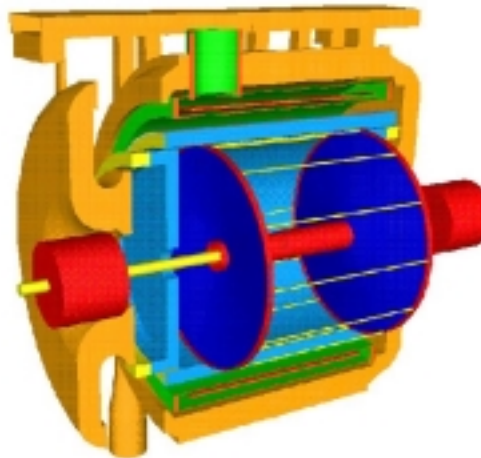
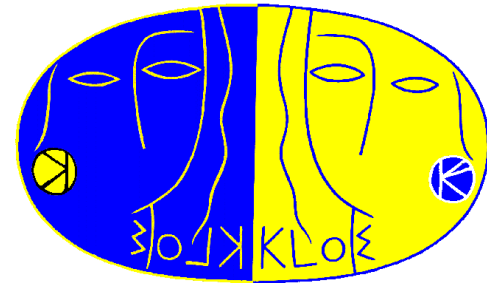


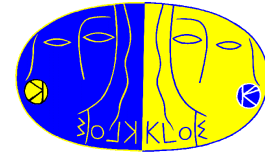
Recent results of the KLOE experiment



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Institute for Theoretical and Experimental Physics,
Moscow, Russia

KLOE physics at ϕ - factory



e^+e^- collider at
 ϕ - peak

Main decays of ϕ (1020)

Decay	BR
$K^+ K^-$	49.5 %
$K_S K_L$	34.4 %
$\rho\pi, \pi^+\pi^-\pi^0$	14.8 %
$\eta\gamma$	1.3%
$f_0\gamma, a_0\gamma, \eta'\gamma$	$\sim 10^{-4}$

$\Rightarrow \phi$ (1020) with $J^{PC} = 1^{--}$

$\Rightarrow \sigma(e^+e^- \rightarrow \phi) \approx 3.2 \mu\text{b}$

$\Rightarrow M\phi = 1020 \text{ MeV}$

$\Rightarrow \Gamma\phi = 4.4 \text{ MeV}$

• K^+K^- at $p = 127 \text{ MeV}/c$:

$\lambda = 95 \text{ cm}$ $\tau = 12.4 \text{ ns}$

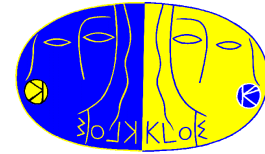
• K_S at $p = 110 \text{ MeV}/c$:

$\lambda = 0.6 \text{ cm}$ $\tau = 90.0 \text{ ps}$

• K_L at $p = 110 \text{ MeV}/c$:

$\lambda = 343 \text{ cm}$ $\tau = 51.7 \text{ ns}$

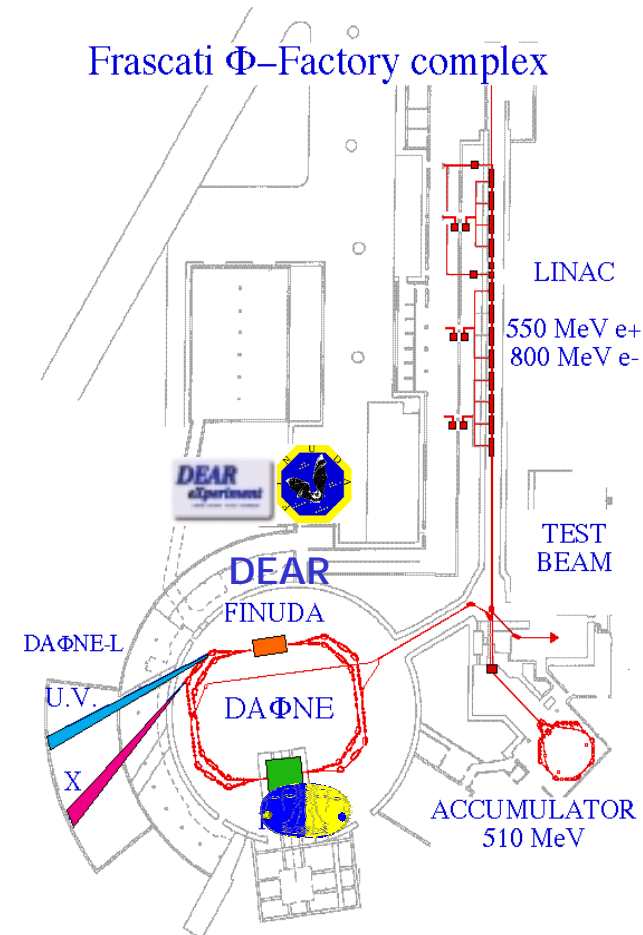
DAPHNE ϕ - factory



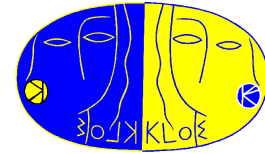
Design parameters

◆ Trajectory (m)	98
◆ Beam energy (MeV)	510
◆ Max number of bunches	120
◆ Bunch spacing (ns)	2.7
◆ Bunch current (mA)	40
◆ Bunch luminosity ($\text{cm}^{-2}\text{s}^{-1}$)	4×10^{30}

Total luminosity ($\text{cm}^{-2}\text{s}^{-1}$) 5×10^{32}

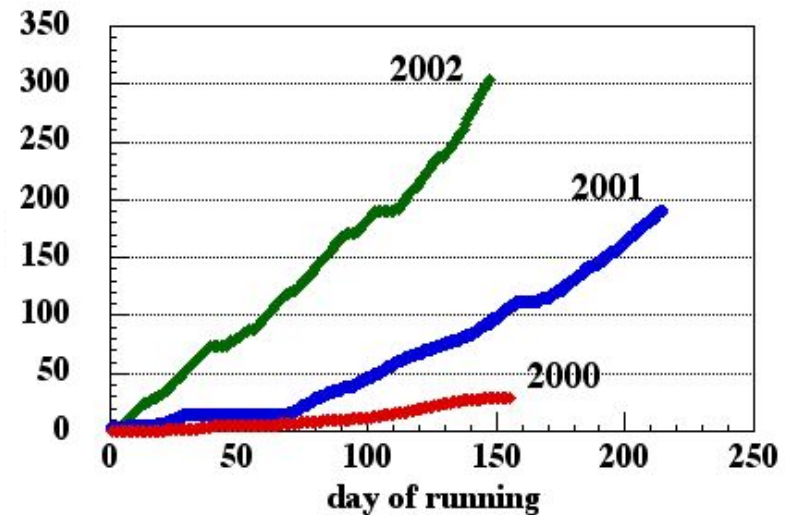


DAFNE present parameters



DAFNE history from 1999

- **1999** : data taking just started ($\sim 2 \text{ pb}^{-1}$)
- **2000** : first KLOE published results ($\sim 20 \text{ pb}^{-1}$)
Published **4 NIM** papers and **5 PL** papers
- **2001** : L improved, but high background ($\sim 190 \text{ pb}^{-1}$), data analysis in progress
- **2002** : Background reduced ($\sim 300 \text{ pb}^{-1}$), new success in L
- **2003** : Background not reduced (?) and $L > 300 \text{ pb}^{-1}/\text{month}$



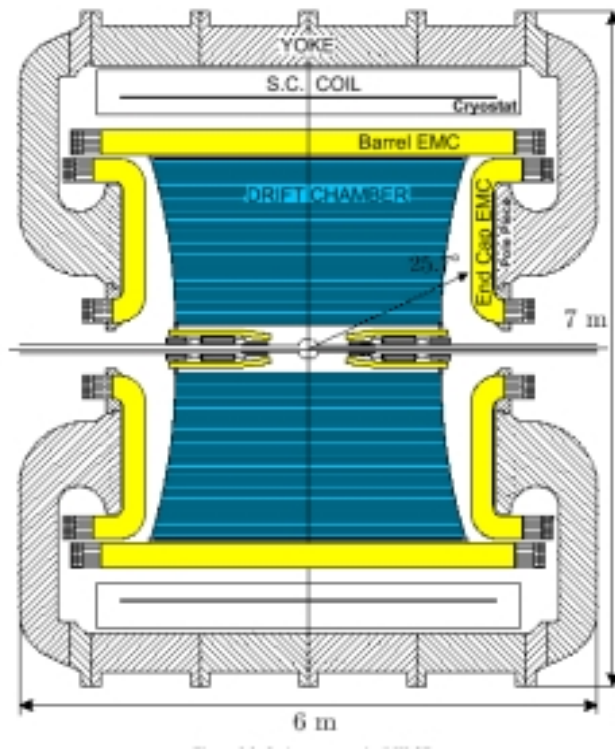
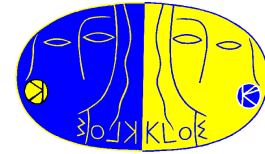
Current DAFNE parameters

