Light Meson Decay working group activities

Susan Schadmand

List of Meson Decays

From Lmdwiki

meson decay	physics	people	data
$\pi \rightarrow \gamma e^+e^-$	transition form factor, Me+e- (dark photon)	Michael Kunkel	g12
$\eta(') \rightarrow \gamma e^+e^-$	transition form factor	Susan Schadmand (Michaela Schever (master 2015))	g12
$\omega \rightarrow \pi^0 e^+e^-$	transition form factor	Susan Schadmand +	g12
$\eta(') \rightarrow \pi^0 e^+e^-$	C violation	Haiyun Lu??	
$\eta(') \rightarrow \pi^+\pi^-e^+e^-$	CP violation	Michael Kunkel	g12
$\eta(')$,$\omega \rightarrow \pi^+\pi^-\gamma$	box anomaly upper limit branching ratio	Georgie Mbianda Njencheu	g11
$\eta' \rightarrow \pi^+\pi^-\gamma$	box anomaly	Xinying Song	g12
η, ω, $\varphi \rightarrow \pi^0\pi^+\pi^-$	Dalitz plot analysis η ω φ	Daniel Lersch, (Diane Schott) Carlos Salgado + , Chris Pederson Haiyun Lu??	g11/g12
$\eta' \rightarrow \pi^+\pi^-\gamma\gamma$ $\varphi \rightarrow \pi^+\pi^-\eta$	Dalitz plot analysis/meson mixing G-parity violation	Sudeep Ghosh	g12,(g11)
$\varphi \rightarrow \omega\gamma$	C parity violation, φ rare decay	Haiyun Lu??	
NULL	invisible decay	Haiyun Lu??	
f_1	isospin symmetry breaking, f1 decay through rho	Haiyun Lu??	

g12 analyses follow procedure
common analysis for dilepton final states

paper(s) on pi0 cross section

planned paper

thesis
planned paper

planned papers

thesis

interested in taking part: Let us know!

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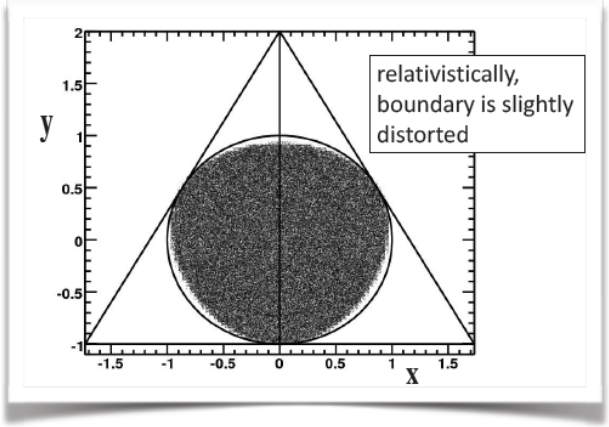
The Dalitz plot of $\eta' \to \eta\pi^+\pi^-$ decay from G12 dataset.

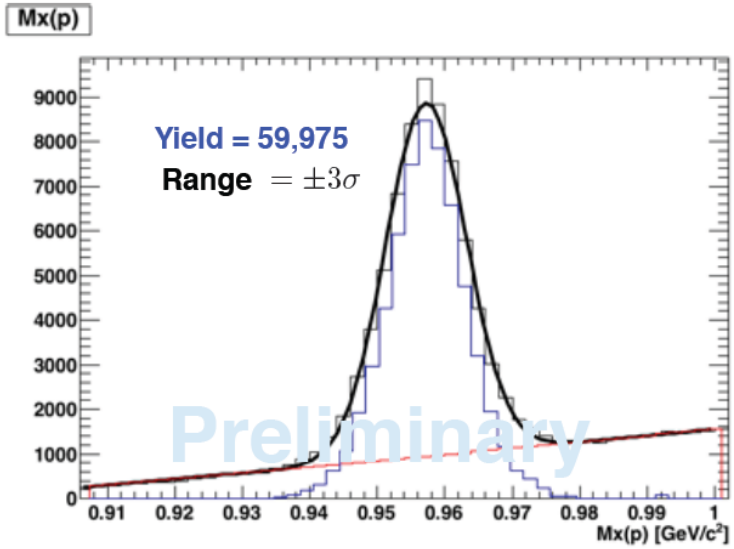
Sudeep Ghosh
Discipline of Physics, School of Basic Science, Indian Institute of Technology Indore, Khandwa Road, Simrol, M.P. India- 452020

Motivation :

