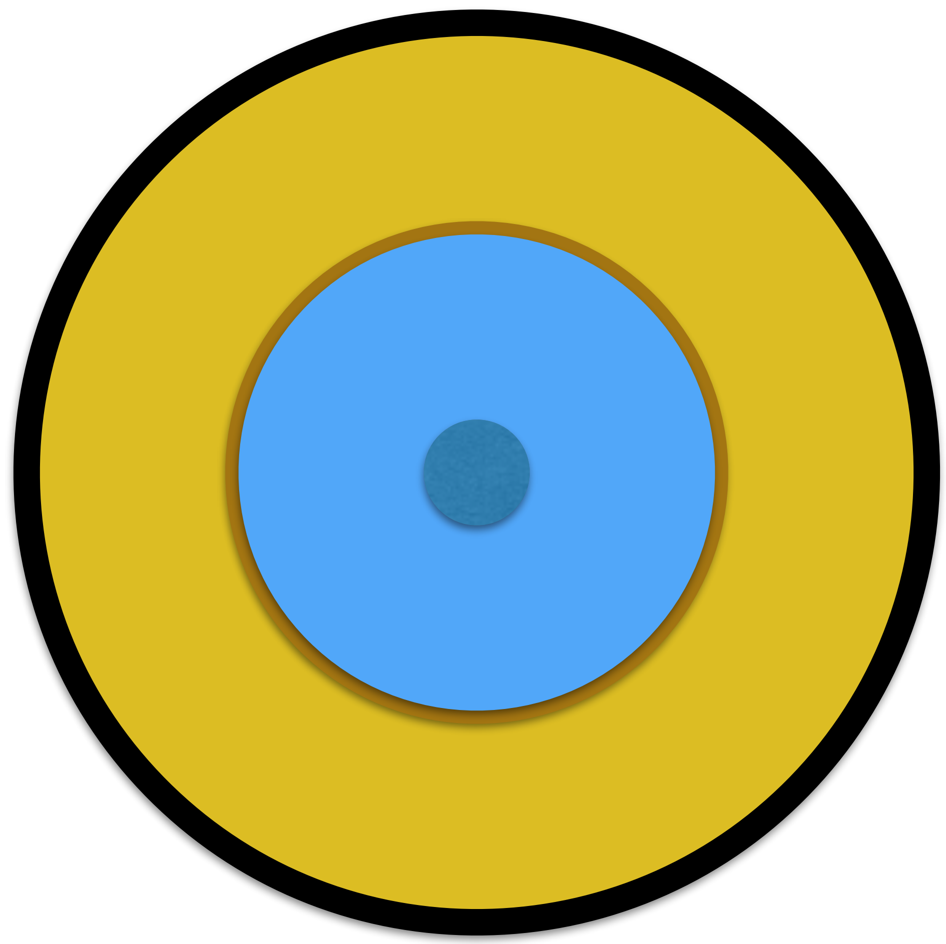
Progress in detector technologies for FCC-ee¶

October 31st 2016

Light silicon vertex r ~ 4 to 40 cm

Light wire chamber r ~ 40 to 180 cm

Pre shower (+ PID ?) r ~ 180 to 190 cm



Copper Dream calorimeter r ~ 190 to 330 cm

Coil for 2 T field r ~ 330 to 350 cm

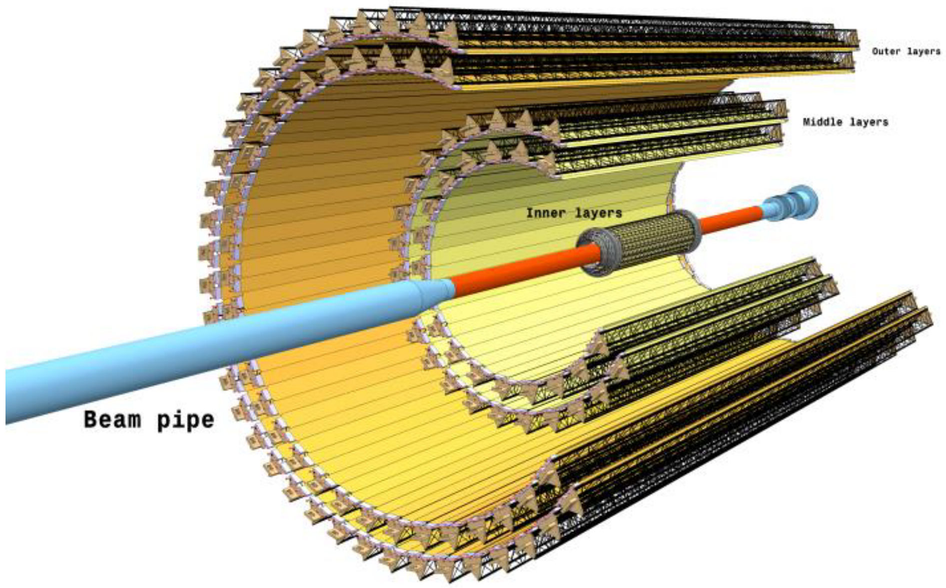
Outer tracking r ~ 350 cm to 1000 cm

Coil for 0.23 T field r ~ 1000 cm

Common requirement of many WGs :
performing vertex detector for b and charm tagging

