

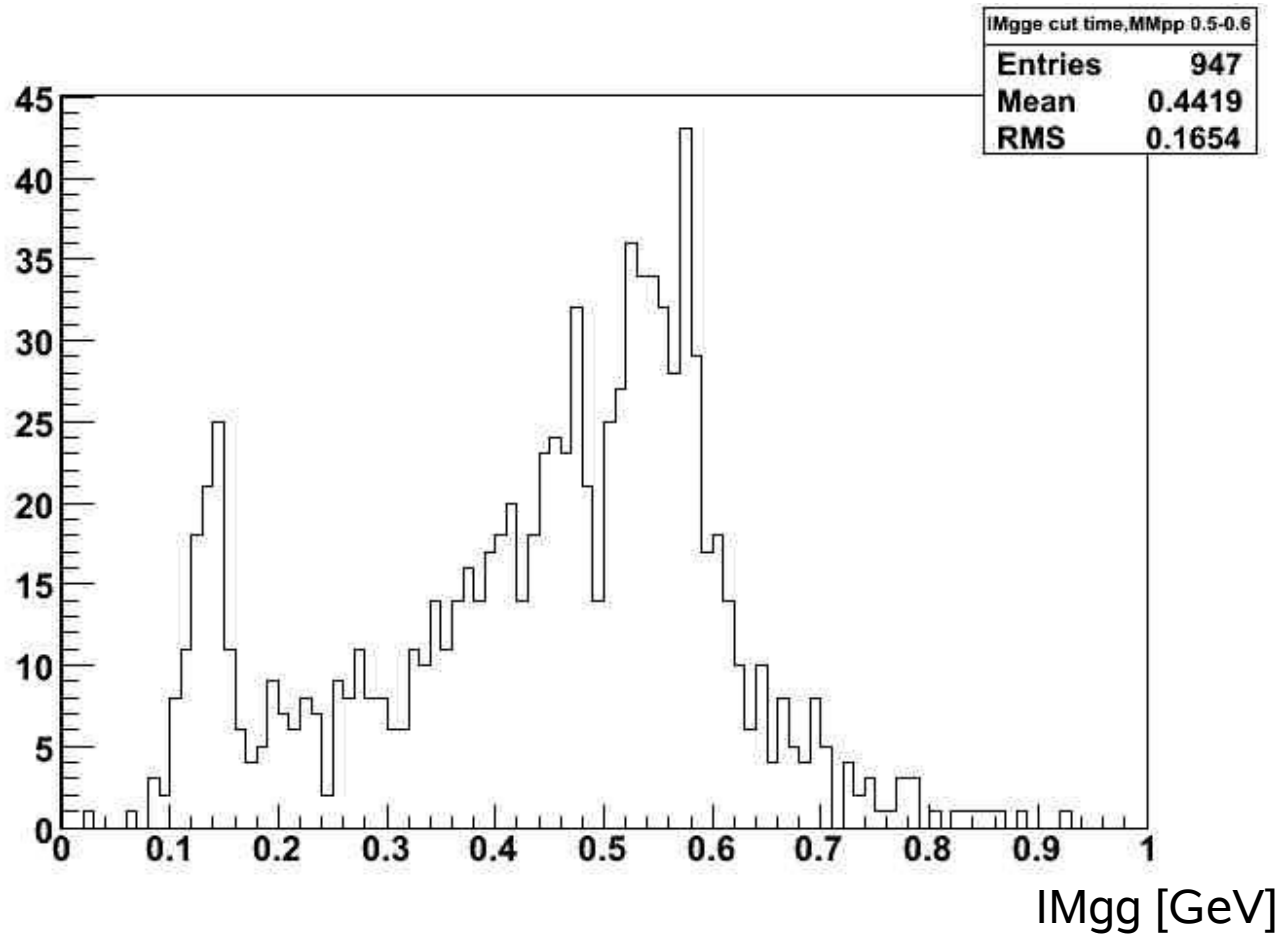
Another step in analysis of trigger PT29 status - $\eta \rightarrow e^+e^-\gamma$ decay reaction

By Marcin Berłowski

Some facts about PT29

- From April 2007, $pp \rightarrow pp\eta$ 1.4 GeV
- PT29 trigger definition [frha2*frhb2*ecrl*Vfvh]
- High energy deposited in both sides of SEC
- It didn't chose between η decays:
 $\eta \rightarrow e^+e^-e^+e^-$, $\eta \rightarrow e^+e^-$, $\eta \rightarrow e^+e^-\gamma$, $\eta \rightarrow \gamma\gamma$
- ~300 runs each around 100k of events

