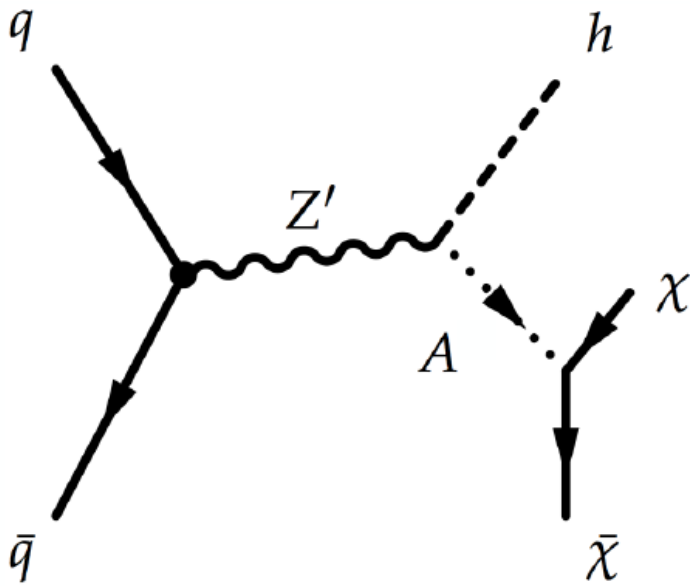


# Validation of CMS-EXO-16-012 with MA5

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# Model & Process



- A Type-2 2HDM is used to formulate the Higgs sector.
- $H \rightarrow b \bar{b}$  channel
- $H \rightarrow \gamma \gamma$  channel
- Higgs could be boosted or resolved.

# Benchmark & SR

- (i) the pseudoscalar mass
- (ii) the DM mass(100GeV)
- (iii) the  $Z'$  mass
- (iv)  $\tan \beta (=1)$
- (v) the  $Z'$  coupling strength ( $=0.8$ )
- (vi) the coupling between the A and DM particles ( $=1$ )
- $Z'$  resonance with mass between 600 and 2500 GeV.
- A with mass between 300 and 800 GeV.

# Setup of Pythia & Delphes

- The pythia settings are then retrieved from the CMS software github
- Repository:
- Pythia8CUEP8M1Settins
- Pythia8CommonSettins.
- Set higgs decay to diphoton 100%.
- For detector simulation, we used Delphes 3 with latest version of delphes card used for CMS-EXO-16-012 recasting.
- Add DM candidate in section EnergyFraction.