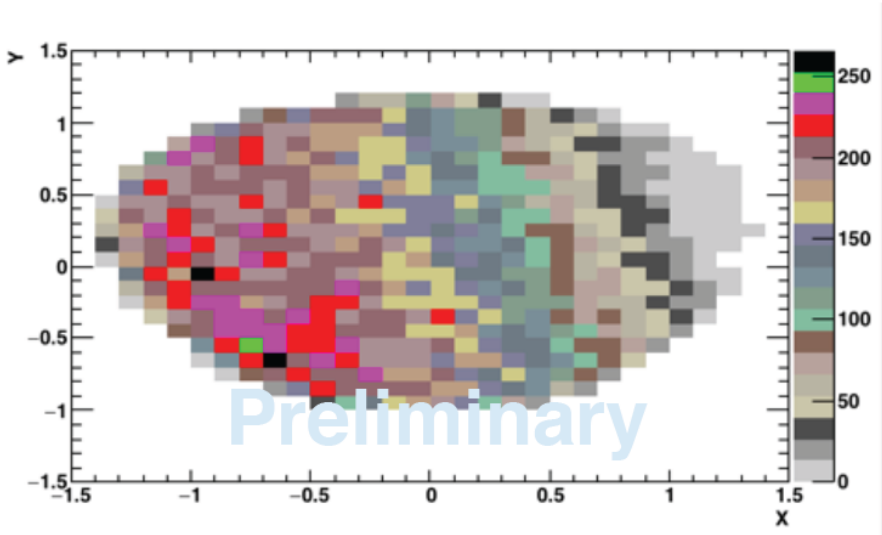
- Dalitz plot provides pure kinematic information of the decay, enabling the study of low-energy QCD dynamics.
- The decay of $\eta' \to \eta\pi^+\pi^-$ has a low Q-value, thus it will help to study effective chiral perturbation theory at a low Q limit.
- The study will report the Dalitz plot parameters in an independent measurement with different systematic errors.

$$X = \frac{\sqrt{3}(T_{\pi+} - T_{\pi-})}{Q}, Y = \frac{(m_\eta + 2m_\pi)}{m_\pi} \cdot \frac{T_\eta}{Q} - 1$$

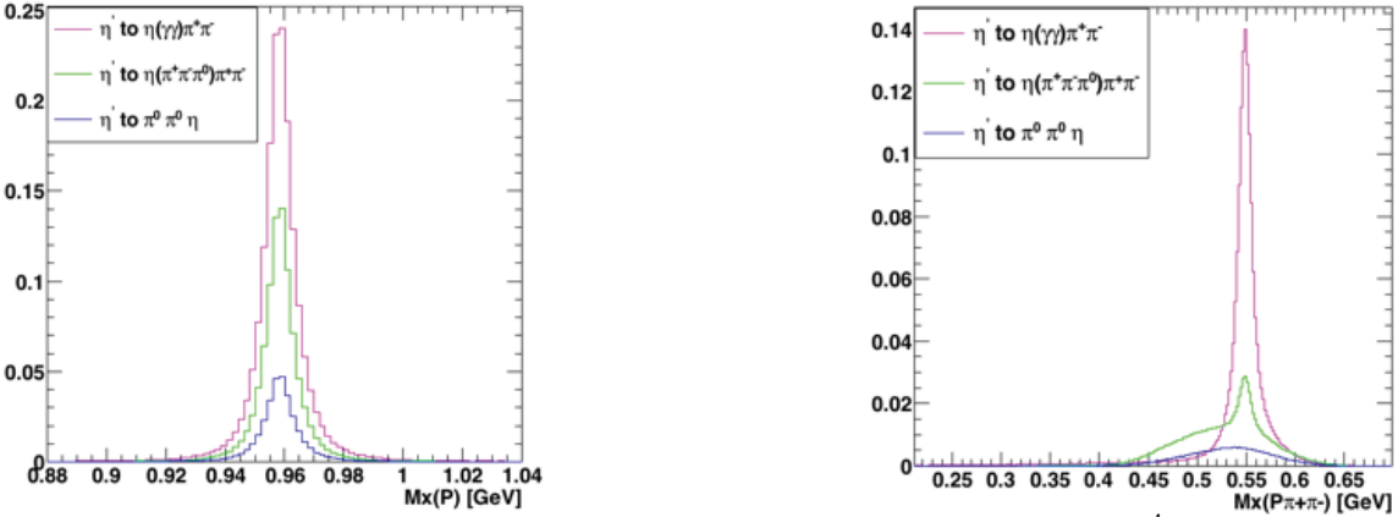




No. of η' after restricting 0.537<$Mx(p\pi^+\pi^-)$<0.557 GeV.



