CALICE-ECAL testbeam topics

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Outline

- **Testbeam results** * :
  - : position resolution, tracking performance
  - : response map, inhomogeneity
  - : transverse containment, Moliere radius

* see www.hep.phy.cam.ac.uk/~gmavroma/calice/documents/d051012_talk_desy.pdf

- **Discussion topics** :
  - : user instructions
  - : shift schedule
  - : run planning
  - : testbeam duration
  - : monitoring
  - : data storage
  - : drift chambers
  - : after the testbeam

CALICE-ECAL testbeam at DESY

- **"30%" equipped Si/W prototype**

  : i.e. 14 W layers (10 at 1.4mm + 4 at 2.8mm) interleaved with 18×12 matrix of active Si cells, 1×1 cm^2 each,
  total: 3024 channels

  : first testbeam at DESY with electrons during Jan/Feb05

- **in summary (configurations: position $\times$ energy $\times$ angle)**

  : position scan (center - edge - corner of wafers)
  energy scan (mainly 1, 2, 3 GeV, some runs at 4, 5, 6 GeV)
  angle scan (0°, 10°, 20°, 30°)

  : total: $\sim$ 25 Mevents ($\sim$ 230 GB)

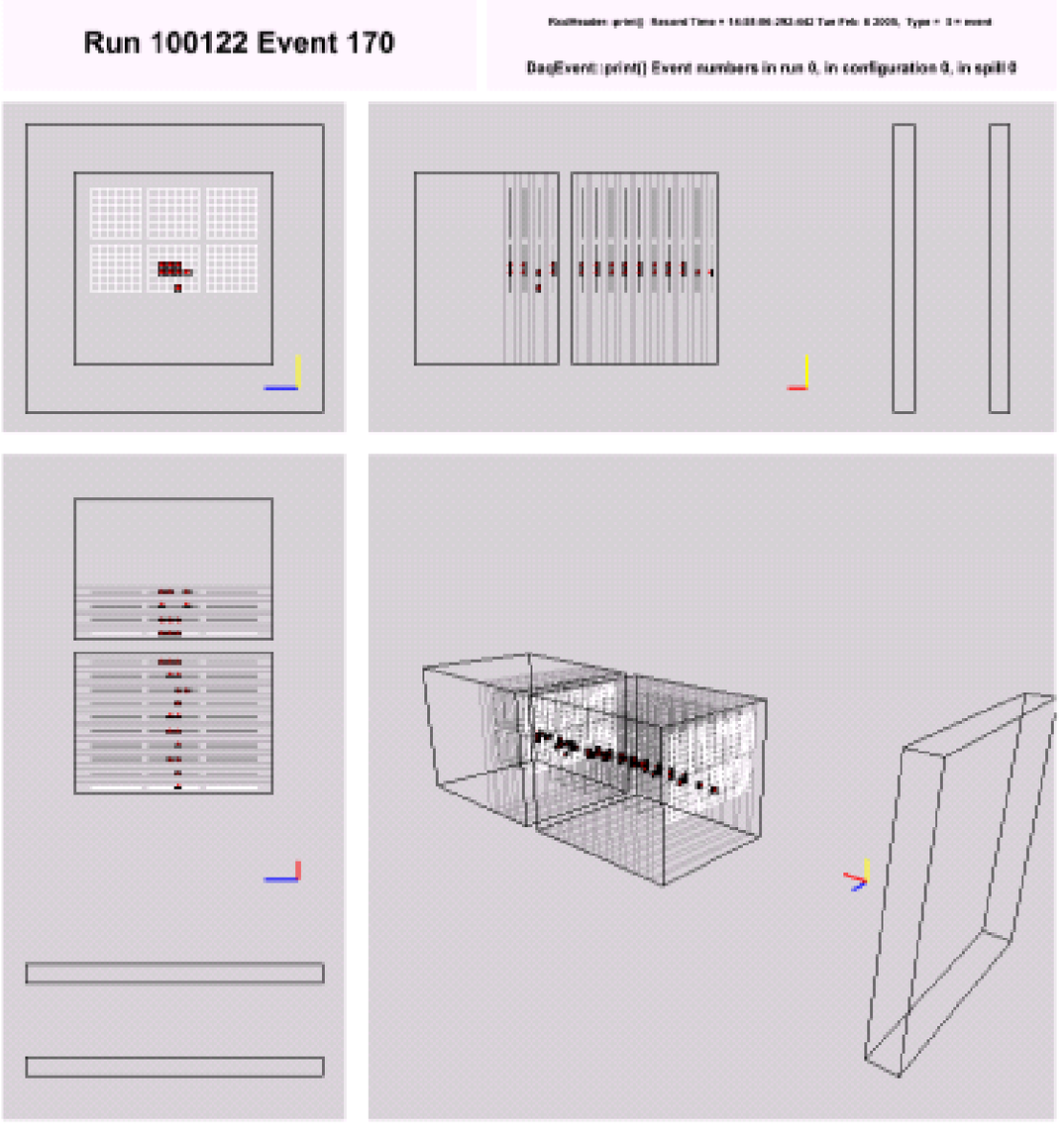
- **next round in xx/2006 with more layers-channels**

Testbeam Summary

week	events (e^- triggers)	time(sec)	average(Hz)	beam (timeON/time)	daq peak(Hz)
1 (Mon 050207 to Sat 050212)	5554662	425 10^3	13.07 Hz	$\sim$ 65%	$\sim$ 20 Hz
2 (Tue 050215 to Fri 050218)	4133217	290 10^3	14.25 Hz	$\sim$ 48%	$\sim$ 30 Hz
3 (Mon 050221 to Thu 050224)	5703056	255 10^3	22.36 Hz	$\sim$ 64%	$\sim$ 35 Hz

- **in total 12 days at 15.5 Hz**
- **equivalent to 8 days at 23 Hz**

"Tracking Calorimetry"

