KLOE FIRST RESULTS ON η, η'

THE KLOE COLLABORATION *
presented by
F. AMBROSINO
Università e Sezione INFN, Napoli (Italy)
E-mail: ambrosino@na.infn.it

The KLOE experiment at the DAΦNE e^+e^- collider in Frascati has collected 2.4 pb^{-1} during its first period of data taking in 1999. The sample of $\sim 8 \cdot 10^6$ ϕ decays has been used to study the radiative decays $\phi \to \eta\gamma$, $\phi \to \eta'\gamma$. Preliminary results show the BR($\phi \to \eta'\gamma$) to be $\simeq 7 \cdot 10^{-3}$ relative to the BR($\phi \to \eta\gamma$); this ratio can be used to extract the pseudoscalar mixing angle ϑ_P.

1 Introduction

The reason for studying the radiative process $\phi \to \eta'\gamma$ is twofold: first, the value of this BR enlightens the gluonium content[1] of the η', and, second, the ratio $R = \frac{\Gamma(\phi \to \eta'\gamma)}{\Gamma(\phi \to \eta\gamma)}$ is strictly related to the pseudoscalar mixing angle[2,3]. Predictions for this BR range between value as low as 10^{-6} for large gluonium admixture up to 10^{-4} in different realizations of the quark model and of the mixing pattern[4]. The past measurements[5,6] have large errors; KLOE[7] can significantly increase the present knowledge by large statistics and by observing different decay chains.

2 Analysis and results

We study four processes, giving rise to two different final states : $\phi \to \eta(\eta')\gamma \to \pi^+\pi^-\pi^0(\eta)\gamma \to \pi^+\pi^-\gamma\gamma\gamma$ and $\phi \to \eta(\eta')\gamma \to \pi^0\pi^0\pi^0(\eta)\gamma \to 7\gamma$. The $\phi \to \eta\gamma$ decays are the main source of background for the rare corresponding $\phi \to \eta'\gamma$ channels, but, since they can be selected with very low background on a simple topological basis, they constitute also a relatively high statistics channel on which testing systematics. Comparison between data and Monte Carlo show very good agreement for the η control sample, both for 7γ and for $\pi^+\pi^-\gamma\gamma\gamma$ final state (see fig. 1). Most of the selection systematics effects (such as uncertainty on trigger efficiencies) are in common for the η and η' corresponding channels and hence almost cancel when evaluating the ratio R , while errors on integrated luminosity and ϕ cross section cancel

*The full KLOE author list can be found in hep-ex/0006036

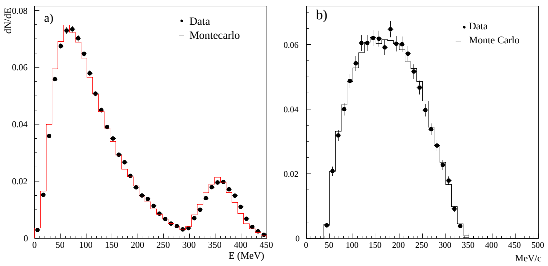

Figure 1. Comparison data Monte Carlo for η control sample: a) photon energy spectrum in 7γ events ; b) charged pions momentum spectrum in $\pi^+\pi^-\gamma\gamma\gamma$ events

exactly in the ratio. After a first level topological selection, where photons are individuated as prompt clusters not associated to charged tracks using the excellent time resolution of the detector ($54\text{ps}/\sqrt{\text{E(GeV)}}$), a kinematic fit is performed with all measured quantities as inputs and costraining the intermediate particle masses together with global energy-momentum conservation. The final selection is made on χ^2 probability for the hypothesis of an event to be either $\eta\gamma$-like or $\eta'\gamma$-like, and, for the 7γ sample, cutting on the energy of the hardest photon. After these selection we are left with 21 ± 4.6 η' events in the $\pi^+\pi^-\gamma\gamma\gamma$ final state and $6^{+3.3}_{-2.2}$ in the 7γ final state with less than one expected background event at 90% CL. This is the first observation of the $\phi \to \eta'\gamma \to 7\gamma$ decay chain. Using the number of selected η and η' events, the efficiencies evaluated by Monte Carlo and the intermediate states BR's as given by PDG we evaluate the ratio $R = (7.1 \pm 1.6(\text{stat.}) \pm 0.3(\text{syst.})) \cdot 10^{-3}$ or $\text{BR}(\phi \to \eta'\gamma) = (8.9 \pm 2 \pm 0.6) \cdot 10^{-5}$. This result has the same level of accuracy of the current world average. Using formula given in Bramon[3] we can use this value of R to extract a mixing angle $\vartheta_P \simeq -19°$. The value of $\text{BR}(\phi \to \eta'\gamma)$ disfavours models with large gluonium admixtures of the η'.

References

1. N. G. Deshpande, G. Eilam, *Phys. Rev.* D **25**, 270 (1982)
2. J. L. Rosner, *Phys. Rev.* D **27**, 1101 (1983)
3. A. Bramon *et al*, *Eur. Phys. J.* C **7**, 271 (1999)
4. F. De Fazio, M.R. Pennington *JHEP* **07**, 051 (2000) and refs. therein
5. V. M. Aulchenko *et al*, *JETP Lett.* **69**, 97 (1999)
6. R. R. Akhmetshin *et al Phys. Lett.* B **473**, 337 (2000)
7. S. Bertolucci for the KLOE collaboration, hep-ex/0002030.