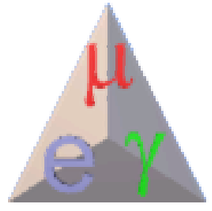
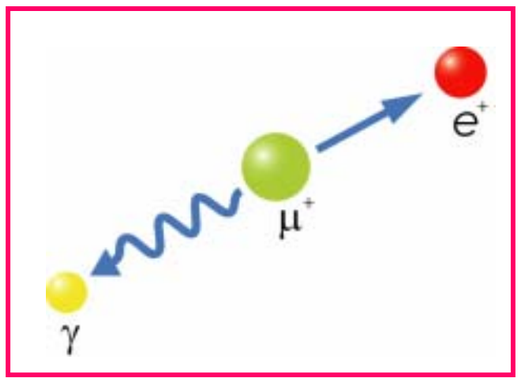
Current status of MEG Experiment



Yasuko HISAMATSU
ICEPP, The Univ. of Tokyo

ICEPP Symposium

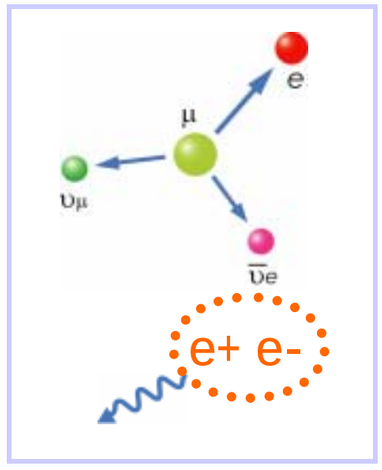
motivation for muegamma

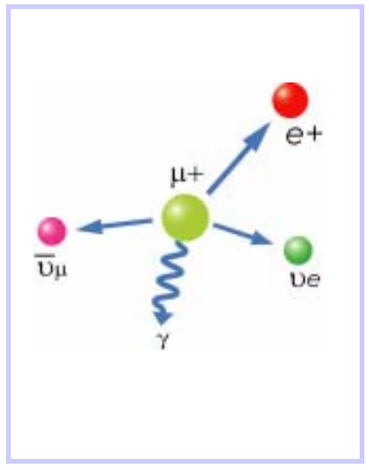


- mu ⟶ e+ gamma
  - ➢beyond SM
  - ➢SUSY-GUT promising

MEG
Br 10^-14

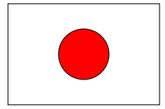
MEGA(~1999)
Br 1.2*10^-11





- Background
  - ➢muon radiative decay
  - ➢accidental background

The MEG collaboration



ICEPP, University of Tokyo Y. Hisamatsu, T. Iwamoto, T. Mashimo, S. Mihara, T. Mori, H. Nishiguchi, W. Ootani, K. Ozone, T. Saeki, R. Sawada, S. Yamada, S. Yamashita

KEK, Tsukuba T. Haruyama, A. Maki, Y. Makida, A. Yamamoto, K. Yoshimura

Osaka University Y. Kuno

Waseda University T. Doke, J. Kikuchi, S. Suzuki, K. Terasawa, A. Yamaguchi, T. Yoshimura

INFN & Genova University S. Dussoni, F. Gatti, D. Pergolesi, R. Valle

INFN & Lecce University S. Spagnolo, C. Chiri, P. Creti, M. Panareo, G. Palama'

INFN & Pavia University A.de Bari, P. Cattaneo, G. Cecchet, G. Nardo', M. Rossella

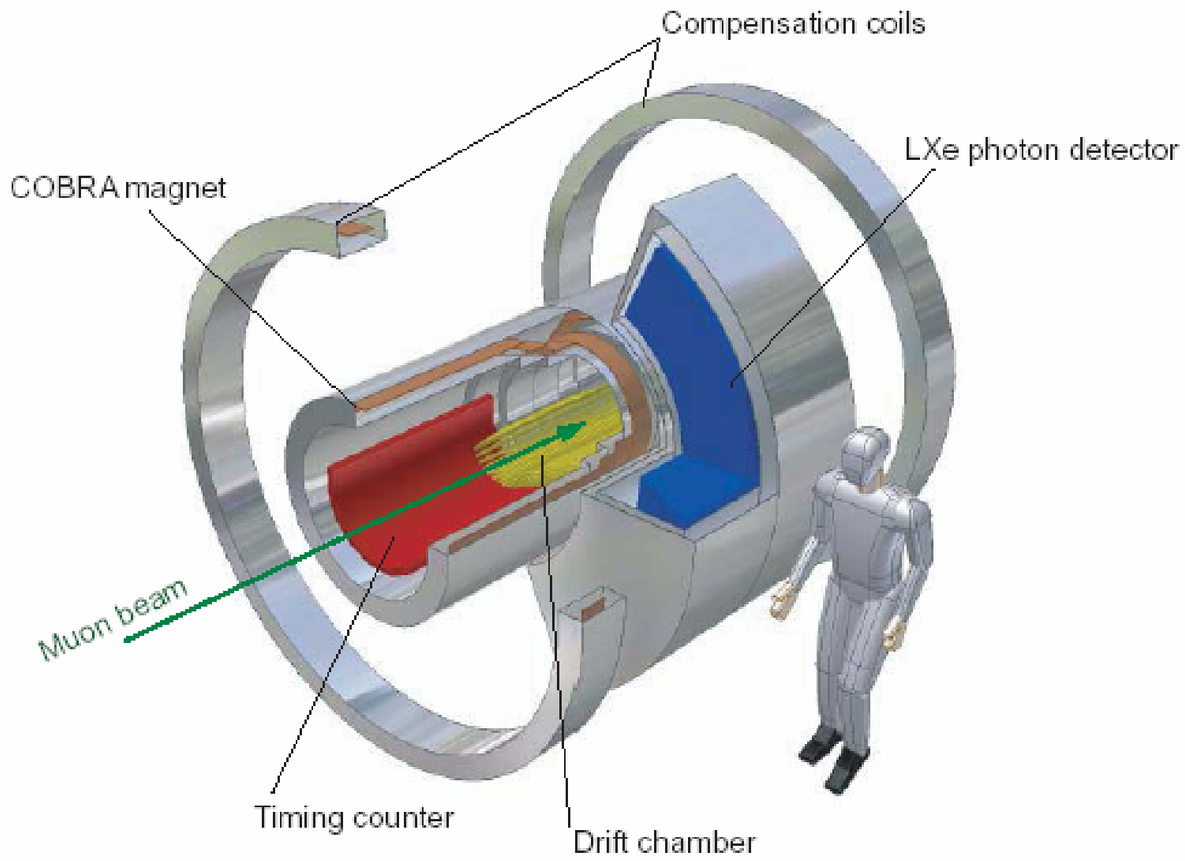
INFN & Pisa University A. Baldini, C. Bemporad, F.Cei, M.Grassi, F. Morsani, D. Nicolo', R. Pazzi, F. Raffaelli, F. Sergiampietri, G. Signorelli

