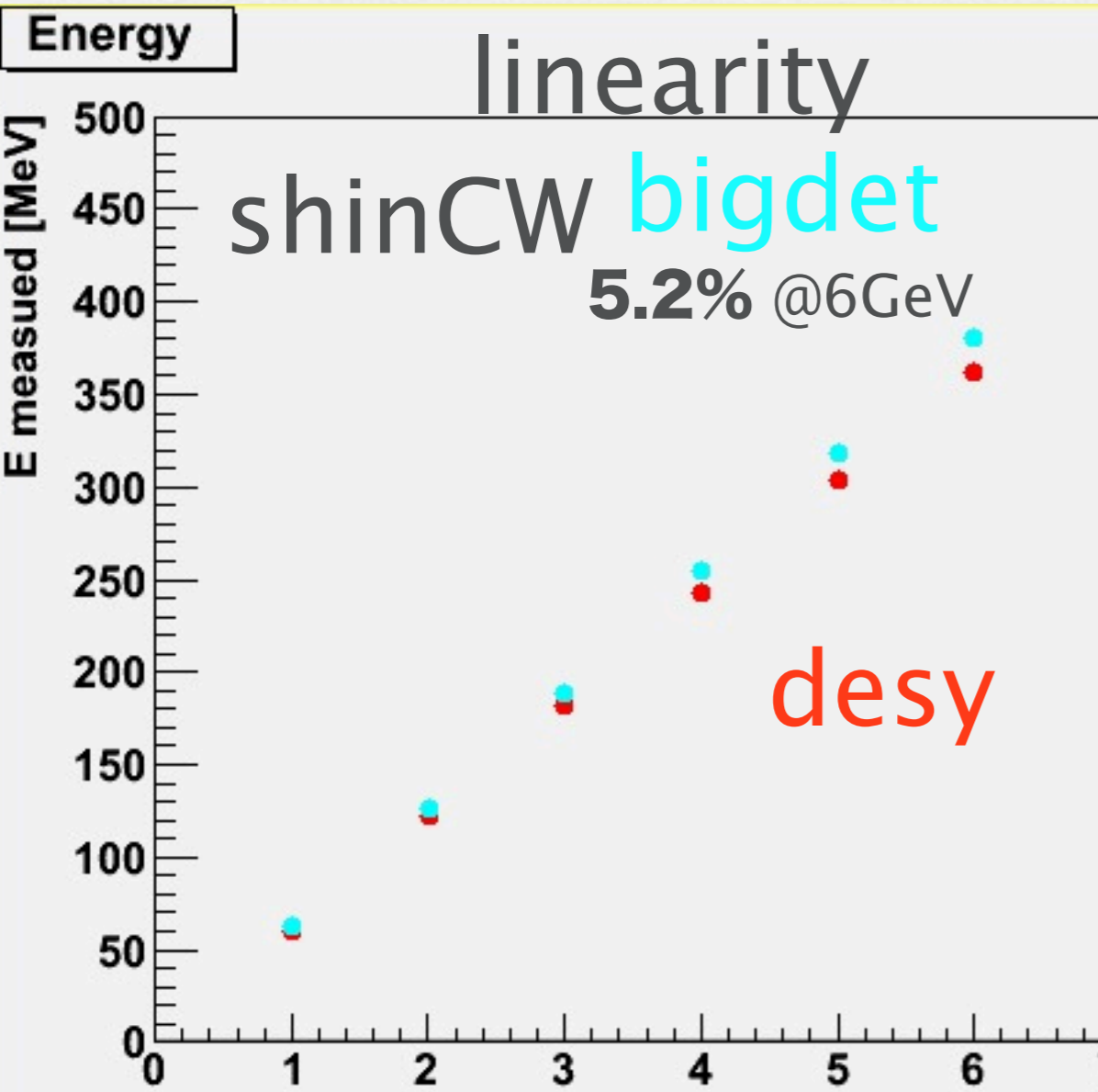
# calibration

- notched clear fiber & LED
