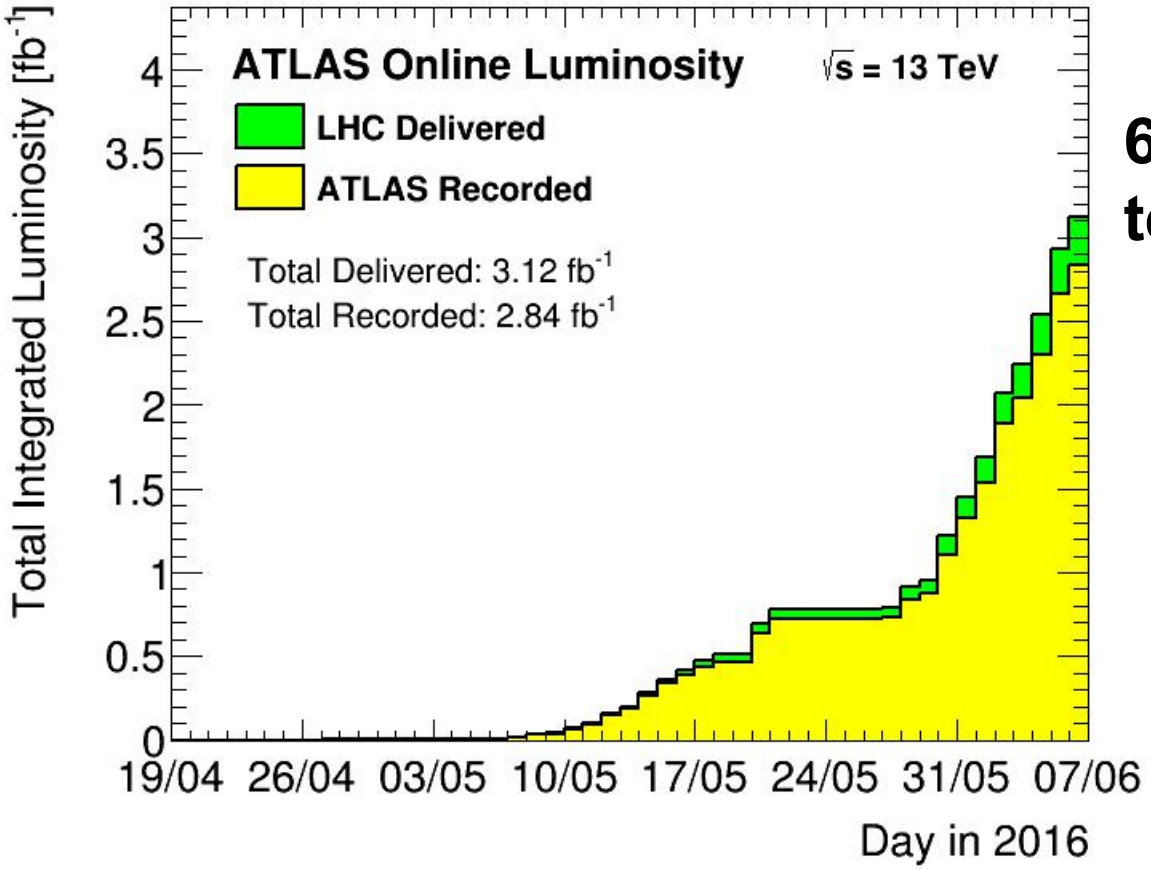
weekly report



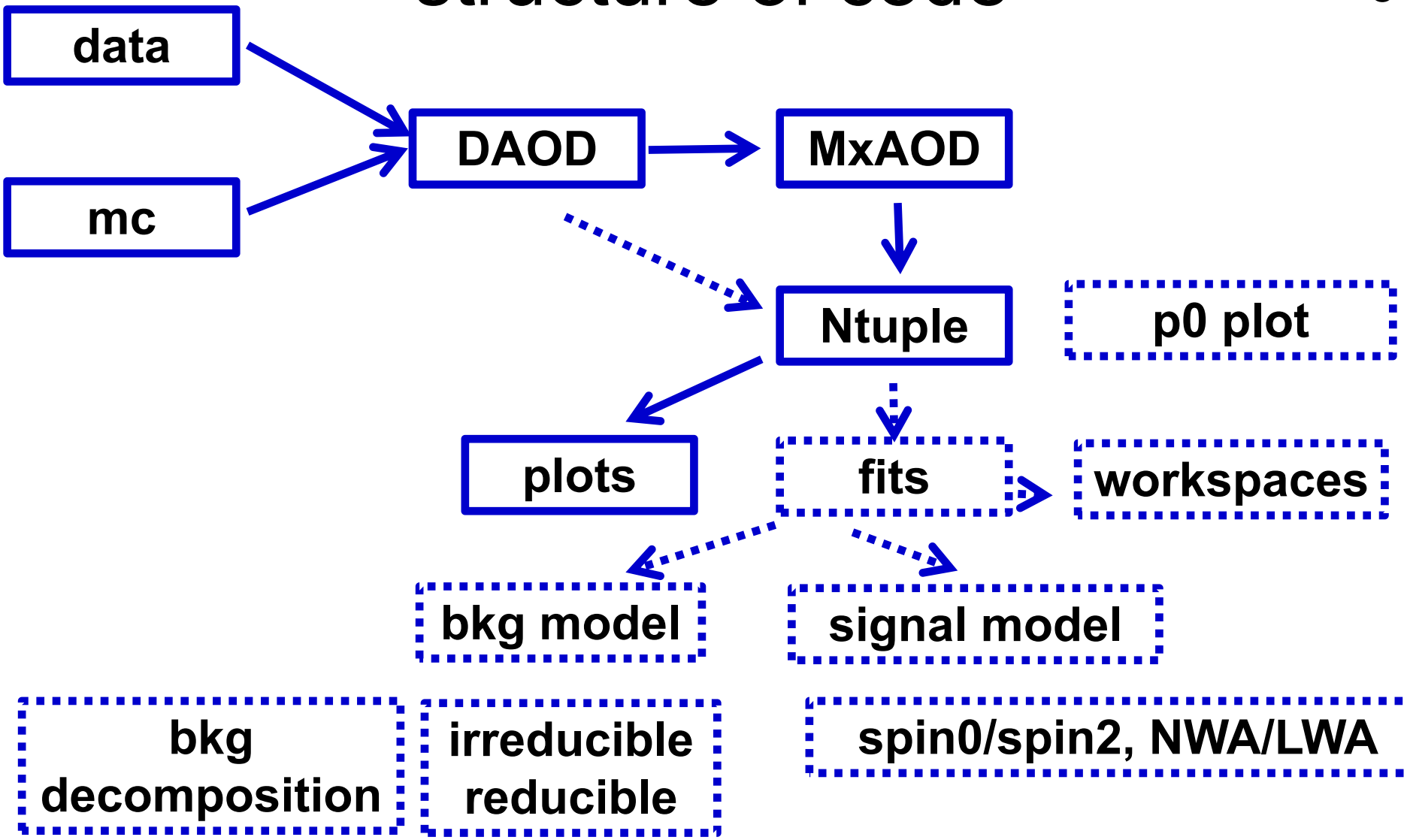
643pb^{-1} in GRL
technique stop is coming!

Yu Zhang
06.06

outline

- cross check on 750GeV diphoton
- discuss on the plan for photon photon fusion
- plan for resloved Z(qq)γ

structure of code



selection

- harmonize the selecton
- special thing is pT and isolation

	Higgs(spin0)	exotic(Graviton, spin2)	
document	**2015paper/CONF**	**paper**	**CONF**
pT	**$pT_{\gamma 1(\gamma 2)}$>0.4(0.3)*$m_{\gamma\gamma}$**	**photon pT>55GeV**	
ID	**Tight**		
Isolation	**calo:E_T^{iso}<0.022*pT+2.45 cone40**		**calo:E_T^{iso}<0.065*pT+7 cone40**
	track:pTcone20<0.05*pT		**NO**

cross check

- **2015 re-analysis with 20.7**
  - **need to understand the difference between release**
- **compare sideband/cotrol region between 2015, 2016 and MC**
  - **need to be done before unblind**
- **check the shape with every alternative selection to see whether the kinematic cut can give a peak**

- **EB meeting**
  - **Thursday 5-7pm**
  - **https://indico.cern.ch/event/539982/**
  - **2015 data re-analysis**
  - **cross-check 2016 data(in control regions)**
  - **Timeline and next steps towards 2016 data**

convenor's email

- **Comparisons in sidebands/excess region in data and MC and 2015/2016 data.**
  - **Here we discussed today that figures in the excess region should only be single photon kinematic variables and properties. No figures based on diphoton variables in the excess region.**
  - **All figures should be shape normalised such that one can not derive**
  - **the number of events in the peak.**
  - **In particular the isolation variable for the graviton selection.**
  - **Consolidate isolation profiles in single photons, electrons and radiative Z decays photons**
  - **Purities for different analyses (scalar,graviton tight, graviton loose, scalar loose, graviton-loose, graviton-scalar, graviton loose-tight isolation) and for the nominal scalar and graviton selection as a function of eta when statistically possible.**

- **blind or unbind**
  - **in public : plots for all mass range, excluding [700,800], and [700,800] only (done)**
  - **in private : check every thing!**

what is incuded in this talk

- Selection
  - higgs selection
  - exotic selection
  - exotic loose isolation selection, corresponding to 2015 CONF
  - exotic - higgs (pass 55GeV but fail relative pT)
  - grey photons : pass loose exotic selection but fail tight isoltion, only pT>55GeV (to do), exotic loose - exotic
- Variables
  - kinamatic, calibration, ID, Isolation, conversion and so on in each eta bin
- ~10000 histograms with different varibles , different eta bin , different selection...

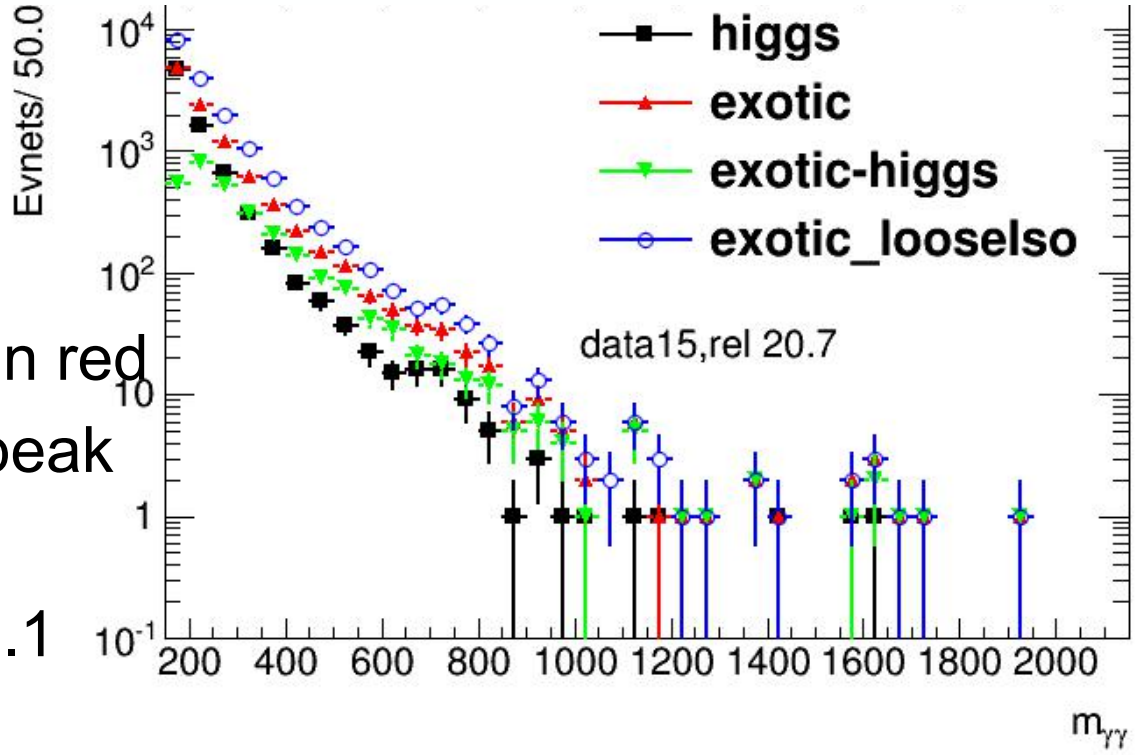
20.7 2015 data

- see Hongtao's talk

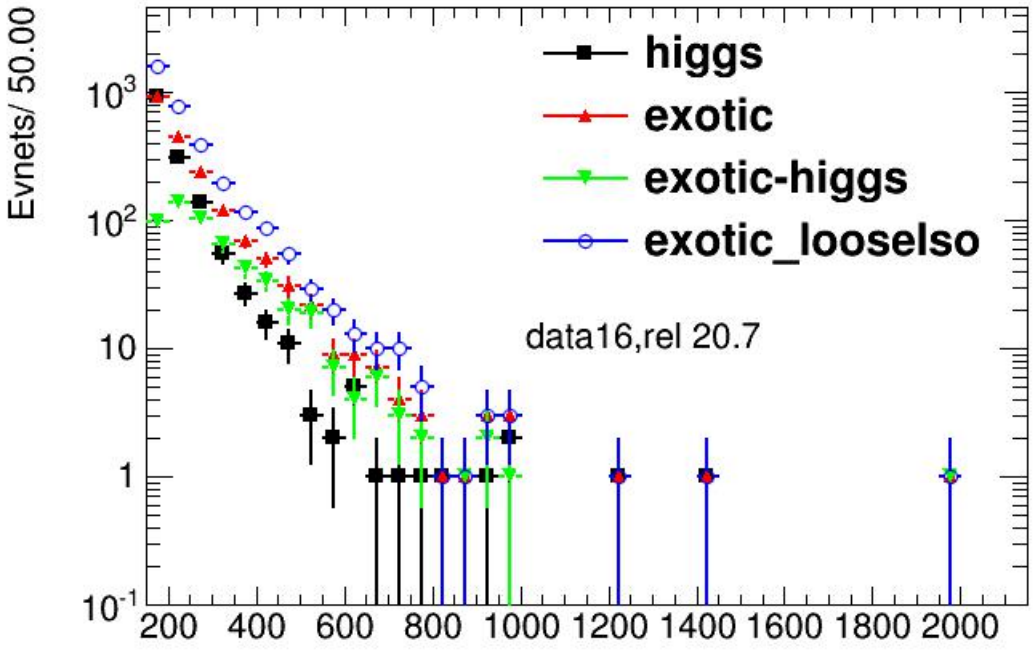
Scalar analysis	h011		h012	
	Z_{max}	Where	Z_{max}	Where
NWA	2.9σ	750 GeV	2.7σ	730 GeV
Γ_X/m_X=6%	3.9σ	750 GeV	3.4σ	740 GeV
2D plane	3.9σ	750 GeV 6%	3.4σ	740 GeV 9%

Graviton analysis	h011		h012	
	Z_{max}	Where	Z_{max}	Where
k/M_{Pl}=0.01	3.3σ	770 GeV	3.1σ	1.61 TeV
k/M_{Pl}=0.2	3.8σ	750 GeV	3.3σ	740 GeV
2D plane	3.8σ	750 GeV 0.23	3.5σ	740 GeV 0.30

- central value shifts
- more wider
- peak at 1.6TeV
- diffrent peak position in red and green give a wider peak in red.
- I haven't check the 20.1 2015 data yet



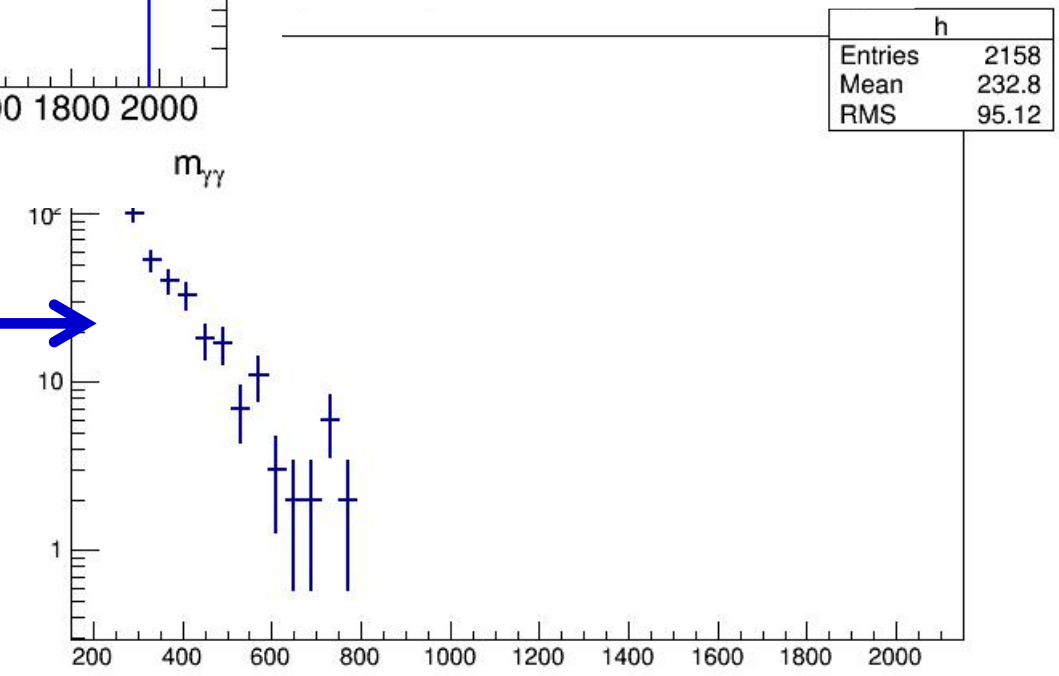
2016 data unblind.....



