CALICE Si/W ECAL prototype, first testbeam results

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Outline

- ▶ **General**

- ▶ **Si/W prototype**

- ▶ **First testbeam results**

- ▶ **Summary**

General

▶ . **particle flow paradigm**

: highly granular EM and HADR calorimeters to allow very efficient
pattern recognition for excellent shower separation and pid
within jets to provide excellent jet reconstruction efficiency

▶ . **CALICE ECAL(Si/W) and HCAL(Scint/Fe, RPC/Fe) prototype
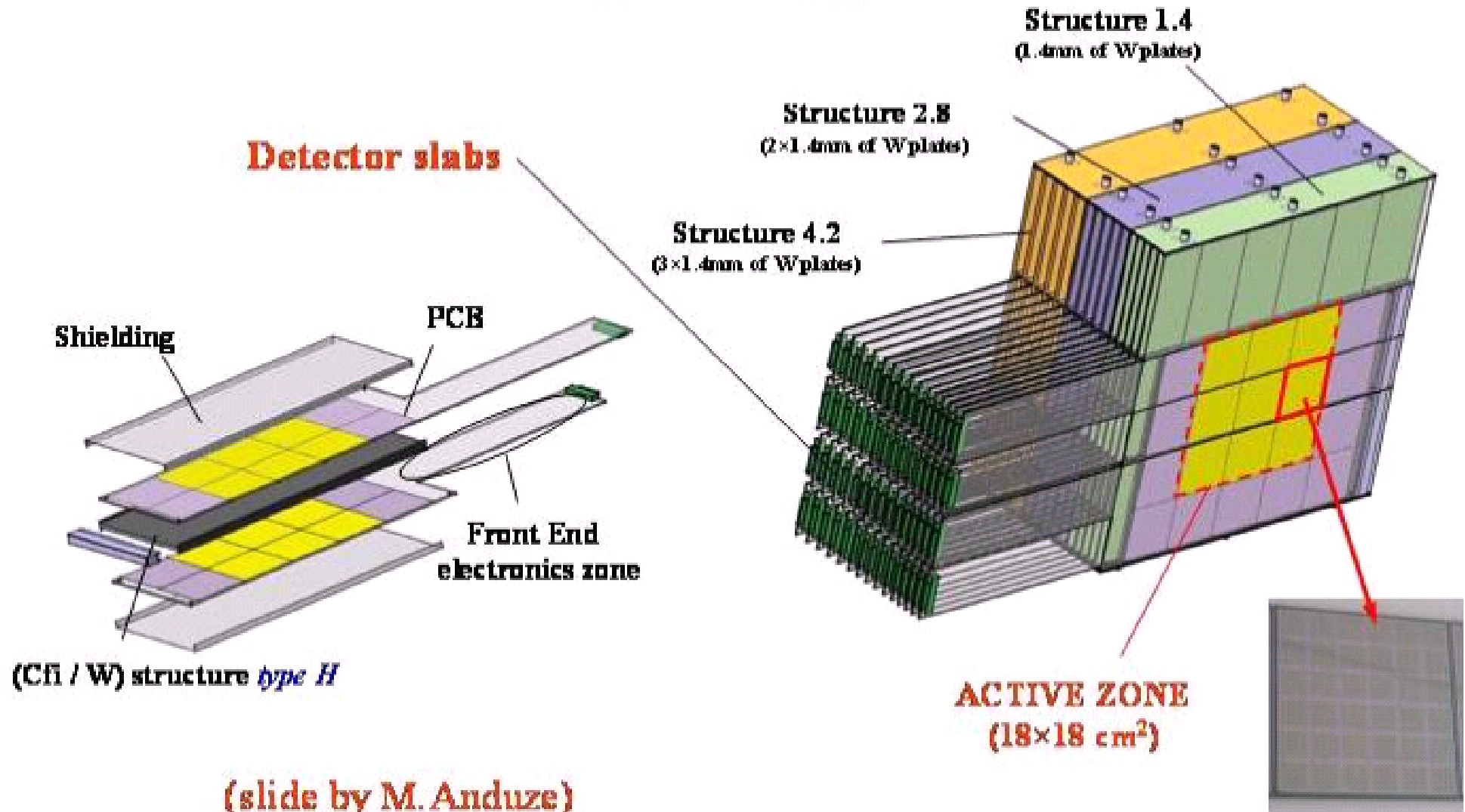studies**

: debug technology/detector concept(s)

: detector characterisation

: test "particle flow paradigm", interplay between hard/soft-ware

: test-validate-improve simulation codes and shower packages

▶ . details about CALICE Si/W ECAL protoype follow

CALICE ECAL prototype

Structure 1.4
(1.4mm of W plates)

Structure 2.8
(2×1.4mm of W plates)

Structure 4.2
(3×1.4mm of W plates)

Detector slabs

PCB

Shielding

Front End electronics zone

(Cfi / W) structure *type H*

ACTIVE ZONE
(18×18 cm²)

Si Wafer :
6×6 pads of detection
$(10 \times 10 \text{ mm}^2)$

(slide by M. Anduze)

full Si/W prototype (24 X_0)

▷ **30 layers $\times$ 18 cm $\times$ 18 cm interleaved with 0.5 mm Si pads**

▷ **W absorber, 10+10+10 layers, 1.4 mm:2.8 mm:4.2 mm thick per respective layer**

▷ **readout by 1 $\times$ 1 cm^2 cells, total: 9720 channels**

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 × energy × angle)**

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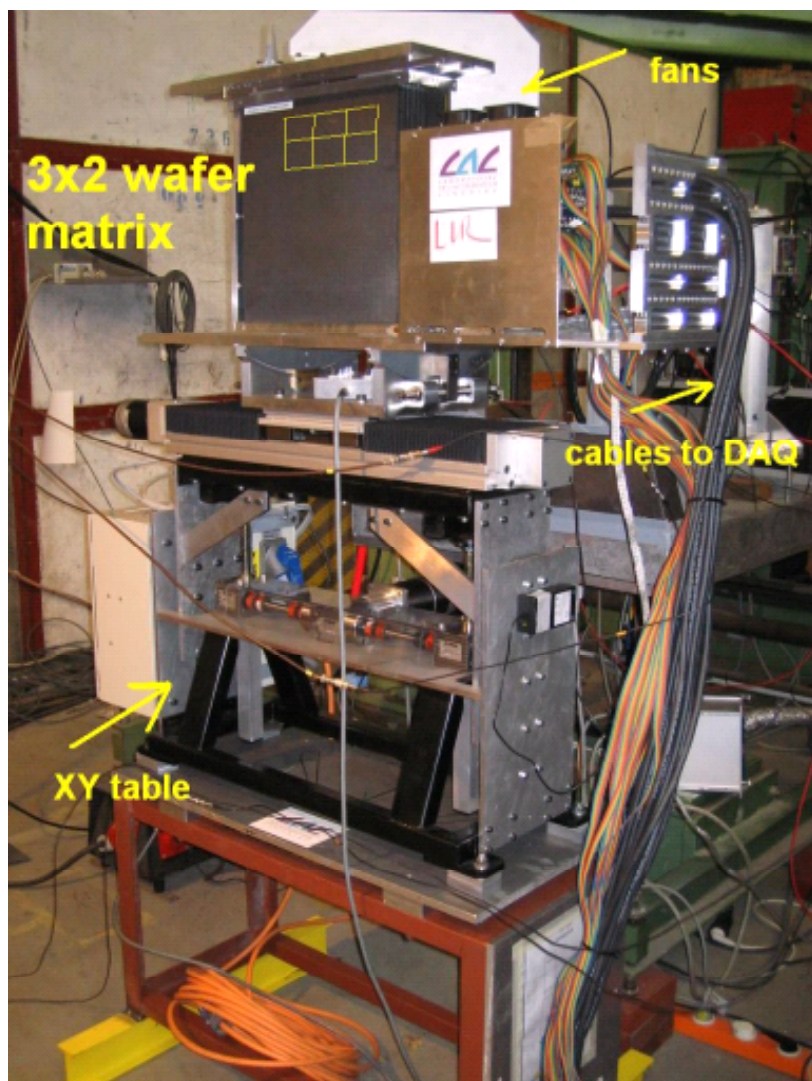energy scan (mainly 1, 2, 3 GeV, some runs at 4, 5, 6 GeV)
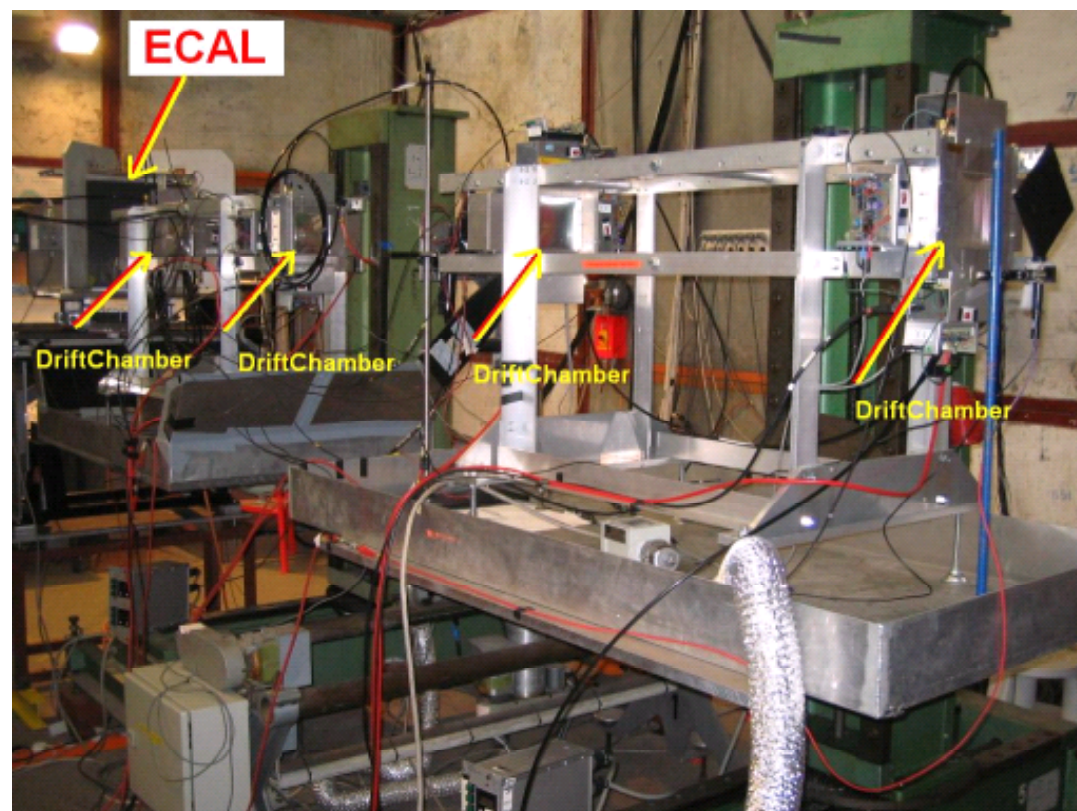angle scan (0°, 10°, 20°, 30°)