- in situ calib. using halo muons



# leakage. simulations

- shinCW absorber
- linearity & resolution

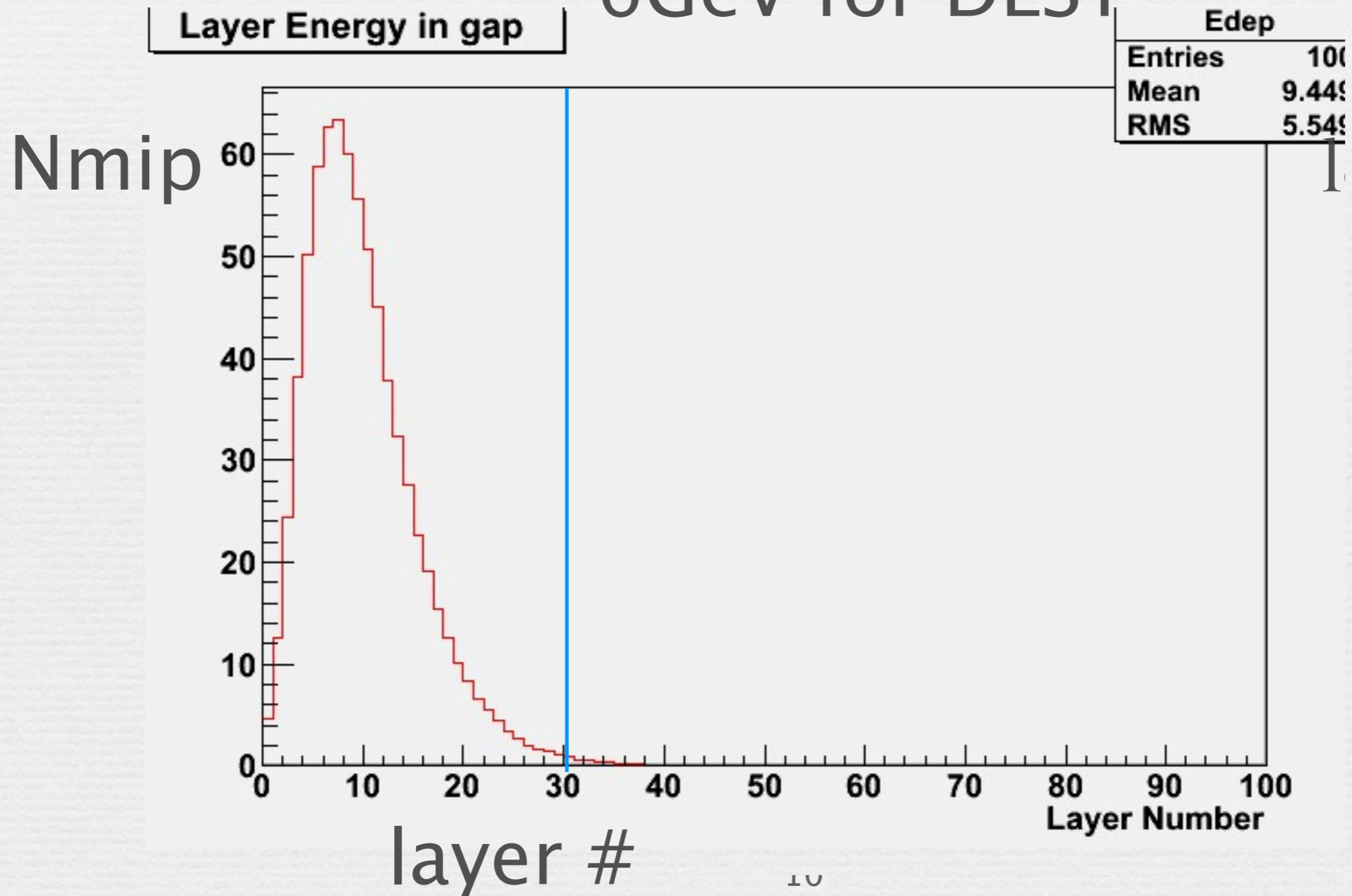


# simulations

# profile

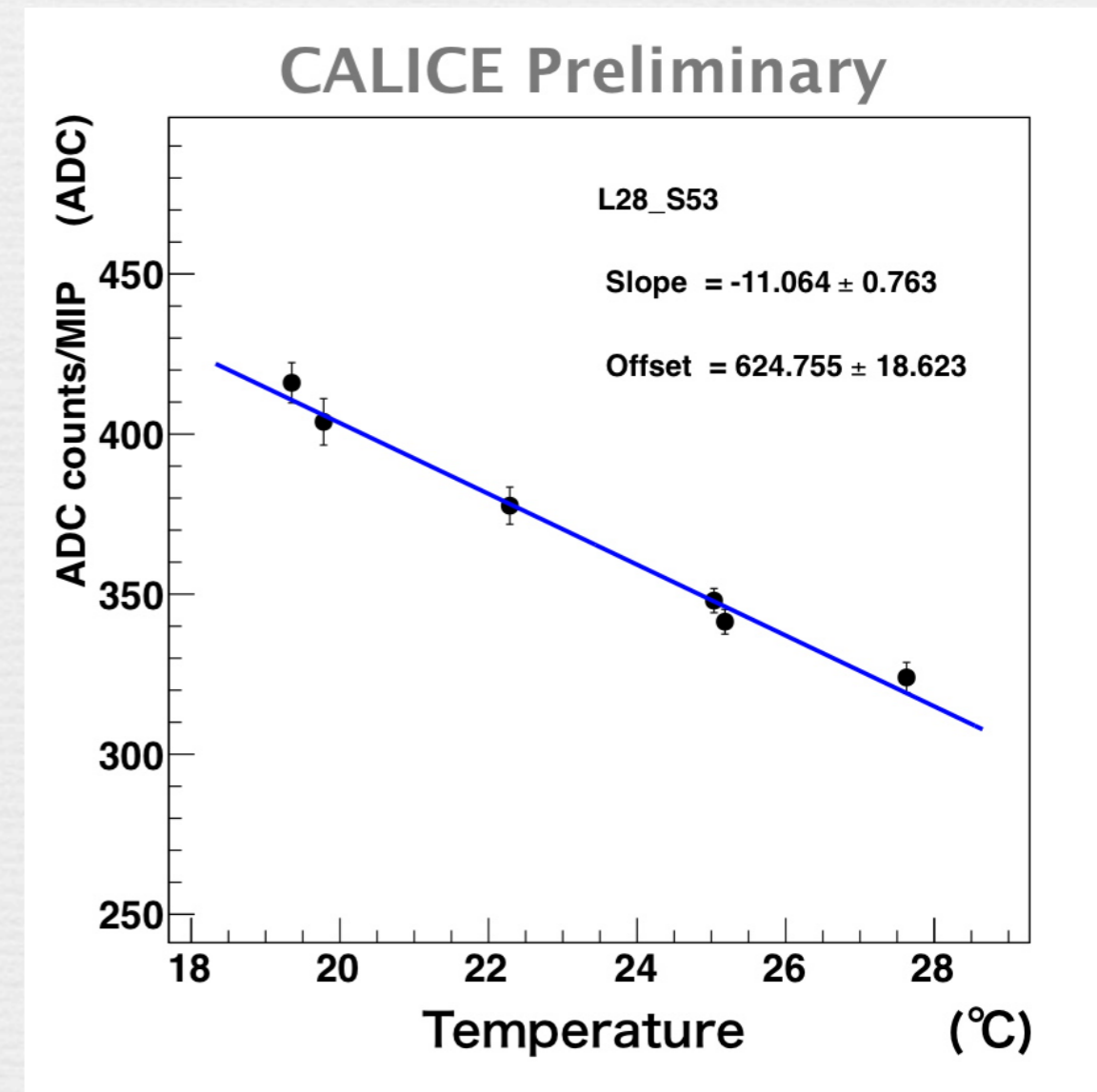
