

Status report on $\eta \rightarrow \pi^- \pi^+ \gamma$

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Phi decays working group meeting, 14 May 2008

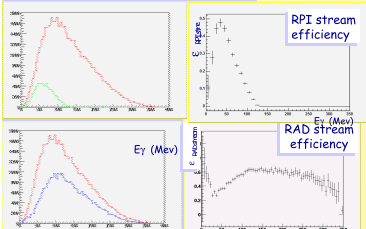
Introduction

- Previous analysis in KLOE:

Ilaria Vilella (Uni. di Napoli) presented during Capri'03:

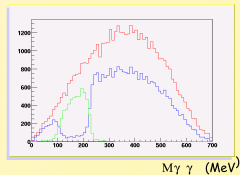
- $L_{int} = 29 \text{ pb}^{-1}$, selected 18508 events
- Could not use single streaming algorithm because all of them cut into kinematical distributions
- Planned analysis on 100 pb^{-1} (?)

$\gamma \eta$ spectrum



Invariant mass of two photons

- MC true
- MC true RAD Stream
- MC true RPI Stream



I. Vilella

May 24th 2003 - 3rd KLOE Physics Workshop, Capri

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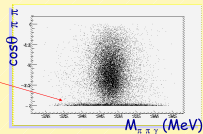
Branching Ratio Accuracy

We select $N=18508$ events \Rightarrow our BR 3% below PDG'02 value

preliminary

$$\Rightarrow \sigma_{BR}/BR = 7 \times 10^{-3}$$

There is still background



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Signal / Background

Reaction:

$$\phi \rightarrow \eta\gamma, \eta \rightarrow \pi^-\pi^+\gamma$$

$$\phi \rightarrow \pi^+\pi^-\pi^0$$

$$\phi \rightarrow \eta\gamma, \eta \rightarrow \pi^-\pi^+\pi^0$$

$$e^+e^- \rightarrow \omega\pi^0$$

X-section $\sigma[\mu b]$

$$1.84 \times 10^{-3}$$

$$0.46$$

$$8.87 \times 10^{-3}$$

$$0.14 \times 10^{-3}$$

- Charged η decays (most frequent):

$$\eta \rightarrow \pi^-\pi^+\pi^0 \quad (22.68 \pm 0.35) \times 10^{-2}$$

$$\eta \rightarrow \pi^-\pi^+\gamma \quad (4.69 \pm 0.10) \times 10^{-2}$$

$$\eta \rightarrow e^+e^-\gamma \quad (6.0 \pm 0.8) \times 10^{-3}$$

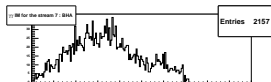
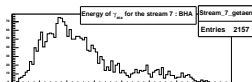
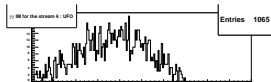
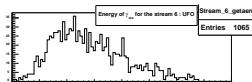
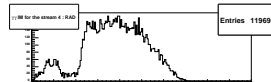
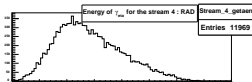
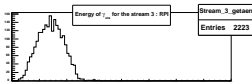
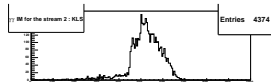
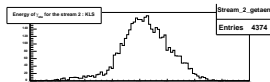
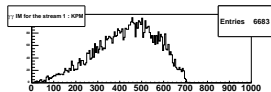
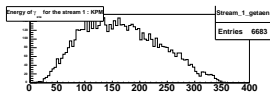
$$\eta \rightarrow \mu^+\mu^-\gamma \quad (3.1 \pm 0.4) \times 10^{-4}$$

Start

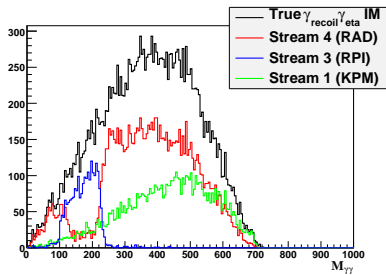
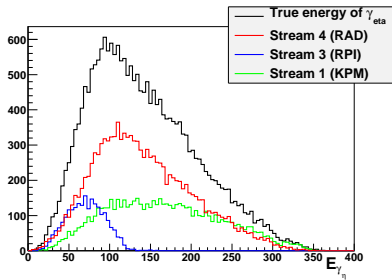
- Idea: “PROD2NTU”-like ntuples -> “h2root” ROOT-TTree -> analysis C++/ROOT
- Jump-start with help of Roberto’s code (*grazie!*)
 - Using 1.194.777 MC events (MRC) (2005(0), from run 34406)(ver. 26)
 - 22131 true $\eta \rightarrow \pi^- \pi^+ \gamma$ events found and used for this presentation

Events selection by streams

1 (KPM)	6683
2 (KLS)	4376
3 (RPI)	2223
4 (RAD)	11969
5 (CLB)	0
6 (UFO)	1065
7 (BHA)	2157

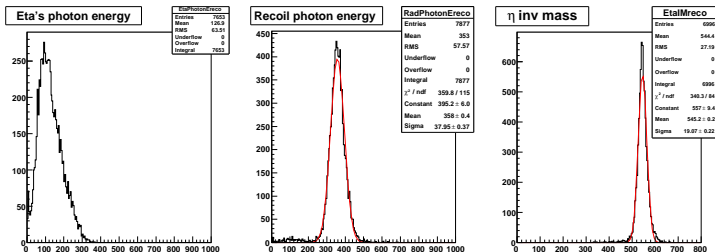


Photons' spectra



Reconstruction of the events

- 1 charged vertex with two associated tracks
- The vertex must be inside : $R_{xy} < 4$ cm, $|Z| < 8$ cm.
- 2 prompt photons $|t_{cl} - l_{cl}/c| < 5\sigma_t$;
- more energetic photon assumed 'recoil'



7469 events fulfilling the conditions (6994 matching correctly true particles in the KINE bank) resulting in **Acc=34%** (in the previous analysis 46% (?)(kin. fit ?)

Spares

Motivation

- BR, background to $\eta \rightarrow e^+ e^- \gamma$, $\eta \rightarrow \mu^+ \mu^- \gamma$
- Study of theoretical models
 - *B.Borasoy and R.Nissler, hep-ph arXiv:0705.0954*
Inconsistency in the old measurements of the γ spectrum
 - $\Gamma(\eta \rightarrow \pi^- \pi^+ e^+ e^-) / \Gamma(\eta \rightarrow \pi^- \pi^+ \gamma)$ Theor. accuracy: 1-2%
- Anomalous (triangle box) vs resonant contribution (VDM)