ECAL PROGRESS (221116)

ZEKUN JIA

Confronted Problems of Endcap EMC

Large material budget and high beam bkg – additional energy resolution worse than the intrinsic one

Physics concerning photon polarization – two body weak radiative decay ($\Sigma^+ \to p\gamma$, $D^0 \to V\gamma$), Precision test of high energy QED, rising interests in particle astrophysics

Idea: Under the moderate energy resolution, improve the spatial resolution and even explore the potential of polarimetry?

Liquid Noble Gas Calorimeter
LKr calorimeter for KEDR detector

68 cm thickness – 15 X0

9 us drift time (0.5 kV/cm)

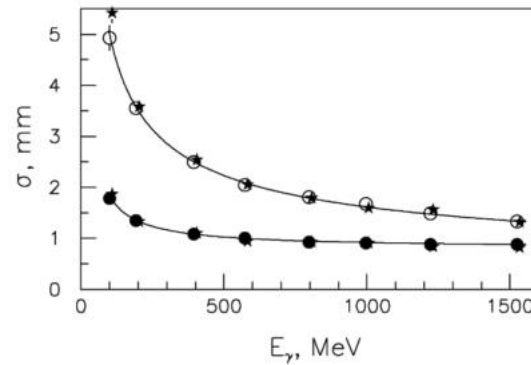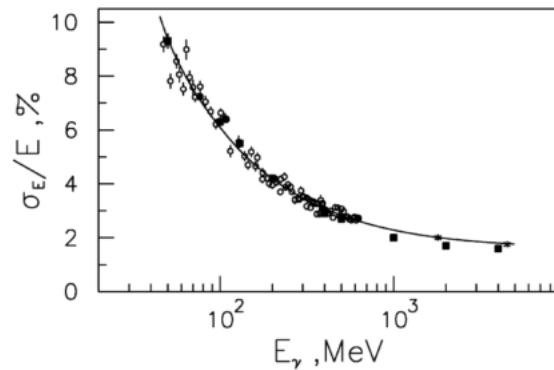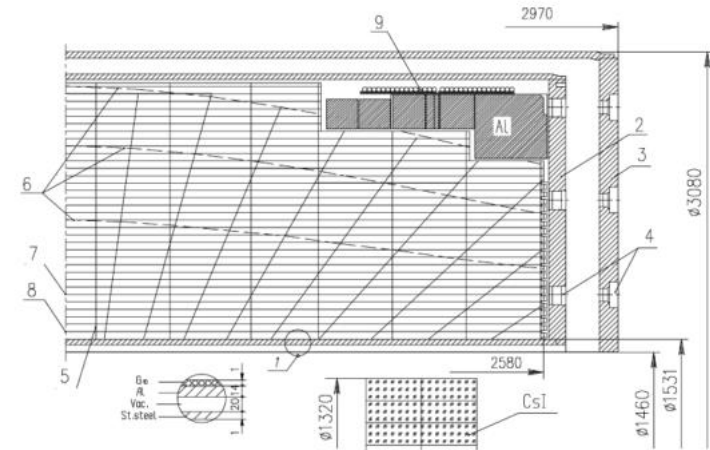Conversion vertex detection efficiency > 97% @ 100 MeV

Fig. 4. The space resolution. Black, open circles – the experimental data for first and second layers respectively, asterisks – MC simulation, curves – the fits.

