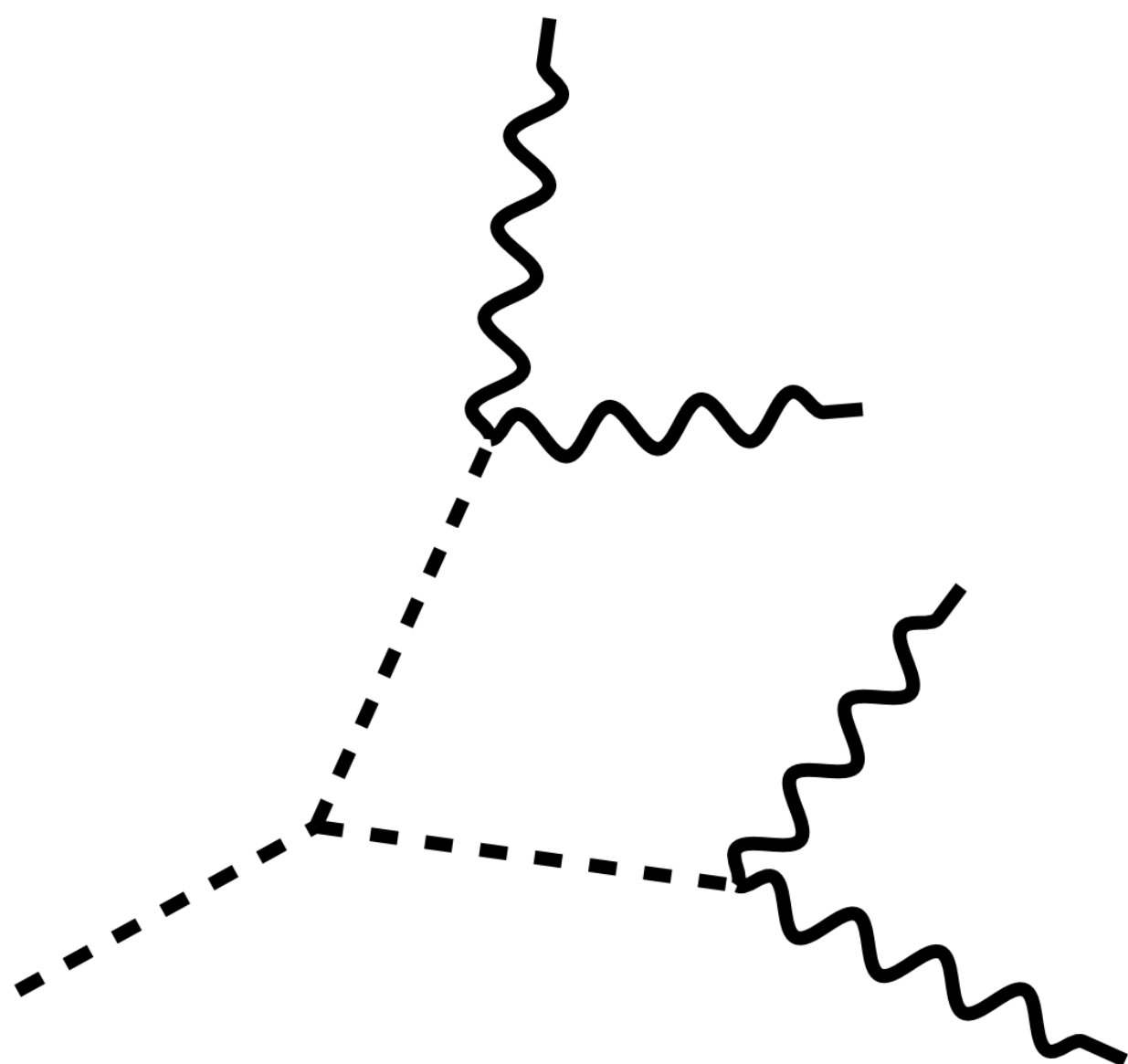


$$h(125) \rightarrow aa \rightarrow \gamma\gamma\gamma\gamma$$



## Higgs to 4 Gamma Update

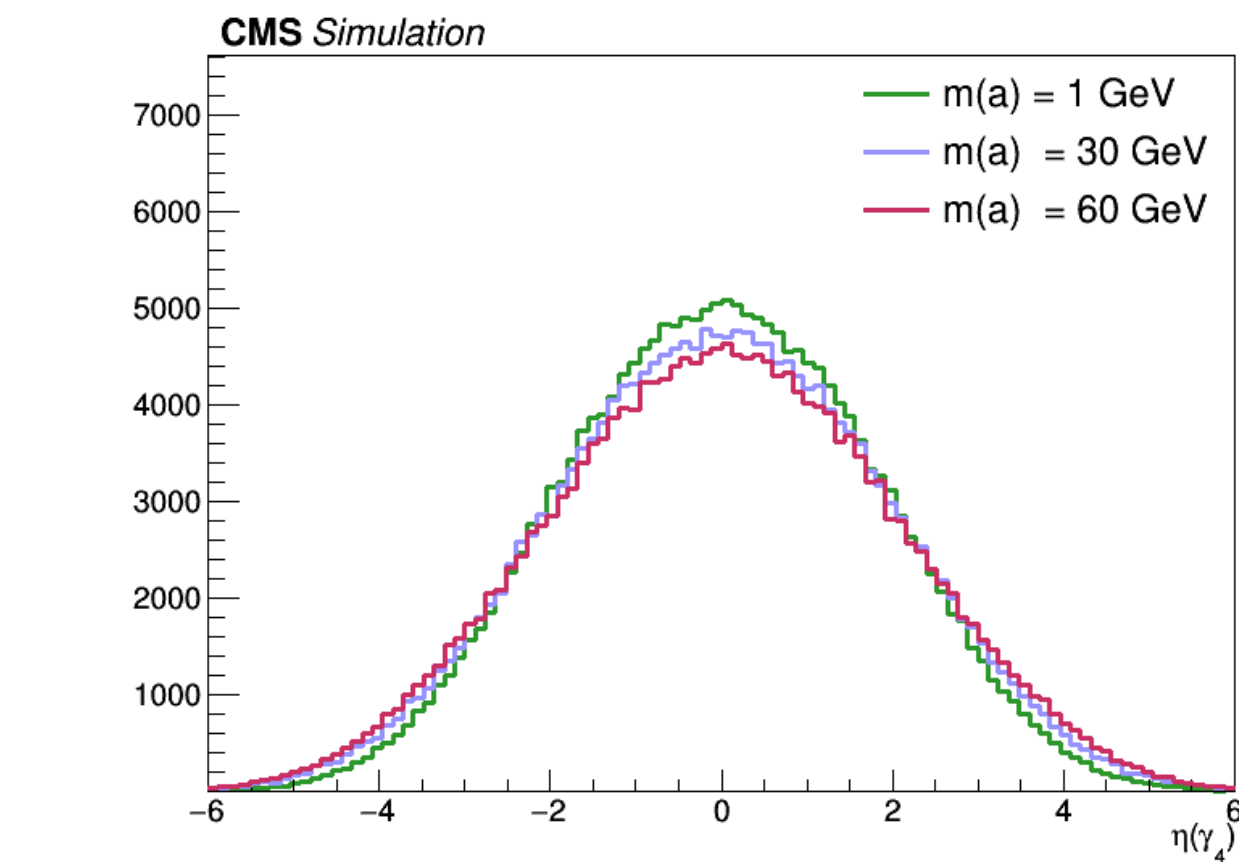
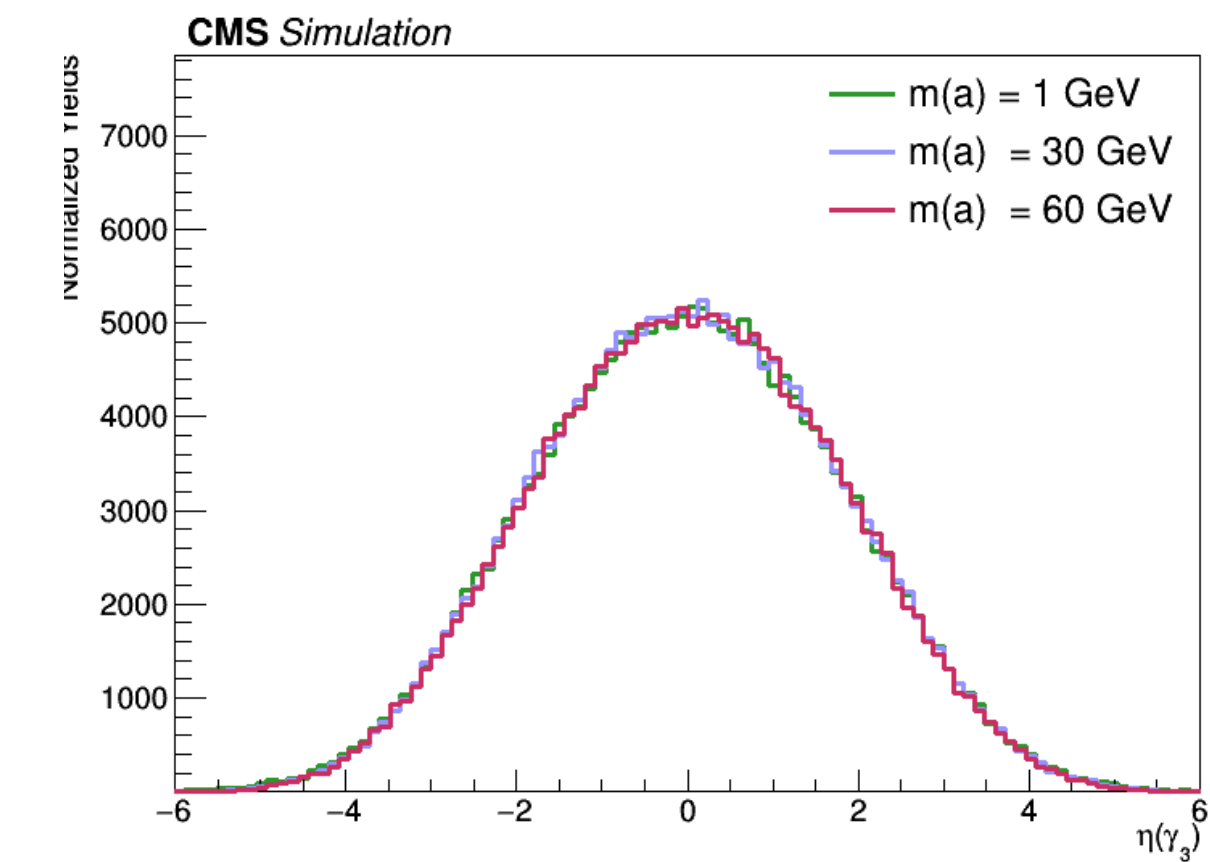
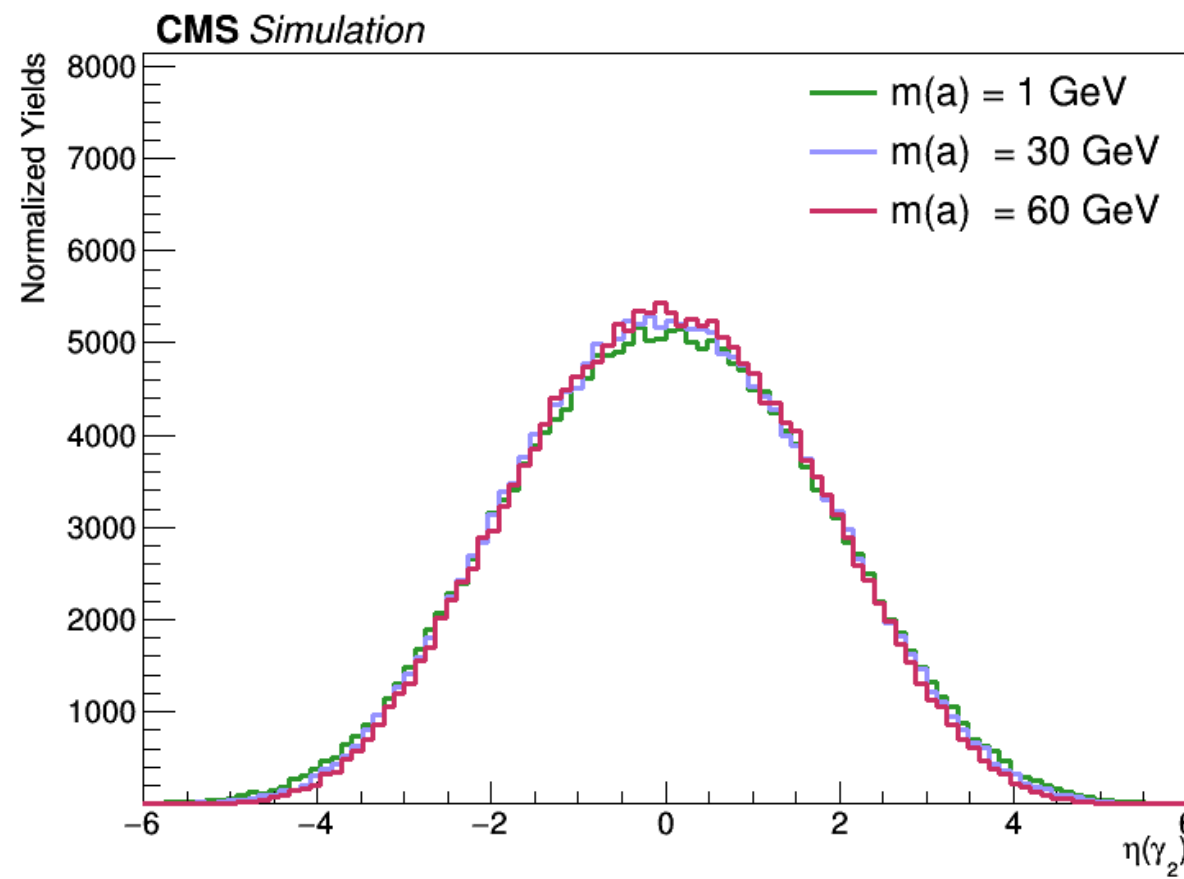
