

Low Mass Pre-selections

➤ **Preselection:** to match the HLT and also with tighter cuts on H/E and $\sigma_{\eta\eta}$ to match the HLT of “single-fake” Zee (*HLT_Ele27_WPTight_Gsf_v**) for systematics on DCB parameters (μ , σ)

		R9 (5x5)	HoE	$\sigma_{\eta\eta}$ (5x5)	pfPhoIso	TrackerIso
Both photons in barrel	Barrel	> 0.5	< 0.07	< 0.0105	< 4 GeV	< 6 GeV
At least one in endcap	Barrel	> 0.85	< 0.07	< 0.0105	< 4 GeV	< 6 GeV
At least one in endcap	Endcap	> 0.9	< 0.035	< 0.0275	< 4 GeV	< 6 GeV



Electron veto: No Pixel Seed (PSV) instead of conversion-safe (CSV) used in std. analysis

Same loose photon ID **MVA > -0.9** as the std analysis

$pT_{\text{leading } \gamma} > 30 \text{ GeV}$, $pT_{\text{subleading } \gamma} > 18 \text{ GeV}$, and both $|\eta| < 2.5$ but not in EB-EE gap

$m_{\gamma\gamma} > 55 \text{ GeV}$

Higgs->4 Gamma Pre-selections

• Pre-Selection

- Loose Photon ID > -0.9
- Trigger strategy on MC based on offline selection similar to online
- Different kind of photon pairs being considered according to their η and R9 values

Offline Trigger like requirements

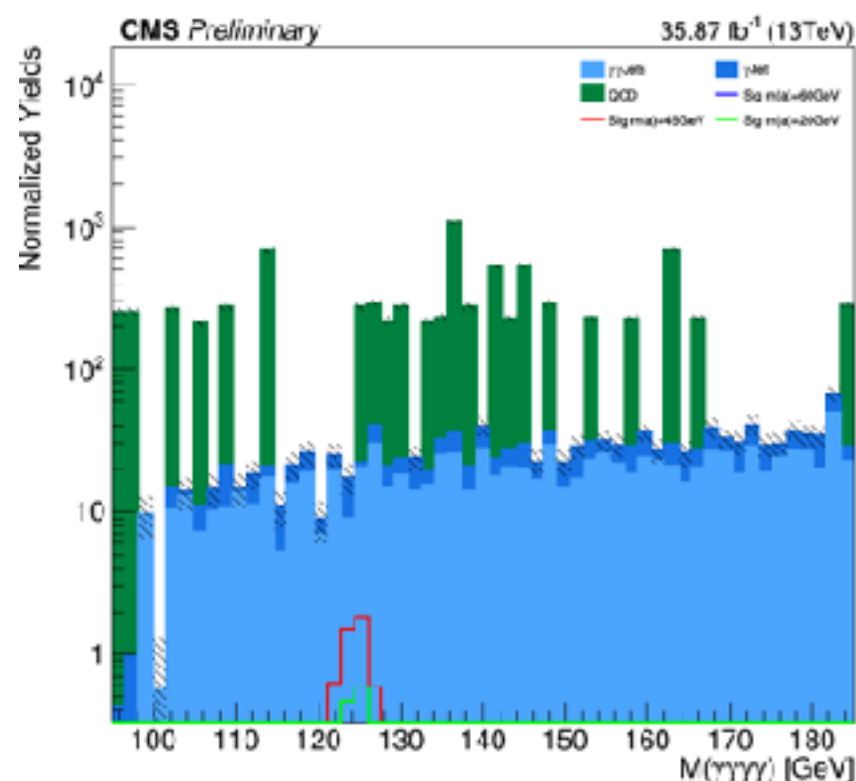
Category		R9	H/E	$\sigma_{\eta\eta}$	Pho Iso	Trk Iso
Both photons in EB		> 0.85	< 0.08	-	-	-
		> 0.5 && < 0.85	< 0.08	< 0.015	4 GeV	6 GeV
At least one Photon in EE	Second photon in EB	> 0.85	< 0.08	< 0.015	4 GeV	6 GeV
	Second Photon in EE	> 0.9	< 0.08	< 0.035	4 GeV	6 GeV