(September 2002)

→ $L \sim 7.5 \times 10^{31} \text{ cm}^{-2}\text{s}^{-1}$

→ Total L / month $\sim 100 \text{ pb}^{-1}$

KLOE detector



Electromagnetic Calorimeter (EMC)

- ⇒ Lead/Scintillating - Fiber calorimeter
- ⇒ 24 Barrel Modules
- ⇒ 64 End-Cap Modules
- ⇒ 4880 channels

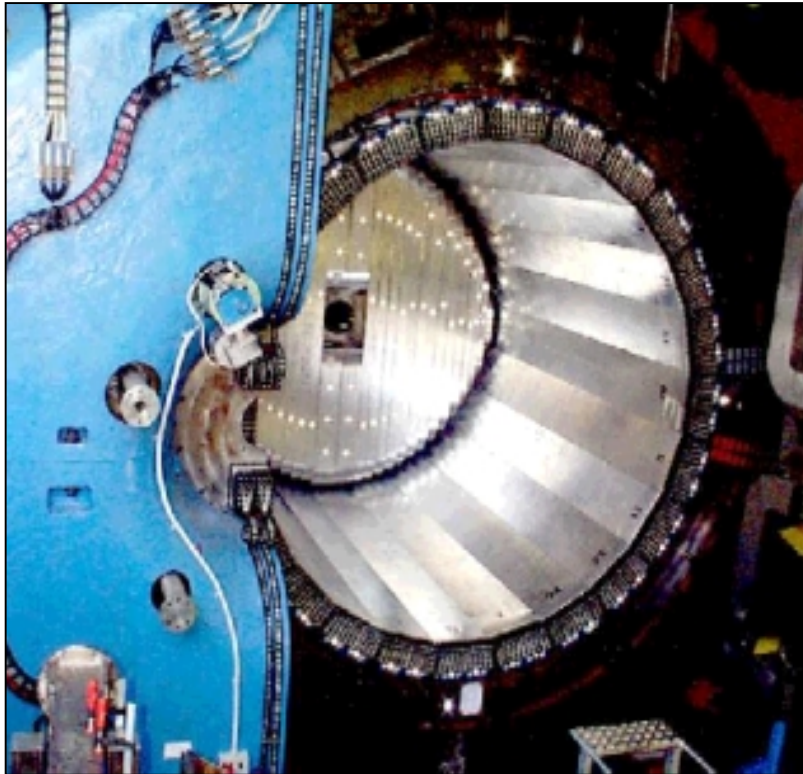
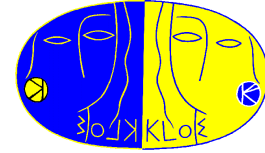
Drift Chamber (DC)

- ⇒ Cylindrical structure, (4 m \varnothing × 3.3 m)
- ⇒ 12582/52140 sense/total wires
- ⇒ All stereo geometry
- ⇒ Helium (90 %) + Isobutan gas mixture (10 %)

Quadrupole Calorimeter (QCAL)

- ⇒ Lead/Scintillator tile calorimeter inside KLOE

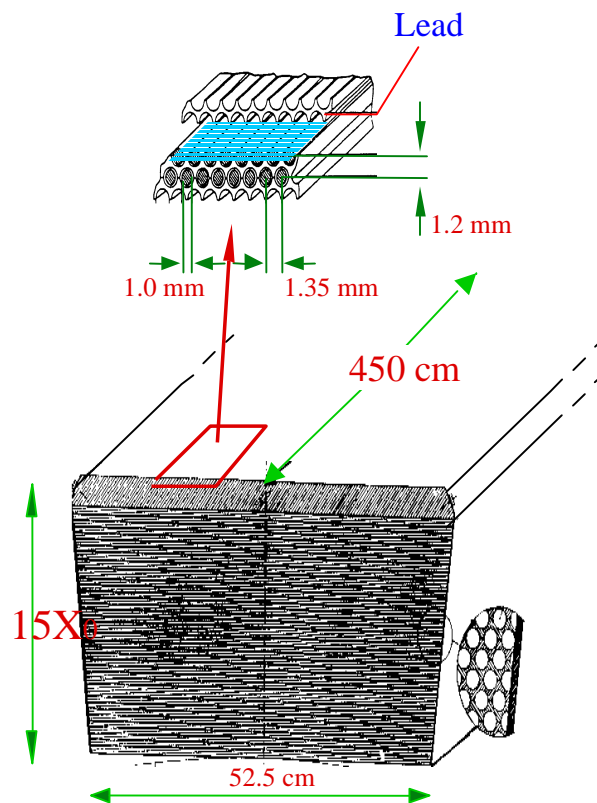
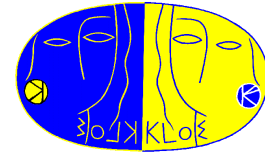
Electromagnetic calorimeter



EMC parameters

- ⇒ Hermetical coverage
- ⇒ 98 % coverage of solid angle
- ⇒ High efficiency for low energy photons
- ⇒ Energy range
$$20 \text{ MeV} < E_\gamma < 300 \text{ MeV}$$
- ⇒ Energy resolution
$$\sigma_E/E = 5.7 \% / \sqrt{E \text{ (GeV)}}$$
- ⇒ Time resolution
$$\sigma_t = 50 \text{ ps} / \sqrt{E \text{ (GeV)}}$$

EMC energy resolution

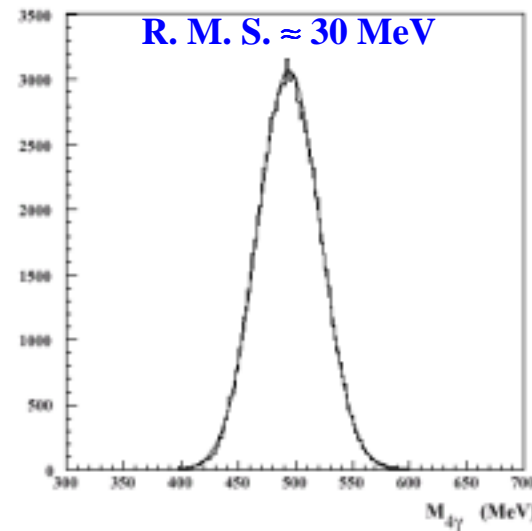


⇒ Fine sampling lead / scintillating fiber calorimeter

⇒ $\rho = 5 \text{ g/cm}^3$ $X_0 = 1.6 \text{ cm}$

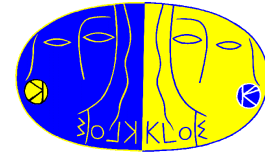
⇒ 23 cm thick : $15 X_0$

⇒ Spatial resolution $\sim 1 \text{ cm}$



Ks mass from
photon energies
in $K_s \rightarrow \pi^0 \pi^0$
decay

Drift chamber



DC parameters

⇒ Cell geometry :

12 inner layers $2 \times 2 \text{ cm}^2$

46 outer layers $3 \times 3 \text{ cm}^2$

⇒ Stereo angle $\pm(60 \div 150) \text{ mrad}$

⇒ Rad. length $X_0(\text{DC}) \text{ } 900 \text{ m}$

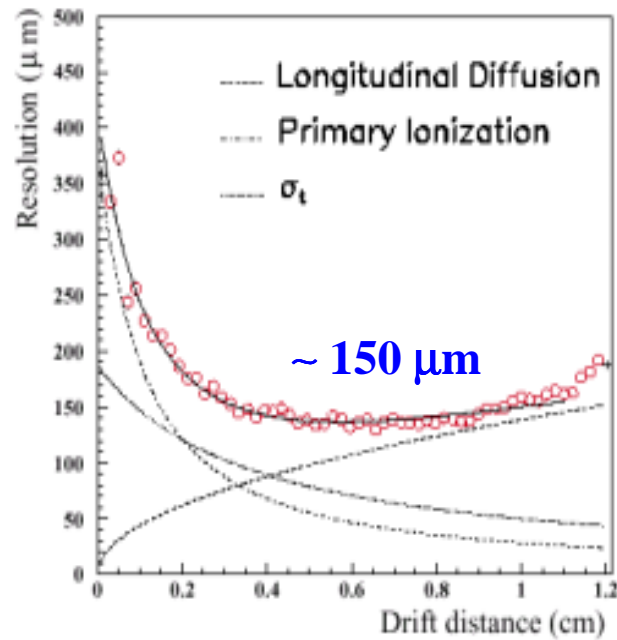
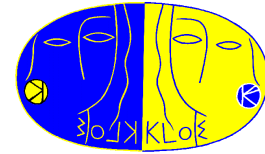
⇒ Field wires : Al(Ag), $80 \text{ } \mu\text{m } \varnothing$