# Cutflow Conditions

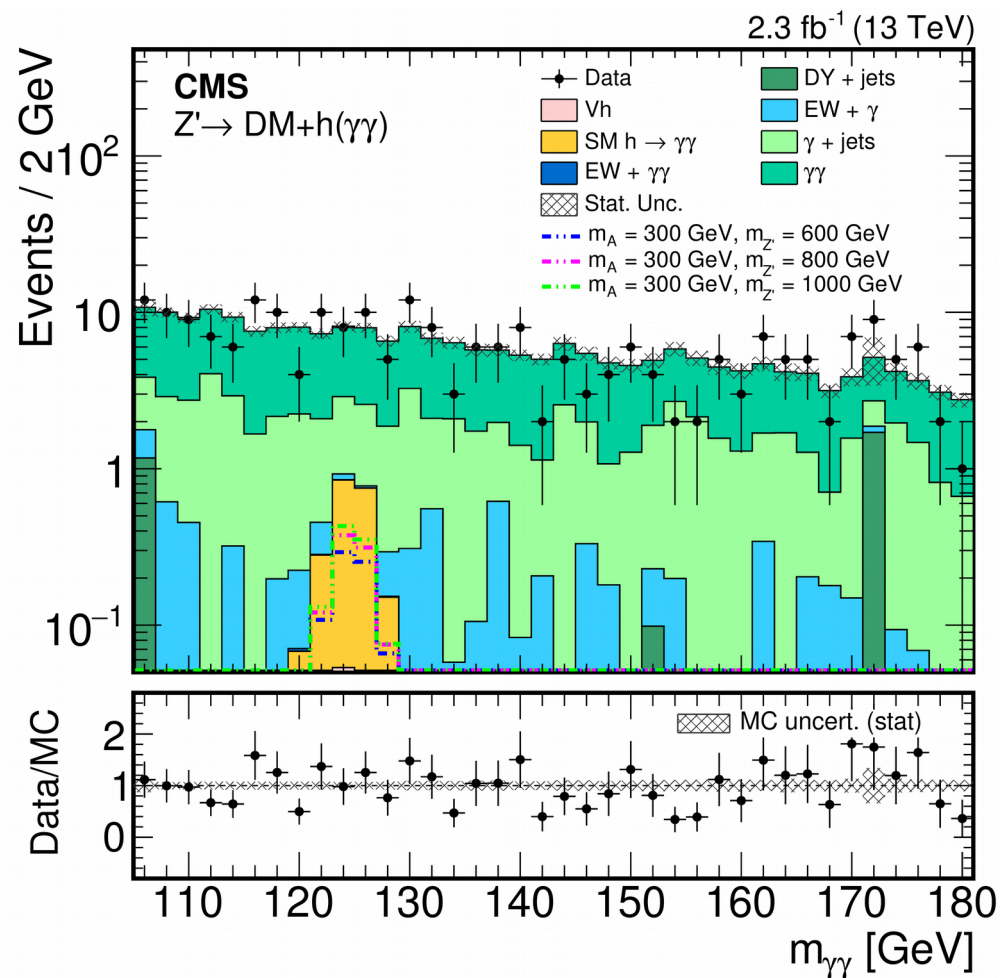
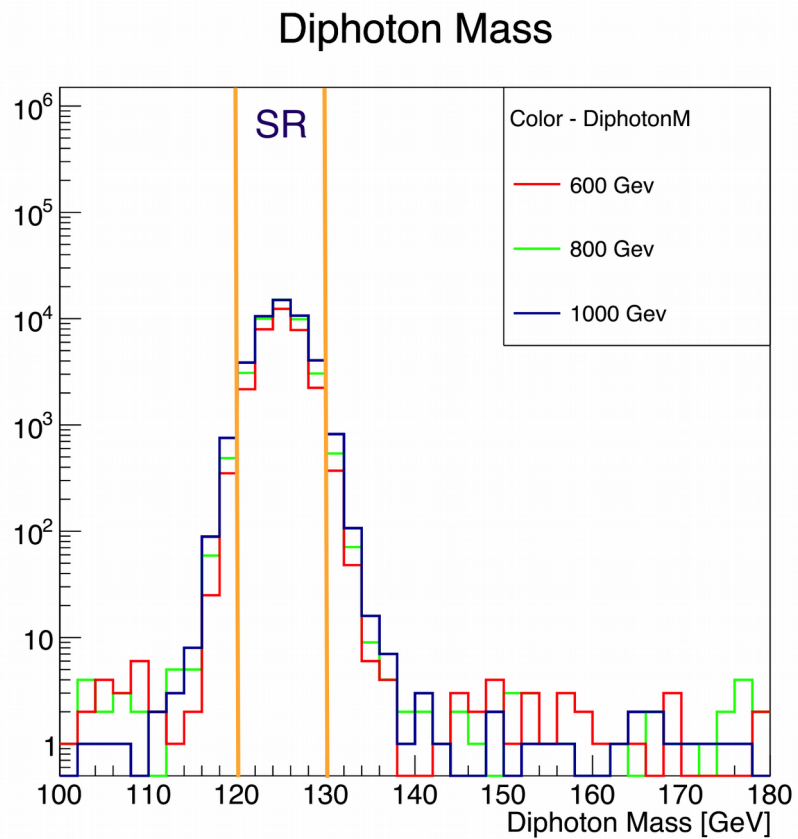
Variable	Barrel Selection	Endcap Selection
H/E		<0.1
Iso <sub>ch</sub> [GeV]	< 3.32	< 1.97
$\rho$ corrected Iso <sub>Neu</sub> [ GeV ]	$< 1.92 + 0.14p_T + 0.000019(p_T)^2$	$< 11.86 + 0.0139p_T + 0.000025(p_T)^2$
$\rho$ corrected Iso <sub><math>\gamma</math></sub> [ GeV ]	$< 0.81 + 0.0053p_T$	$< 0.83 + 0.0034p_T$

- The angle  $\phi$  between missing pT and diphoton should be less than 2.1
- The minimum between missing pT and reconstructed jet should be larger than 0.5.
- $p_{T\_1} / m_{\gamma\gamma} > 0.5$
- $p_{T\_2} / m_{\gamma\gamma} > 0.25$
- the two key variables that are used in this analysis to discriminate the signal from the background are  $m_{\gamma\gamma}$  and missing pT.
- We define the SR of this analysis the region with  $120 < m_{\gamma\gamma} < 130$  GeV and missing pT above 105 GeV