- $m_{\gamma\gamma} > 55 \text{ GeV}$, $P_T \text{ lead } \gamma > 30 \text{ GeV}$, $P_T \text{ sub-lead } \gamma > 18 \text{ GeV}$, Pixel Veto applied

m(a)	MicroAOD	4gamma	3gamma	2gamma
0.1	200000	33	886	47346
1	200000	13	188	6633
5	200000	12	85	3160
10	195505	4534	15134	13009
15	200000	9292	24847	15473
20	200000	10004	26947	16355
25	200000	10517	28141	17349
30	200000	10223	28229	17780
35	200000	10419	28577	18121
40	200000	11197	27693	17410
45	198033	12441	26205	14986
50	200000	15285	23995	10971
55	199200	22056	23267	6520
60	198014	31693	22319	4850

SIGNAL & BACKGROUND COMPARISON

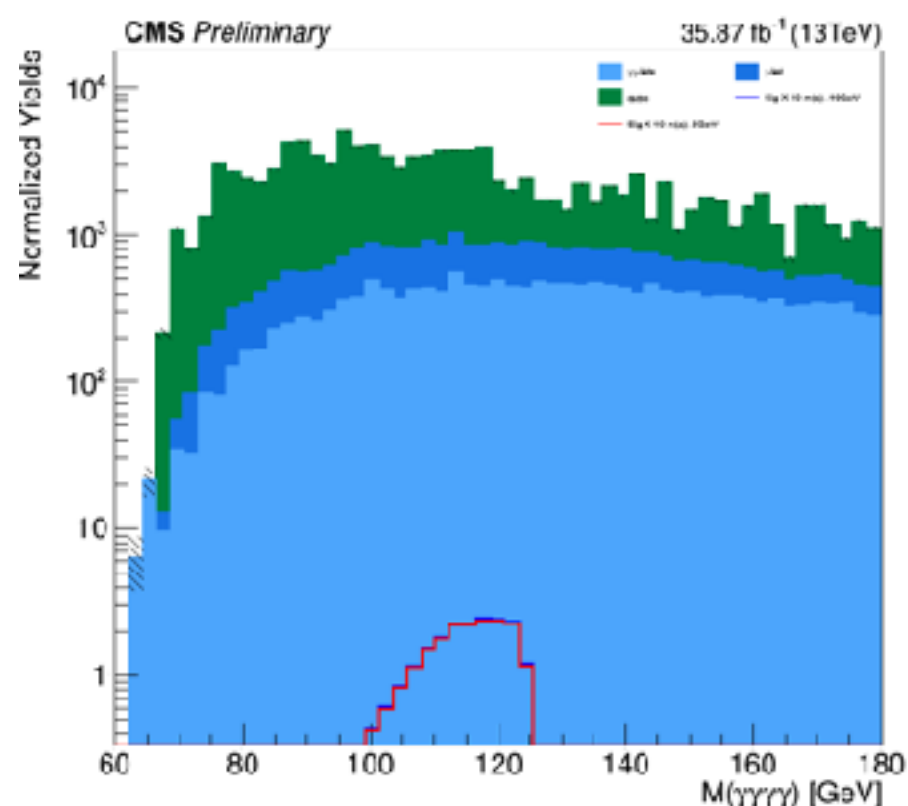
- Plots showing Background and Signal MC comparison
- Are only being used as a guide to determine the fitting and blinding range for the 4 photon, 3 photon and 2 photon categories