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

▶ · **next round in Jun05 with more layers-channels**

CALICE-ECAL testbeam at DESY

ECAL   **layout at DESY T21**

**DriftChambers courtesy of KEK
installed by K.Kawagoe, Y.Tamura**

Calibration with cosmics
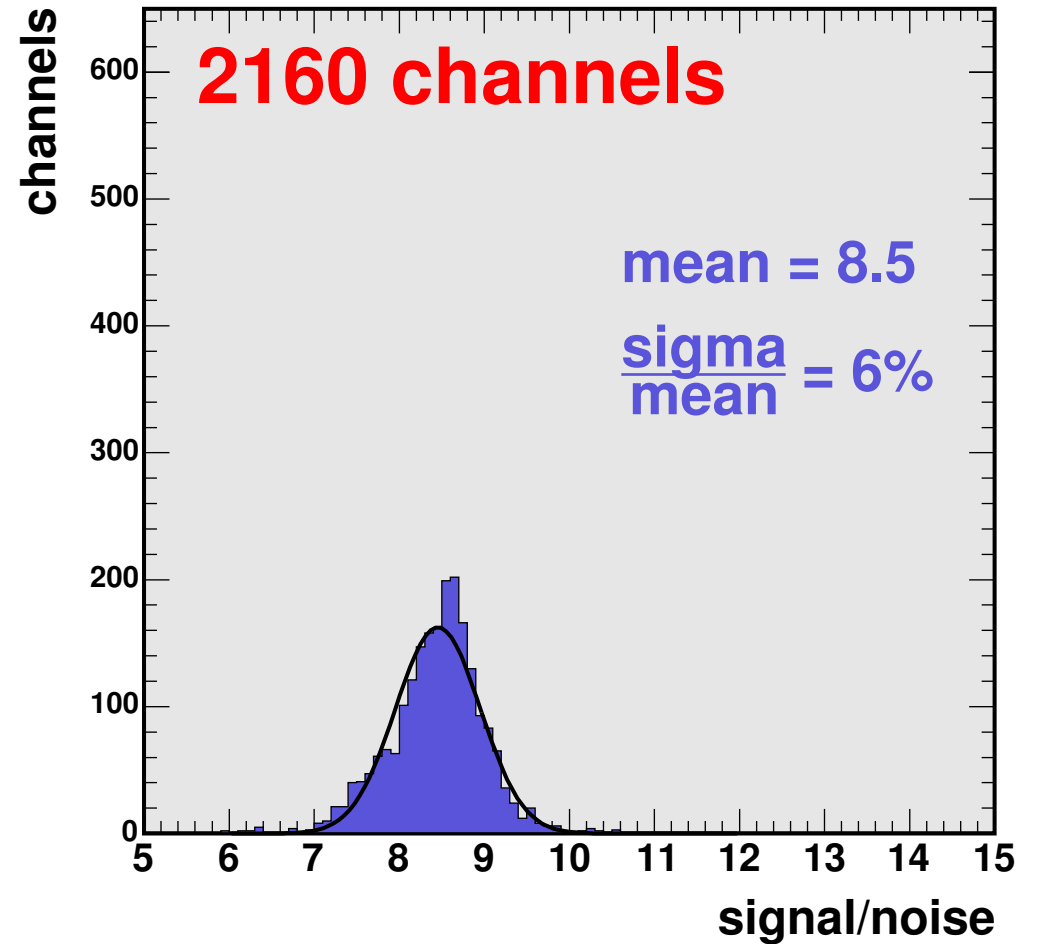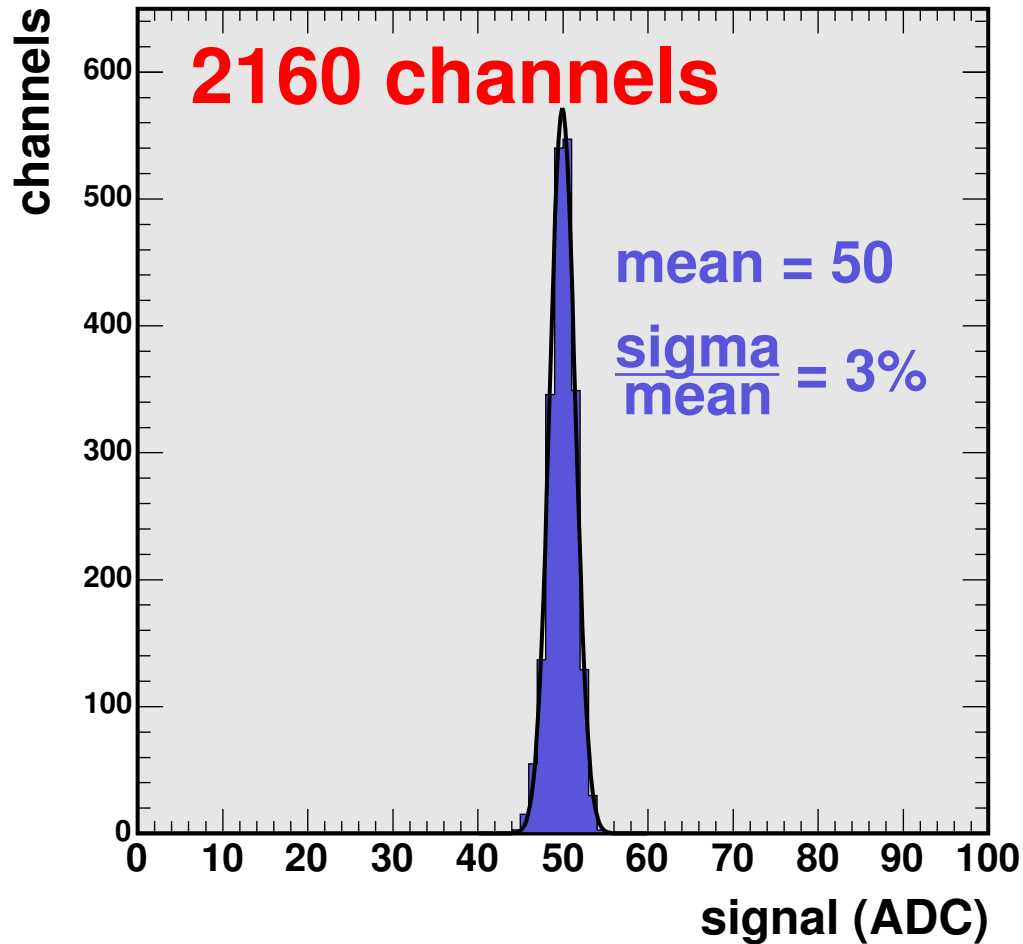
▷ **10 layers (2160 channels) calibrated with cosmics (1 Mevents)**

(LLR-Paris, Dec04)

Calibration with cosmics
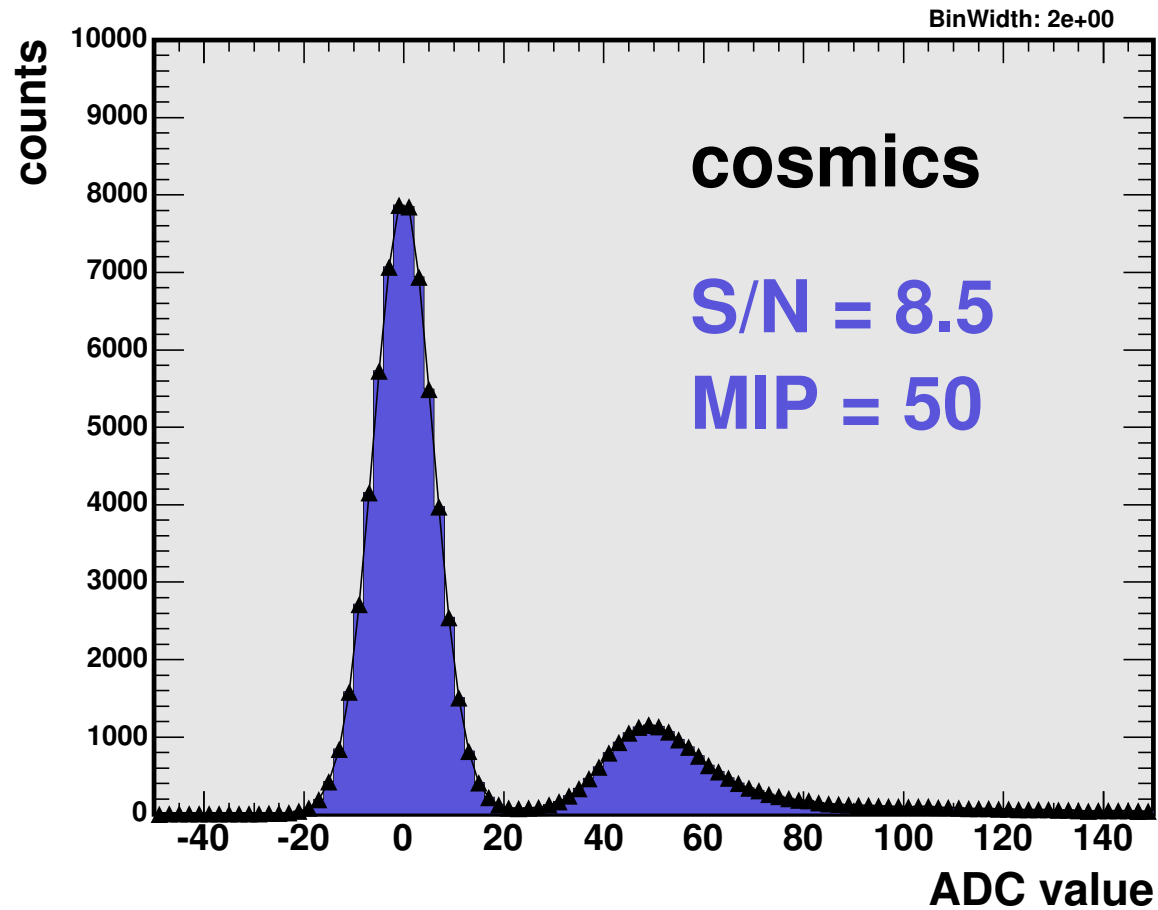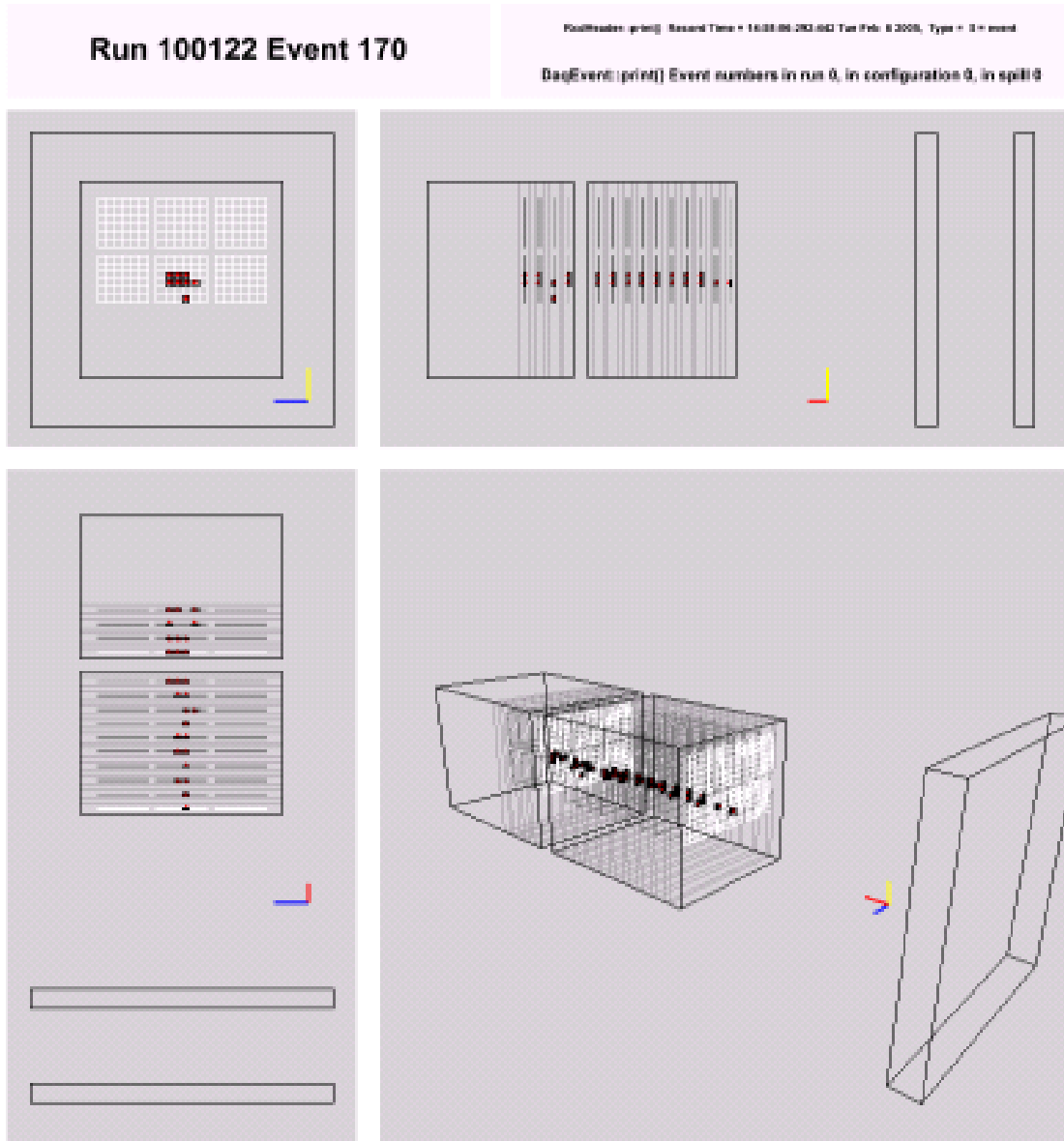