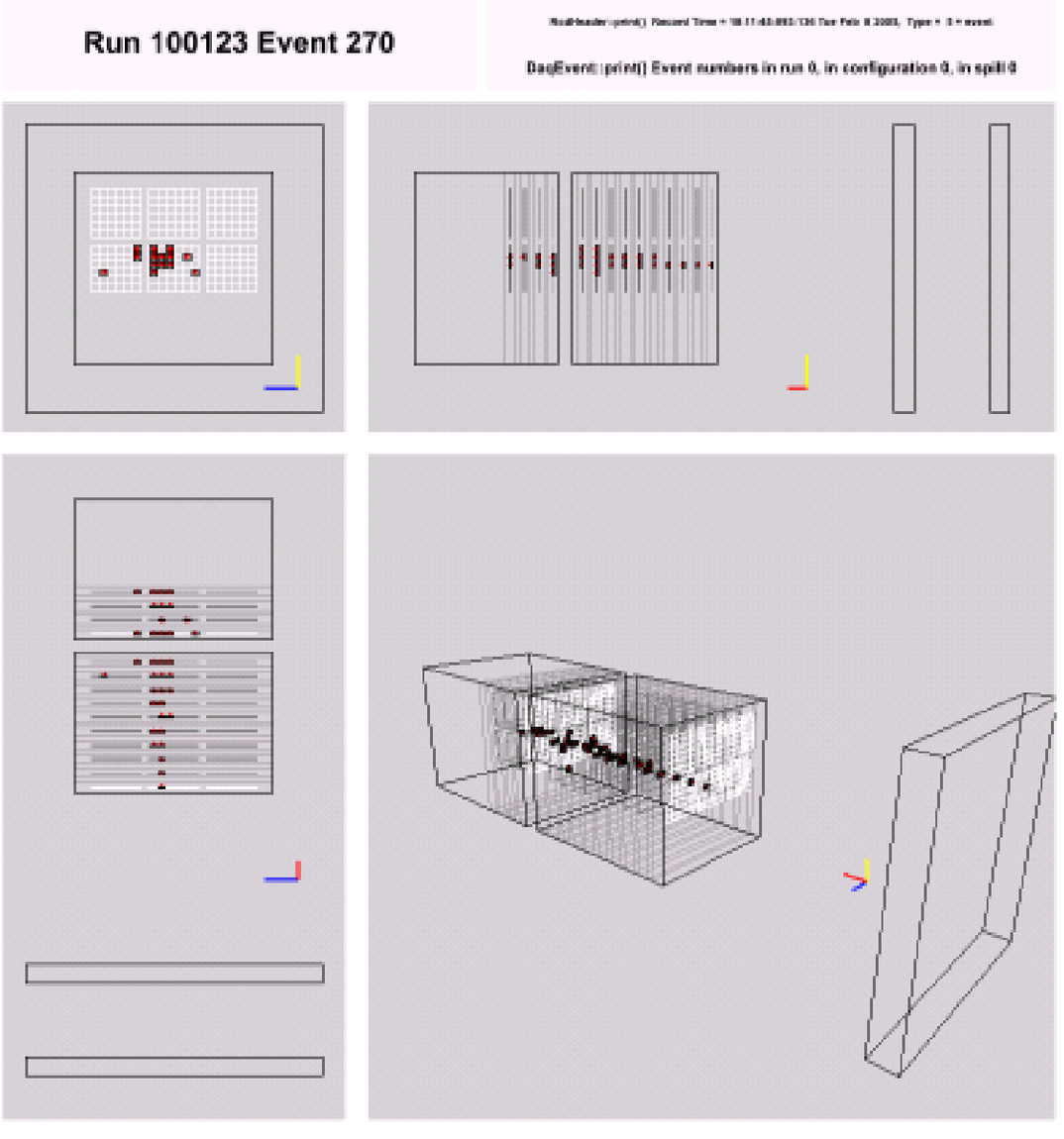


(not to scale)

e^- 1 GeV

cell threshold = 0.5 mip

"Tracking Calorimetry"

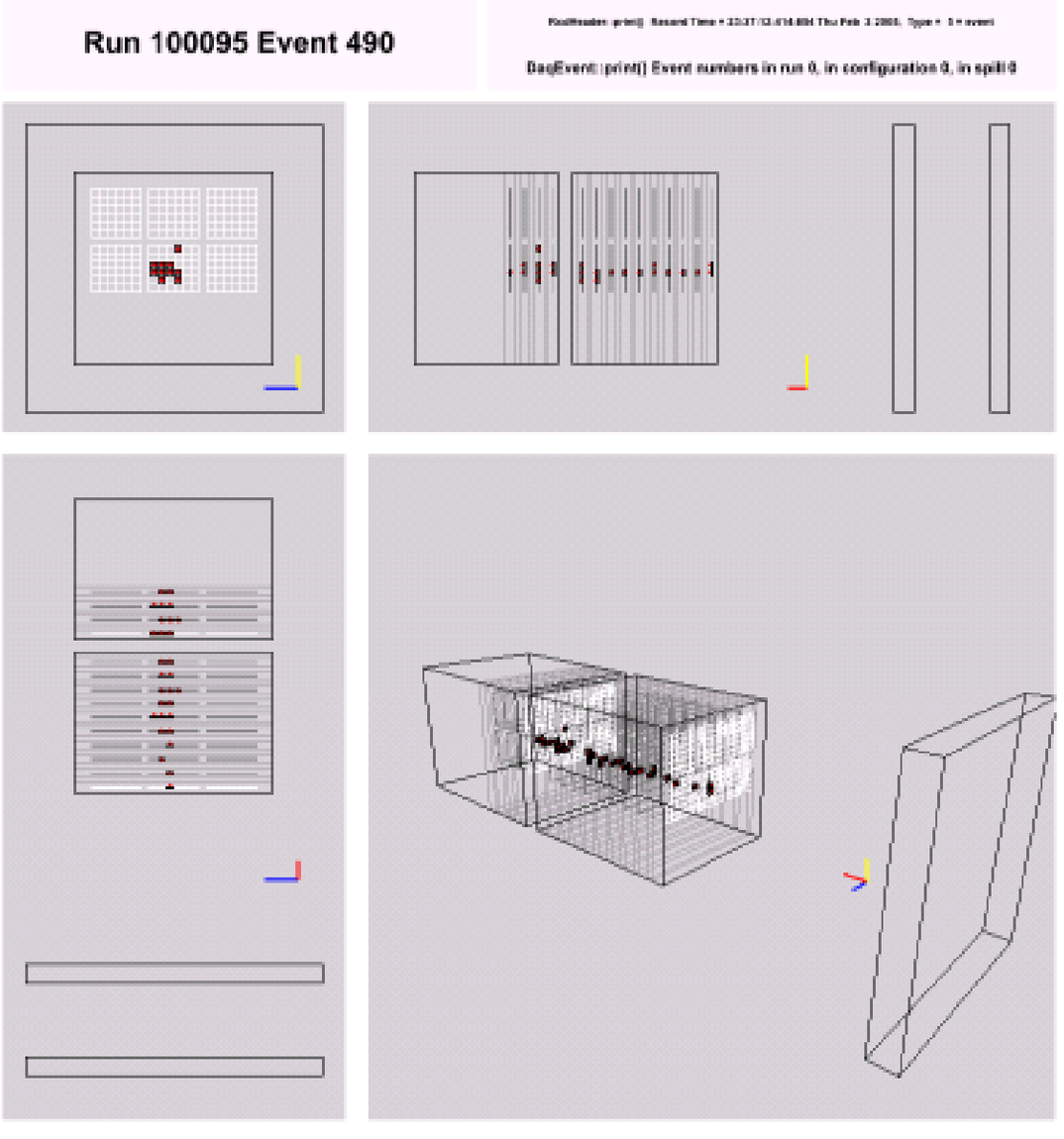


(not to scale)

e^- 2 GeV

cell threshold = 0.5 mip

"Tracking Calorimetry"