INFN Roma I D. Zanello

PSI, Villigen J. Egger, P. Kettle, M. Hildebrandt, S. Ritt

Budker Institute, Novosibirsk L.M. Barkov, A.A. Grebenuk, D.G. Grigoriev, B, Khazin, N.M. Ryskulov

MEG detector



COBRA Magnet (Constant Bending Radius)

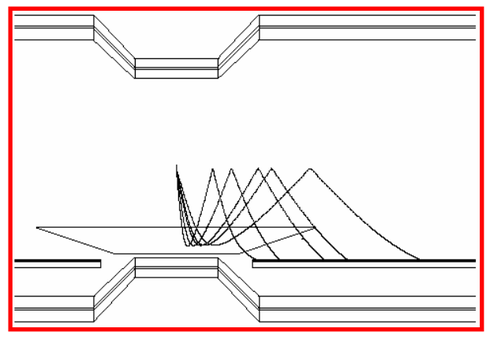
Solenoid with a gradient field

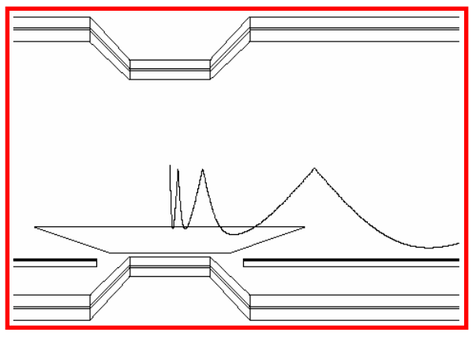
➢Constant bending radius independent of emission angles

-> Enable to sharply define the absolute momentum window of positrons

➢Low energy positrons quickly swept out

-> Good pattern recognition and stable chamber operation





Construction finished! Now @PSI

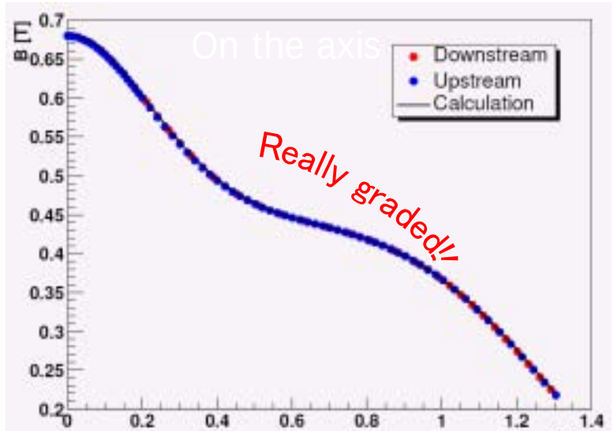
Excitation Test Completed Successfully!

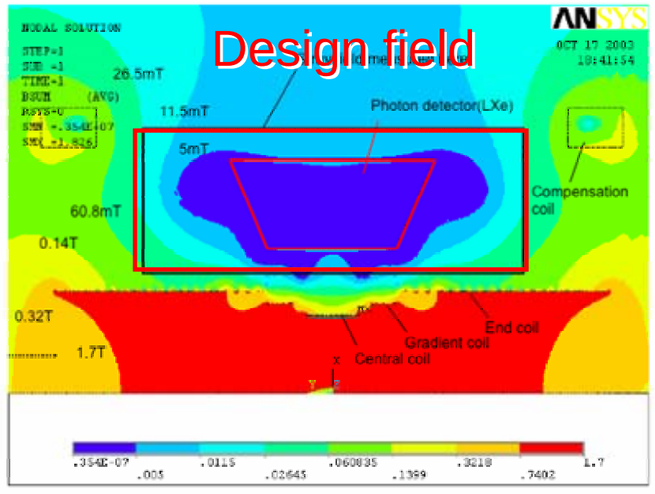
➢Magnetic field inside the SC was measured.

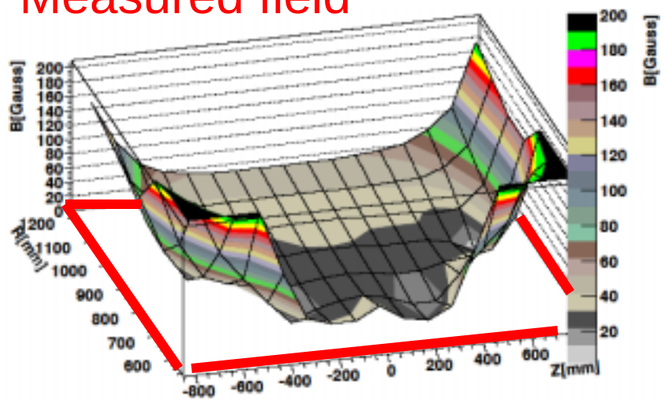
→Good Agreement with the calculation!