ALICE ITS :
0.3 -1 % X0/layer
7 layers pixel 30*30 μm
r_max = 40 cm

need * 3 for θ coverage

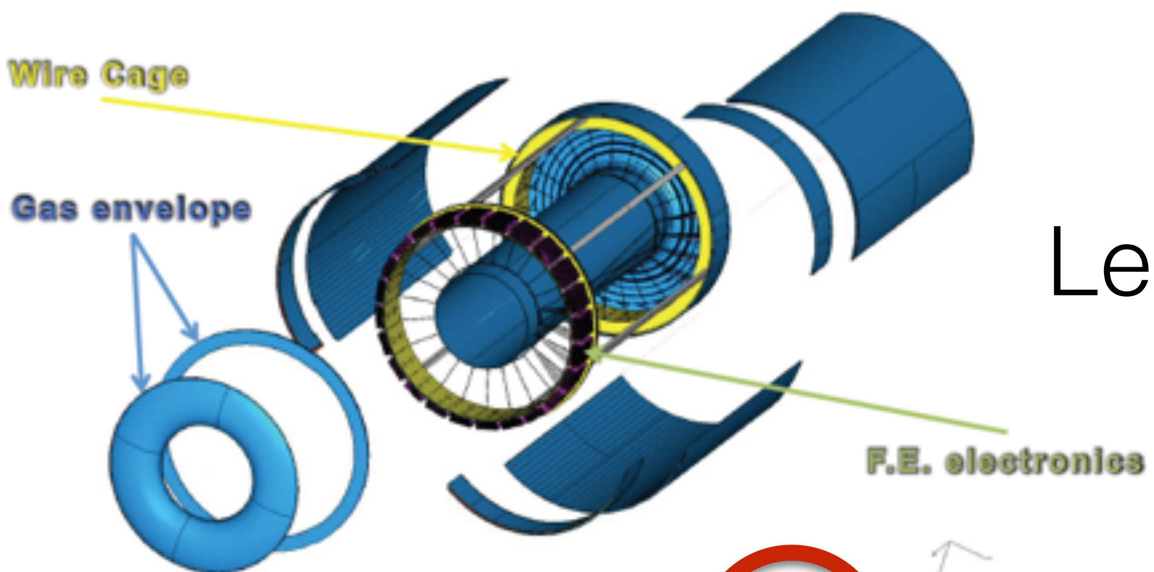


In Alice it is readout at 100 kHz, but can be significantly increased (ref: Walter Snoeys)

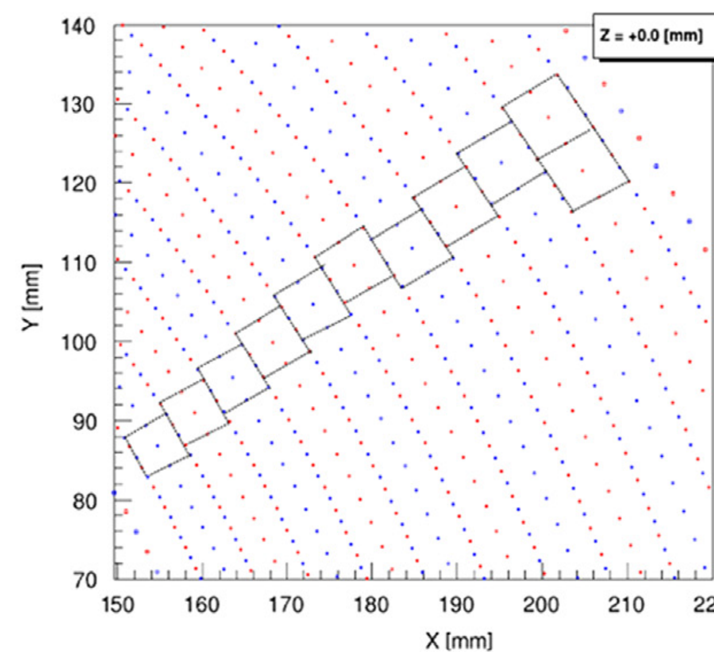
Occupancy will be extremely low. This detector will provide full 3d reconstruction of all charged tracks within angular acceptance and with very low momentum threshold + dE/dx information.