Liquid Noble Gas Calorimeter
LKr calorimeter for NA48 experiment

27 X0

Very short drift time (5 kV/cm)
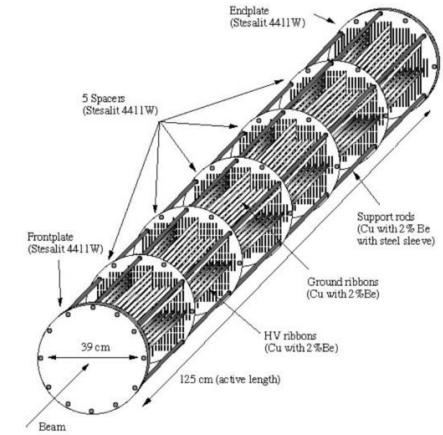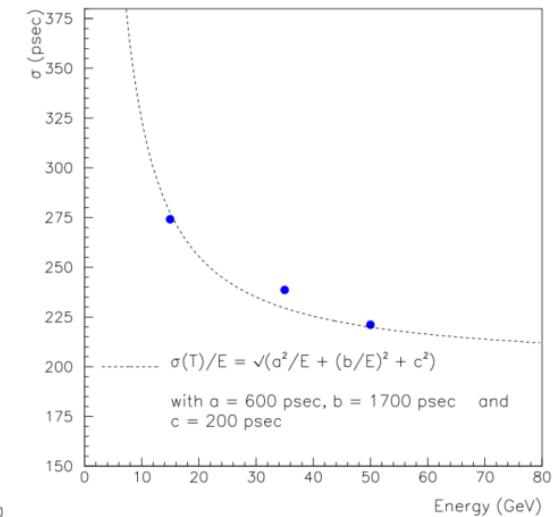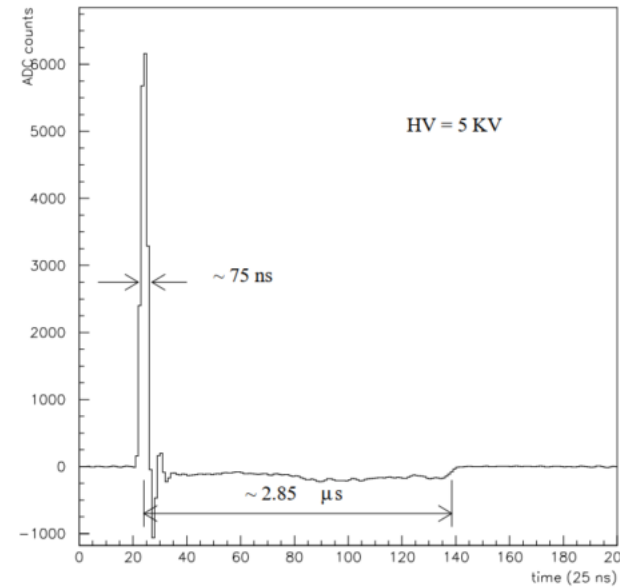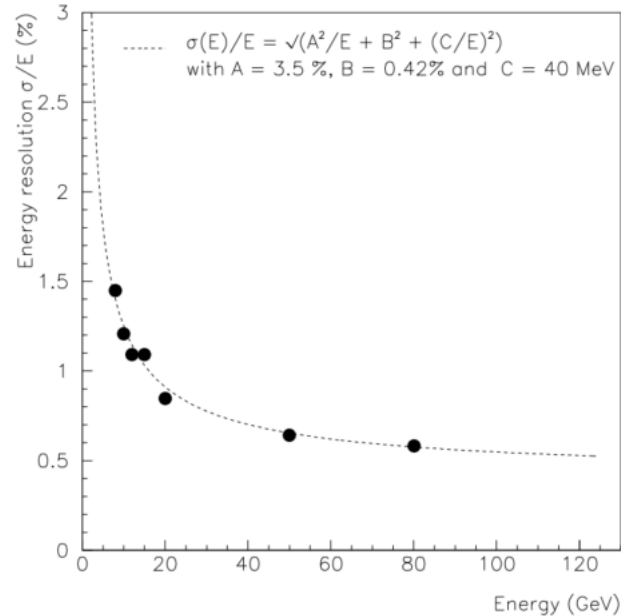
Good time resolution (272ps @ 50GeV)

Figure 1: The prototype electrode structure.

$$\sigma(E)/E = \sqrt{A^2/E + B^2 + (C/E)^2}$$
with A = 3.5 %, B = 0.42% and C = 40 MeV

HV = 5 KV

~ 75 ns

~ 2.85 μs

$$\sigma(T)/E = \sqrt{a^2/E + (b/E)^2 + c^2}$$
with a = 600 psec, b = 1700 psec and c = 200 psec
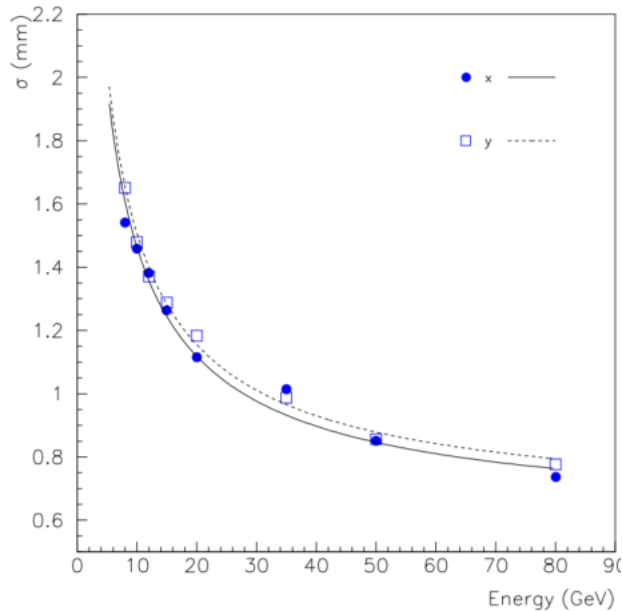
Liquid Noble Gas Calorimeter