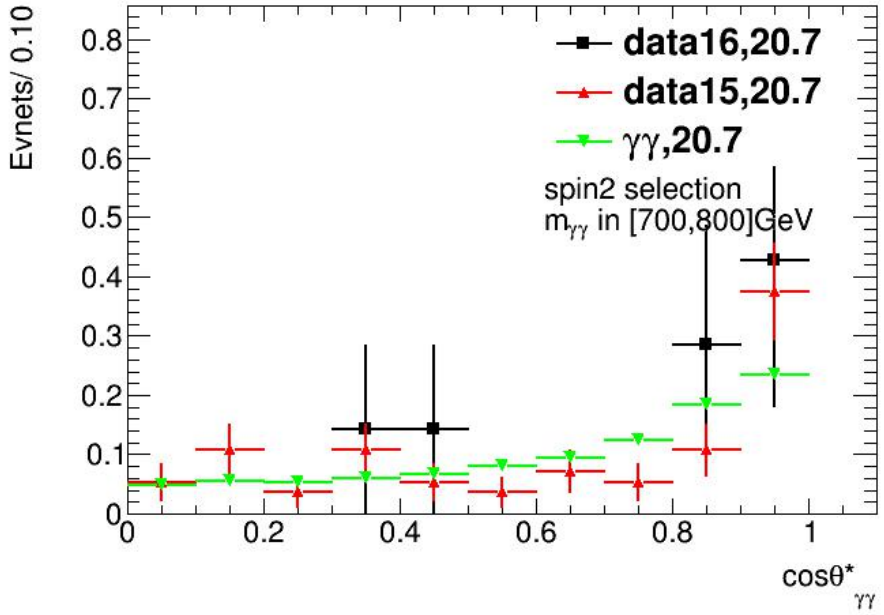
- 600GeV?(black)
- 700GeV?(green)
- wide bump in red?

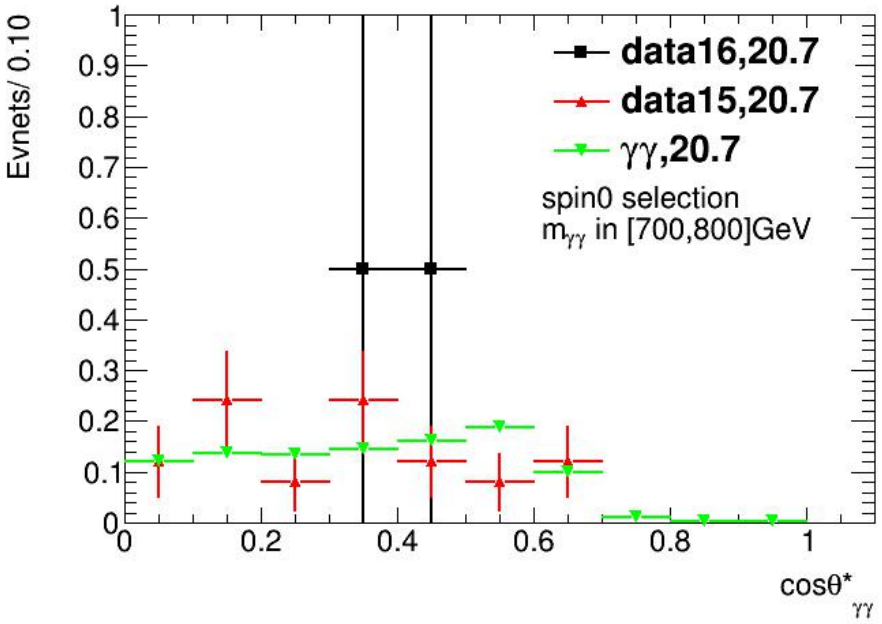
exotic_looselso - exotic

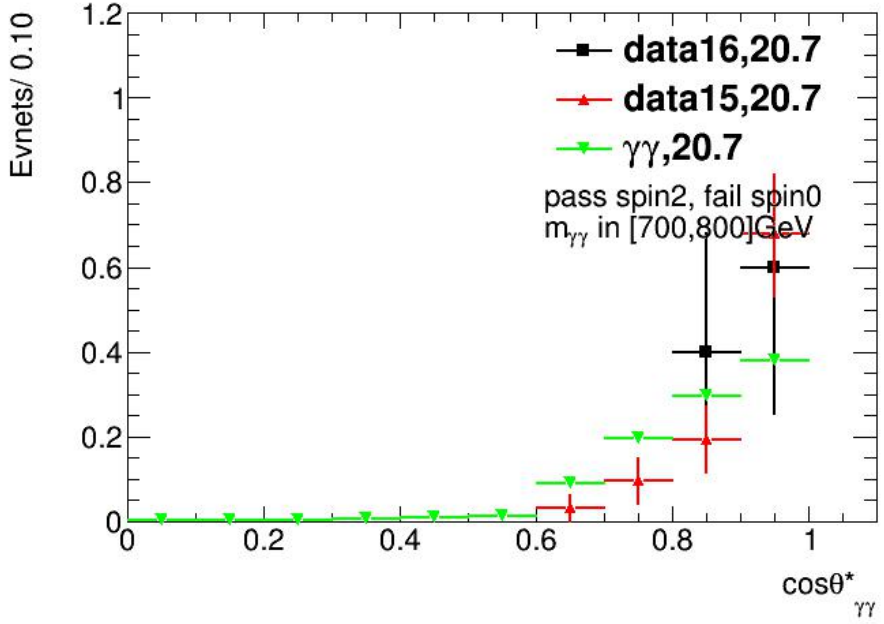
blue - red in the top plot pass loose Iso, but pass tight Iso



$\cos\theta^*_{\gamma\gamma}$

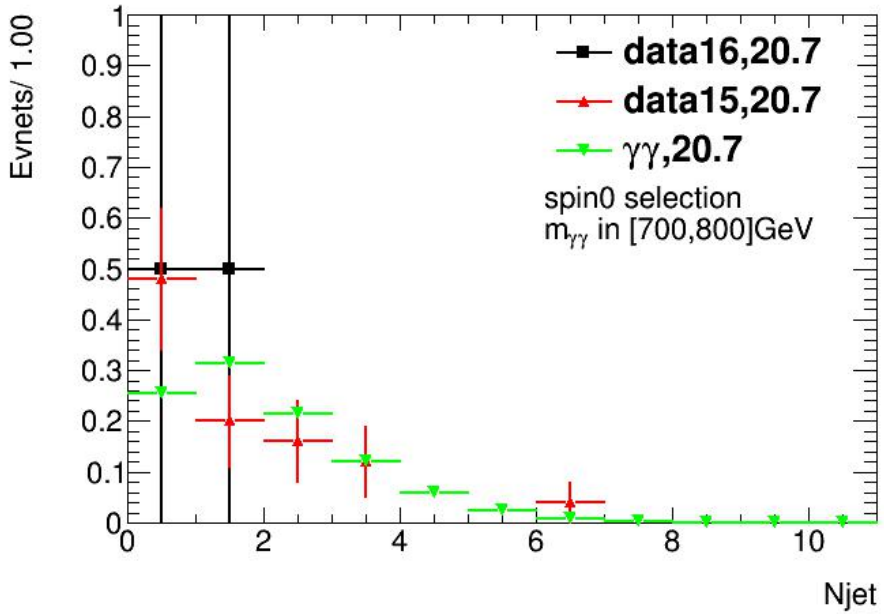


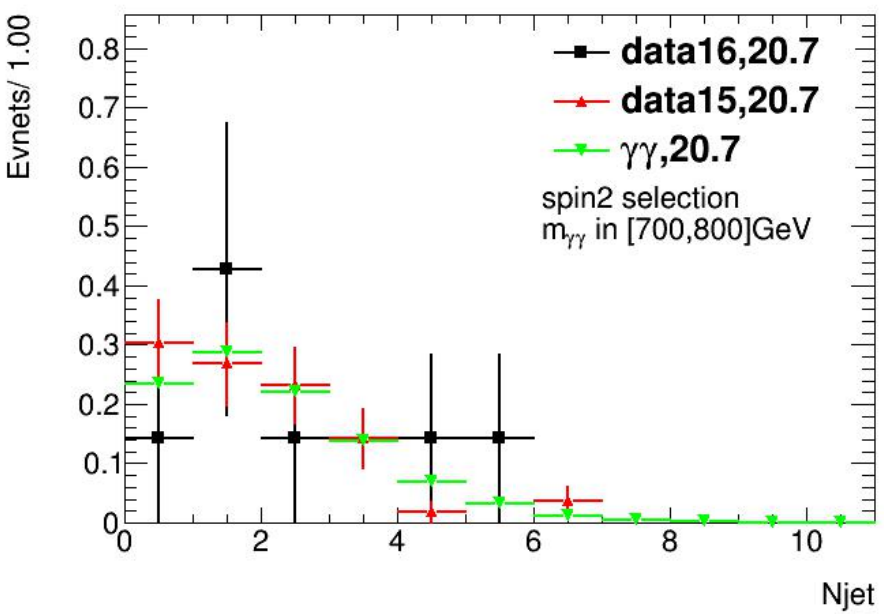


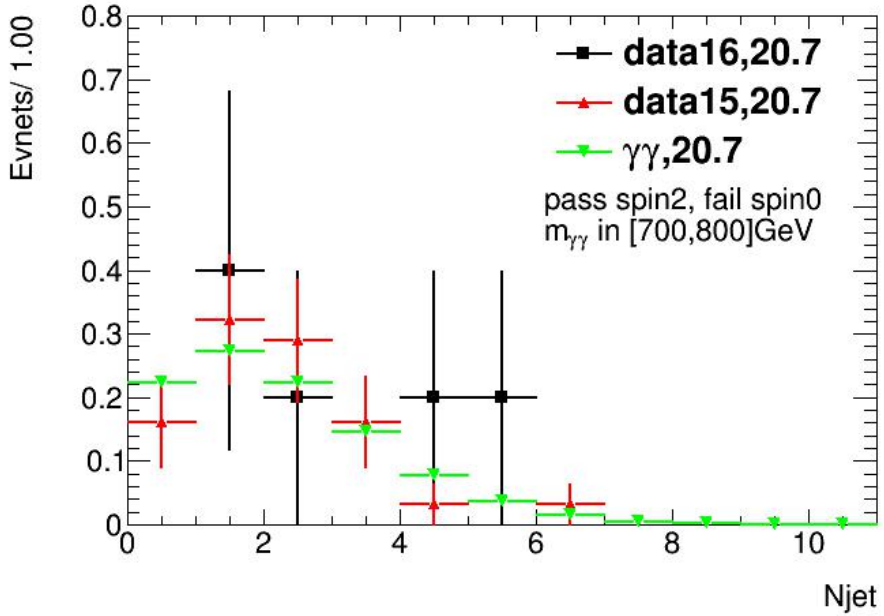


- relative pT kills spin2 events
- two components in spin2 plot

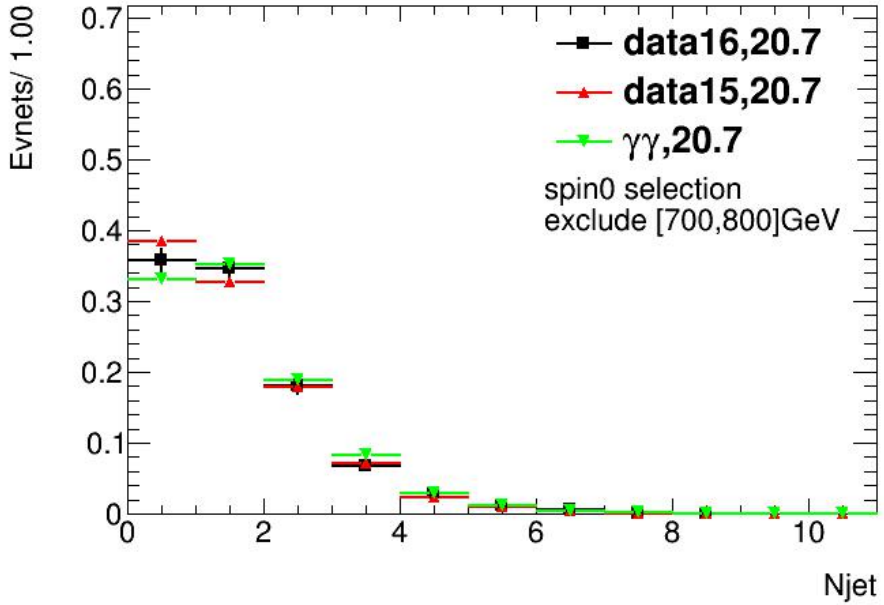
Njet

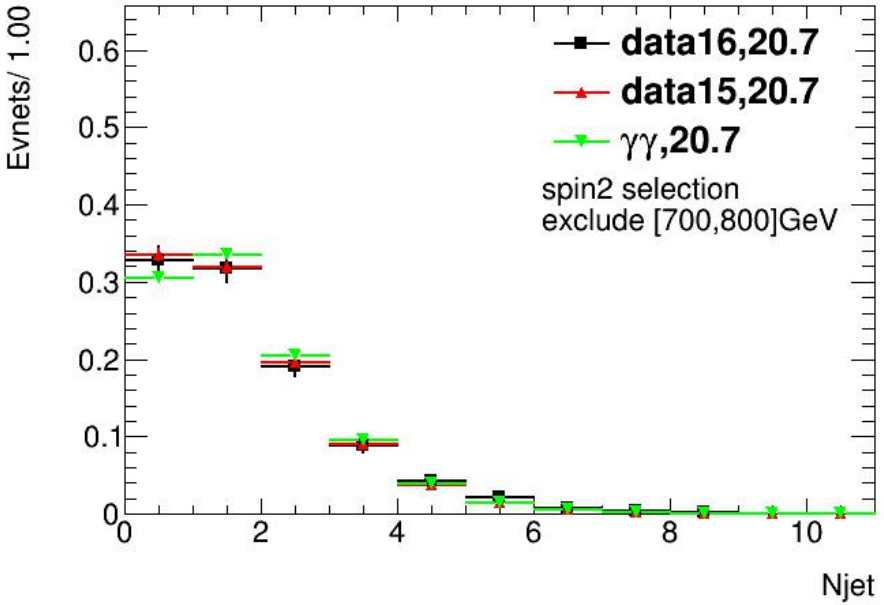

Evnets/ 1.00
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
$m_{\gamma\gamma}$ in [700,800]GeV
Njet

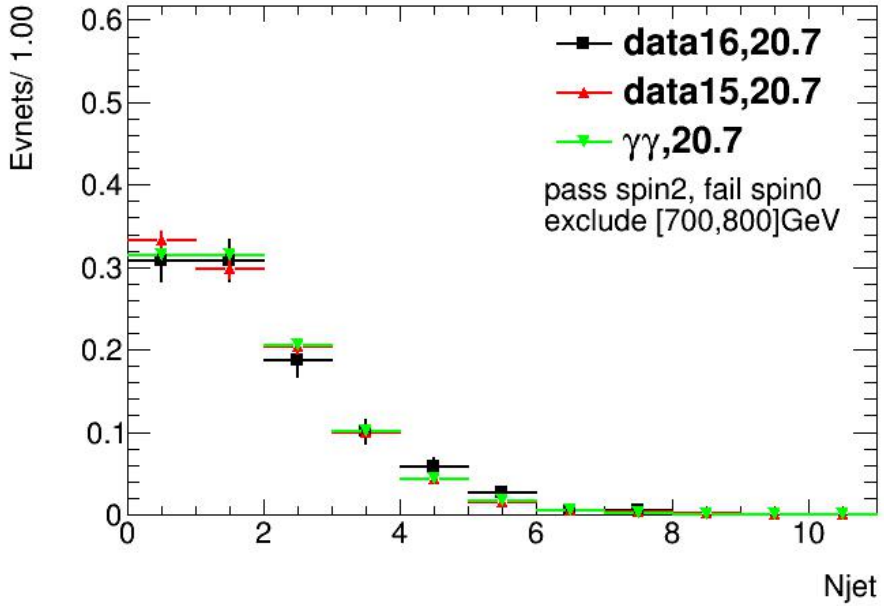

Evnets/ 1.00
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
$m_{\gamma\gamma}$ in [700,800]GeV
Njet


Evnets/ 1.00
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
$m_{\gamma\gamma}$ in [700,800]GeV
Njet