▷ **a typical channel: gaussian noise, landau signal**

"Response" vs cell threshold

BinWidth: 1e-01

ECAL 0° (7.2 X_0)

e^-

▲ 1 GeV
▼ 2 GeV
● 3 GeV

Event Energy (ADC)
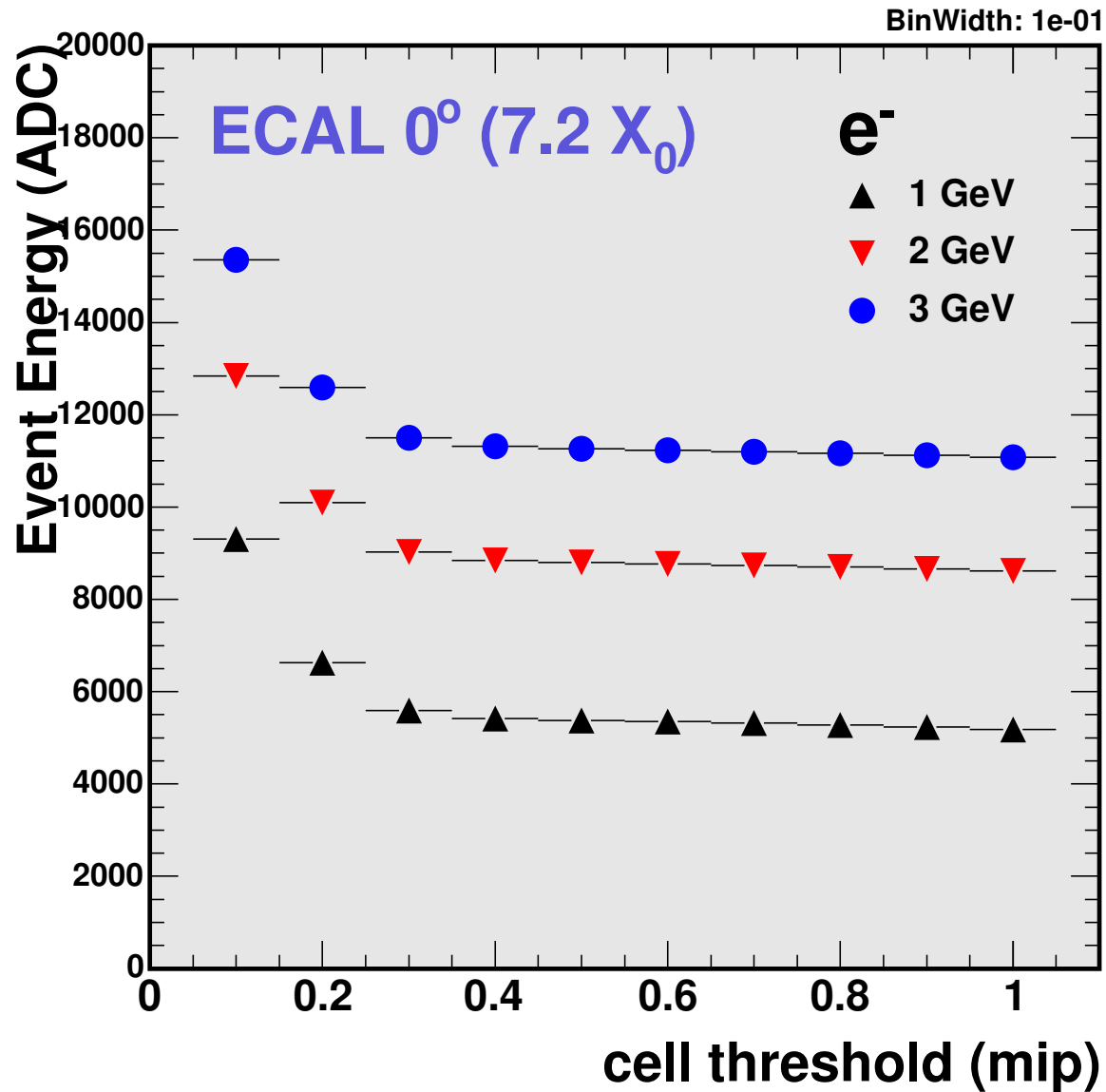
cell threshold (mip)

▷ **safe limit a threshold around 0.5 - 0.6 mip**

▷ **following analysis with threshold = 0.5 mip**

"Tracking Calorimetry"

(not to scale)

e$^-$ 1 GeV

cell threshold = 0.5 mip
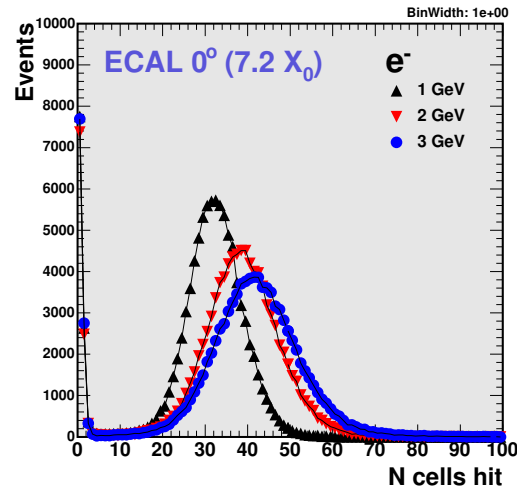
"Tracking Calorimetry"

(not to scale)

e⁻ 2 GeV

cell threshold = 0.5 mip

"Tracking Calorimetry"

Run 100095 Event 490
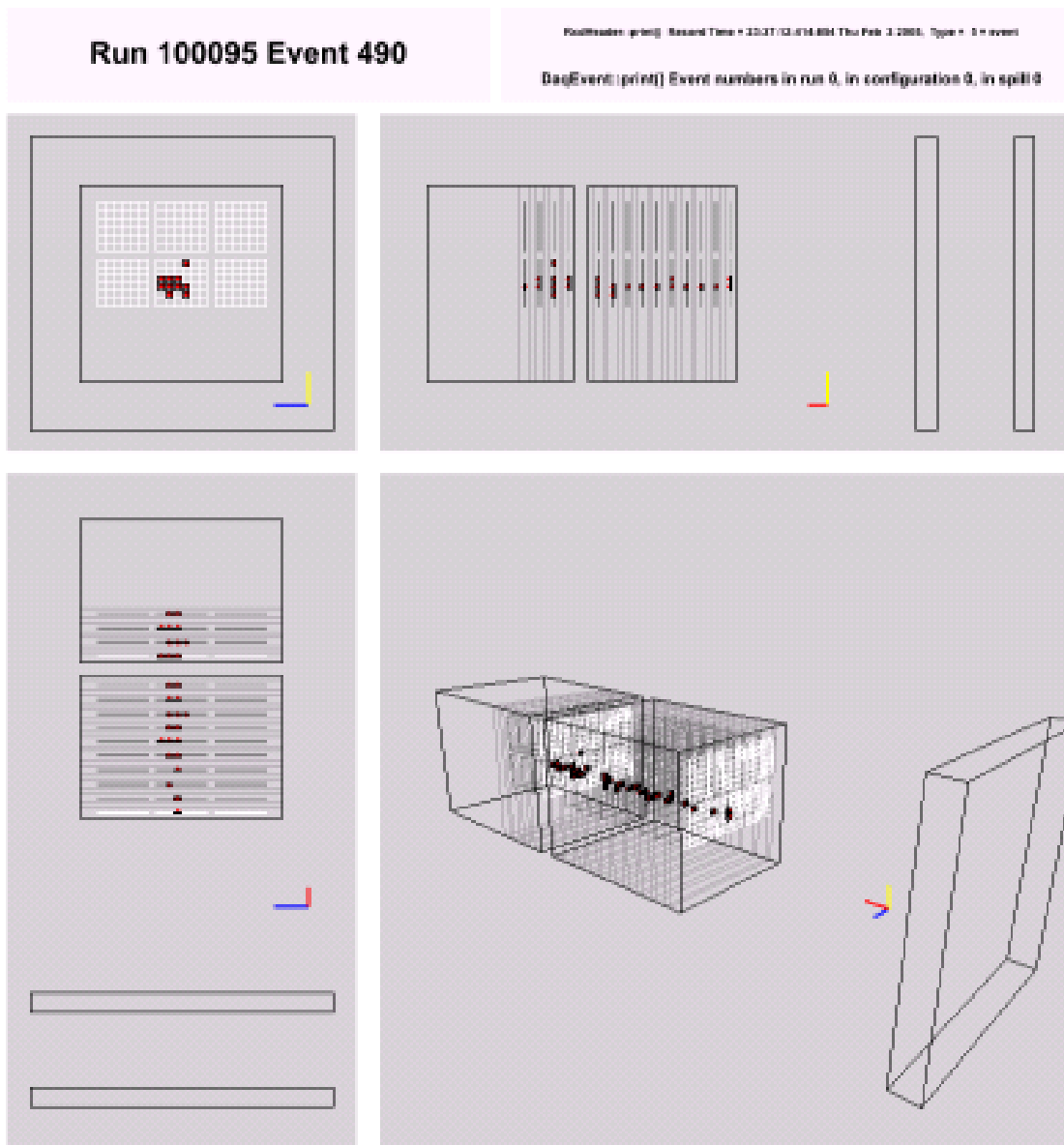
(not to scale)
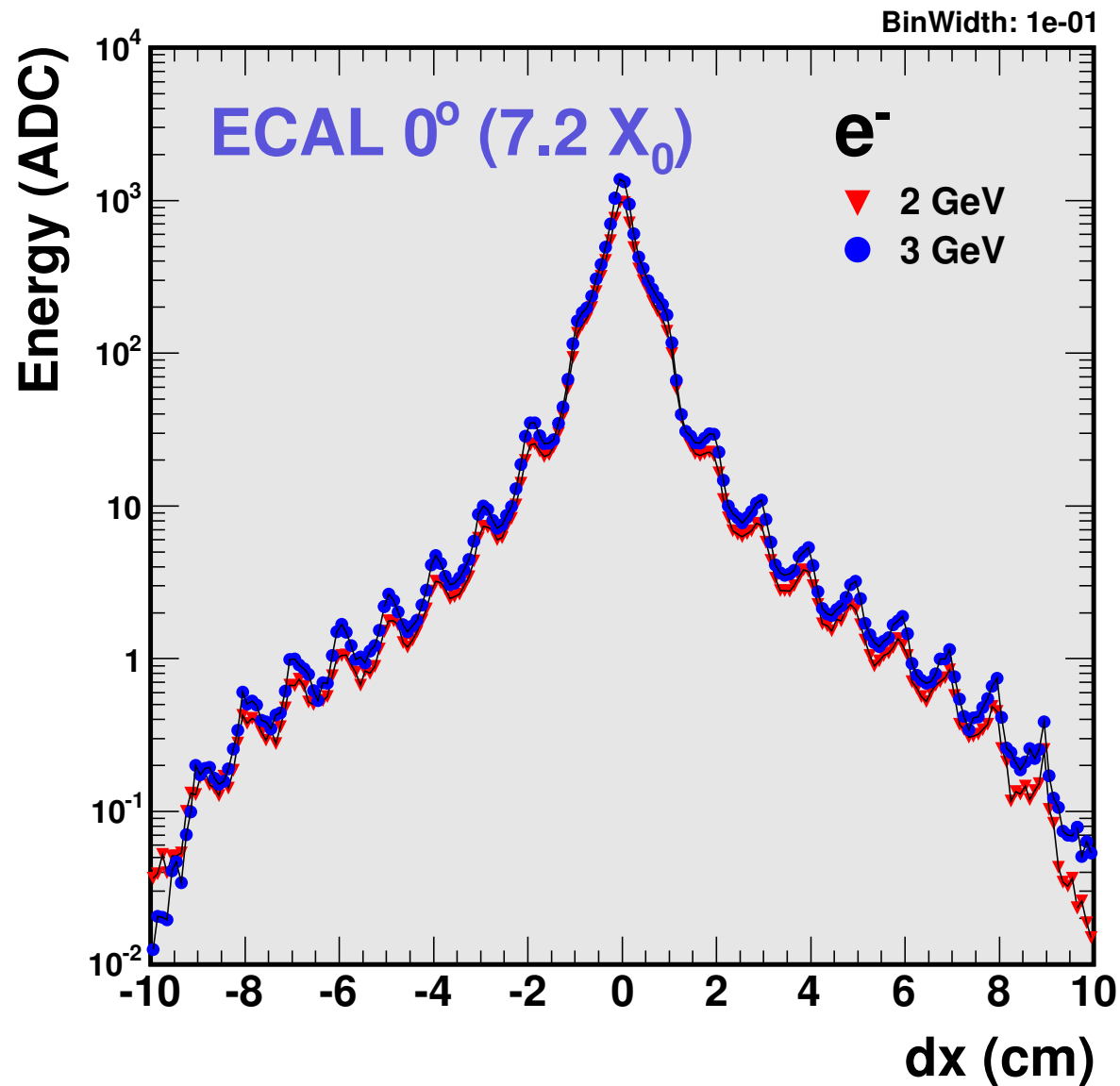
e⁻ 3 GeV

