Progress on ECAL design: towards a new baseline solution

Walter M. Bonivento, INFN Cagliari; J.Chauveau, LPNHE Paris; R.Wanke, Mainz University; M.Villa, University and INFN Bologna

good progress with the arrival of the Mainz group

still an activity quite understaffed!

Why we wanted to change compared to TP?

1) reduce possibly cost

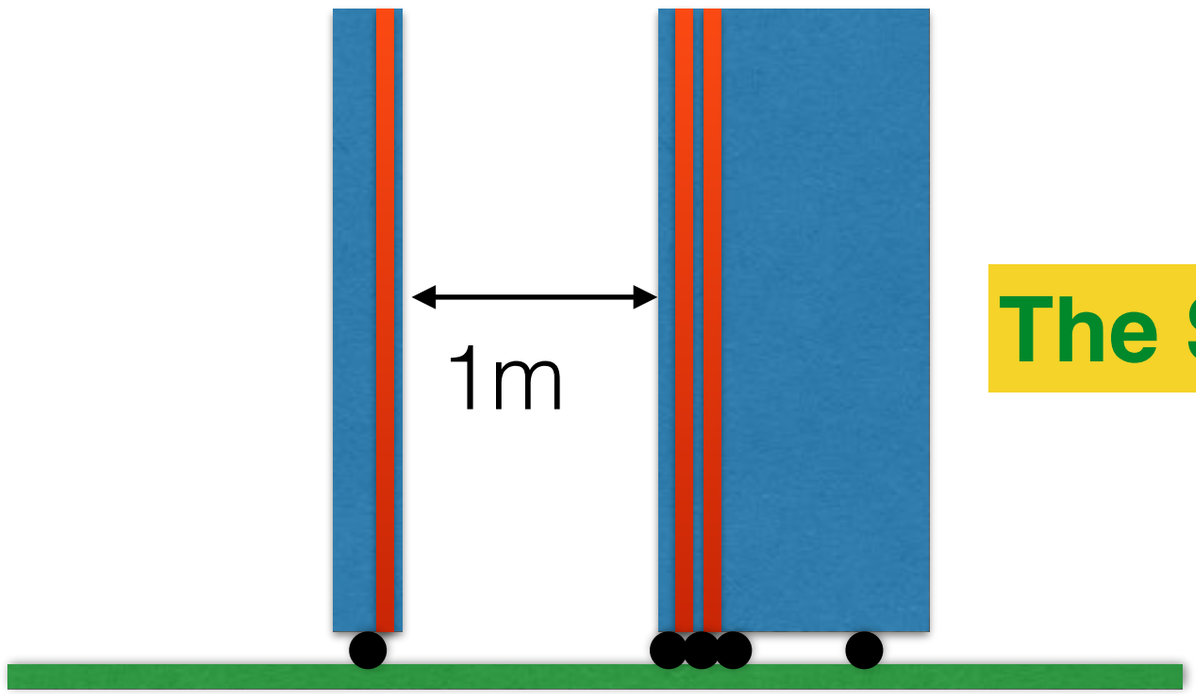
2) add the measurement of shower angle for neutral final states (need few mrad resolution for ALP—>γγ) and possibly suppress background

3) improve e/pi separation

of course it is a 5x10 m² guy…

We have tested with simulation a few options

The only viable seems to be …



The SplitCal

Implemented in FairShip and “tested” (with some cheating…) in blue a sampling Pb ECAL with X-Y plastic scintillator bars readout via WLS fibres from the sides (see our ICL June2016 talk)

in red the high precision layers that can be staged in case of lack of money

How is made?