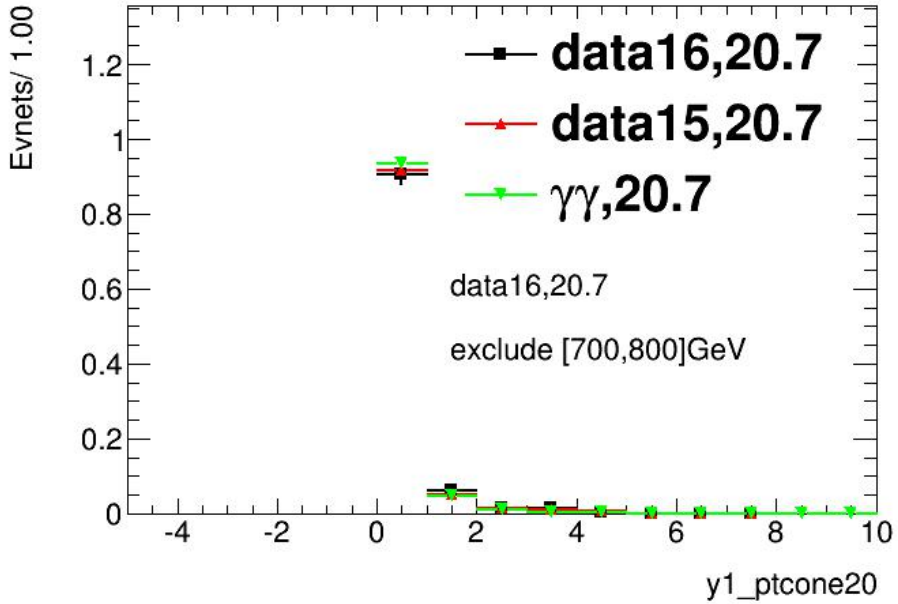
Njet ---exclude SR

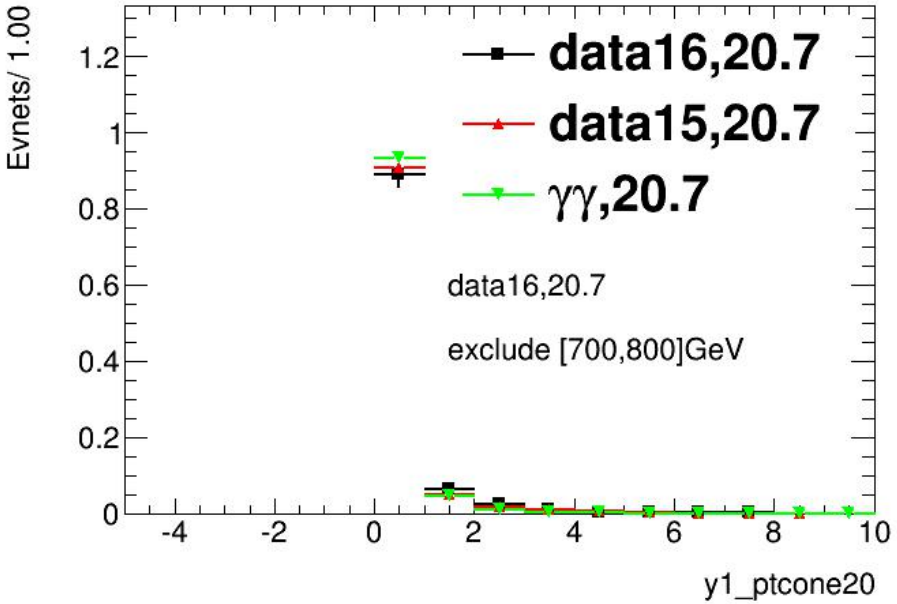


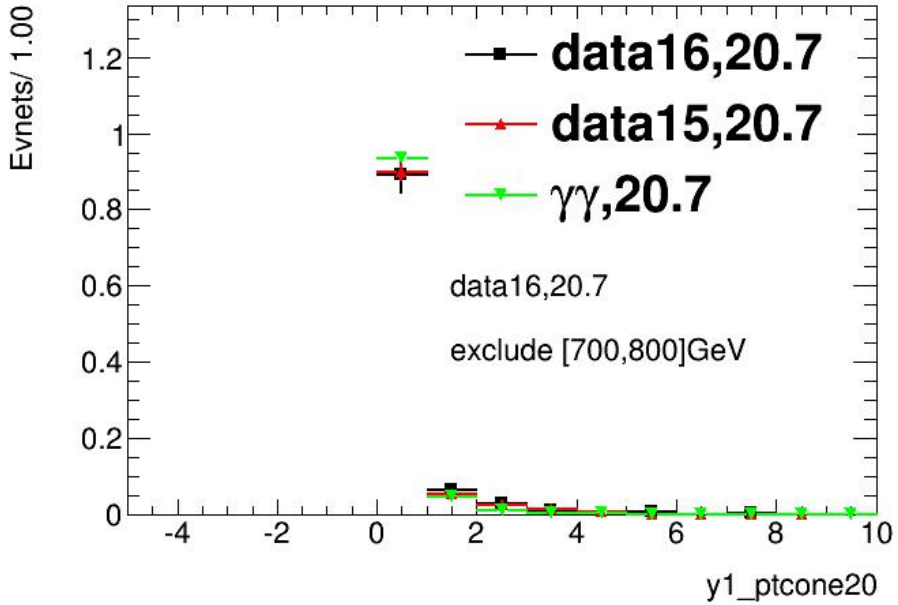




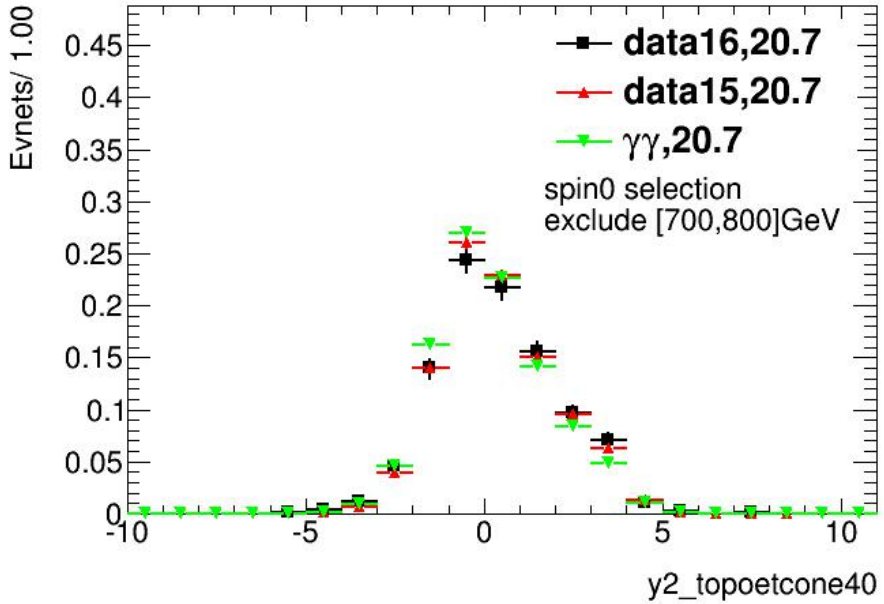
Isolation ptcone20

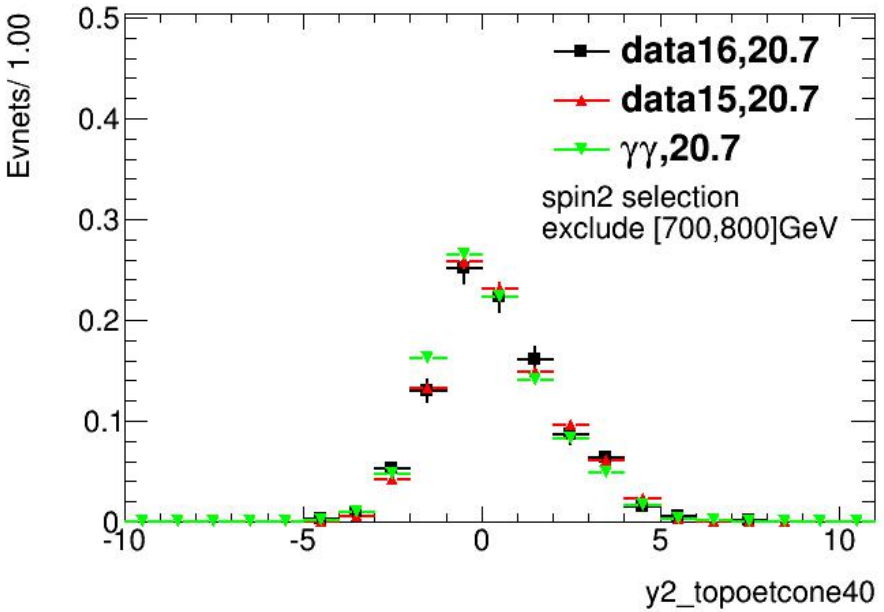


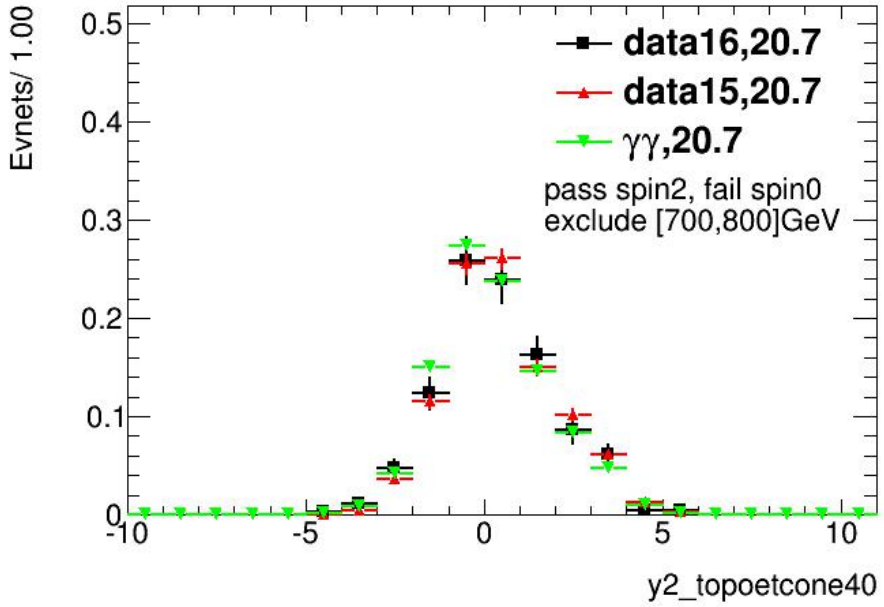




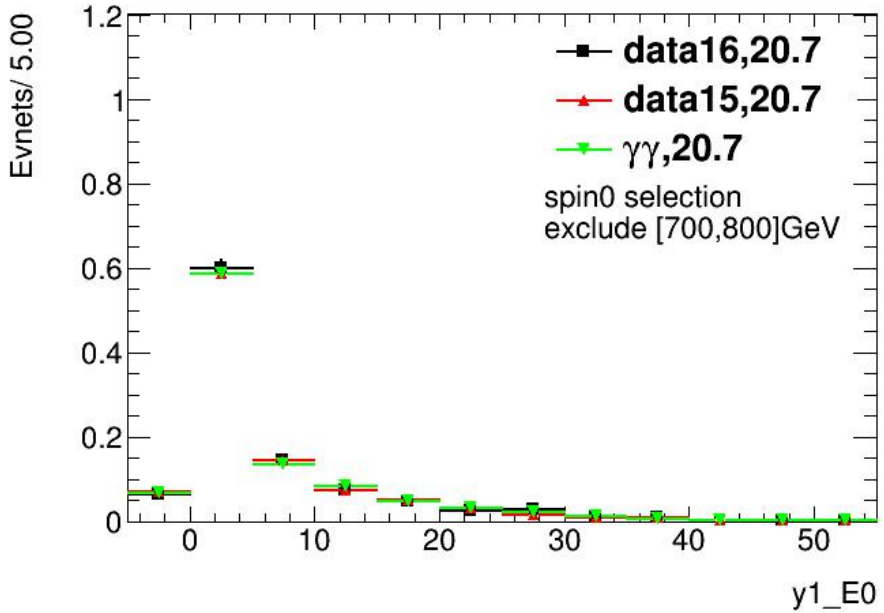
Isolation topoetcone40

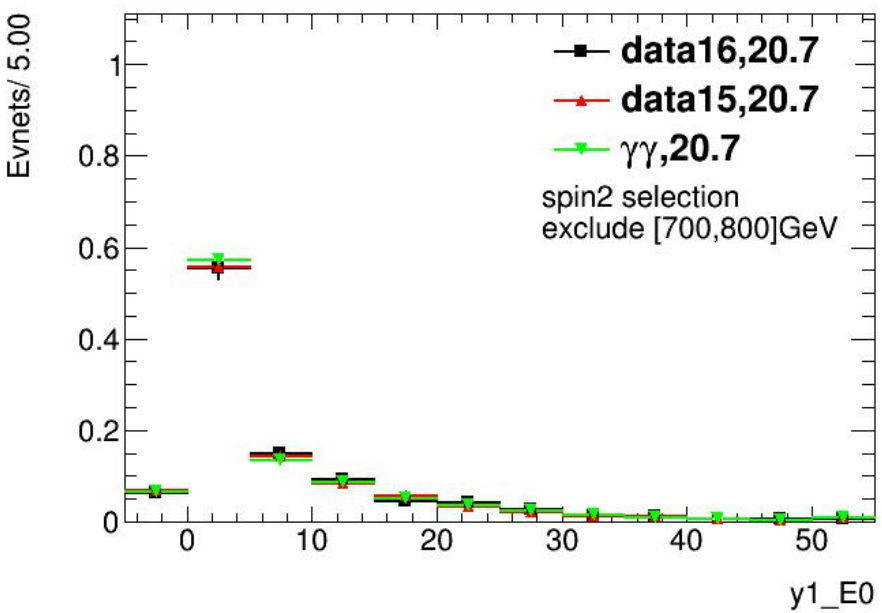


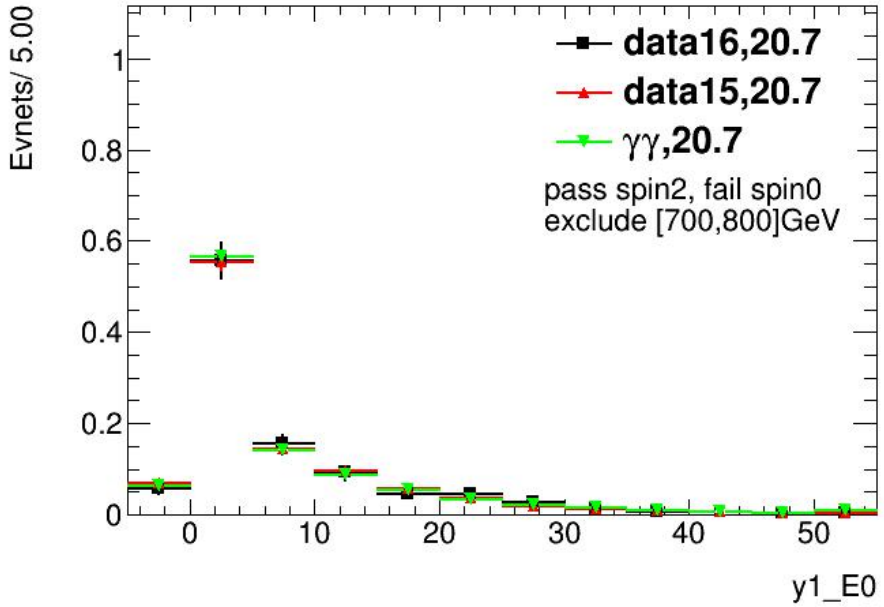




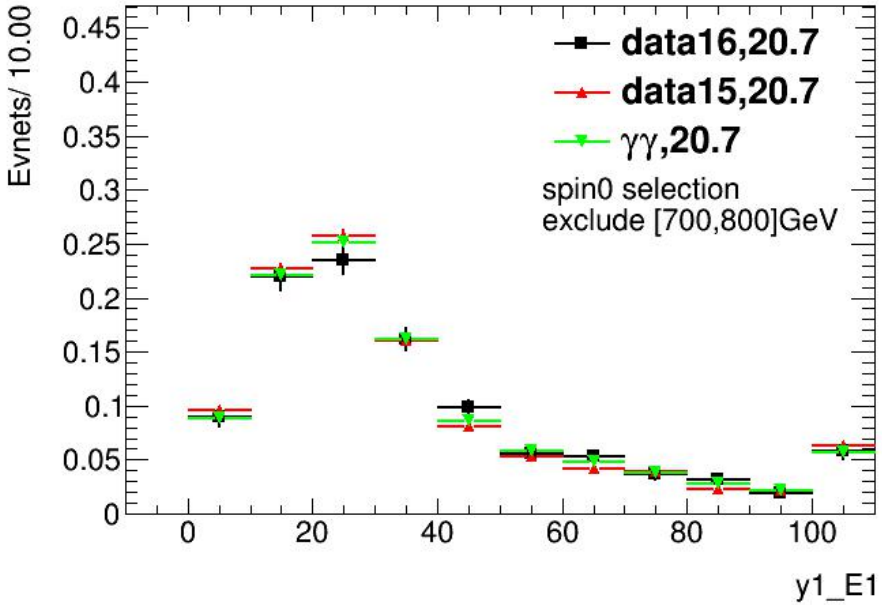
layer energy E0

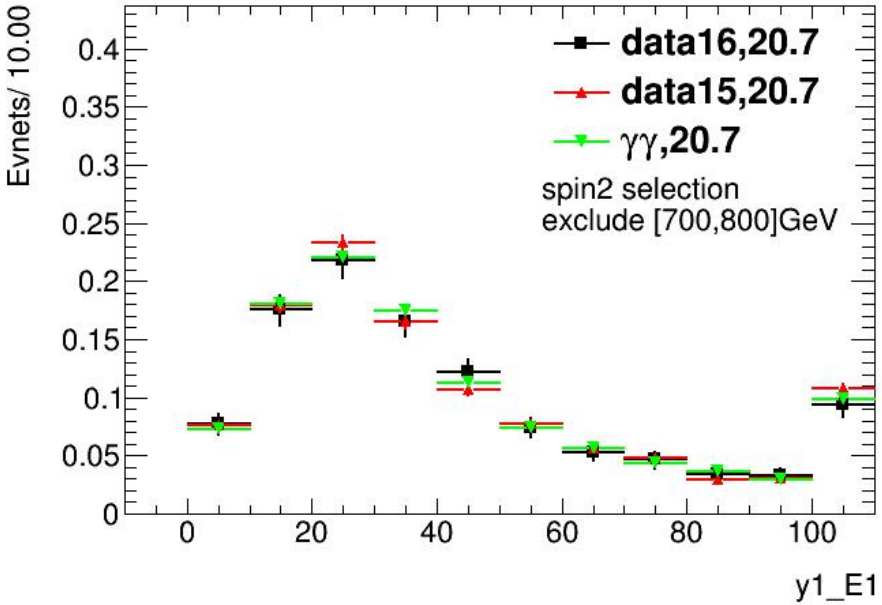


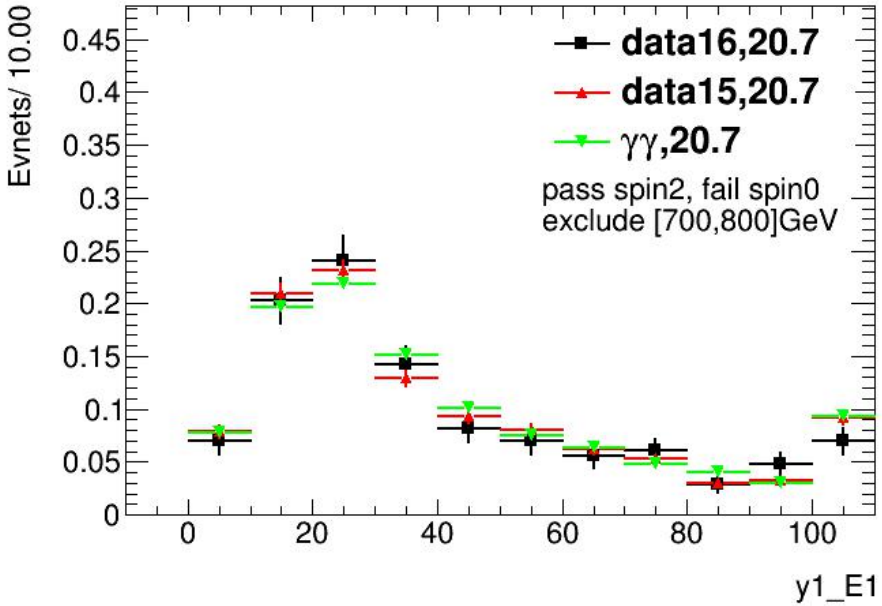




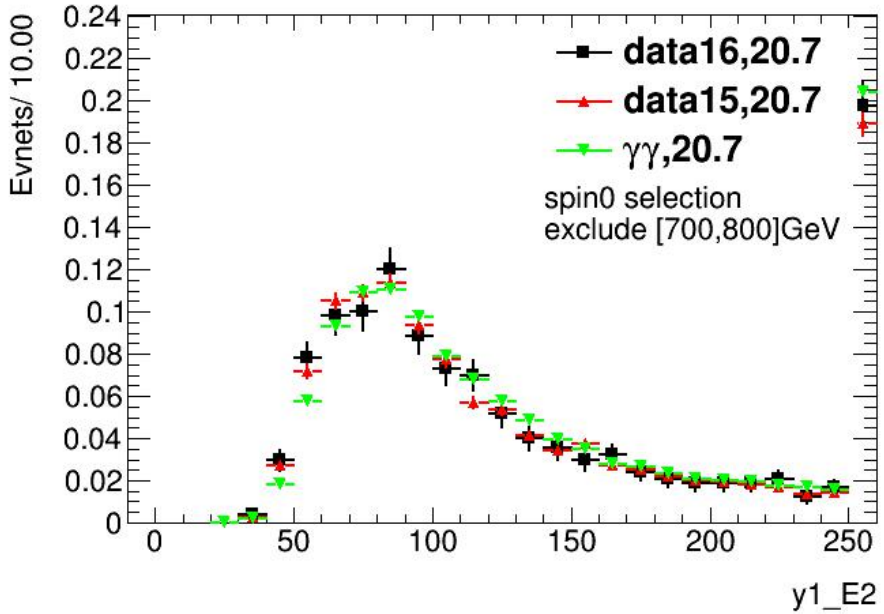
layer energy E1

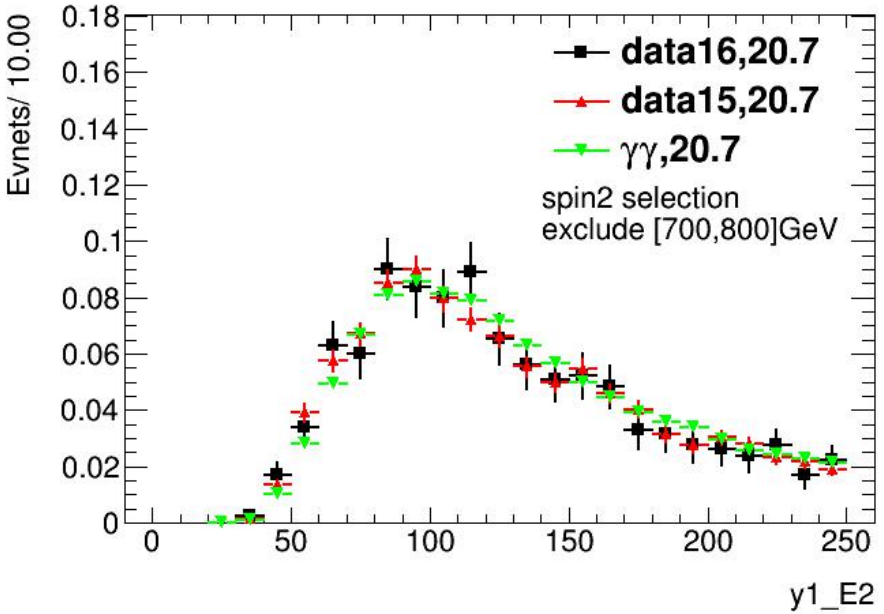


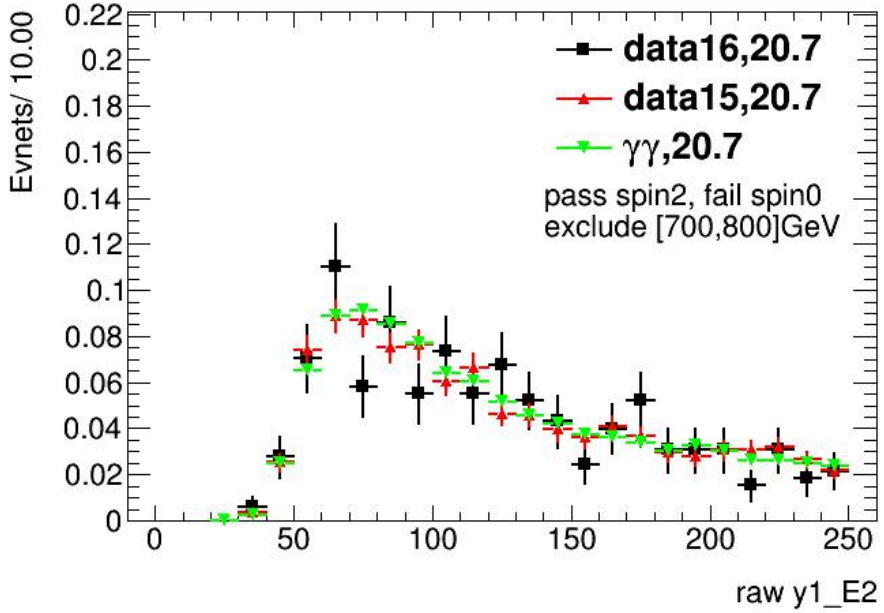




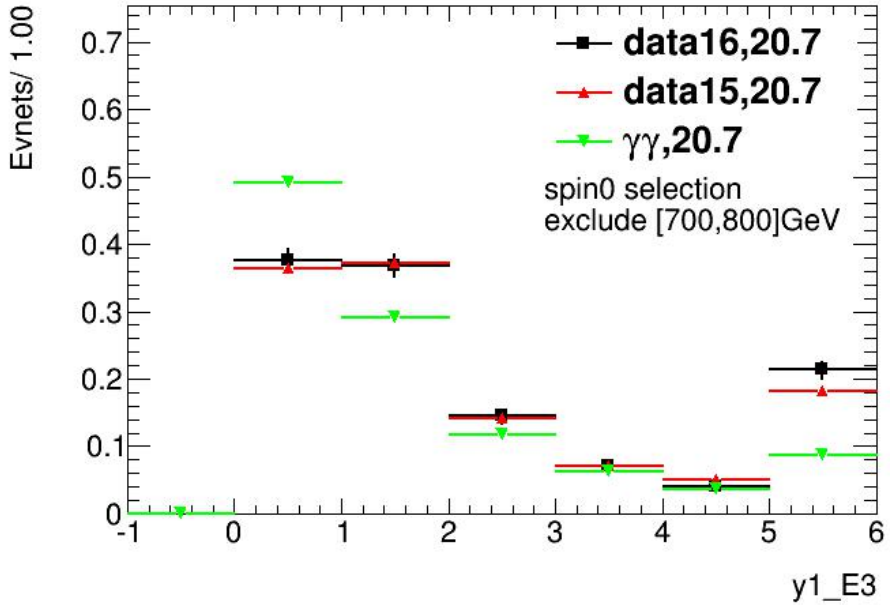
layer E2

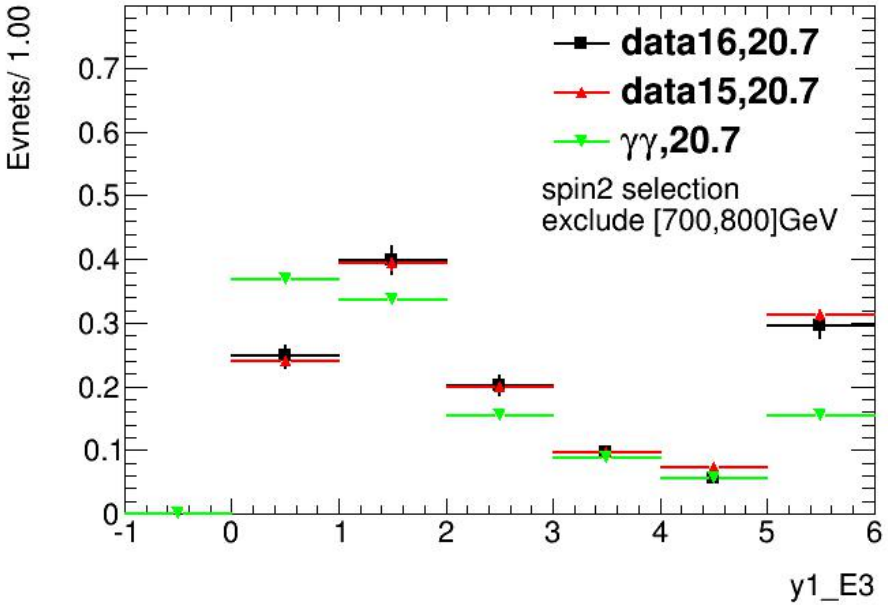