Sense wires : wW(Au), $25 \text{ } \mu\text{m } \varnothing 25$

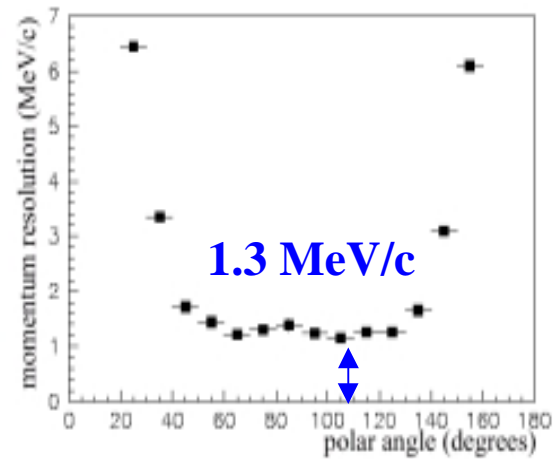
⇒ Space resolution :

$\sigma_{r,\phi} = 200 \text{ } \mu\text{m}$ and $\sigma_z = 2 \text{ mm}$

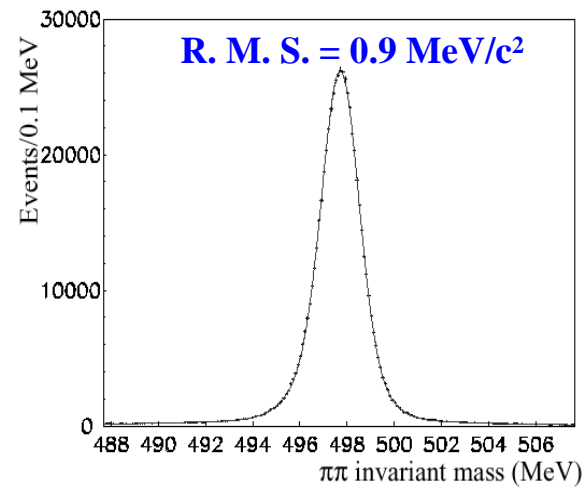
DC resolution



DC average spatial resolution

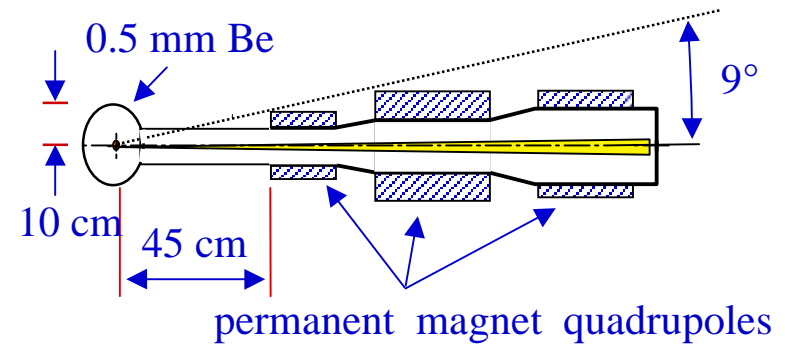
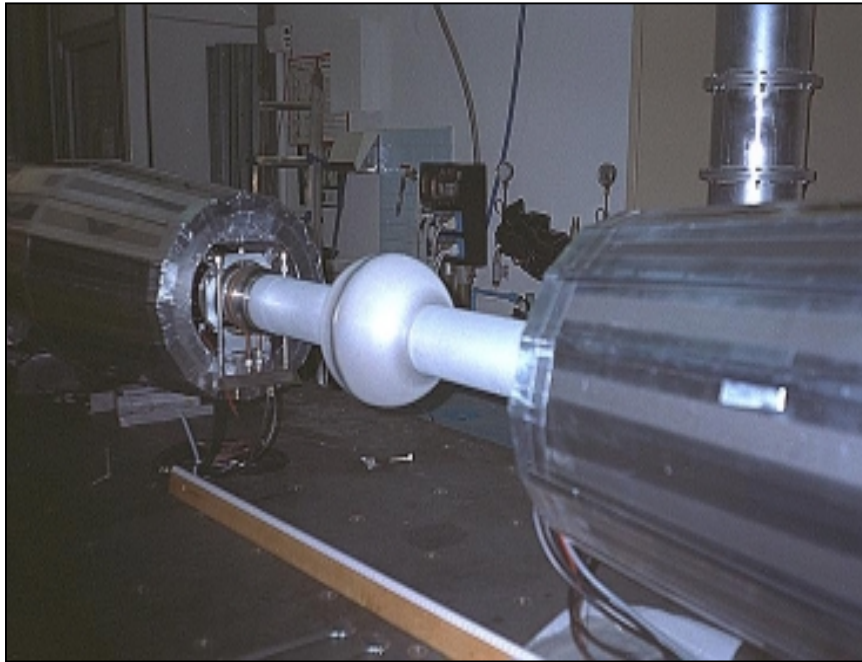
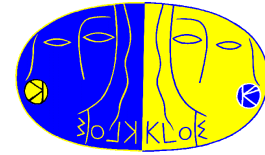


Momentum resolution for e^+e^- at 510 MeV/c



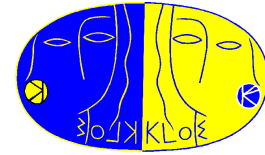
$\pi^+\pi^-$ invariant mass with two unlike sign tracks

QCAL and beam pipe



- ⇒ Be walls minimize regeneration, multiple scattering, and energy loss
- ⇒ Quadrupoles improves the rejection of $K_L \rightarrow 3\pi^0$ by a factor of 5 and decrease machine background

KLOE physics



Kaon physics

⇒ CP violation parameters

- Double ratio $\text{Re}(\epsilon'/\epsilon)$
- Interference $K_L, K_S \rightarrow f_1, f_2$

⇒ Semileptonic asymmetry

- $K_S \rightarrow \pi^+ e^- \nu / K_S \rightarrow \pi^- e^+ \nu$
- $K_L \rightarrow \pi^+ e^- \nu / K_L \rightarrow \pi^- e^+ \nu$

⇒ Rare K_S decay

⇒ Kaon form factor ($K_L \rightarrow \pi l \nu, K^\pm \rightarrow \pi^\pm l \nu$)

⇒ Kaon regeneration at low energies

Radiative ϕ decays

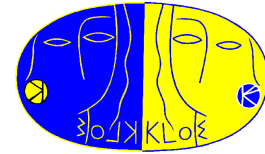
⇒ Branching ratios

- $\phi \rightarrow \pi^0 \gamma \rightarrow \gamma \gamma$
- $\phi \rightarrow \eta' \gamma, \phi \rightarrow \eta \gamma$
- $\phi \rightarrow f_0 \gamma \rightarrow \pi^0 \pi^0 \gamma$
- $\phi \rightarrow a_0 \gamma \rightarrow \eta \pi^0 \gamma$
- $\phi \rightarrow \pi^+ \pi^- \pi^0, \rho \pi, \text{etc}$

Hadronic cross section

⇒ $\delta(e^+ e^- \rightarrow \pi^+ \pi^- \gamma)$

Measurement of $\text{Re}(\epsilon'/\epsilon)$



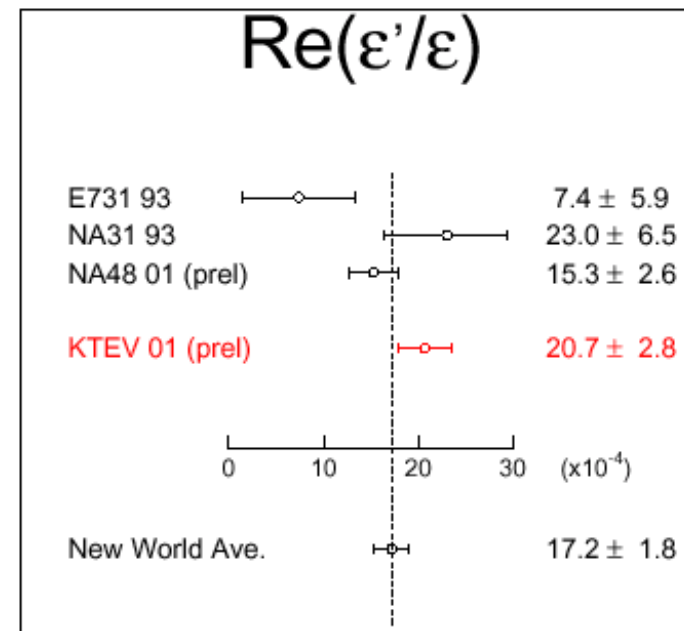
$$R = \frac{BR(K_L \rightarrow \pi^+\pi^-)/BR(K_S \rightarrow \pi^+\pi^-)}{BR(K_L \rightarrow \pi^0\pi^0)/BR(K_S \rightarrow \pi^0\pi^0)} = 1 + 6 \times \text{Re}\left(\frac{\epsilon'}{\epsilon}\right)$$

World average data (2001)

