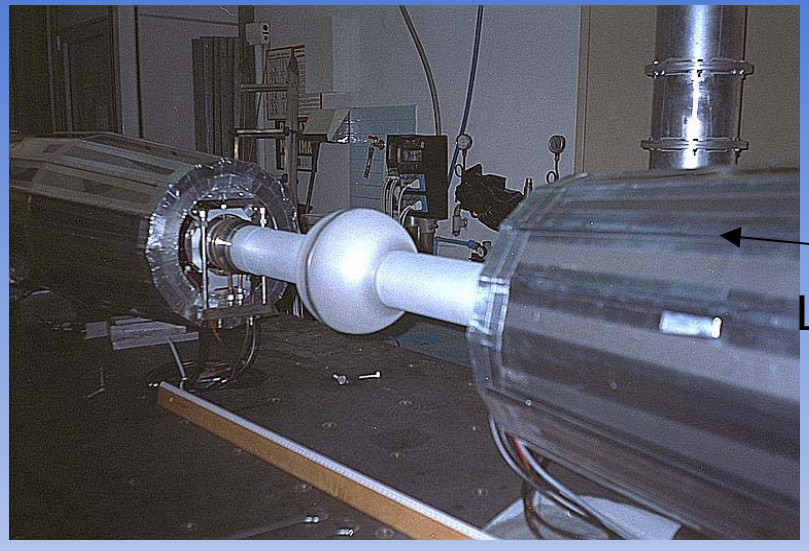
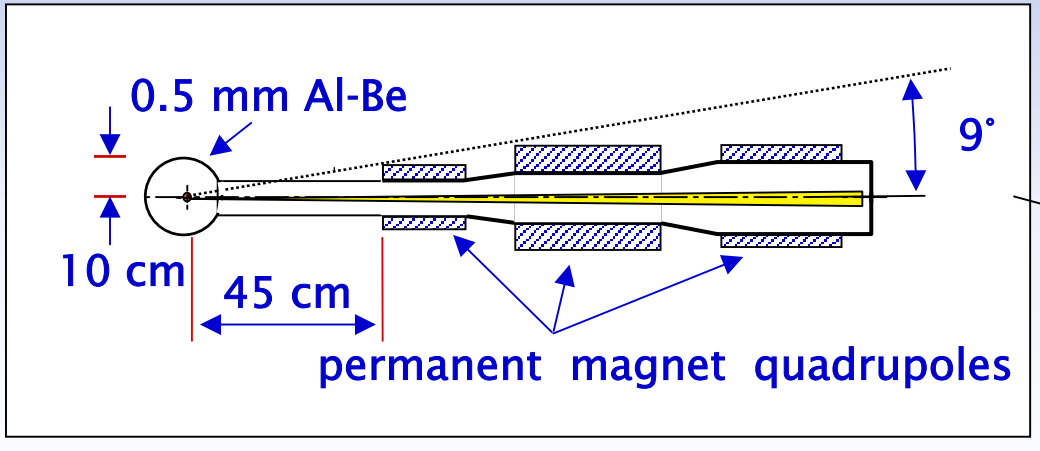
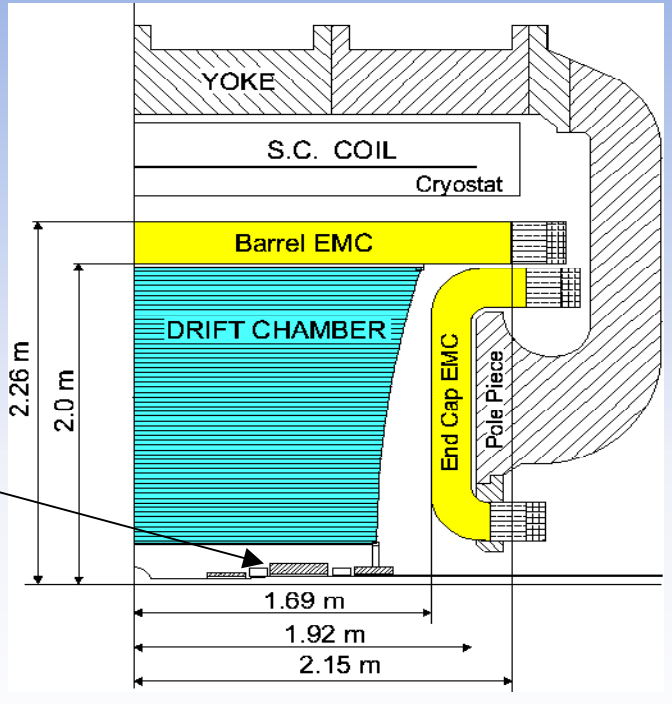
Spare transparencies

The KLOE quadrupole tile calorimeter

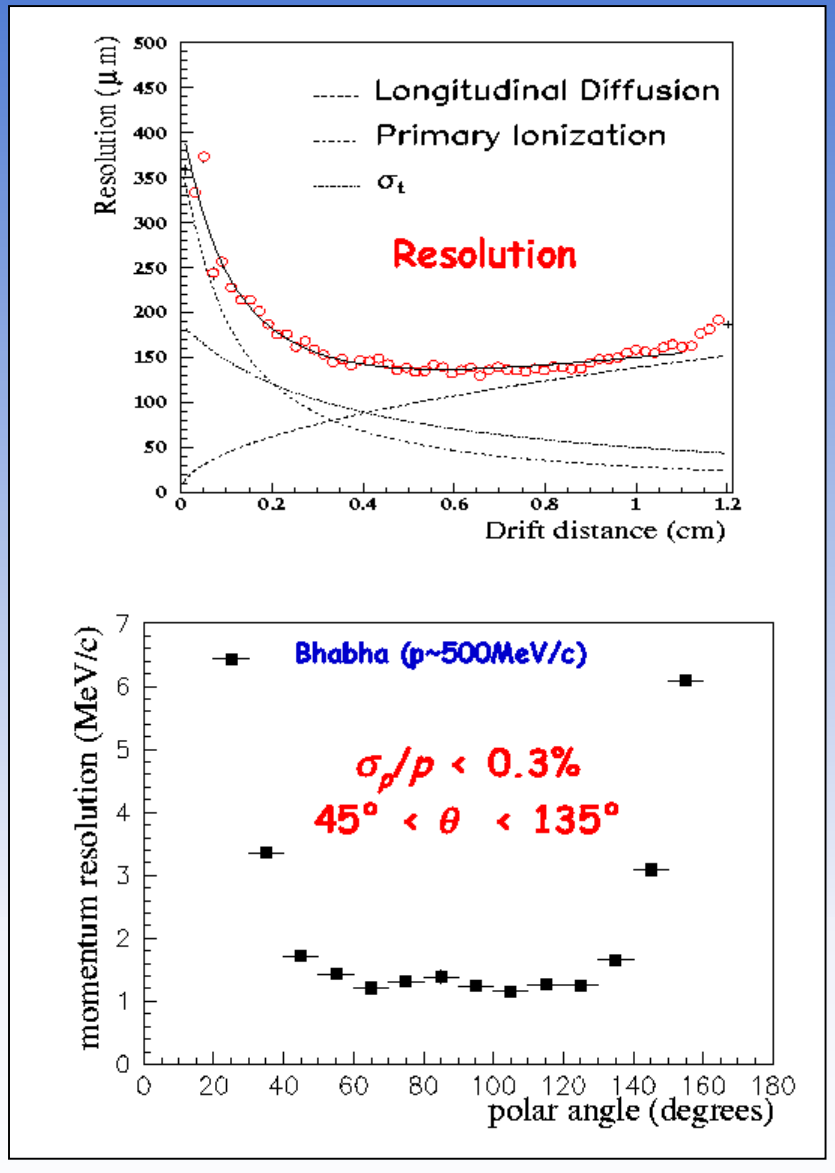


Lead/Scintillator tile calorimeter (QCAL)