Selection of $\eta \rightarrow \gamma\gamma$



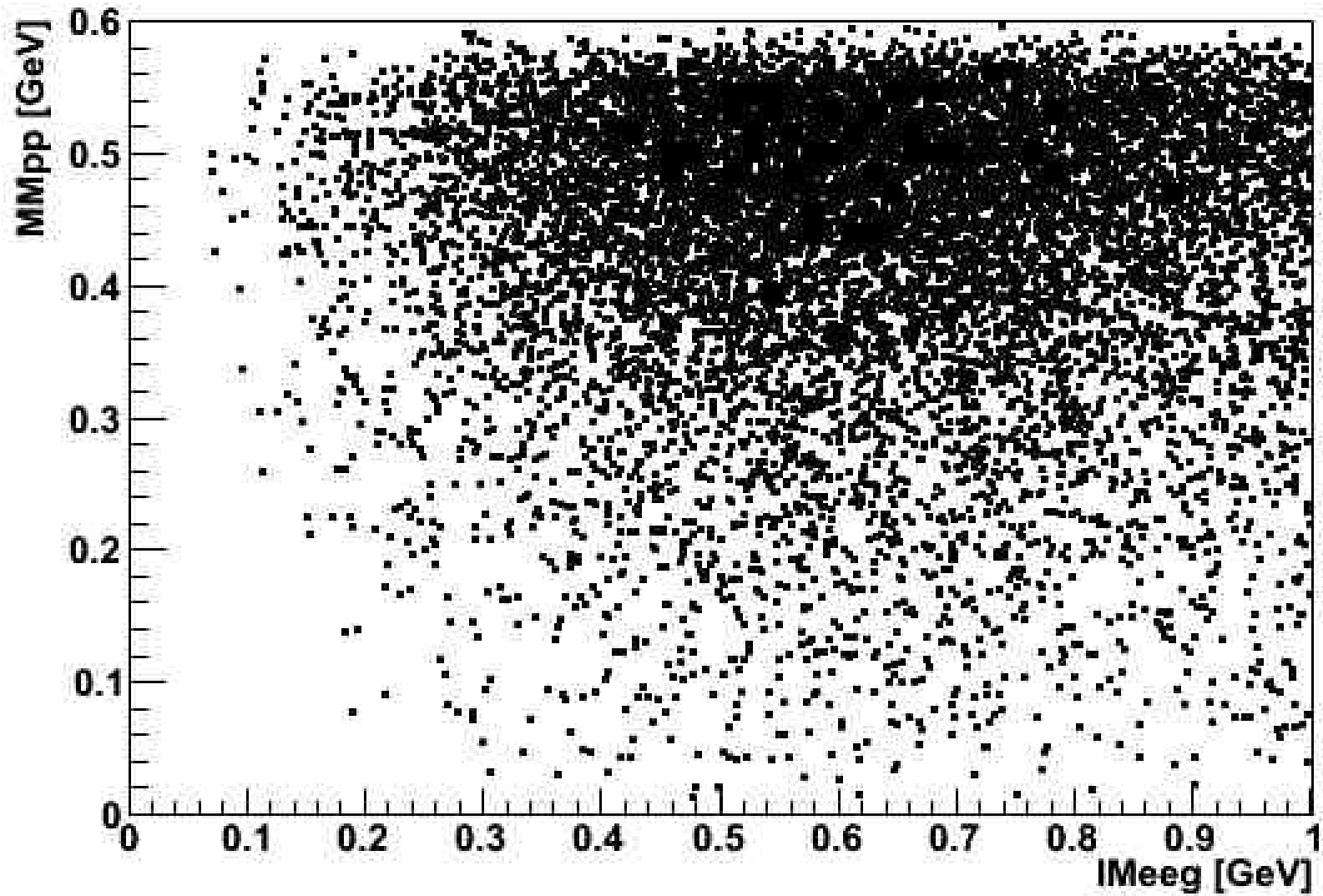
Conclusions from $\eta \rightarrow \gamma\gamma$

- ∇ $\eta \rightarrow \gamma\gamma$ channel is seen, hopefully other will be also visible
- Roughly 60k events of $\eta \rightarrow \gamma\gamma$ ($\text{BR}_{\text{PDG}} \approx 39\%$), so $\eta \rightarrow e^+e^-\gamma$ ($\text{BR}_{\text{PDG}} \approx 6 \times 10^{-3}$) ~ 200 ev (detector acceptance and reconstruction efficiency included), also background study for $\eta \rightarrow e^+e^-$ ($\text{BR}_{\text{PDG}} < 8 \times 10^{-5}$)
- Above numbers are for all ~ 200 runs from April 2007 data sample