Dalitz Plot distribution from G12 data



Simulated signal and background channels contributing at the η' region of Mx(p)

Analysis Steps :

1. Events with one proton, $\pi+$, $\pi-$ and 2γ selected
2. The signal and background channel's simulated with differential cross-section and branching ratio.
3. The Kinematically fitted events are corrected by acceptance and the relative branching ratio is crosschecked

Future Steps:

5. Optimised bin width is under study from simulation
6. The optimised binned Dalitz plot will be fitted to the function below to report the Dalitz plot parameters

$$f(X_j^c, Y_j^c) = N(1 + a(Y_j^c) + b(Y_j^c)^2 + c(X_j^c) + d(X_j^c)^2)$$

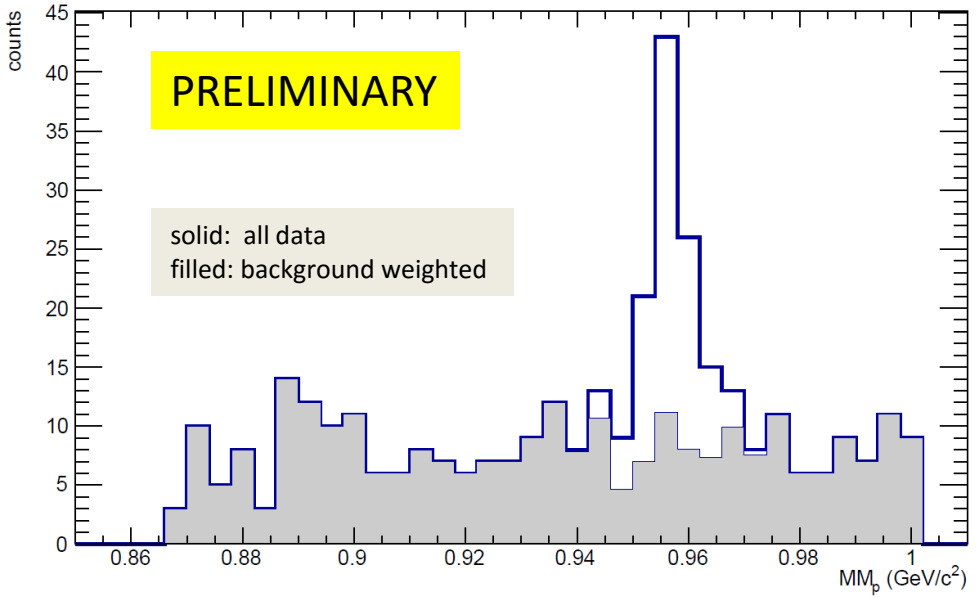
$\eta' \rightarrow \gamma ee$: cut-based analysis

- lepton skim MK: IsLepG7_g12.root
- analysis cuts

- g12 fiducial cuts
- event efficiency
- q-factor signal extraction

evaluate <u>smooth background</u> event-by-event

➢ 359 event candidates
➢ 82 events (signal weight)
full g12 beam energy range



- insufficient statistics for transition form factor
- branching ratio not competitive

(BESIII (2.13 +- 0.09(stat) +- 0.07(sys)) x 1e-2)