Evnets/ 10.00
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_E2

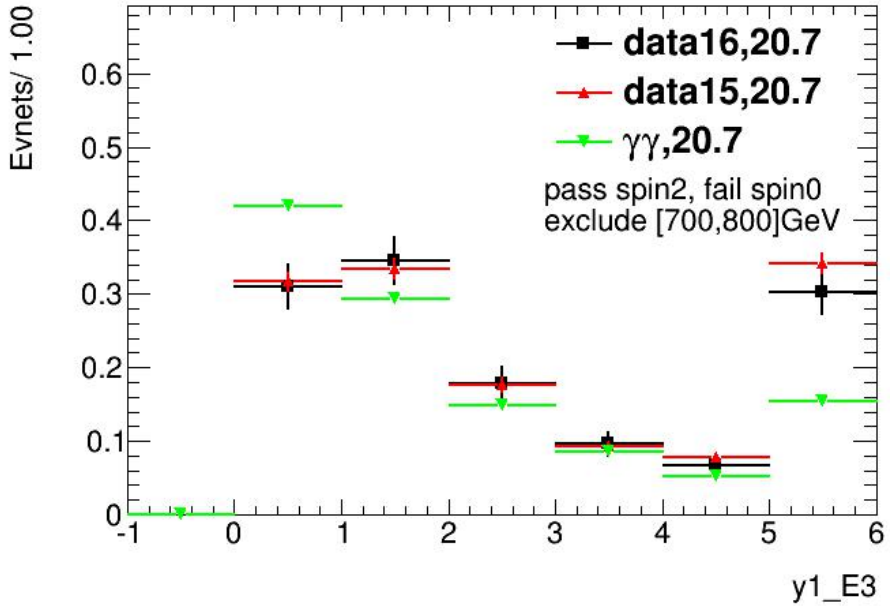

Evnets/ 10.00
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_E2


Evnets/ 10.00
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
raw y1_E2

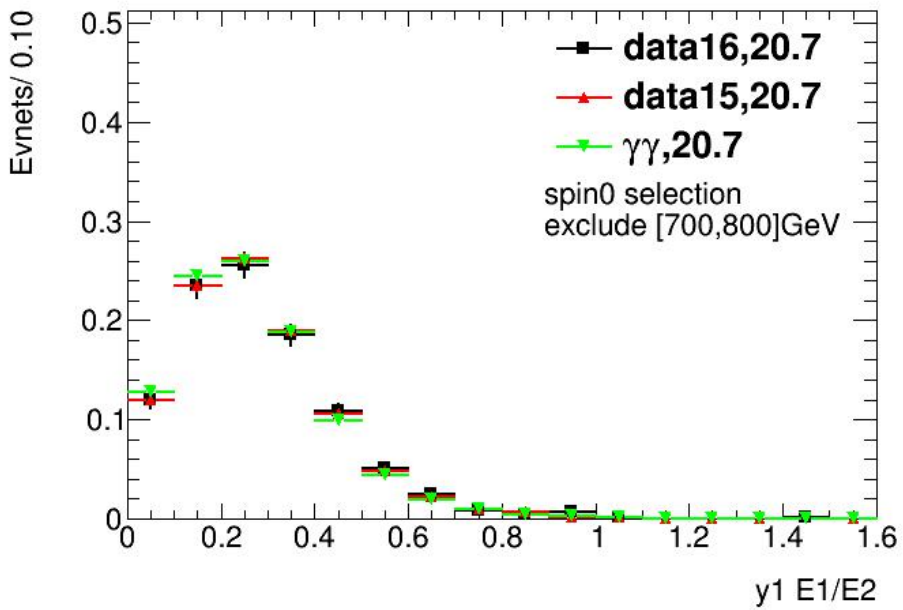
layer energy E3

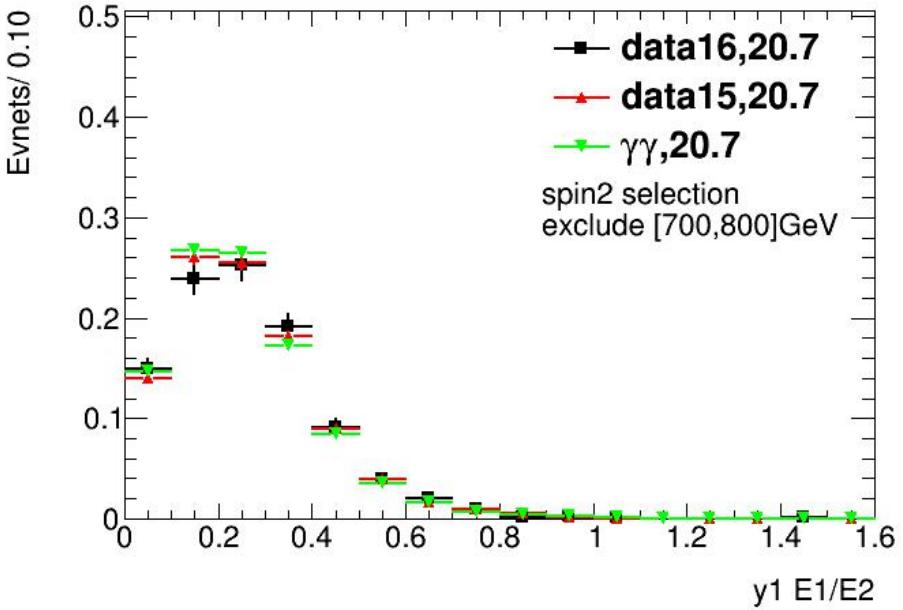


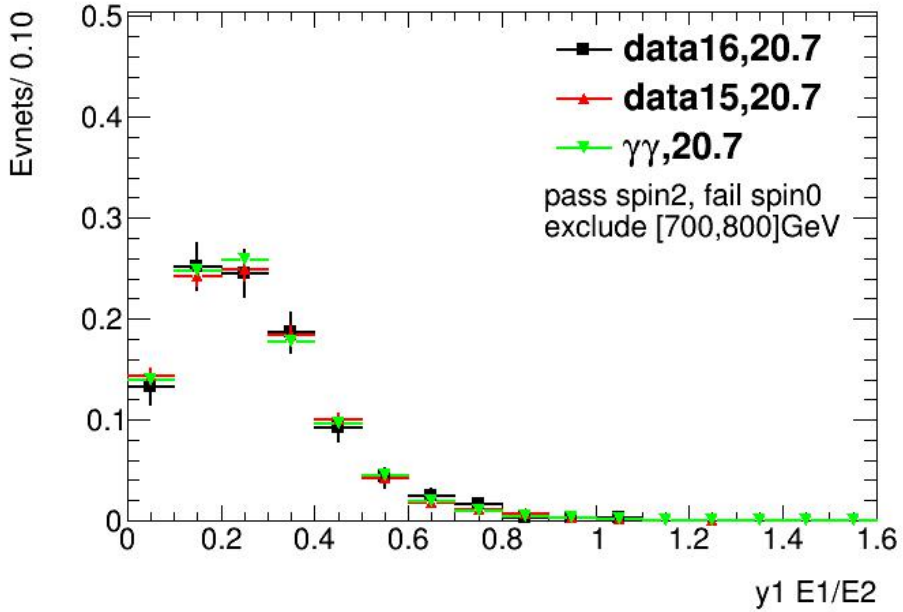




layer energy ratioE1E2







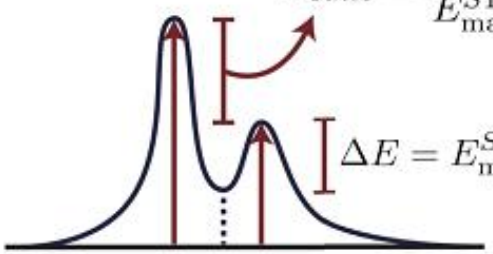
Photon identification

Variables and Position

	Strips	2nd	Had.
Ratios	f_1, f_{side}	R_η*, R_ϕ	$R_{Had.}$*
Widths	$w_{s,3}$, $w_{s,tot}$	$w_{\eta,2}$*	-
Shapes	ΔE, E_{ratio}	* Used in PhotonLoose.	

Shower Shapes

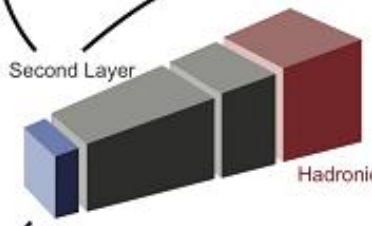
$$E_{ratio} = \frac{E^{S1}_{max,1} - E^{S1}_{max,2}}{E^{S1}_{max,1} + E^{S1}_{max,2}}$$