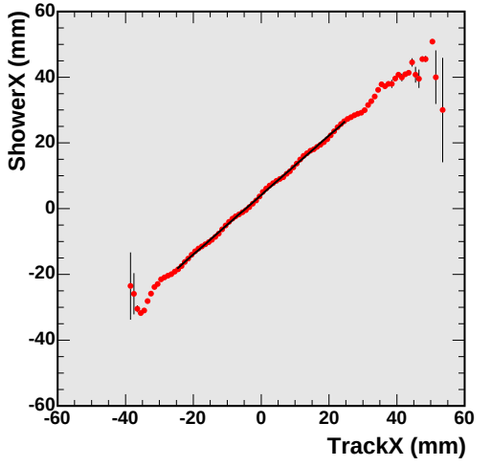


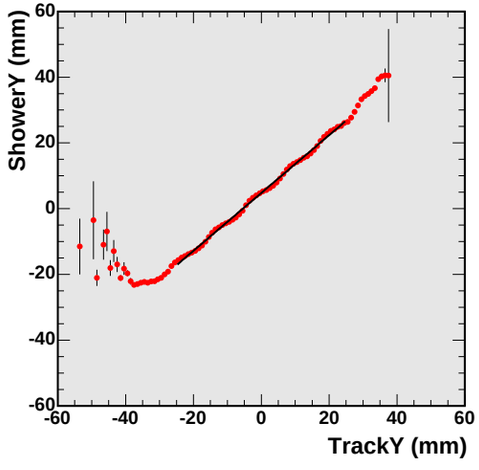
(not to scale)