The ECAL:

- Pb(Fe)-Scint: 50 Pb layers, 25X_0 in total

Full detection planes (segmented only in the readout), 0.5cm thickWLS fibres readout, low granularity, details in Rainer's talk including cost estimate

The angular measurement part:

- Gas detector; x,y resolution on hit 150um

- still, technology (μmega or μWELLS) and cost of this part undefined

In Berlin: we presented some simulation results of

1) energy resolution

2) e/pi separation(already studied since 19 Jan meeting)

3) angular resolution

Since Berlin:

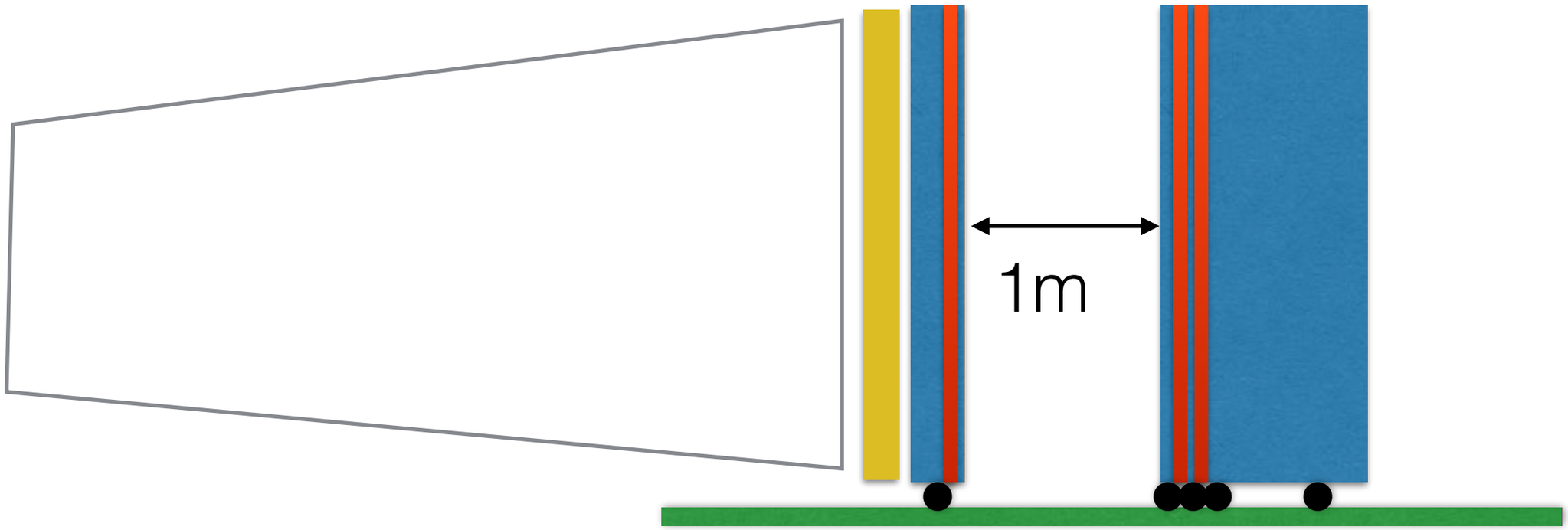
- starting technical design and costing of the main body ECAL (see Rainer talk)

- new improved simulations and new ideas for angular resolution

- evaluation of criticality of material in front of ECAL (29 March meeting)

- code from INFN Cagliari shared with the Mainz group to start to implement more realistic simulations and test reconstruction codes

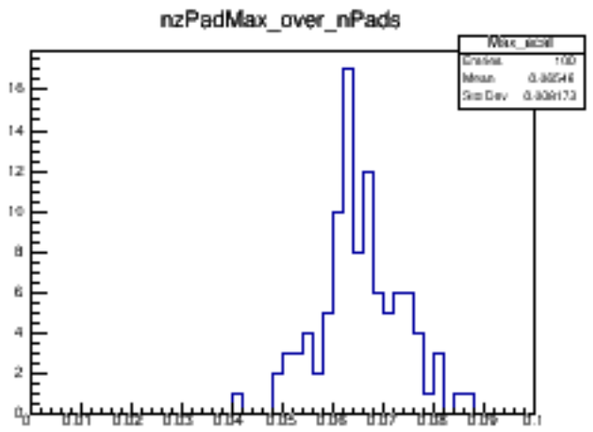
Given the new “light” end plug a configuration with <1X0 in front of ECAL is possible