Energy Ratios

$$R_\eta = \frac{E^{S2}_{3\times7}}{E^{S2}_{7\times7}}$$

$$R_\phi = \frac{E^{S2}_{3\times3}}{E^{S2}_{3\times7}}$$



$$R_{Had} = \frac{E^{Had}_T}{E_T}$$

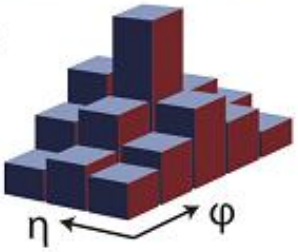
$$f_1 = \frac{E_{S1}}{E_{Tot.}}$$

$$f_{side} = \frac{E^{S1}_{7\times1} - E^{S1}_{3\times1}}{E^{S1}_{3\times1}}$$

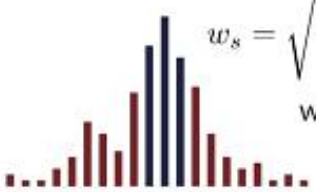
Widths

$$w_{\eta,2} = \sqrt{\frac{\sum E_i \eta_i^2}{\sum E_i} - \left(\frac{\sum E_i \eta_i}{\sum E_i}\right)^2}$$

Width in a 3×5 (Δη×Δφ) region of cells in the second layer.

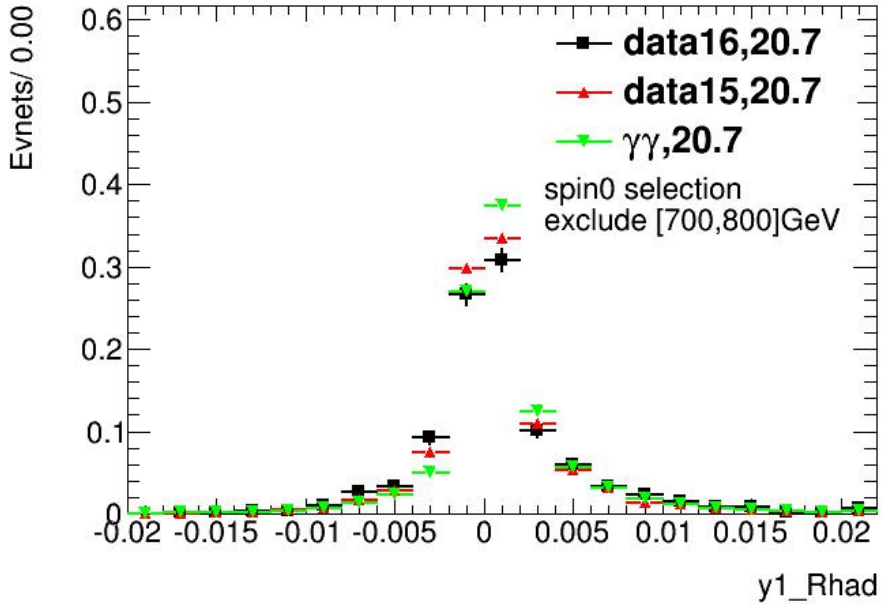


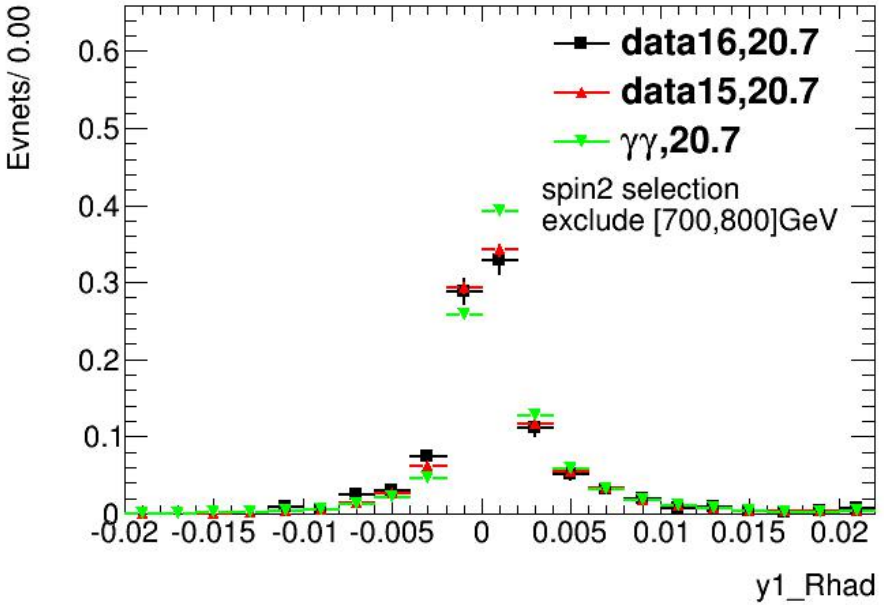
$$w_s = \sqrt{\frac{\sum E_i (i - i_{max})^2}{\sum E_i}}$$

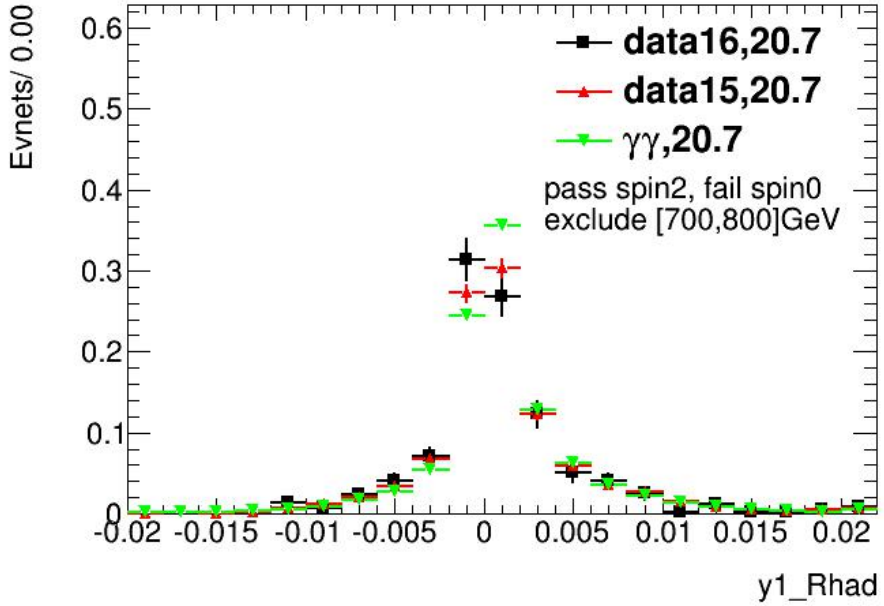


ws3 = w_1 uses ±1 strips (three total); wstot is defined similarly, but uses 20×2 strips.