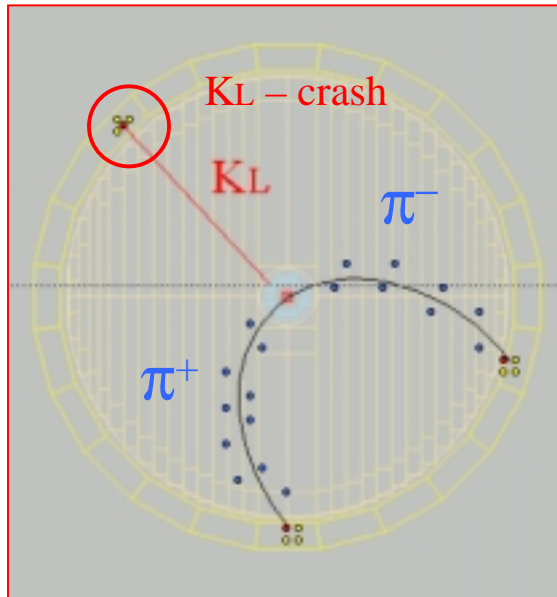
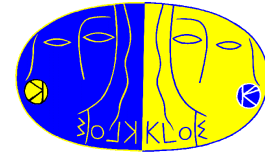
$$\text{Re}(\epsilon'/\epsilon) = (1.72 \pm 0.18) \times 10^{-3}$$

KLOE goal is to measure $\text{Re}(\epsilon'/\epsilon)$
via double ratio with a sensitivity
 $\approx 10^{-4}$ (total statistics $\approx 2 \text{ fb}^{-1}$)

- Ratio $K_S \rightarrow \pi^+\pi^- / K_S \rightarrow \pi^0\pi^0$
has already done



Ks tagging



Ks tagging by identification of KL
interacting in the EmC (KL crash)

2000 data $\approx 5.4 \times 10^6$ KL crash

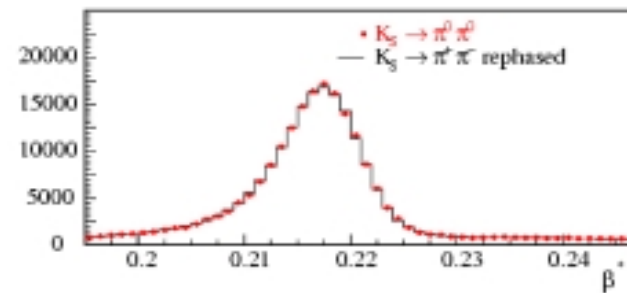
2001 data $\approx 6 \times 10^7$ KL crash

Ks selection

⇒ Selection cuts:

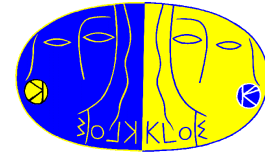
- $E_{\text{clust}} > 100 \text{ MeV}/c$
- $|\cos(\theta_{\text{clust}})| \leq 0.7$
- $0.195 \leq \beta \leq 0.247$

Tagging efficiency $\approx 30 \%$



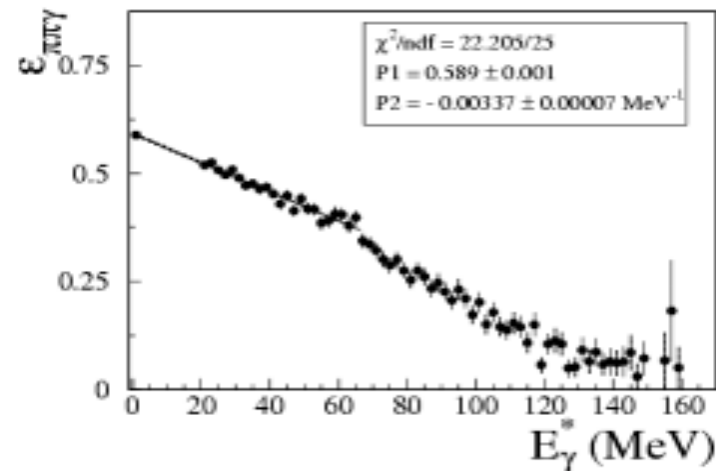
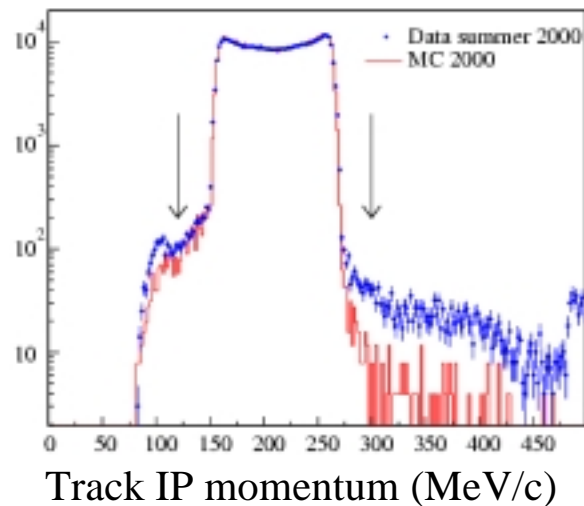
Nominal velocity of KL in the rest
frame of ϕ (β^*) ≈ 0.218

Ratio $K_S \rightarrow \pi^+ \pi^- / K_S \rightarrow \pi^0 \pi^0$ / I



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

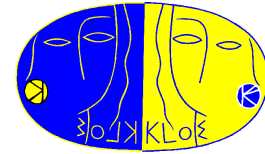
- ⇒ K_S - tagging
- ⇒ 2 track from IP
- ⇒ $120 < p < 300$ MeV/c for rejection of $\phi \rightarrow K^+ K^-$ events
- ⇒ $30^\circ < \Theta < 150^\circ$
- ⇒ Both tracks impinged to EMC



Selection efficiency by $K_S \rightarrow \pi^+ \pi^- (\gamma)$

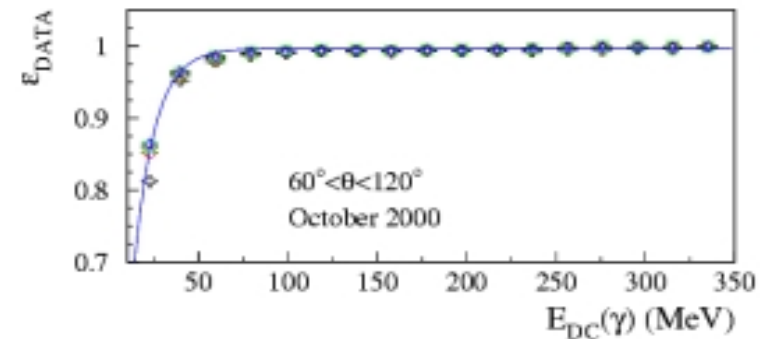
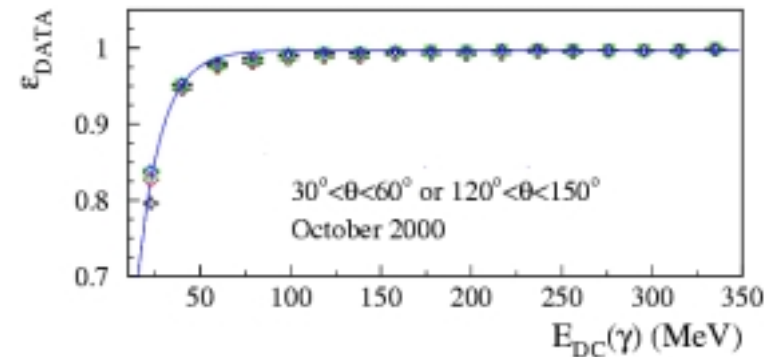
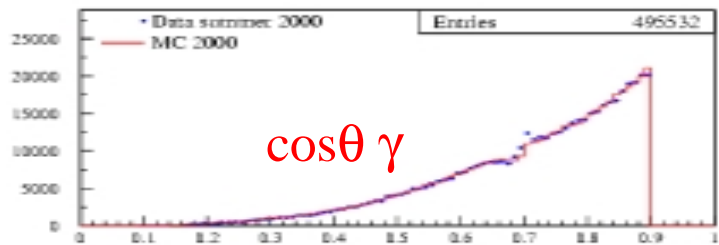
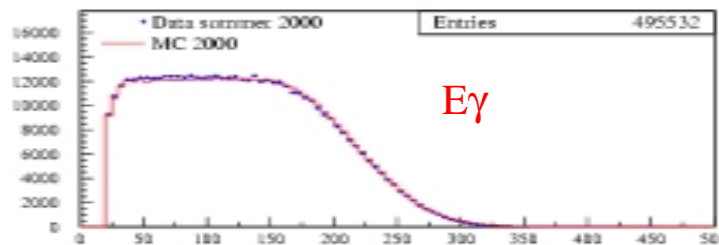
- ⇒ Measurement of E_γ^*
($E_{\gamma \text{ max}}^* = 170$ MeV)
- ⇒ Folded with theoretical γ - spectra
- ⇒ Selection efficiency
 $(57.6 \pm 0.2) \%$