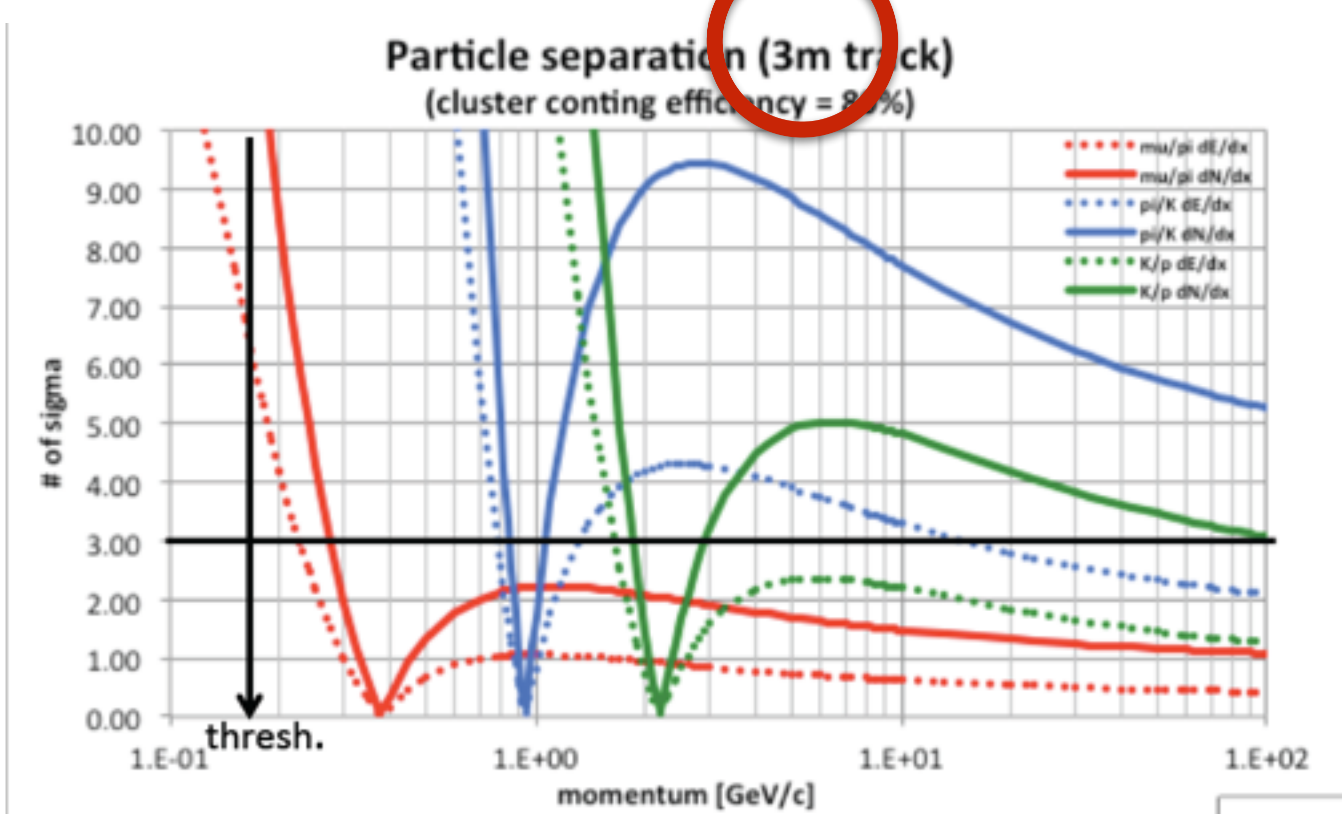
Tracking with redundancy in gas with high precision

5 m long wires drift chambers with ~ 100 points per track
one sense wire every 1.4 cm $\sigma_{xy}\sim$ 100µm $\sigma_z\sim$ 1mm