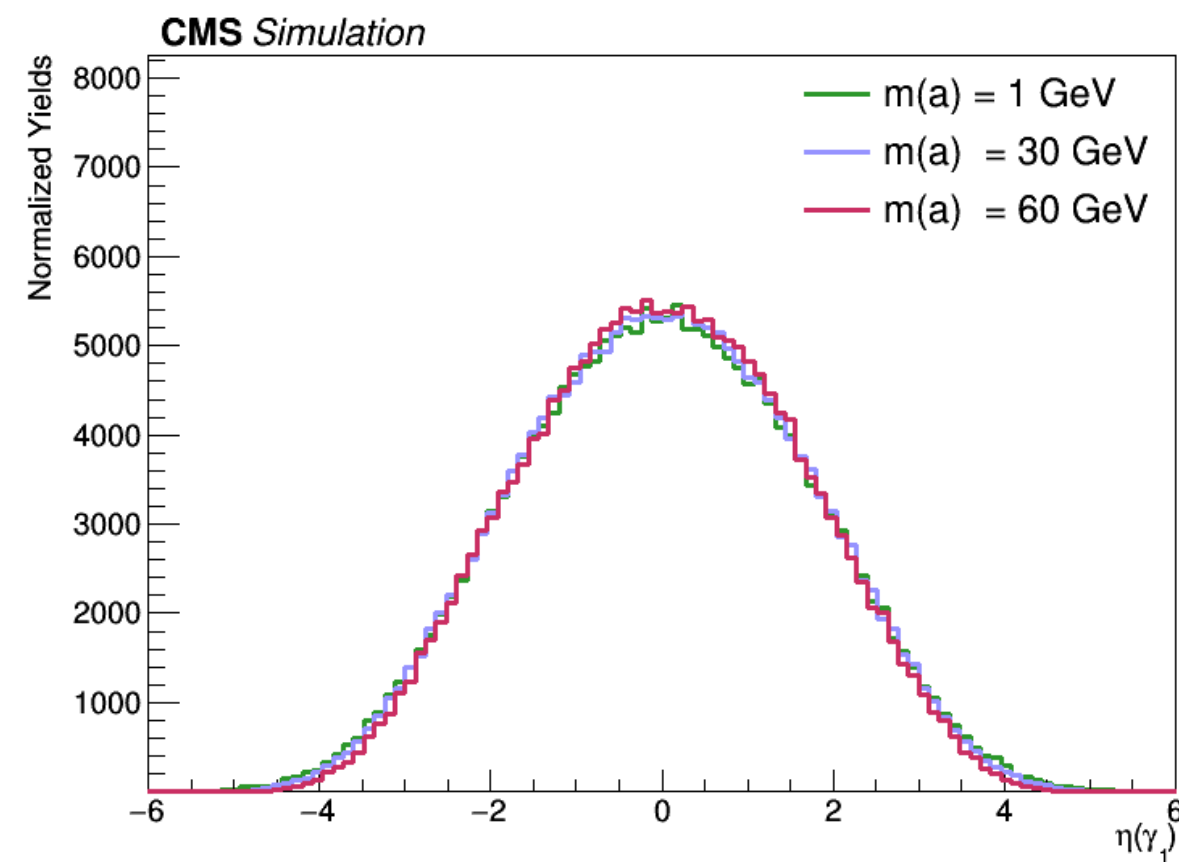
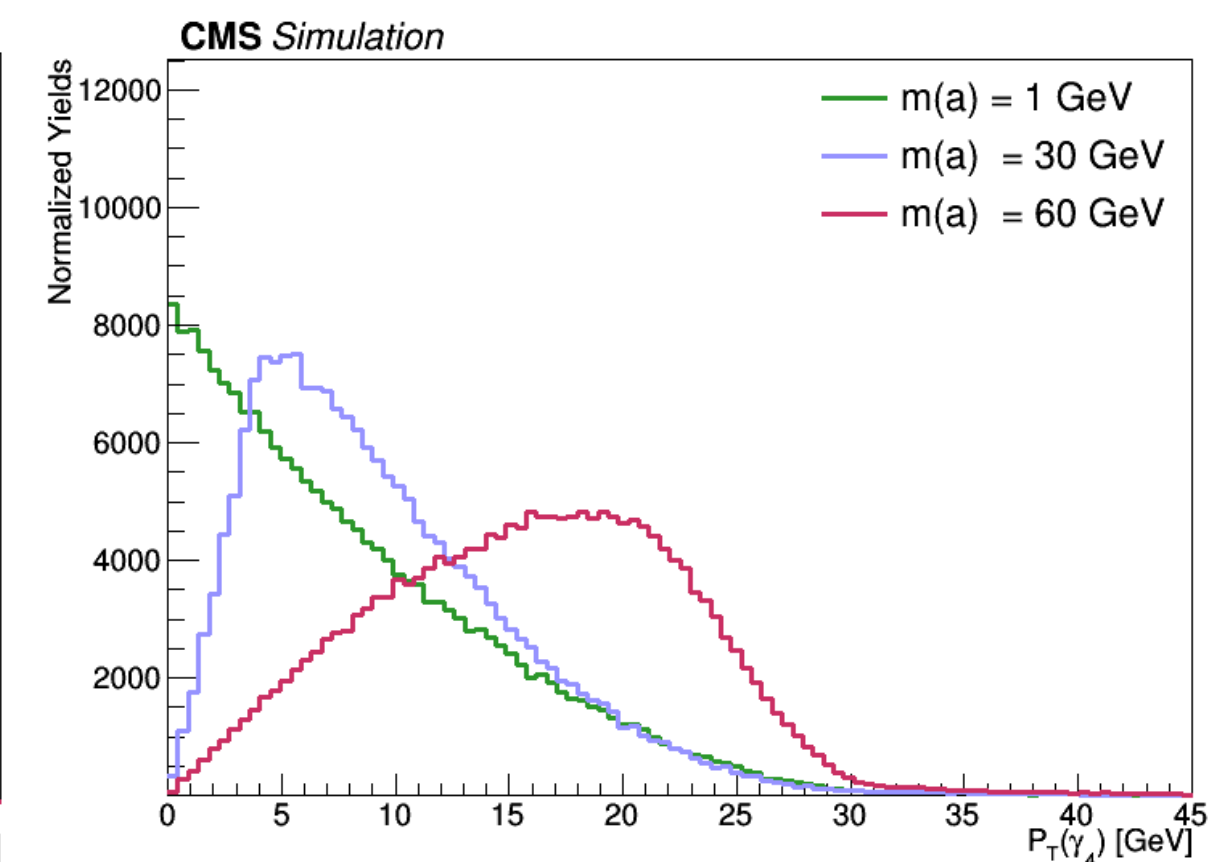
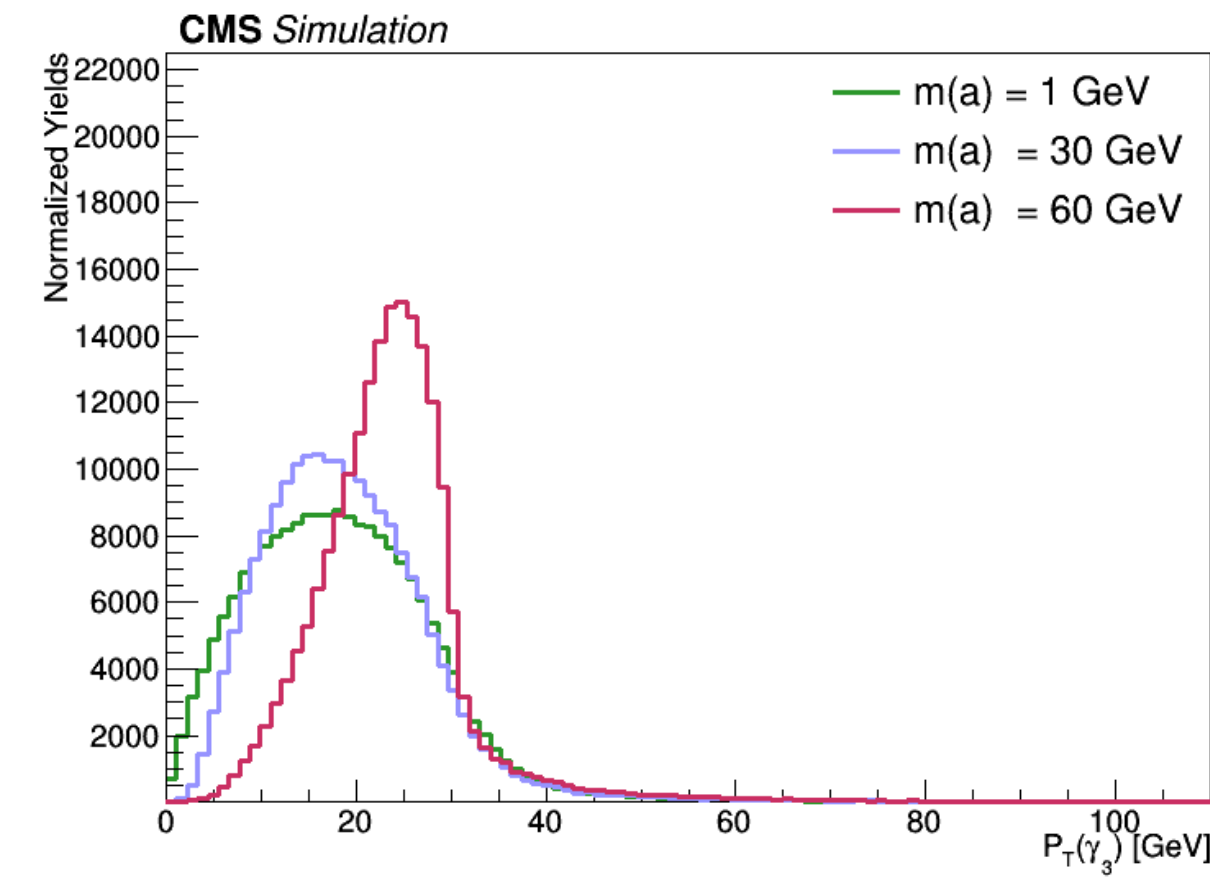
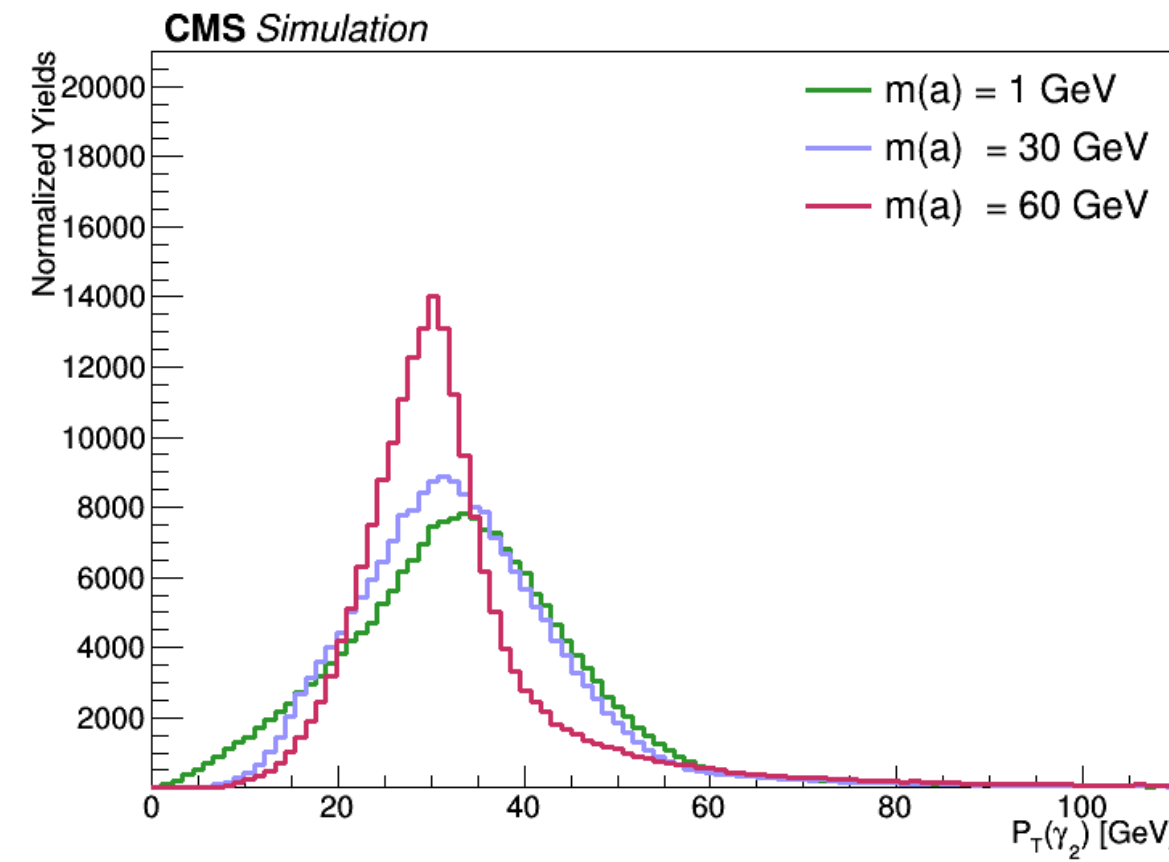
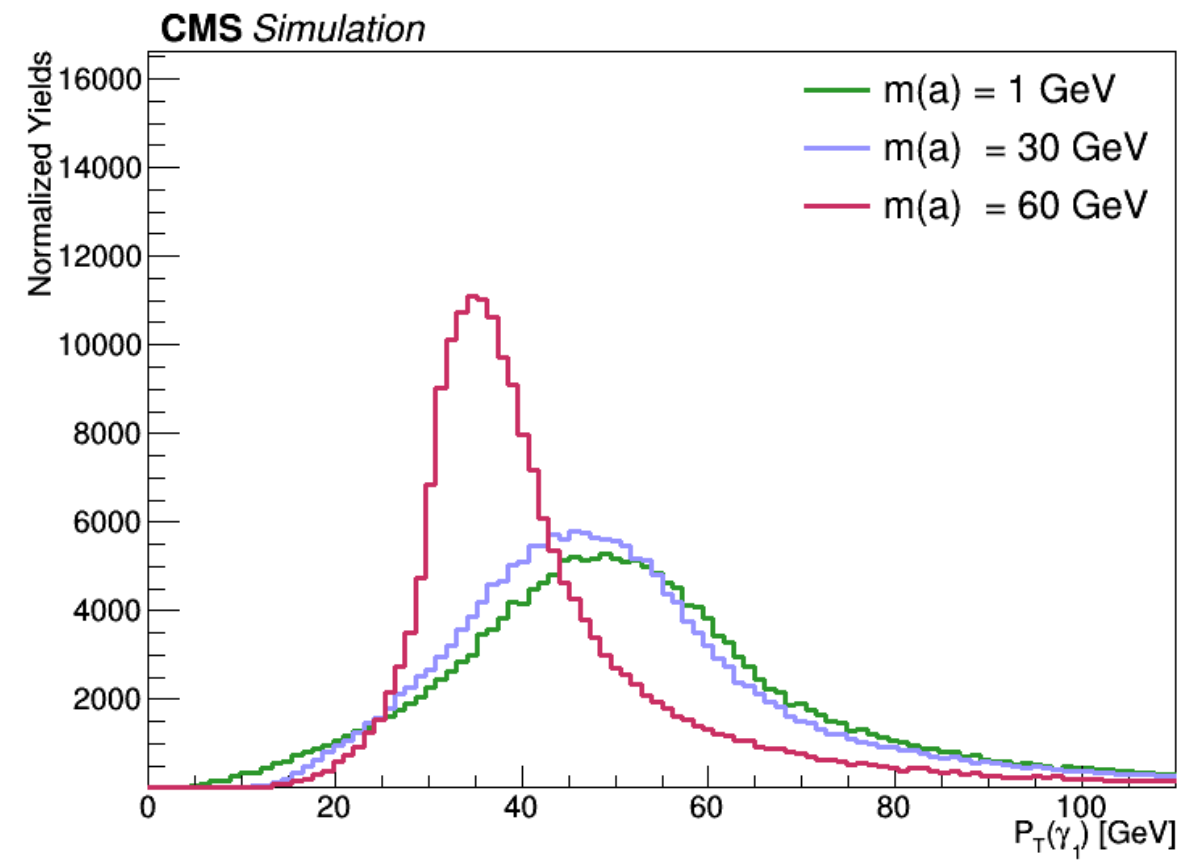
Tanvi Wamorkar<sup>1</sup>  
Toyoko Orimoto<sup>1</sup>  
Andrea Massironi<sup>2</sup>