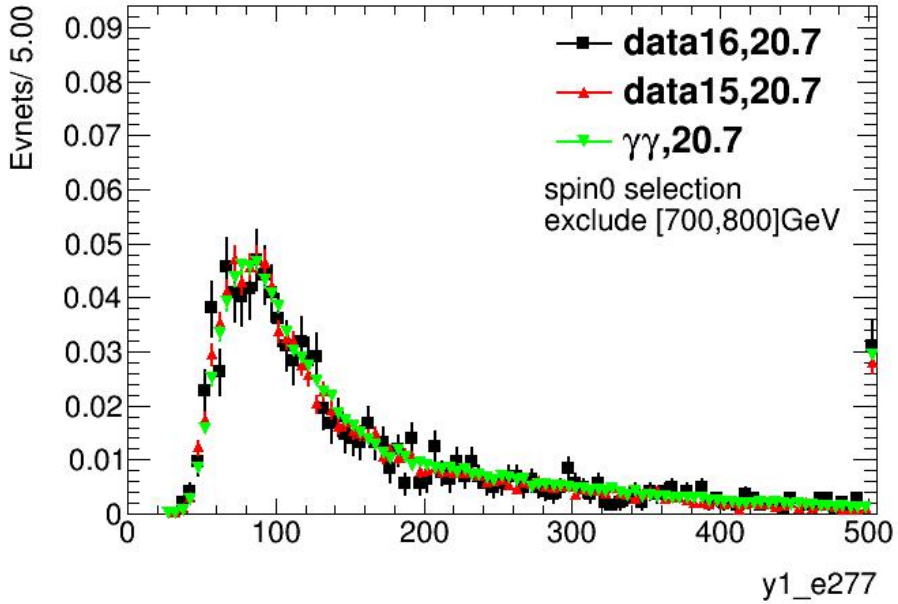
ID Rhad

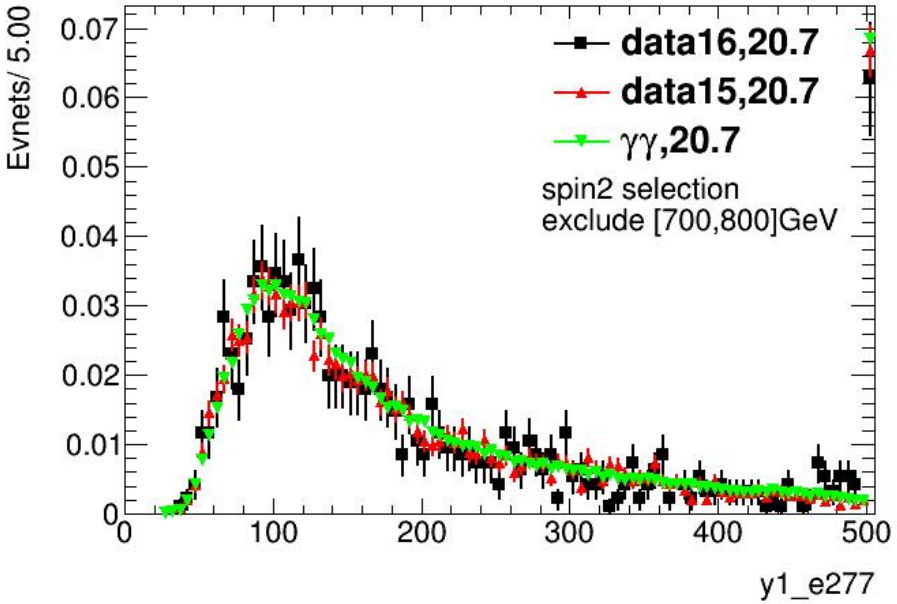

Evnets/ 0.00
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_Rhad

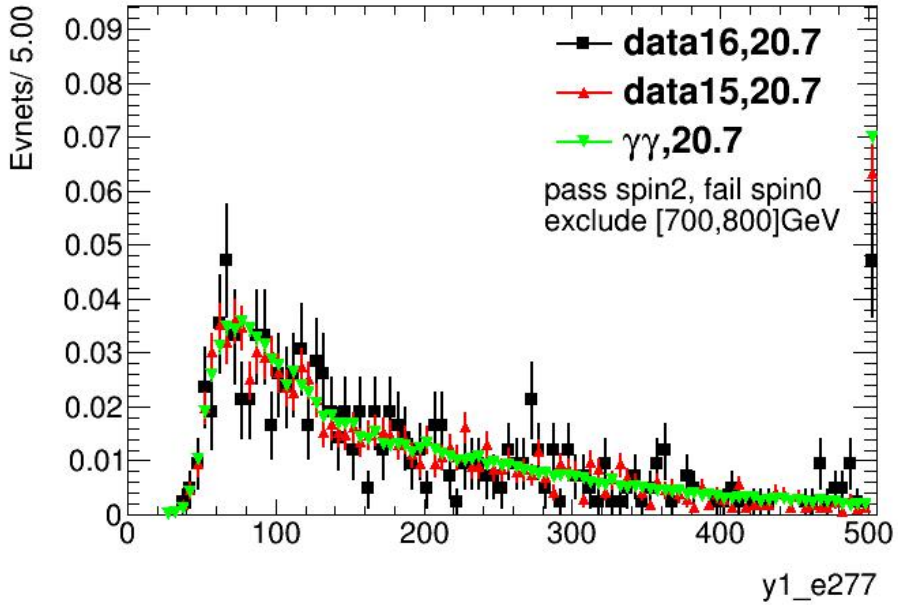

Evnets/ 0.00
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_Rhad


Evnets/ 0.00
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_Rhad

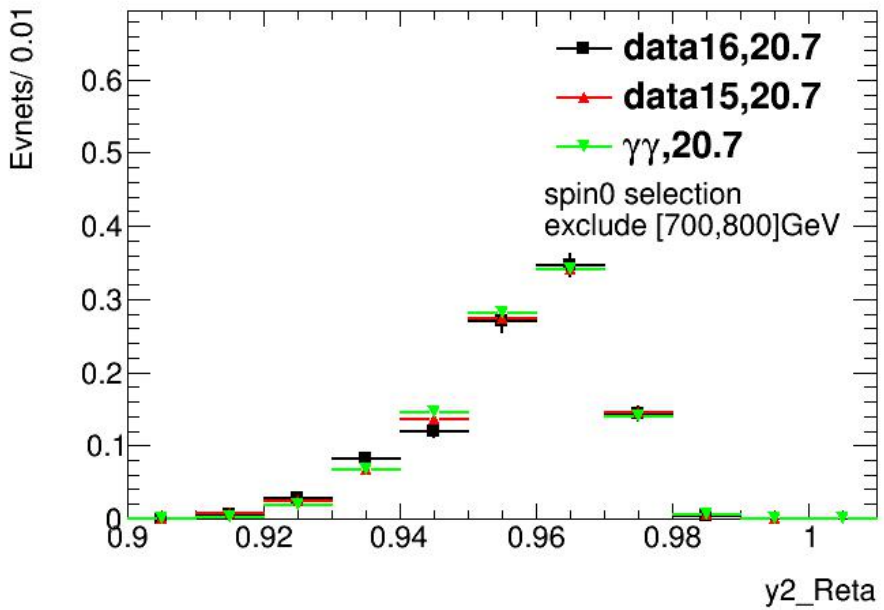
ID e277

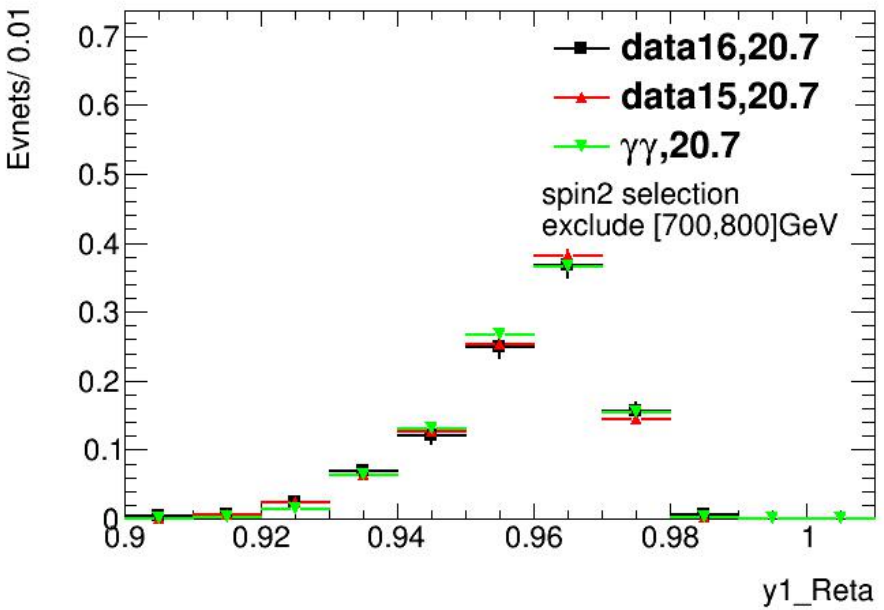

Evnets/ 5.00
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_e277

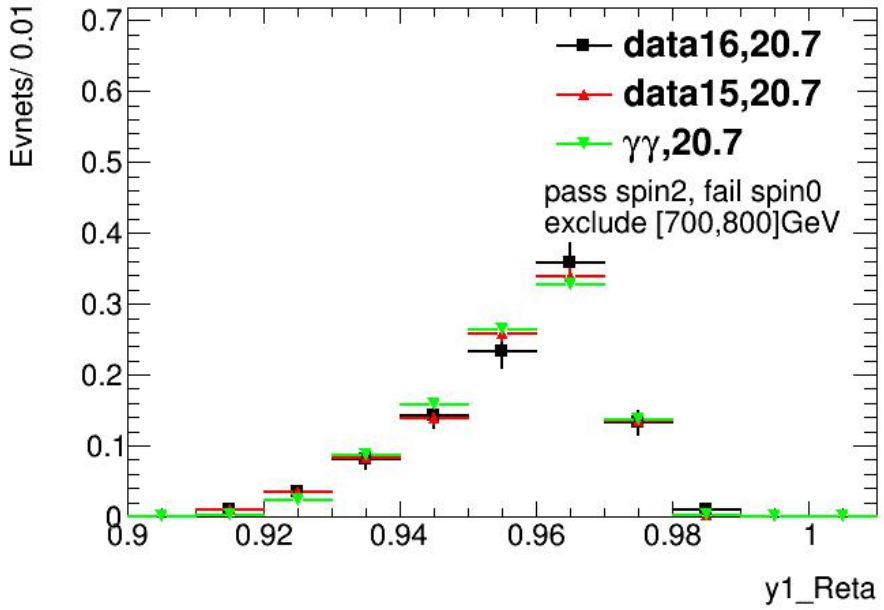

Evnets/ 5.00
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_e277


Evnets/ 5.00
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_e277

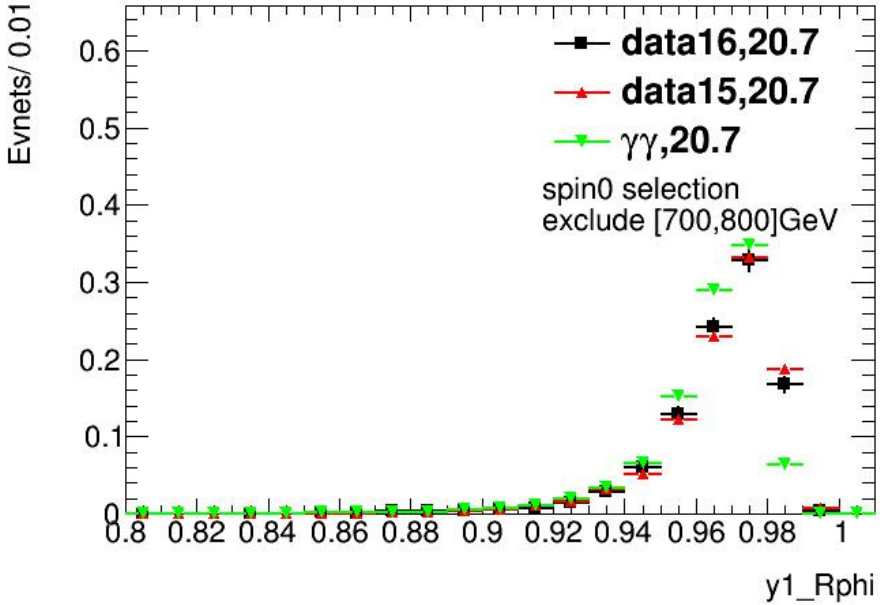
ID Reta

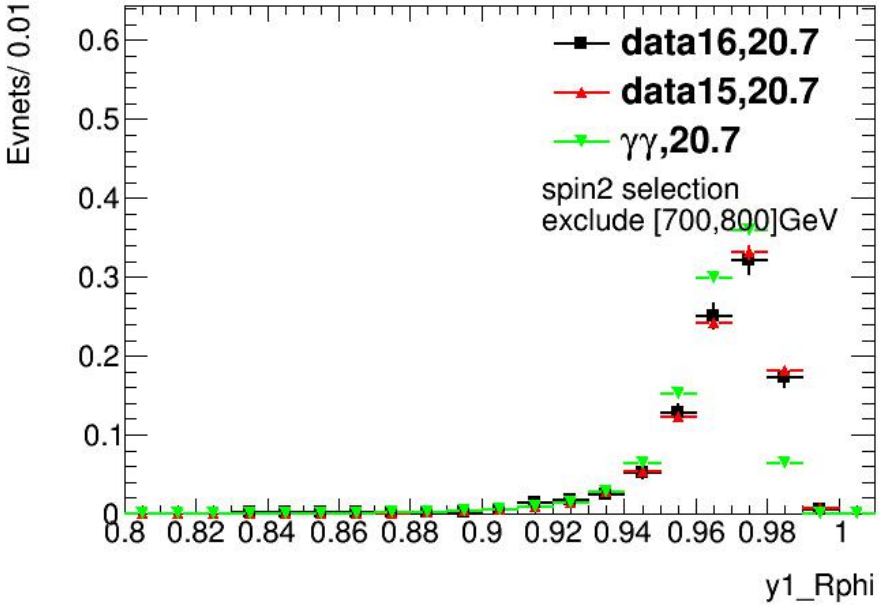

Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y2_Reta

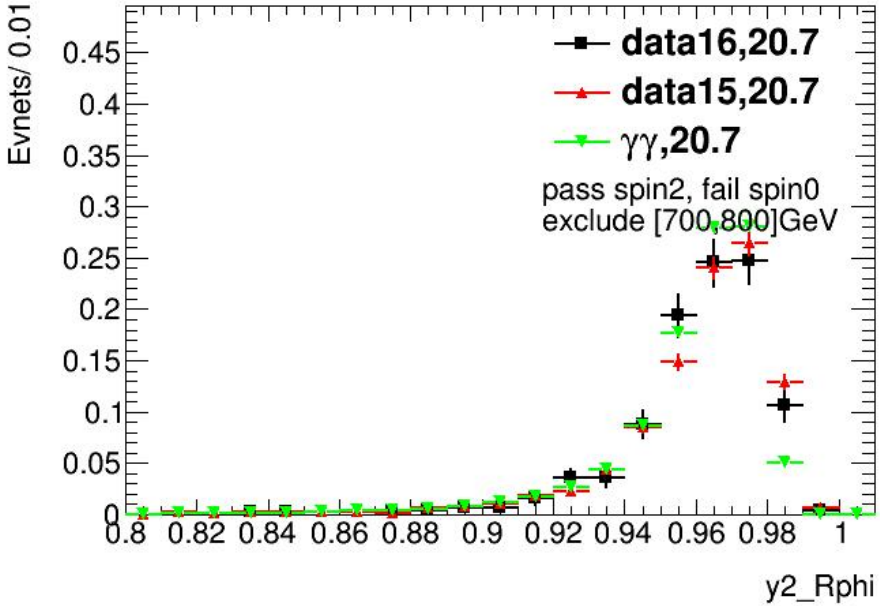

Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_Reta


Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_Reta

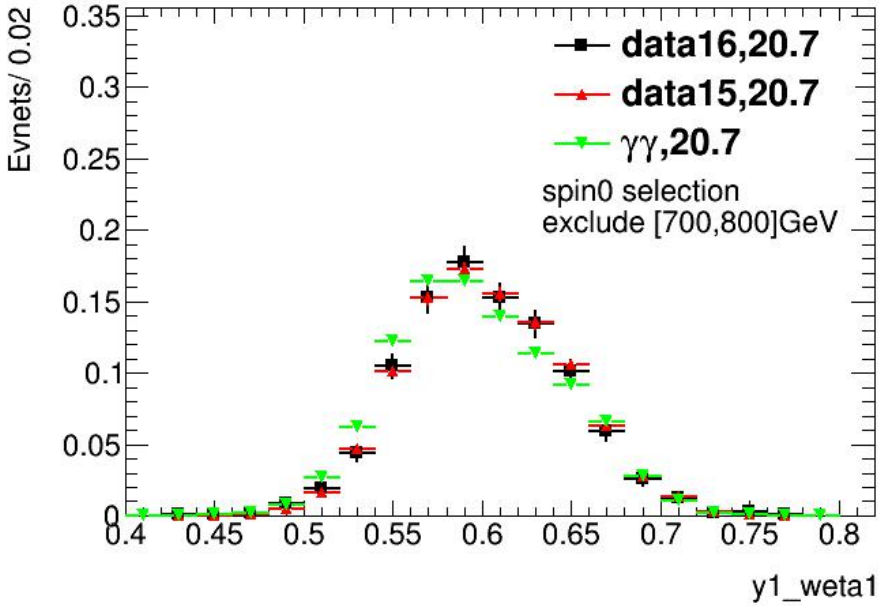
ID Rphi

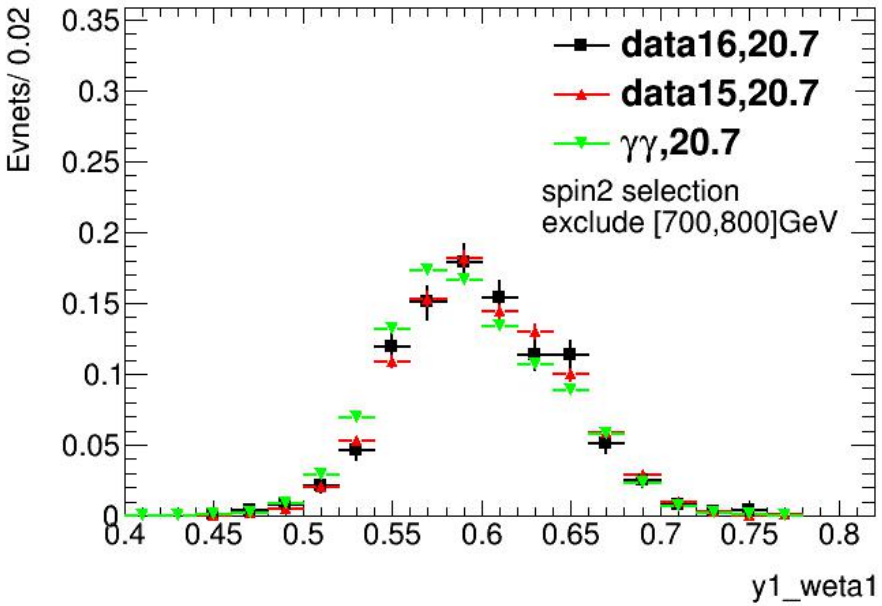

Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_Rphi

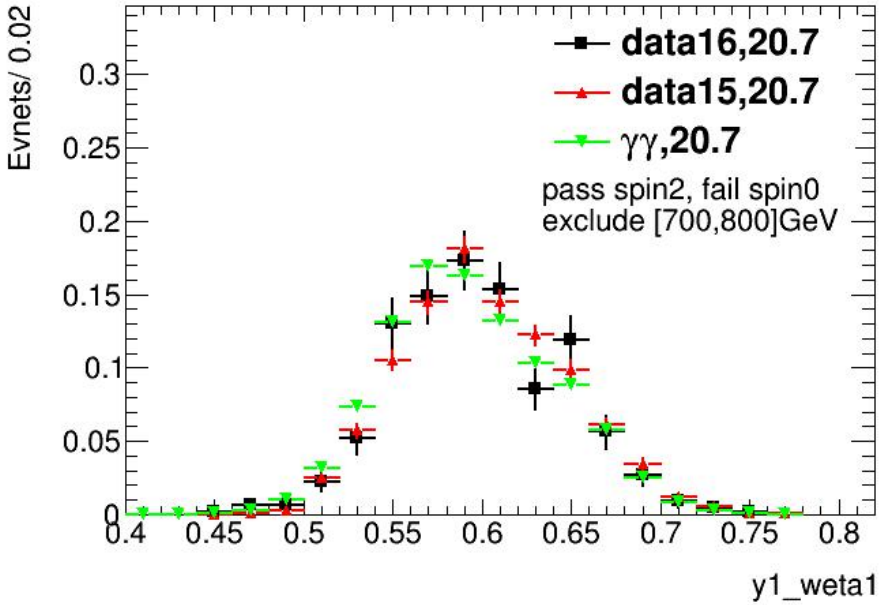

Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_Rphi


Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y2_Rphi

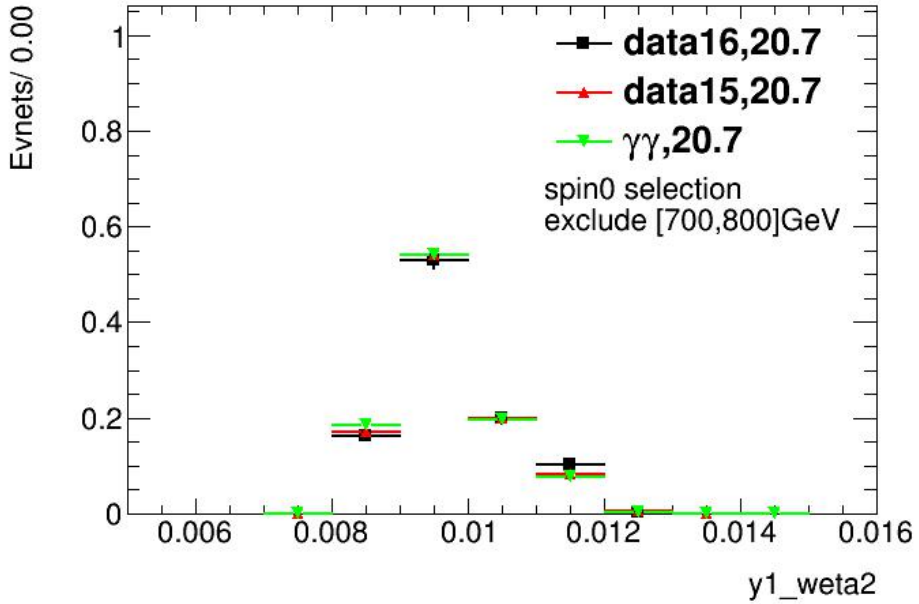
ID weta1

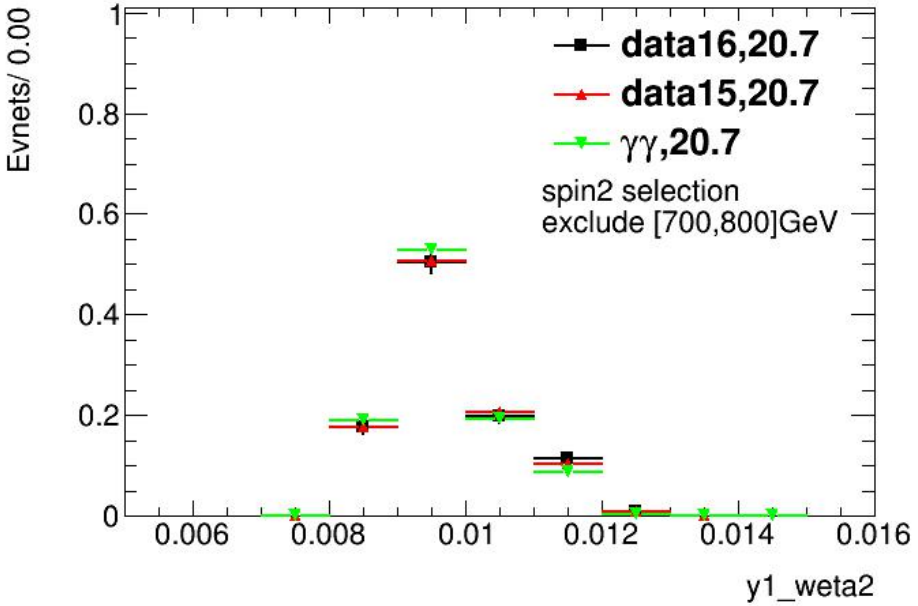

Evnets/ 0.02
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_weta1

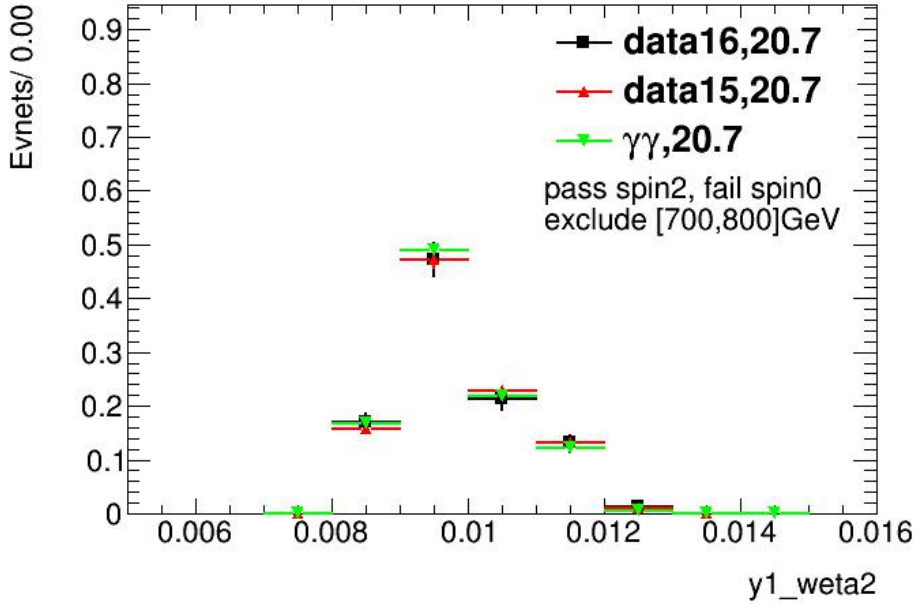

Evnets/ 0.02
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_weta1


Evnets/ 0.02
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_weta1

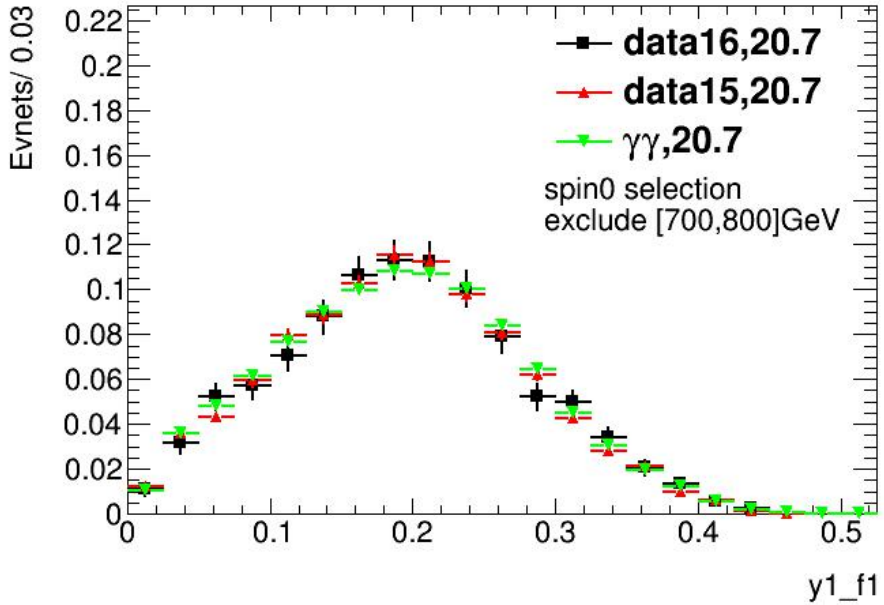
ID weta2

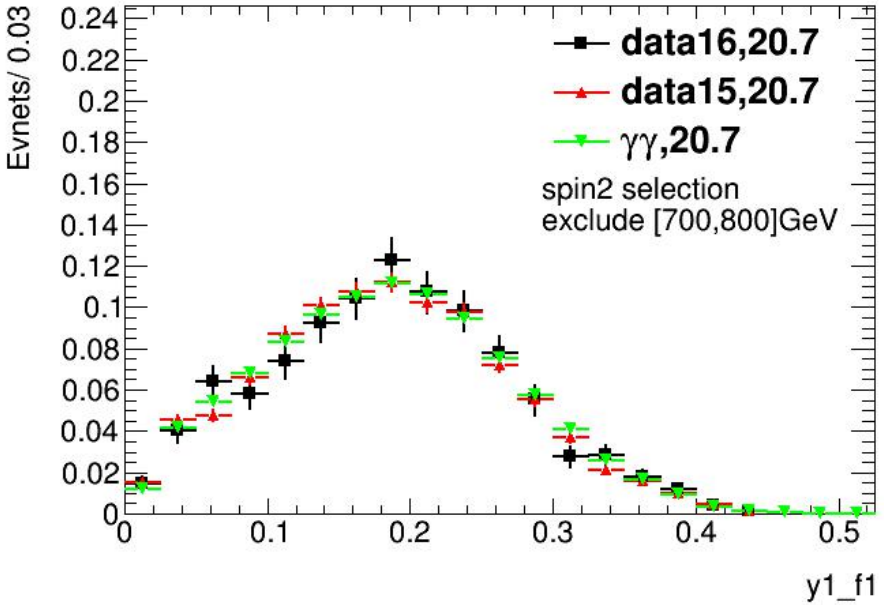

Evnets/ 0.00