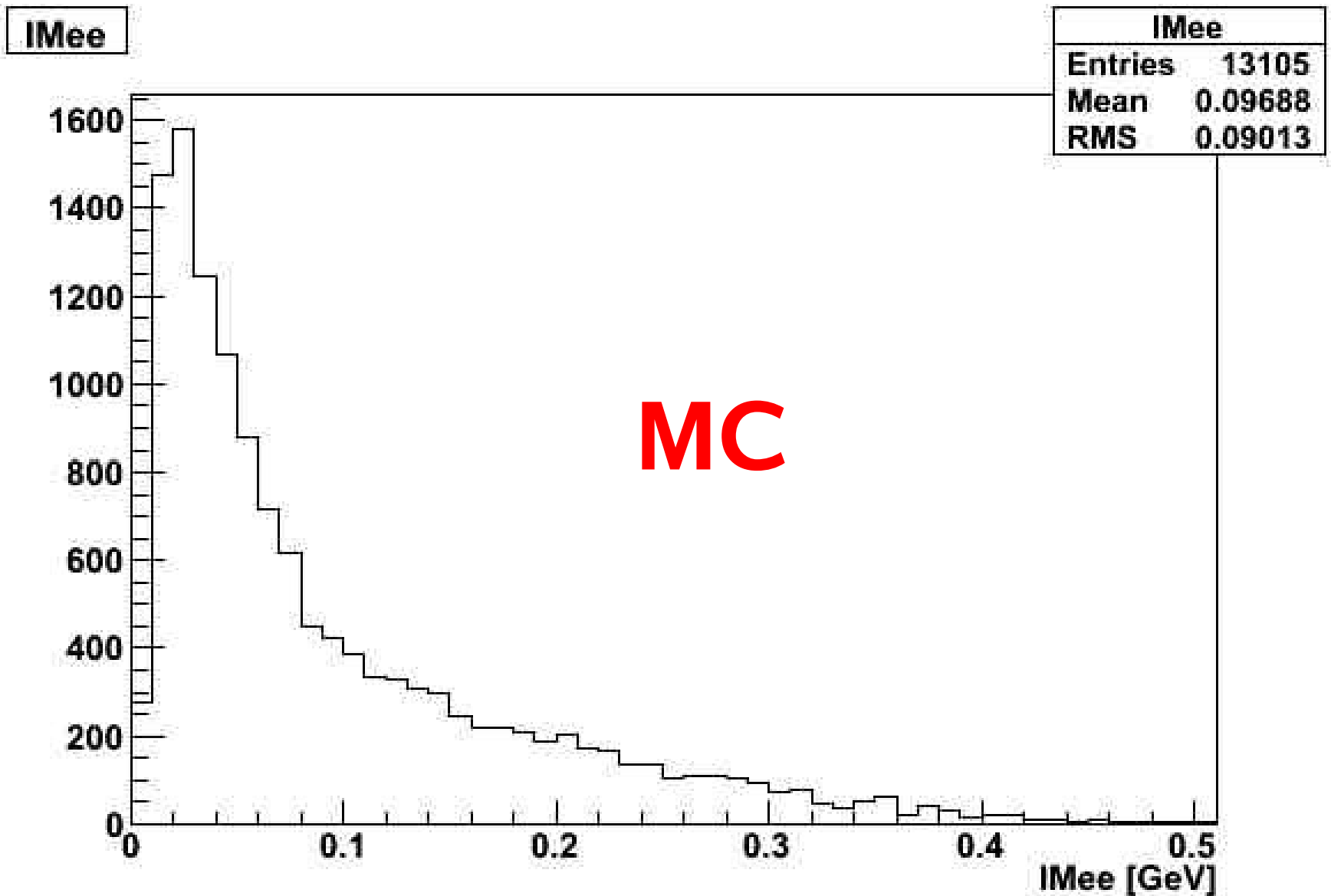
Selection of $\eta \rightarrow e^+e^-\gamma$

- So I took 86 runs and tried to search for $\eta \rightarrow e^+e^-\gamma$
- Particle selection:
 - Two charged from FD closest in time, within 3° - 18° , $e_{dep} > 0.1$ GeV
 - Two charged giving lowest IM_{ee} (must have opposite charges)
 - Photon of energy > 0.2 GeV, giving greatest angle to e^+e^- pair on a XY plane
- Time cuts:
 - Coincidence between FDC, CDC, CDN (any combination of above in $[-25, +35]$ ns bounds)
 - PS hit in CDC time window
 - For each of FDC, CDC: ($max_time - min_time$) in 20 and 50 ns respectively