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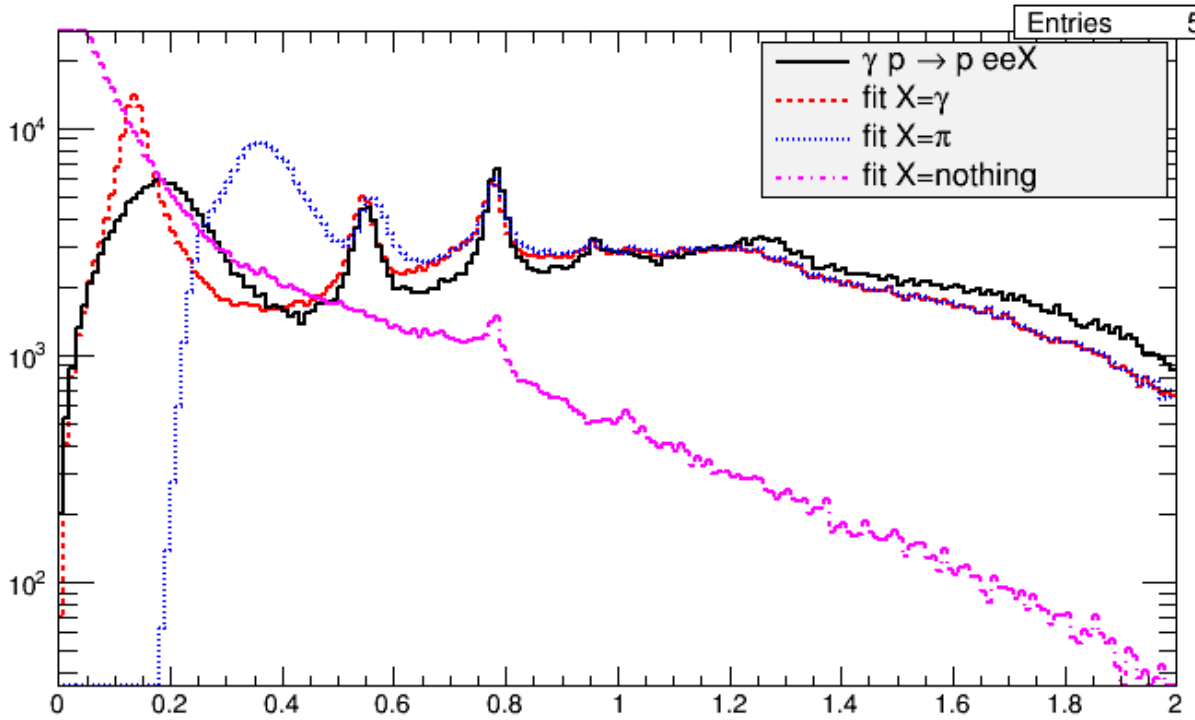
kinematic fit for g12 dileptons

based on root tree with g7 leptons, (*Npr==1 && G7_ep==1 && G7_em==-1 && miss_pee.M2()<0.08),*
which had 457918 entries in spectra (best-time beam photon was chosen).
here more entries because looping over in-time beam photons.



using
g12_corrections script

- Beam Corrections
- Momentum Corrections
- TOF knockouts
- EC Knockouts
- Geometric Fiducial Cuts

(pulls are still under scrutiny)

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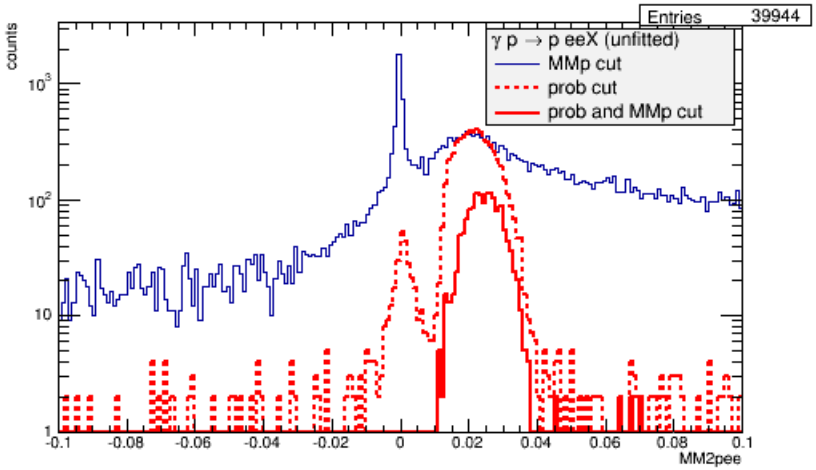
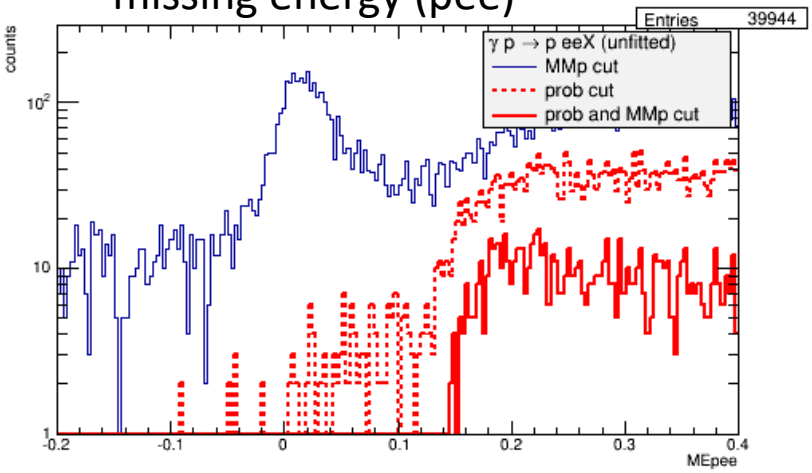
ω→πee