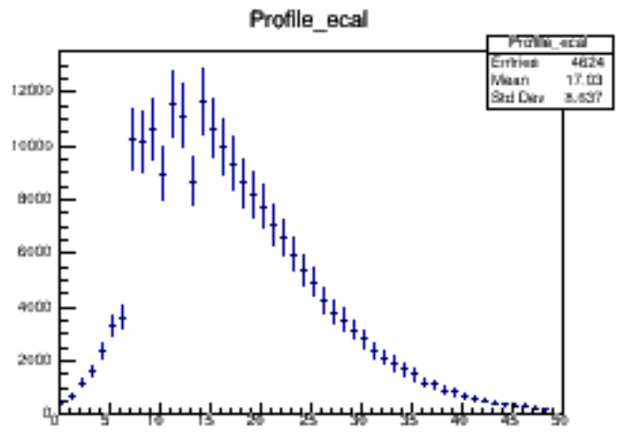


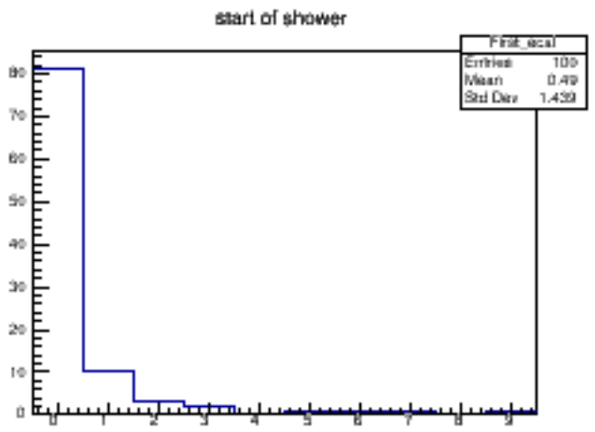
in yellow the Timing Detector (if the TD light enough)