MMpp vs IMeeg



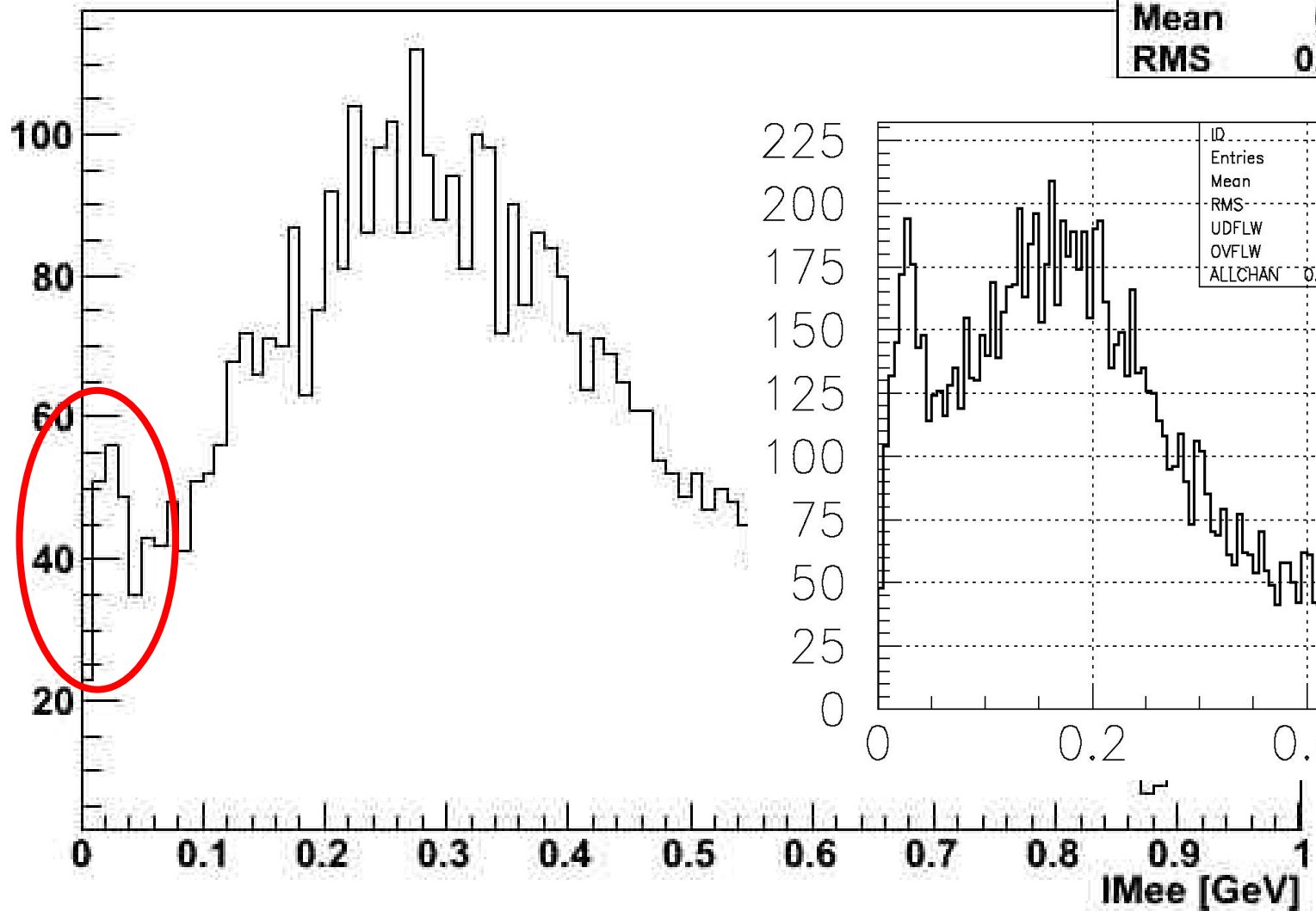
Indication of e^+e^- pair(s)



IMee cut MMpp