4 γ Category

Fitting range: [100,180] GeV

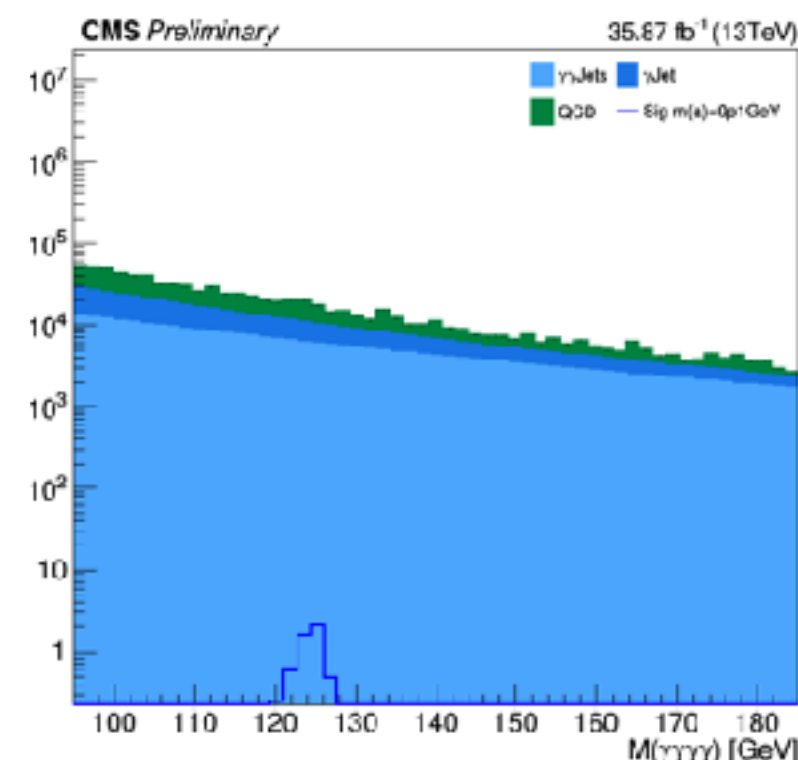
Blinding range: [115,135] GeV



3 γ Category

Fitting range: [80,180] GeV

Blinding range: [95,135] GeV