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_weta2

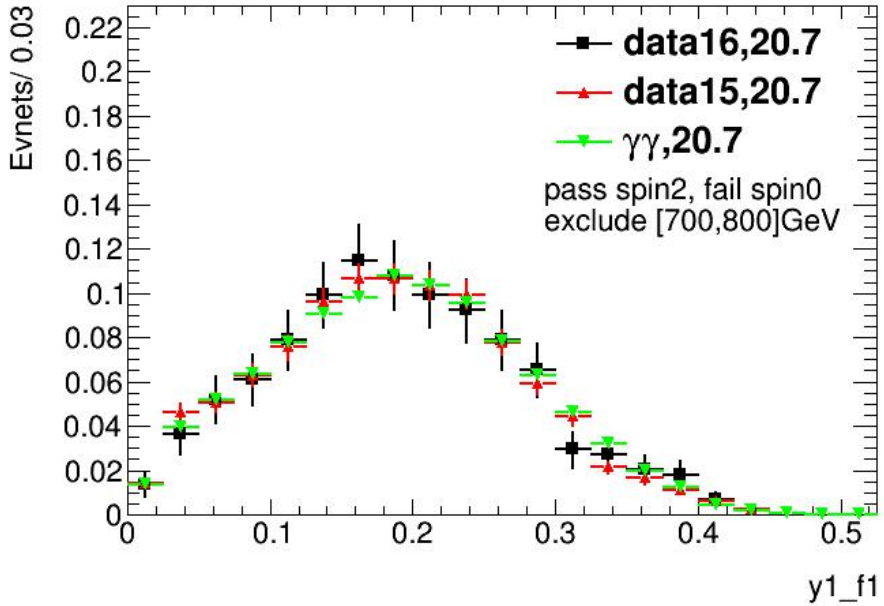

Evnets/ 0.00
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_weta2


Evnets/ 0.00
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_weta2

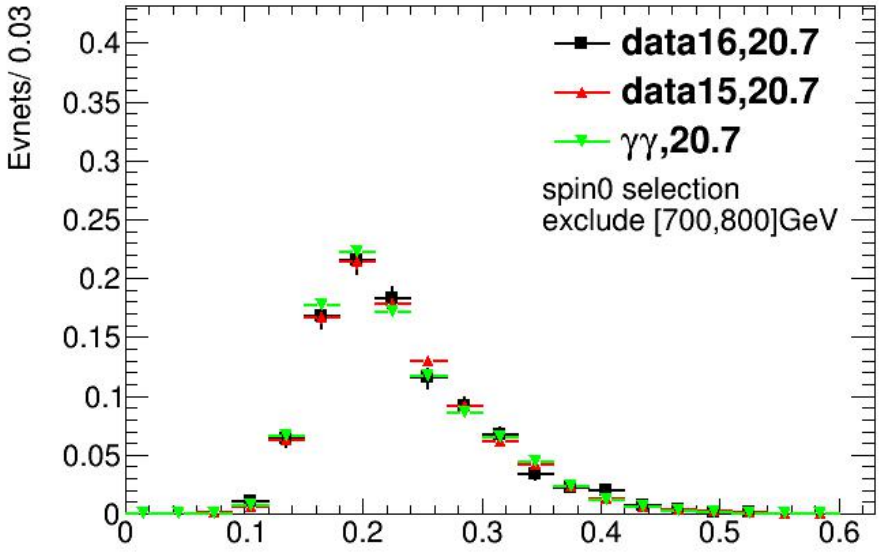
ID f1

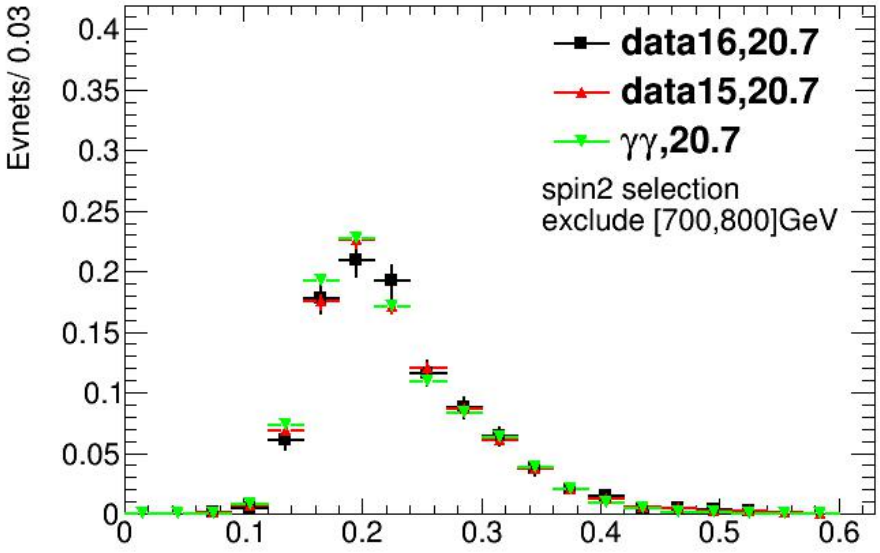

Evnets/ 0.03
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_f1

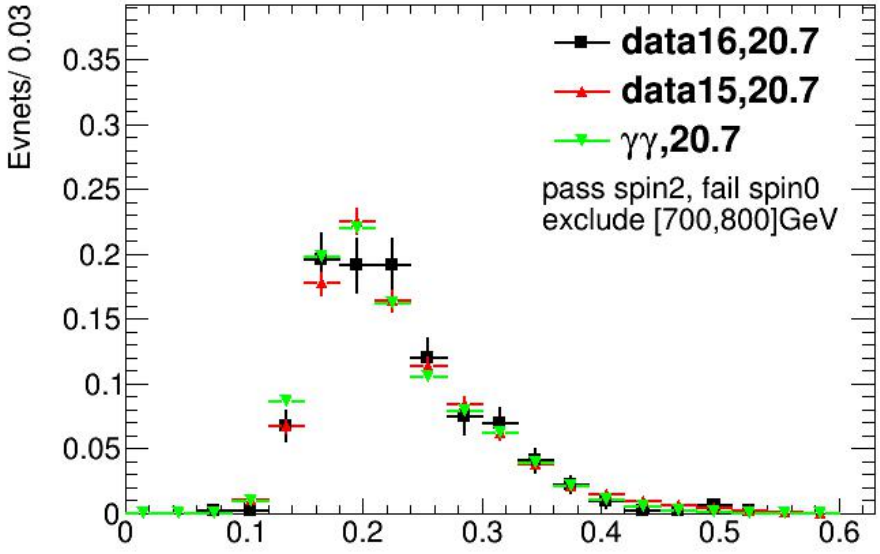

Evnets/ 0.03
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_f1


Evnets/ 0.03
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_f1

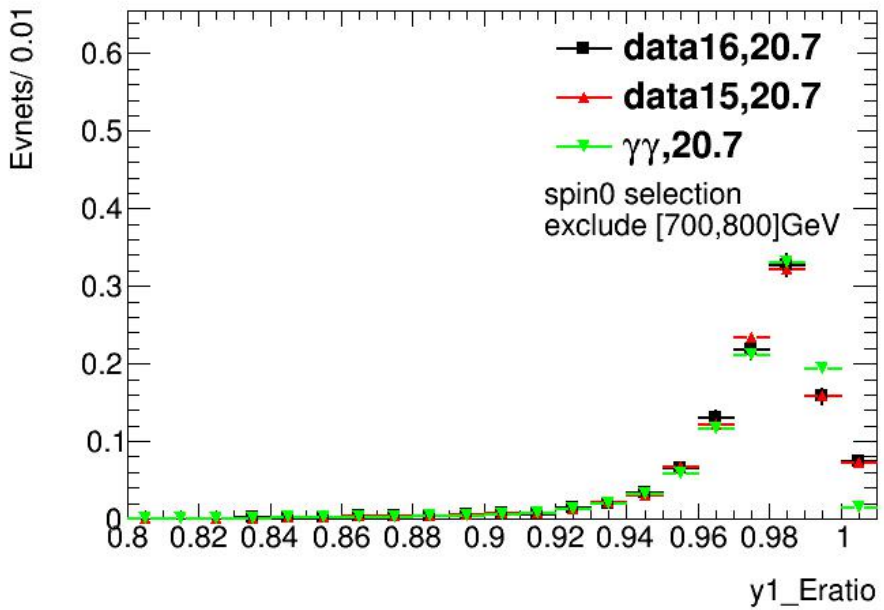
ID fside

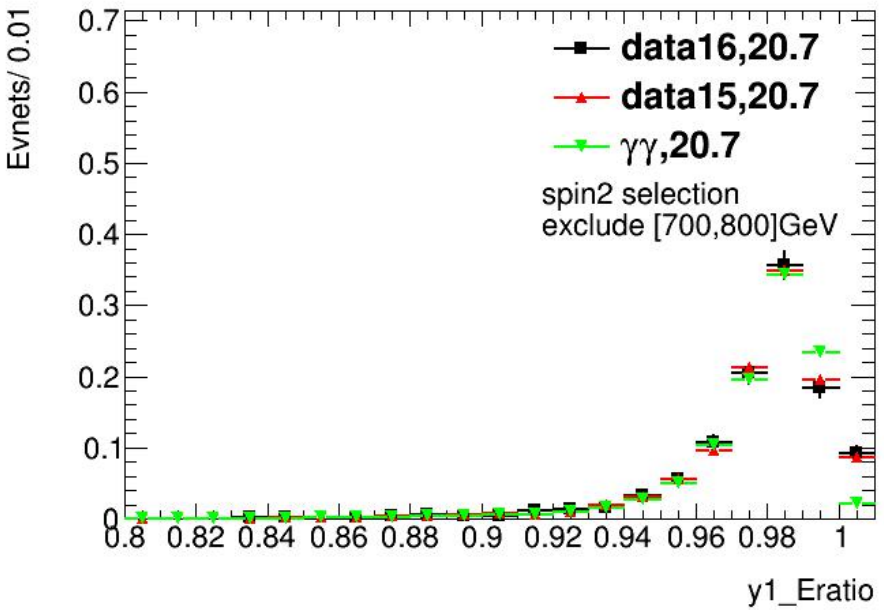

Evnets/ 0.03
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV

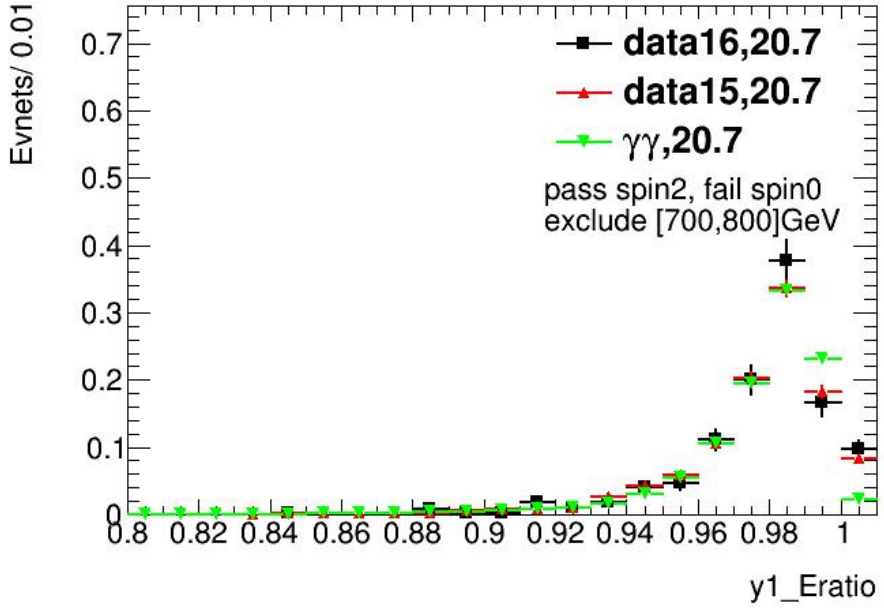

Evnets/ 0.03
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV


Evnets/ 0.03
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV

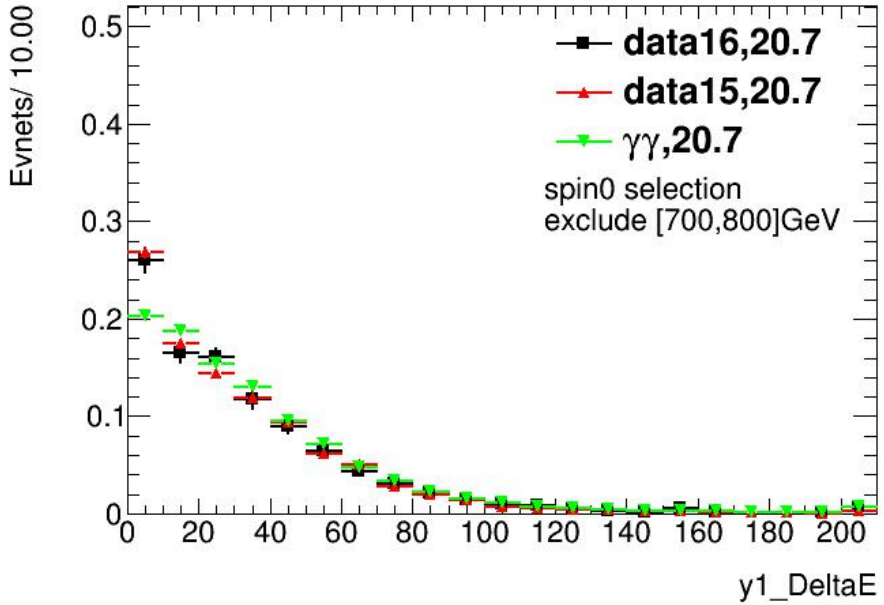
ID Eratio

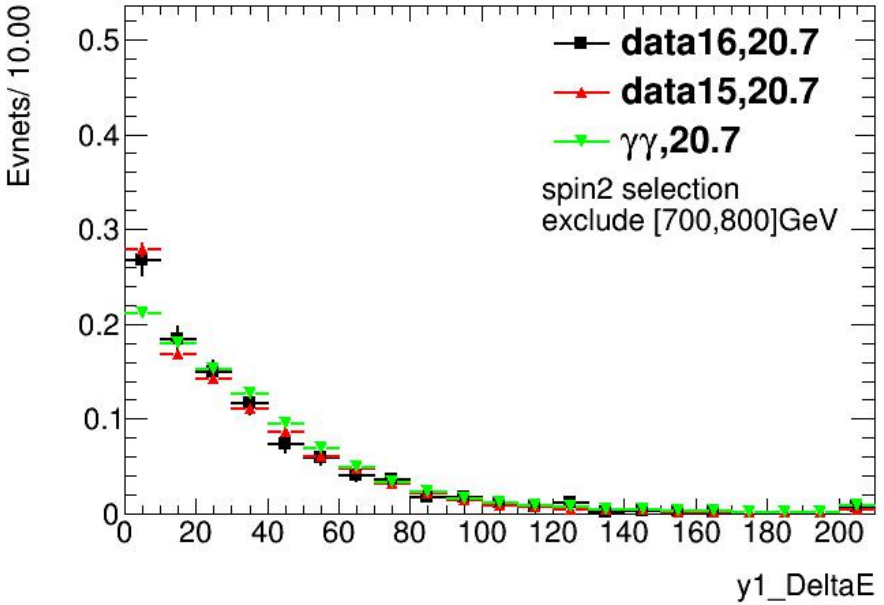

Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_Eratio

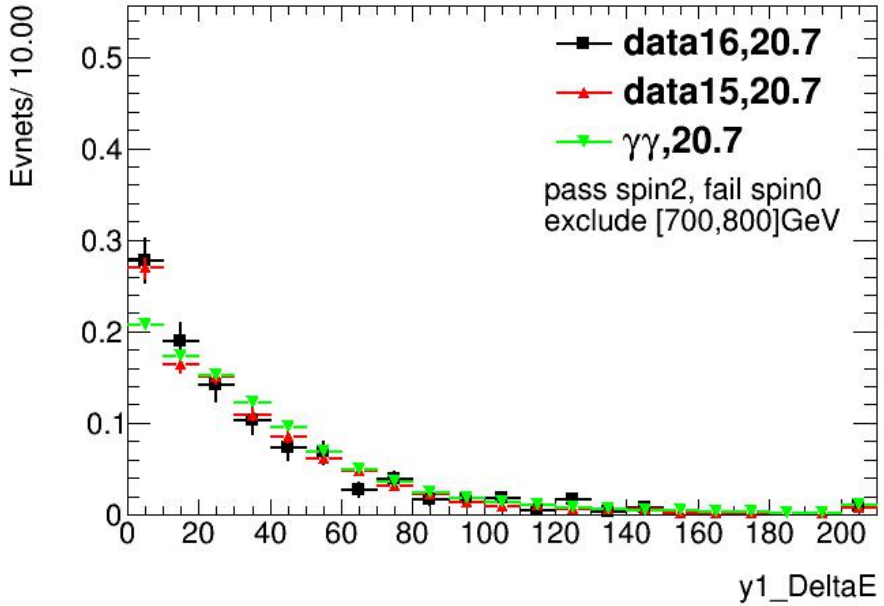

Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_Eratio


Evnets/ 0.01
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_Eratio

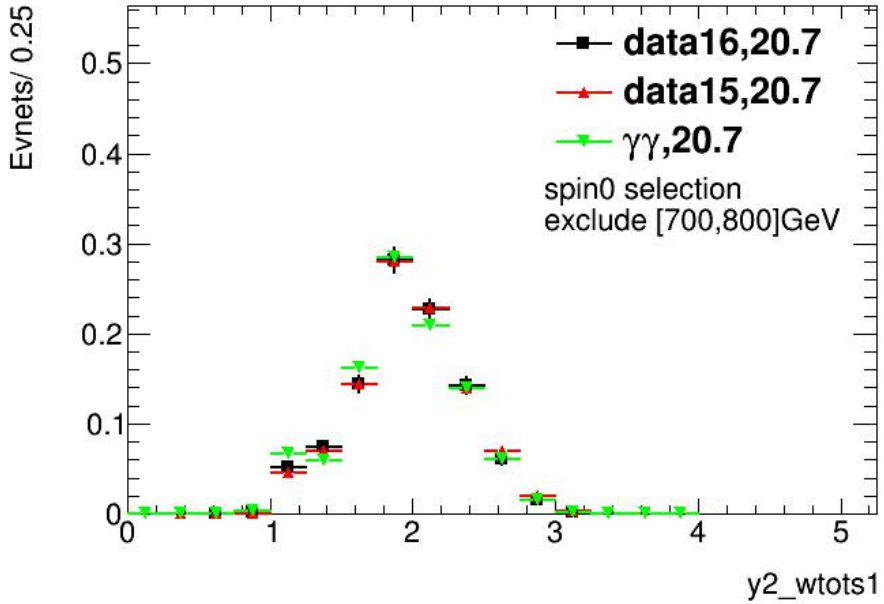
ID DeltaE

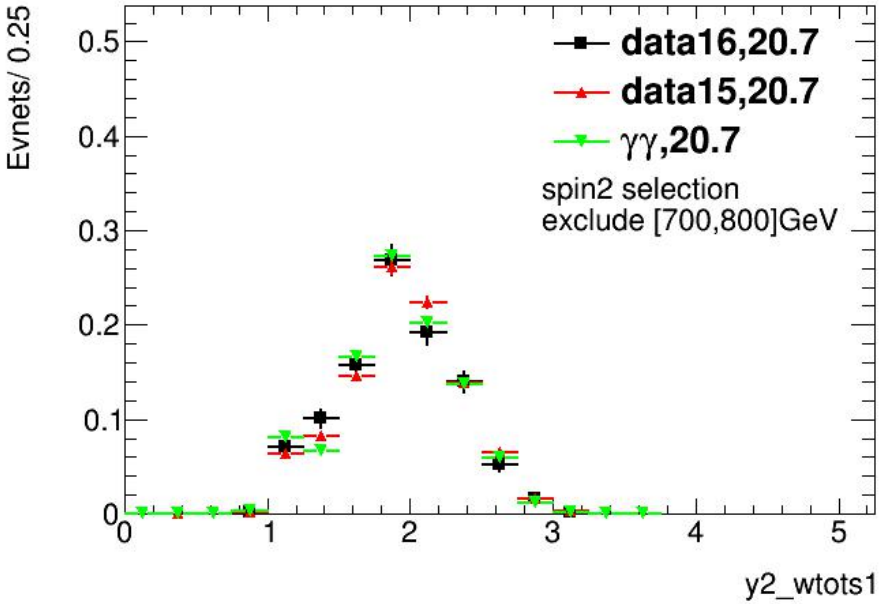

Evnets/ 10.00
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y1_DeltaE

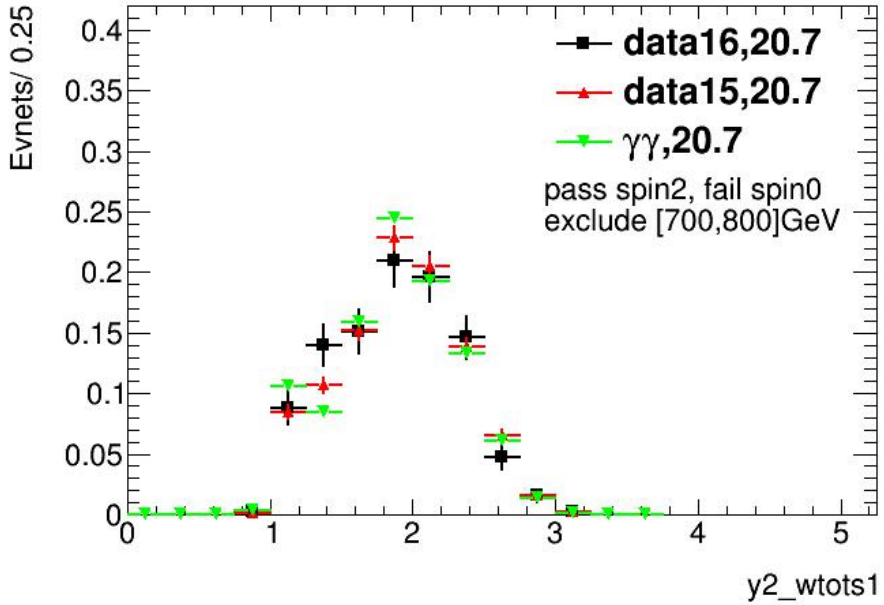

Evnets/ 10.00
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y1_DeltaE


Evnets/ 10.00
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y1_DeltaE

ID wtots1


Evnets/ 0.25
data16,20.7
data15,20.7
γγ,20.7
spin0 selection
exclude [700,800]GeV
y2_wtots1


Evnets/ 0.25
data16,20.7
data15,20.7