<sup>1</sup>Northeastern University

<sup>2</sup>INFN Milano-Bicocca

**H4G chat**  
**27/03/2018**

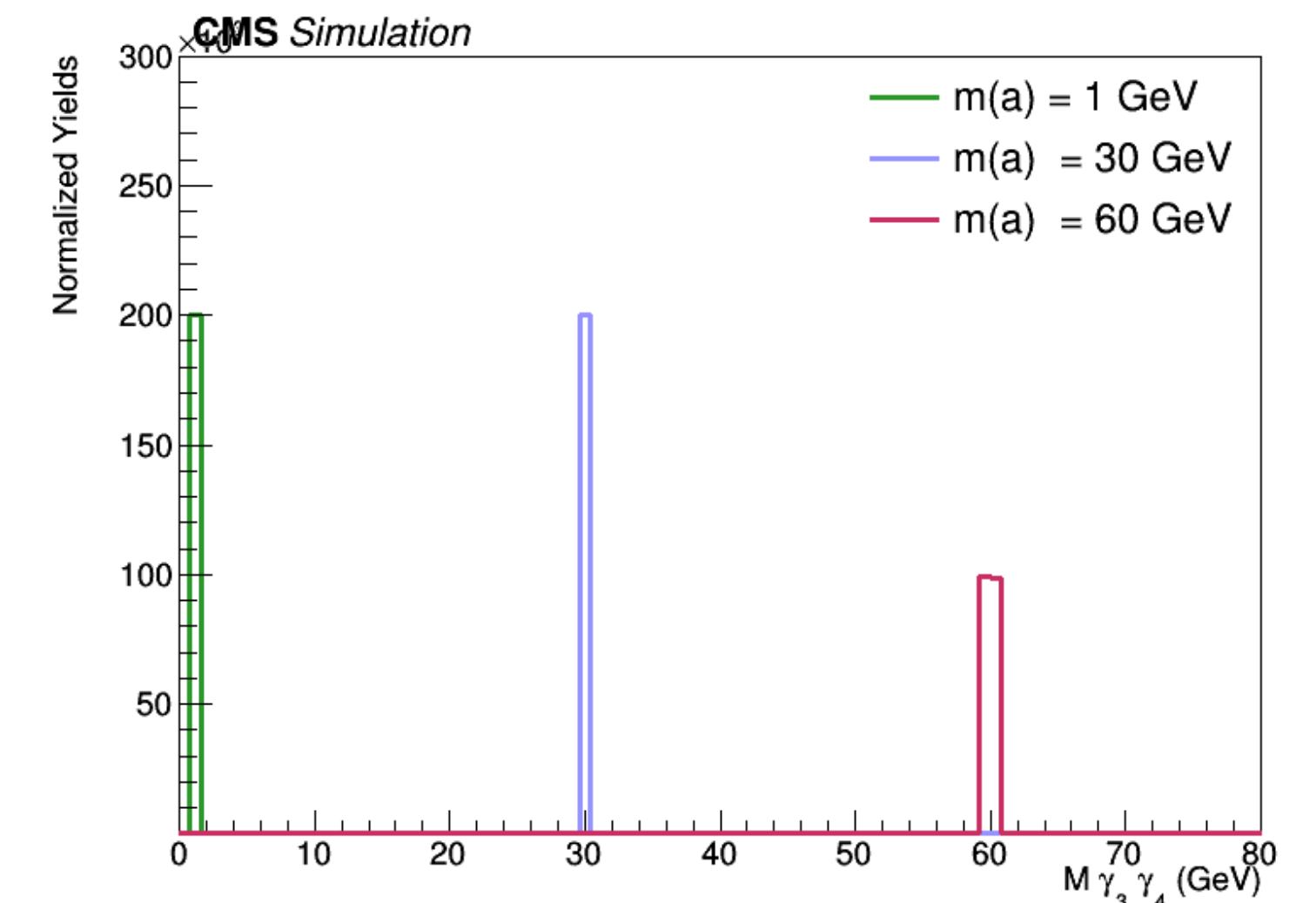
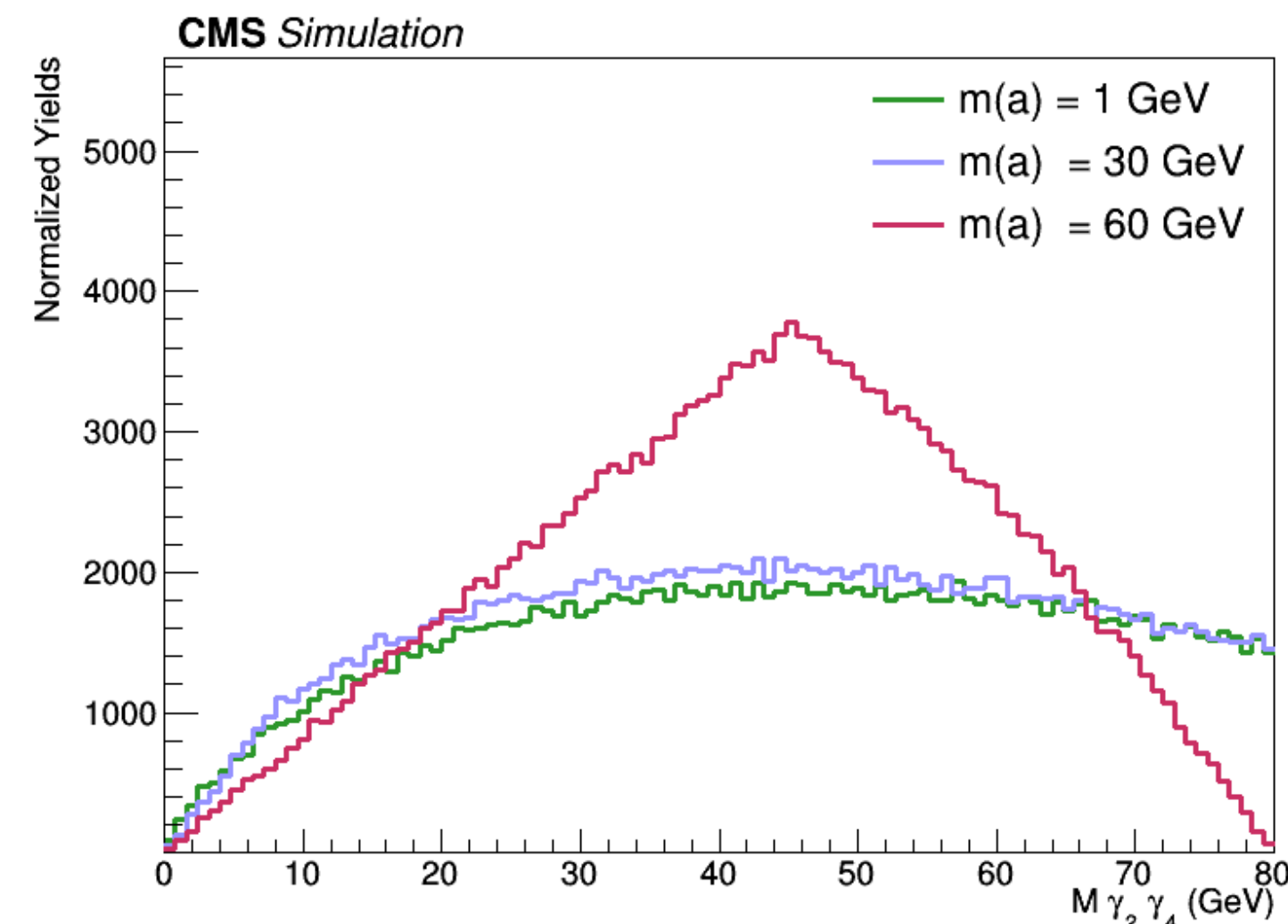
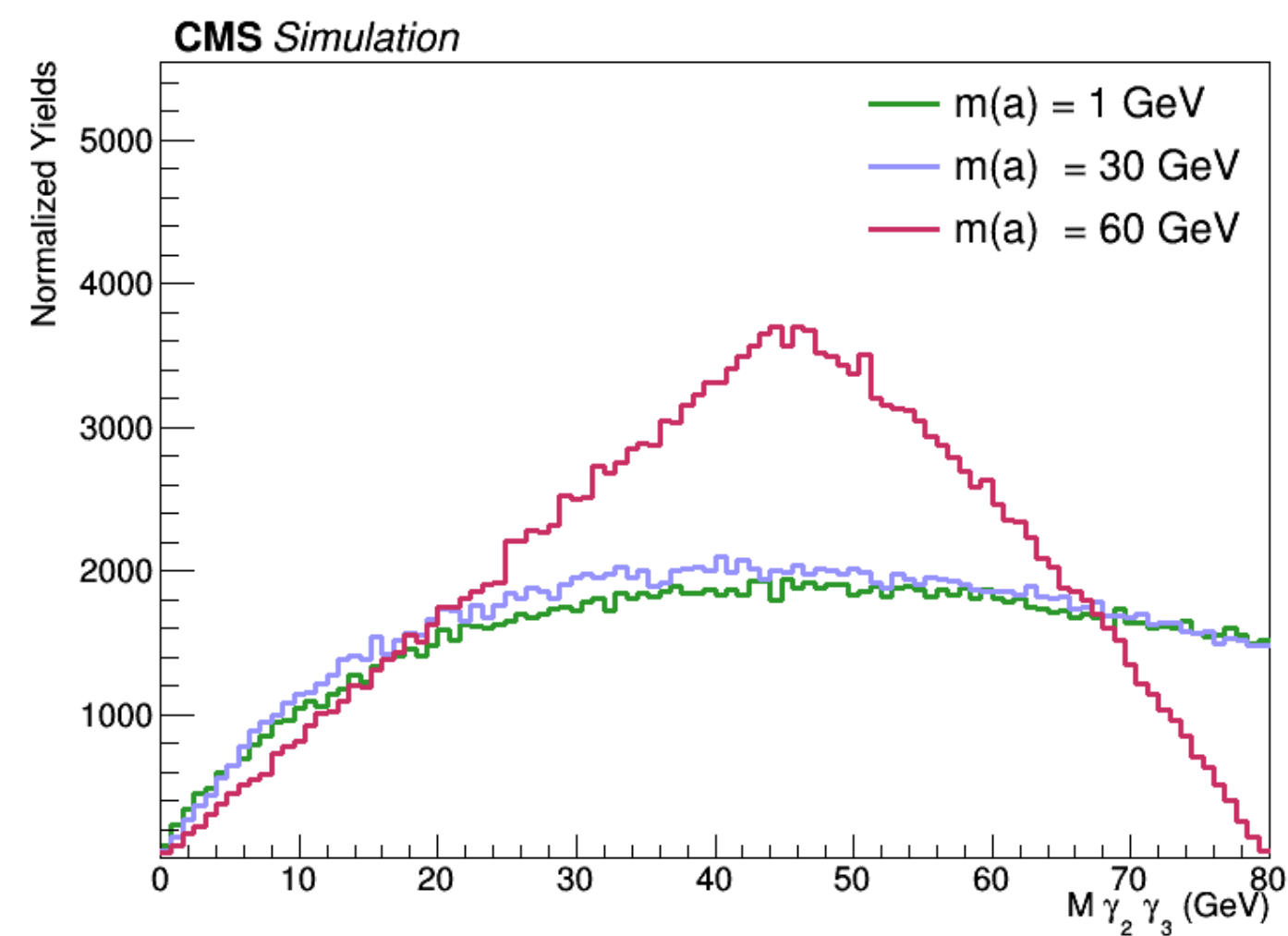
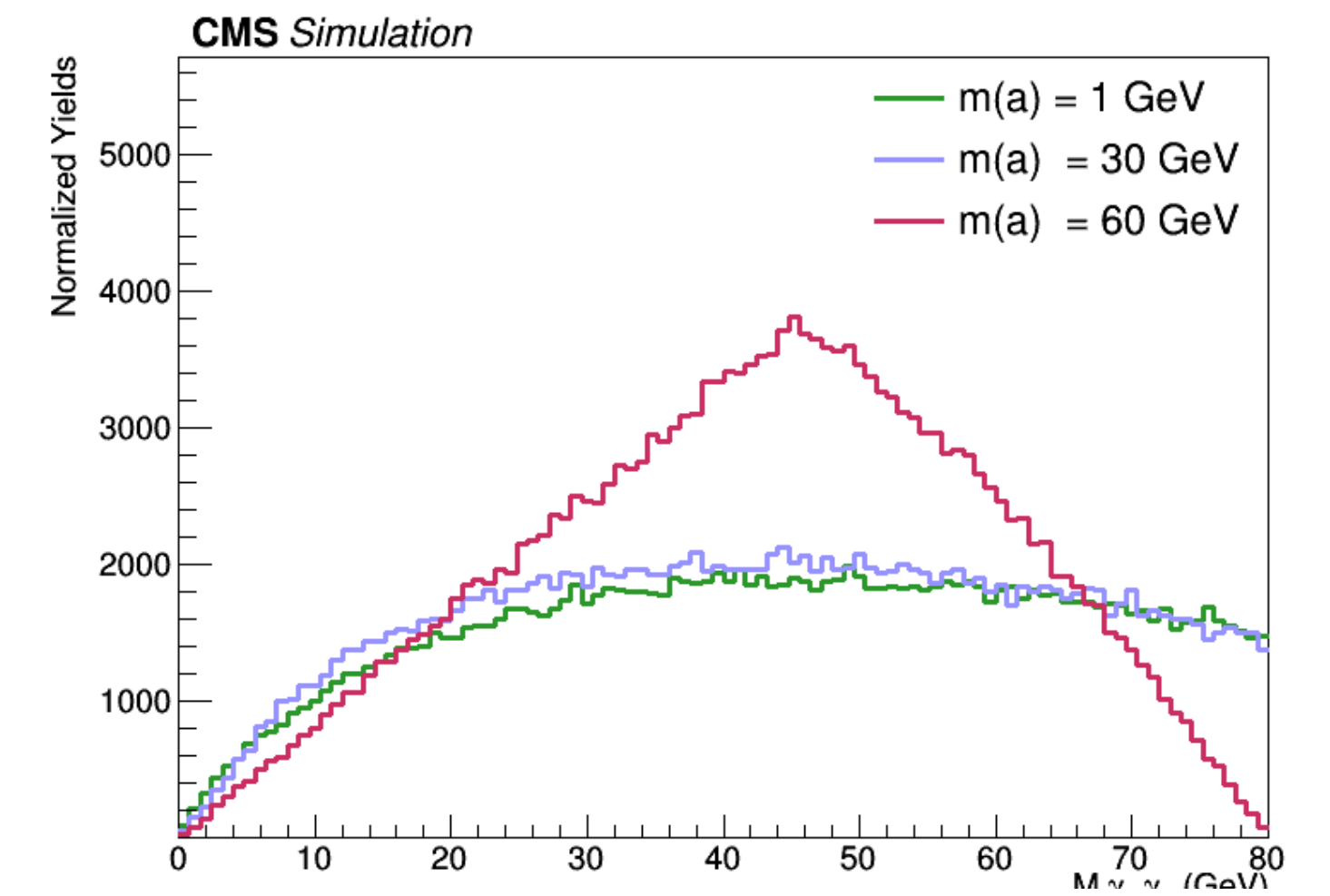
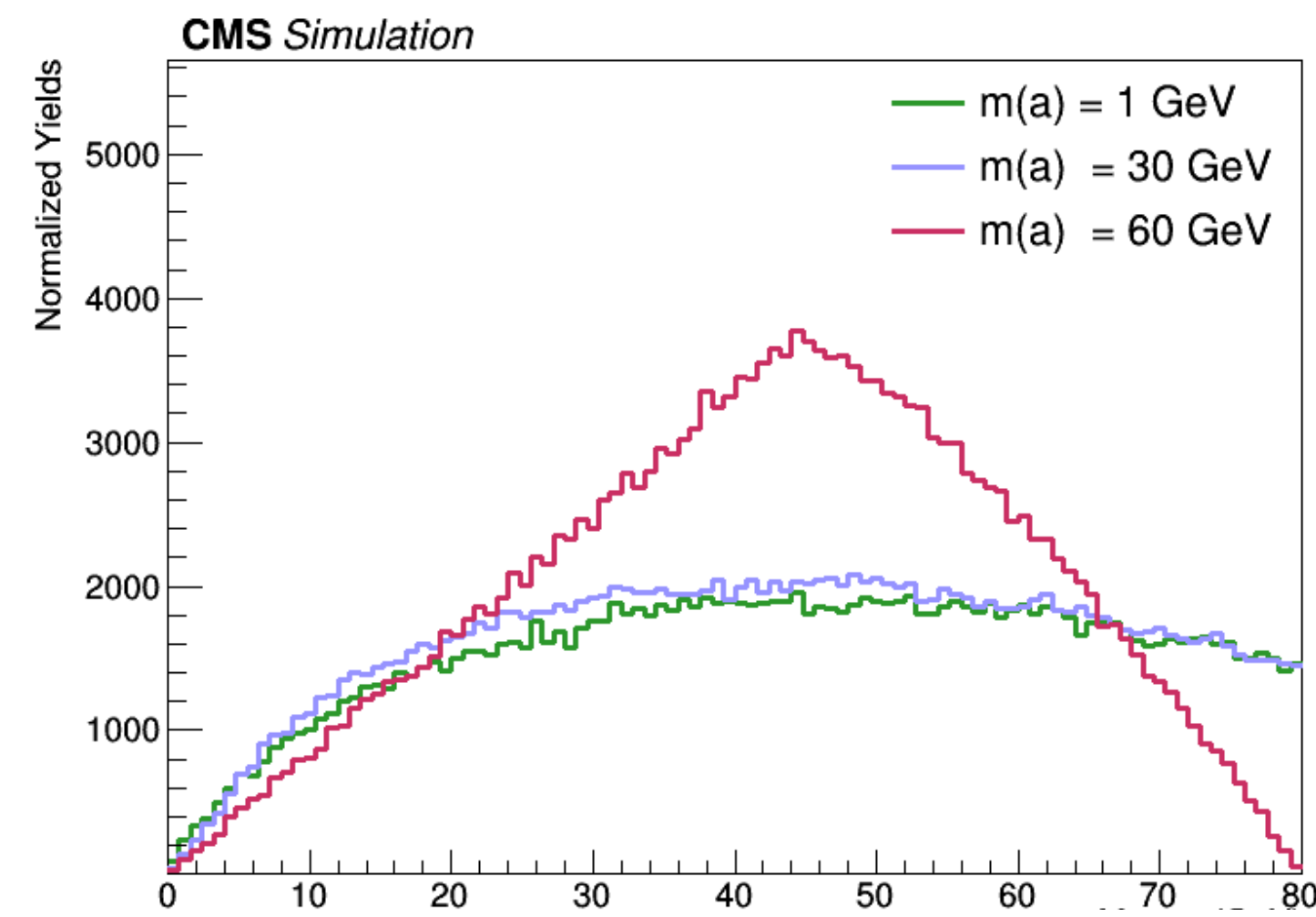
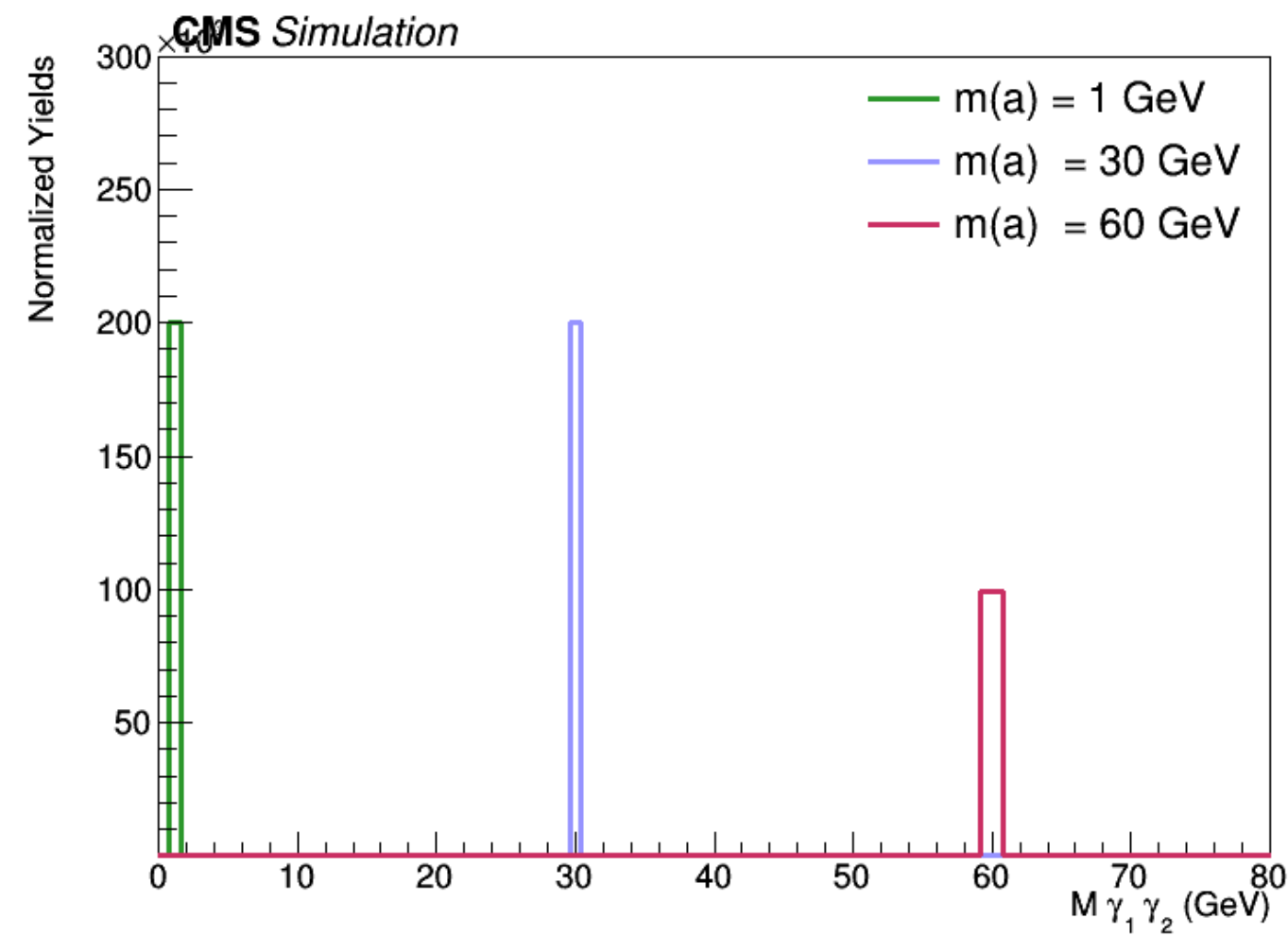
# Gen level distributions