The KLOE drift chamber



Cylindrical Drift Chamber

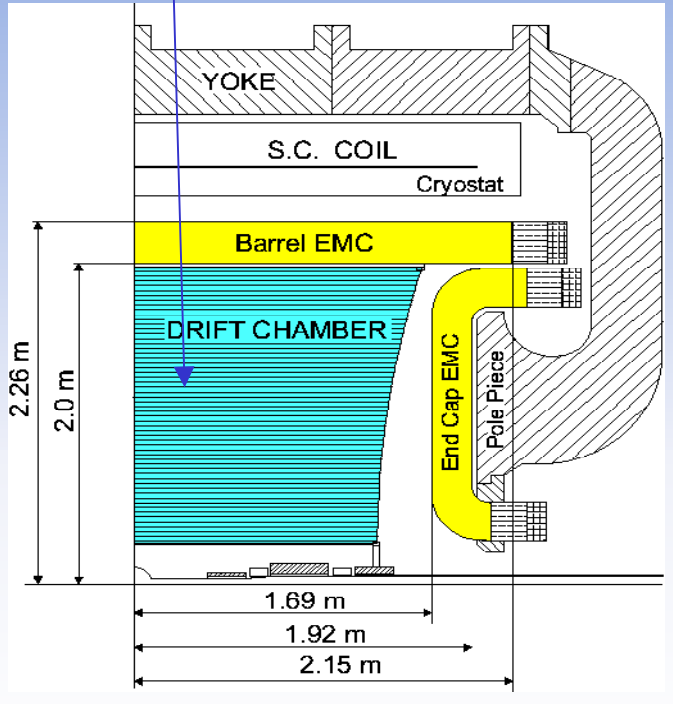
4 m ∅, *3.3 m* Length

90% Helium, *10%* Isobutane

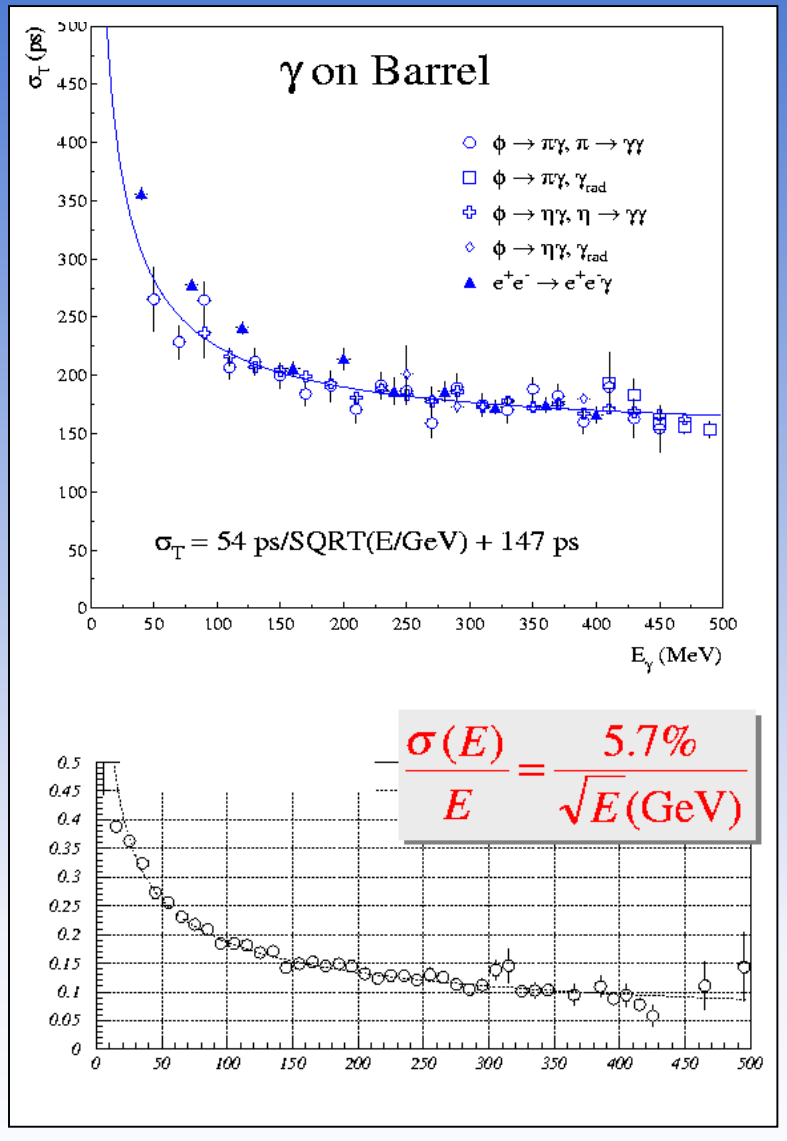
12582/52140 sense/total wires

12 layers 2×2 cm^2 + 46 layers 3×3 cm^2

all stereo wires

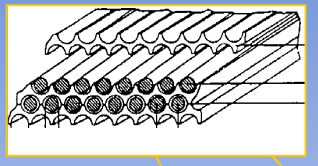


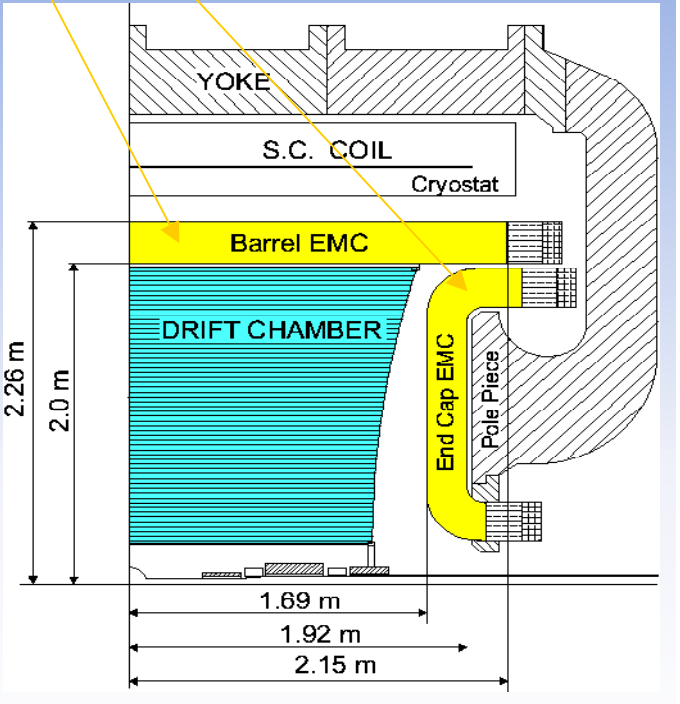
The KLOE calorimeter



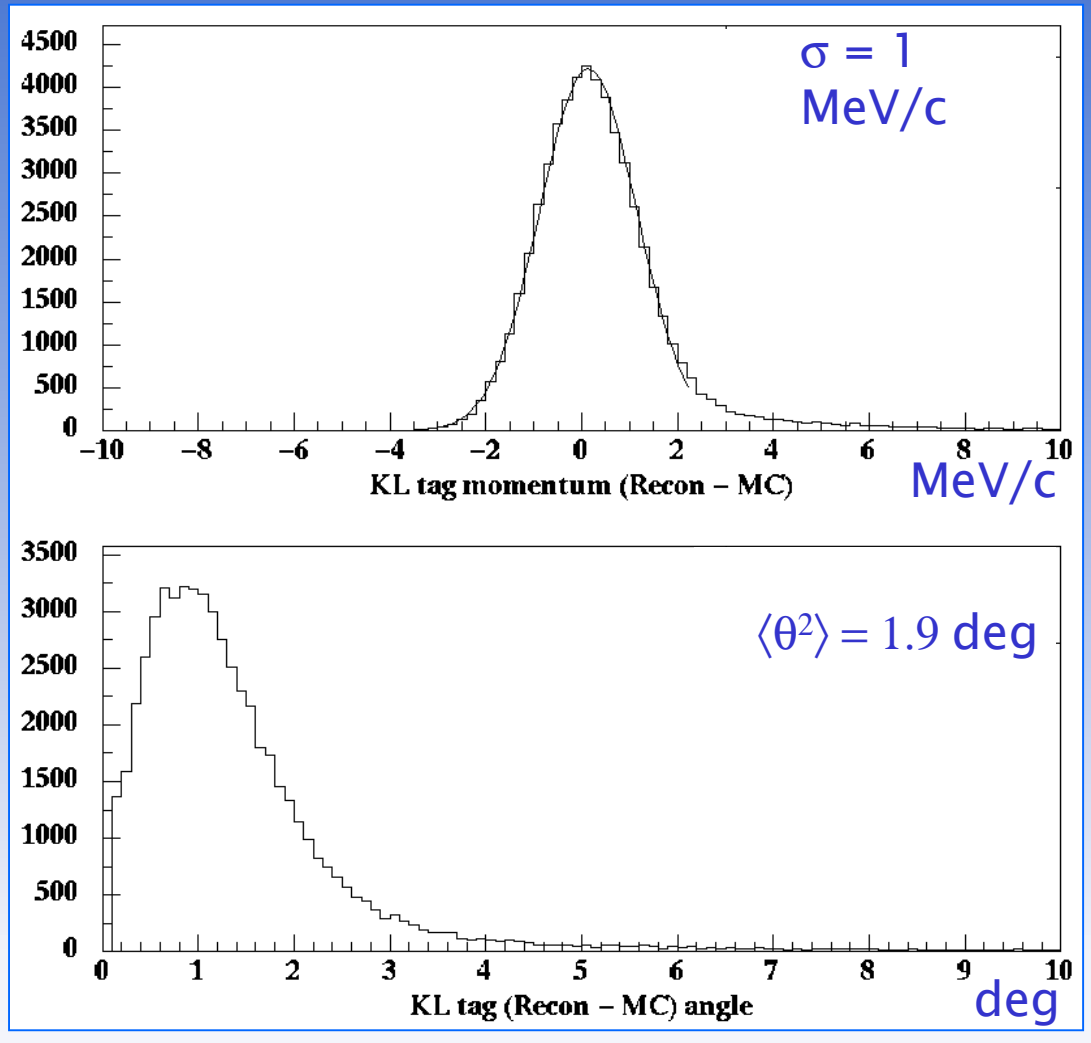
Electromagnetic Calorimeter

- Pb / Scintillating Fibers
- 4880 PMTs
- 2 × 32 Endcap + 24 Barrel modules
- 98% coverage of solid angle