γγ,20.7
spin2 selection
exclude [700,800]GeV
y2_wtots1

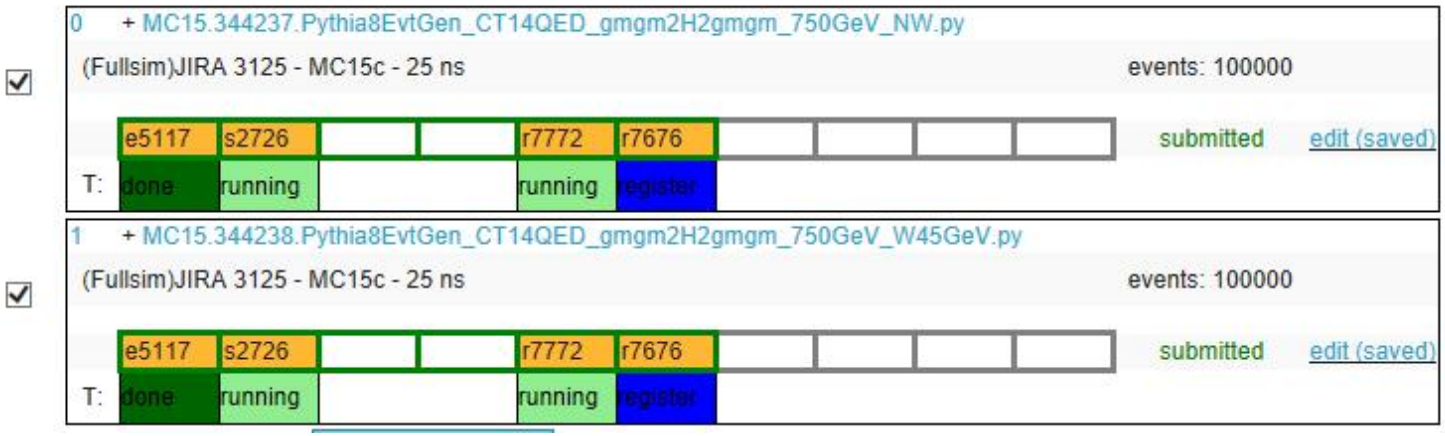

Evnets/ 0.25
data16,20.7
data15,20.7
γγ,20.7
pass spin2, fail spin0
exclude [700,800]GeV
y2_wtots1

Summary

- Many plots are not shown here!
- statistic may be not enough in each eta region
- need more time to organize, digest and conclude the results
- need to compare 20.1 and 20.7 2015 data
- check more control region.

poton photon fusion model

- mc request



- plan
  - based on 2015 baseline spin0 analysis
  - 2jet VBF-like cut-base:j1_pt, j2_pt, mjj
  - 0jet, 1jet :pTyy?
  - statistic will be a challenge
  - spin2 analysis?

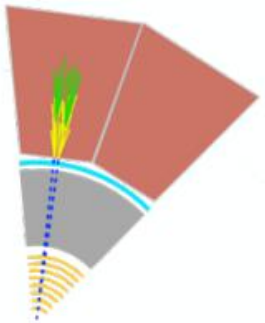
efforts from other group

- H->aa->multiphotons---they need to tunning the ID
- https://twiki.cern.ch/twiki/bin/view/AtlasProtected/NSDiphoton13TeV
- request MC

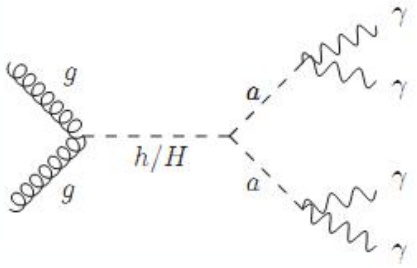
Multi-photon / diphoton

Multi-photon BSM final states can yield diphoton events

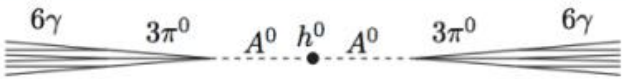
- Low-mass resonances can be highly boosted, leading to completely collimated groupings of photons that appear as one photon in the detector



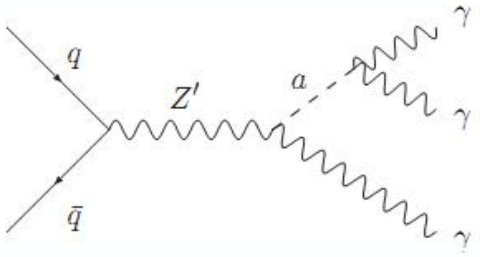
- H —> aa —> 4γ



- H —> aa —> $6\pi^0$



- Z′ —> a+γ —> 3γ



- For 700 GeV < m_X < 800 GeV, m_a < 1 GeV yields single photon EM cluster

https://twiki.cern.ch/twiki/bin/view/AtlasProtected/NSDiphoton13TeV

resolved Z(qq)γ

- prepare a detailed cutflow to cross-check with Cyril
- prepare to do cut-based study with TMVA package
- from my feeling, it is hard to further optimize, but can try
- some personal concerns
  - SF ~1.4 is used to normalize yjj mc to data
    - how to verify yjj is dominant if you don't trust the Xsec
  - any plan for LWA?
  - spin2 is suppressed?
  - Cyril : what is the time scale?