• longitudinal

## 6GeV for DESY



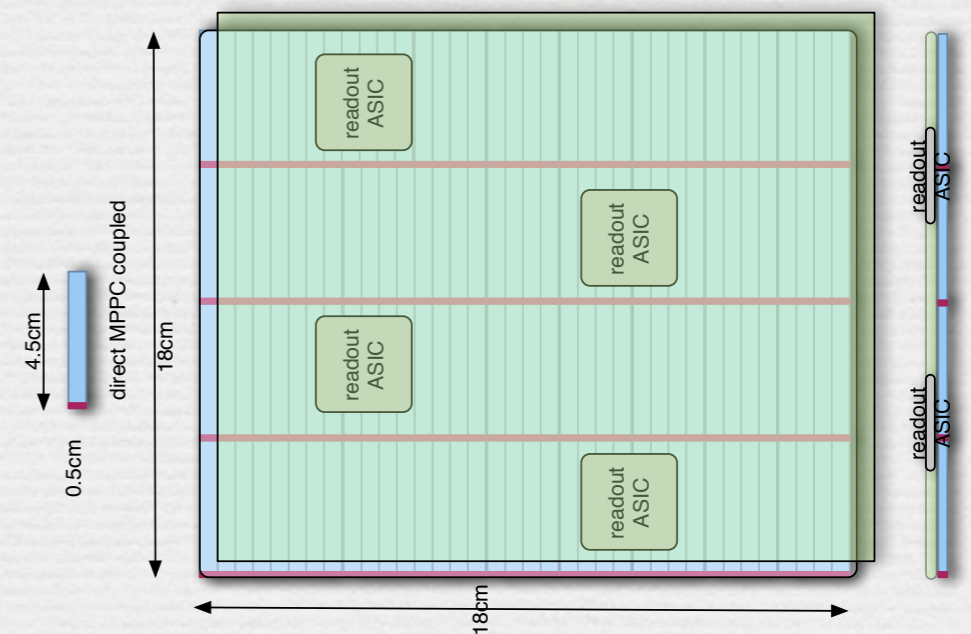