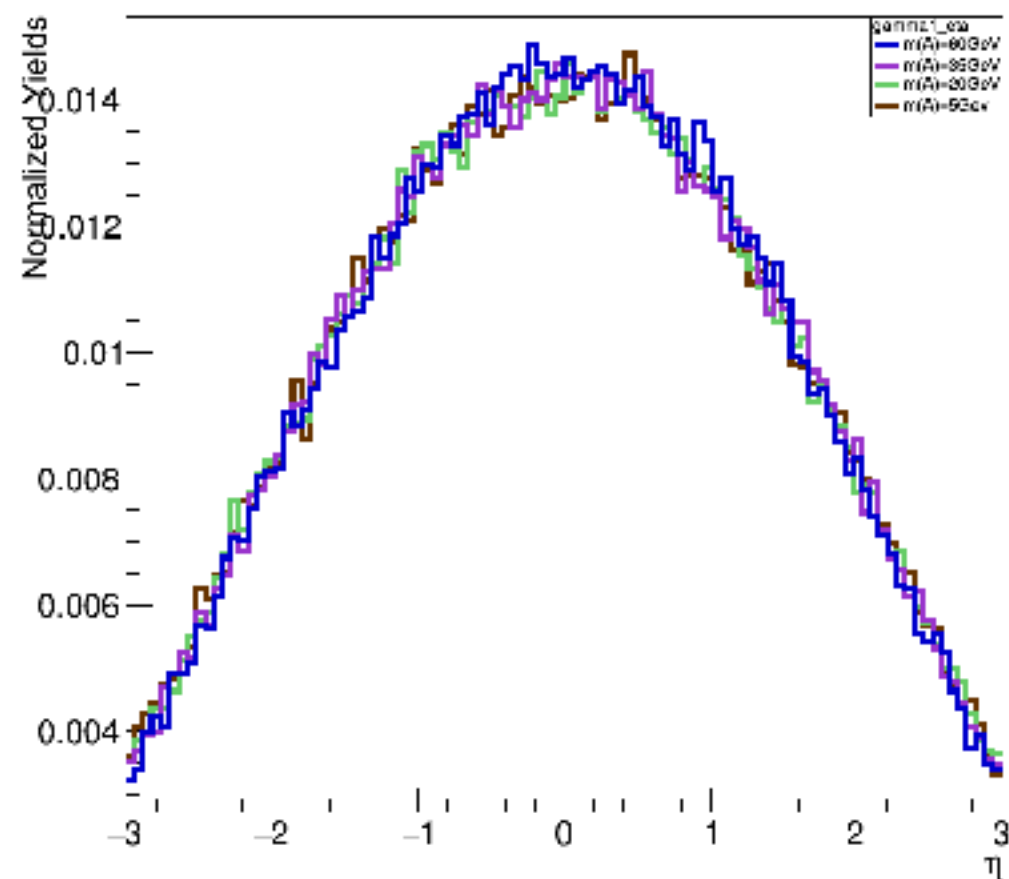
2 γ Category

Fitting range: [100,180] GeV

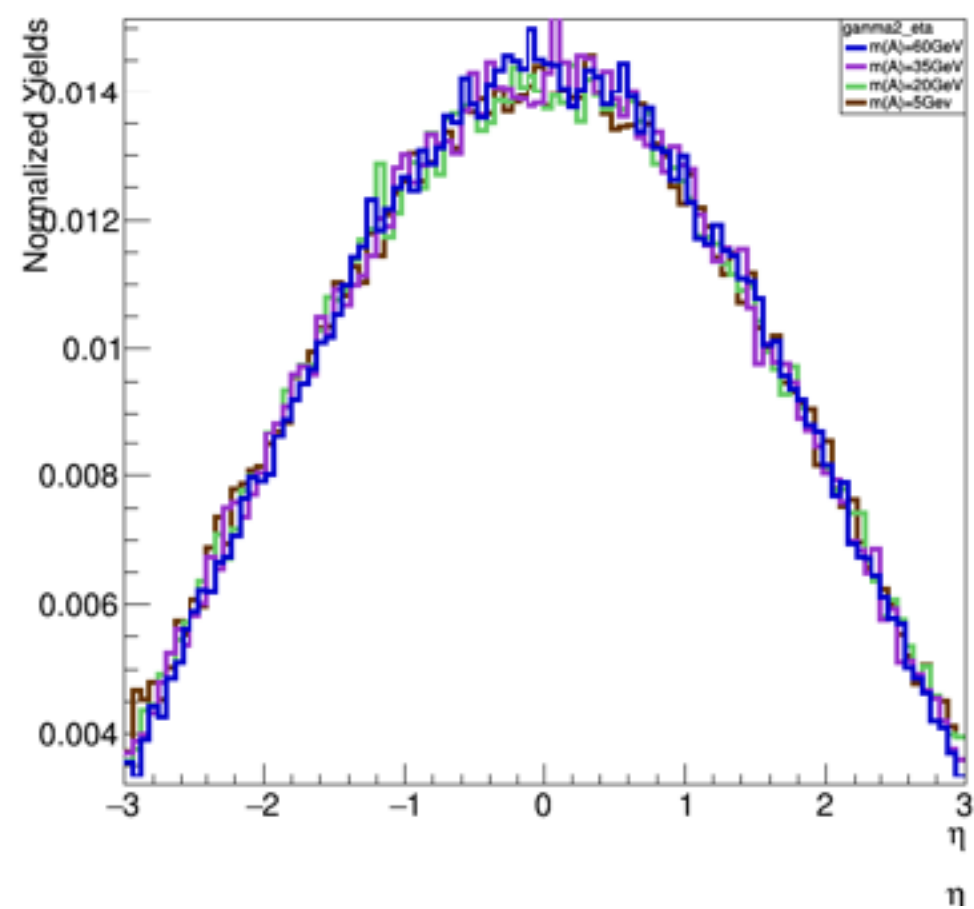
Blinding range: [115,135] GeV

Reason for increasing distribution for 3 and 4 gamma category?

