ϕ Radiative Decays with the KLOE Detector

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for the KLOE Collaboration

Xth Eurodaphne Meeting, Granada, 9-12 February 2000

The KLOE Detector

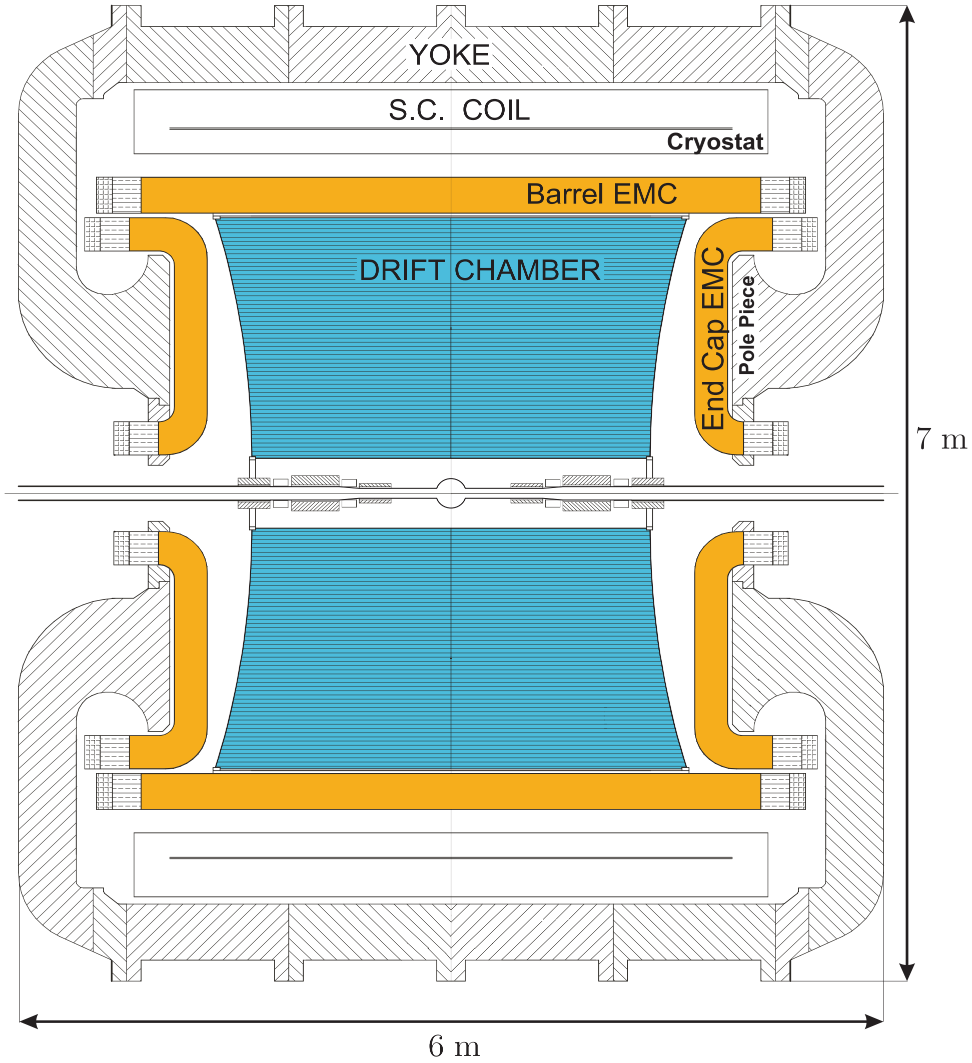
Typical e^+e^- general purpose detector w/solenoid geometry

- Beryllium Beam pipe
  (radius = 10 cm >16 λ_S)
- Helium Drift Chamber
  (12,582 Sense Wires)
- Lead-Scintillating Fiber
  EM Calorimeter (4,880 PMs)

  + Two Lead-Scintillator Tile
  Calorimeters (32 PMs)
- Superconducting Coil (B=0.6 T)

KLOE “key”features

- Hermetic coverage
- Large acceptance
- High efficiency for low energy photons
- Good measurement of track momentum : $\sigma_p/p \sim 0.5\%$
- Good measurement of photon energy : $\sigma_E /E \sim 6\% / \sqrt{E}$ (GeV)
- Excellent measurement of Time-of-Flight : $\sigma_T \sim 110\text{ps} / \sqrt{E}$ (GeV) (at present limited by lack of data for calibration)
- April 1999: first collisions in Daphne, followed by four periods of data taking: 10 days in August, 1 week in October, 1 week in November, 3 weeks in December
- During 1999 $\sim 2.4\text{pb}^{-1}$ ($\sim 7.7\text{x}10^6$ ϕ decays) have been collected
- Data taking will restart in spring 2000



YOKE
S.C. COIL
Cryostat
Barrel EMC
DRIFT CHAMBER
End Cap EMC
Pole Piece
7 m
6 m

Φ Radiative Decays

The rare decays $\Phi \rightarrow f_0\gamma$, $a_0\gamma$, $\eta'\gamma$ are of big interest for light meson spectroscopy:

$f_0(980)$	$I^G(J^{PC}) = 0^+(0^{++})$	$\pi\pi$ decay	(E_γ~ 40 MeV)
$a_0(980)$	$I^G(J^{PC}) = 1^-(0^{++})$	$\eta\pi$ decay	(E_γ~ 40 MeV)
$\eta'(958)$	$I^G(J^{PC}) = 0^+(0^{-+})$	$\eta\pi\pi$ decay	(E_γ~ 60 MeV)

Only recently observed at VEPP-2M $\rightarrow$ BR ~ 10^{-4}

- The *qq* nature of f_0, a_0 is still controversial: possible alternatives *qqqq* state or *KK* molecule.
- A precise measurement of the BR($\Phi \rightarrow f_0\gamma$), $BR(\Phi \rightarrow a_0\gamma)$ and of their ratio can help solving the puzzle.