Ratio $K_S \rightarrow \pi^+ \pi^- / K_S \rightarrow \pi^0 \pi^0$ / II



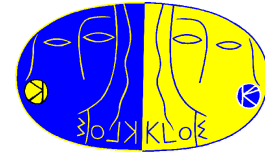
$K_S \rightarrow \pi^0 \pi^0$ selection

- ⇒ K_L - crash
- ⇒ 3 neutral clusters from IP
- ⇒ $E_\gamma > 20$ MeV, $\cos\theta_\gamma < 0.9$
- ⇒ $|t - R/C| < \min(5\delta t, 3 \text{ ns})$



Photon detection efficiency as
function of expected γ -energy and
different polar angle region

Ratio $K_S \rightarrow \pi^+ \pi^- / K_S \rightarrow \pi^0 \pi^0$ / III



- Measurement was done on 17 pb^{-1} integrated during year 2000

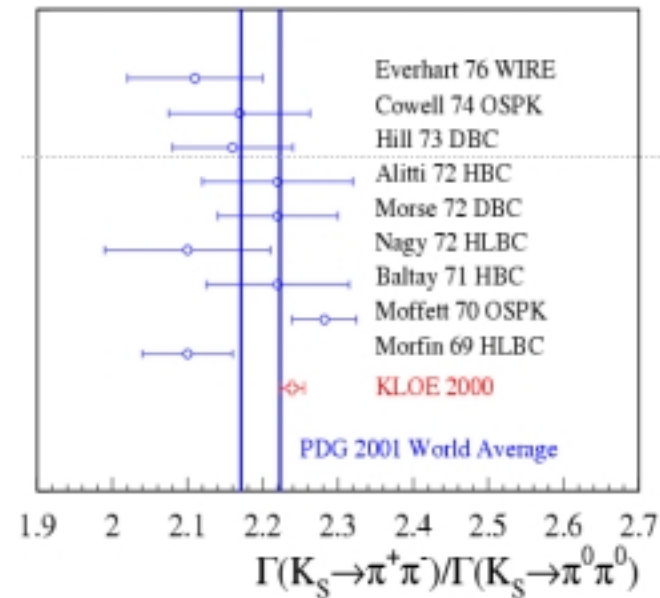
$$N(K_S \rightarrow \pi^+ \pi^-) = 1.098 \times 10^6$$

$$N(K_S \rightarrow \pi^0 \pi^0) = 0.788 \times 10^6$$

- Relative contributions to the final systematic error

Source	Error, %
Tagging	0.55
γ -counting	0.20
trigger and t_0	0.23
tracking	0.26

Total error 0.68 %

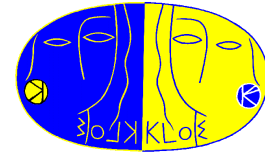


KLOE 2000 data $2.239 \pm 0.003_{\text{(stat.)}} \pm 0.015_{\text{(syst.)}}$

PDG 2000 2.197 ± 0.026

Phys. Lett. B 538 (2002), 21

BR ($K_S \rightarrow \pi e \nu$) / I



Motivation

Test of $\Delta S = \Delta Q$ rule : $\Gamma(K_S \rightarrow \pi e \nu) = \Gamma(K_L \rightarrow \pi e \nu)$

It means $BR(K_S \rightarrow \pi e \nu) =$

$$BR(K_L \rightarrow \pi e \nu) \times (\Gamma_L / \Gamma_S) = (6.70 \pm 0.07) \times 10^{-4}$$

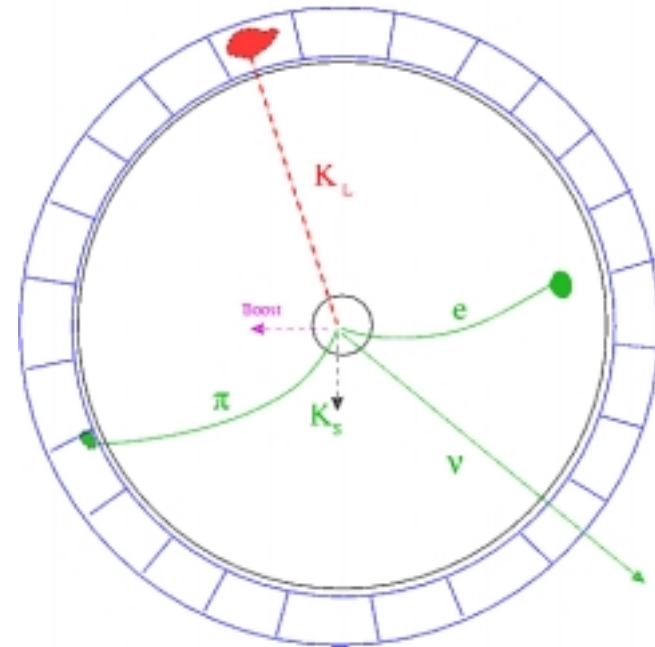
Only one measurement was done

$$BR(K_S \rightarrow \pi e \nu) = (7.2 \pm 1.4) \times 10^{-4}$$

(CMD2, 75 ± 13 events)

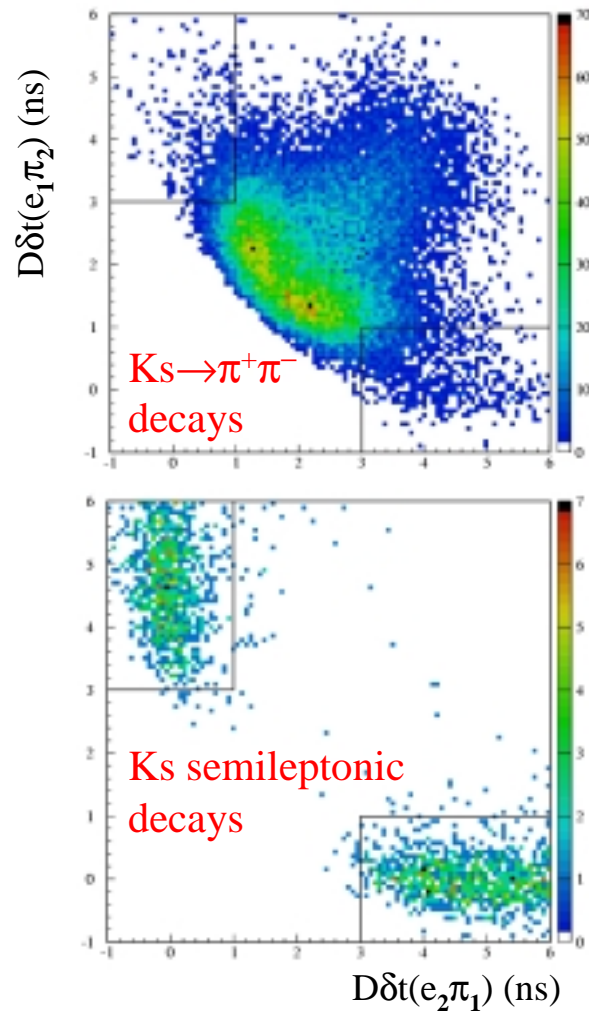
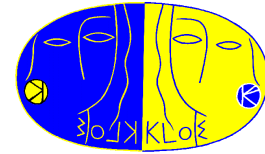
Preselection

- ⇒ K_L - crash
- ⇒ Charged vertex with $r < 8\text{cm}$, $|z| < 10\text{cm}$
- ⇒ 2 tracks with associated with EmC clusters
- ⇒ Kinematical preselection : two tracks from IP,
cut on $M(\pi\pi)$ and $P(K_S)$