➢Fringe field around the photon detector region was measured.

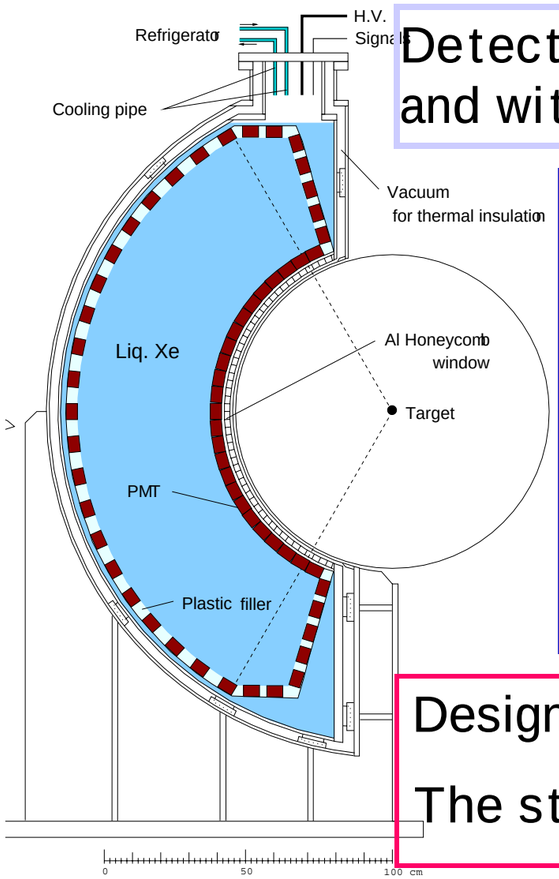
→Suppressed by compensation coils.







Liq. Xe calorimeter



Detect scintillation light with 800 Liter liq.Xe and with 800 PMTs

Liq. Xe

- ➢Uniform detector
- ➢High Light yield
- ➢Short decay time

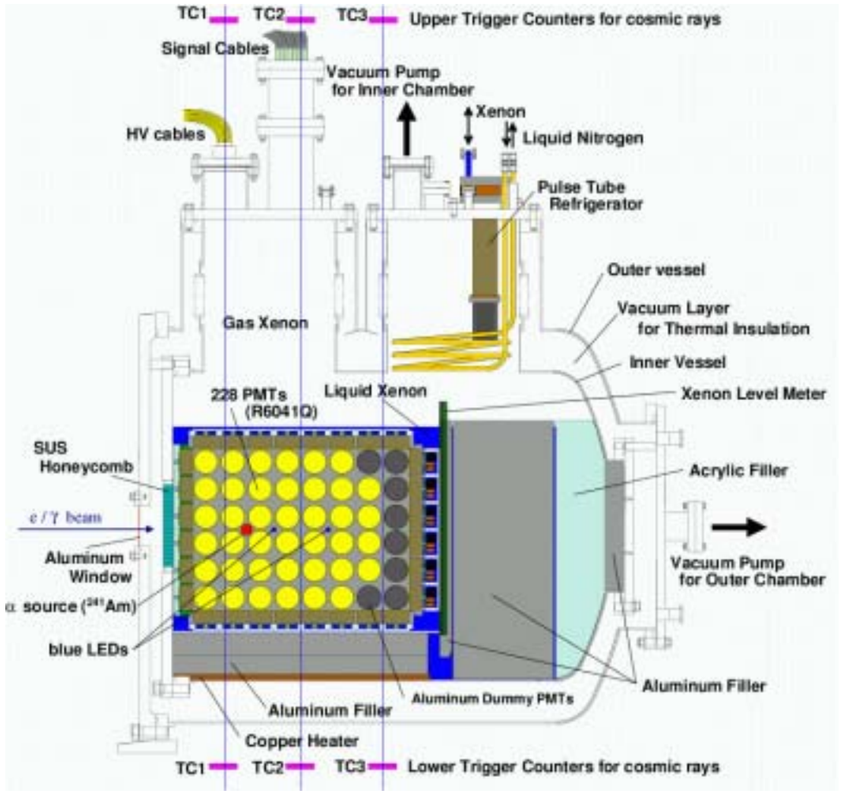
  Minimize the pile-up of gamma event

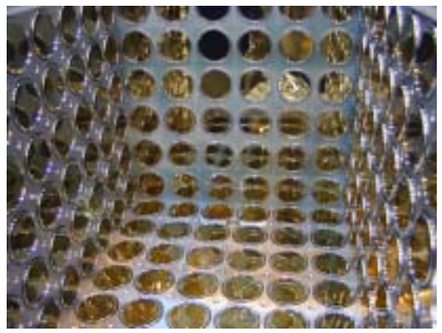
Design of liq.Xe calorimeter almost completed