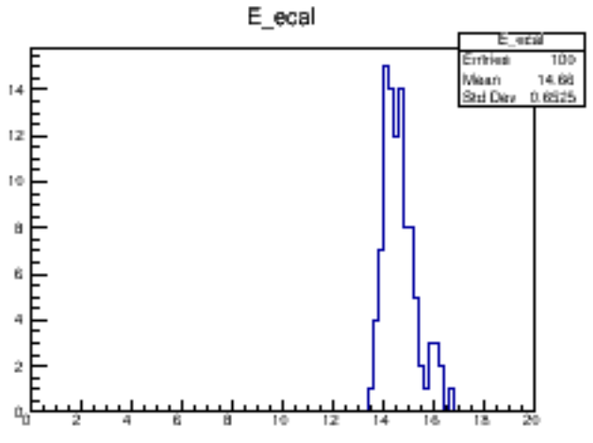
Add 1X0 of Lead in front

20 GeV generated in the yz plane with 100mrad angle and z=20m from ECAL surface in vacuum



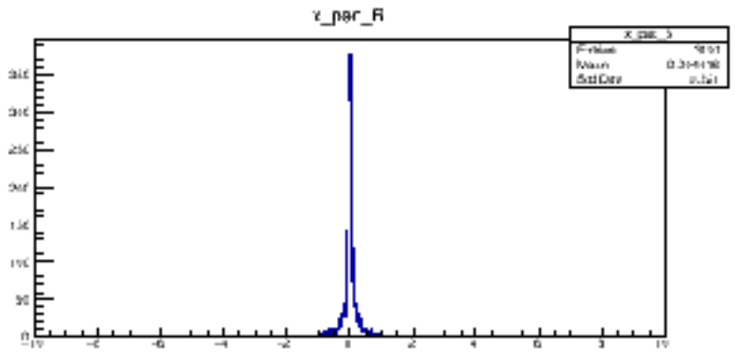


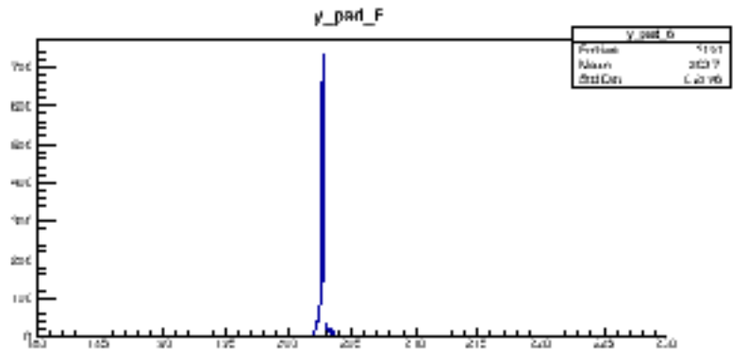


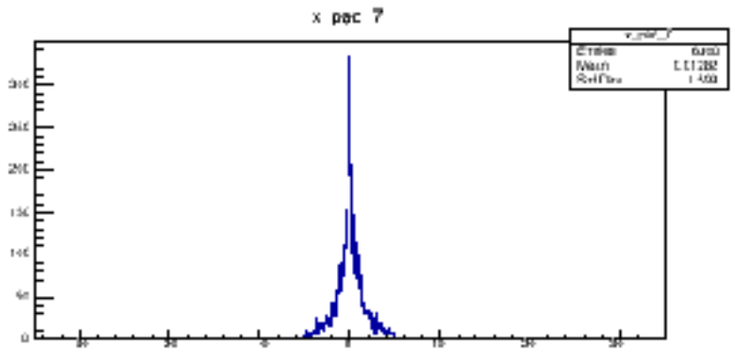


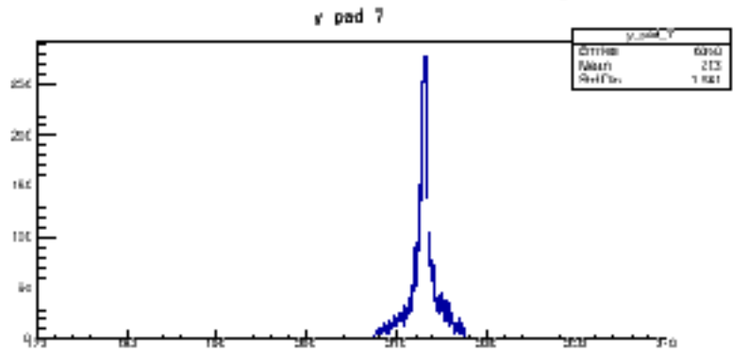
energy deposited in Scintillator *0.5% (fraction of light eventually detected by Muon-like detectors)