Typical selected
event $K_S \rightarrow \pi e \nu$

BR ($K_S \rightarrow \pi e \nu$) / II



Distributions of the time difference in the πe vs $e \pi$ mass hypothesis for MC

e / π TOF identification

\Rightarrow Time difference of particle x :

$$\delta t_x = T_{cl} - L/(c\beta_x)$$

\Rightarrow Time difference in $\pi e / e \pi$ hypothesis:

$$D \delta t(e_i \pi_k) = \delta t(e_i) - \delta t(\pi_k)$$

\Rightarrow For rejection of $\pi \pi$ - events

$$|D \delta t(\pi, \pi)| > 1.5 \text{ ns}$$

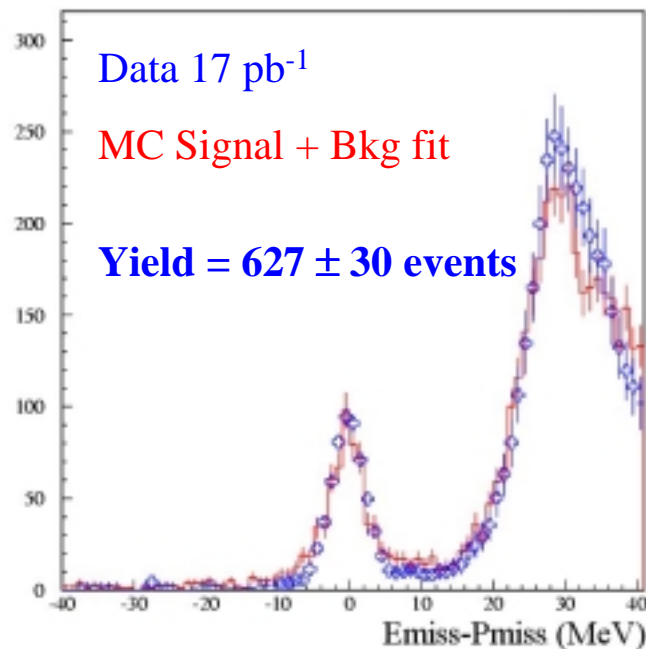
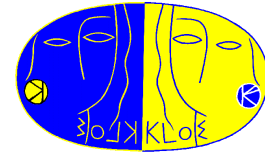
$\Rightarrow \pi e / e \pi$ events

$$1. |D \delta t(e_2, \pi_1)| < 1 \text{ ns}$$

$$2. |D \delta t(e_1, \pi_2)| > 3 \text{ ns}$$

$$\text{or } 1 \leftrightarrow 2$$

BR ($K_S \rightarrow \pi e \nu$) / III



Peak at $E_{\text{miss}}(\pi e) - P_{\text{miss}} \rightarrow 0$
corresponds to a clean signal of
 $K_S \rightarrow \pi e \nu$

Kinematical identification

⇒ Fit $E_{\text{miss}}(\pi e) - P_{\text{miss}}$ using MC spectra for signal and $\pi^+\pi^-$ background ($\phi \rightarrow \pi^+\pi^-\pi^0$, $K_S \rightarrow \pi^+\pi^-$)

⇒ Overall selection efficiency
($21.9 \pm 0.7\%$)

⇒ Normalize to $K_S \rightarrow \pi^+\pi^-$ decays
($1.64 \cdot 10^6$)

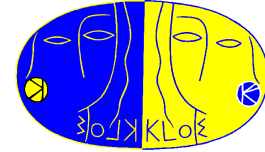
⇒ Statistical error 4.9 %
(lower with data 2001)

KLOE 2000 : BR ($K_S \rightarrow \pi e \nu$) =
($6.91 \pm 0.34(\text{stat.}) \pm 0.15(\text{syst.})$) $\times 10^{-4}$

Total error 5.3 %

Phys. Lett. B 535 (2002), 37

Charged kaon's physics / I



⇒ $\phi \rightarrow K^+ K^-$ stream has a large statistics, or 49 % of ϕ decays, but is hard for track reconstruction

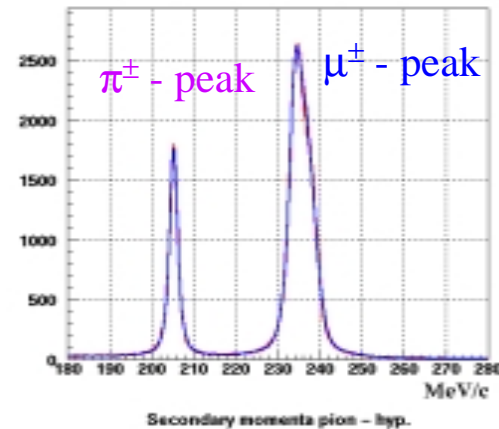
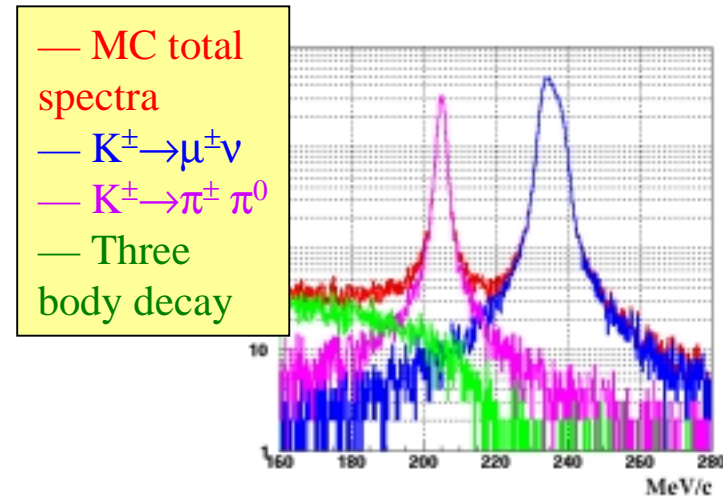
⇒ Slow kaons (~ 127 MeV/c) has energy losses up to 30 MeV/c (20 %) by momenta

⇒ Multiple scattering makes charged kaons difficult for reconstruction procedure

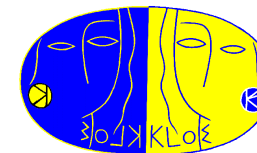
⇒ Tagging strategy :

- π^\pm - peak around 205 MeV/c, has a trigger efficiency ≈ 100 %
- μ^\pm - peak around 235 MeV/c, has a low contamination from other decays

⇒ Both decays can be used for tag of the charged kaon decays



Charged kaon's physics / II

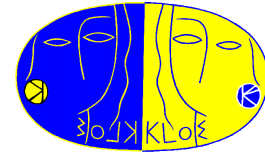


Recent results of charged kaon physics

- Measurement of $\phi \rightarrow K^+ K^-$ cross section (at the peak and by energy scan)
- Ratio $BR(K^\pm \rightarrow \pi^\pm \pi^0)/BR(K^\pm \rightarrow \mu^\pm \pi^0)$ for estimation DC possibilities
- Measurement of V_{us} through $BR(K\ell 3)$ evaluation
- Estimation of form factors $K\ell 3$ and $K\mu 3$
- Measurement of $BR(K^\pm \rightarrow \pi^\pm \pi^0 \pi^0)$, estimation of Dalitz plot parameters

Measurement	KLOE preliminary	PDG fit data	Publications
$\phi \rightarrow K^+ K^-$	≈ 1600 nb	—	LNF Spring School, 2002
$K^\pm \rightarrow \pi^\pm \pi^0 / K^\pm \rightarrow \mu^\pm \nu$	$0.3306 \pm 0.0012(\text{stat.})$	0.3331 ± 0.0028	World Scientific Publ.Co, 2002, 114
$K^\pm \rightarrow e^\pm \pi^0 \nu / K^\pm \rightarrow \mu^\pm \nu$	$0.084 \pm 0.002(\text{stat.})$	0.0759 ± 0.0011	—
K^\pm lifetime	$12.40 \pm 0.08(\text{stat.}), \text{ ns}$	0.0759 ± 0.0011	—

$\phi \rightarrow \eta' \gamma, \eta \gamma / I$



Motivation

⇒ BR($\phi \rightarrow \eta' \gamma$) can probe the gluonic content of η'

$R = \frac{BR(\phi \rightarrow \eta' \gamma)}{BR(\phi \rightarrow \eta \gamma)}$ related to η' - η mixing parameters and determines the mixing angle φ_p

⇒ In the quark flavour basis the mixing can be described by one parameter - angle φ_p and

$$R = \cot^2 \varphi_p \left(1 - \frac{m_s}{\bar{m}} \frac{\tan \varphi_v}{\sin 2\varphi_p} \right)^2 \left(\frac{P_\eta^3}{P_\eta} \right)^3$$

$$\frac{m_s}{\bar{m}} = 1.45$$

$$\varphi_v = 3.40$$

Datat sample : 16 pb⁻¹ from 2000 data

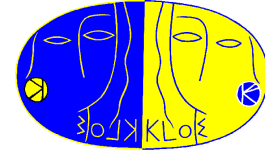
Selection

⇒ Final states :

- $\phi \rightarrow \eta \gamma; \eta \rightarrow \pi^+ \pi^- \pi^0; \pi^0 \rightarrow \gamma \gamma$
- $\phi \rightarrow \eta' \gamma; \eta' \rightarrow \pi^+ \pi^- \eta; \eta \rightarrow \gamma \gamma$

⇒ Possible background : $\phi \rightarrow \pi^+ \pi^- \pi^0$ (additional photon detected due to accidental or splitting clusters), $\phi \rightarrow K_s K_L$ (K_L is decaying near the interaction region)