missing mass (pee)



missing energy (pee)



analysis strategy:
e+e- detection
and missing particle

missing pion: **ω→πee**
- missing mass is pion mass
- missing energy

missing photon: **η(´)→γee**
- missing mass zero
- missing energy

missing nothing: **ρ/ω→ee**
- missing mass and nergy zero

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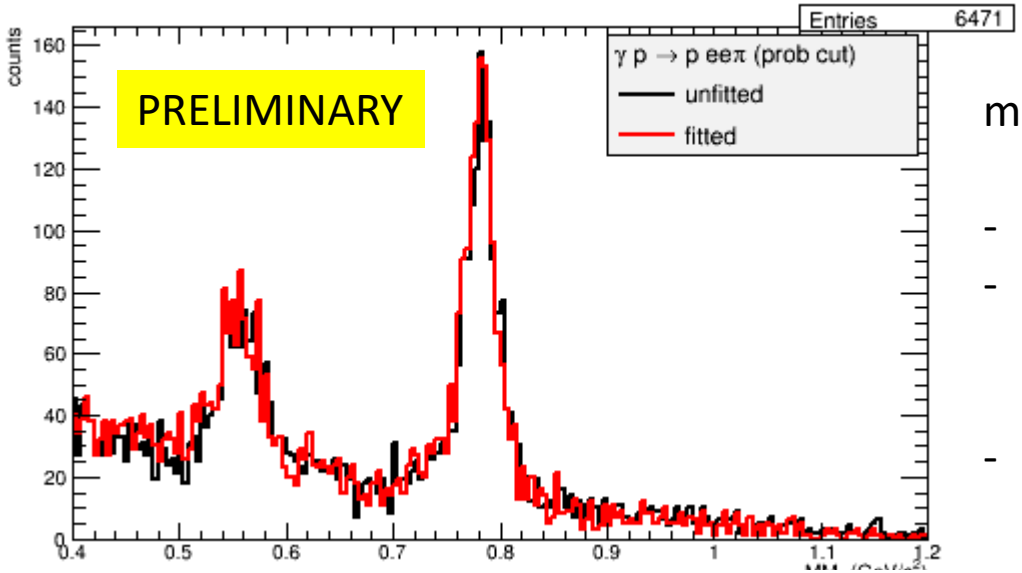
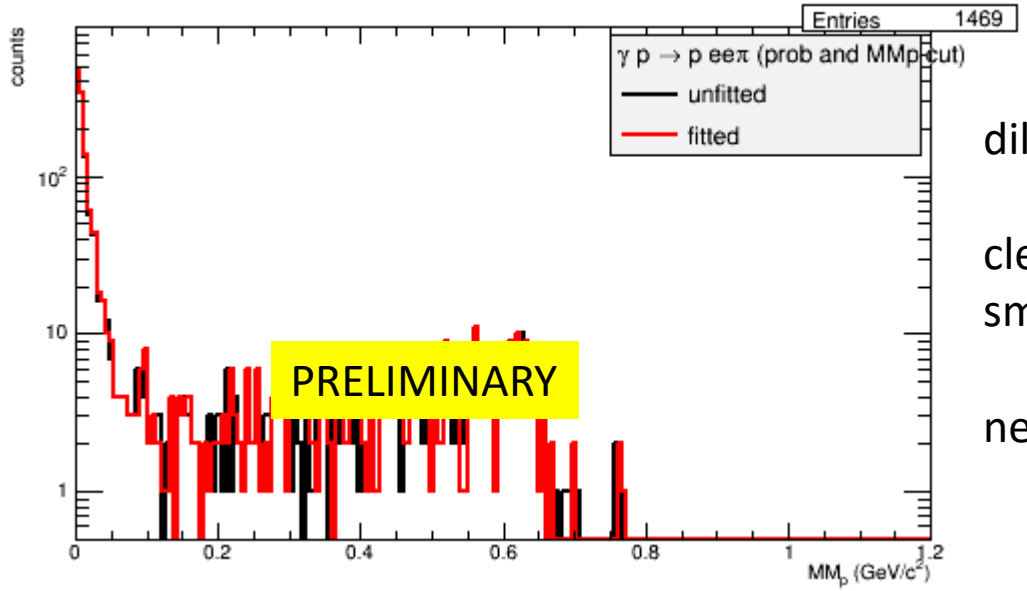
ω→πee



missing mass (p)

- smooth background
- in-peak background:
  competing decays
  photon external conversion
- peaking background?



dilepton mass

clearly dominated by background
small masses: external conversion

next step: simulations

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