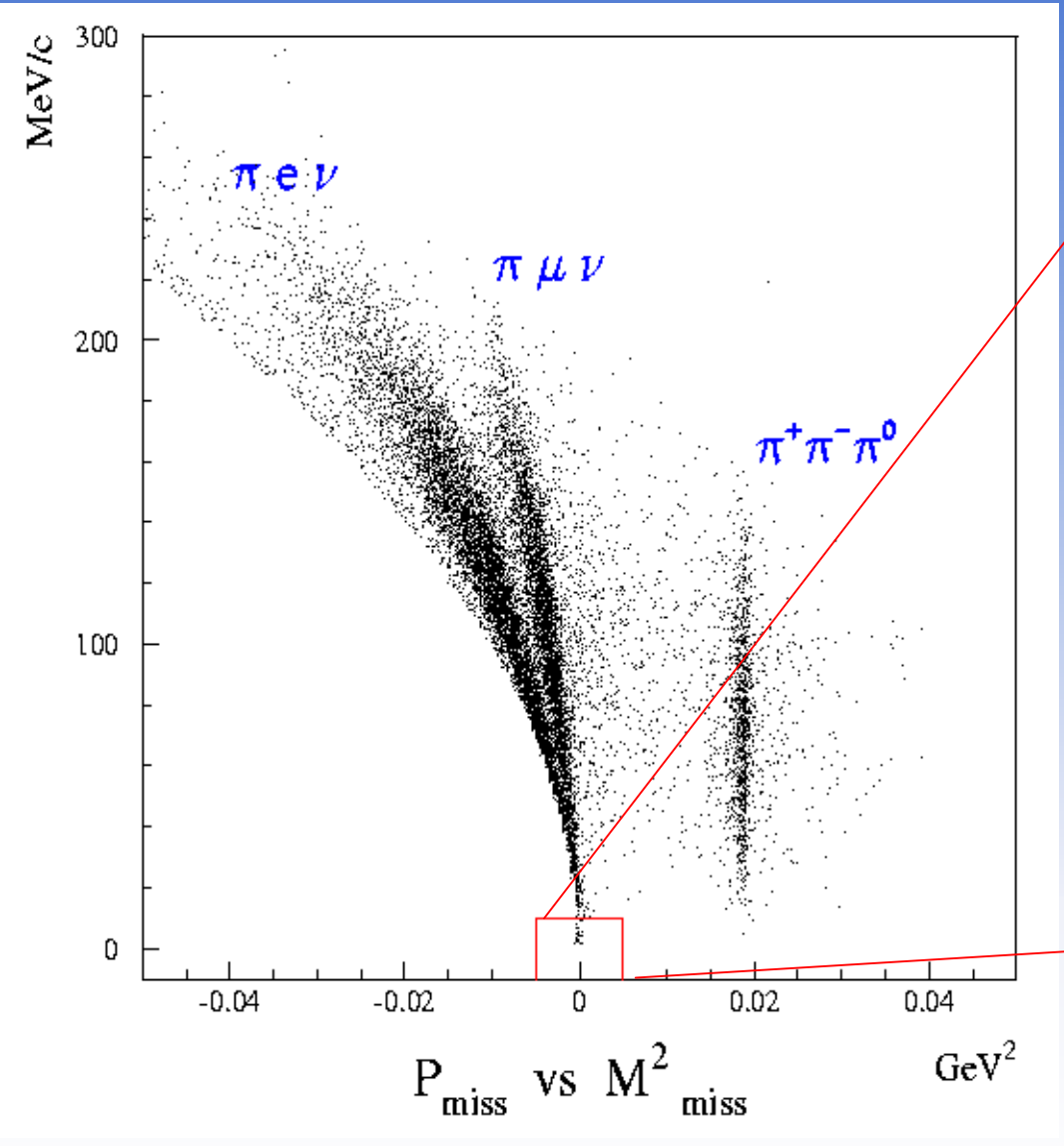


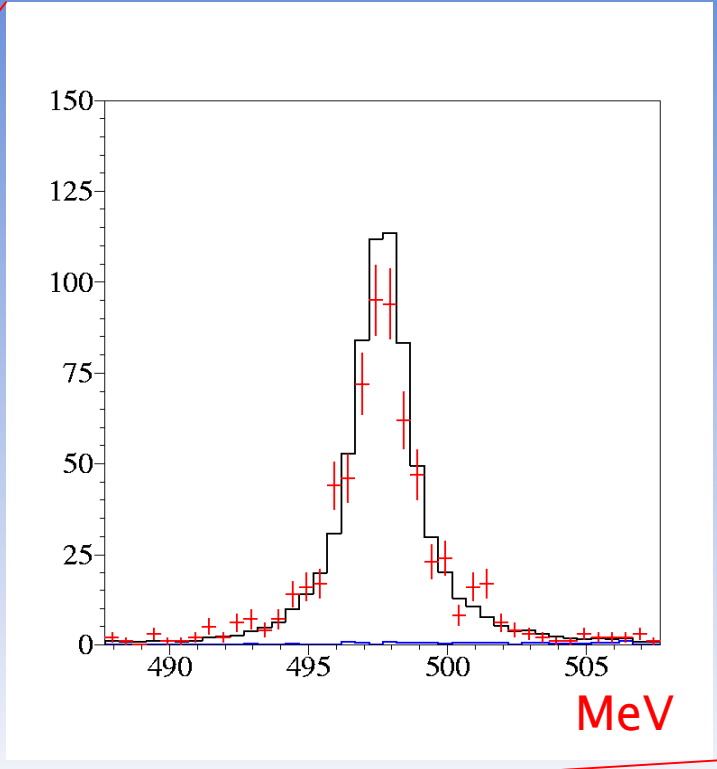


K_L Tag


σ = 1
MeV/c
KL tag momentum (Recon – MC)
MeV/c
⟨θ²⟩ = 1.9 deg
KL tag (Recon – MC) angle
deg

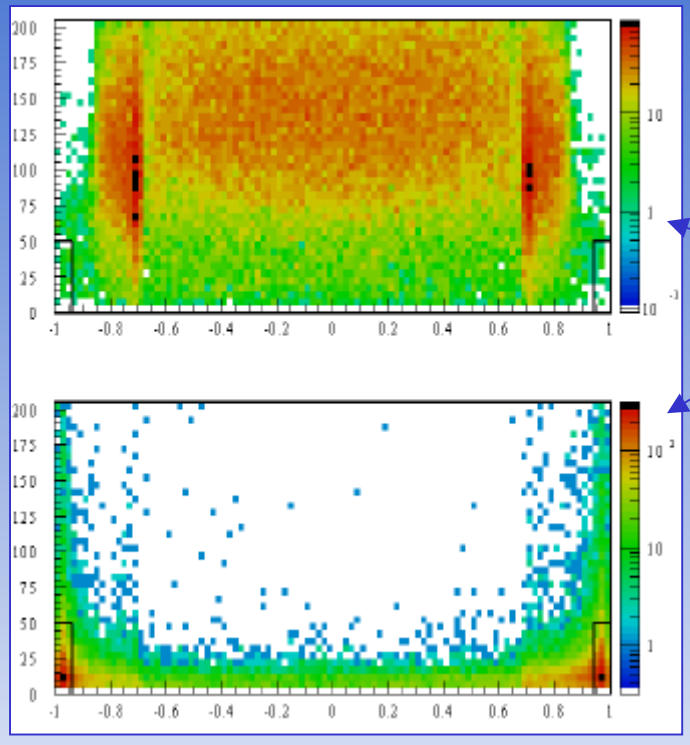