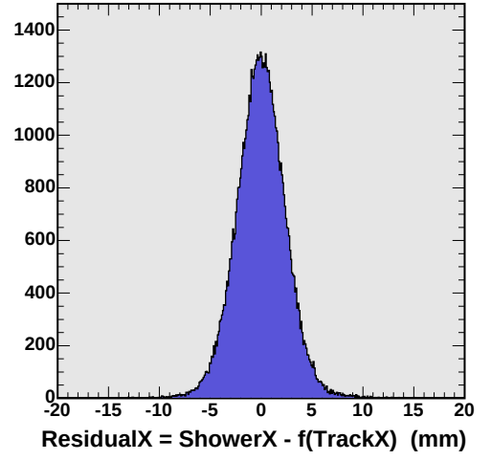
e^- 3 GeV

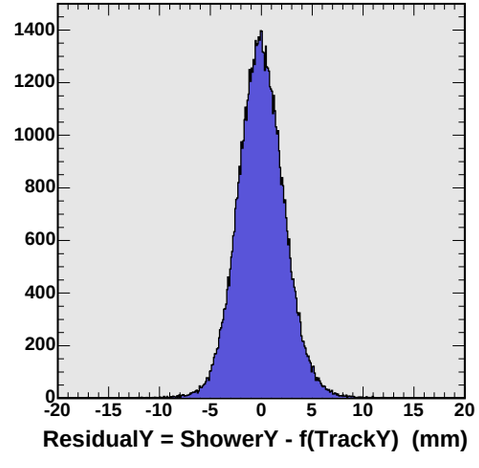
cell threshold = 0.5 mip

Tracking - Residuals



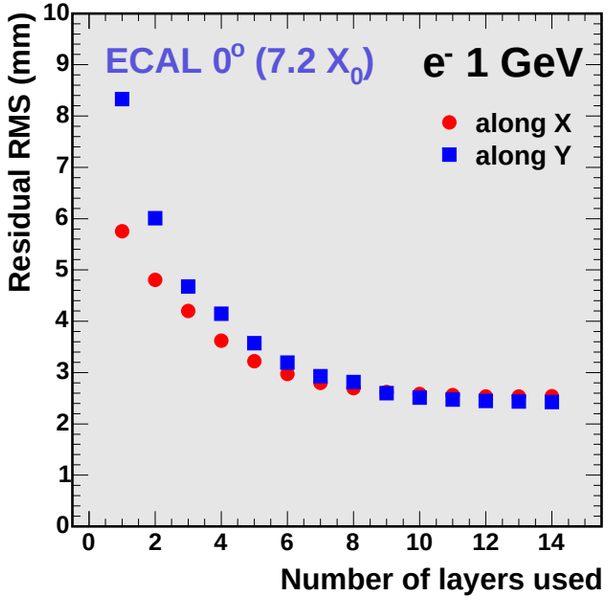


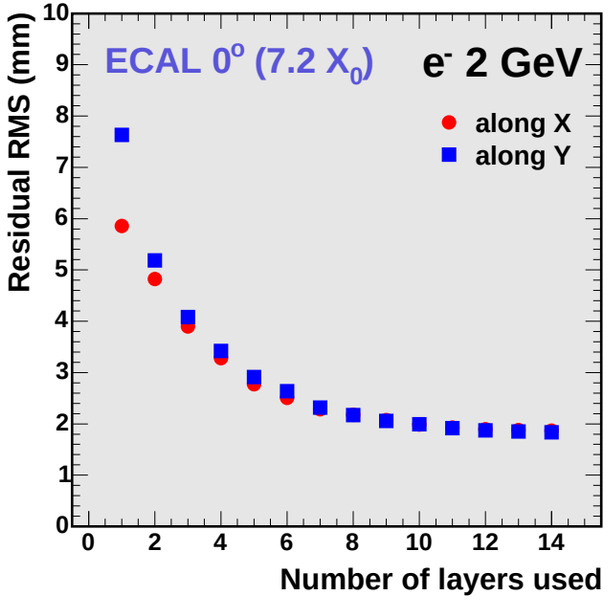


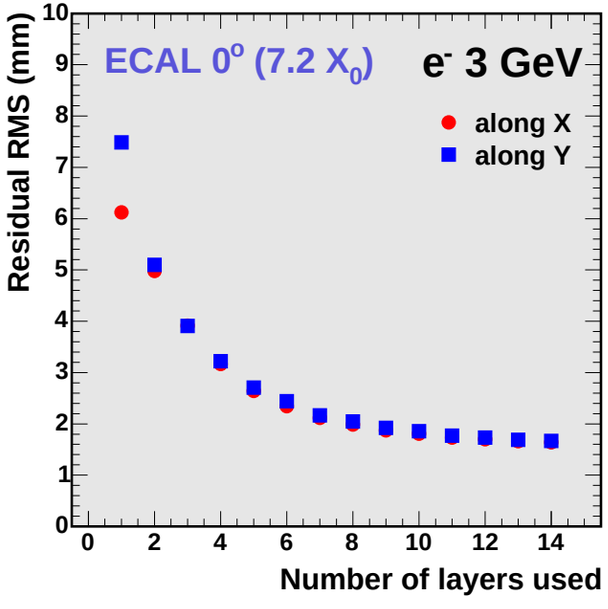