The start of the construction: 2004

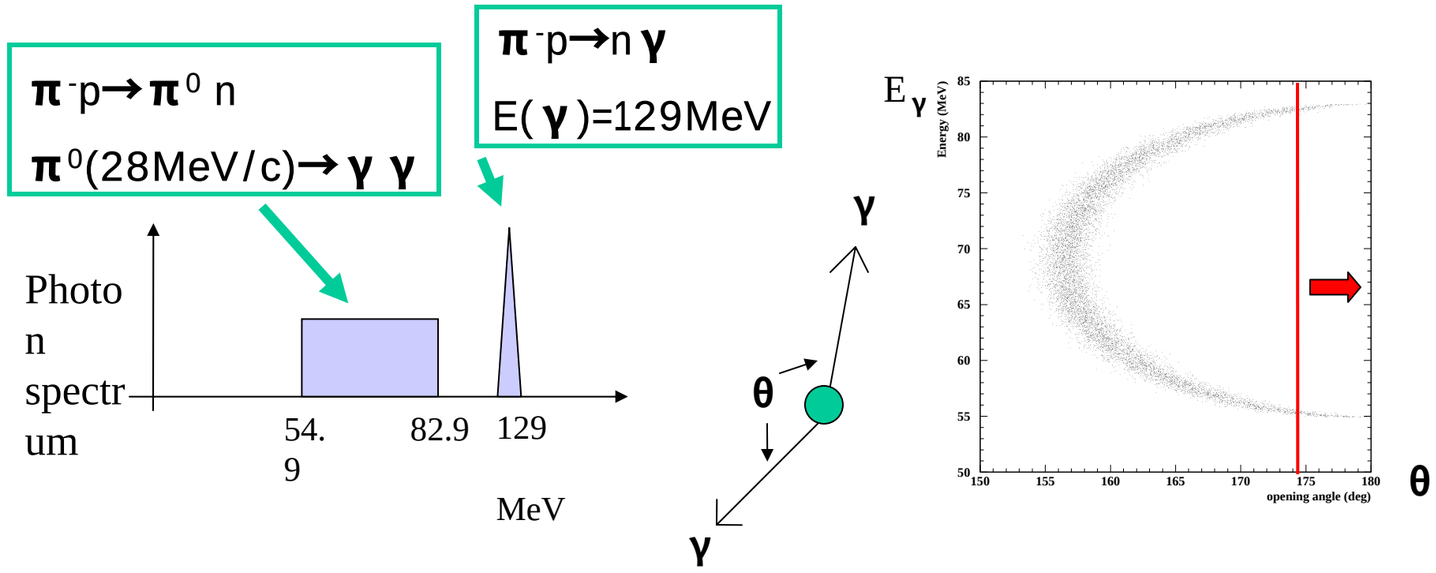
Large Prototype

Stability of the detector, Study of cryogenics, absorption length, calibration method…





Pi0 beam Test @PSI elementary process



2 gamma rays emitted back to back in lab.
frame: 55 & 84 MeV

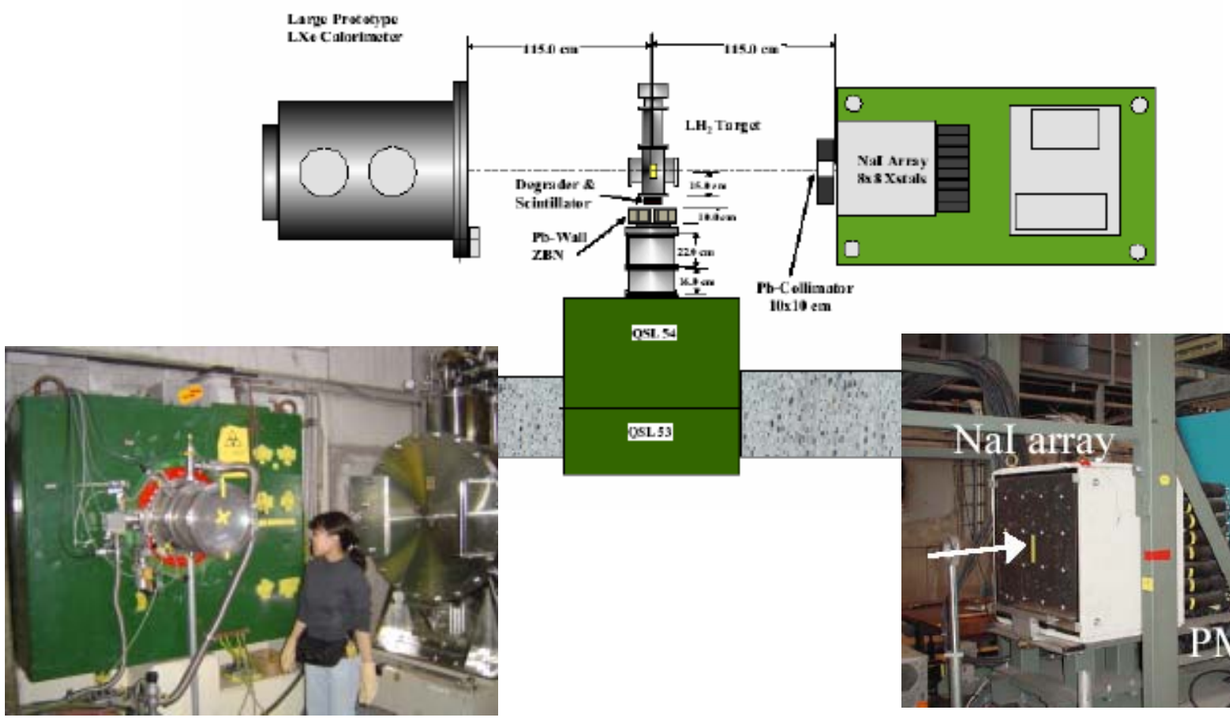
$\delta E_\gamma/E_\gamma < 1\% \Rightarrow \theta < 5°$

5° =87mrad=8.7cm@1m

Experimental Setup

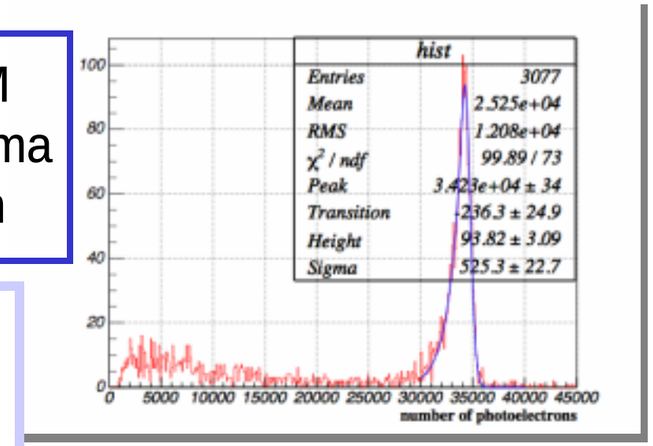
monochromatic **γ** beam ⟹ the Energy Calibration