$K_L \rightarrow \pi^+\pi^-$





K_S Tag

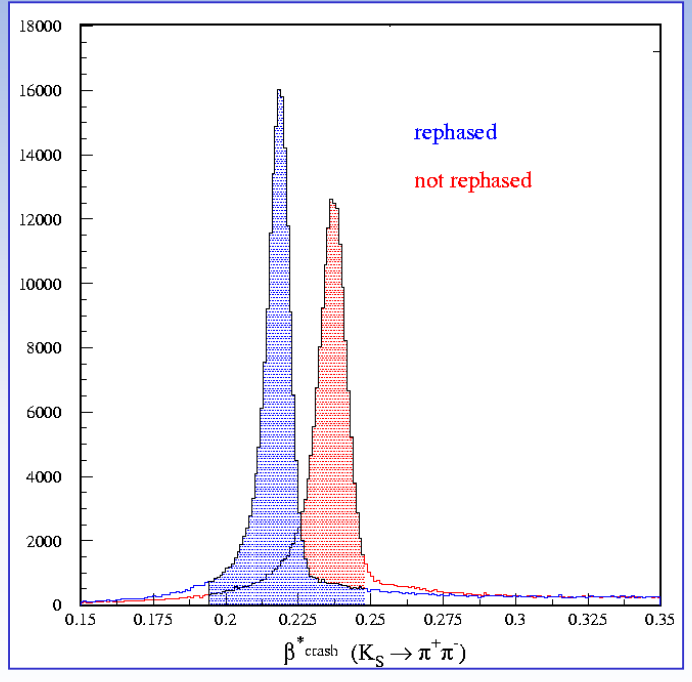
$E > 50$ MeV; $\cos\theta > 0.945$



K_S K_L

Machine background

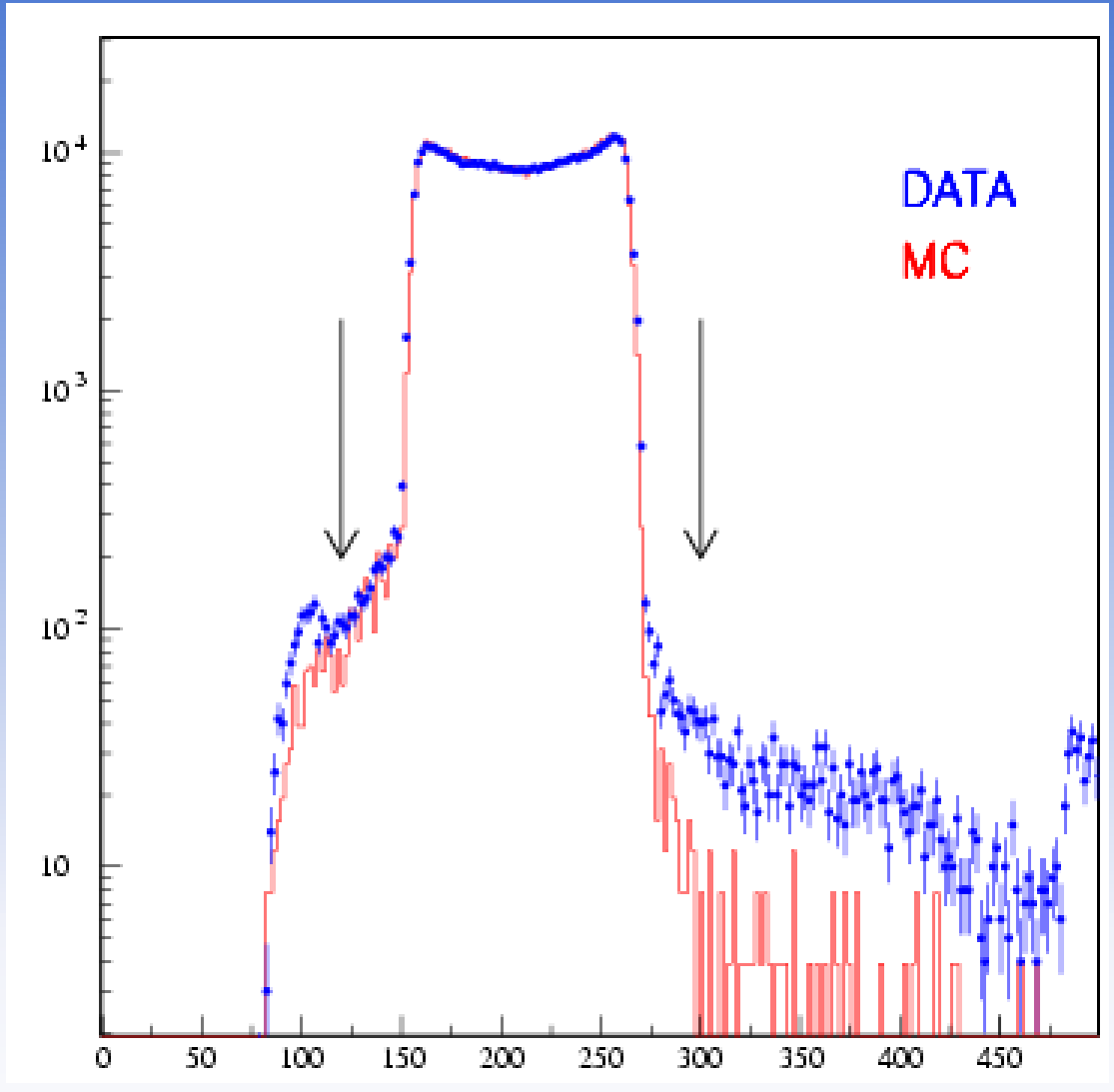
$\varepsilon^{+-} / \varepsilon^{00} = (95.030 \pm 0.005)$ %