- The gluonic content of η' and the value of the η -η' mixing angle are stills controversial.
- A precise measurement of the BR($\Phi \rightarrow \eta\gamma$), $BR(\Phi \rightarrow \eta'\gamma)$ and of their ratio can help solving the puzzle.
- ***Last but not least***… DAΦNE is also an η factory: in 3pb^{-1} ~ 1.1×10^5 $\Phi \rightarrow \eta\gamma$ are produced

Produced events for 2.4 pb^{-1} ~ 7.7×10^6 Φ decays collected in 1999

(according to the present experimental values)

Decay channel	Produced Events ($\varepsilon = 1$)
(*) $f_0\gamma \rightarrow \pi^0\pi^0\gamma$	810 ± 83
(*) $f_0\gamma \rightarrow \pi^-\pi^+\gamma$ (interf<0)	310 ± 96
(*) $a_0\gamma \rightarrow \eta\pi^0\gamma \rightarrow 5\gamma$	260 ± 44
$a_0\gamma \rightarrow \eta\pi^0\gamma \rightarrow \pi^+\pi^- 5\gamma$	150 ± 26
(*) $a_0\gamma \rightarrow \eta\pi^0\gamma \rightarrow 9\gamma$	220 ± 36

(*) See the KLOE talks in this session

Produced events for 2.4 pb^{-1} ~ 7.7x10^6 Φ decays collected in 1999

(according to the present experimental values)

Decay channel	Produced Events ($\varepsilon = 1$)
(*) $\eta'\gamma \rightarrow \eta\pi^+\pi^-\gamma \rightarrow \pi^+\pi^-3\gamma$	100$\pm$24
$\eta'\gamma \rightarrow \eta\pi^+\pi^-\gamma \rightarrow \pi^+\pi^-7\gamma$	90$\pm$22
$\eta'\gamma \rightarrow \eta\pi^0\pi^0\gamma \rightarrow \pi^+\pi^-7\gamma$	30$\pm$7
(*) $\eta'\gamma \rightarrow \eta\pi^0\pi^0\gamma \rightarrow 7\gamma$	50$\pm$12
$\eta'\gamma \rightarrow \eta\pi^0\pi^0\gamma \rightarrow 11\gamma$	40$\pm$10
(*) $\eta\gamma \rightarrow 3\gamma$	38000 (PDG `98)
(*) $\eta\gamma \rightarrow 7\gamma$	31000 (PDG `98)
(*) $\eta\gamma \rightarrow \pi^+\pi^-\pi^0\gamma$	22000 (PDG `98)
(*) $\pi^0\gamma \rightarrow 3\gamma$	10000 (PDG `98)

(*) See the KLOE talks in this session

Present experimental values (DAϕNE `99)

$B(\Phi \rightarrow f_0\gamma \rightarrow \pi^0\pi^0\gamma) = (1.14 \pm 0.10 \pm 0.12) \times 10^{-4}$ (SND , based on ~ 150 events)

$B(\Phi \rightarrow f_0\gamma \rightarrow \pi^0\pi^0\gamma) = (1.06 \pm 0.09 \pm 0.06) \times 10^{-4}$ (CMD-2 , based on ~ 270 events)

$B(\Phi \rightarrow f_0\gamma \rightarrow \pi^+\pi^-\gamma) = (0.41 \pm 0.12 \pm 0.04) \times 10^{-4}$ (CMD-2) (*)

$B(\Phi \rightarrow a_0\gamma \rightarrow \eta\pi^0\gamma) = (0.89 \pm 0.14 \pm 0.06) \times 10^{-4}$ (SND , based on ~ 70 events $\eta\pi^0\gamma$ with $\eta \rightarrow \gamma\gamma$)

$B(\Phi \rightarrow a_0\gamma \rightarrow \eta\pi^0\gamma) = (0.90 \pm 0.24 \pm 0.06) \times 10^{-4}$ (CMD-2 , based on ~ 80 events $\eta\pi^0\gamma$ with $\eta \rightarrow \gamma\gamma$)

$B(\Phi \rightarrow \eta'\gamma) = (1.2^{+0.7}_{-0.5}) \times 10^{-4}$ (PDG `98)

$B(\Phi \rightarrow \eta'\gamma) = (0.67^{+0.34}_{-0.29}) \times 10^{-4}$ (SND , based on ~ 5 events)

$B(\Phi \rightarrow \eta'\gamma) = (0.82^{+0.21}_{-0.19}) \times 10^{-4}$ (CMD-2, based on ~ 20 events)

(*) Result obtained with 9.24 pb^{-1} at the ϕ and 3.89 pb^{-1} outside the ϕ region.