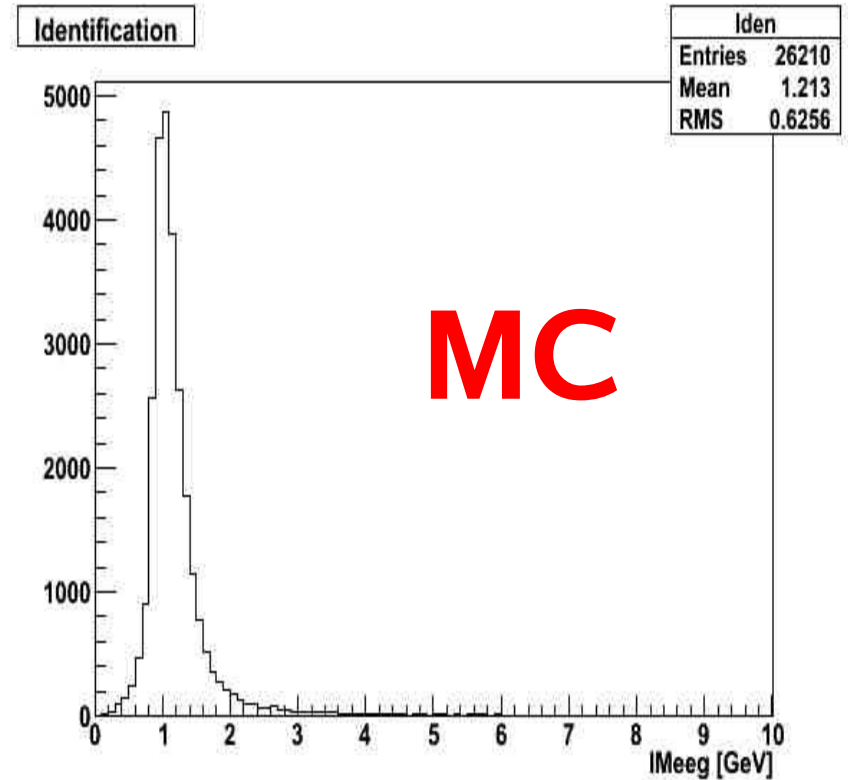
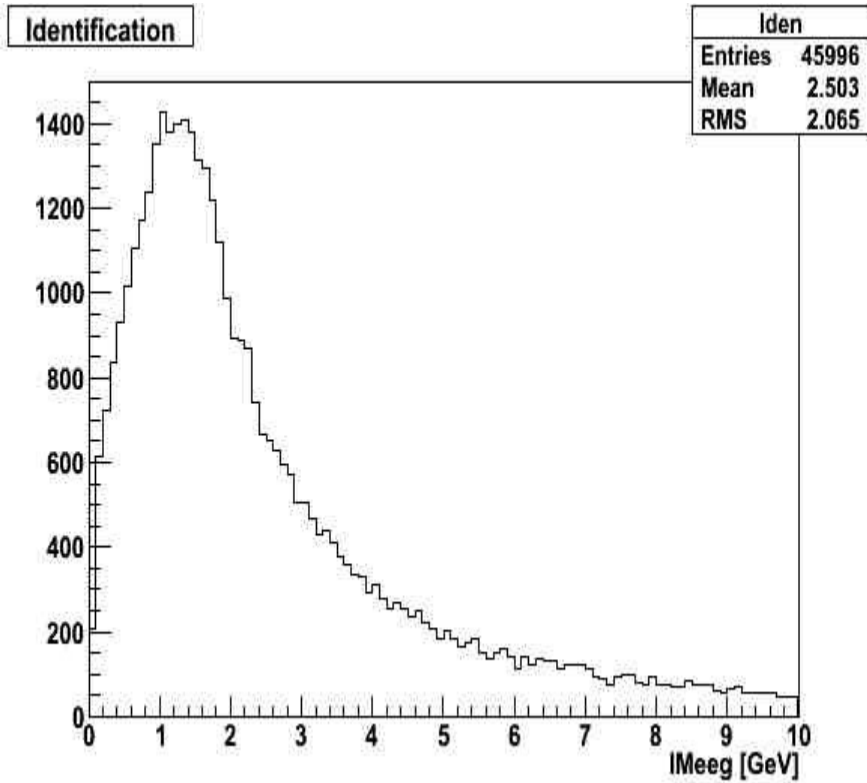
IMee cut MMpp