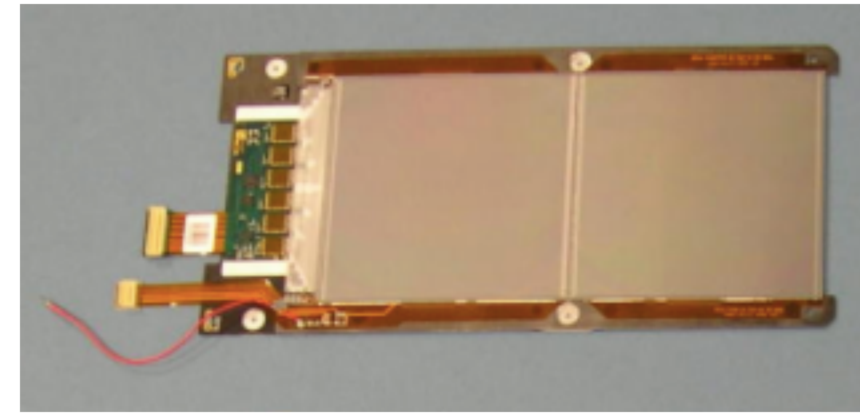
Less than 1% X_0





$dN_{cl}/dx \sim 2\%$

Pre-shower



Lead-silicon sandwich cylinder at R = 180 cm.

- Measures precisely impact points of charged particles and photons.
- Defines the acceptance

4 silicon strips layers with small overlap for alignment and with thin 2-3 mm lead in front

5 m * 1.8 m * 2π = 60 m^2 /layer

Photons from a 100 GeV π^0 are separated by 2 mm

Muon Momentum resolution

Sagitta of a 100 GeV muon with L=1.8 m and B= 2T is **2.4 mm**

7 Measurement at 10 μm from 4 to 40 cm

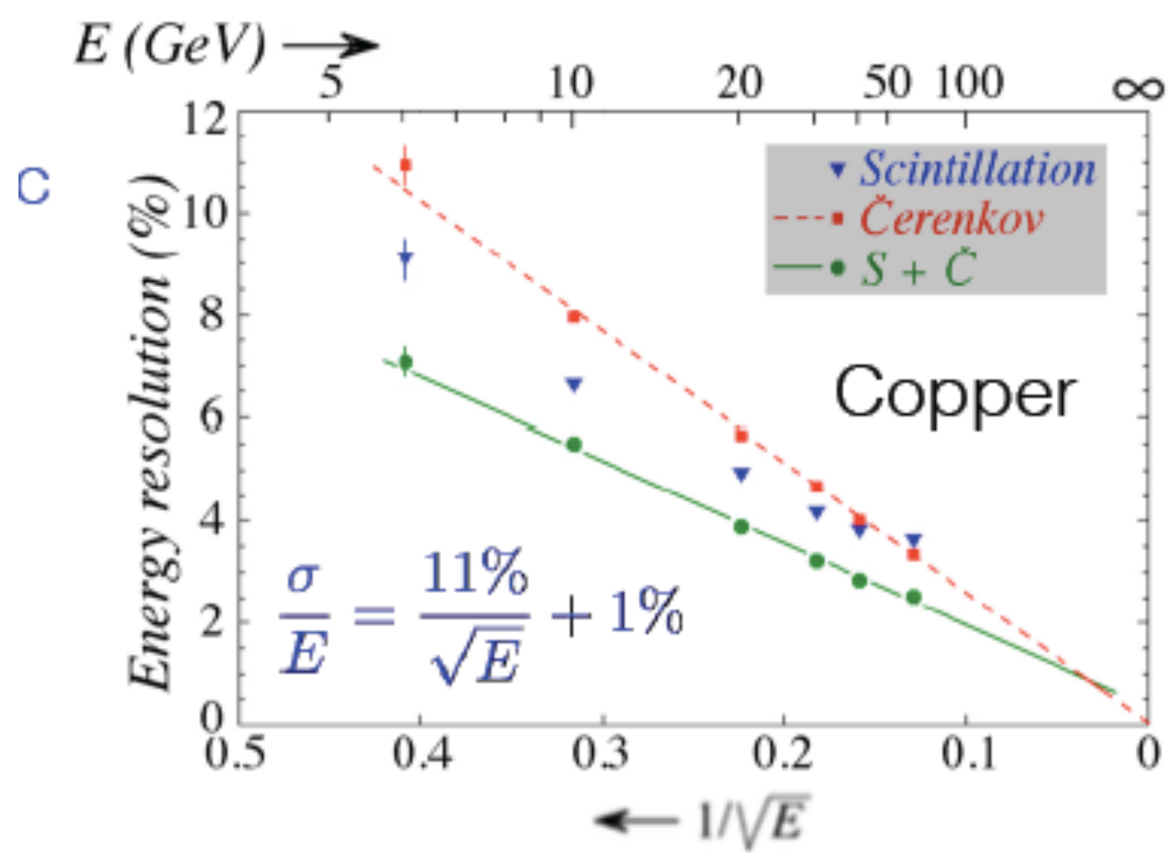
100 Measurements at 100 μm from 40 to 180 cm