[http://twamorka.web.cern.ch/twamorka/H4G\\_forPrelim/](http://twamorka.web.cern.ch/twamorka/H4G_forPrelim/)

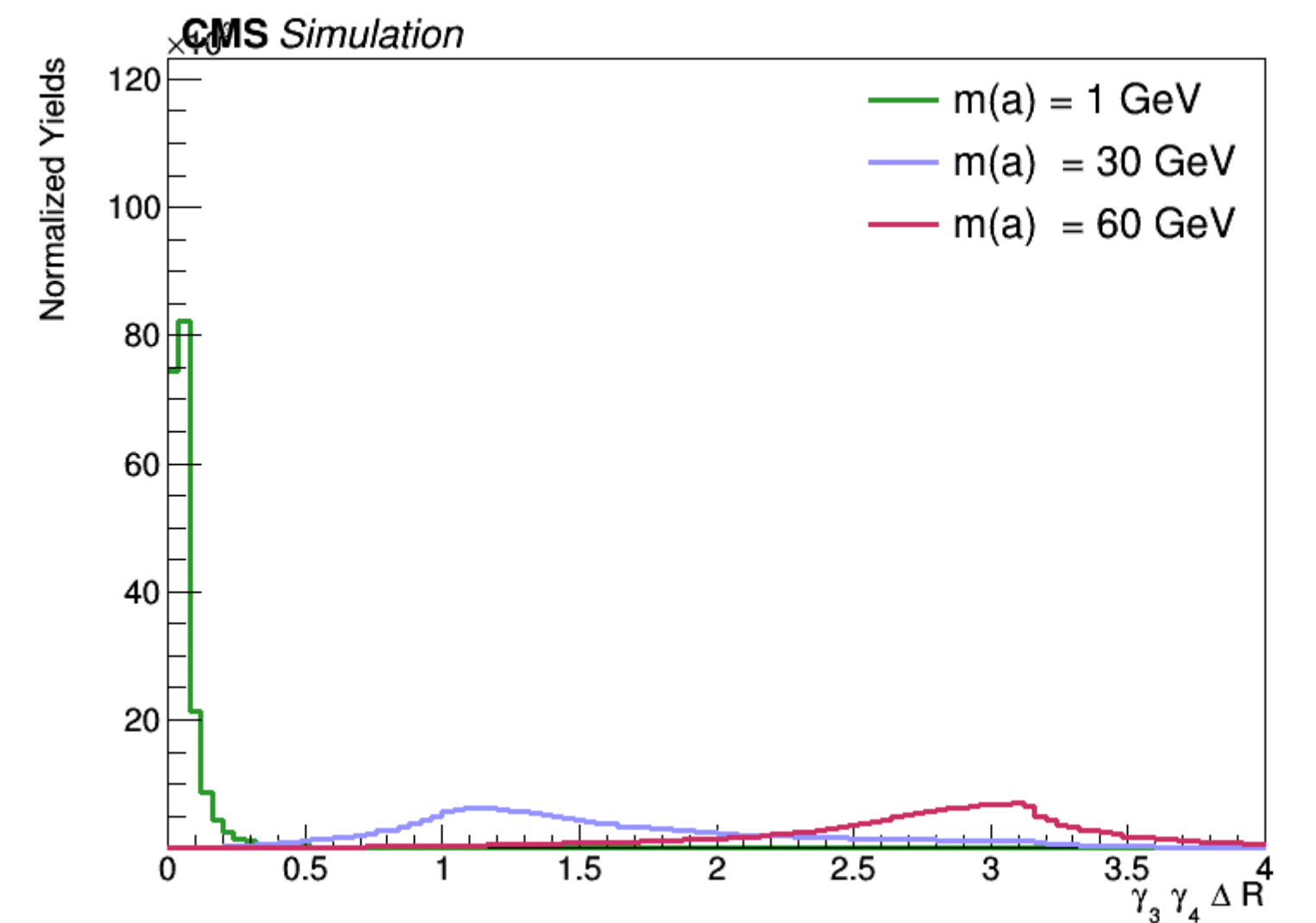
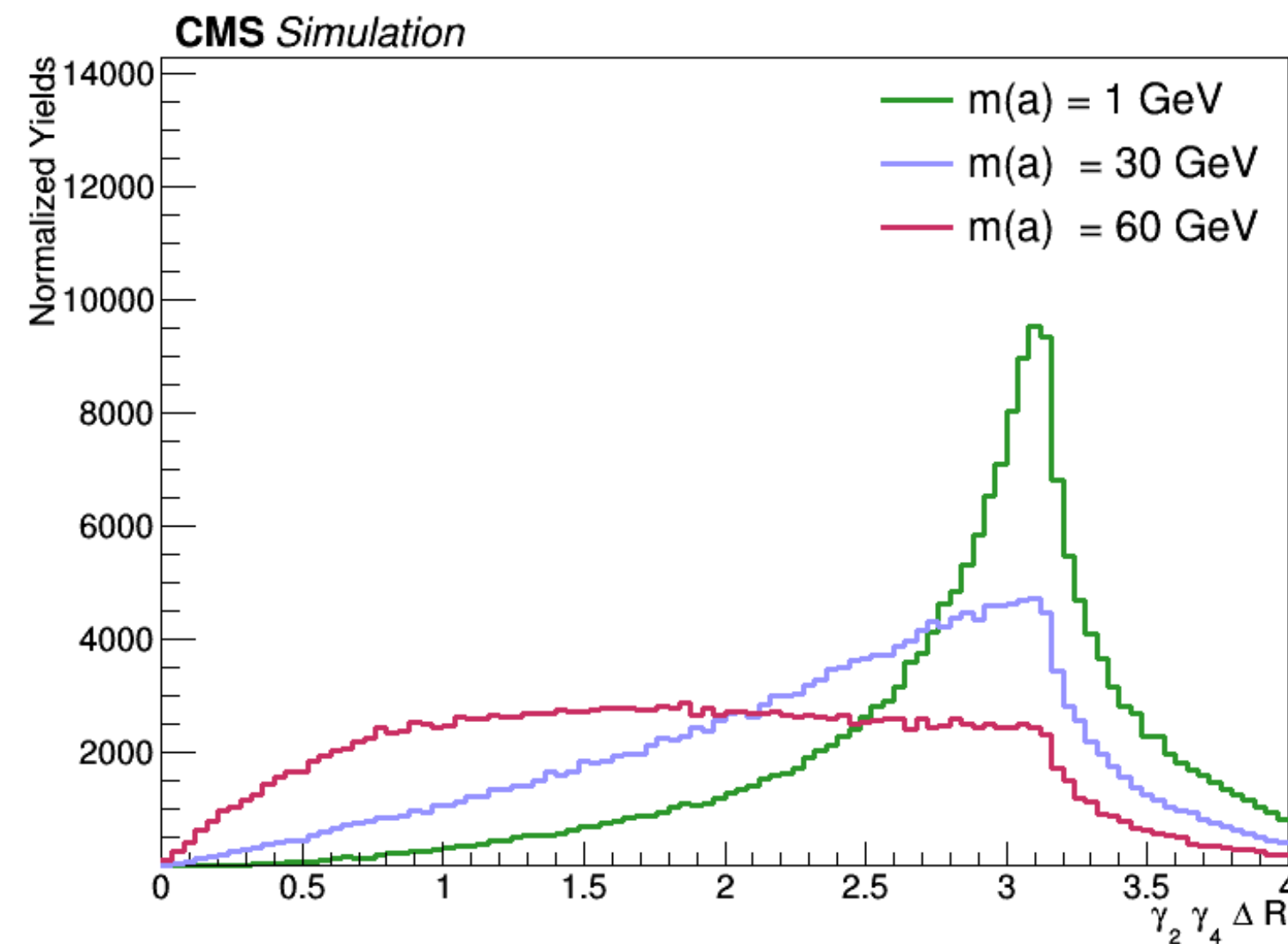
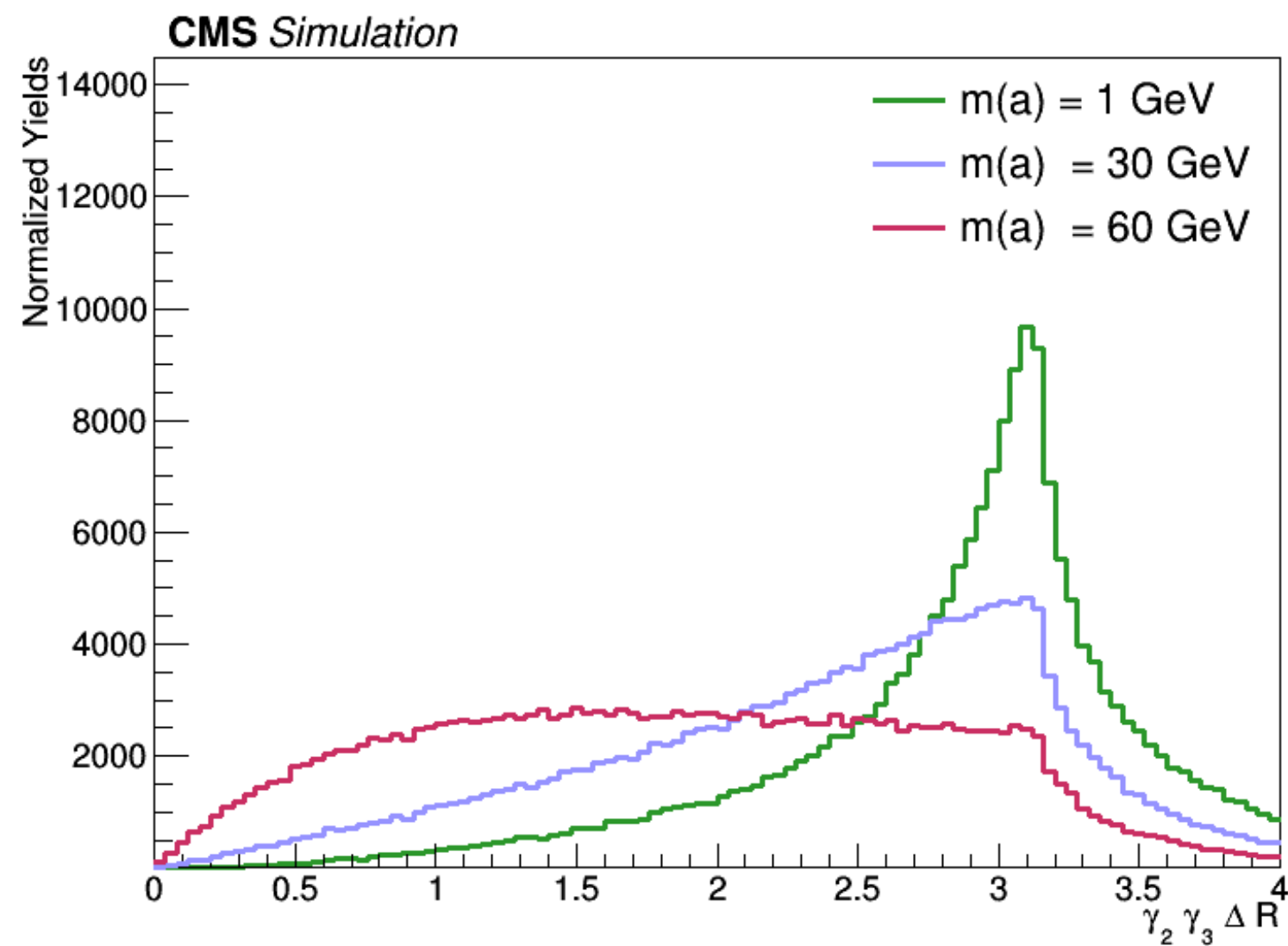
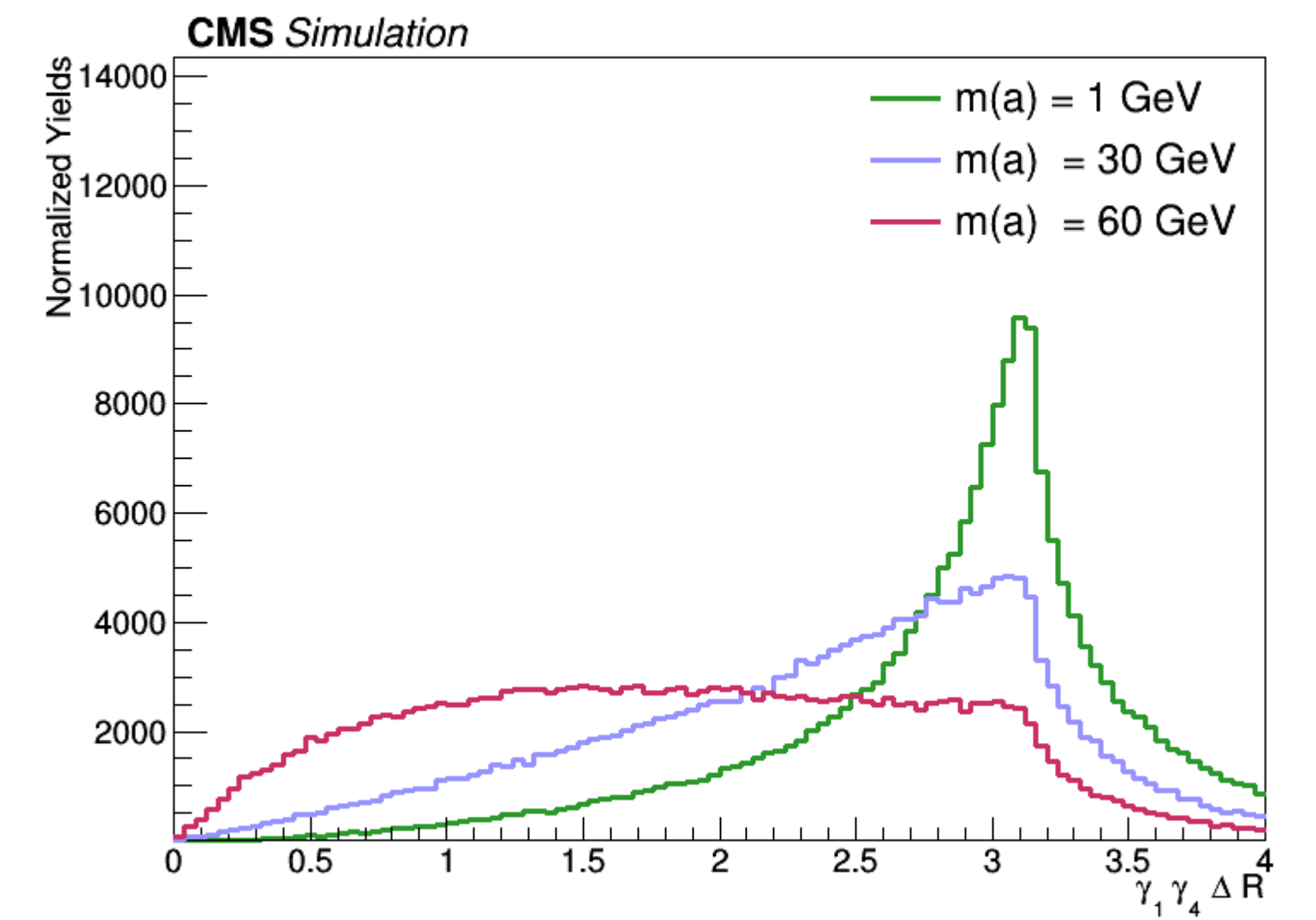
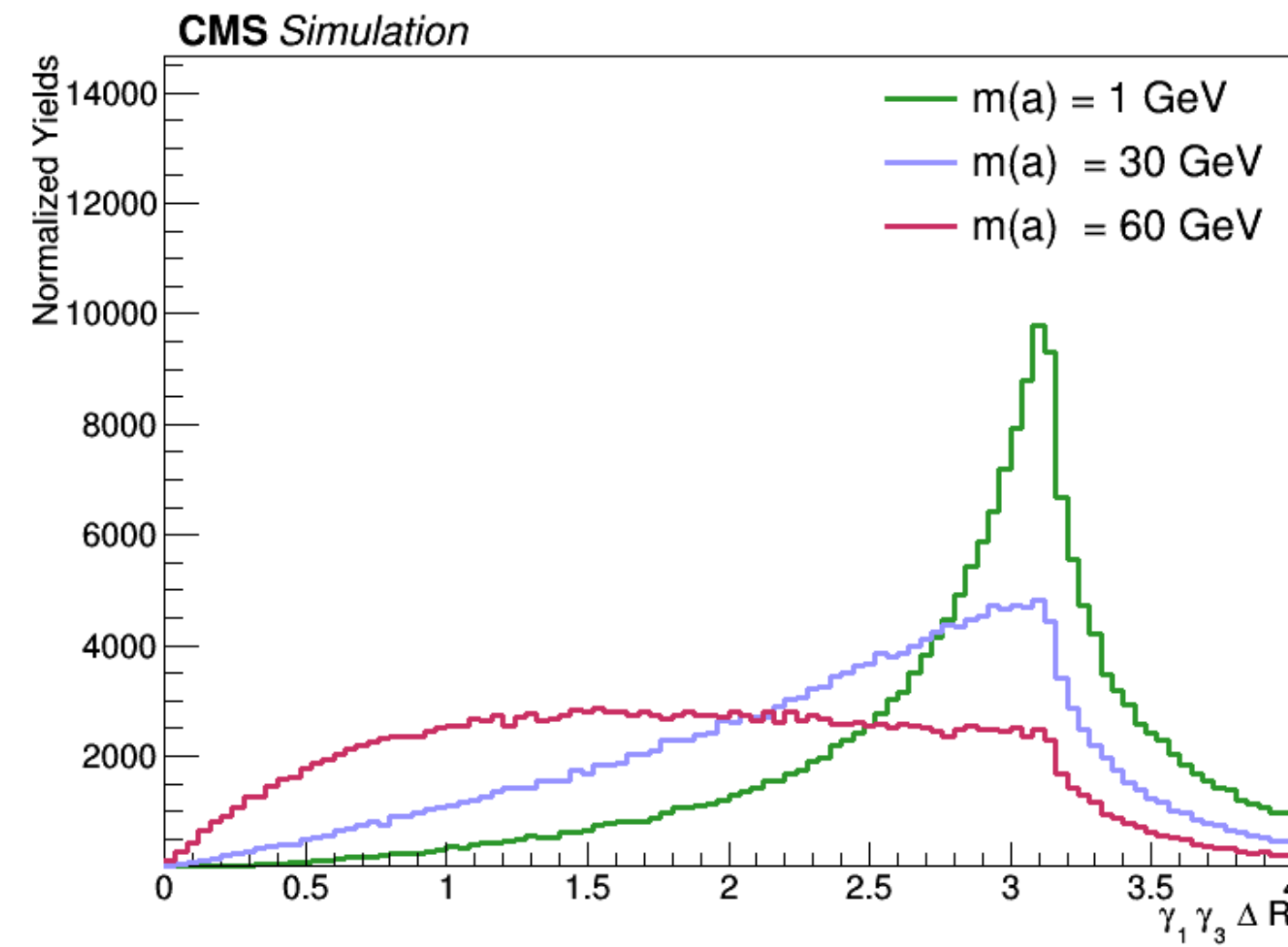
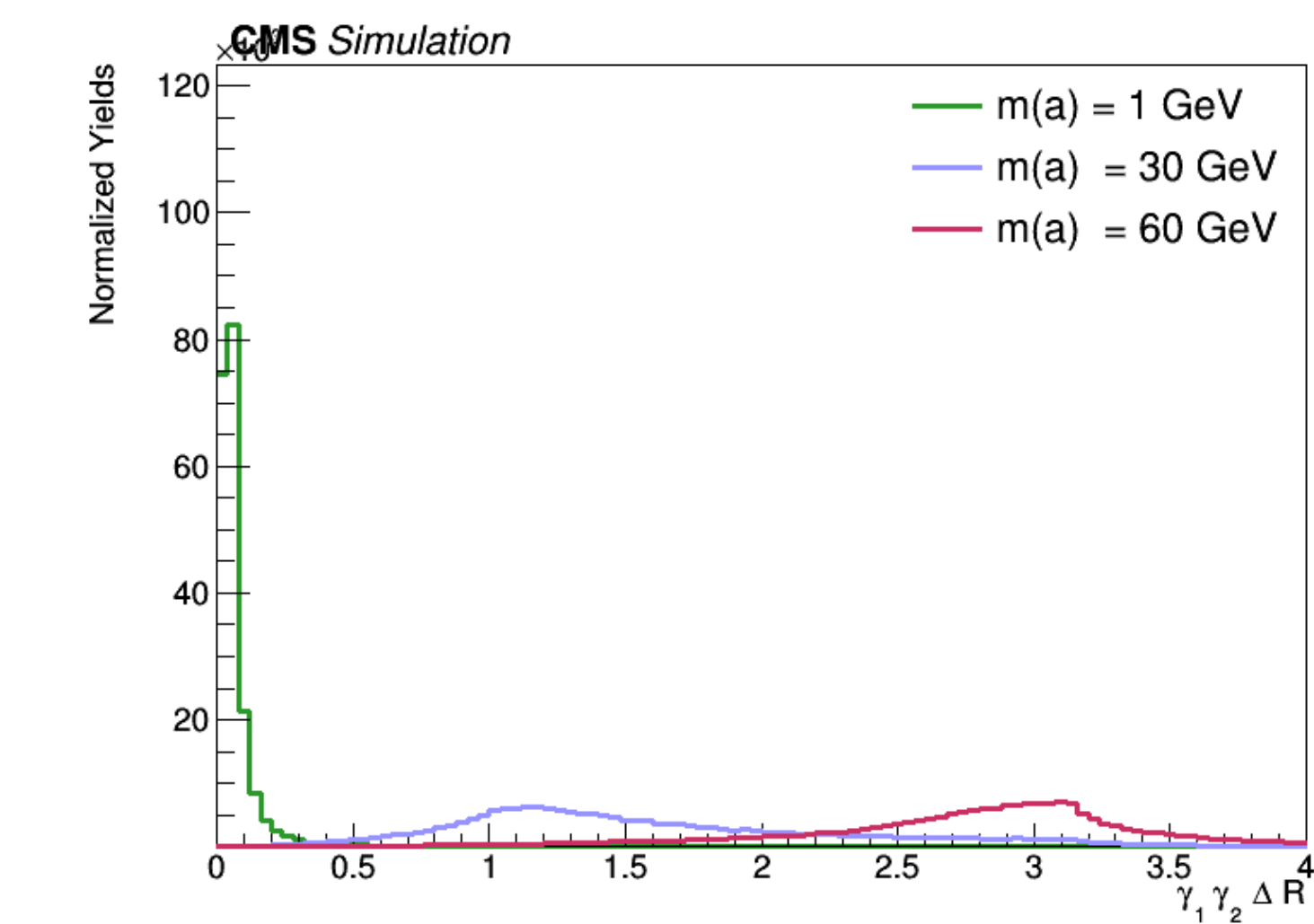
# Gen level distributions

$\gamma_1, \gamma_2$  come from  $a_1$  and  $\gamma_3, \gamma_4$  come from  $a_2$



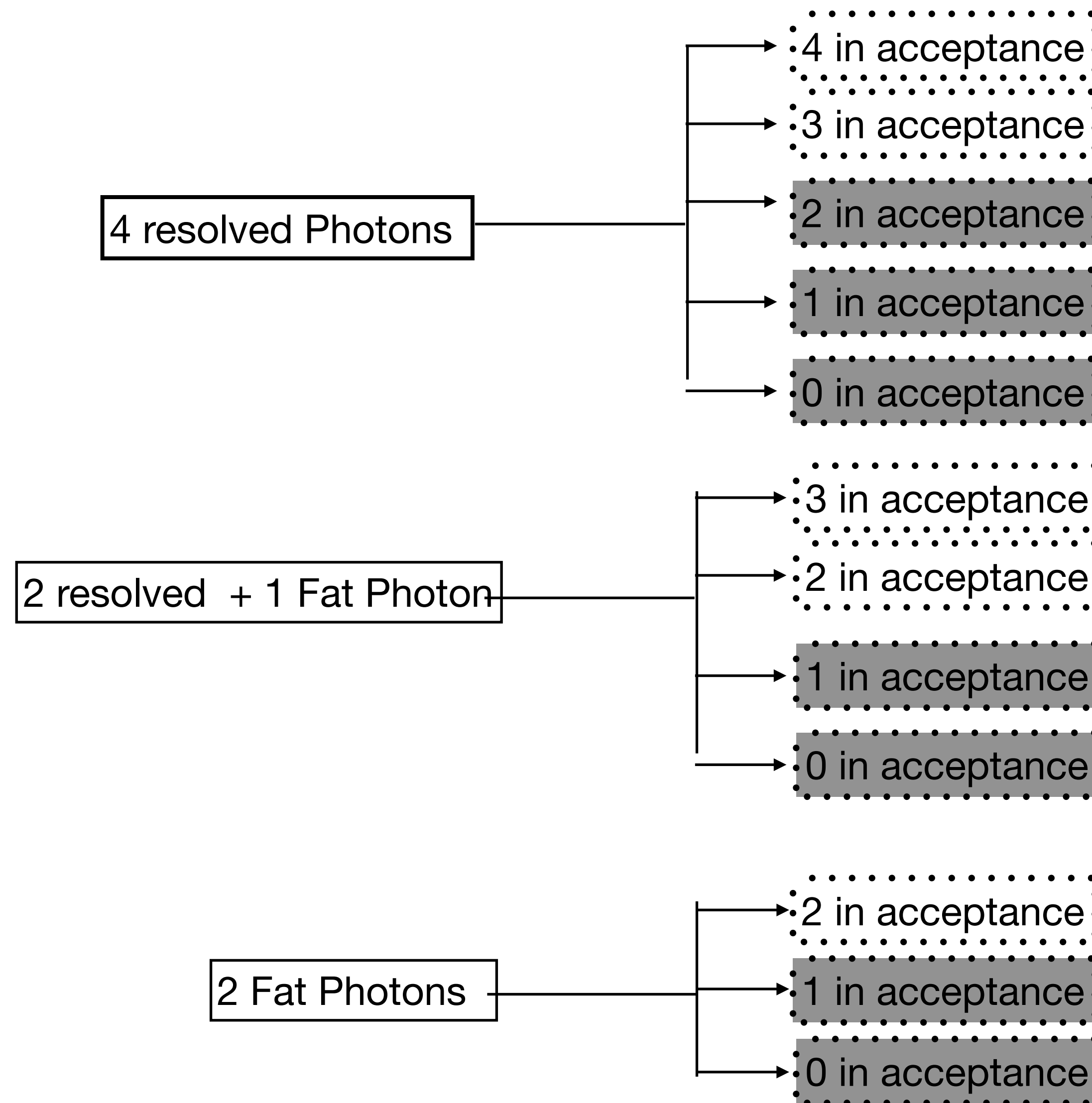


# Gen level distributions



# Categorization Process

- Start with 4 photons
- Identify the two photons coming from the same “a”
- Calculate deltaR b/w those 2 photons
- If 0 photon pairs w/  $\Delta R < 0.3 \rightarrow$  **4 resolved**
- If 1 photon pair w/  $\Delta R < 0.3 \rightarrow$  **2 resolved + 1 fat**
- If 2 photon pairs w/  $\Delta R < 0.3 \rightarrow$  **2 fat**