Tag efficiency from data:

Systematic effect due to different velocity of γ (from $\pi^0\pi^0$) and of $\pi^\pm$

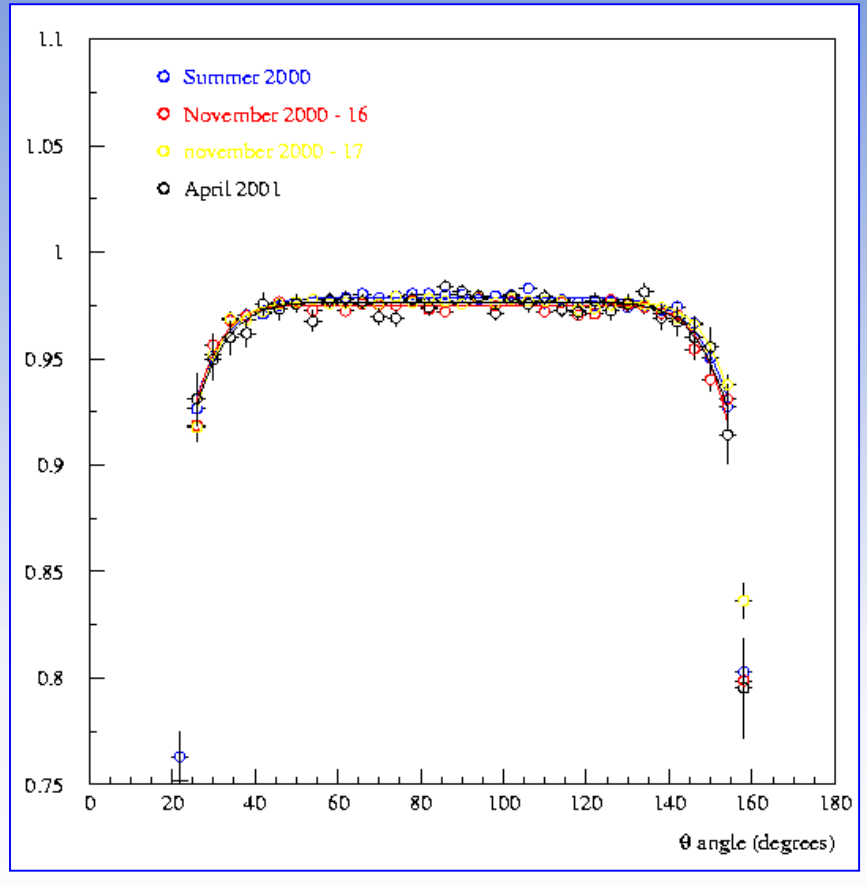
$K_S \to \pi^+\pi^-$ selection



Tracking efficiency

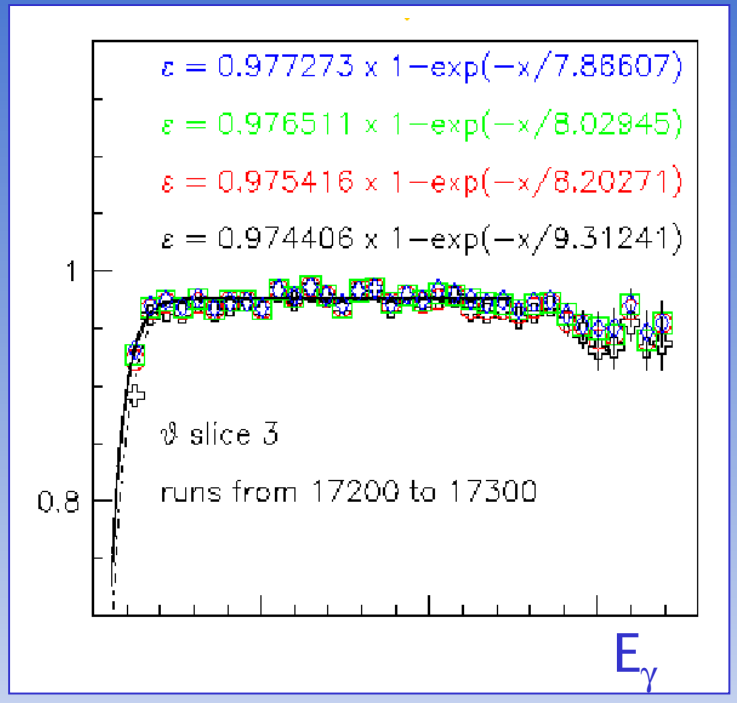
Tracking efficiency from $K_S \rightarrow \pi^+\pi^-$ sub samples in p_T and θ bins:

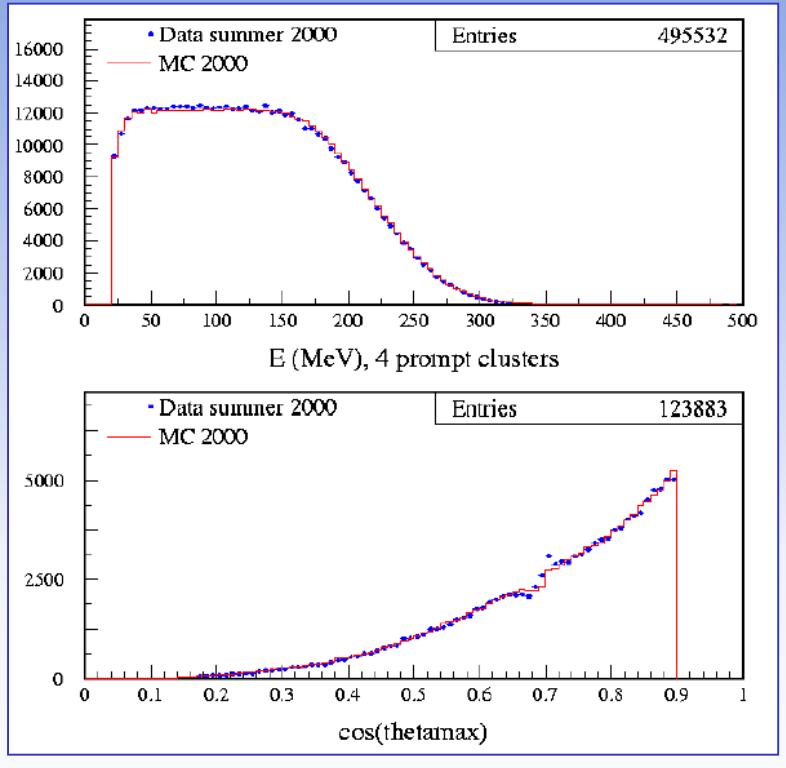
- Use p of K_L and one π track to close kinematically the event
- Then look for the other π track