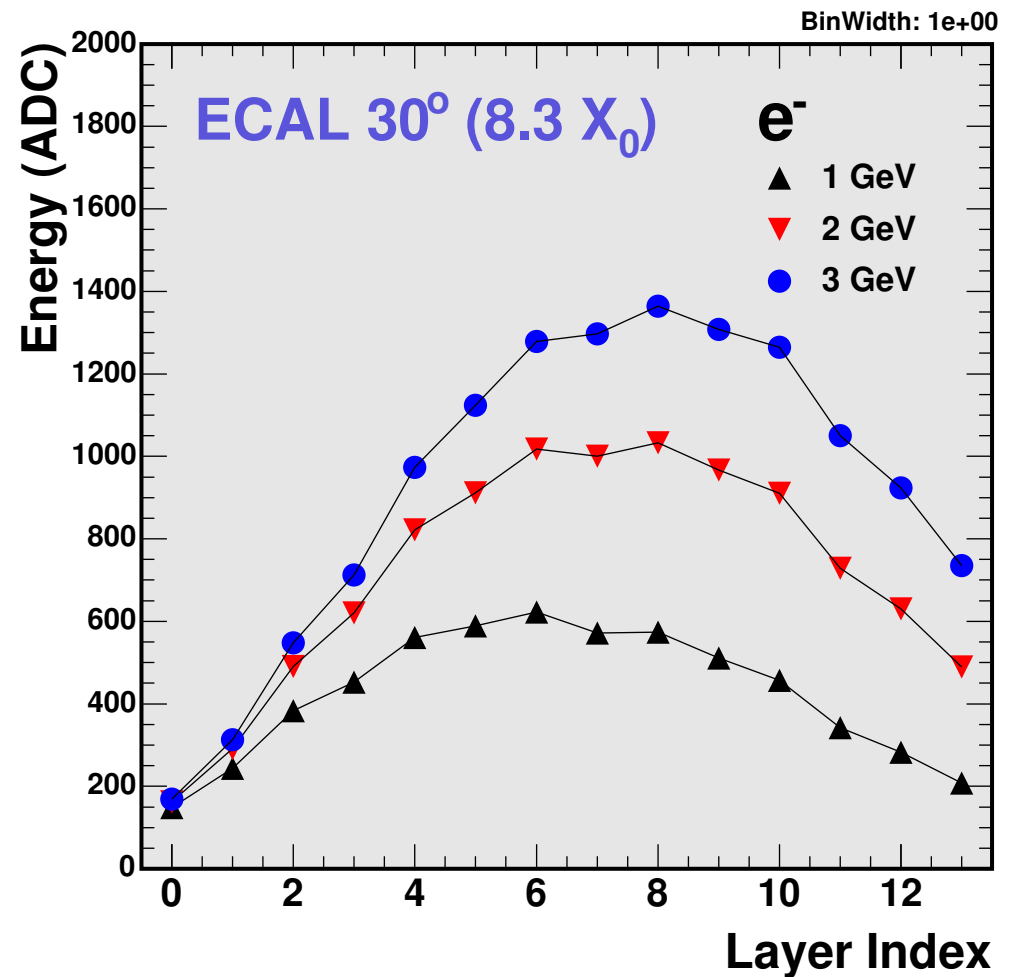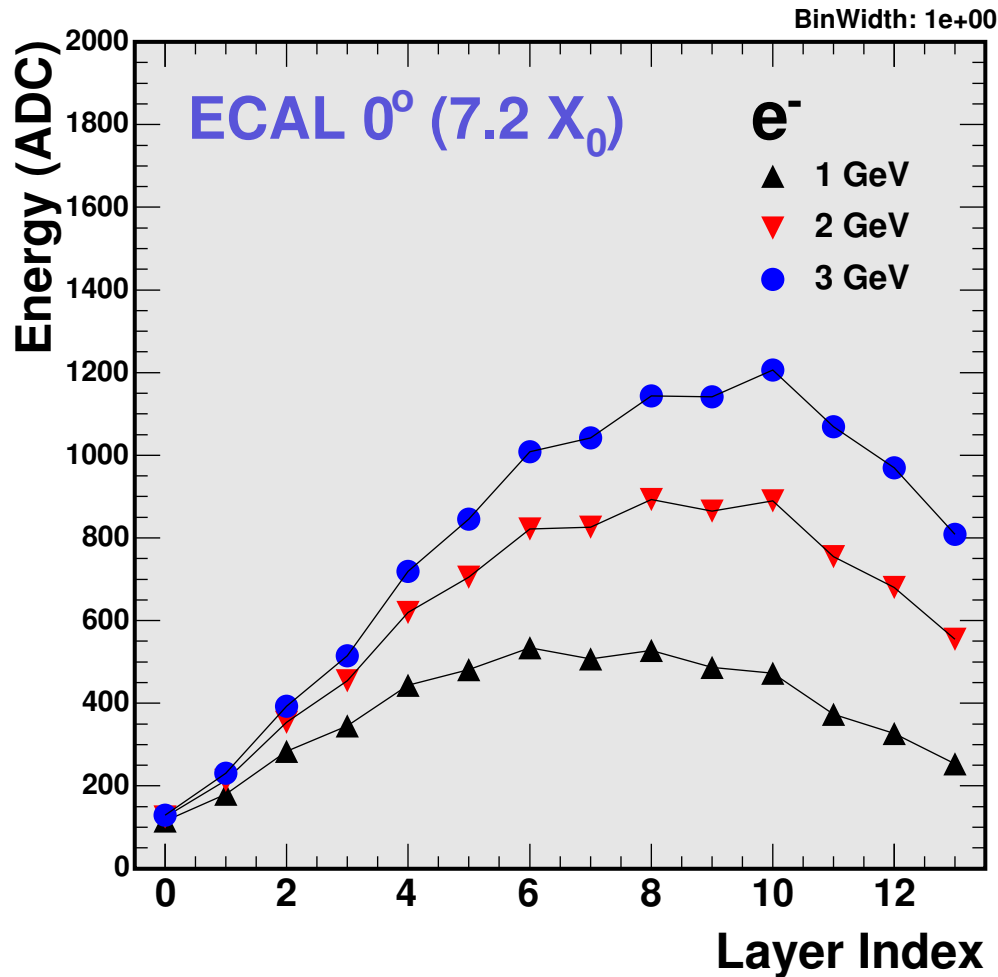**cell threshold = 0.5 mip**

"Response" to electrons

▷ **no weighting, no event selection, no tracking**
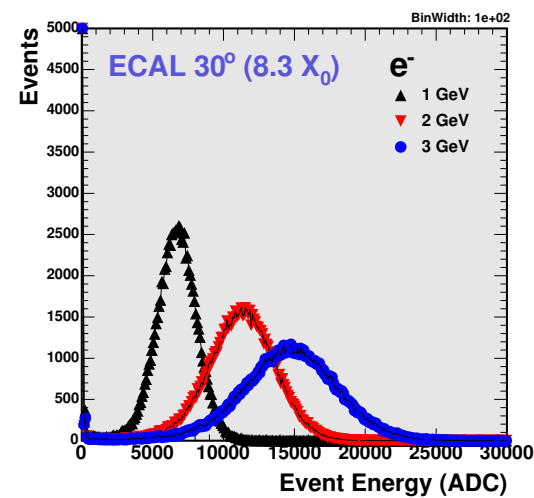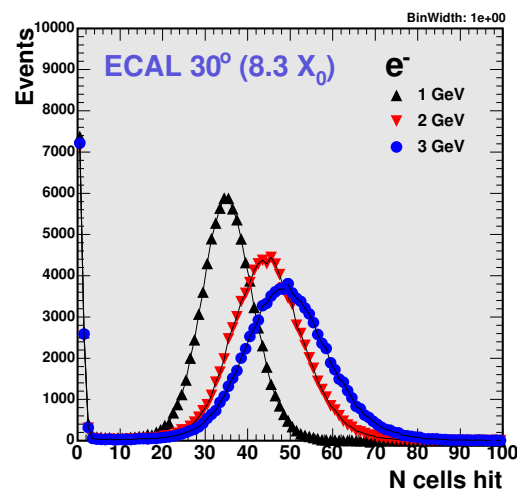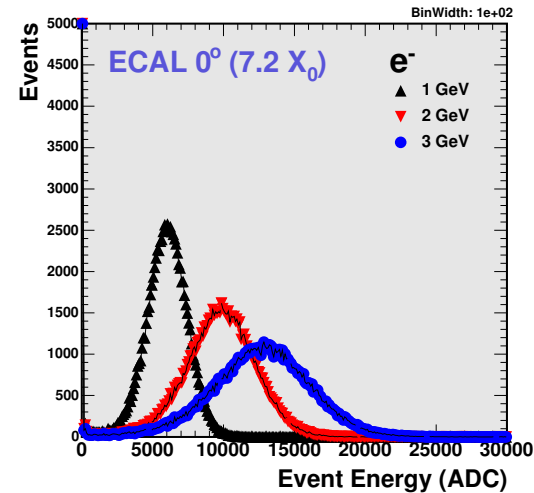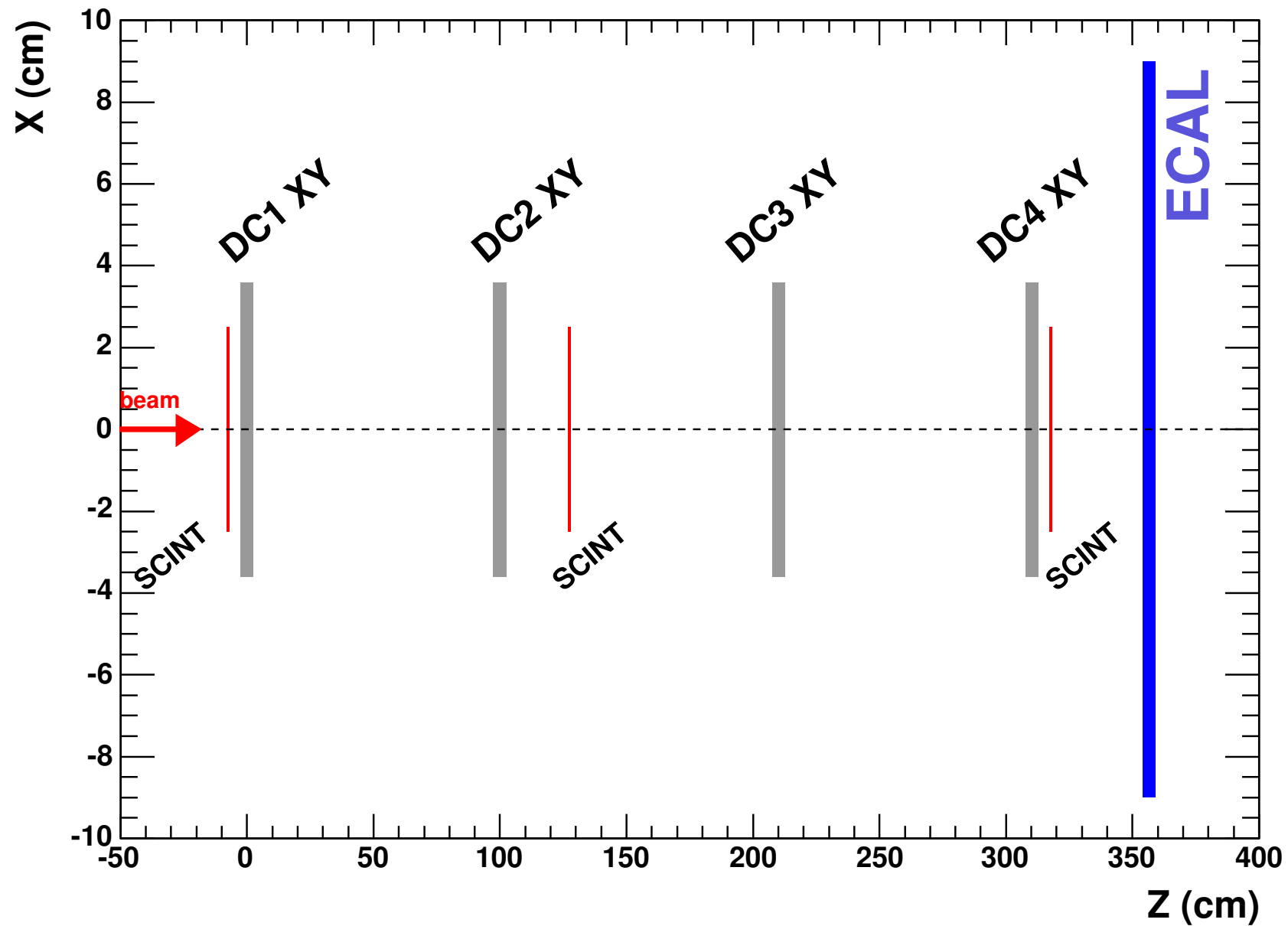
▷ **showers better contained at 30°**