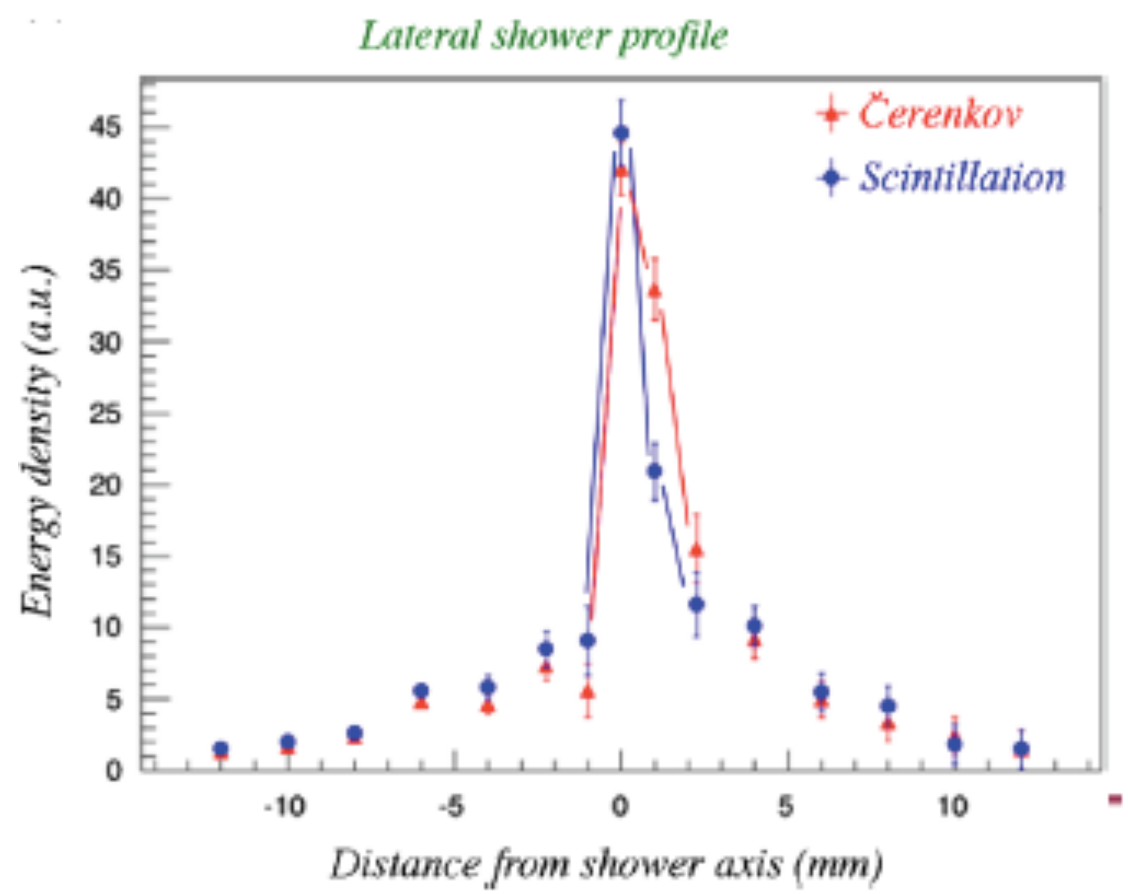
2 Measurements at 20 μm @ 190 cm

Calculation of momentum of resolution requires some simulation

guess estimate $\Delta p_t/p_t \sim 0.3\%$ @ $p_t = 100$ GeV

Dual readout copper calorimeter 140 cm radial depth





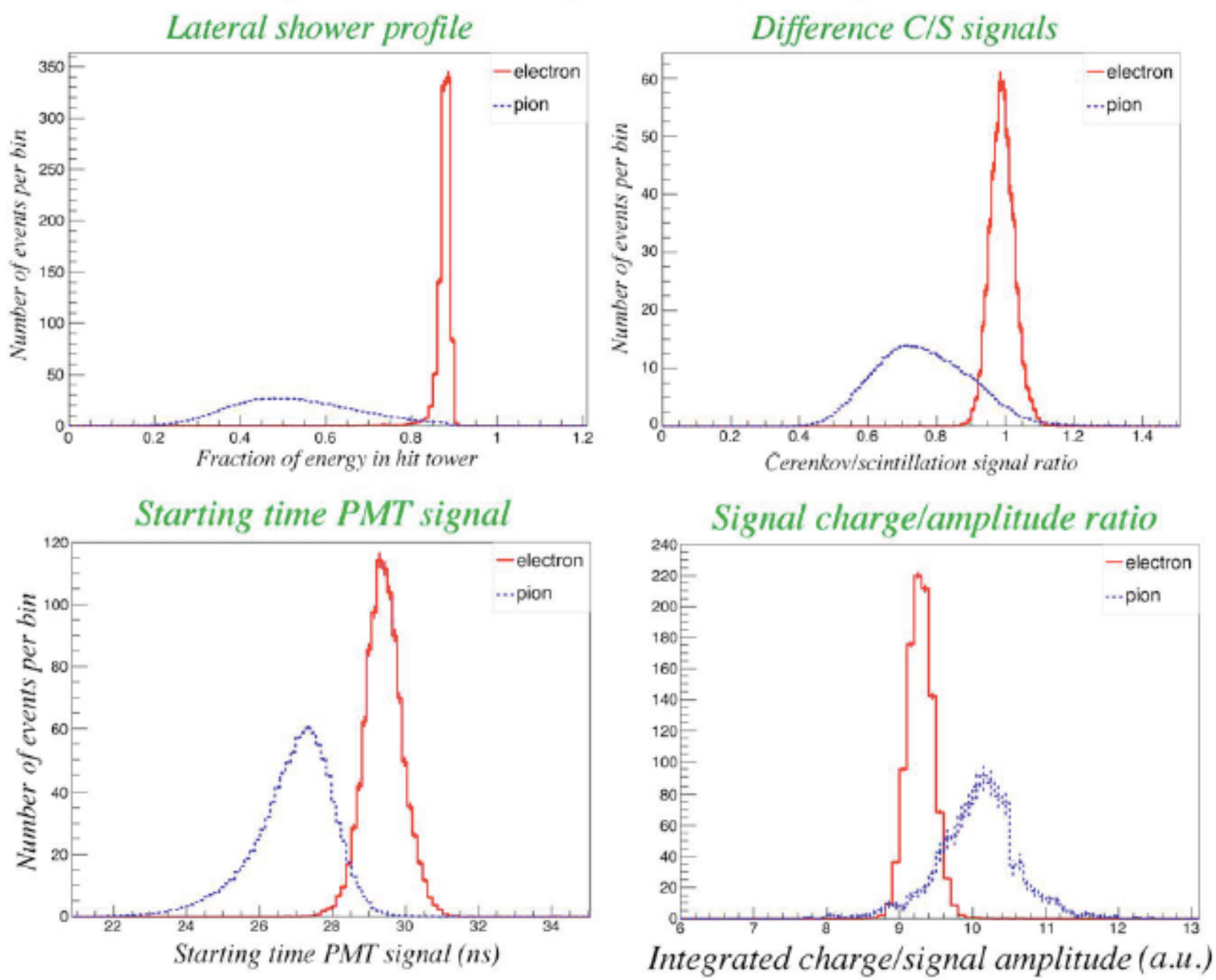
Very good electromagnetic performance

~ 2 GeV resolution on m_h