- **ShowerX,Y from barycenter in ecal**
- **TrackX,Y from 4 drift chambers**

Position resolution

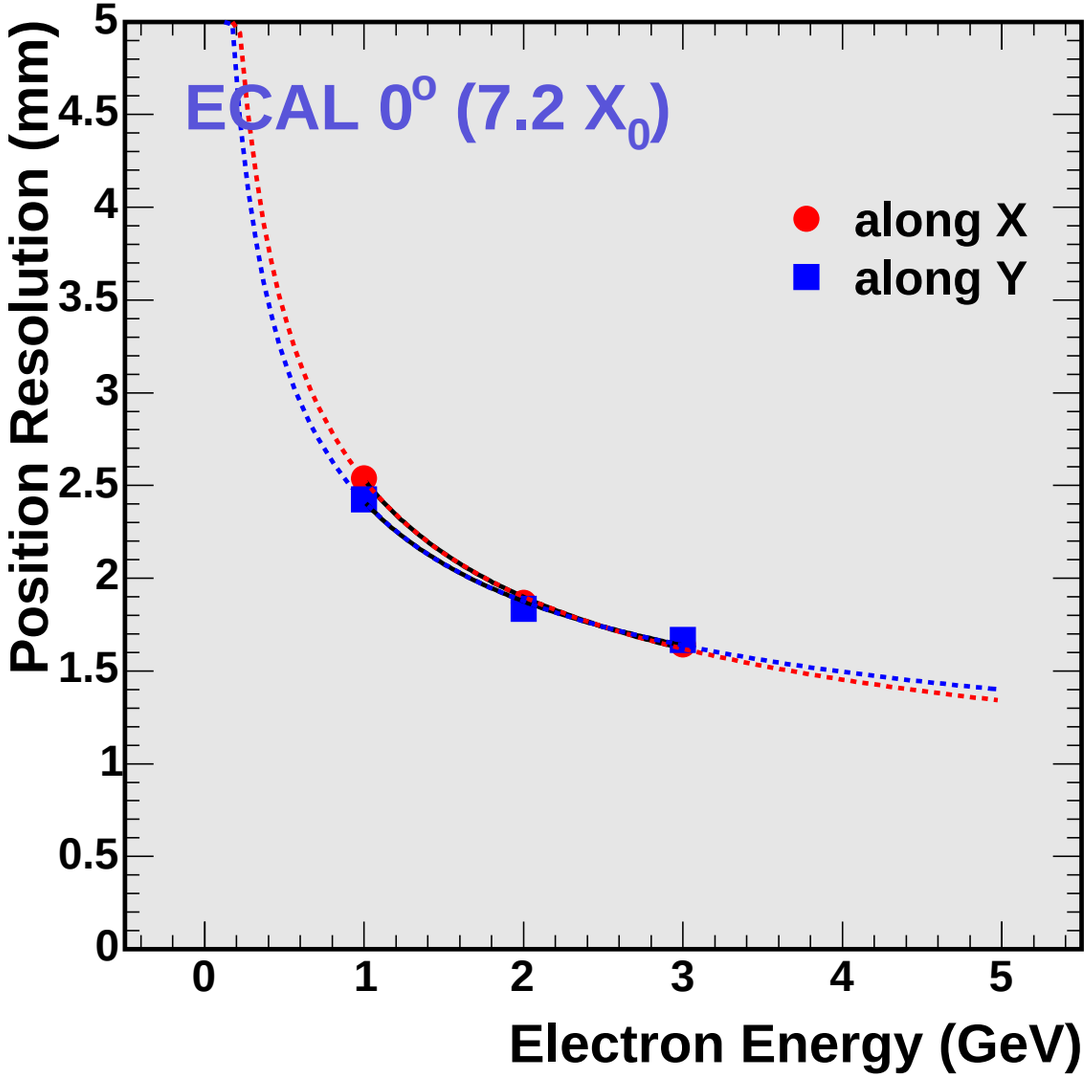






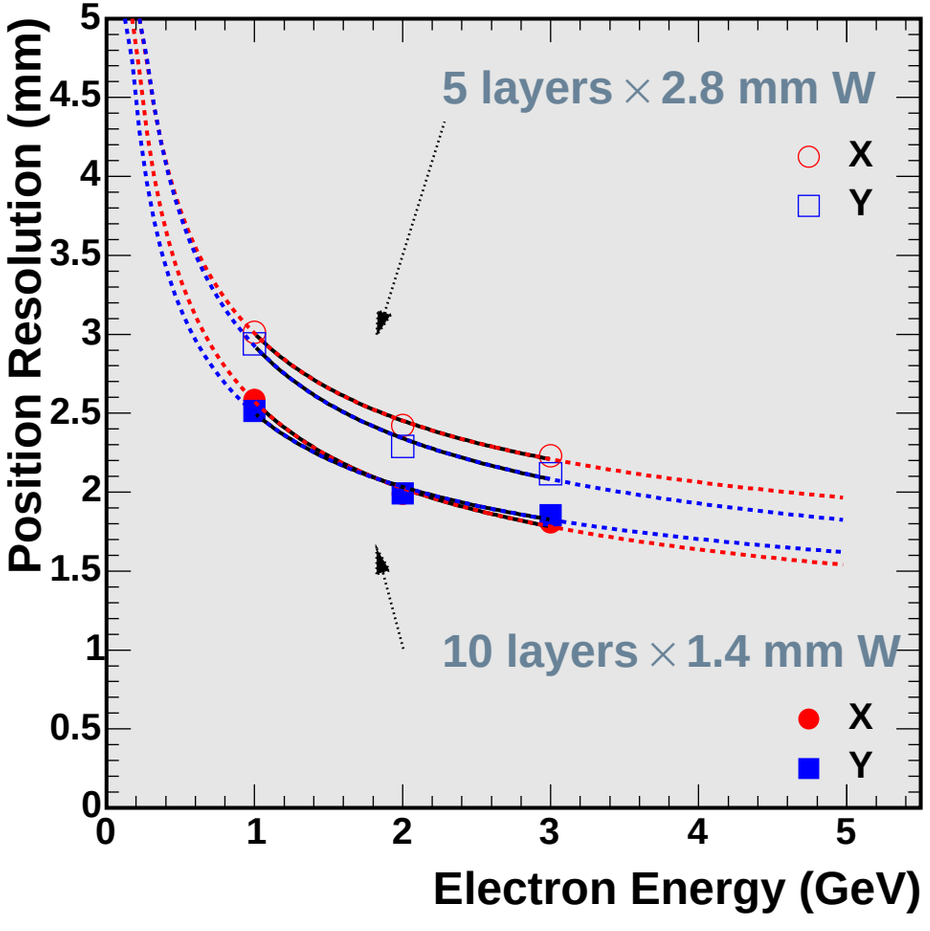
▷ **Residual RMS as a function of the number of ecal layers used**