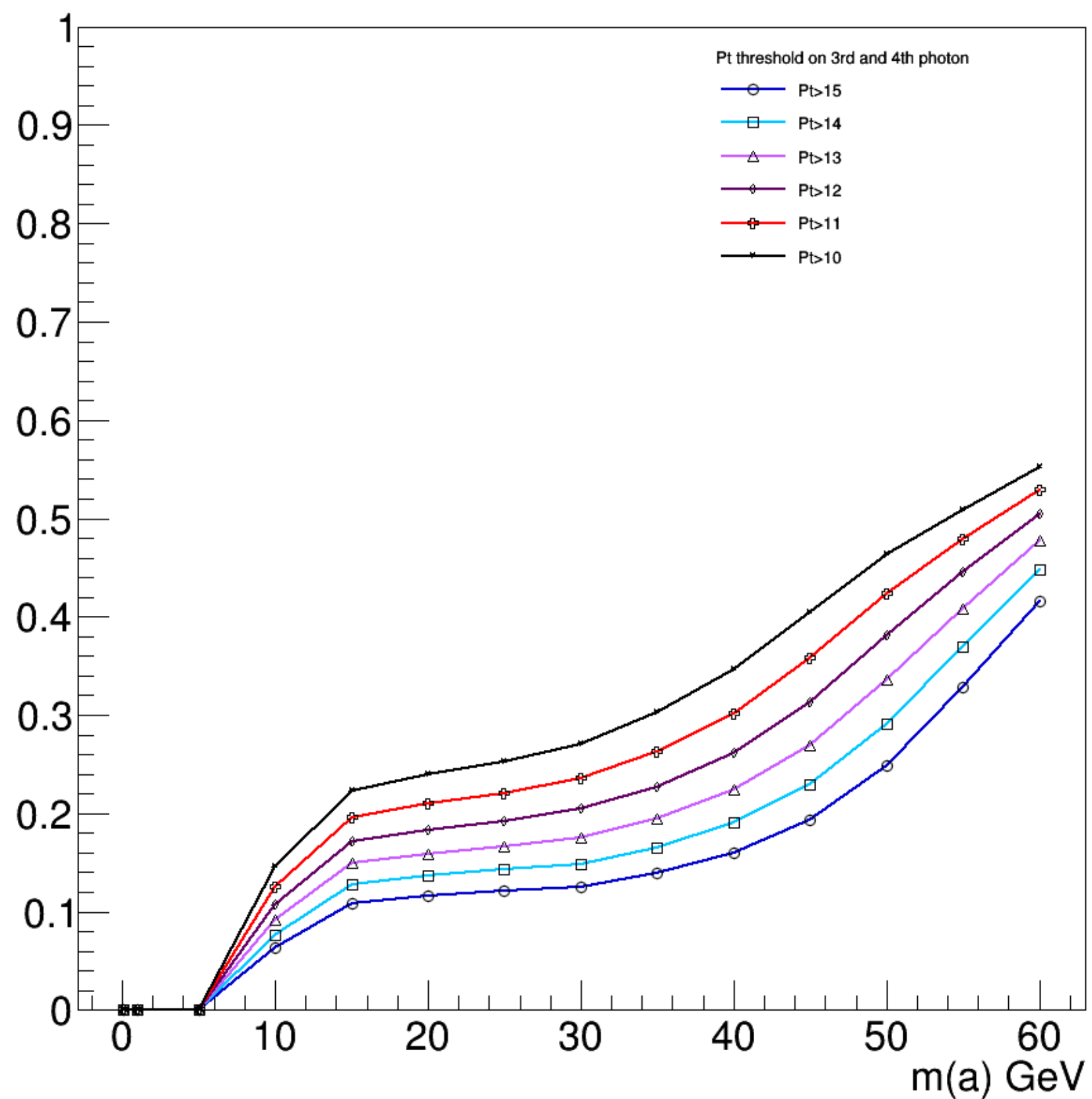


**Classified as Others**

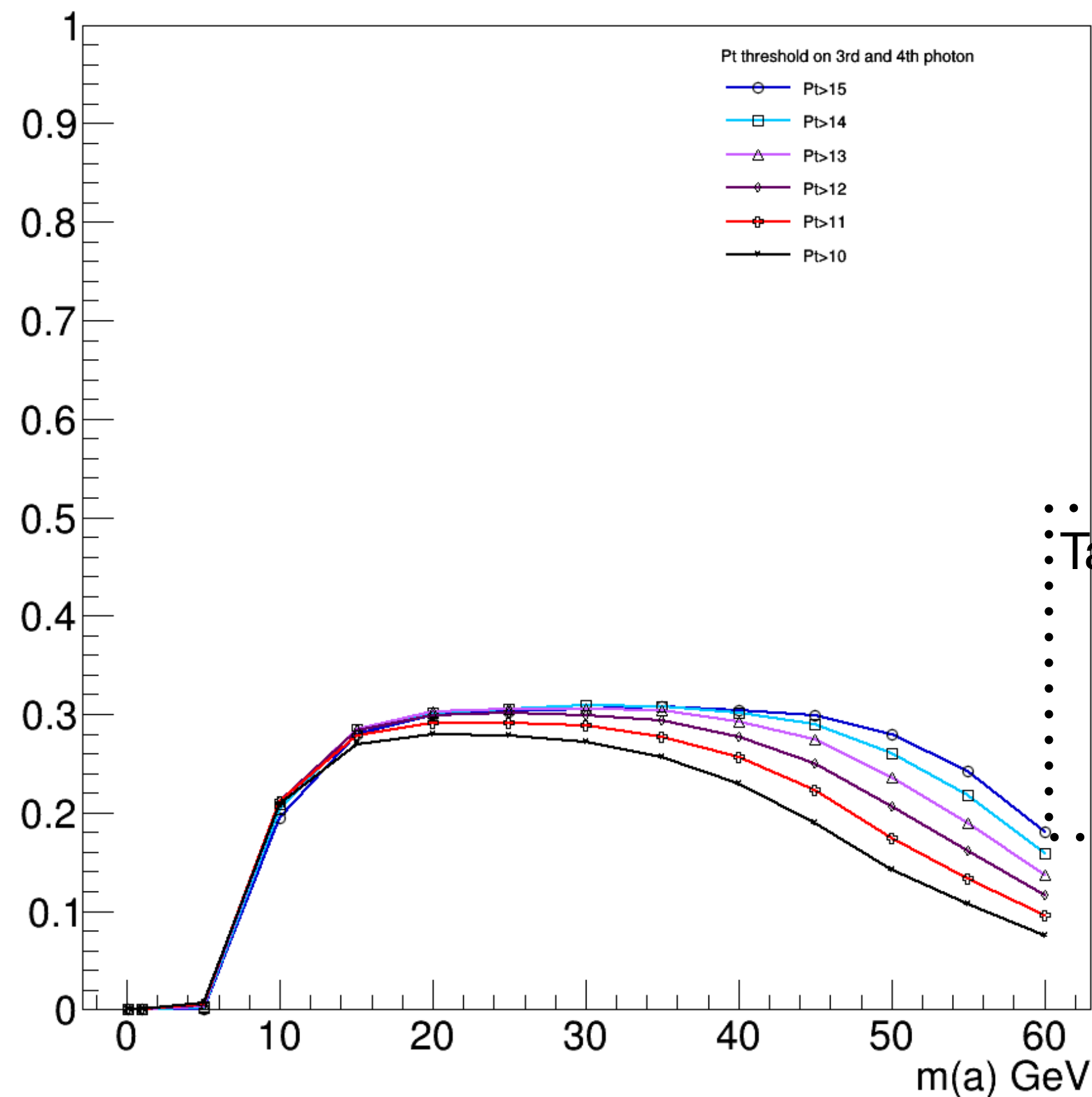
# 4 Resolved $\gamma$ 's

- Eta acceptance — all 4  $\gamma$ 's must have  $|\eta| < 2.5$  (because photons need to be in ECAL region)
- Pt acceptance —  $\gamma$  Pt > 15 , this pt threshold can be lowered for  $\gamma_3$  and  $\gamma_4$

4 resolved photons -- all in acceptance



4 resolved photons -- 3 in acceptance

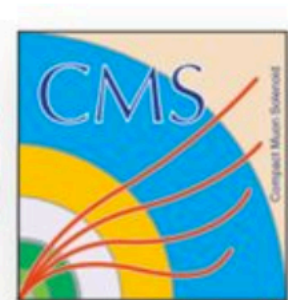


- Different cases:
    - All 4 $\gamma$ 's in acceptance (4A)
    - 3 $\gamma$ 's in acceptance (3A)
    - 2 $\gamma$ 's in acceptance (2A)
    - 1 $\gamma$  in acceptance (1A)
    - 0 $\gamma$ 's in acceptance (0A)
- } Not of interest

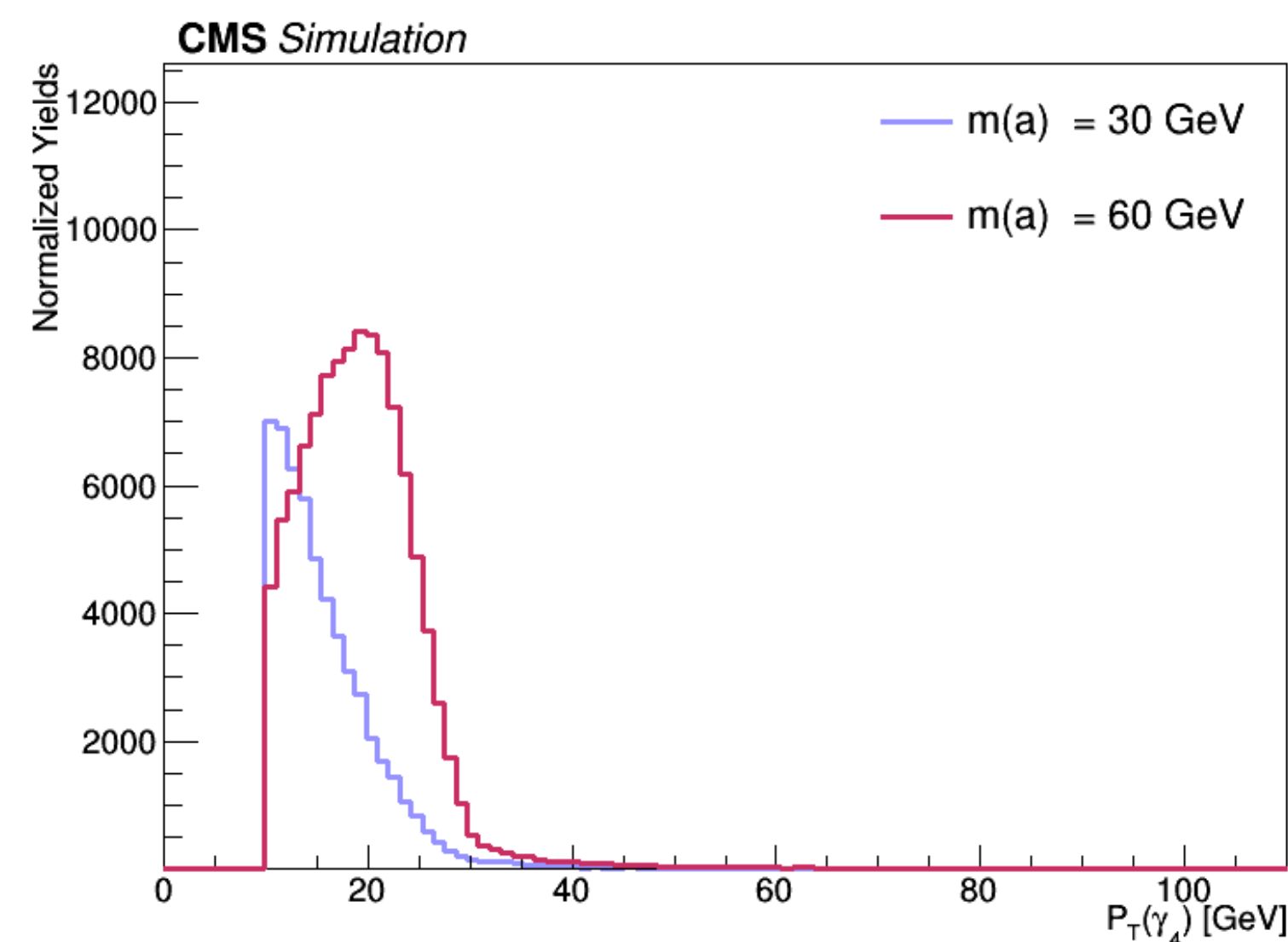
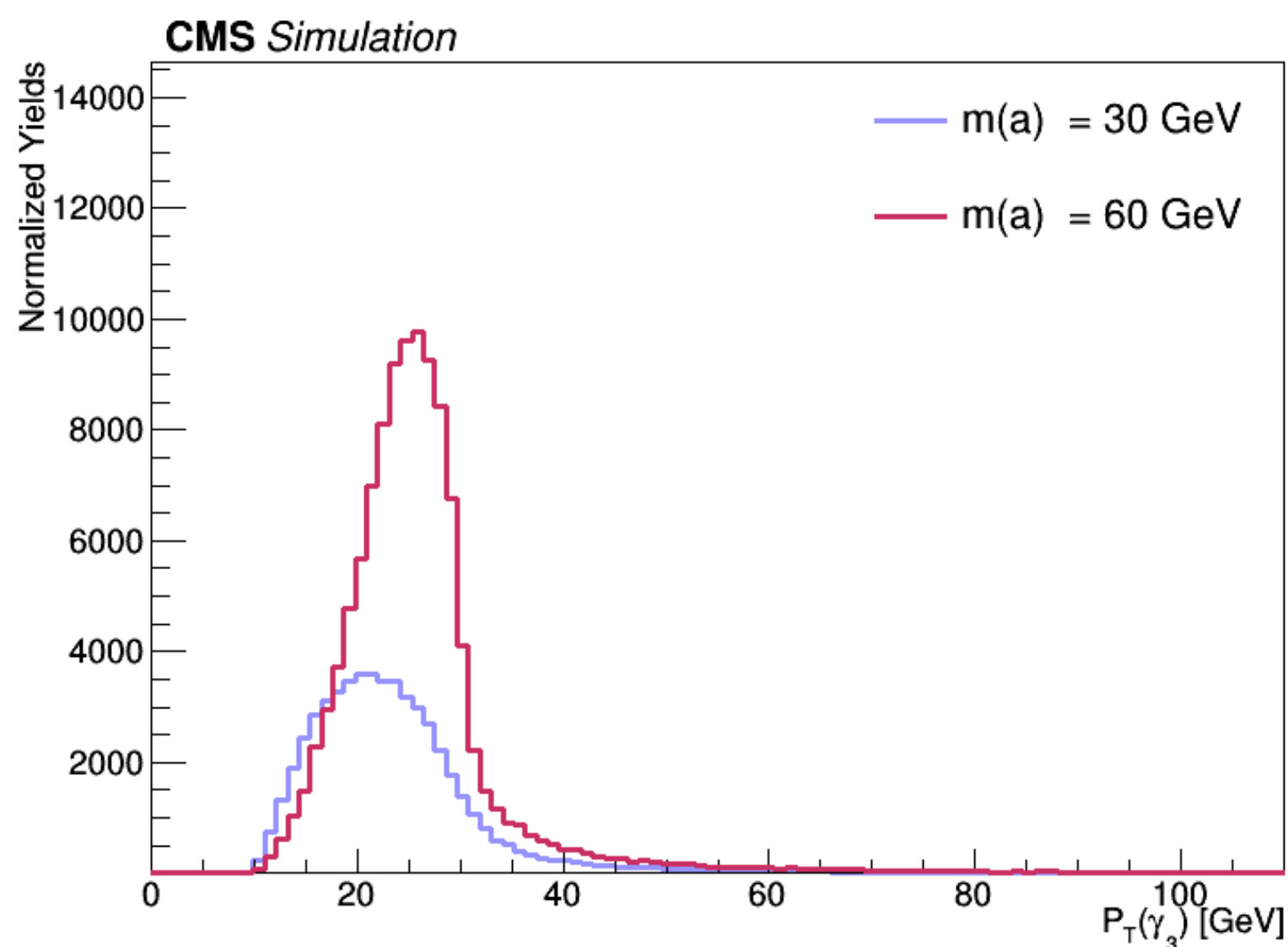
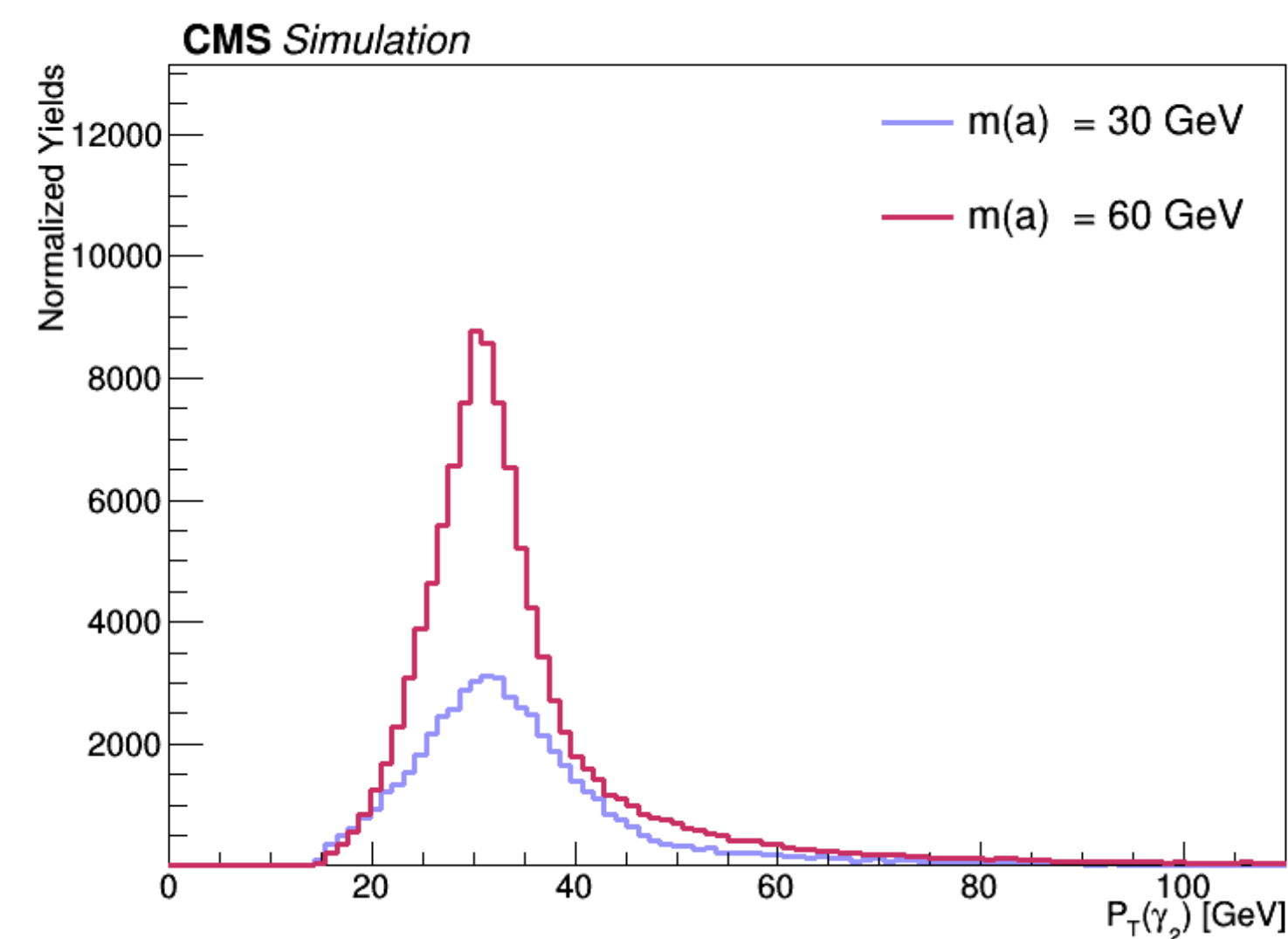
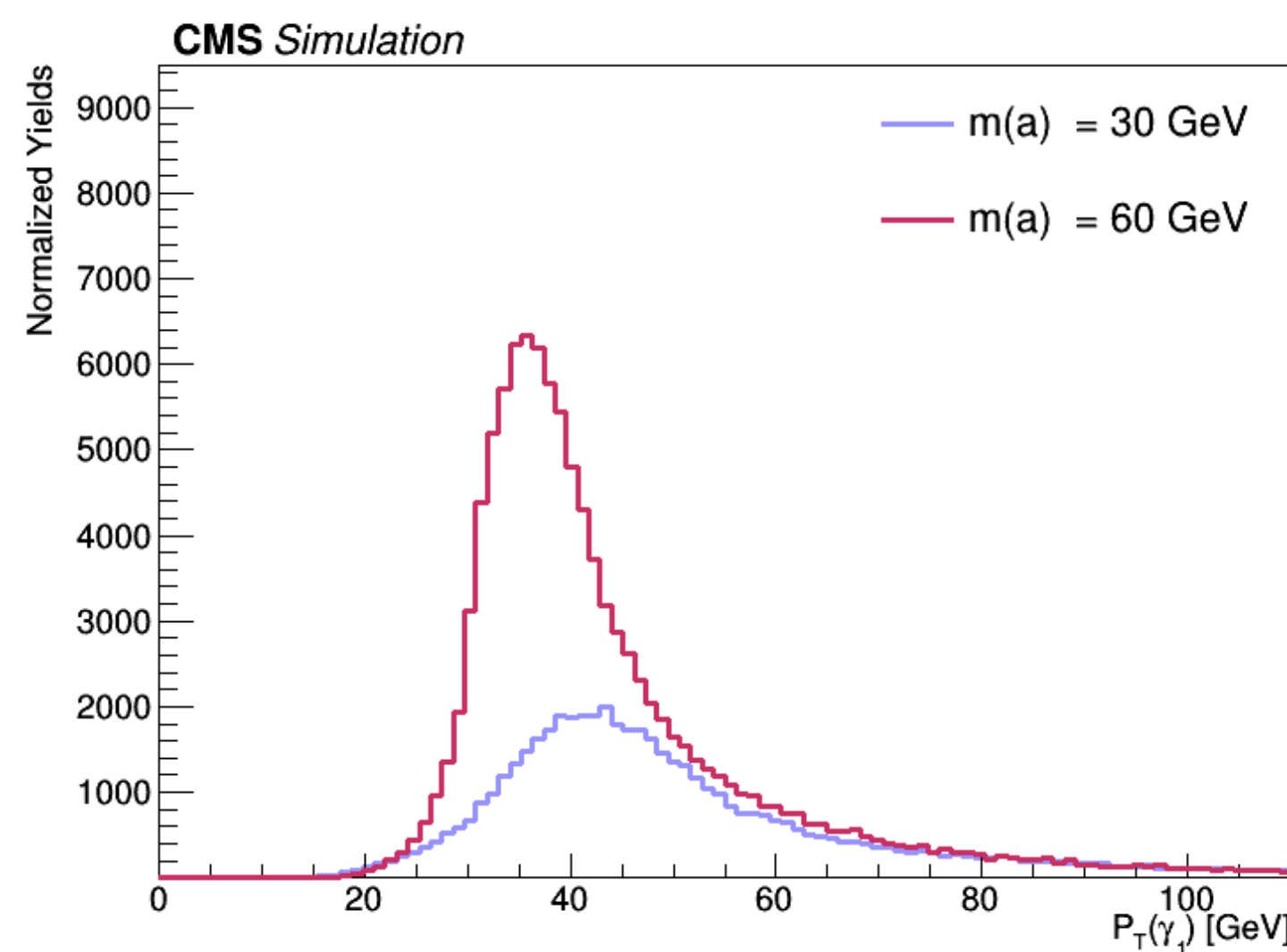
Take away from the plots:

- As the pt threshold on 3rd and 4th photon is decreased, the efficiency of the 4A case goes up and that of 3A goes down