Entries	5533
Mean	0.376
RMS	0.2287



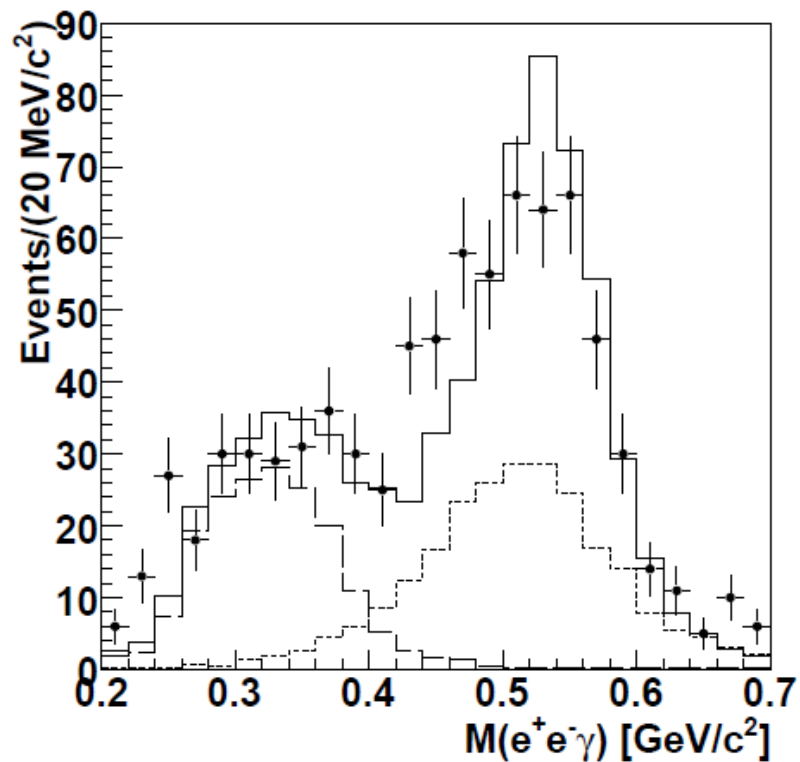
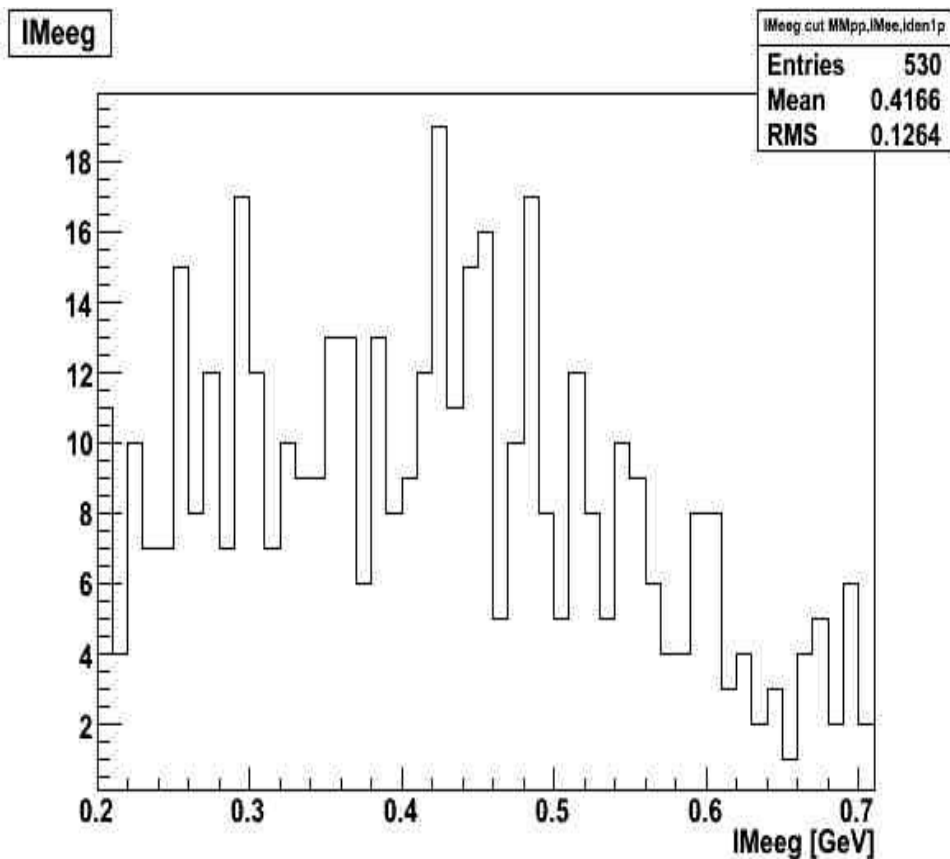
Cut – $0.5 \text{ GeV} < MMpp < 0.6 \text{ GeV}$