Position resolution



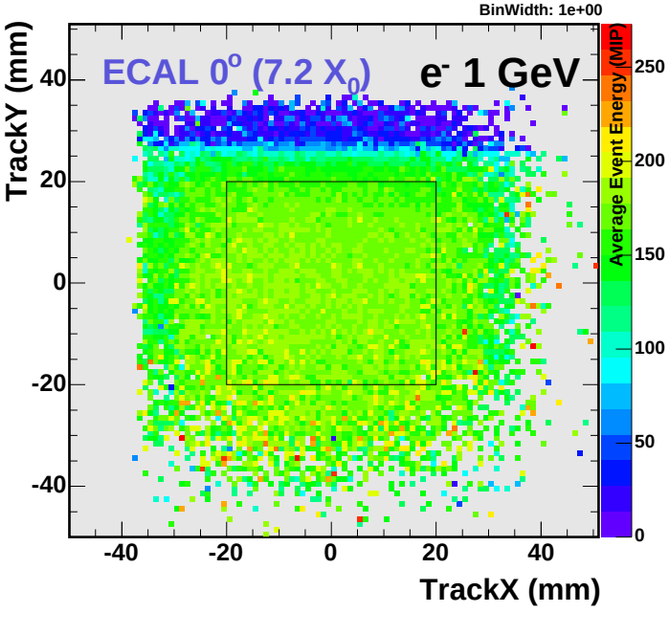
▷ **highly granular ECAL** ⟶ **excellent position resolution**

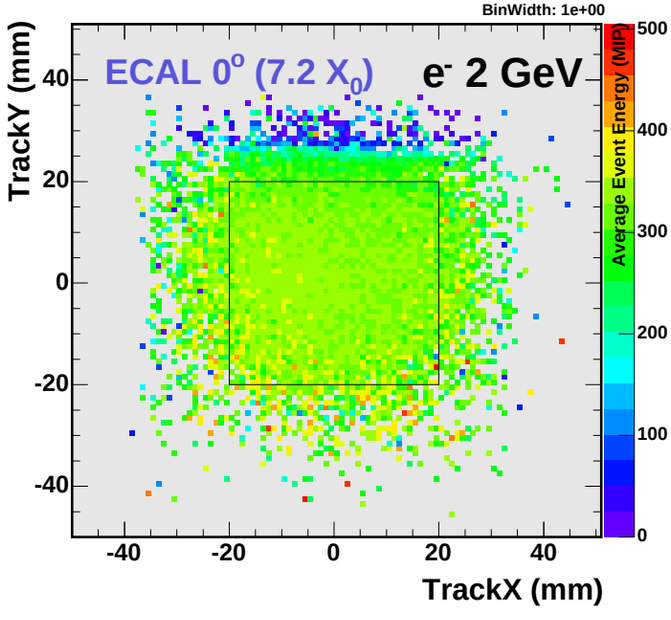
Position resolution - undersampling

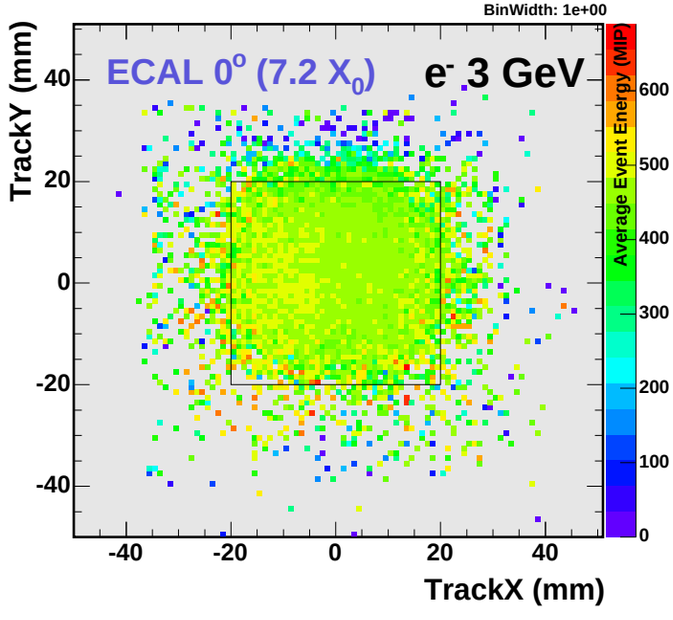


- do tracking by using only hits from every 2nd layer
- to investigate the tracking performance of an ecal with 5 layers × 2.8 mm W
  (instead of 10 layers × 1.4 mm W)
- expect position resolution to degrade by factor $\frac{\sigma_5}{\sigma_{10}} \approx \frac{\sqrt{10}}{\sqrt{5}}$