Dual readout copper calorimeter 140 cm radial depth

Excellent hadron/electron separation

Methods to distinguish e/π in longitudinally unsegmented calorimeter



Combination of cuts: >99% electron efficiency, <0.2% pion mis-ID

Dual readout copper calorimeter 140 cm radial depth

about 7 $\lambda_{interaction}$

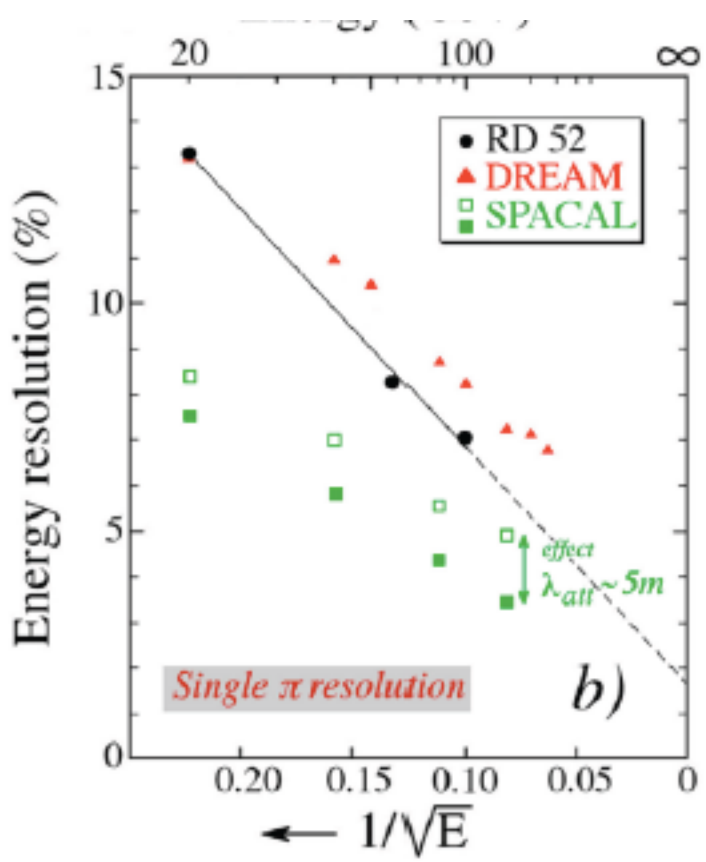
Jet resolution should to be studied with Particle Flow