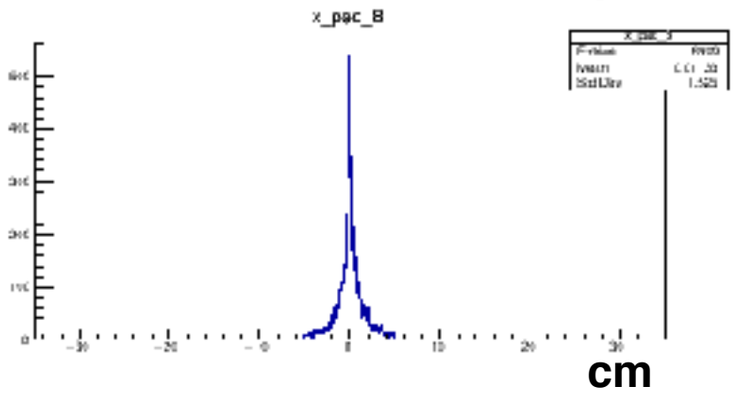
14.5 0.51 —> 3.6%

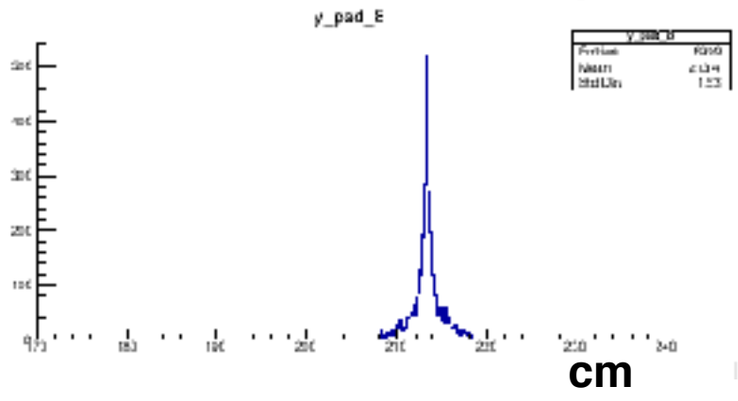








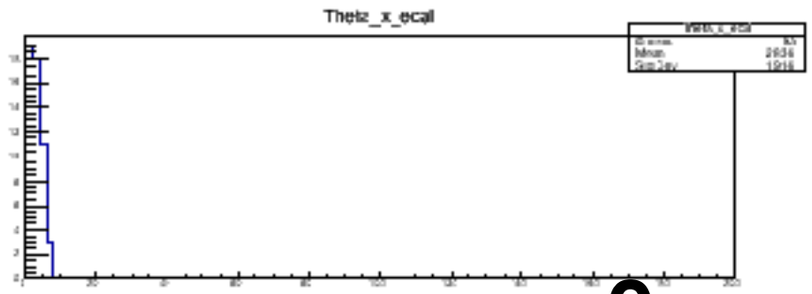


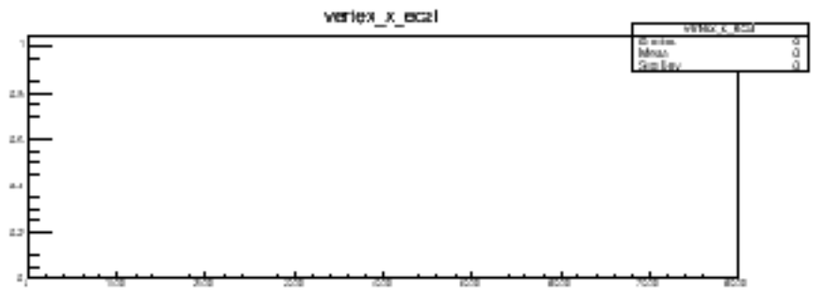


cumulative shower profiles in the three high precision layers

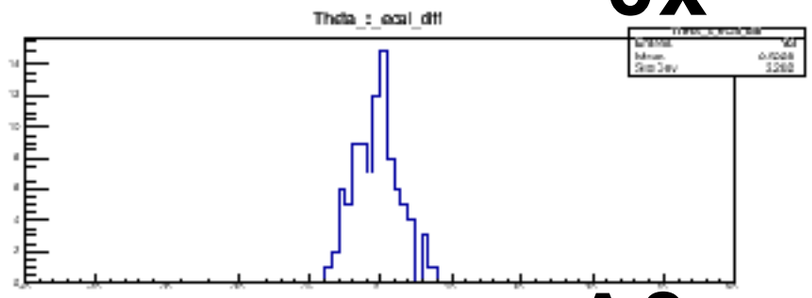
shower direction reconstructed from linear fit to the reconstructed median distribution in each of the tree high precision layers

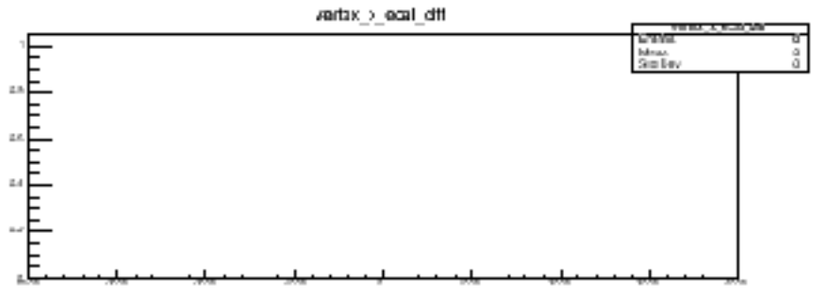
fiducial cut at+-5cm from MCTruth point' (the real procedure would be an iterative one starting from the median without cut)