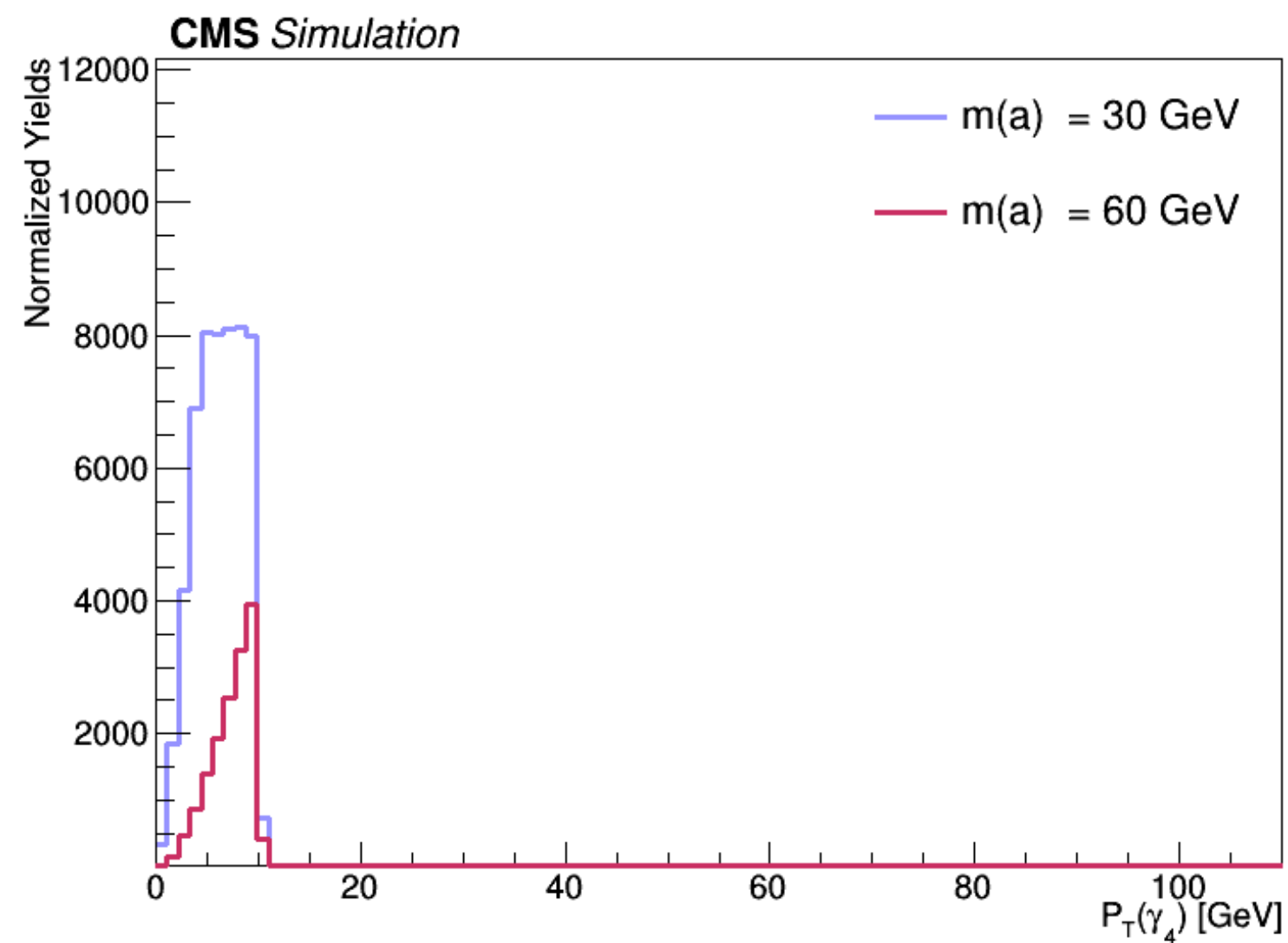
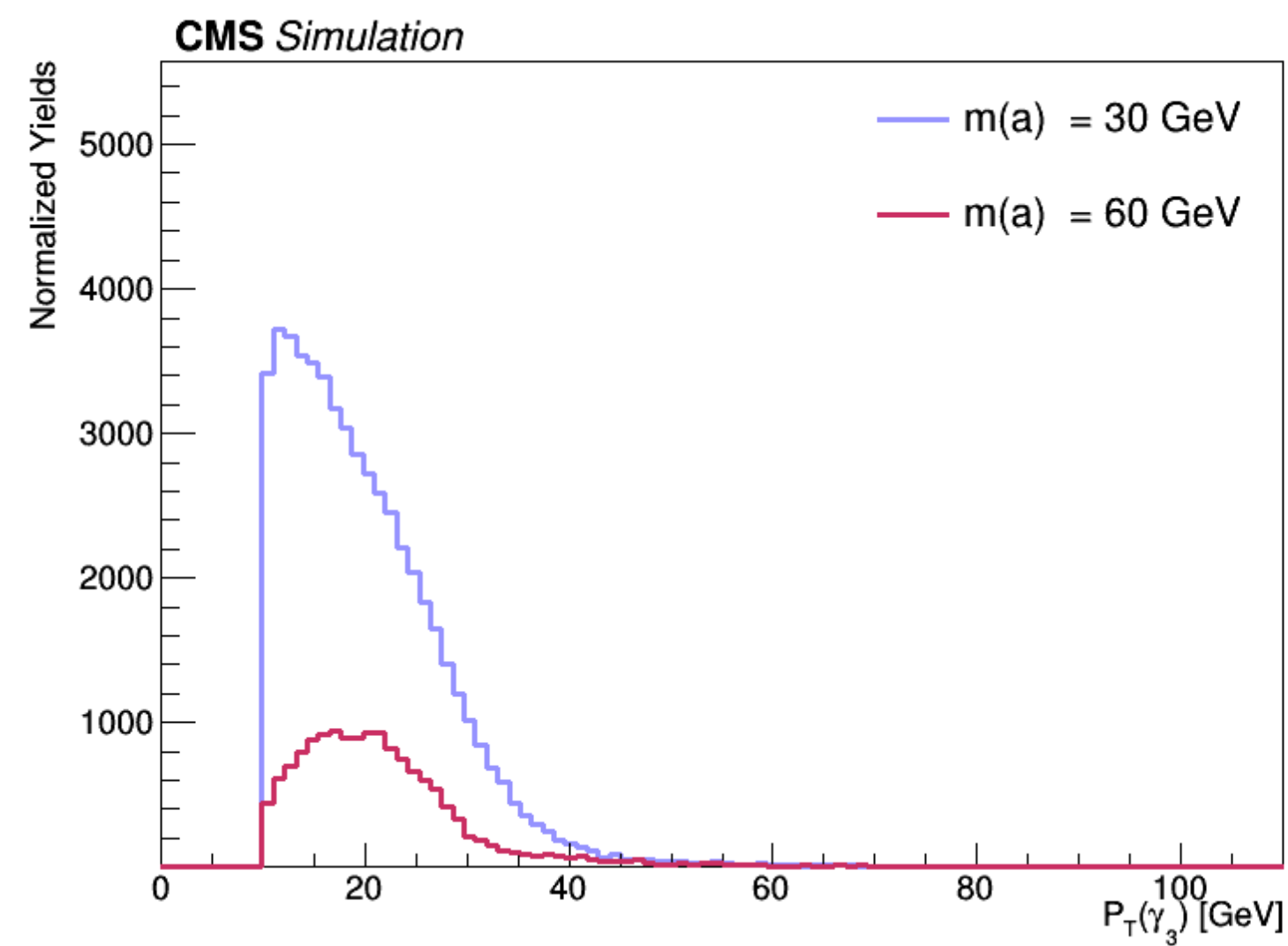
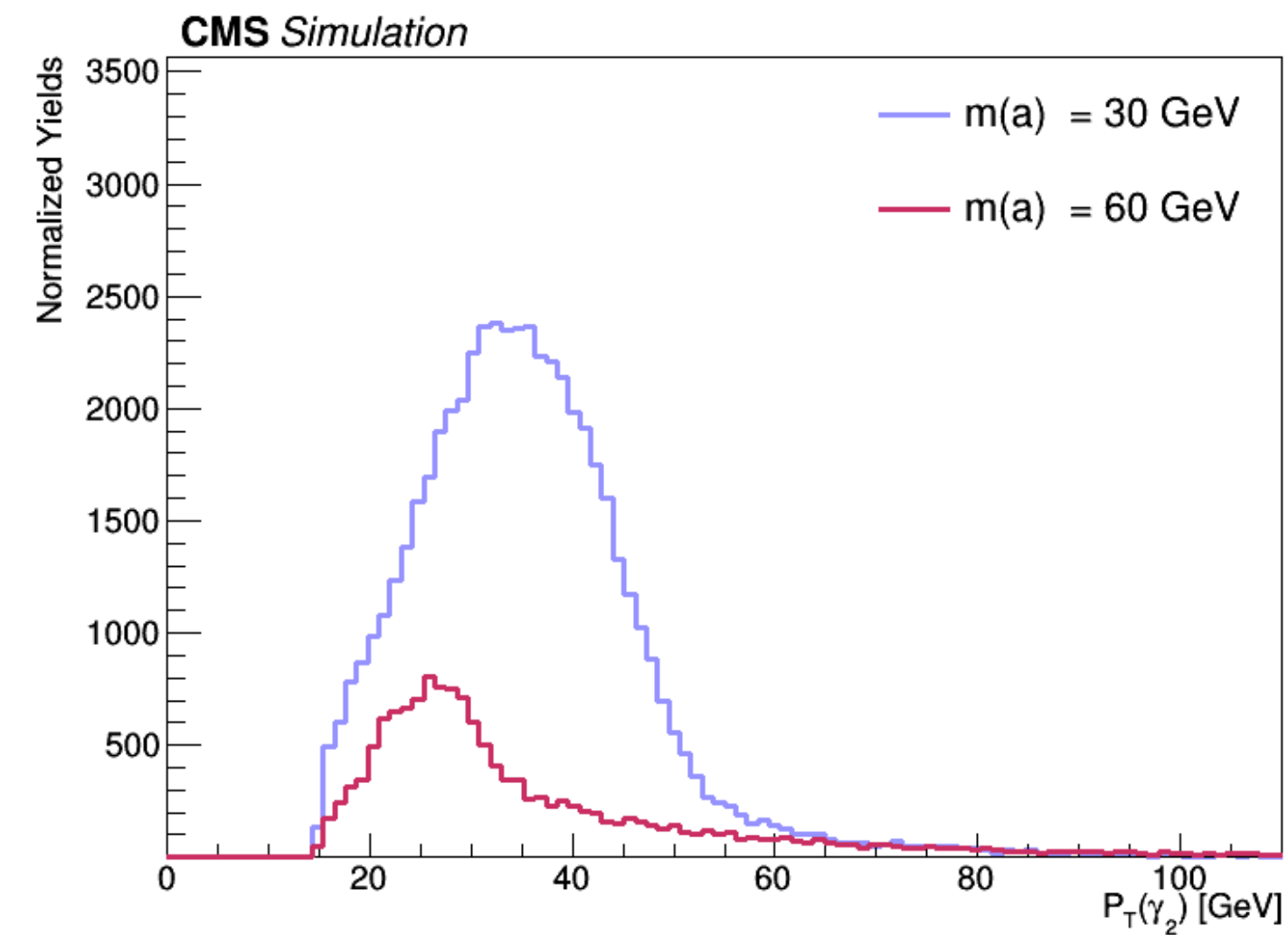
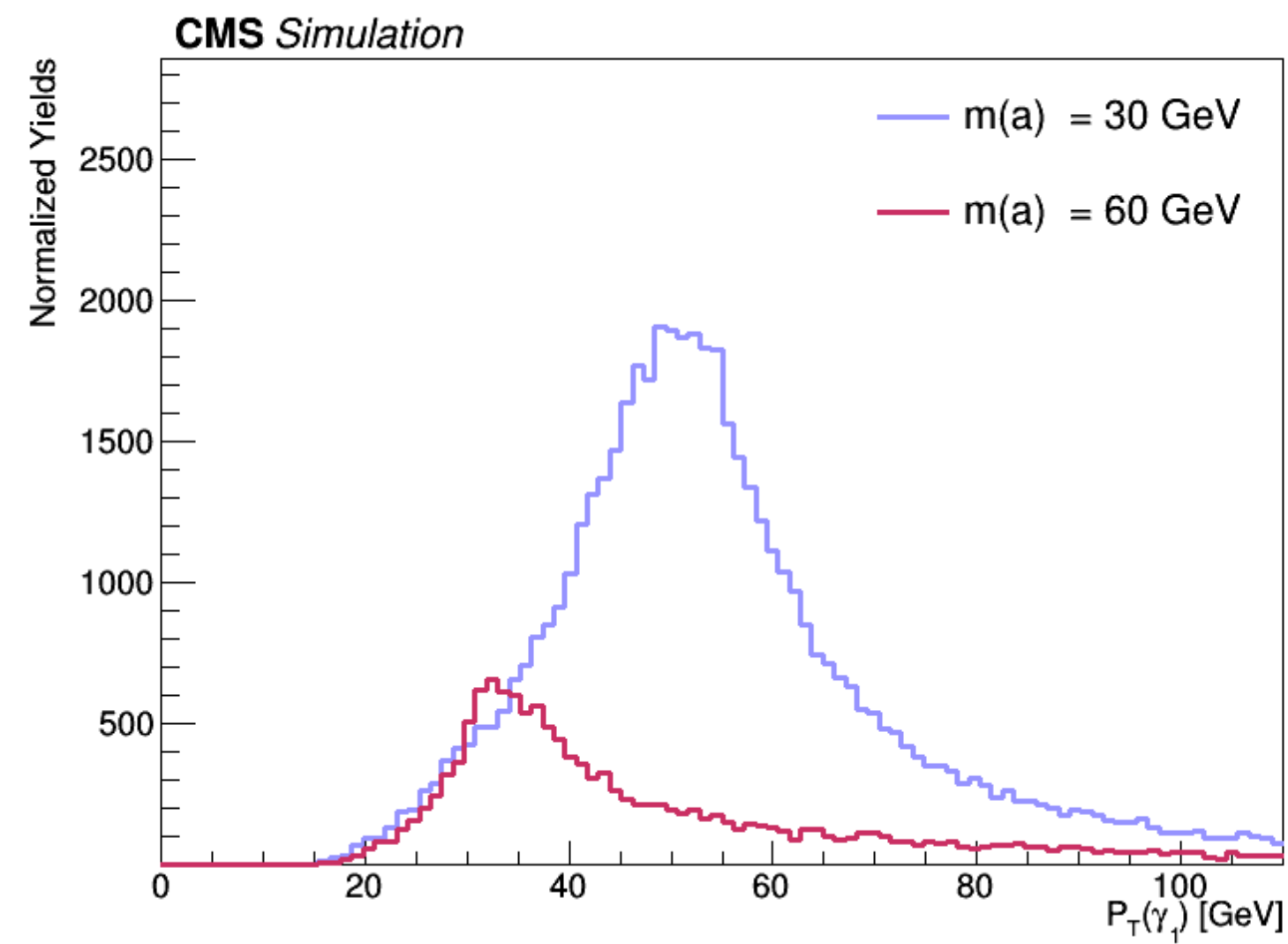




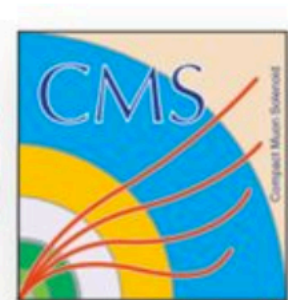
# 4 Resolved $\gamma$ 's : 4 in acceptance



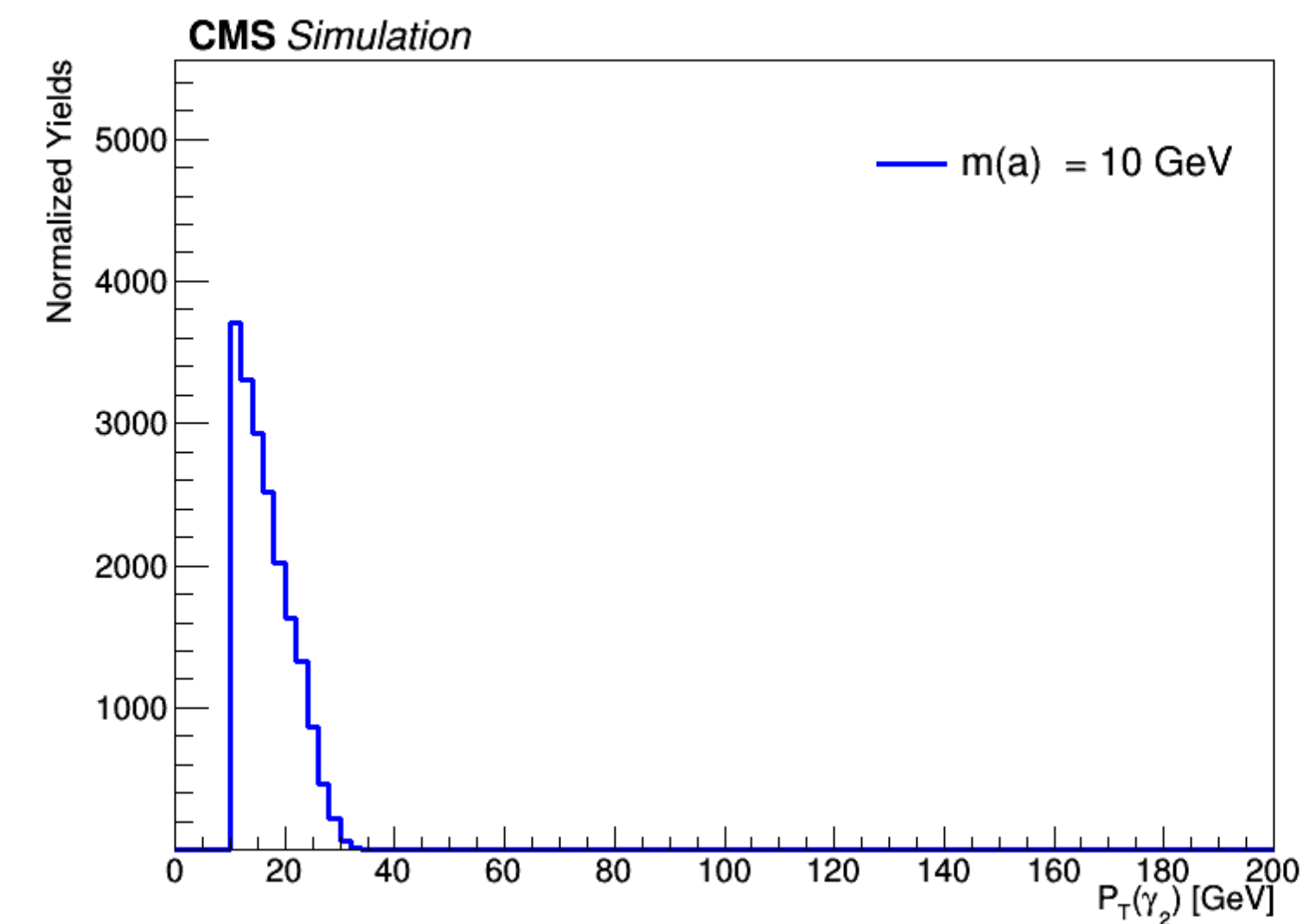
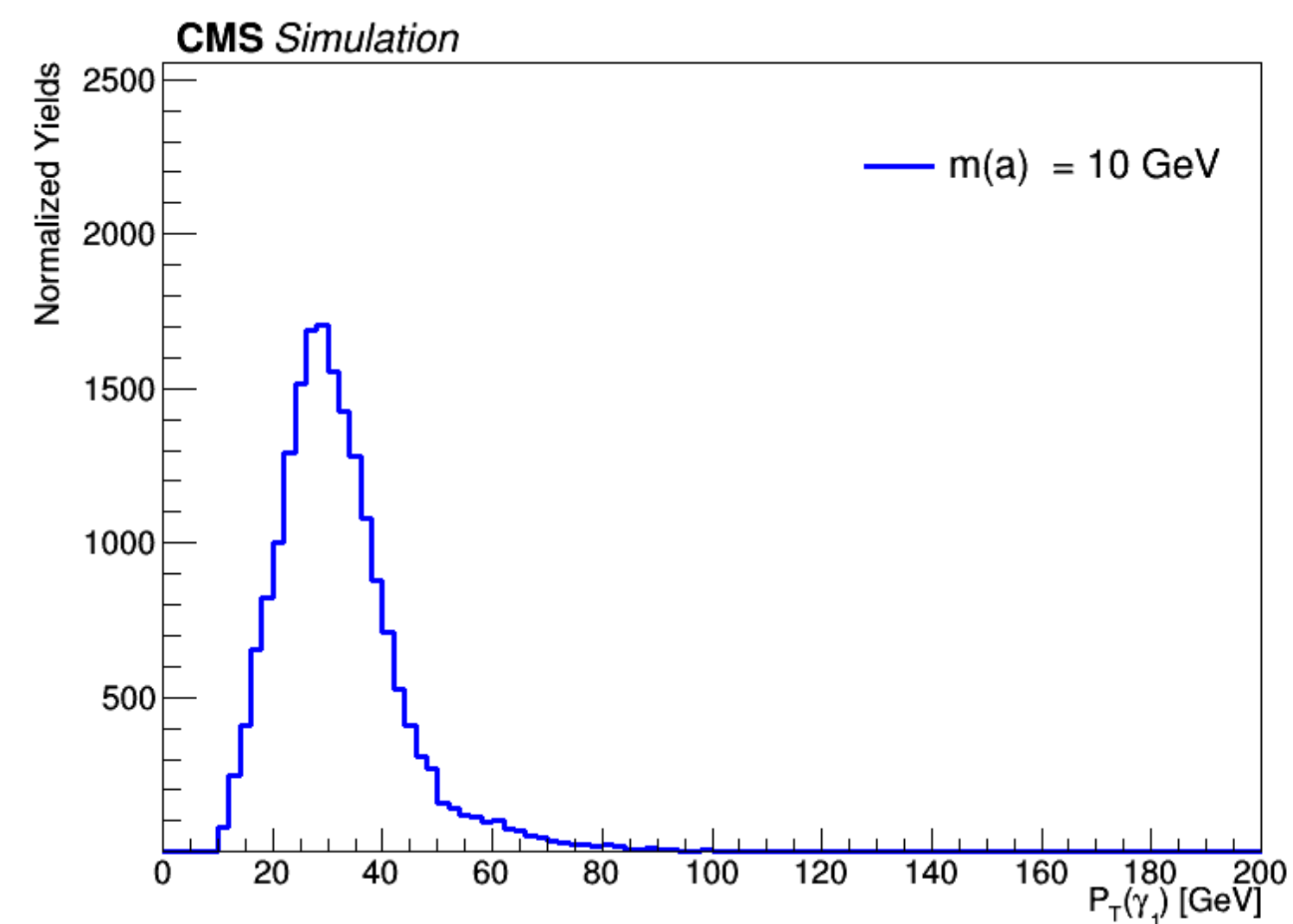
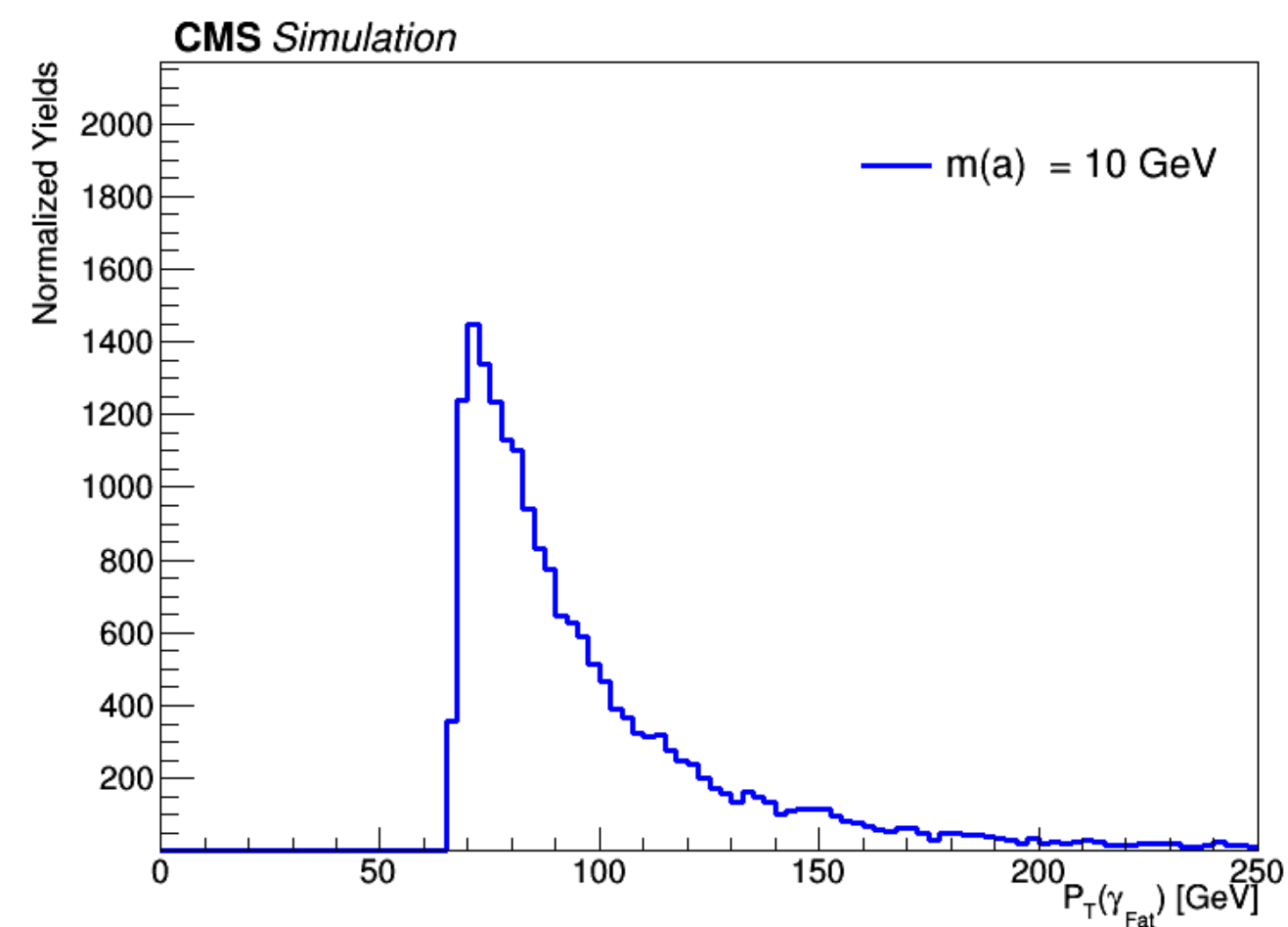
# 4 Resolved $\gamma$ 's : 3 in acceptance