2 **γ** from **π**0→2 **γ** ⟹ the absolute timing measurement



Energy, Timing and Position Resolution

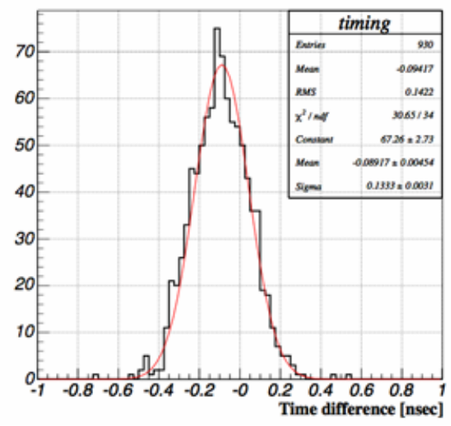
Energy Resolution: 4.5% FWHM
Timing Resolution: 100psec Sigma
Position Resolution: 4.5~9.0 mm



Expected Detector performance
Energy Resolution: 1.4~2.0 %FWHM
Timing Resolution: ~100psec FWHM
Position Resolution: 4~16mm

Q.E. improvement
Wave form analysis

Better resolution is expected

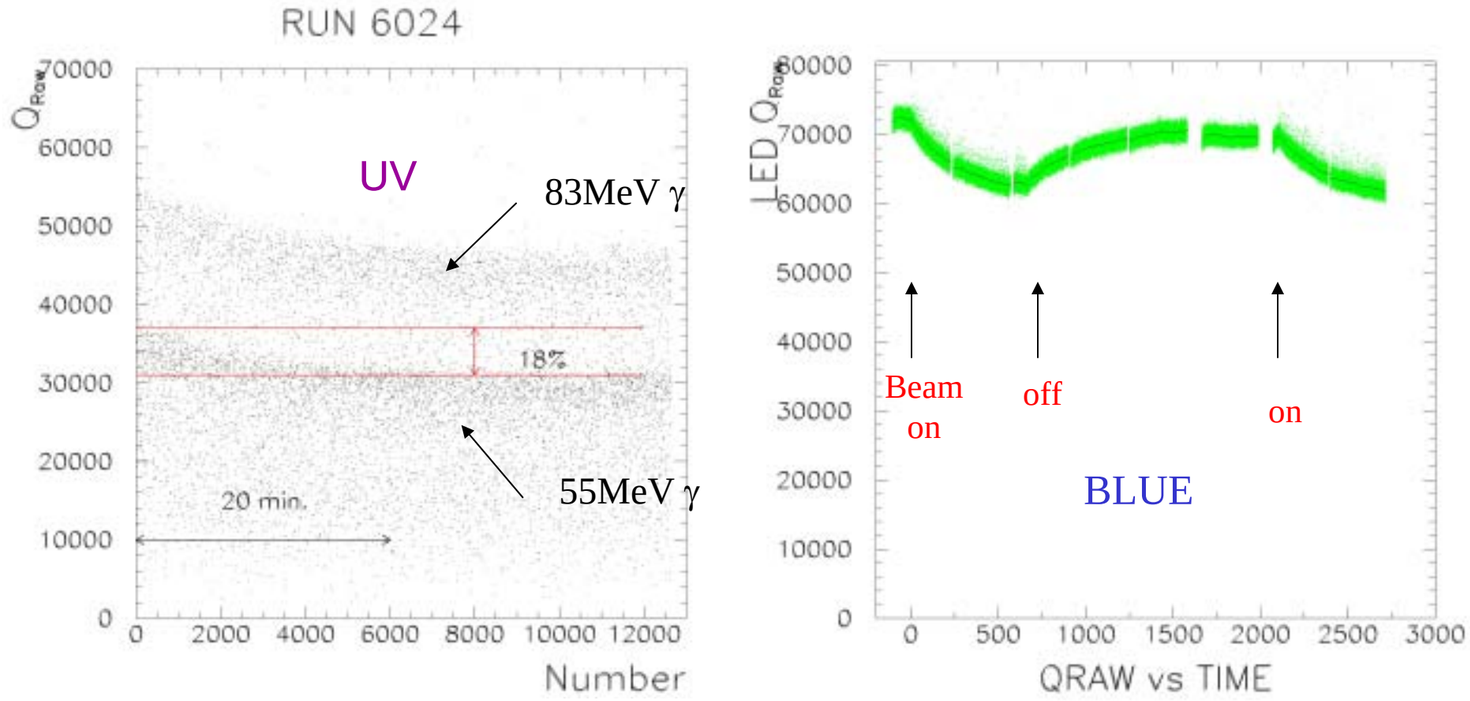


PMT R&D

Hamamtsu R6041
photocathode: Rb-Cs-Sb
Q.E. : ~10%
Installed in Large Prototype

Hamamatsu R9288
photocathode: K-Cs-Sb