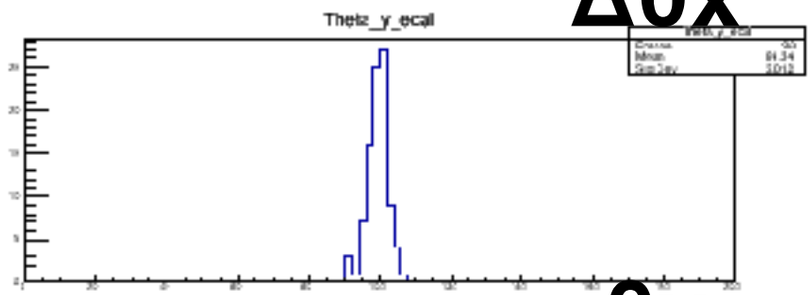


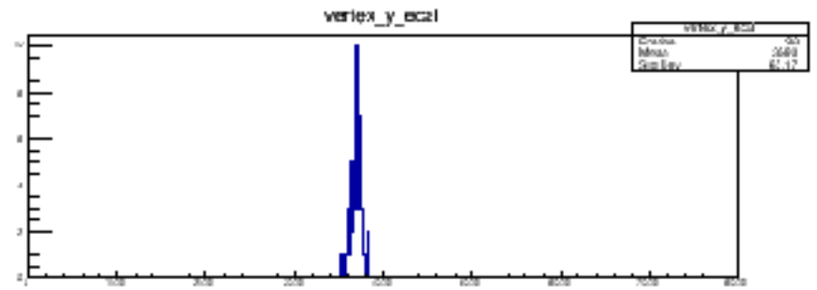
θx



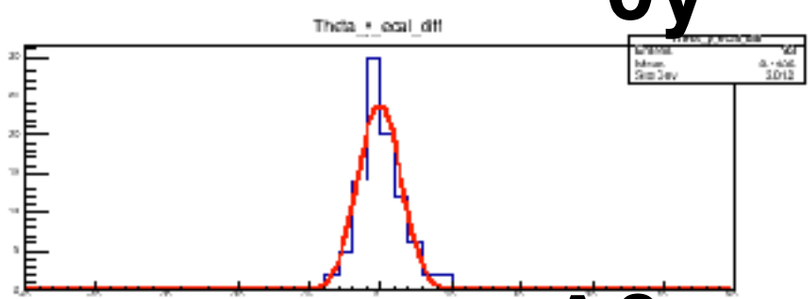


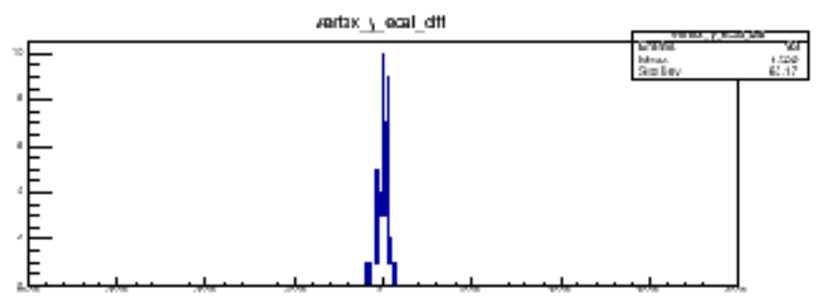
Δθx





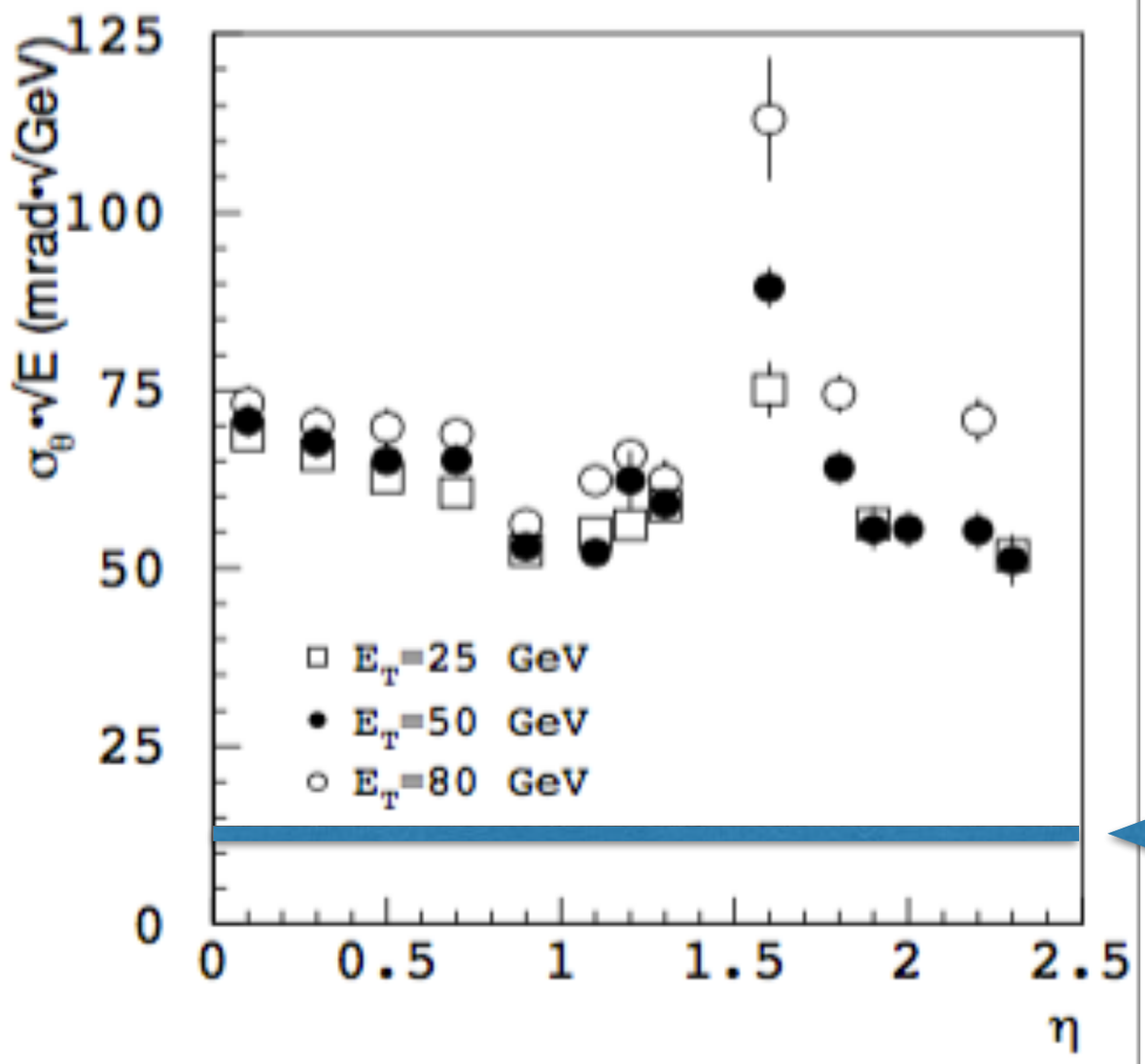
θy





Δθy

3.0mrad (about 2.5mm position resolution at shower maximum)



SplitCal

ATLAS ECAL performance TDR: in blue our result at 20GeV ; large improvement but cost??

CMS recently estimated for 140m^2 (similar to our requirements) of μWELLS about 1M€ (detector only)

Readout to be optimised

Future needed simulation work:

the main issue to be demonstrated before claiming that the scintillator part could be a baseline solution is to see if X vs Y strip readout can work in a calorimetric environment

for the high precision detector we also need to test Xvs Y strip readout and try some new ideas that may lead to optimisation of strip size and cost reduction:

- try to fit an analytical shape instead of doing the median (in the past used to get good spatial resolution e.g. CDF SMD calorimeter used Lorentzian shape and 6 mm strips)

Planning

2-3 months for the simulations (Rainer has a PhD student and a post-doc who are starting working on this + Cagliari work)

For the end of the year 2017 we could have some pre-technical design

Some experimental tests (e.g readout) could be planned for 2018 once the concept is shown to work in simulation

Still the combination of HCAL+MUON needs to be optimised ; nobody is working on these simulations ; help needed!

will be committed soon

Particle Identification tools and performance in the SHiP Experiment

Behzad Hosseini, Walter Bonivento

INFN Cagliari

Abstract. This note describes in detail the HNL Particle Identification in SHiP experiment.

backup

assuming crossed XvsY strips (that we have not tested yet in the MC, only pads used so far) 500μm strip pitch with 20cm length (as CMS) it is 10,000x50+20,000x25=1M channels x 3planes — >3M channels

for the sake of comparison of large numbers: CMS outer tracker upgrade has 200m^2, 50M strips and 218M macro-pixels; EM calo 6M channels