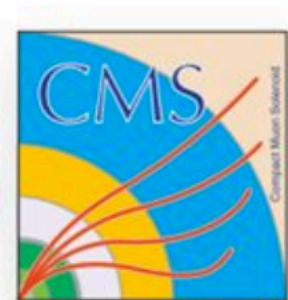




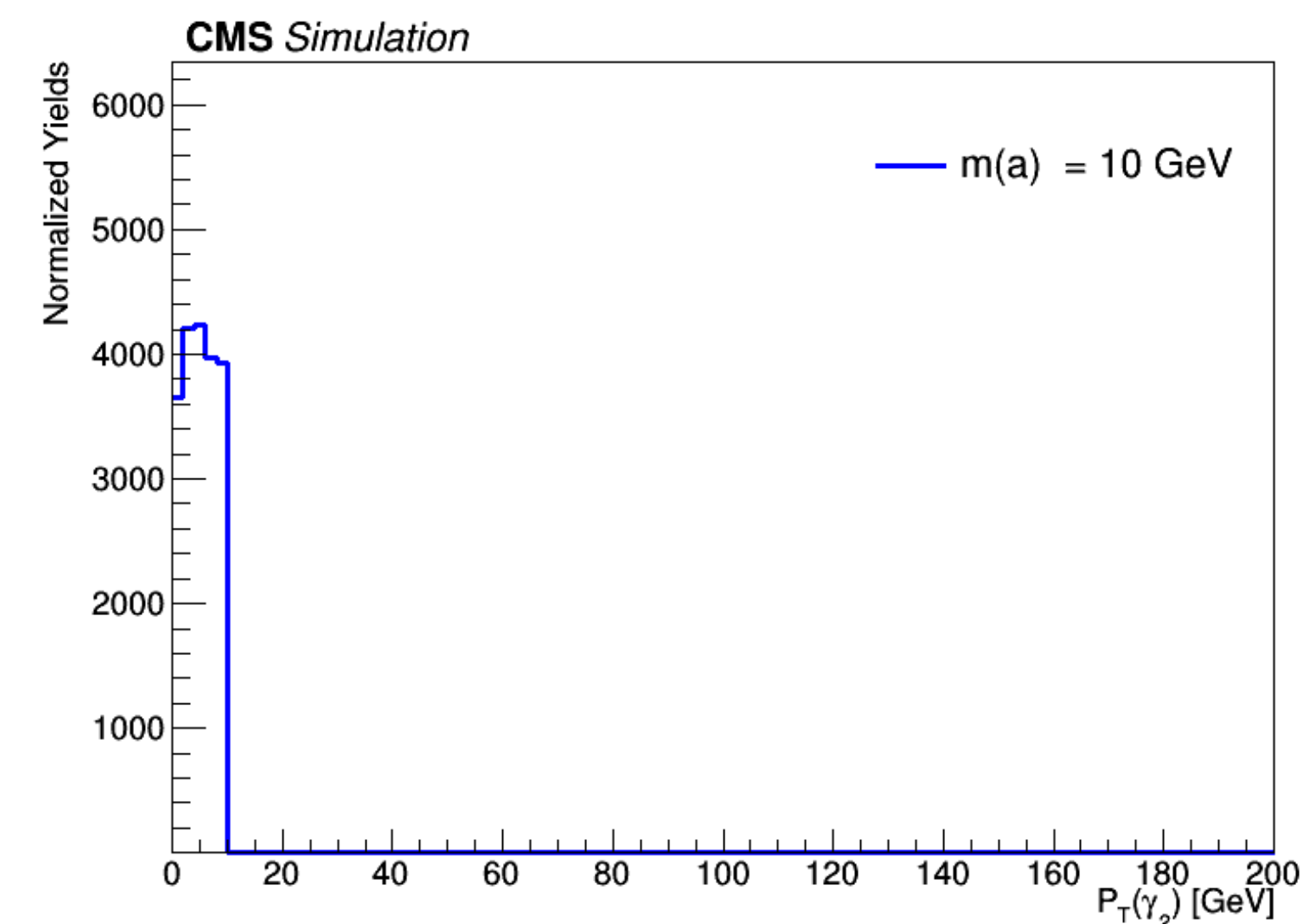
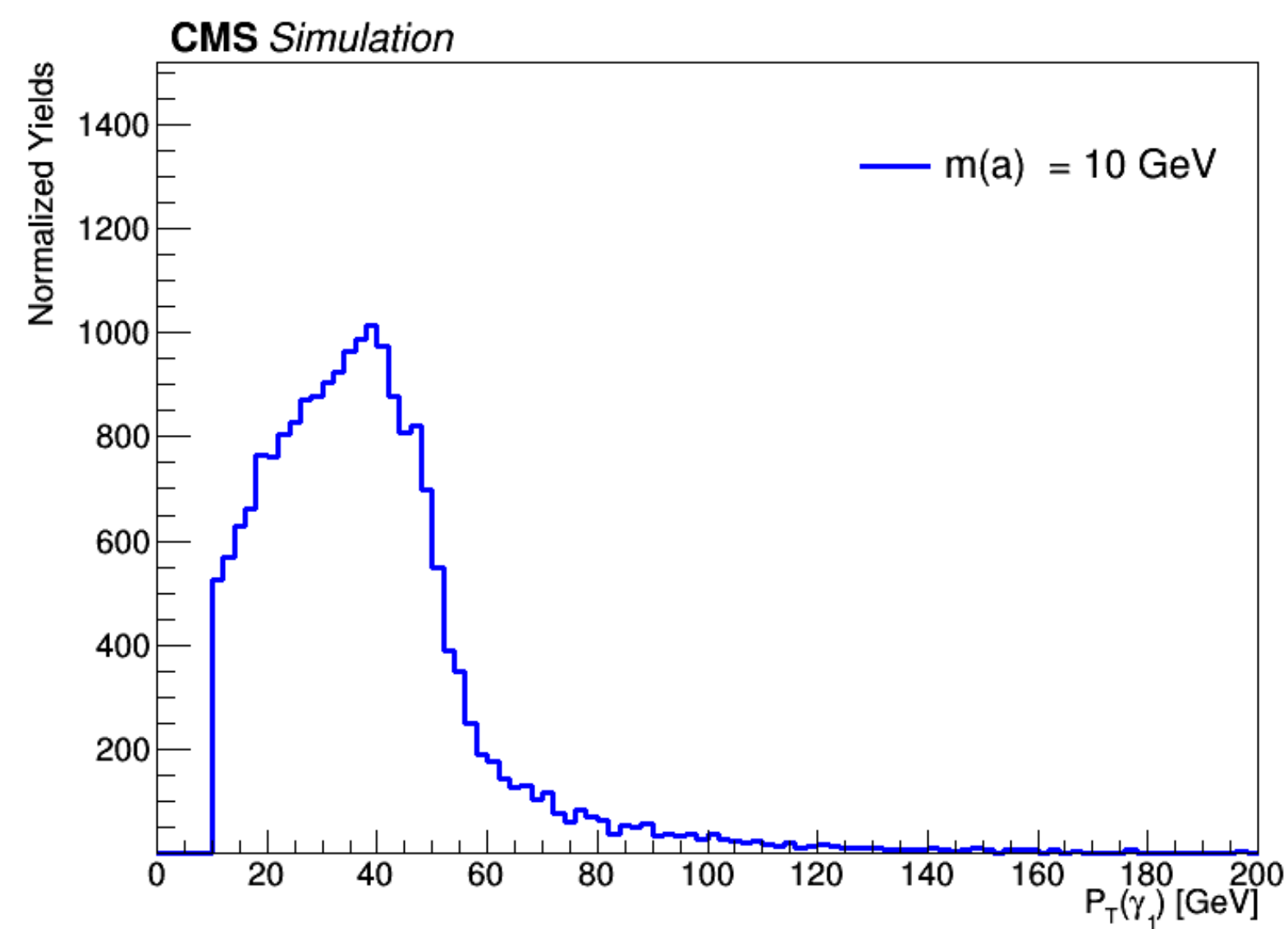
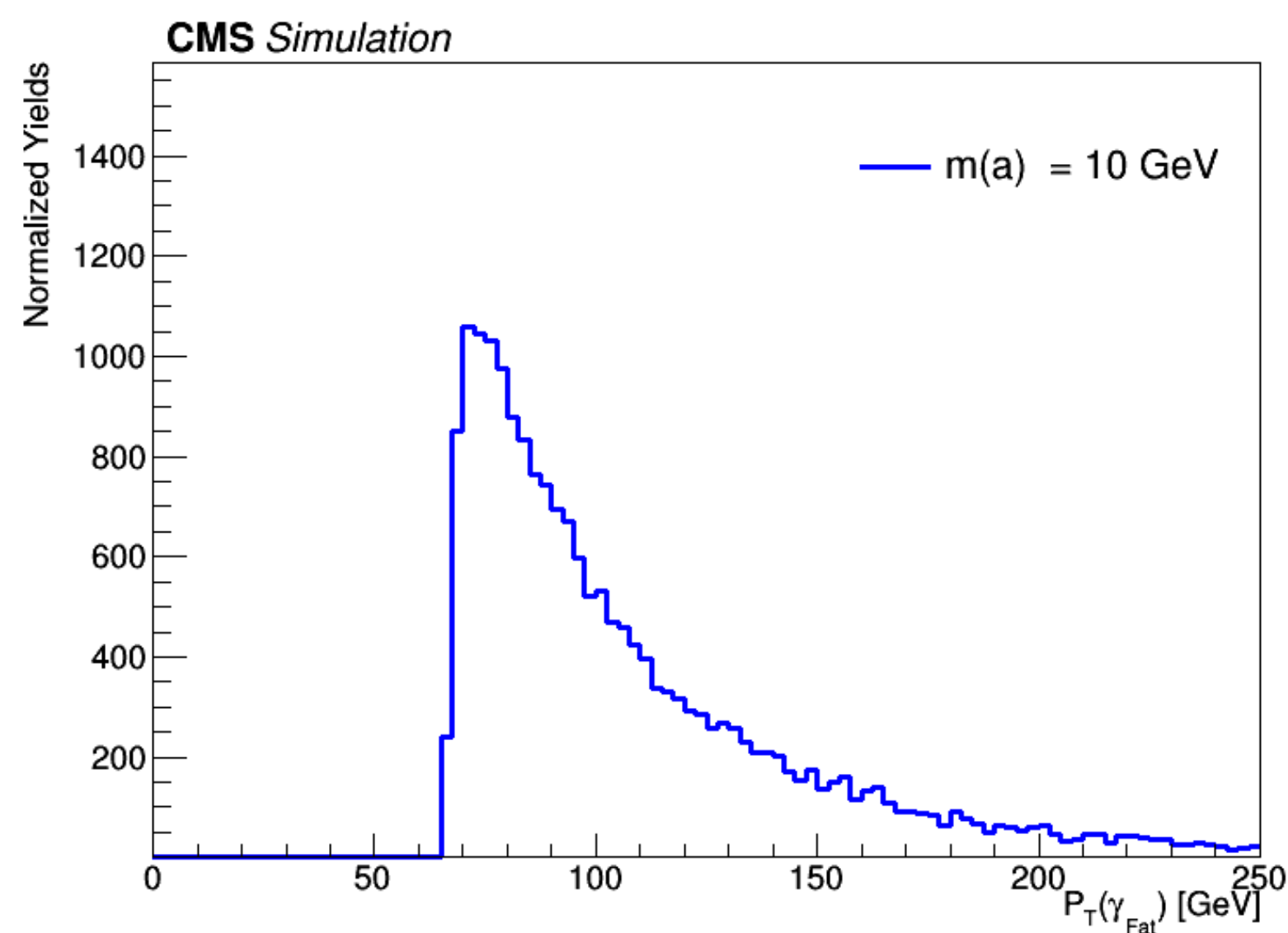


# 2 Resolved $\gamma$ 's + 1 Fat : All in acceptance

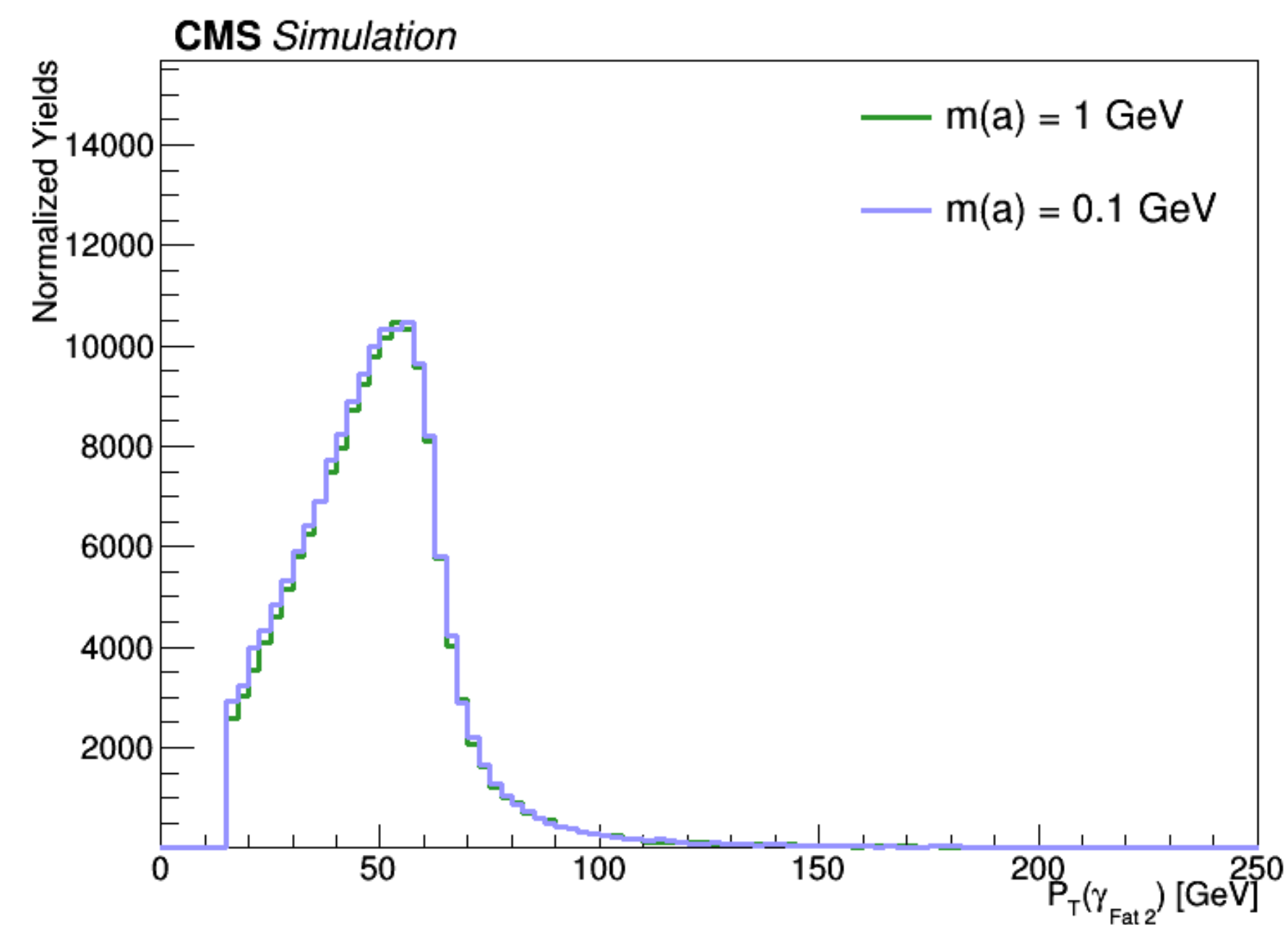
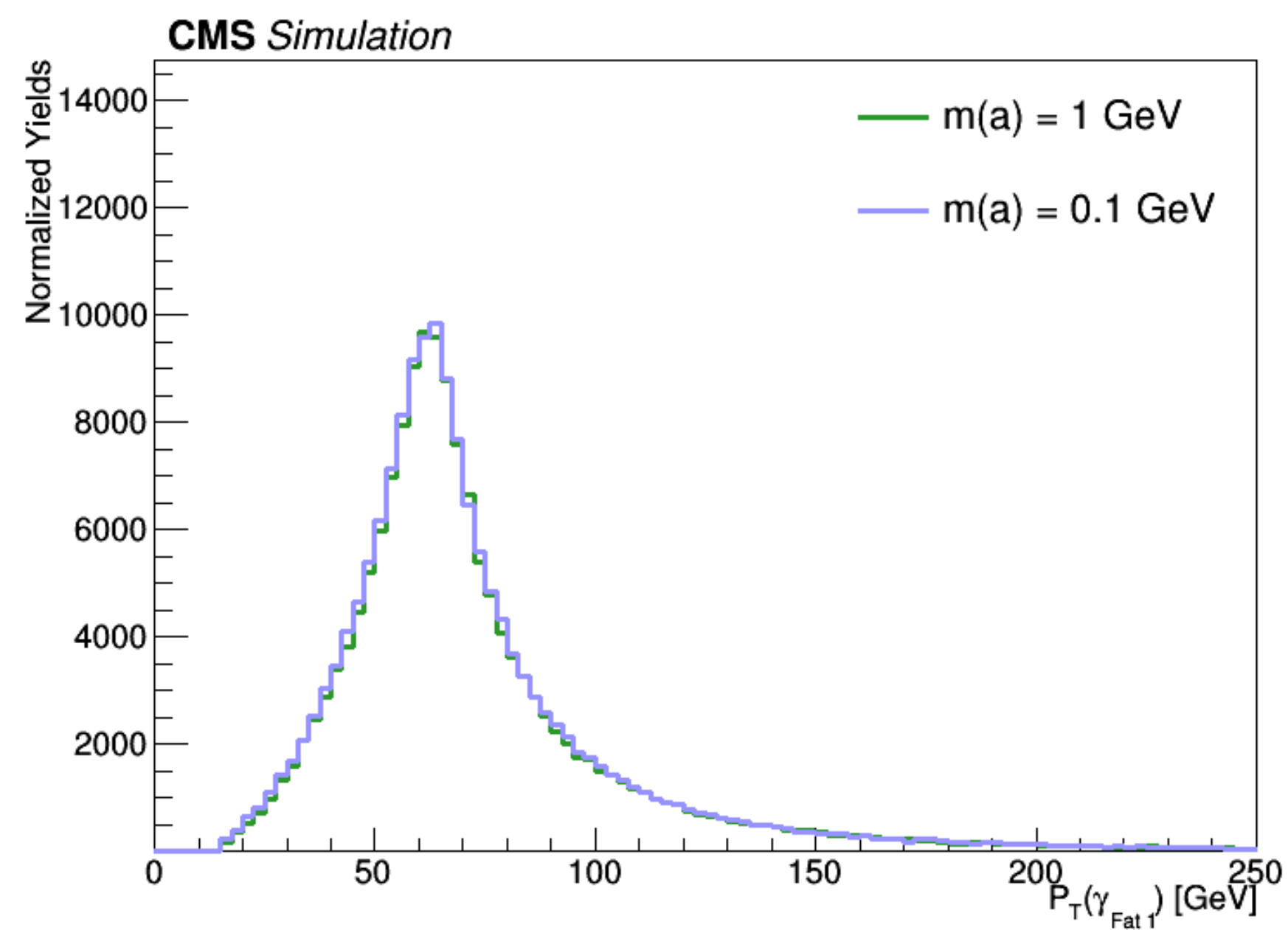