Transverse tomography

▷ **no weighting, no event selection, no tracking**

▷ **dx = CellX - BarycenterX**

▷ **distance between peaks = 1 cm = transverse granularity**
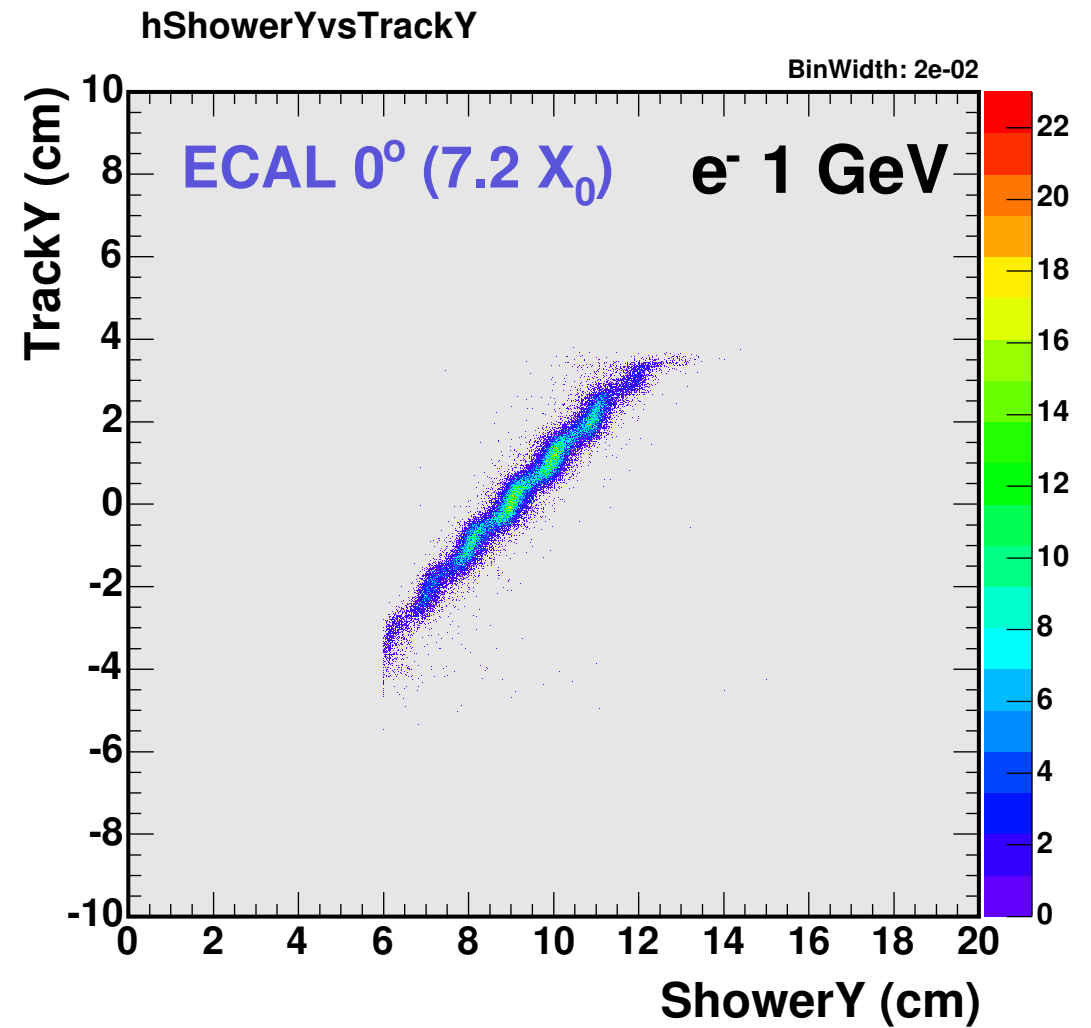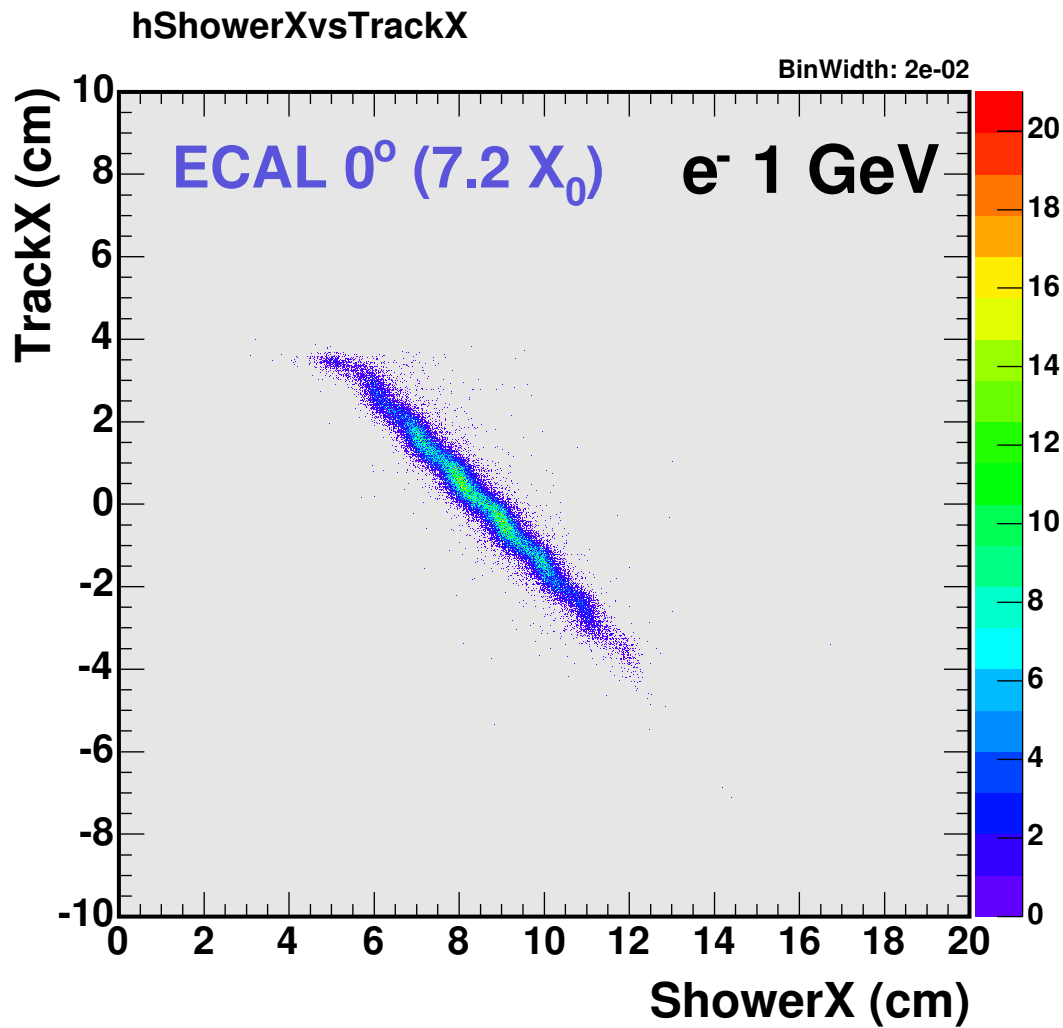
Shower longitudinal profile