Photon efficiency

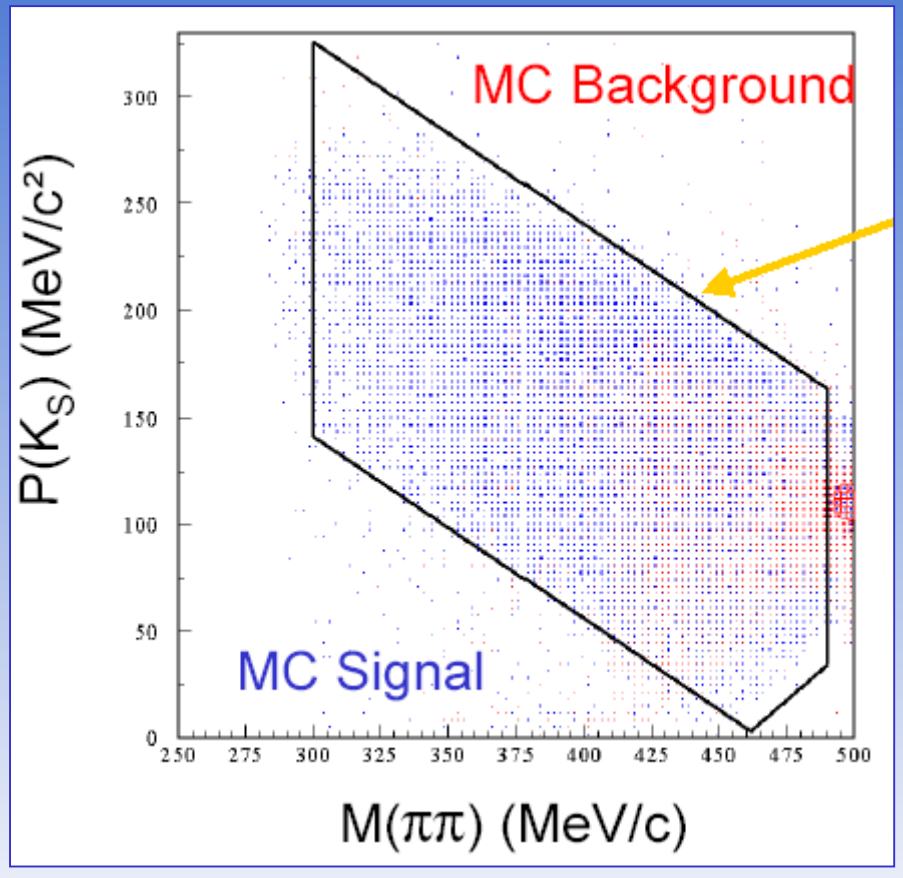
❖ Photon efficiency is evaluated from $\phi \rightarrow \pi^+\pi^-\pi^0$ control sample in θ bins and as function of energy





❖ 4 prompt cluster θ and E distributions compared with $K_S \rightarrow \pi^0\pi^0$ Monte Carlo

$K_S \to \pi e \nu$ preselection



- 2 tracks from the IP
- Cuts in $p(K_S)$ vs. $M_{\pi\pi}$

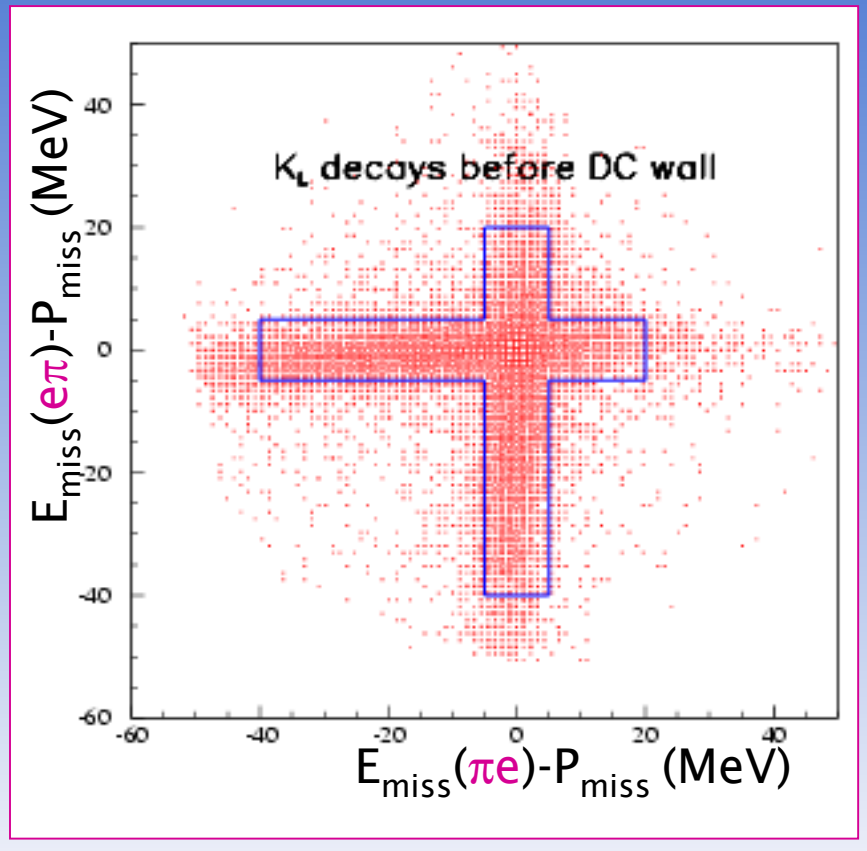
$\varepsilon = 62.4\ \%$

t_0, TCA and trigger efficiencies

t_0, TCA and trigger efficiencies estimated directly from data using several control samples:

$K_L \to \pi e \nu$, $\phi \to \pi^+\pi^-\pi^0$, $K_S \to \pi^+\pi^-$

$\varepsilon_{TCA+T0+TRG} = (81.7 \pm 0.5)\ \%$



Method A:

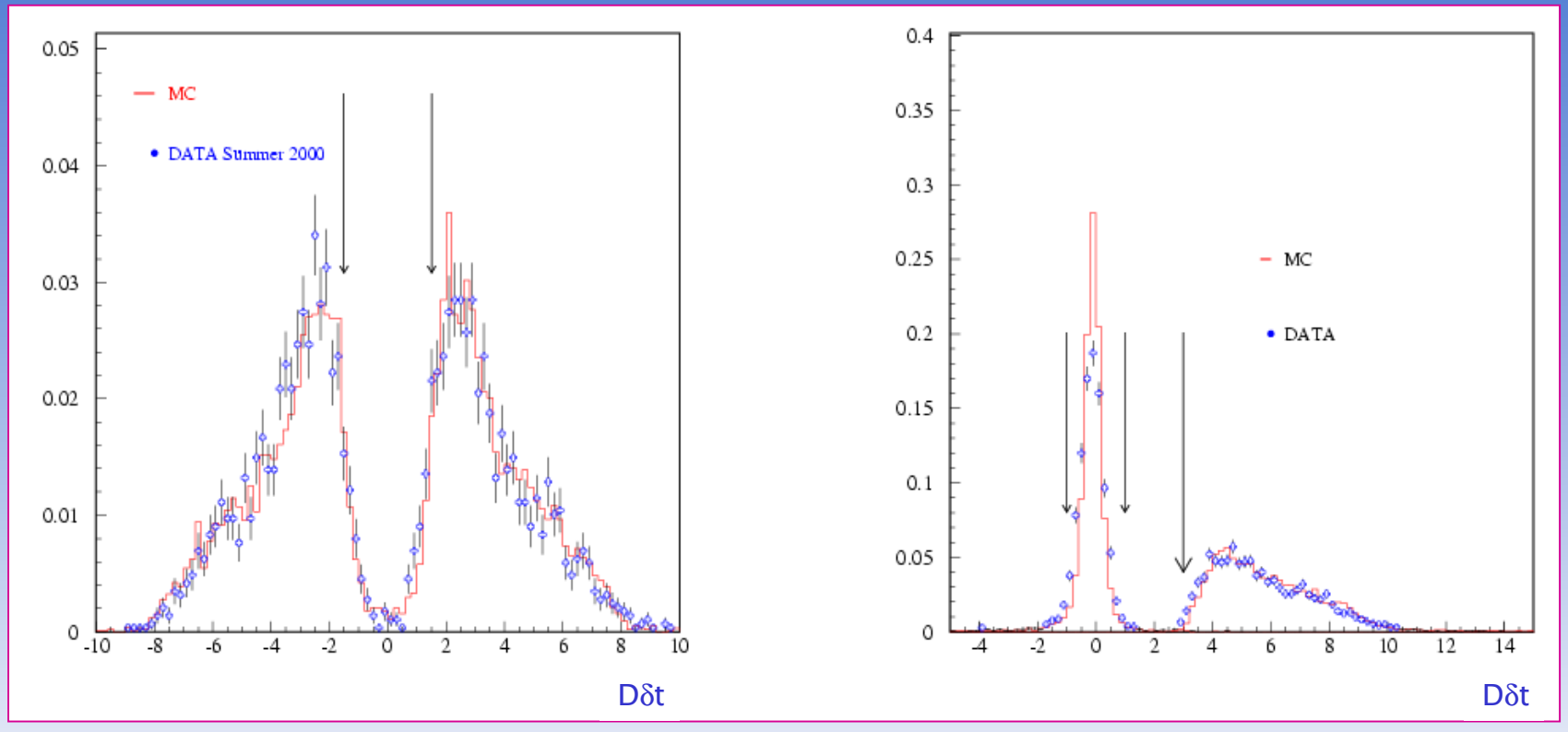
- Single particle efficiency from data
- Plug in Monte Carlo

Method B:

- Select events using only the chamber

Consistent results using the 2 methods

π/e separation by TOF: data vs. MC

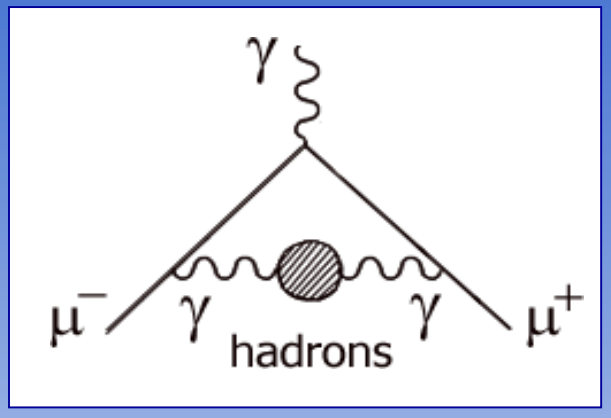


Dδt in $K_L \rightarrow \pi e \nu$ before the DC wall used to evaluate the efficiency (and weight MC events)

Efficiency for the cut |Dδt (π,π)| = (91.5 ± 0.5) %
Efficiency for the cut |Dδt (π,*e*)| = (91.8 ± 0.5) %

Hadronic cross section (g-2)

$$(g-2)/2 = a_\mu^{QED} + a_\mu^{hadr} + a_\mu^{weak} + \ldots$$



Use dispersion integral to express a_μ in terms of $R = \sigma^{hadr}/\sigma^{\mu\mu}$

$$a_\mu^{hadr} = (\alpha \cdot m_\mu / 3\pi)^2 \int_{4m^2_\pi}^{\infty} ds \, \frac{R(s) \cdot \hat{K}(s)}{s^2}$$

Recently a 2.6σ discrepancy with SM value of a_μ^{hadr} observed by E821:
$(420 \pm 170) \times 10^{-11}$

