Update on ZH->llyy channel

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MC samples

3T fast simulation $\sqrt{s} = 240 GeV$

- Signal:
  - $Z \rightarrow \mu\mu, H \rightarrow \gamma\gamma$ 100K events
  - $Z \rightarrow \tau\tau \rightarrow \mu\mu\nu\nu, H \rightarrow \gamma\gamma$ 100K events
    Select the same final state, Br($\tau \rightarrow \mu$)=17.39%

- Background:
  - $ee \rightarrow \mu\mu$ ~26M
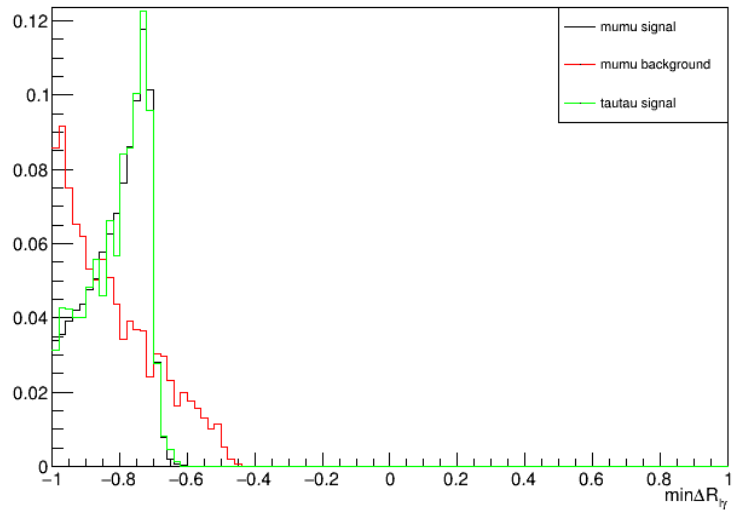 - $ee \rightarrow \tau\tau \rightarrow \mu\mu\nu\nu$ 10M

Selection

- $E_\gamma > 30 GeV$
- $\left|cos\theta_\gamma\right| < 0.9$
- $10GeV < pT_{\gamma1} < 70GeV$
- $30GeV < pT_{\gamma2} < 100GeV$
- $110GeV < m_{\gamma\gamma} < 140GeV$
- $84GeV < M_{\gamma\gamma}^{recoil} < 103GeV$
- $125GeV < E_{\gamma\gamma} < 143GeV$
- $\min\{\left|cos\theta_{\gamma l}\right|\} < 0.9$
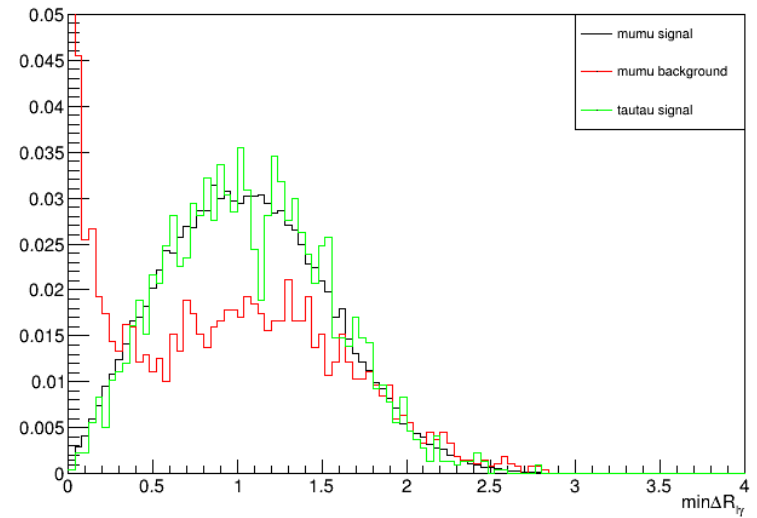- $\Delta R_{l\gamma}^{min} > 0.2$
- $cos\theta_{\gamma\gamma} > -0.95$