Aluminum strip
Q.E. improved

Problem with old Type PMT

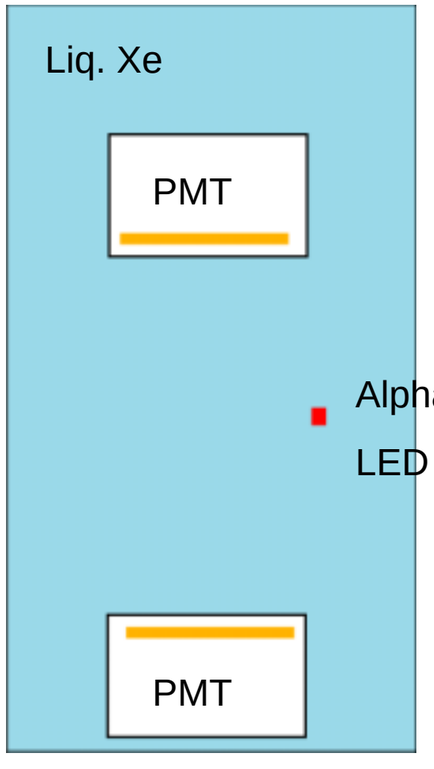


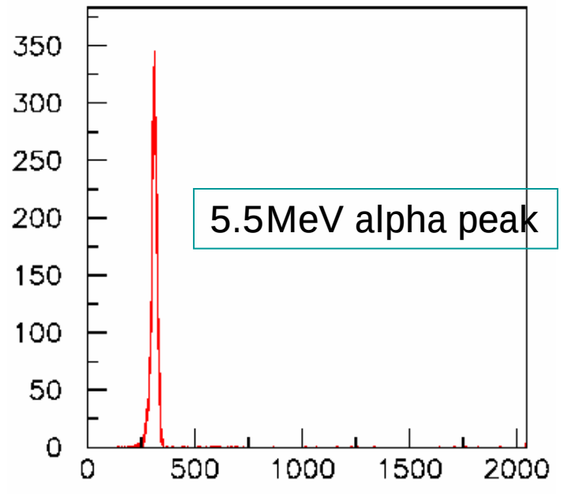
The Deterioration of old type PMT output due to the high rate background.

➢Output from Al Strip Type PMT (new type) needs to be tested under the high rate background, 10^6 ~ 10^8 p.e. per sec

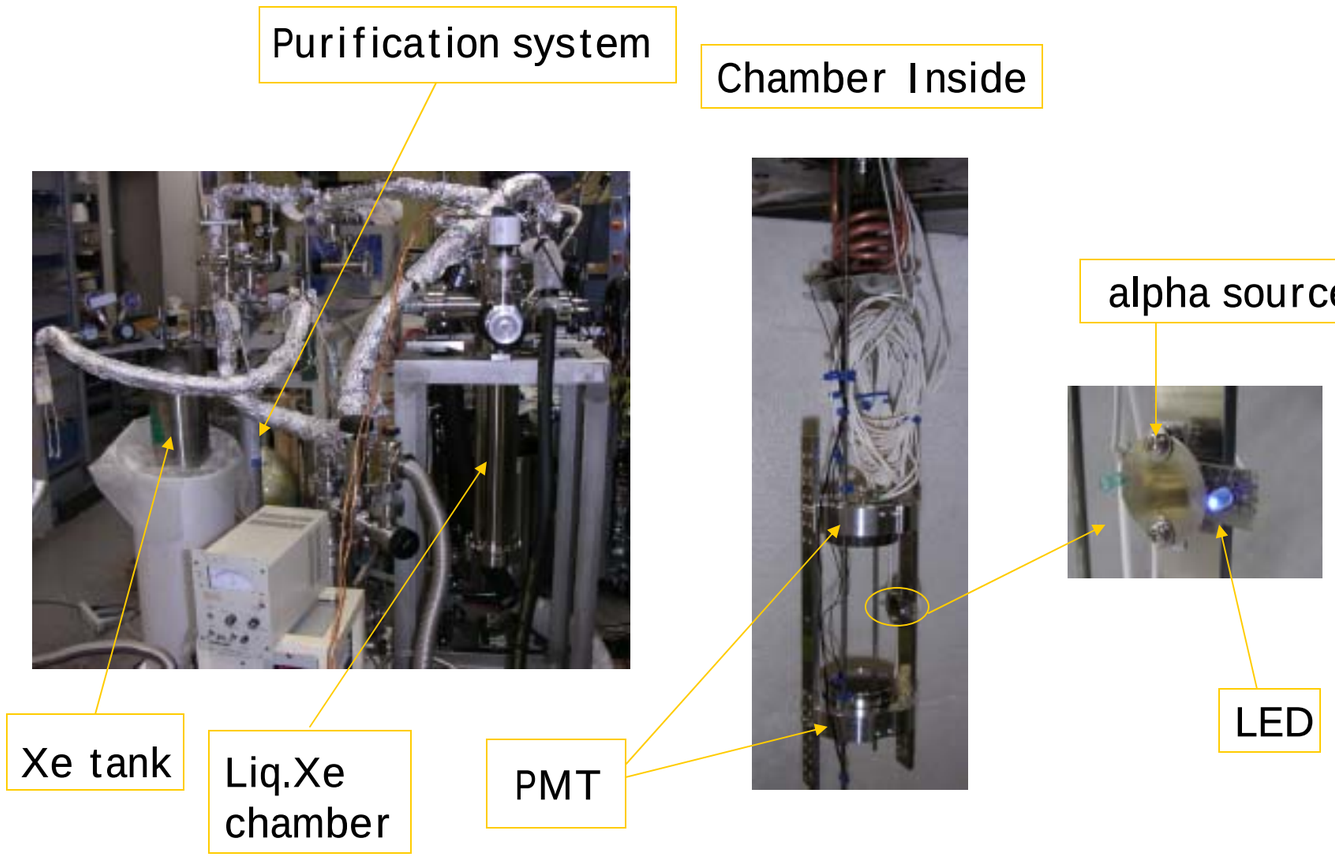
PMT Test @ Univ. of Tokyo

- Set up





PMT Test Facility @Univ. of Tokyo



Condition and Procedure

- alpha source : ~200Hz,
- LED pulse height:500p.e. ~ 12000p.e. per event
  pulse shape: ~10nsec
  rate: 100Hz ~ 10KHz