Particle identification

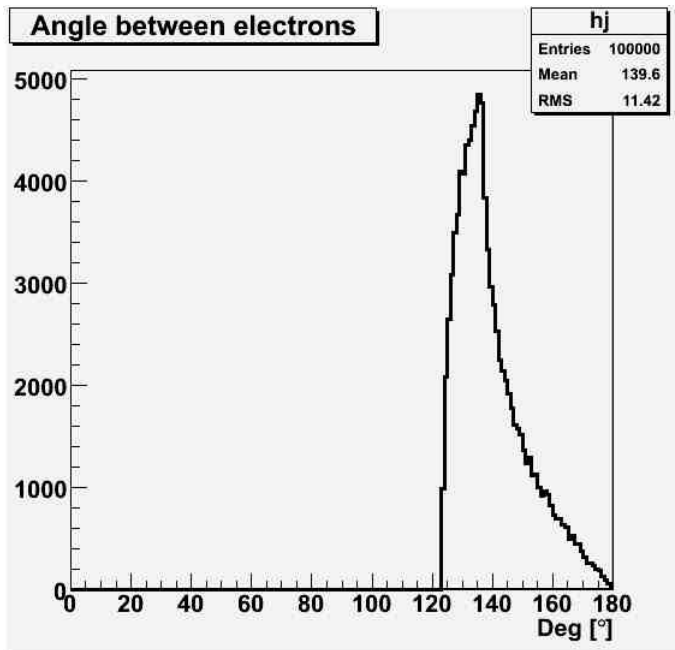


- $P/edep < 1.65$

Cuts - MMpp, Iden, IMee < 0.125 GeV

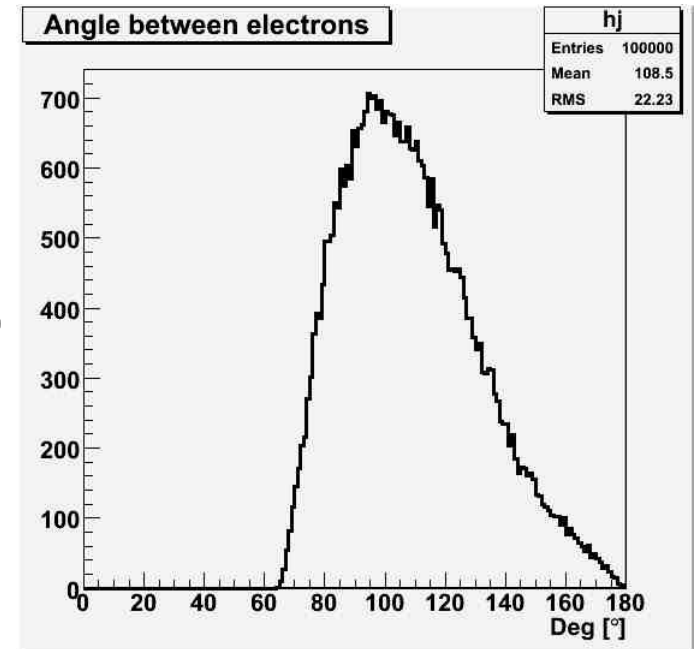


Two body decay - comparison



$pd \rightarrow {}^3\text{He}\eta$
893 MeV

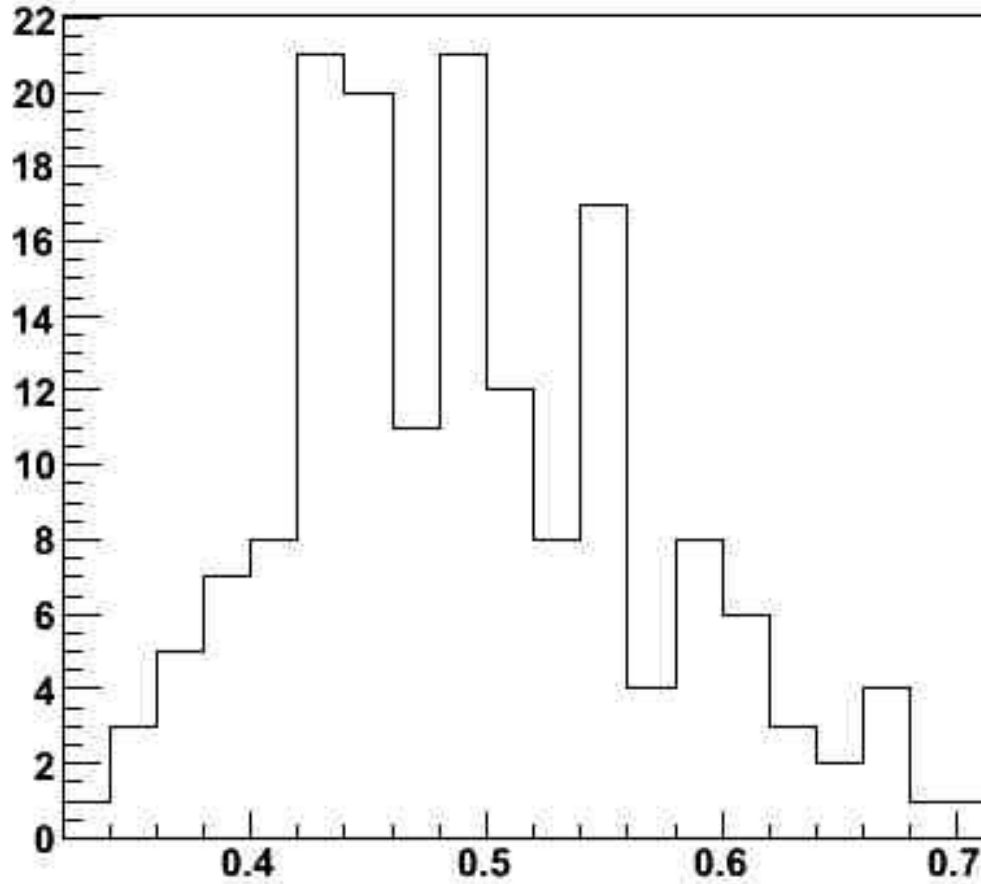
Monte Carlo
(without detector)