▷ **no weighting, no event selection, no tracking**
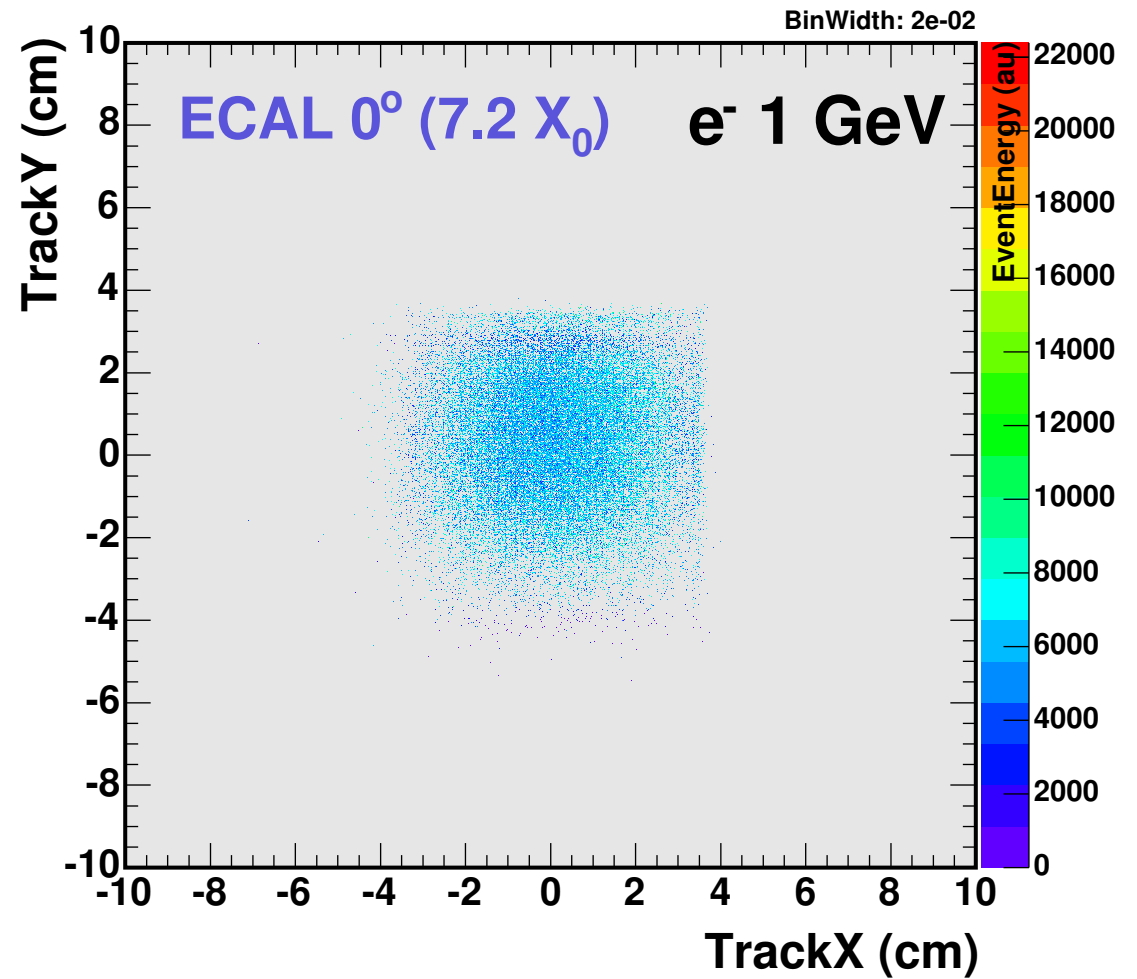
▷ **showers better contained at 30°**
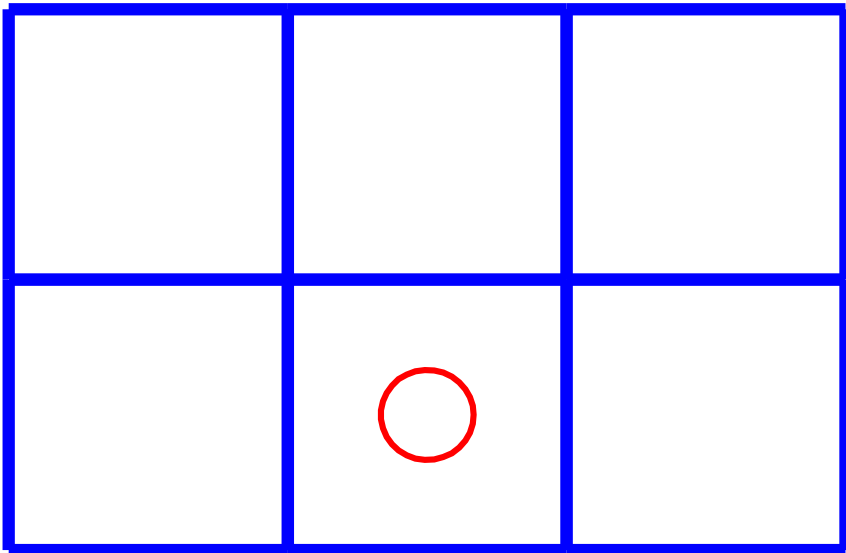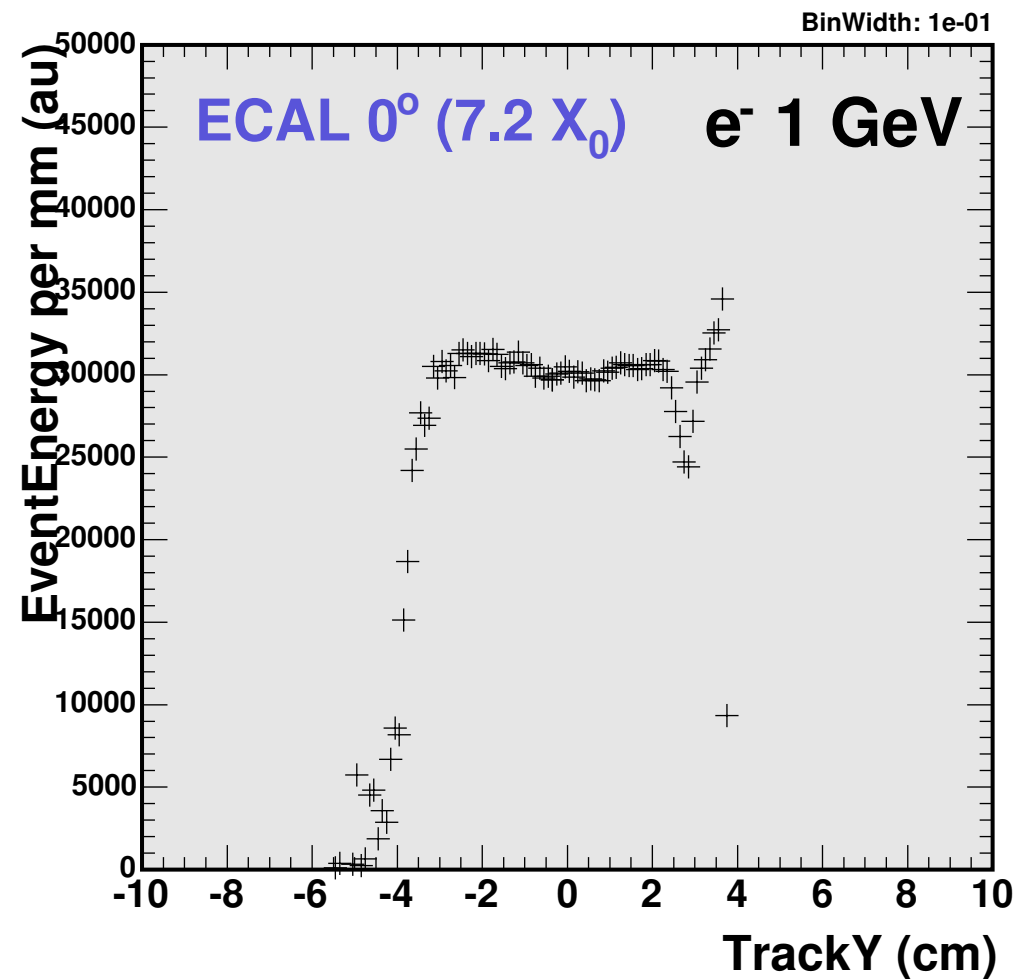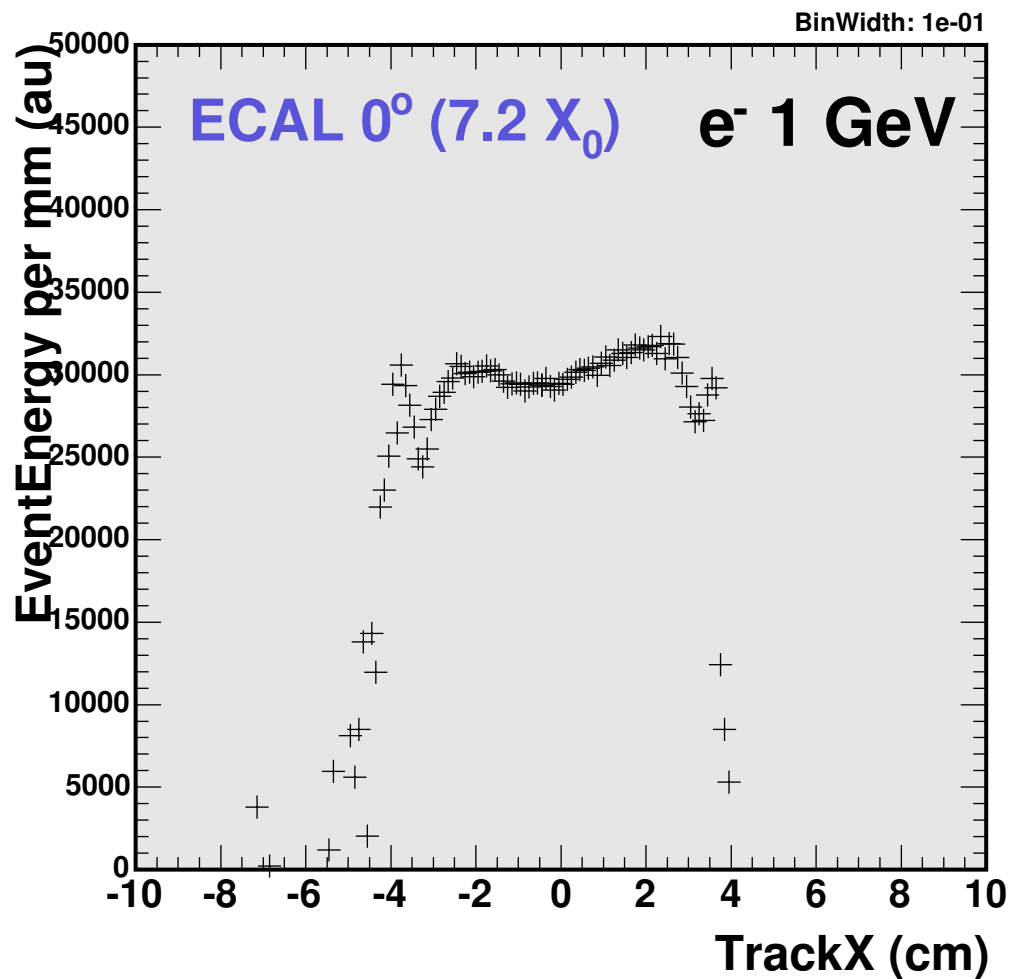
Testbeam layout

Position scan

▷ **ShowerX,Y from barycenter in ecal**
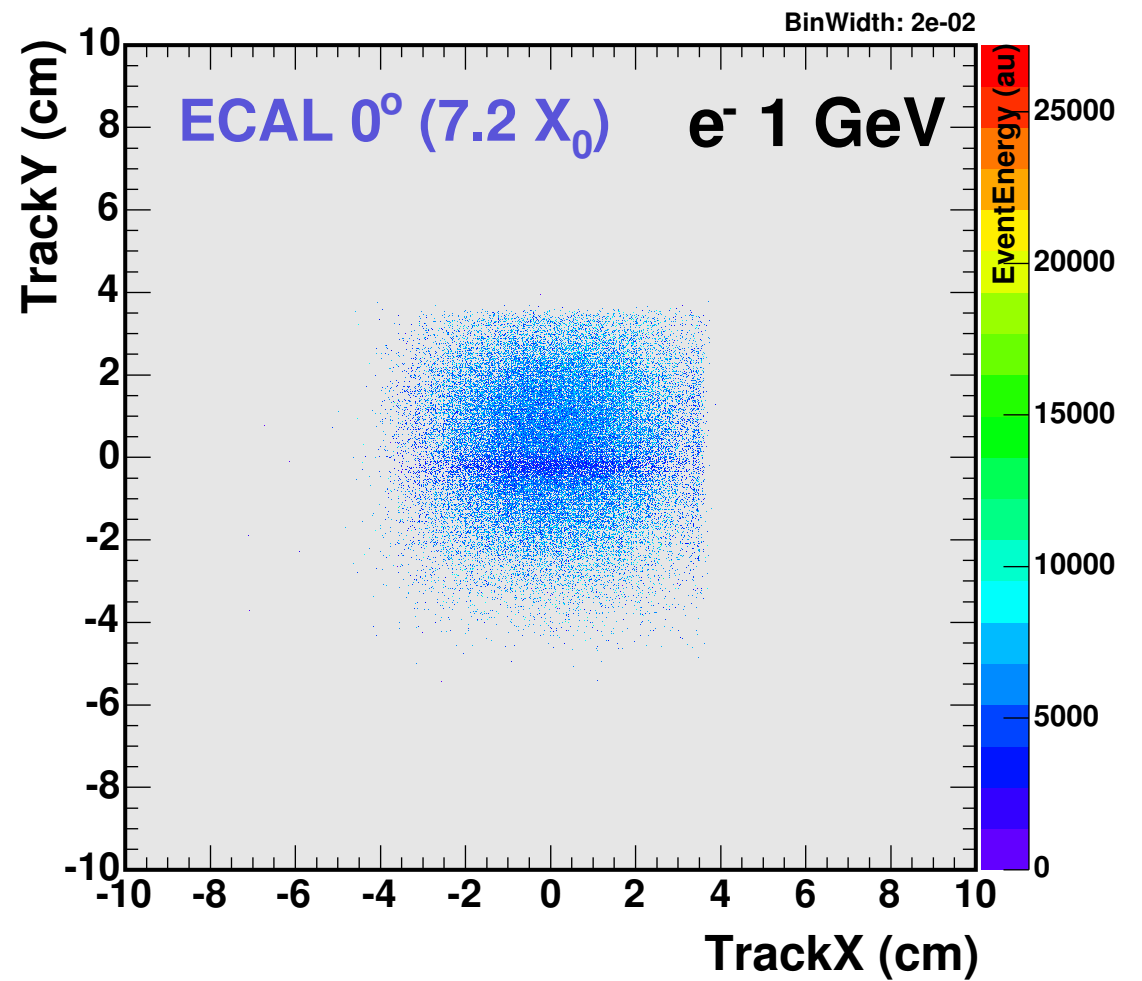
▷ **TrackX,Y from 4 drift chambers**
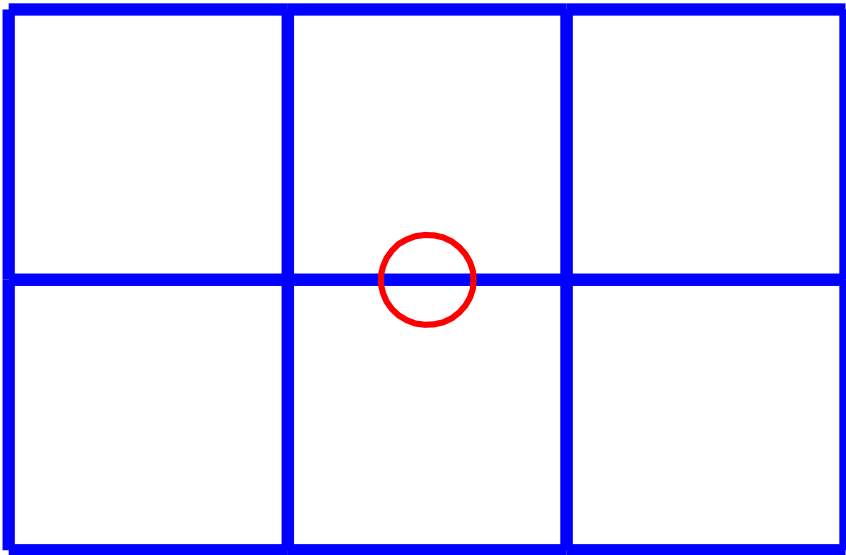
Position scan - center of wafer