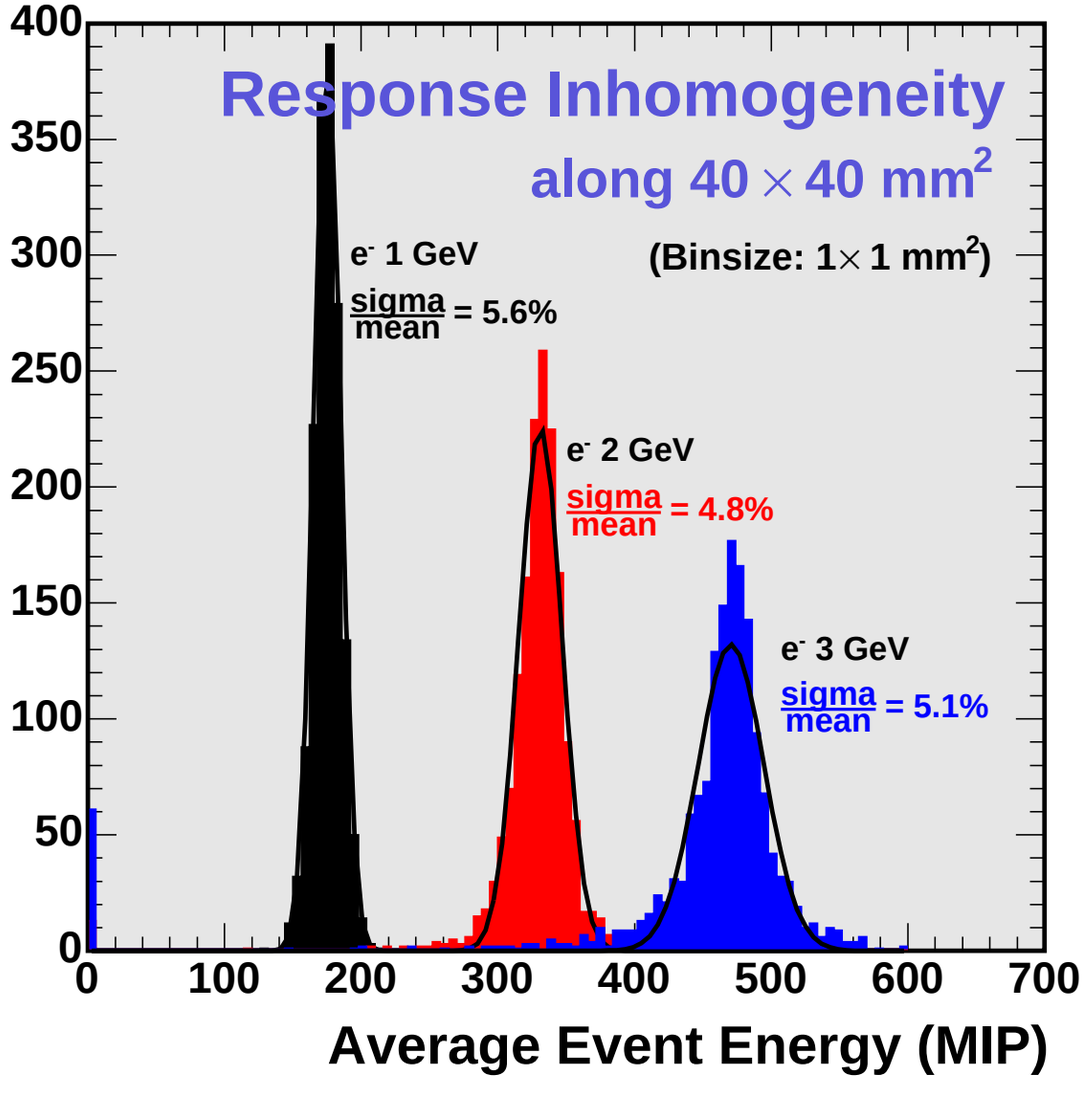
Response map - center of wafer





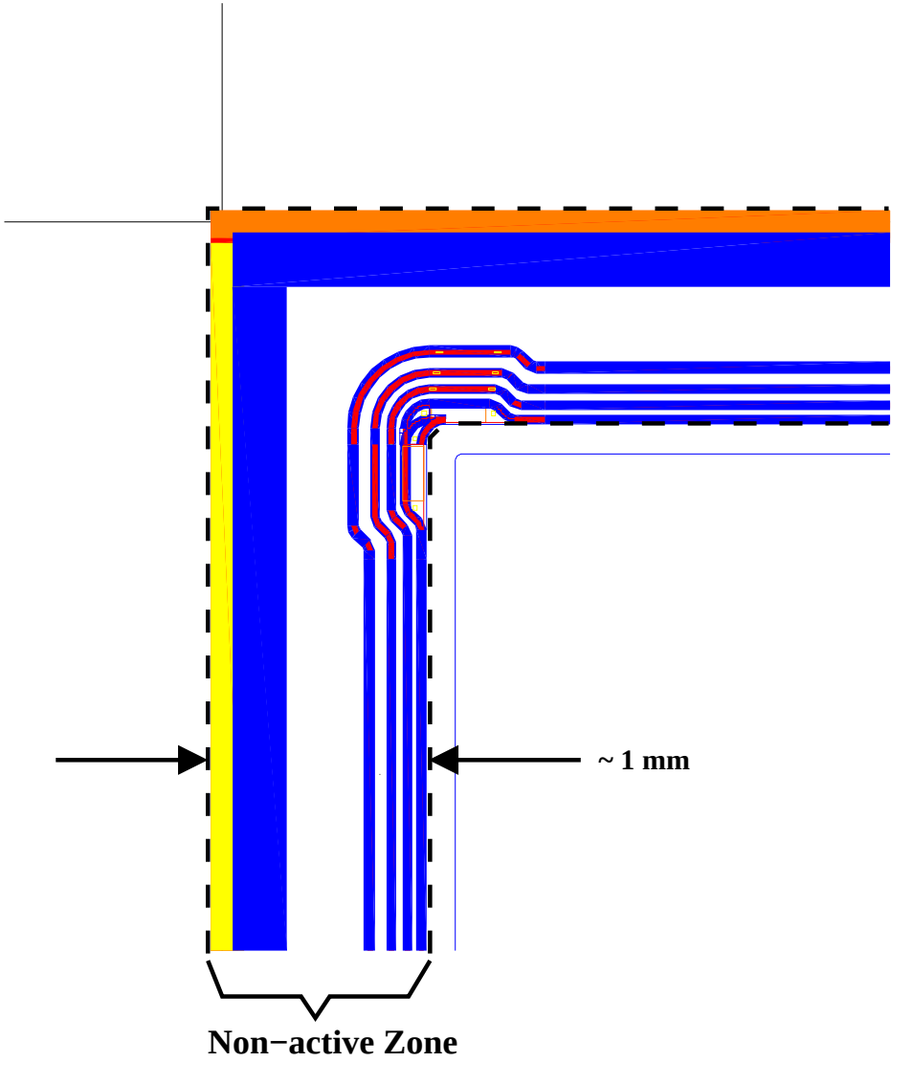


Response Inhomogeneity



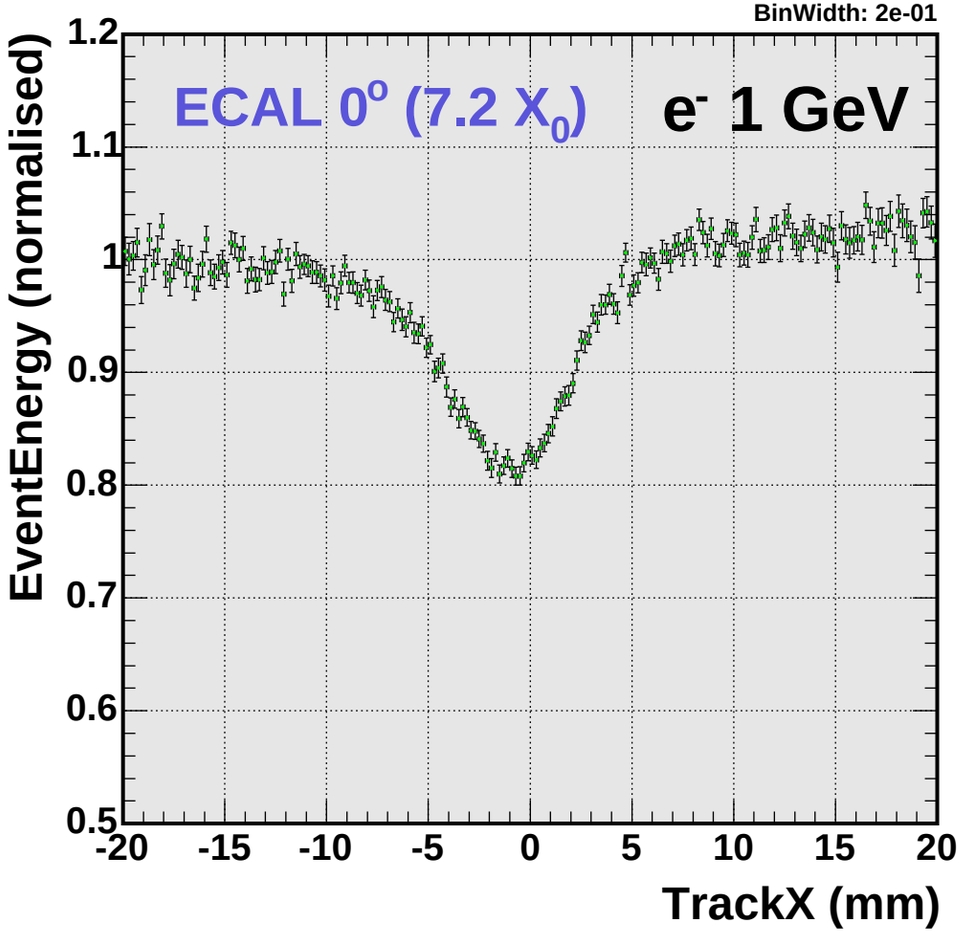
▷ **response variation around the center of wafer**