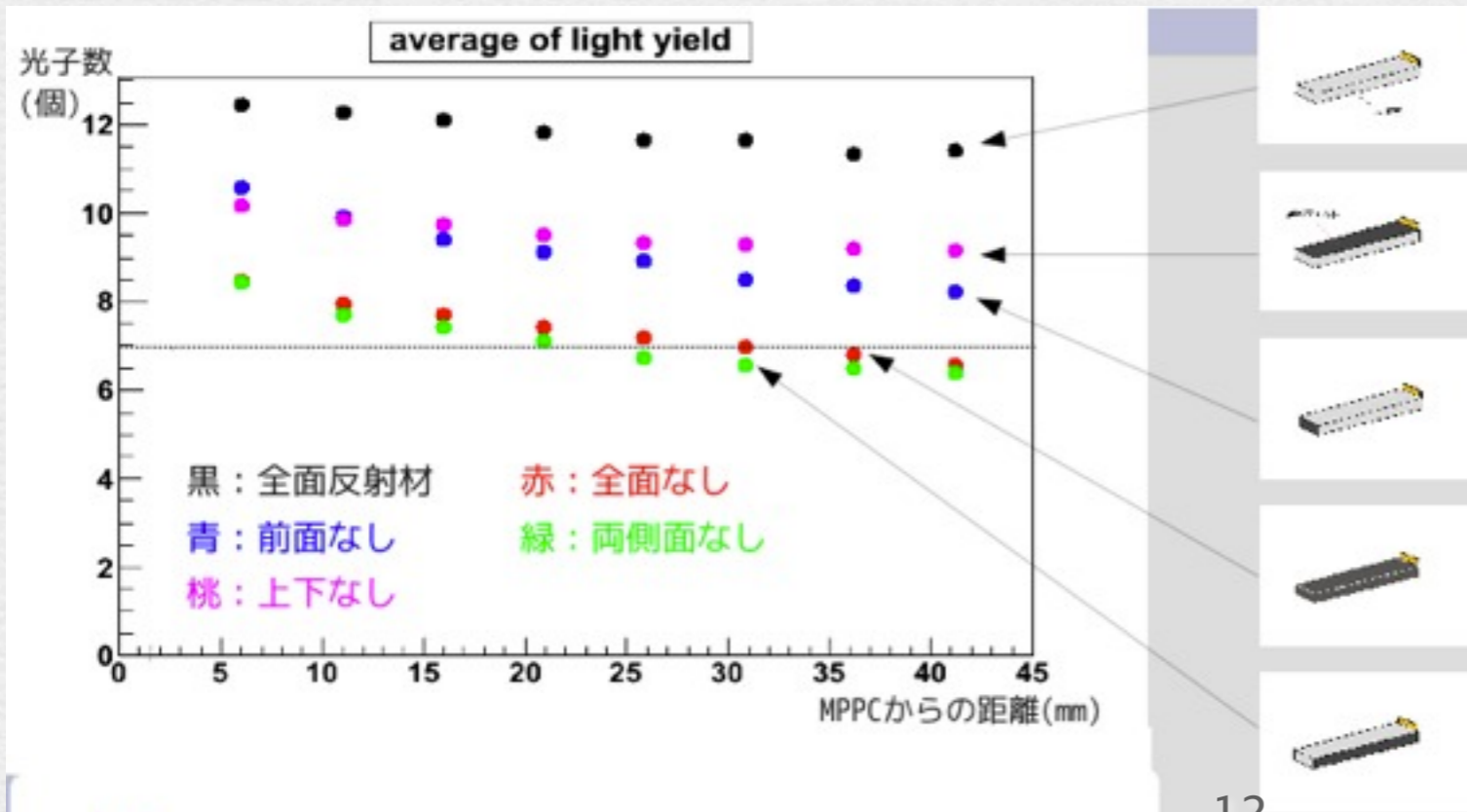
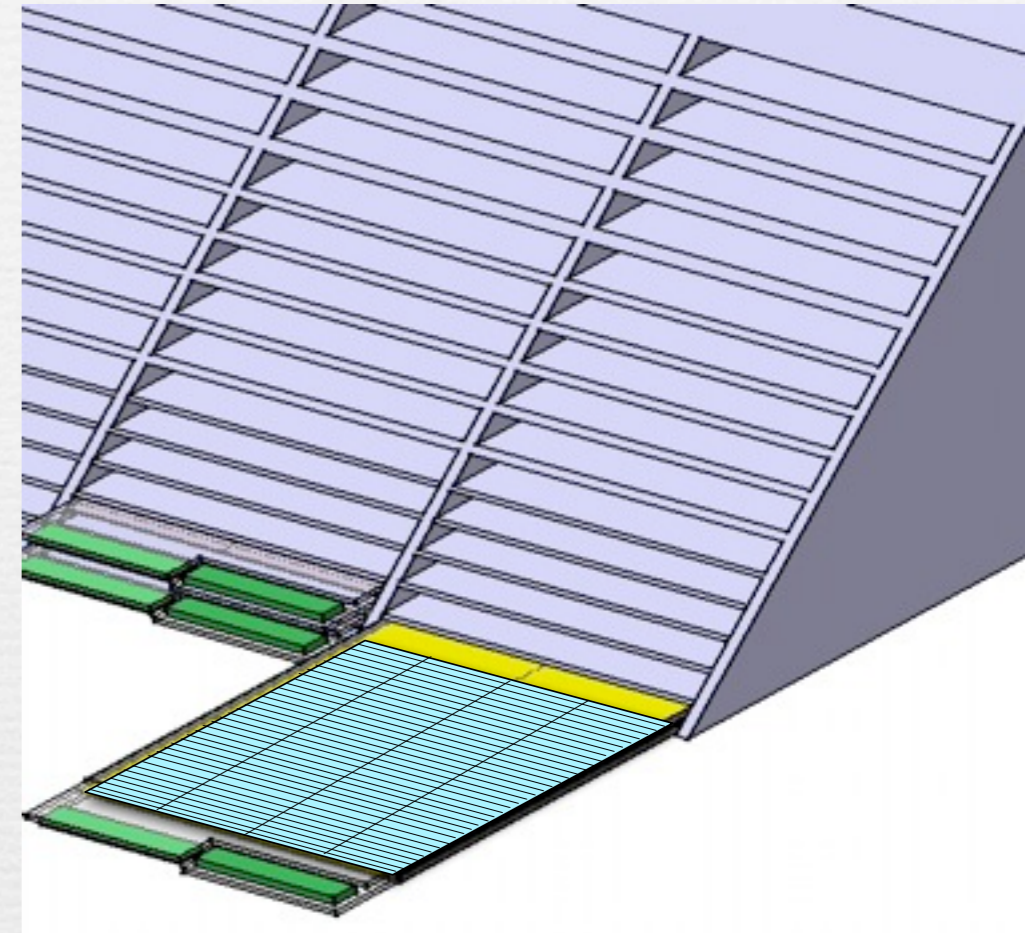
# Experience