$\phi \rightarrow \eta' \gamma, \eta \gamma / \text{II}$



$\Rightarrow \phi \rightarrow \eta \gamma$ selection

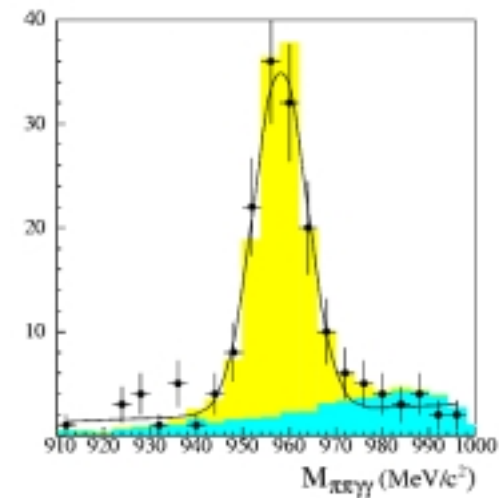
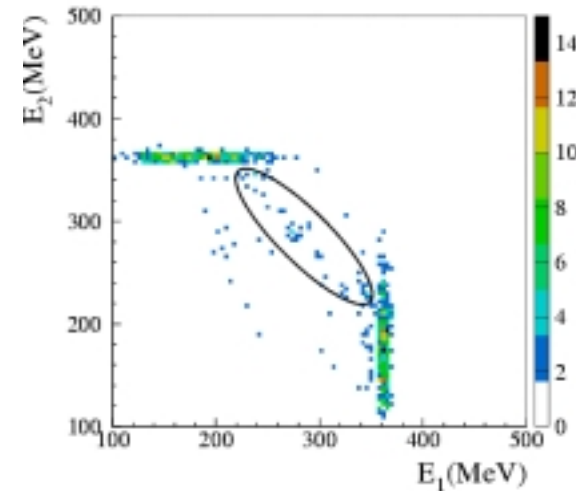
- Vertex with opposite charge track from IP
- Three photons with $E_\gamma > 10 \text{ MeV}$ and $21^\circ < \theta_\gamma < 159^\circ$
- Constrained kinematic fit
- $320 \text{ MeV} < E_{\gamma^{\text{rad}}} < 400 \text{ MeV}$
- $E_{\pi^+} + E_{\pi^-} < 550 \text{ MeV}$

$\Rightarrow \phi \rightarrow \eta' \gamma$ selection

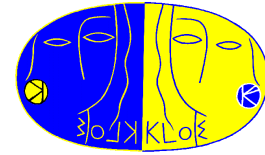
- Main background from $\phi \rightarrow \eta \gamma$
- Elliptic cut in the plane of the two photons

$N_{\eta \gamma} = 50210 \pm 220$ events, $\epsilon_{\eta \gamma} = 37 \%$

$N_{\eta' \gamma} = 120 \pm 12$ events, $\epsilon_{\eta' \gamma} = 23 \%$



$\phi \rightarrow \eta' \gamma, \eta \gamma$ / III



$$R = \frac{N_{\eta\gamma} \varepsilon_{\eta\gamma} BR(\eta \rightarrow \pi^+ \pi^- \pi^0) BR(\pi^0 \rightarrow \gamma\gamma)}{N_{\eta'\gamma} \varepsilon_{\eta'\gamma} BR(\eta' \rightarrow \pi^+ \pi^- \pi^0) BR(\eta \rightarrow \gamma\gamma)} K\rho$$

$K\rho = 0.95$ (interference with $e^+e^- \rightarrow \rho \rightarrow \eta(\eta')\gamma$)

$$R = (4.70 \pm 0.47_{\text{(stat.)}} \pm 0.31_{\text{(syst.)}}) \times 10^{-3}$$

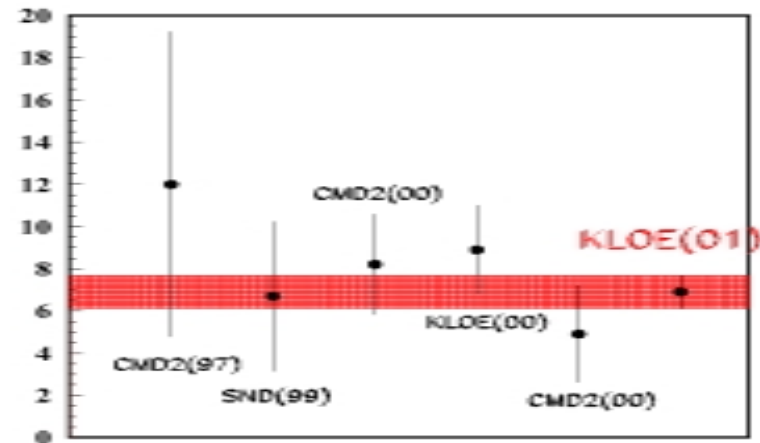
Using $BR(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.003) \%$ (PDG) \Rightarrow

$$BR(\phi \rightarrow \eta' \gamma) = (6.10 \pm 0.61_{\text{(stat.)}} \pm 0.43_{\text{(syst.)}}) \times 10^{-5}$$

$$PDG: BR(\phi \rightarrow \eta' \gamma) = 6.7^{+5.3}_{-3.1}$$

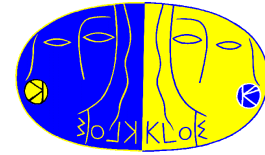
Mixing angle : $\Phi_p = (41.8 \pm 1.7)^\circ \Rightarrow$

$$\vartheta_p = -(12.9 \pm 1.7)^\circ$$



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$$\phi \rightarrow (a_0(980), f_0(980)) + \gamma$$



Motivations

$f_0(980)$ and $a_0(980)$ are not easily described as **qq** states and other interpretations are suggested :

⇒ **qqqq** states (lower mass)

⇒ **KK** molecule ($m(f_0, a_0) \sim 2m(K)$)

⇒ f_0, a_0 and $\sigma \rightarrow$ lowest mass scalar **qq** nonet

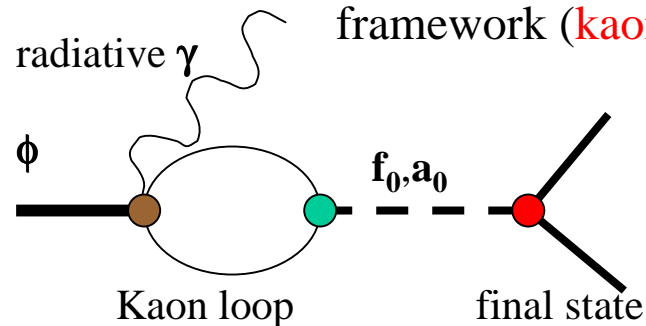
⇒ Data collected in the year 2000, L
 $\sim 16 \text{ pb}^{-1}$ (5×10^7 ϕ - meson decays)

⇒ For the f_0 analysis used $\phi \rightarrow (f_0 \gamma) \pi^0 \pi^0 \gamma$ decay (5 γ final state)

⇒ For $\phi \rightarrow (a_0 \gamma) \eta \pi^0 \gamma$ decay analyzed :

- 5 γ final state ($\eta \rightarrow \gamma \gamma$)
- 2tracks + 5 γ final state ($\eta \rightarrow \pi^+ \pi^- \pi^0$)

⇒ $\phi \rightarrow f_0 \gamma, a_0 \gamma$ ⇒ sensitive to f_0, a_0 nature: phenomenological framework (**kaon loop model**)



● $g(\phi KK)$

● $g(f_0 KK) \quad g(a_0 KK)$

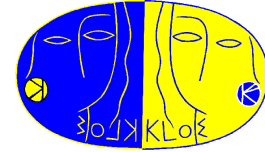
● $g(f_0 \pi \pi) \quad g(a_0 \eta \pi)$

from $\Gamma(\phi \rightarrow K^+ K^-)$

f_0, a_0 model

$M(\pi^0 \pi^0) \quad M(\eta \pi)$ spectra

$$\phi \rightarrow (f_0 \gamma) \pi^0 \pi^0 \gamma$$



Selection

⇒ 5 γ with $E_\gamma > 7$ MeV

⇒ Kinematic fit

Possible background from

- $e^+e^- \rightarrow \omega \pi^0 \rightarrow \pi^0 \pi^0 \gamma$
- $\phi \rightarrow \eta \pi^0 \gamma \rightarrow 5\gamma$
- $\phi \rightarrow \eta \gamma \rightarrow 3\pi^0 \gamma$

$N = 2438 \pm 61$ events

$$\text{BR}(\phi \rightarrow \pi^0 \pi^0 \gamma) = (1.09 \pm 0.03(\text{stat.}) \pm 0.05(\text{syst.})) \times 10^{-4}$$