Position scan - center of wafer
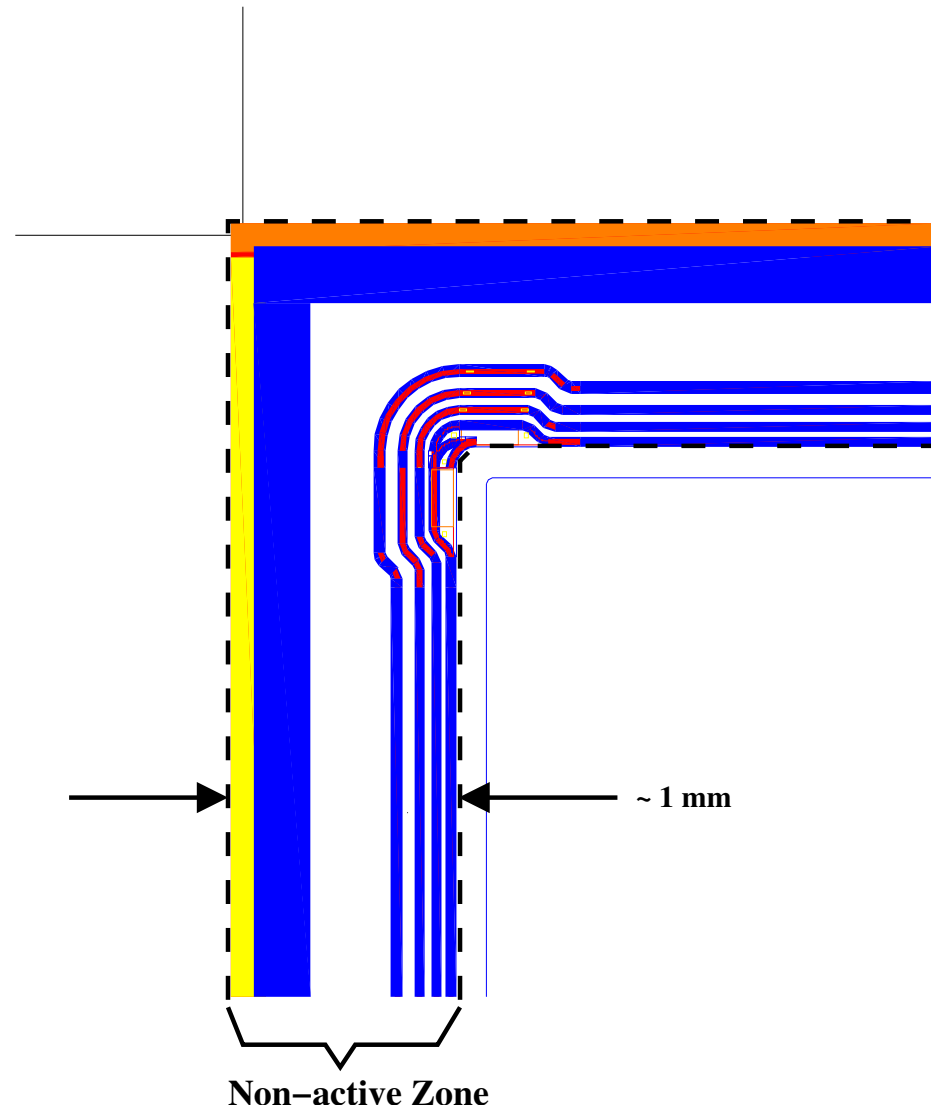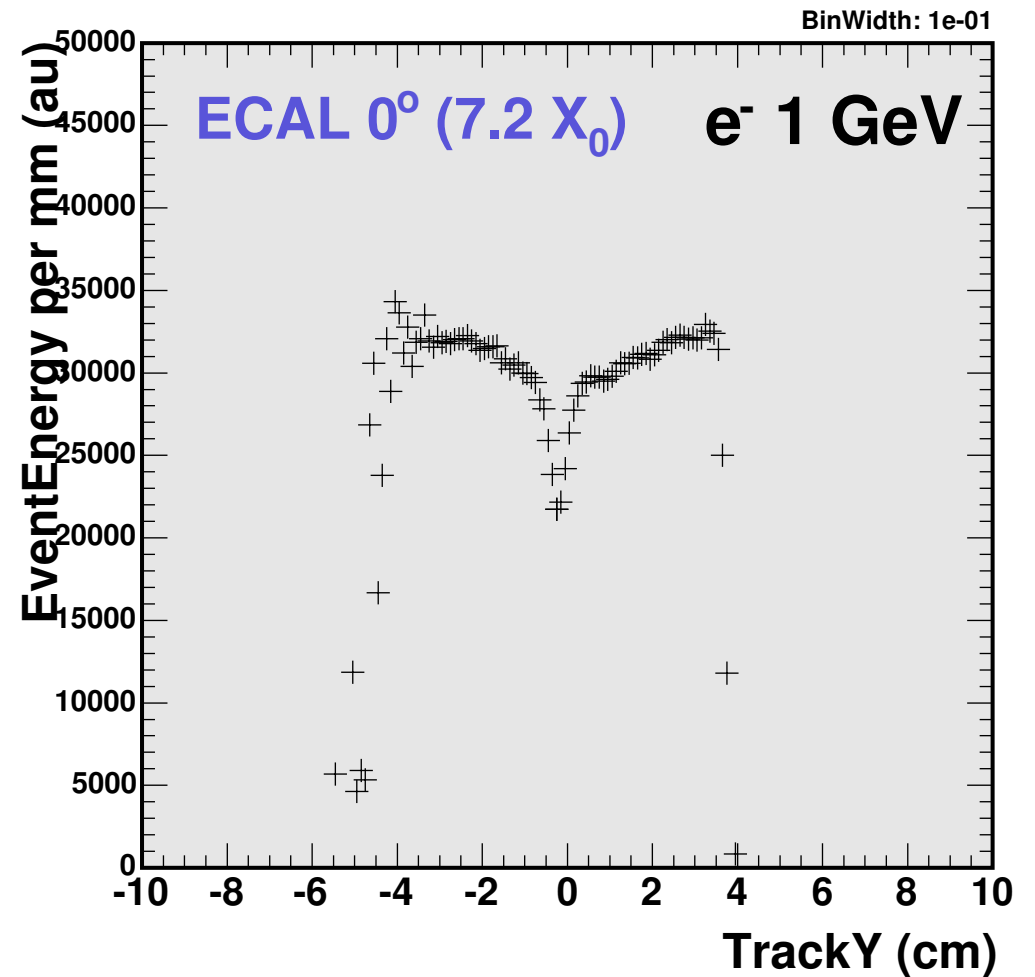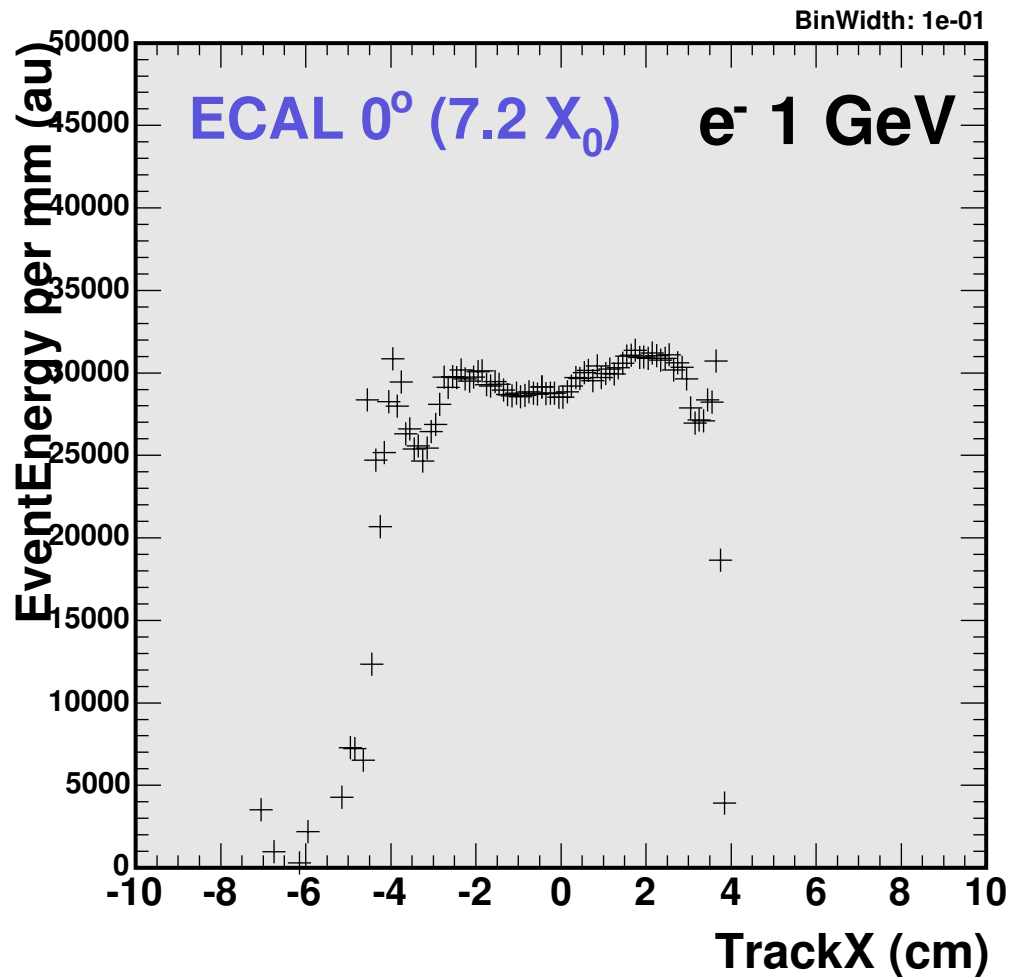