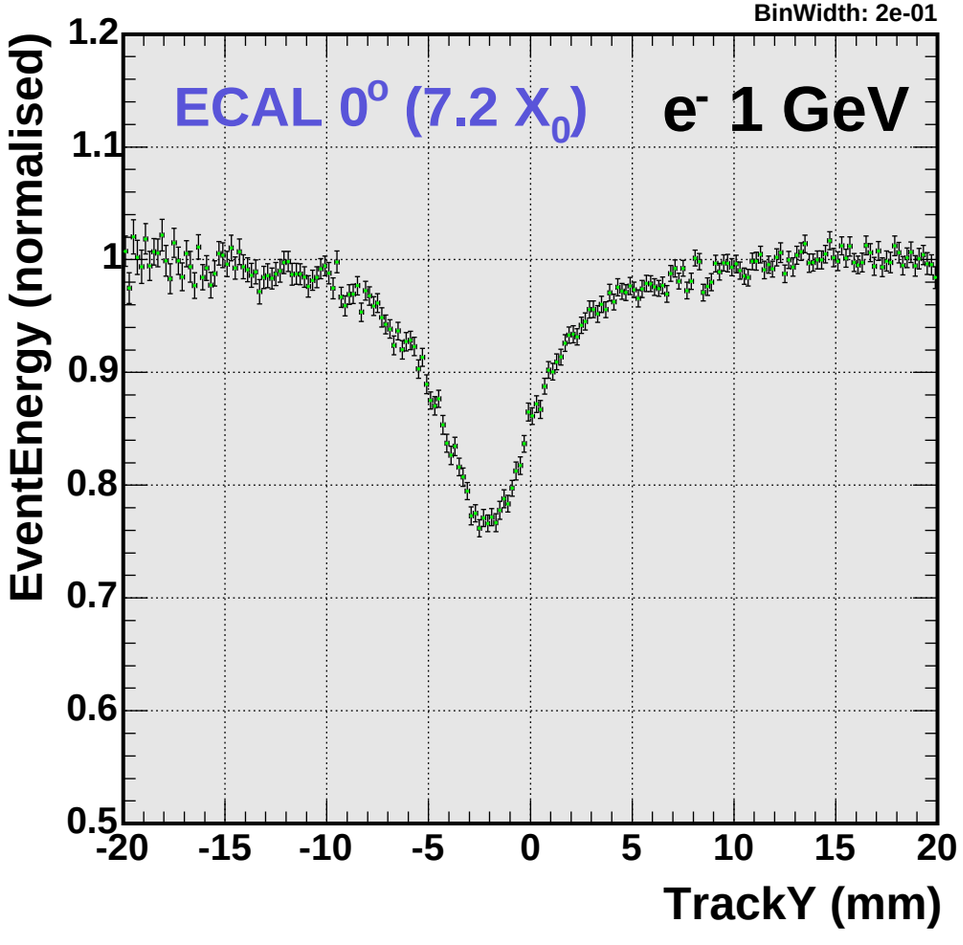
Wafer border



▷ **(C.LoBianco, LC-DET-2004-007)**

Position scan along wafer borders

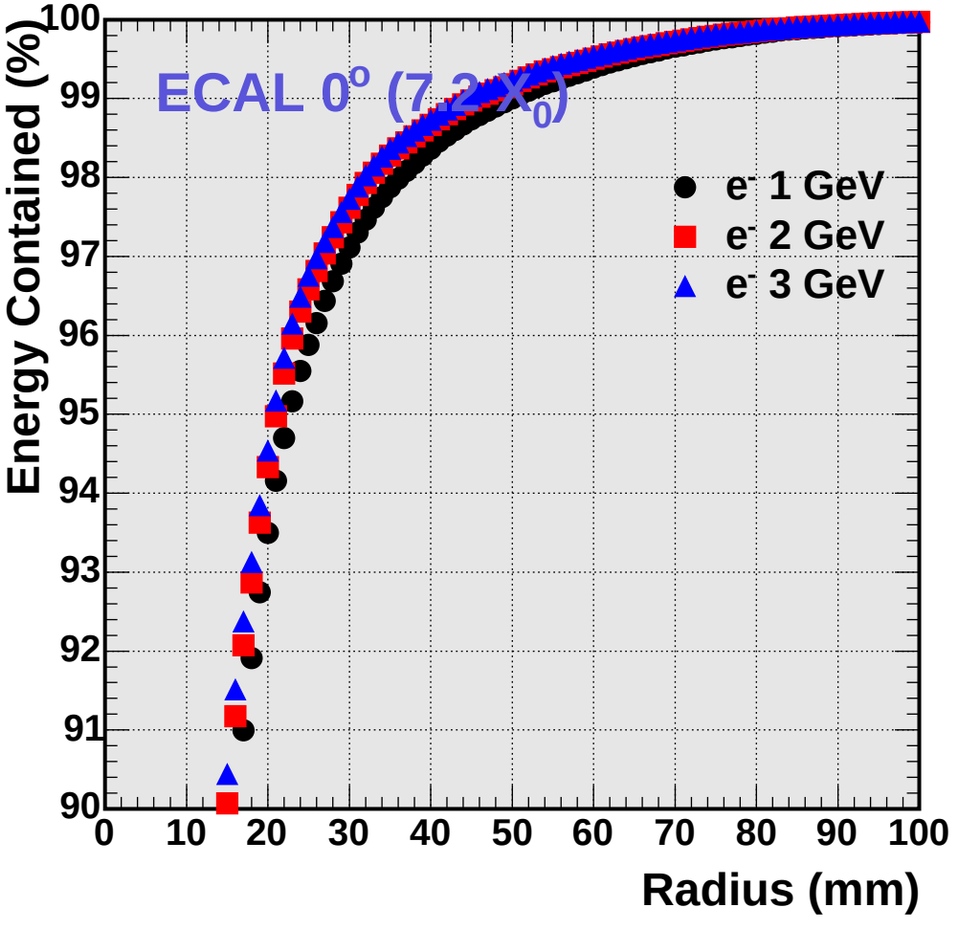


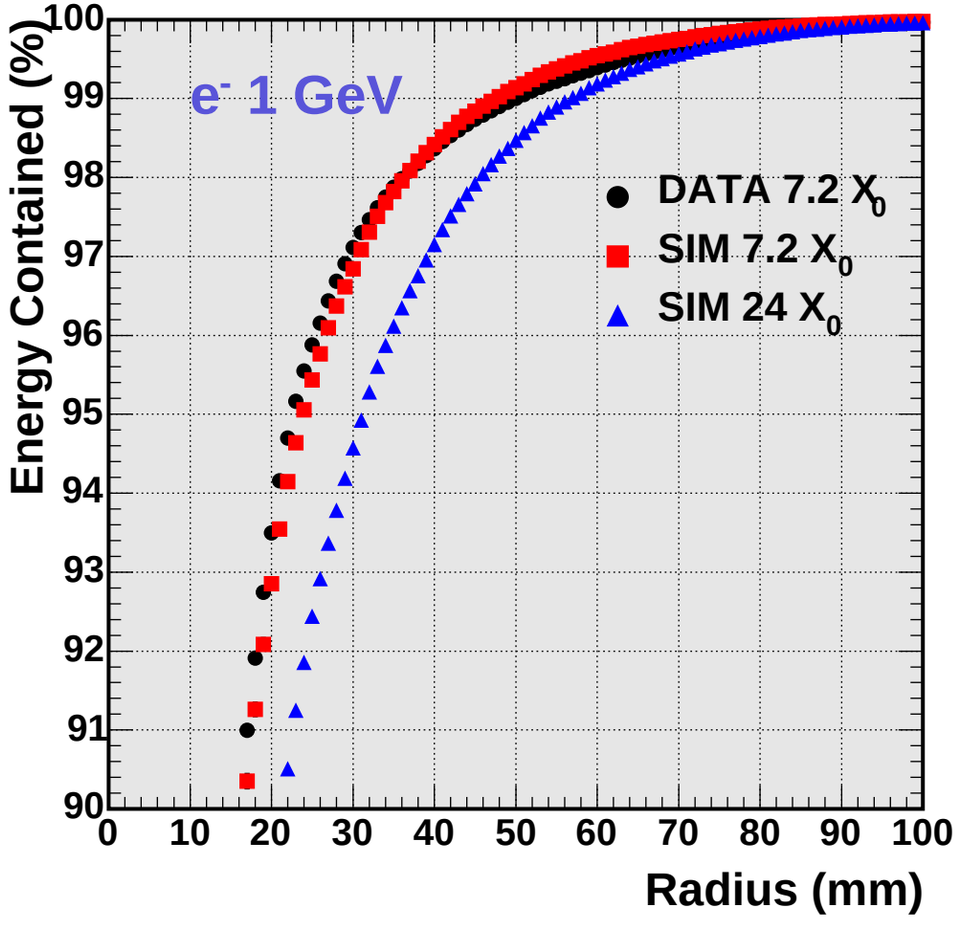


- alternate layers staggered along X (by 2.5 mm)
- dip is shallower and wider

- layers not staggered along Y
- dip is deeper and narrower

Transverse containment (Moliere radius)





▷ **e.g. 1 GeV e^- shower "contained" at**

: 90% within radius 16 mm
: 95% 23 mm
: 99% 50 mm

▷ **data-simulation comparison**

▷ **results expected for the 24 X_0 prototype**

REMINDER: **for an infinitely long and wide calorimeter**
shower contained at 90% within radius $\sim 1\ R_M$
95% $\sim 2\ R_M$
99% $\sim 3.5\ R_M$

(for solid W, $R_M \simeq$ 10 mm)

Topics for discussion

- . user instructions
- . run planning
- . monitoring
- . drift chambers
- . shift schedule
- . testbeam duration
- . data storage, backup
- . after the testbeam

- **user instructions (hardware)**

  : leaflet with basic instructions on how to run the system

  : update and refine (trouble shooting, key contacts etc.)

- **user instructions (software)**

  : a complete mess, almost a "no-go" area for non experts

  : bundle packages, howto's, key instructions in one "box"
  with proper support and proper maintenance

- **run planning**

  : priority list

  : basic schedule (when everything goes reasonably fine)
  AND
  thin/fat versions (when everything goes terribly bad/well)

- **monitoring**

  : we had NO proper monitoring

  : need additional pc's for data processing/histogramming, webcasting key plots/parameters

- **drift chambers**

  : flammable gas

  : 24hr gas flushing before turn on

- **shift schedule**

  : IT WAS A BIG PROBLEM !

  : may improve with shorter testbeam time
  AND
  better planning (e.g. at least 1 month in advance)

- **testbeam duration**

  : it lasted 18 days = 3 days flushing gas + 3 days off + 12 days data taking

  : "one go" equivalent of 13 days (1 day flushing gas + 12 days data taking)

  : if possible, keep duration short to focus limited manpower

- **data storage, backup**

  : during data-taking we had a rsync relay from DESY to ICL to LLR

  : use local mass storage system (dcache at DESY, castor at CERN)

  : note finally will be 4 versions of data
  : **"raw"**
  : **"raw-converted"**
  : **"reconstructed"**
  : **"simulation"**

- **after the testbeam**

  : a lot of effort put on having a successful testbeam run

  : AND THEN
  complete silence/lack of interest on analysis of the data !
  WHY ?