•Trigger: alpha self trigger (veto by LED driver pulse)

•Procedure

Pedestal Run & Gain calibration using LED

Alpha Run @ LED OFF

Alpha Run @ LED ON (LED : high rate background)

-Change LED Pulse height, rate and PMT gain

➢ Investigate the cause of the change in PMT output

➢Breeder current ? → Peak/Sigma (gain independent)

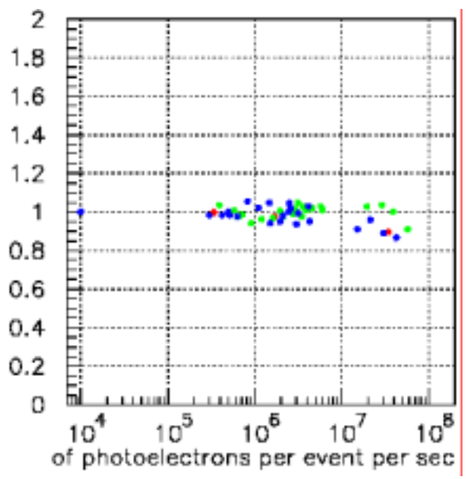
➢Deterioration of photocathode?

Result 1*e6gain

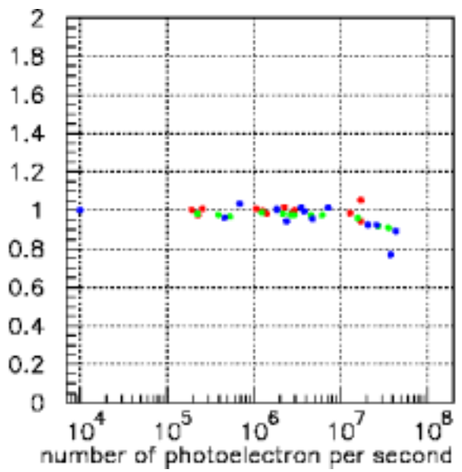
X: number of photoelectrons per second from LED

Y: (peak/sigma @LED ON) / (peak/sigma @LED OFF)

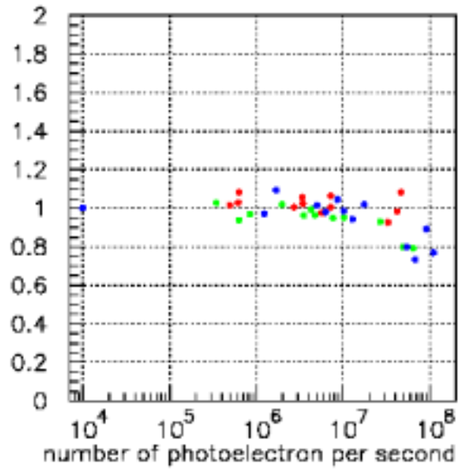
TB0094 TB0302 TB0268



TB0568 TB0102 TB0415



TB0284 TB0439 TB0239



Stable output up to 10^7p.e. !

Summary

Photon detector : Large prototype @PSI
background estimation
The construction start in 2004.

COBRA magnet :Now @ PSI !
Installation & Engineering runs in piE5

PMT R&D : Problems with background in the beam area will be investigated this year.
(Background measurement)

All the detectors will be installed in piE5 beam line by 2005.

Engineering runs will start in 2005.

MEG experiment starts at the beginning of 2006.

piE1 beam line @PSI

Beam properties:

Max. momentum: 280 [MeV/c]

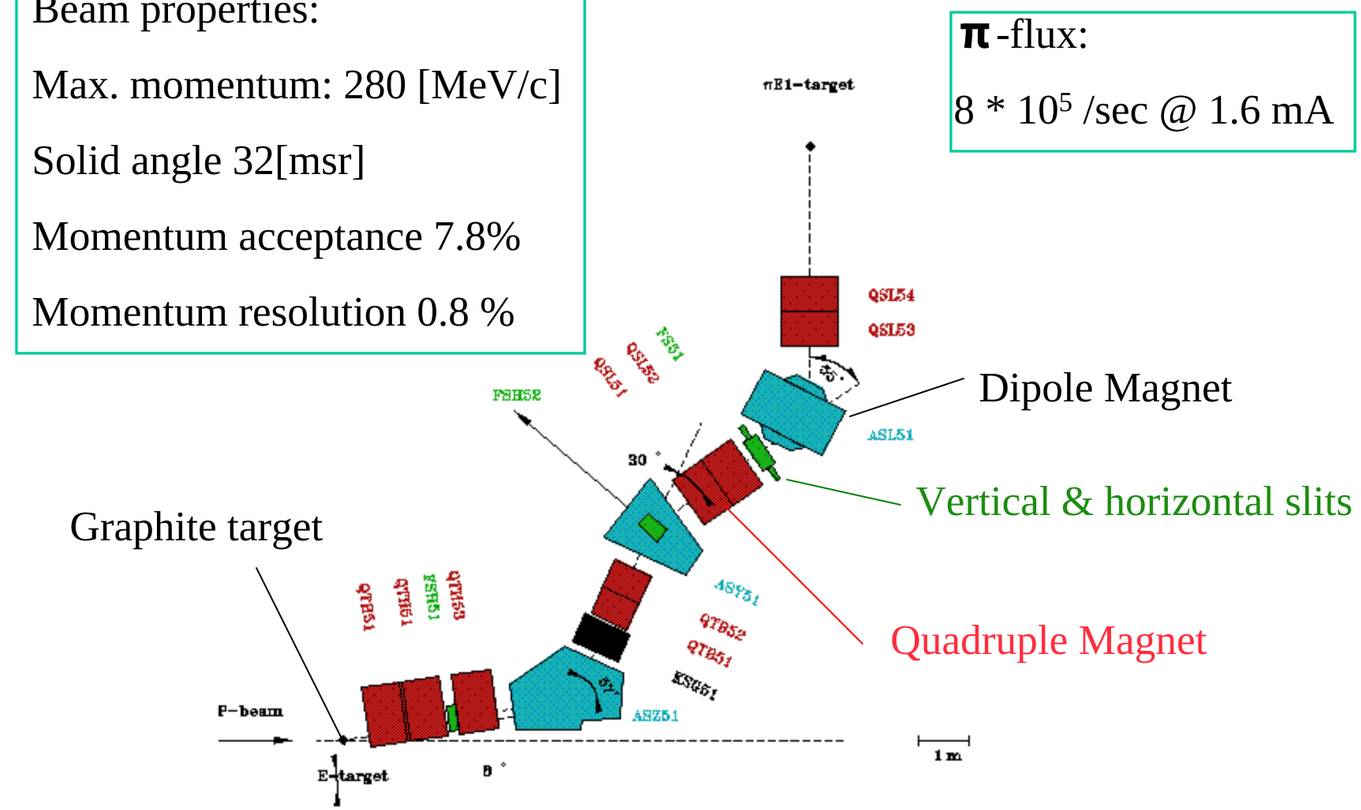
Solid angle 32[msr]