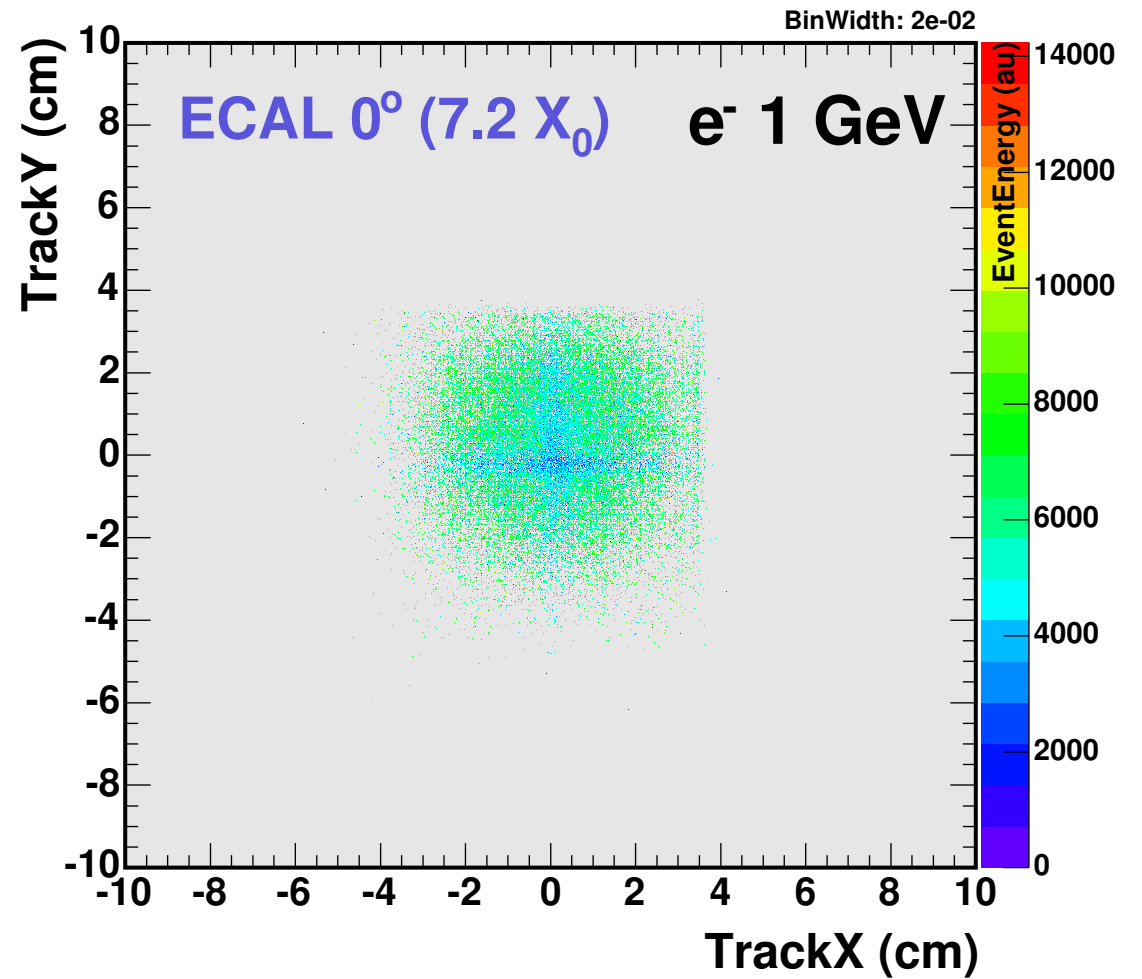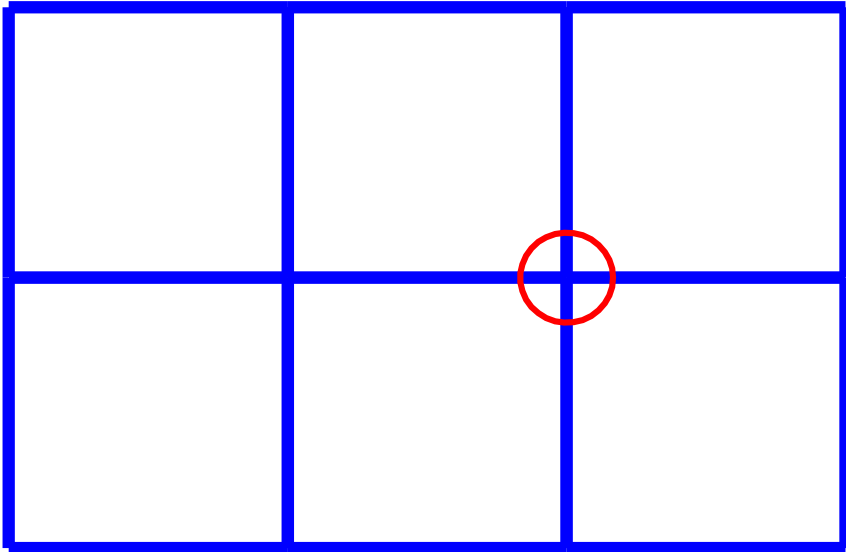▷ **P R E L I M I N A R Y**

Position scan - edge of wafer

Wafer border

~ 1 mm

Non−active Zone

▷ **(C.LoBianco, LC-DET-2004-007)**

Position scan - edge of wafer

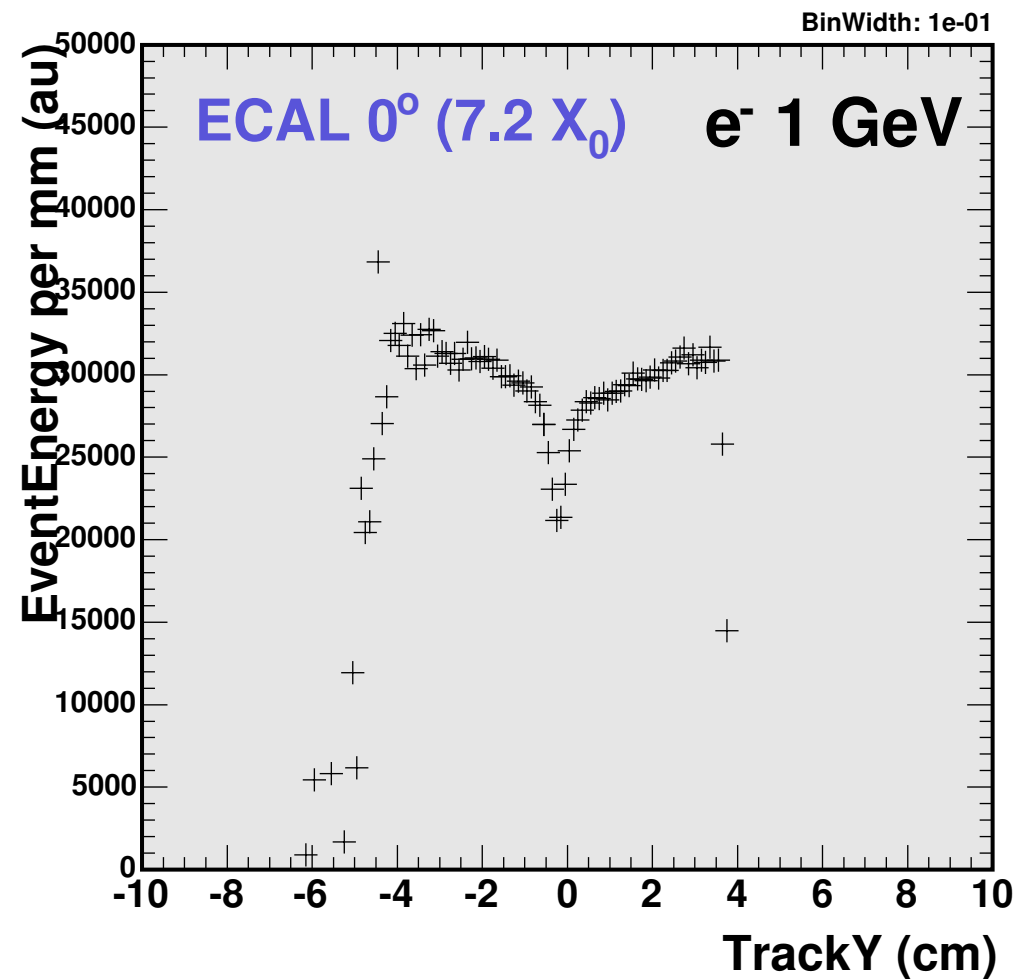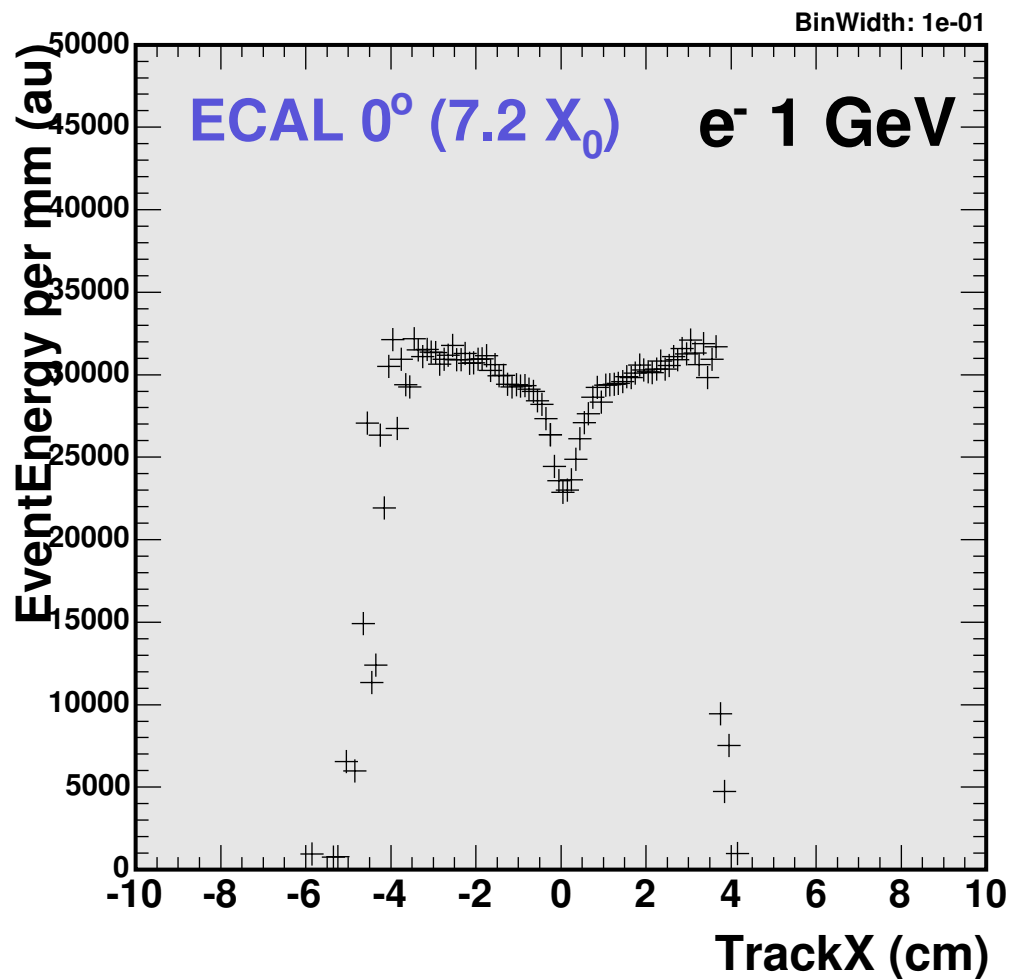▷ **P R E L I M I N A R Y**

Position scan - corner of wafer

Position scan - corner of wafer

▷ **P R E L I M I N A R Y**

Summary

► **.**
    very smooth first testbeam

    : no major problems

    : preliminary results without surprises

► **.**
    proper analysis has just started

    : do proper calibration, event filtering/cleaning

    : systematic studies, crosstalk, stability, ...

    : good understanding before the next round

Credits

▶ . **For the testbeam setup/run special thanks should go to**

P.Dauncey	J.C.Vanel	B.Bouquet	C.LoBianco
E.Garutti	N.Meyners	M.Warren	N.Malden
M.Wing	C.Fry	G.Gaycken	M.Groll
H.Meyer	B.Lutz	Y.Kawagoe	Y.Tamura