LXe calorimeter for CMD-3 detector

15 cm – 5.4 X0

Drift time 4.5 us (1.1 kV/cm)

sigmaE = 0.22 MeV

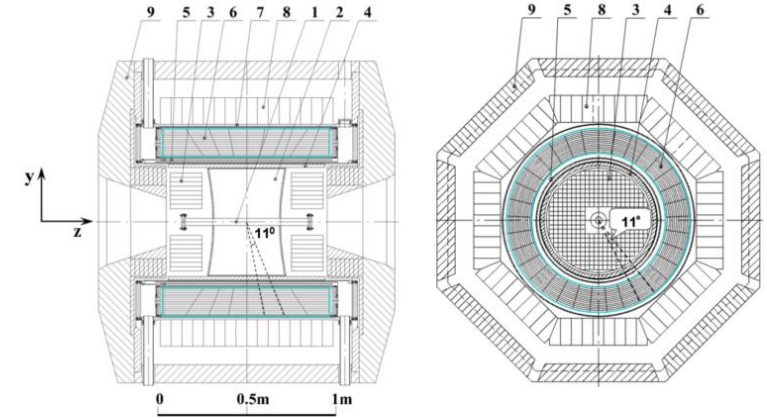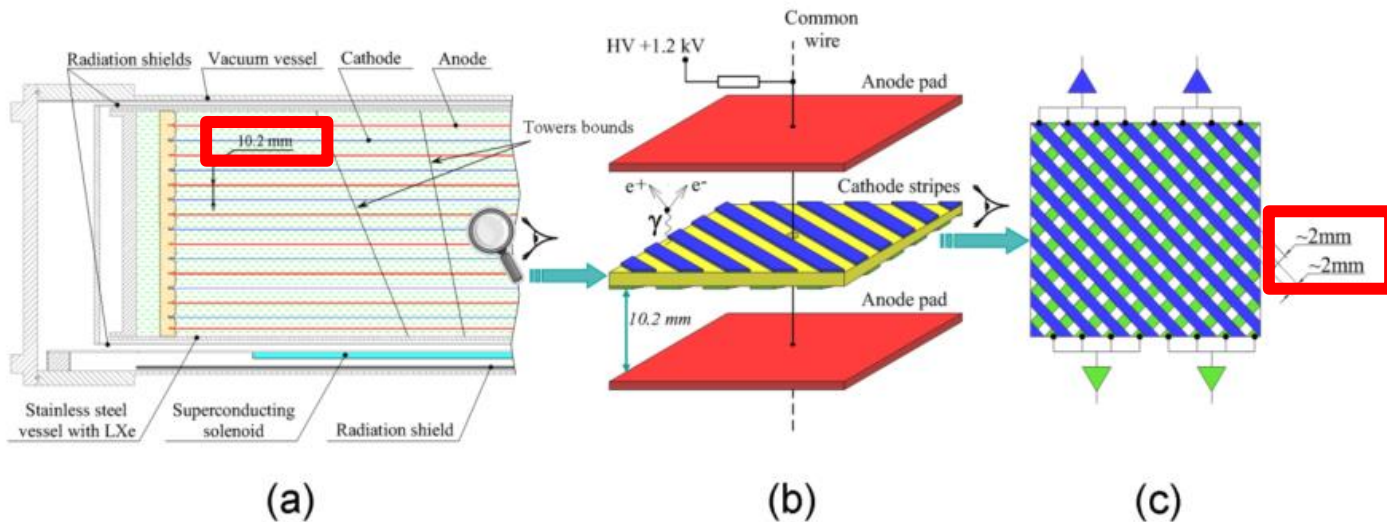Time resolution better than 3ns @ 200 MeV