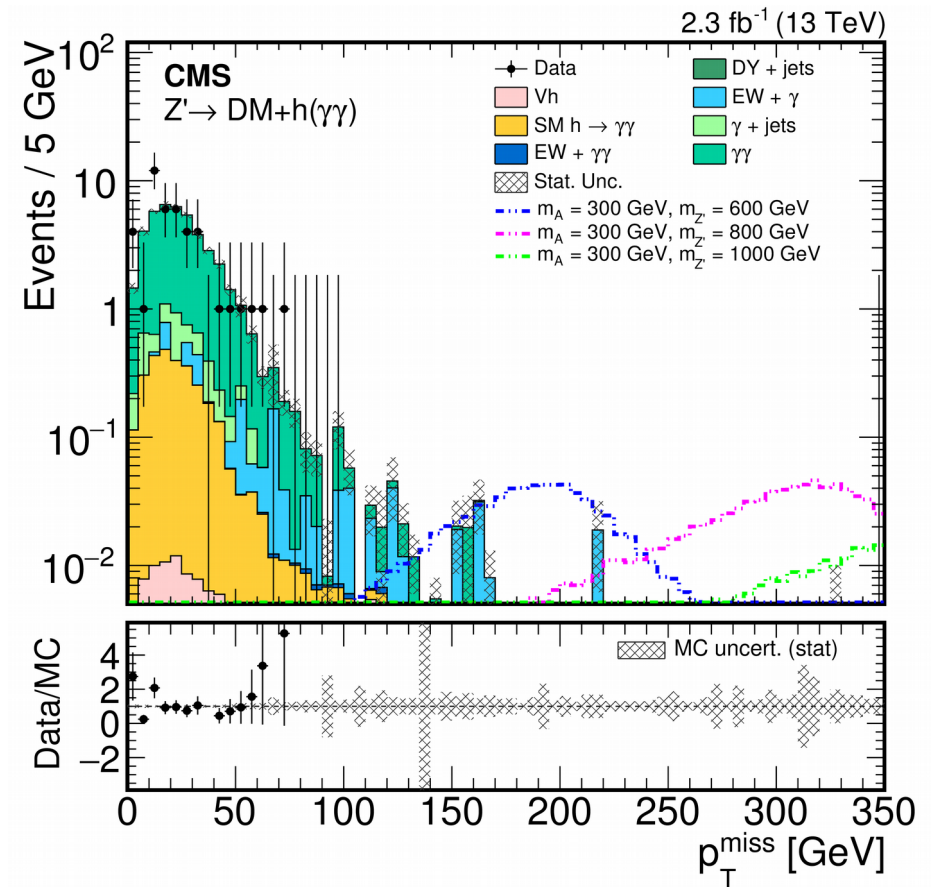
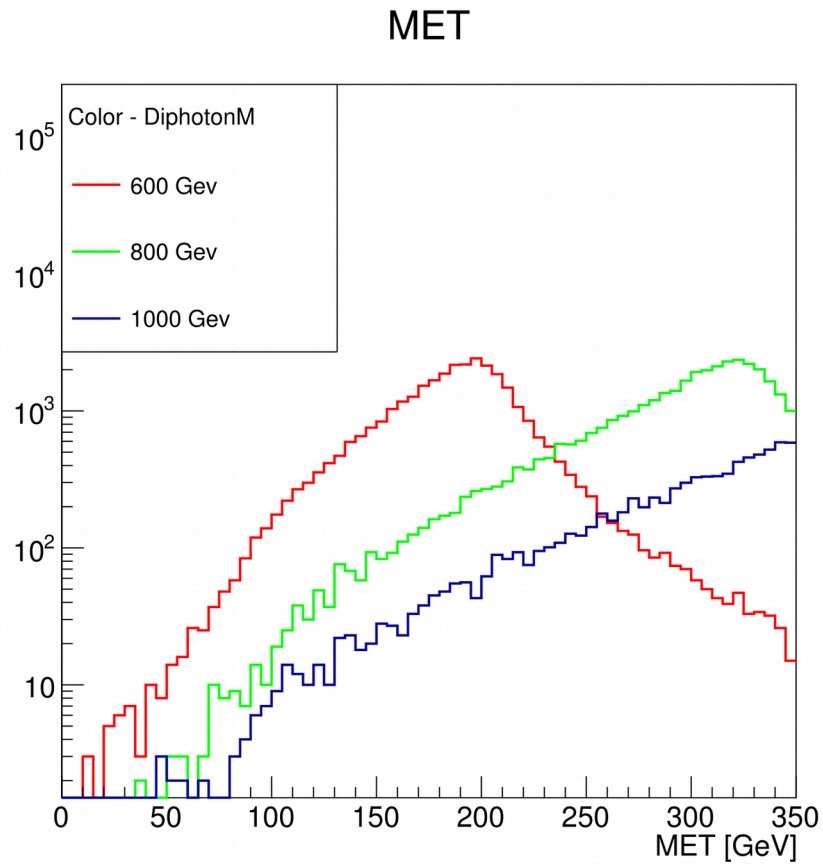
# Results

$m_{Z_p}$ (GeV)	Acceptance $\times$ efficiency ( $A \cdot \epsilon$ )		
	CMS EXO-16-012	MA5	Error
600	$0.317 \pm 0.004$	$0.317 \pm 0.001$	0 %
800	$0.399 \pm 0.004$	$0.410 \pm 0.001$	-2.8 %
1000	$0.444 \pm 0.004$	$0.441 \pm 0.001$	0.6 %
1200	$0.474 \pm 0.004$	$0.343 \pm 0.001$	27.6 %
1400	$0.492 \pm 0.004$	$0.221 \pm 0.001$	55.1 %
1700	$0.493 \pm 0.004$	$0.129 \pm 0.0004$	73.8 %
2000	$0.351 \pm 0.004$	$0.082 \pm 0.0002$	76.4 %
2500	$0.213 \pm 0.004$	$0.046 \pm 0.0001$	78.4 %

# Results



# Results





**The End**