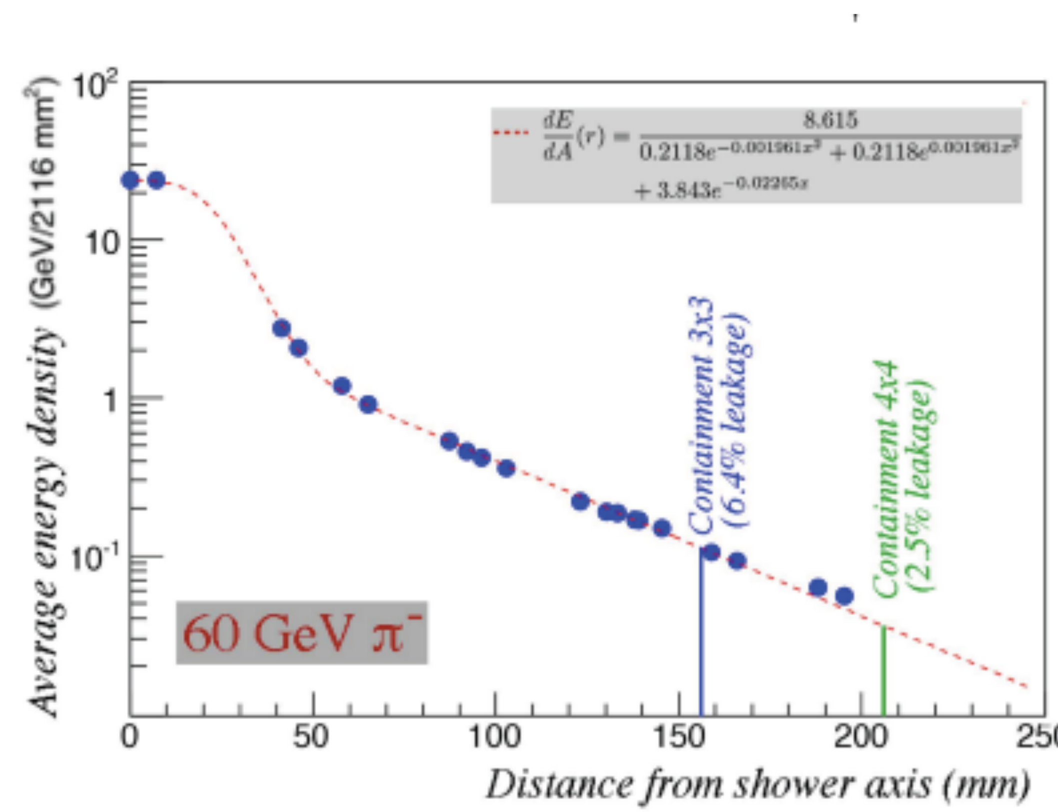
Single particle

Hadronic Resolution
(Pb Module)