# 2 Resolved $\gamma$ 's + 1 Fat : 1 Missing

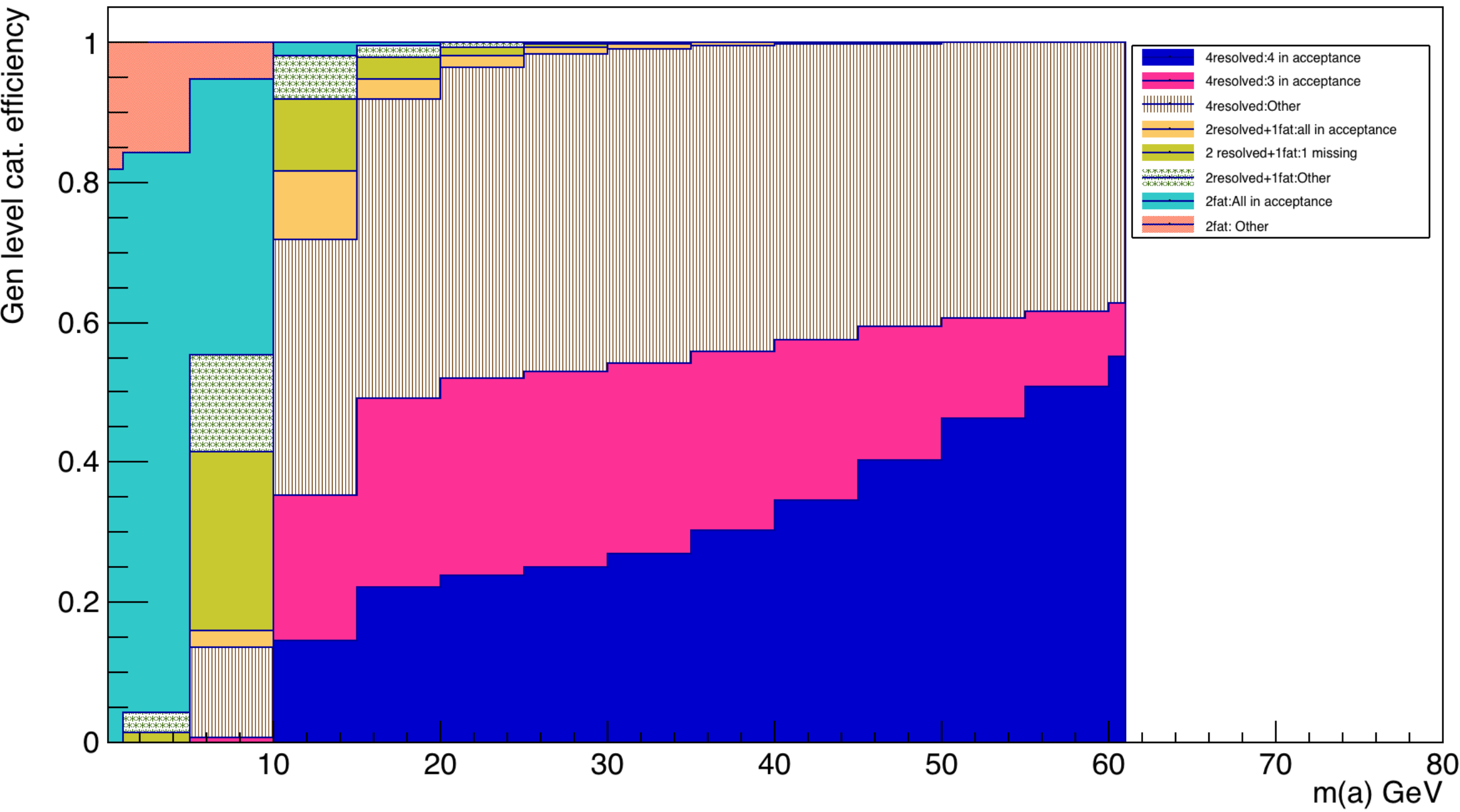


# 2 Fat $\gamma$ 's : All in acceptance

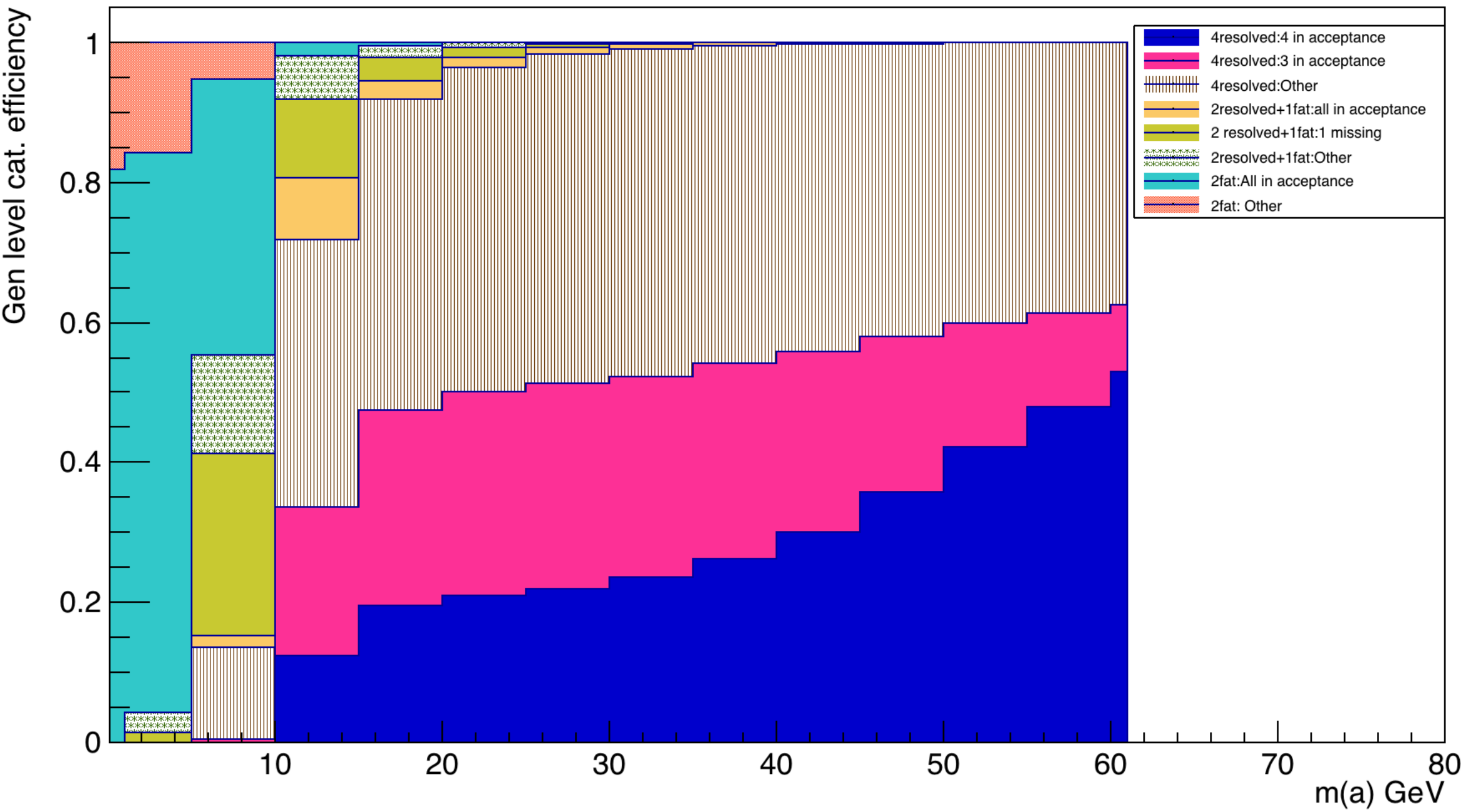




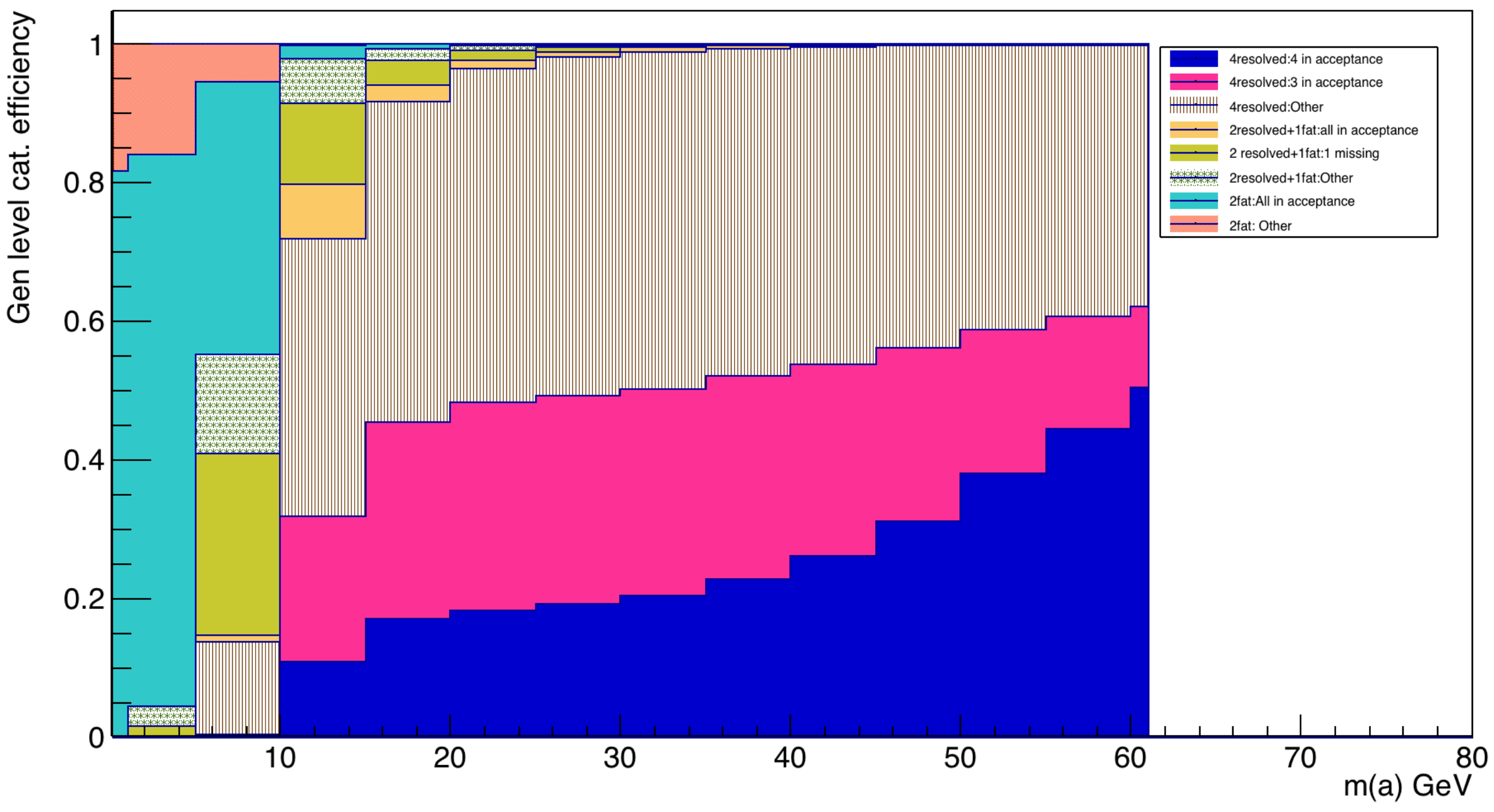
# 10 GeV



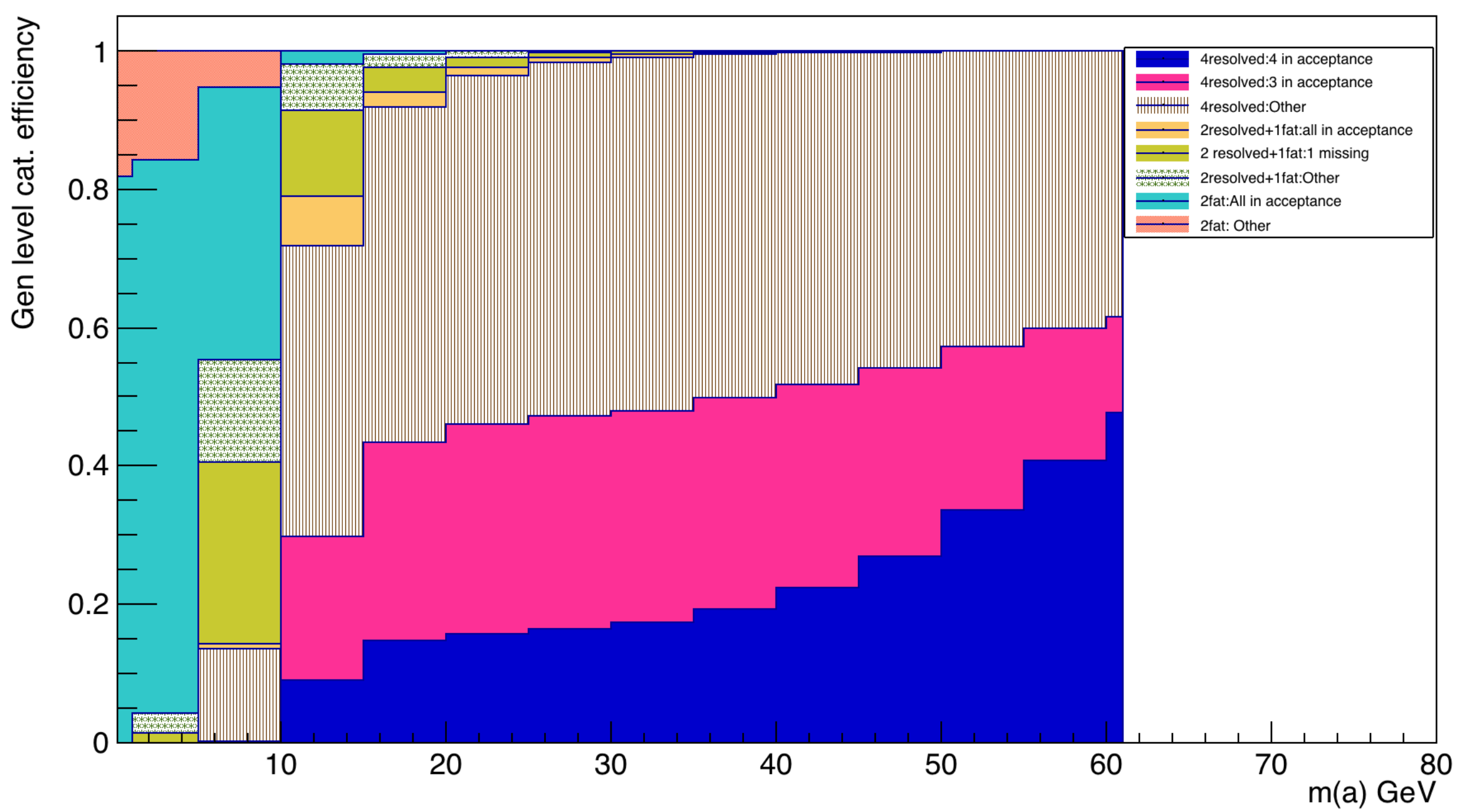
# 11 GeV



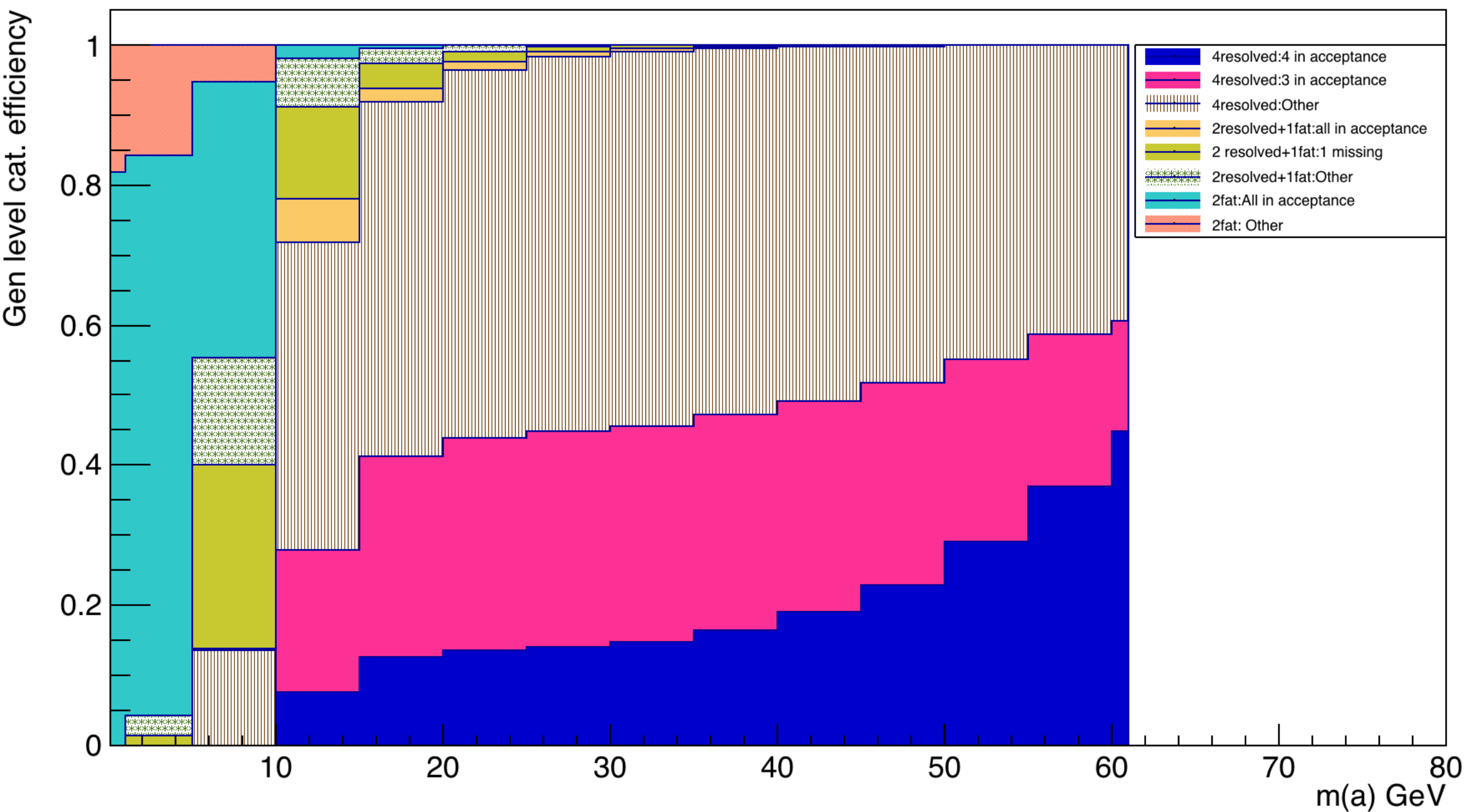
# 12 GeV



# 13 GeV



14 GeV



15 GeV