a_μ with ISR: rejection of FSR

Rejection of final state radiation (FSR) background

ISR peaked at the ρ
FSR peaked at low E

- $E_\gamma > 10$ MeV

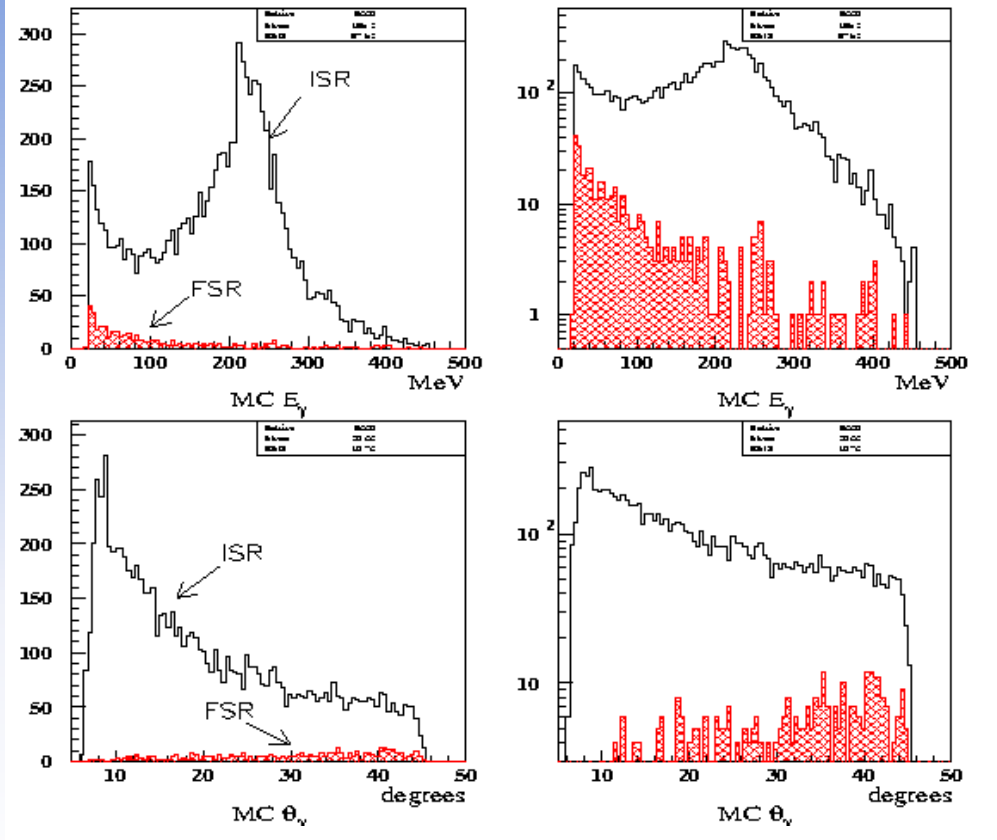
+

ISR peaked at small angle
FSR follows π distribution

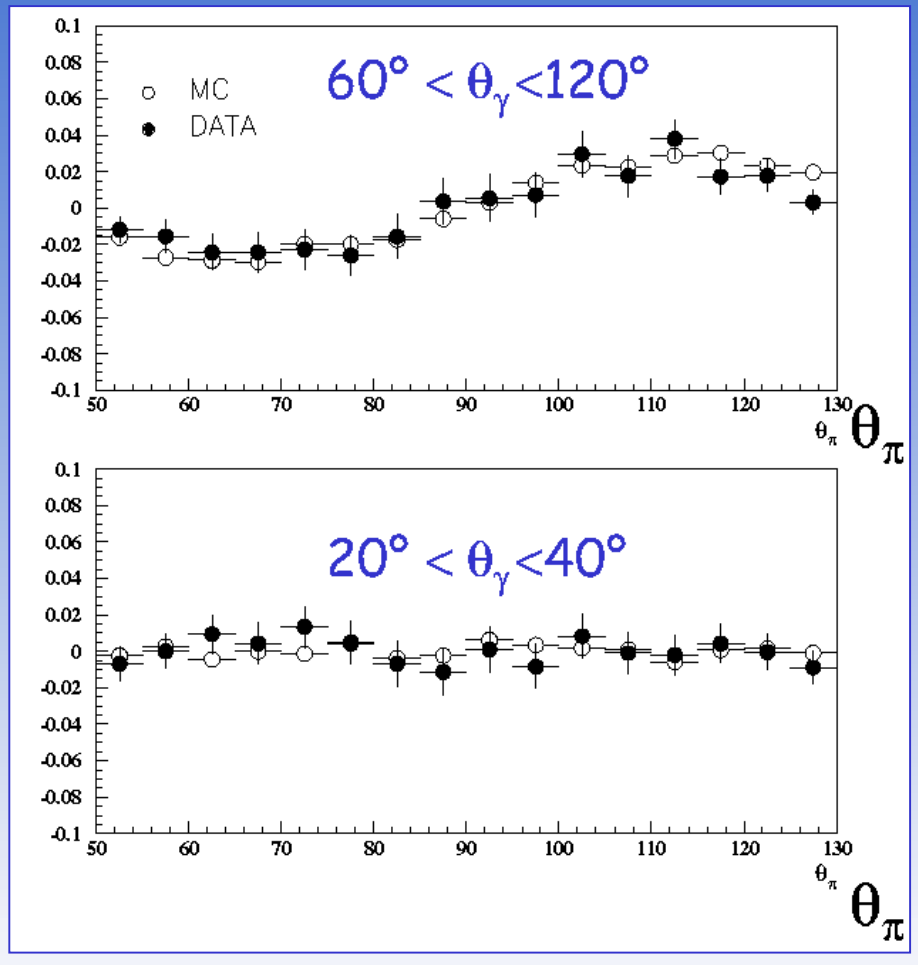
- $5^\circ < \theta_\gamma < 21^\circ$
- $55^\circ < \theta_\pi < 125^\circ$

+ $p_T > 200$ MeV/c

= purity > 99%



Check of FSR parameterization



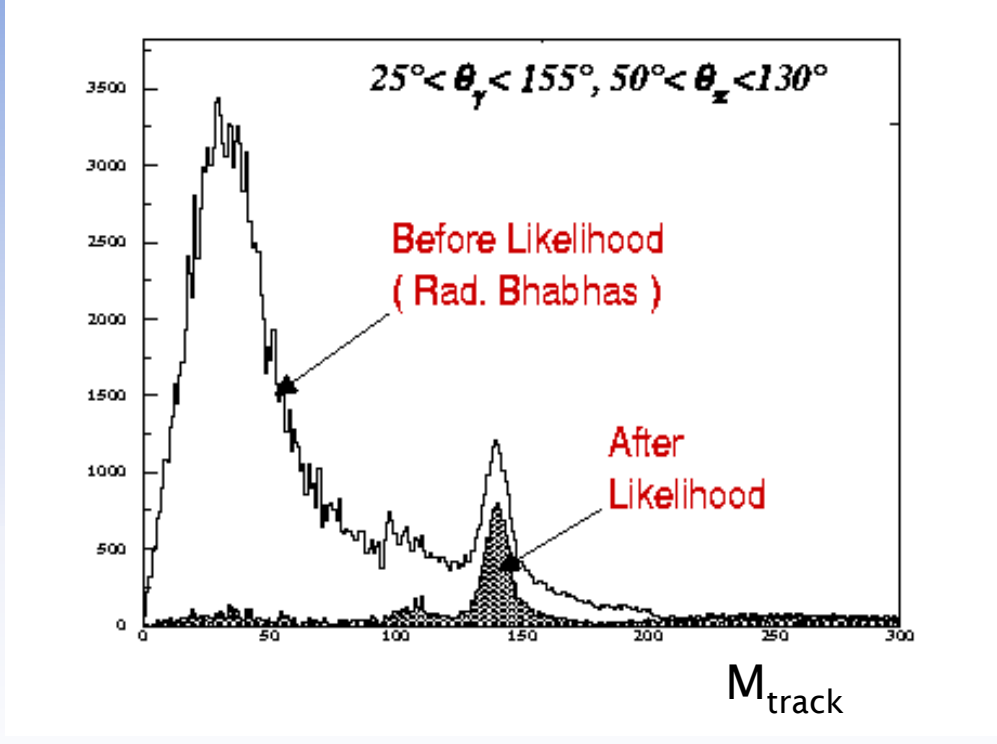
Pion charge asymmetry: $A(\theta_i) = \dfrac{N^{\pi+}(\theta_i) - N^{\pi-}(\theta_i)}{N^{\pi+}(\theta_i) + N^{\pi-}(\theta_i)}$

Backgrounds to $\pi^+\pi^-\gamma$ at KLOE

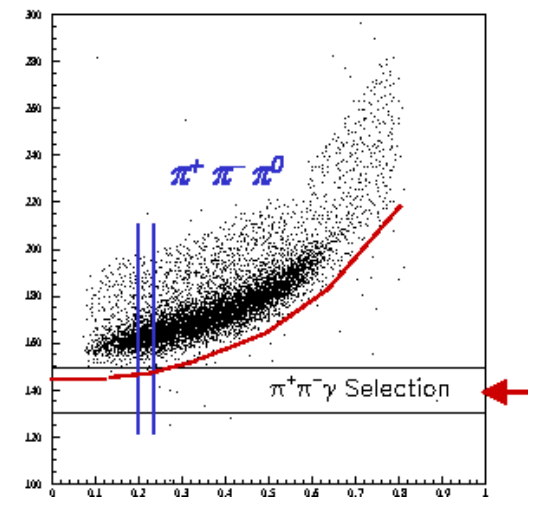
$$q_\gamma^2 = \left(M_\phi - \sqrt{\vec{p}_1^{\,2} + M_{track}^2} - \sqrt{\vec{p}_2^{\,2} + M_{track}^2} \right)^2 = 0$$

M_{track} definition

Likelihood using TOF and shower profile
to reject radiative Bhabha



$\pi^+\pi^-\gamma$



M_{track} vs. Q^2

Kinematical cut in M_{track} vs. Q^2 to reject $\pi^+\pi^-\pi^0$

High Q^2 region:
data suppressed by 'cosmic veto' in the trigger