PDG : $(1.08 \pm 0.17 \pm 0.09) \times 10^{-4}$

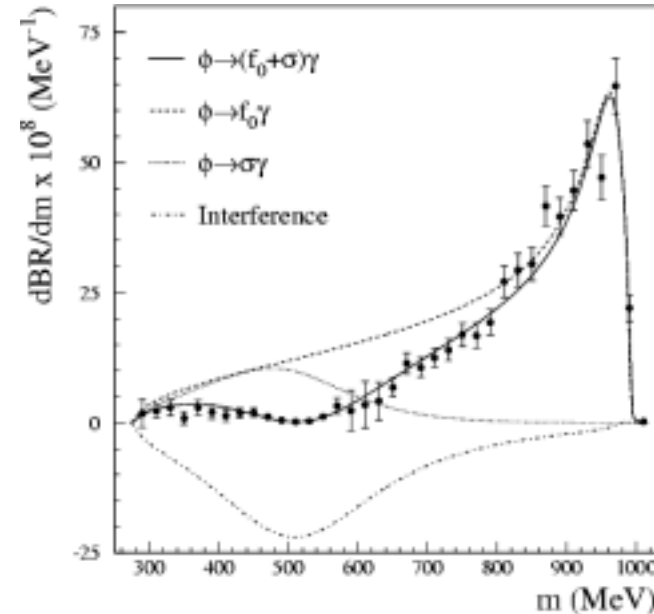
Fit result

$$M(f_0) = 973 \pm 1 \text{ MeV}$$

$$g^2(f_0 \text{KK})/4\pi = 2.79 \pm 0.12 \text{ GeV}^2$$

$$g(f_0 \pi\pi) / g(f_0 \text{KK}) = 0.50 \pm 0.01$$

$$g(\phi \sigma \gamma) = 0.060 \pm 0.008$$

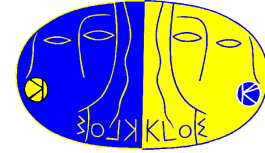


Fit to the $M_{\pi^0 \pi^0}$ spectrum (kaon loop)

- contributions from $\phi \rightarrow f_0 \gamma$ and $\phi \rightarrow \sigma \gamma$ + negative interference
- $\phi \rightarrow \rho \pi^0 \rightarrow \pi^0 \pi^0 \gamma$ contribution is negligible

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$\phi \rightarrow (a_0 \gamma) \eta \pi^0 \gamma$



Investigation of $\phi \rightarrow \eta \pi^0 \gamma$ was done by two samples :

1) $\eta \rightarrow \gamma \gamma$ (5 γ)

N = 916 events at background N = 309 ± 20

$$\text{BR}(\phi \rightarrow \eta \pi^0 \gamma) = (8.5 \pm 0.5(\text{stat.}) \pm 0.6(\text{syst.})) \times 10^{-5}$$

2) $\eta \rightarrow \pi^+ \pi^- \pi^0$ (2 charged tracks + 5 γ)

N = 197 events at background N = 4 ± 4

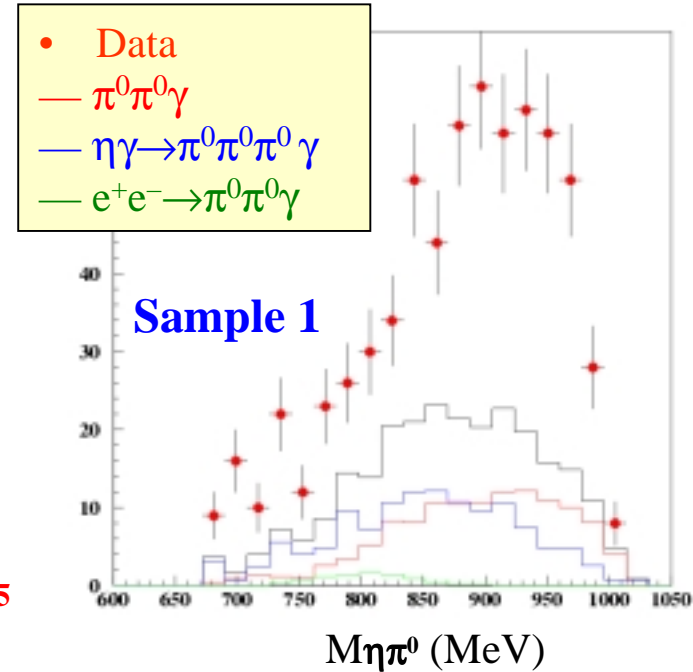
$$\text{BR}(\phi \rightarrow \eta \pi^0 \gamma) = (8.0 \pm 0.6(\text{stat.}) \pm 0.5(\text{syst.})) \times 10^{-5}$$

Fit result

Using $M_{a_0} = 984.8$ MeV (PDG) fit to the $M_{\eta \pi^0}$ spectra gives:

$$g^2(a_0 \text{KK}) / 4\pi = 0.40 \pm 0.04 \text{ GeV}^2$$

$$g(a_0 \eta \pi) / g(a_0 \text{KK}) = 1.35 \pm 0.09$$

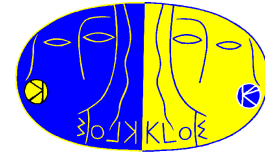


$$\text{BR}(\phi \rightarrow a_0 \gamma \rightarrow \eta \pi^0 \gamma) = (7.4 \pm 0.7) \times 10^{-5}$$

$$\text{BR}(\phi \rightarrow f_0 \gamma) / \text{BR}(\phi \rightarrow a_0 \gamma) = 6.0 \pm 0.6$$

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Summary of fit results



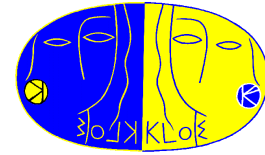
Comparison of fit results with predictions based on the [kaon loop model](#) suggested by Achasov-Ivanchenko, (Nucl.Phys.B315(1989), 465)

f_0	KLOE	4q model
$g^2(f_0\mathbf{K}\mathbf{K})/4\pi \text{ (GeV}^2\text{)}$	2.79 ± 0.12	"super-allowed" (few GeV^2)
$g(f_0\pi\pi) / g(f_0\mathbf{K}\mathbf{K})$	0.50 ± 0.01	0.3-0.5
a_0	—	—
$g^2(a_0\mathbf{K}\mathbf{K})/4\pi \text{ (GeV}^2\text{)}$	0.40 ± 0.04	"super-allowed" (few GeV^2)
$g(a_0\eta\pi) / g(a_0\mathbf{K}\mathbf{K})$	1.35 ± 0.09	0.91

⇒ f_0 parameters compatible with 4q model

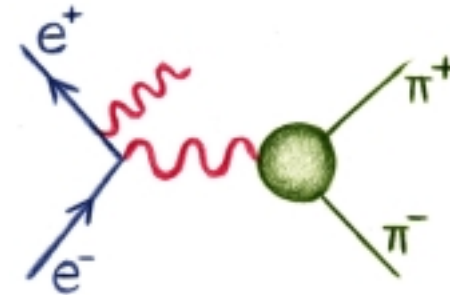
⇒ a_0 parameters not well described by the 4q model (2001 Data ⇒ more accurate study of a_0)

$\sigma(e^+e^- \rightarrow \text{hadrons})$



⇒ KLOE can measure hadronic cross section using radiation return method (studying the process $e^+e^- \rightarrow \text{hadrons} (\pi^+\pi^-) + \gamma$)

⇒ KLOE energy range is responsible for 67 % of δa_μ and for 17 % of $\delta \alpha(M_Z)$



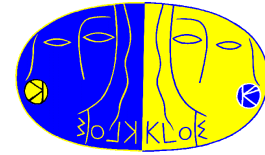
Absolute cross section of $e^+e^- \rightarrow \pi^+\pi^- + \gamma$ measured as :

$$\frac{d\sigma_{\pi\pi\gamma}}{dM_{\pi\pi}^2} = \frac{N_{obs} - N^{bkg}}{\Delta M_{\pi\pi}^2} \times \frac{1}{\epsilon_{select} \epsilon_{accept}} \times \frac{1}{L}$$

⇒ Data samples corresponds to an integrated luminosity 22.6 pb^{-1} shows a well understanding of background N^{bkg} , efficiencies (ϵ_{select} and ϵ_{accept}) and luminosity (L)

⇒ Convenient measurement of hadronic cross section at level $< 1 \%$ will come on 2002 data analysis

Conclusion and perspective



- DAFNE improved continuously during the two years of KLOE data taking and collected $\sim 500 \text{ pb}^{-1}$
- Physics runs showed a good performance of the KLOE detector
- From 2000 we measured :
 - ⇒ Ratio $K_S \rightarrow \pi^+ \pi^- / K_S \rightarrow \pi^0 \pi^0$
 - ⇒ $\text{BR}(K_S \rightarrow \pi e \nu)$
 - ⇒ $\phi \rightarrow (\phi_0 \gamma) \pi^0 \pi^0 \gamma$, $\phi \rightarrow (\alpha_0 \gamma) \eta \pi^0 \gamma$, $\phi \rightarrow \eta' \gamma$, $\eta \gamma$ physical parameters
- Present PDG values are improved considerably
- Analysis of 2001 data in progress ($\sim 200 \text{ pb}^{-1}$). Expected new results are :
 - 1) rare K_S decays ($\text{BR} \sim 10^{-5}$), 2) K_L decays ($\rightarrow \pi^0 \pi^0$, $\rightarrow \gamma \gamma$), 3) charged kaon physics, 4) hadronic cross section (with error $< 1 \%$)