$pp \rightarrow pp\eta$
1400 MeV

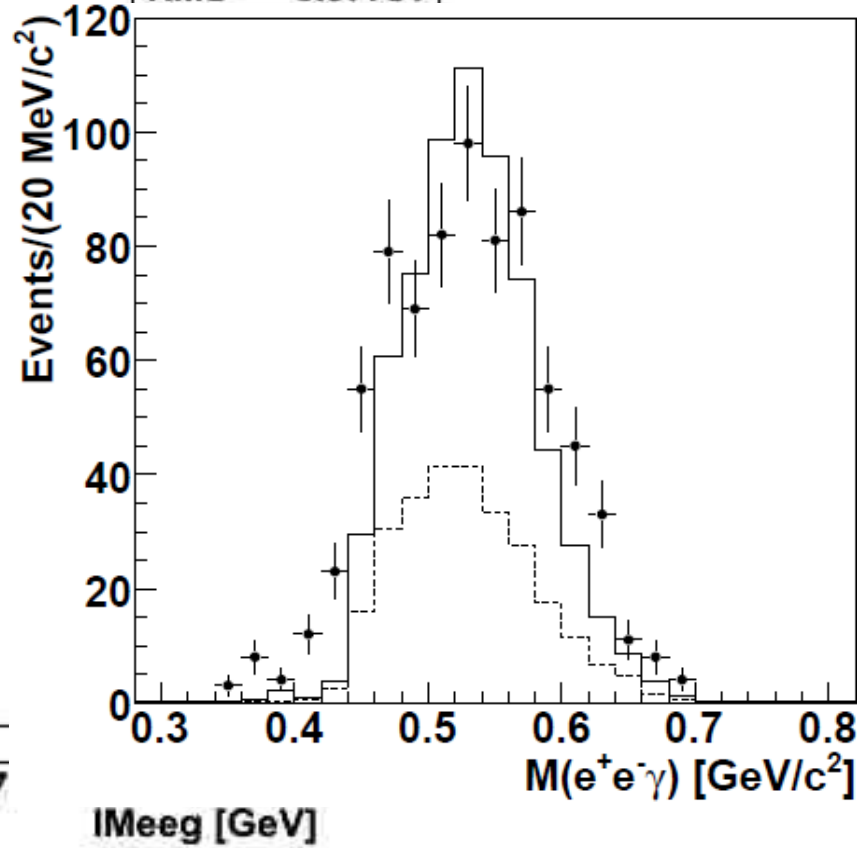
Final result

IMeeg



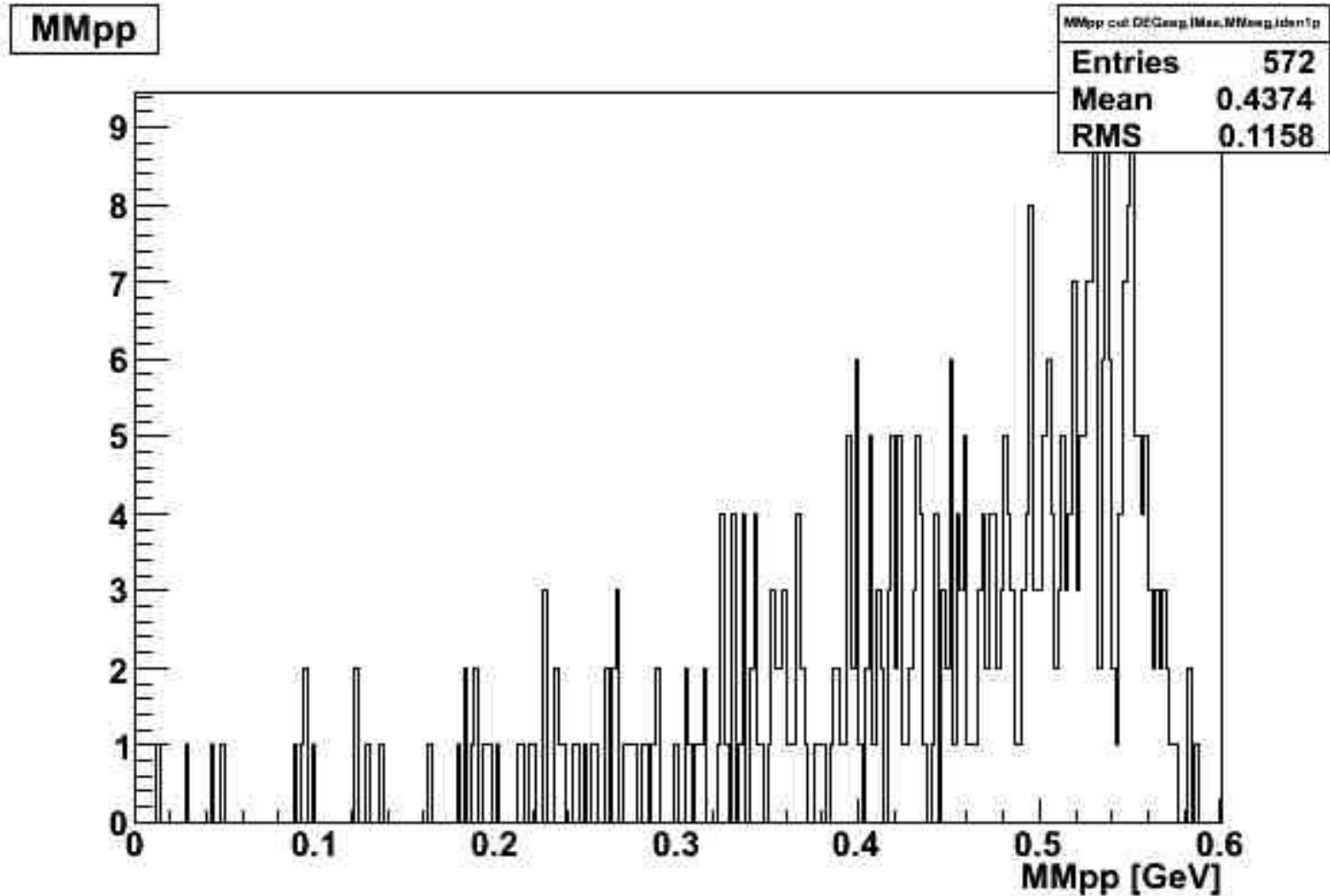
IMeeg cut 0.45 < IMeeg < 0.55

Entries	171
Mean	0.4931
RMS	0.07781



Cuts – MMpp, IMee, Iden, $-0.15 < MM_{eeg} < 0.15$, $70^\circ < \theta_{eeg} < 140^\circ$

Influence in MMpp spectrum



Conclusions

- Still only 40% of all data collected with trigger PT29 is already analyzed
- Background studies for $\eta \rightarrow e^+e^-\gamma$
- Background for $\eta \rightarrow e^+e^-$ must be done