Momentum acceptance 7.8%

Momentum resolution 0.8 %

π-flux:

8 * 10^5 /sec @ 1.6 mA



Result 1*e6gain

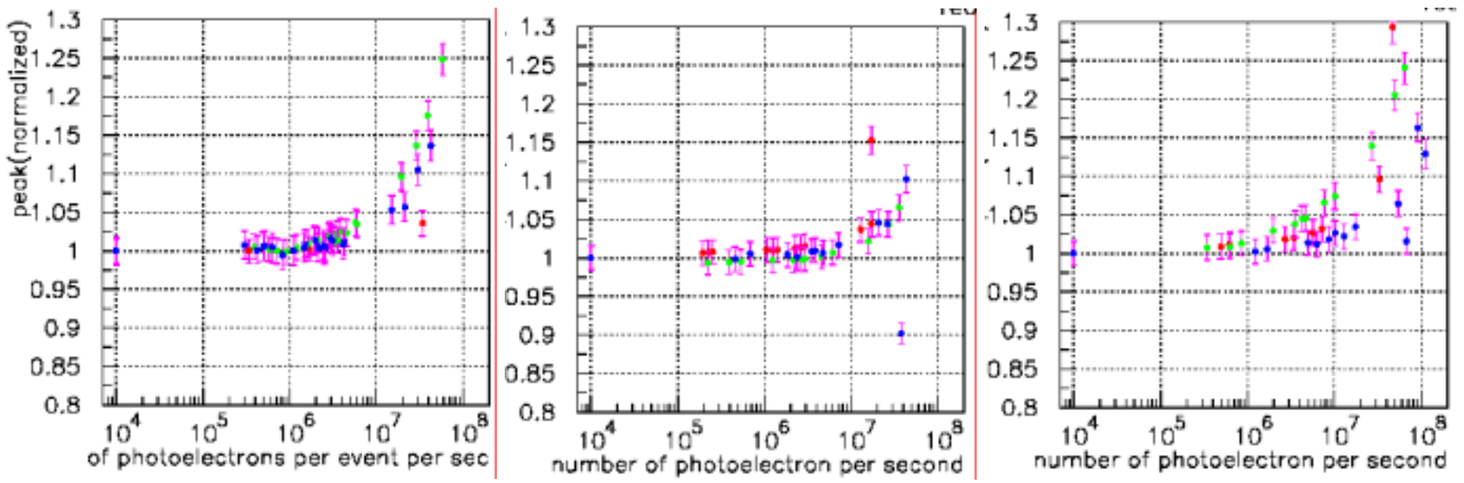
X: number of photoelectrons per second from LED

Y: alpha peak (@LED ON) / alpha peak (@LED OFF)

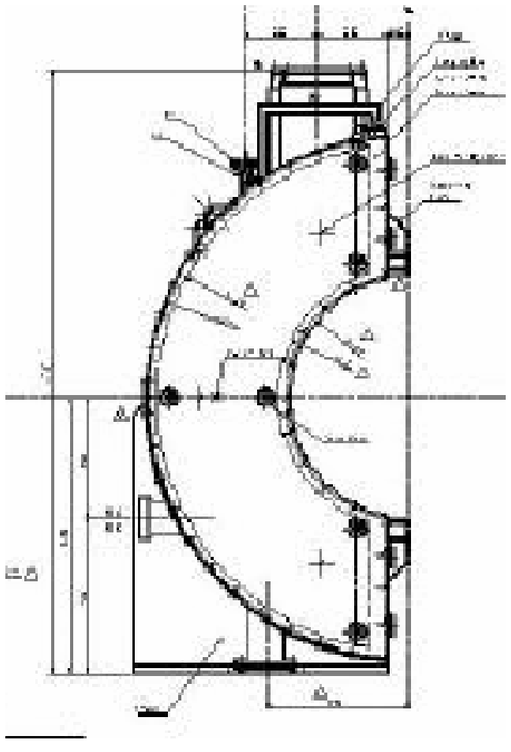
TB0094 TB0302 TB0268

TB0568 TB0102 TB0415

TB0284 TB0439 TB0239



Thermal neutron background estimation



- Condition of the estimation

➢16 n/cm^2/sec (MEG TN022)
➢From all direction

- 6*10^5 photons (: ~9MeV gamma) are generated in LP MC

➡ 5.2 * 10^6 p.e. /PMT/sec @LP

- Scaled to the final detector (surface area)

➡ 3.2 * 10^7 p.e./PMT/sec @final detector
= 5.0 *10^-6 A @10^6gain