$$\frac{\sigma}{E} = \frac{53\%}{\sqrt{E}} + 1.7\%$$

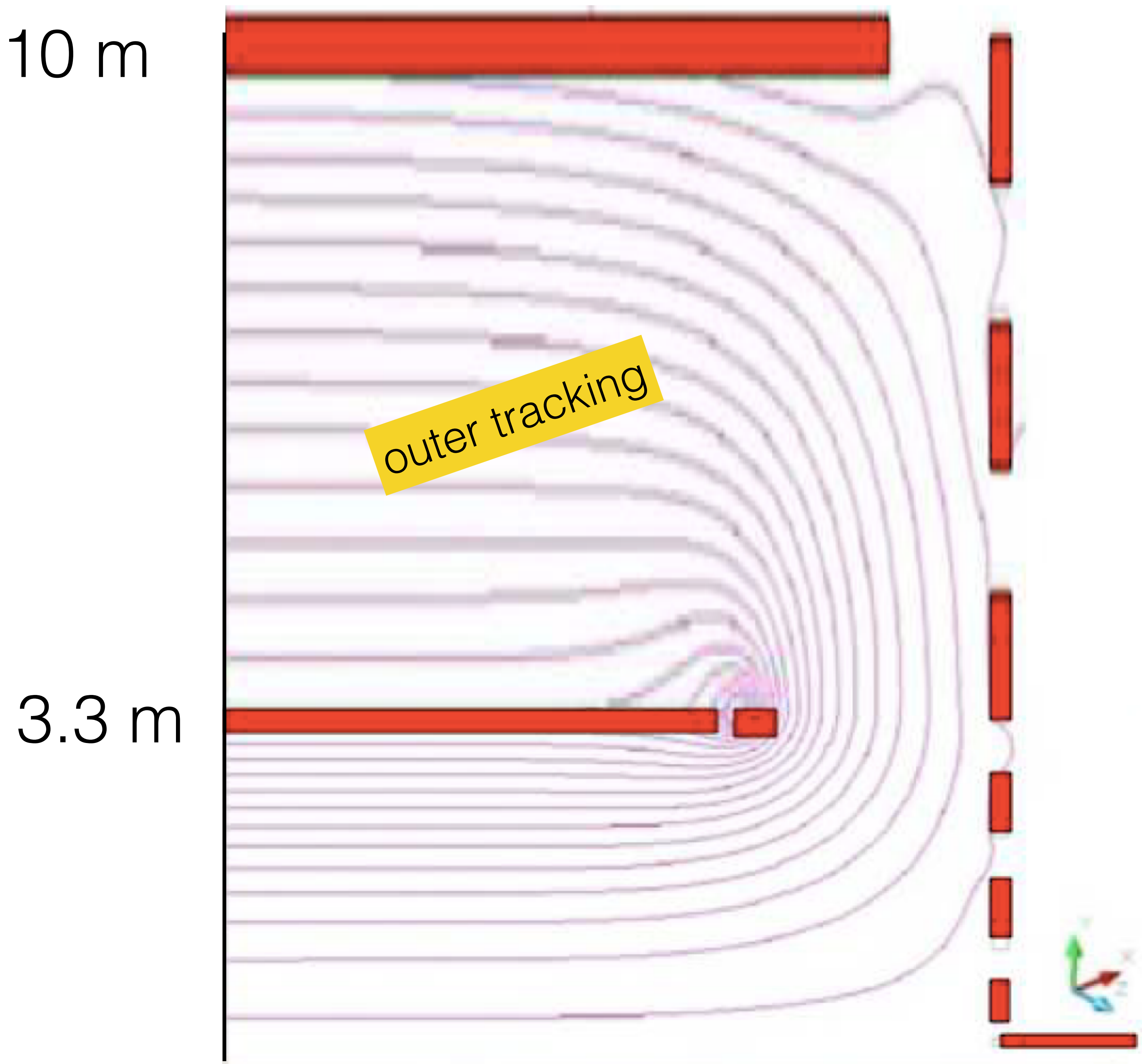
To include corrections on:
- light attenuation
- lateral leakage





4th detector LOI quotes 30%/√E for jets

Muon detection and tracking in low magnetic field



(some of the)

Questions to be addressed by FCCee physics groups

Physics motivations for muon momentum resolution at 100 GeV.
Case for dp/p = 4 - 2 - 1 10^{-3}

How physics reach changes with Jet energy resolution of $a/\sqrt{E(GEV)}$ with a= 50% - 30% - 20% ?

How important is photon separation for tau related measurement (H-> ττ , τ polarization)?.

How important will be the H—>γγ measurement at FCCee (after LHC campagne) ?

Is PID important for charm tagging ? What are the needed PID requirement (pi/k separation and momentum range) ?

2nd mini-workshop on FCC-ee detector requirements

23-24 November 2016
CERN
Europe/Zurich timezone

Search

- Overview
- Scientific Programme
- Timetable
- Contribution List
- My Conference
- Registration
- Participant List

The main goal of this mini-workshop is to get input on detector requirements from the FCC-ee physics working groups.

The secondary goal is to make progress on detector design comparing different technologies. Background rates and status of the development of software tools will be also discussed.

Starts 23 Nov 2016 09:00
Ends 24 Nov 2016 12:00
Europe/Zurich

CERN
40-S2-B01 - Salle Bohr

Do not forget to register asap

Topics to be discussed at the workshop include

- Physics requirements from working groups
- Status of the simulation and how to describe a detector
- Machine detector interface
- Magnets
- ………..