Figure 1. CMD-3 detector: 1 – Beam pipe, 2 – Drift chamber, 3 – BGO electromagnetic calorimeter, 4 – Z-chamber, 5 – SC solenoid (0.13X_0, 13kGs), 6 – LXe electromagnetic calorimeter (the segmentation with "towers" specially shown), 7 – TOF system, 8 – CsI electromagnetic calorimeter, 9 – Yoke.
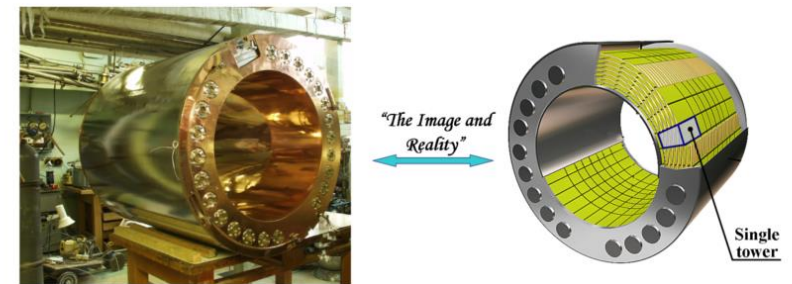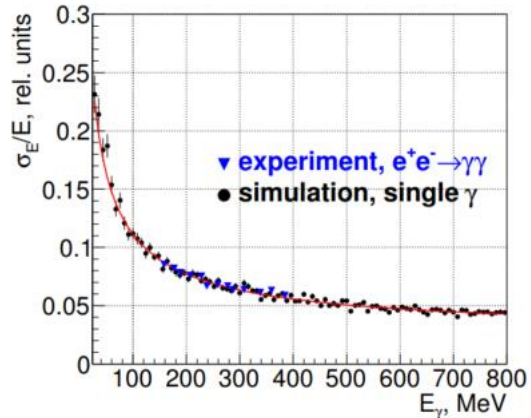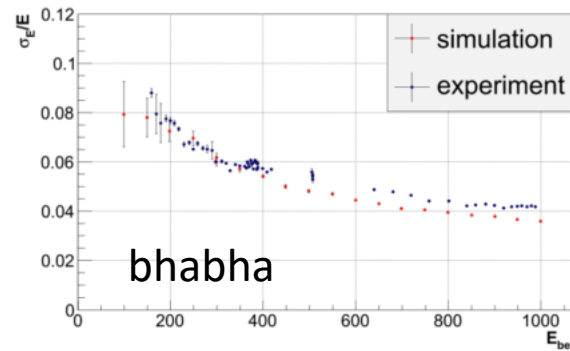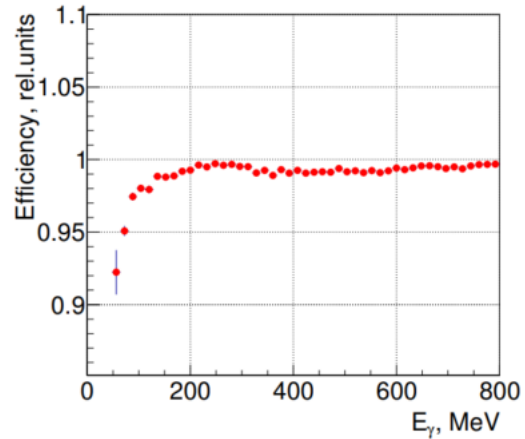
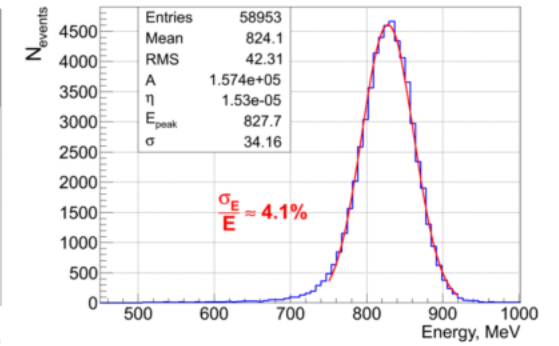**Figure 2**. The LXe calorimeter.

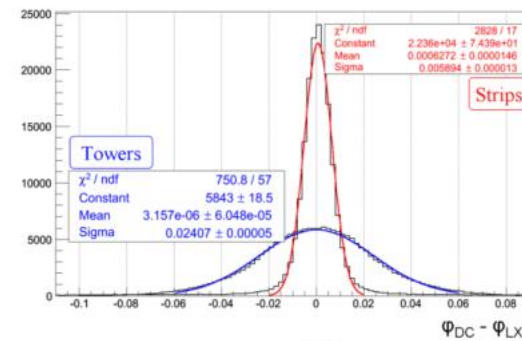# Liquid Noble Gas Calorimeter
LXe calorimeter for CMD-3 detector

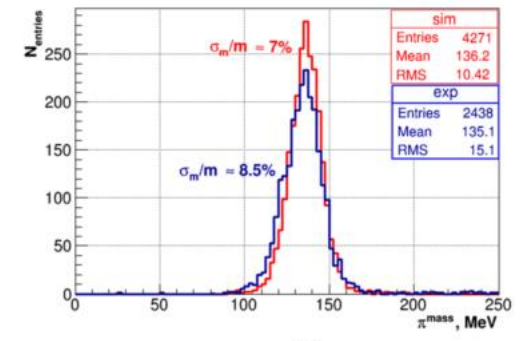bhabha

Liquid Noble Gas Calorimeter
LXe calorimeter for MEG II detector

Scintillation readout scheme not applicable!

Gamma Ray Polarimetry in space

Limited working environment in space

Main schemes:
- Gas TPC
- Liquid/solid TPC
- Full-silicon calorimeter

How to balance shower growth condition and conversion efficiency?