- FNAL 2160 channels = 72/layer x 30 layer
- dead channel = 4 (~0.2%) reflector sheet
- noise RMS ~ small  $\ll$  mip
- stability < a few %/month
- temperature coef. ~6%
- monitoring : clear fiber



# Current activity

- ☞ EBU for integrated layer structure
- ☞ device study
  - ☞ MPPC : timing # of pix.
  - ☞ 30ps
  - ☞ scintillator strip 5mm



# hardware open issues

- ✧ scintillator ECAL with strips DBD point of view
- ✧ scintillator strip
  - ✧ wrapping
- ✧ MPPC
  - ✧ saturation correction
- ✧ electronics
  - ✧ mounting on the FE board : EBU
  - ✧ relying upon AHCAL activity

# Relying issues

- upon Silicon ECAL works
- common parts
- Scalable technology solutions: power and heat reduction, low volume interfaces, data reduction, mechanical structures, dead spaces, services and supplies

# Software un-readiness

## open issues

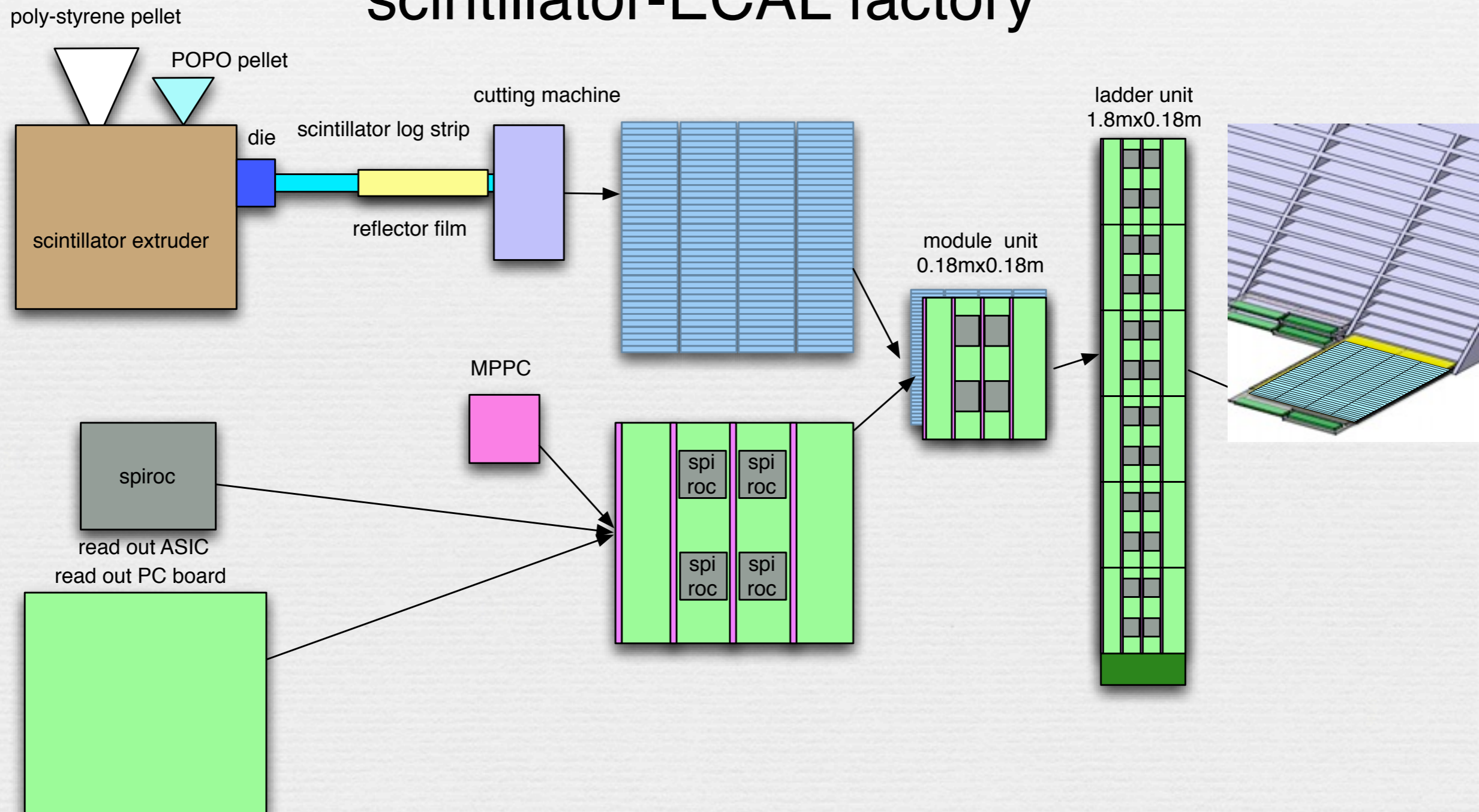
- need simulation including
  - non-uniformity
  - saturation behavior
  - physics performance
- ILD matter:
  - SSA
  - Hybrid performance



# ECAL post-DBD

- ✿ establish mass production procedure

## scintillator-ECAL factory



# ScECAL toward DBD

- hardware almost ready
  - need to demonstrate integration of the system in 2012
- software need more effort : ILD matter
  - SSA
  - Hybrid performance
- need some more effort to the DBD