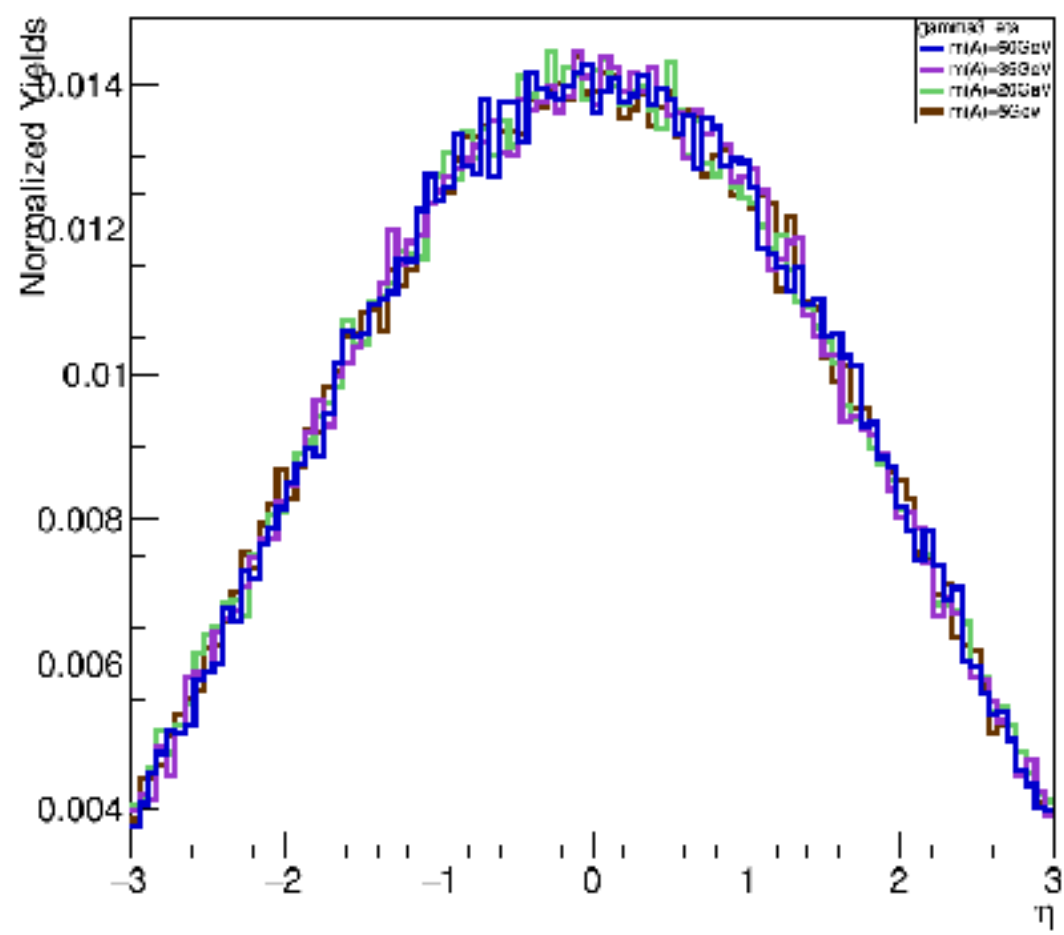
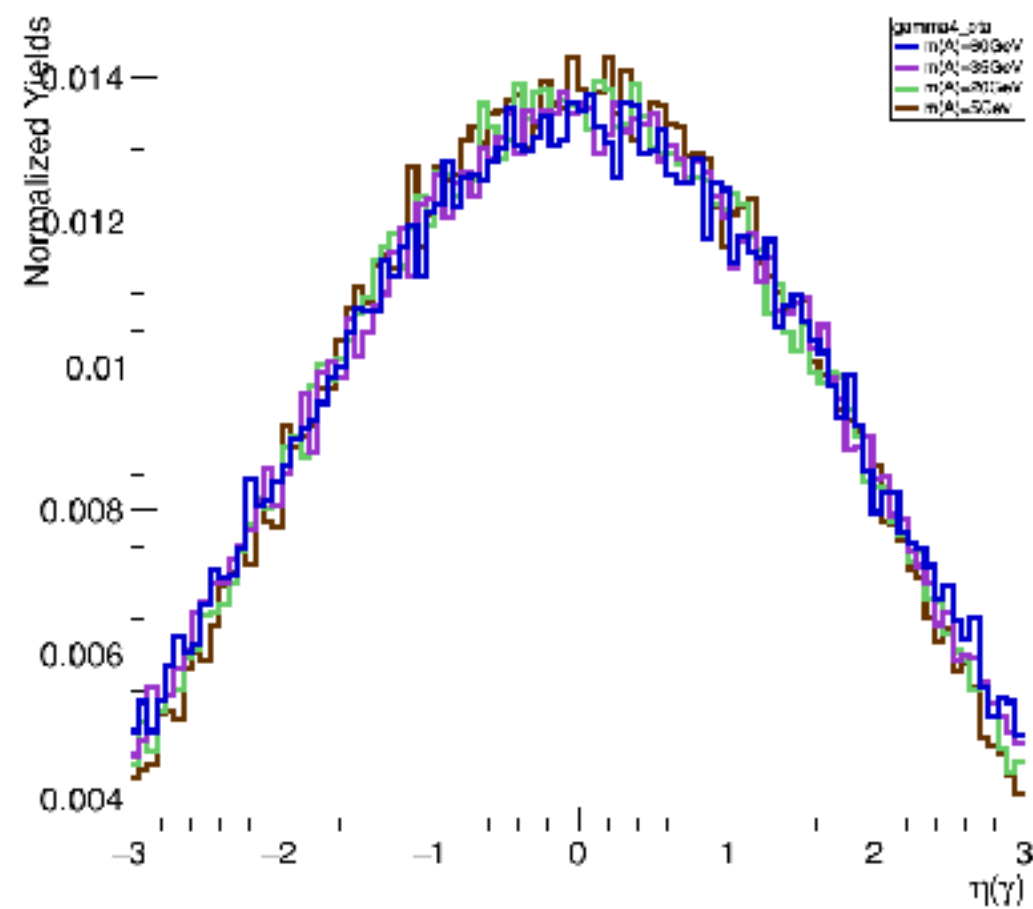
gen1 eta

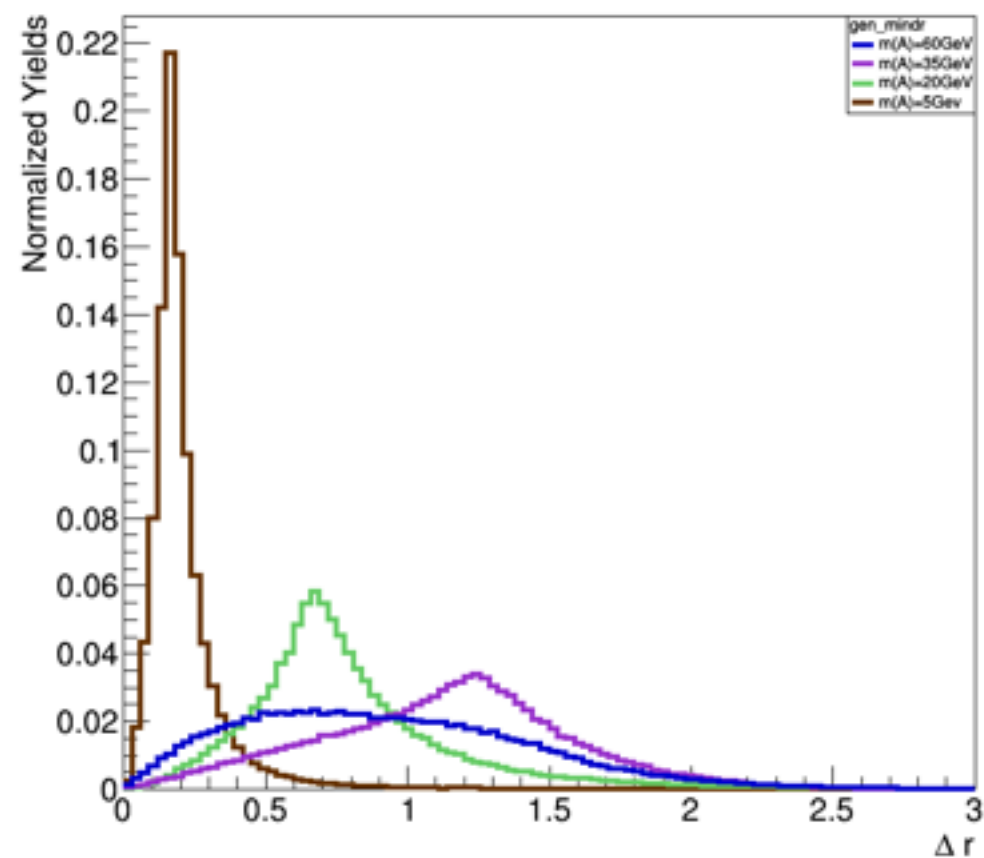


gen2 eta

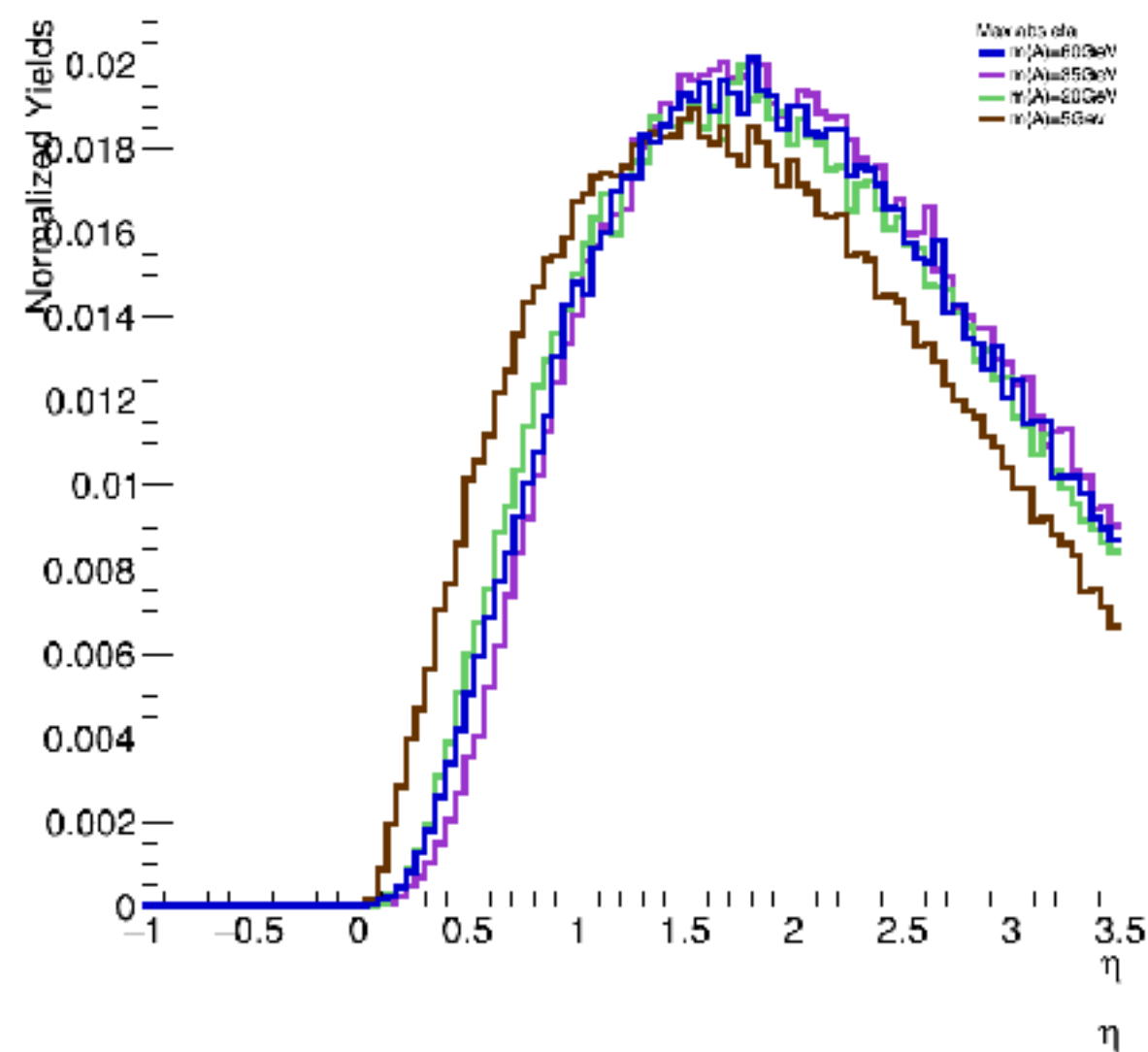


gen3 eta

 η of Gen photons

Gen Minimum Δr 

abs max gen eta



gen TetraPhoton Invariant mass