Mu and tau share the same criteria

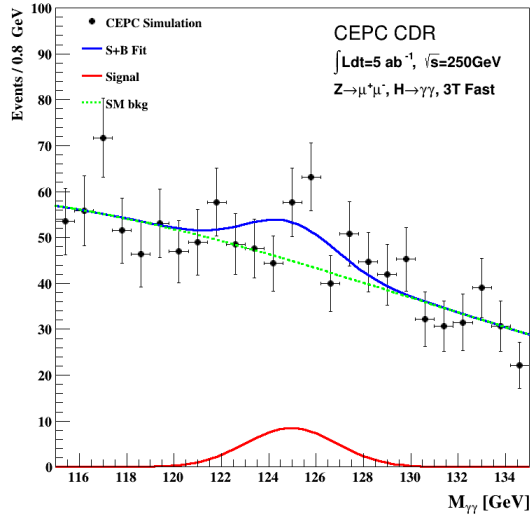# Distribution

Cut flow

	Signal				background			
	mumu		tautau		mumu		tautau	
generated	100000		100000		26930165		10000000	
mumuyy	138039	138.039%	3274	3.274%	1393678	5.175%	6204	0.062%
E_y>30GeV	100602	72.879%	2980	91.020%	149107	10.699%	1045	16.844%
|Costheta_y|<0.9	83759	83.258%	2470	82.886%	58507	39.238%	369	35.311%
10<pT_y1<70	83740	99.977%	2470	100.000%	55978	95.677%	358	97.019%
30<pT_y2<100	83509	99.724%	2466	99.838%	48173	86.057%	327	91.341%
110<m_yy<140	81610	97.726%	2449	99.311%	16799	34.872%	126	38.532%
84<recoM_yy<103	71416	87.509%	2180	89.016%	3174	18.894%	37	29.365%
125<En_yy<143	71409	99.990%	2180	100.000%	3048	96.030%	35	94.595%
min|costheta_yl|<0.9	71248	99.775%	2172	99.633%	2704	88.714%	35	100.000%
minDeltaR_y_l>0.2	69691	97.815%	2131	98.112%	1856	68.639%	32	91.429%
Costheta_yy>-0.95	63549	91.187%	1925	90.333%	1555	83.782%	24	75.000%
		63.549%		1.925%		0.006%		0.0002%
weight to 5ab-1	49.44		1.47		1539.61		57.03	

Channel	Generate	cut1	cut2	cut3	cut4	cut5	cut6
$\mu^+\mu^- H\_aa$	Efficiency	100%	91.56%	72.28%	55.42%	54.21%	42.17%
$\mu^+\mu^- H\_aa$	83	83	76	60	46	45	35
$\mu^+\mu^- aa$	1135659	214725	66703	23786	6427	1887	1026
$\tau^+\tau^- H\_aa$	Efficiency	98.67%	89.33%	61.33%	48.00 %	46.67%	41.89%
$\tau^+\tau^- H\_aa$	75	74	67	46	36	35	31
$\tau^+\tau^- aa$	429975	146922	49424	14533	3562	1778	1410

$$\sigma = \frac{S}{\sqrt{S+B}} = 1.25$$

Fit precision

47.2%
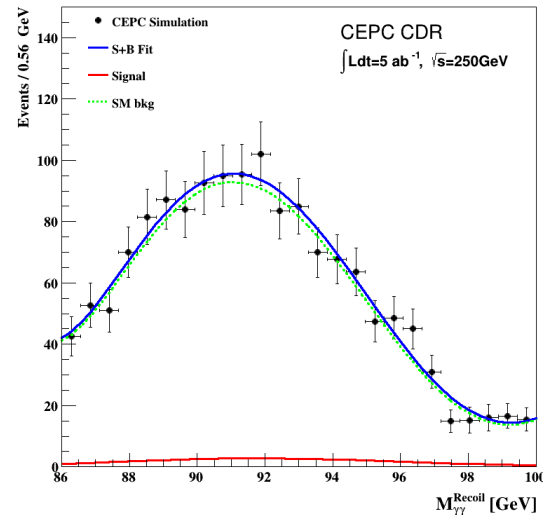
93.8%

81.6%

36.7%

Fit precision

$Z \rightarrow \mu^+\mu^-$, $H \rightarrow \gamma\gamma$, 3T Fast, Signal Events

$CEPC$, $\int L=5$ ab^{-1}, $\sqrt{s}=250$GeV

Signal Events, 50.91

$\sigma_{data} = 1.92$, $\sigma_{pdf} = 1.92$

$\chi^2 = 808.14$
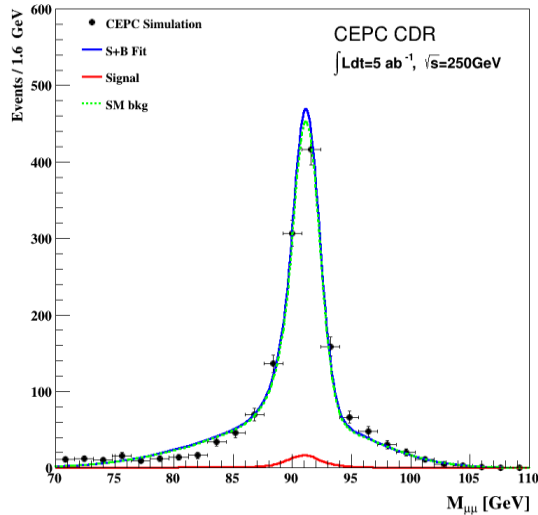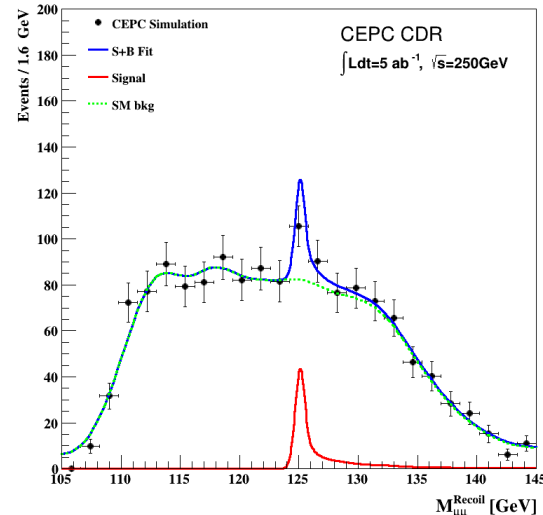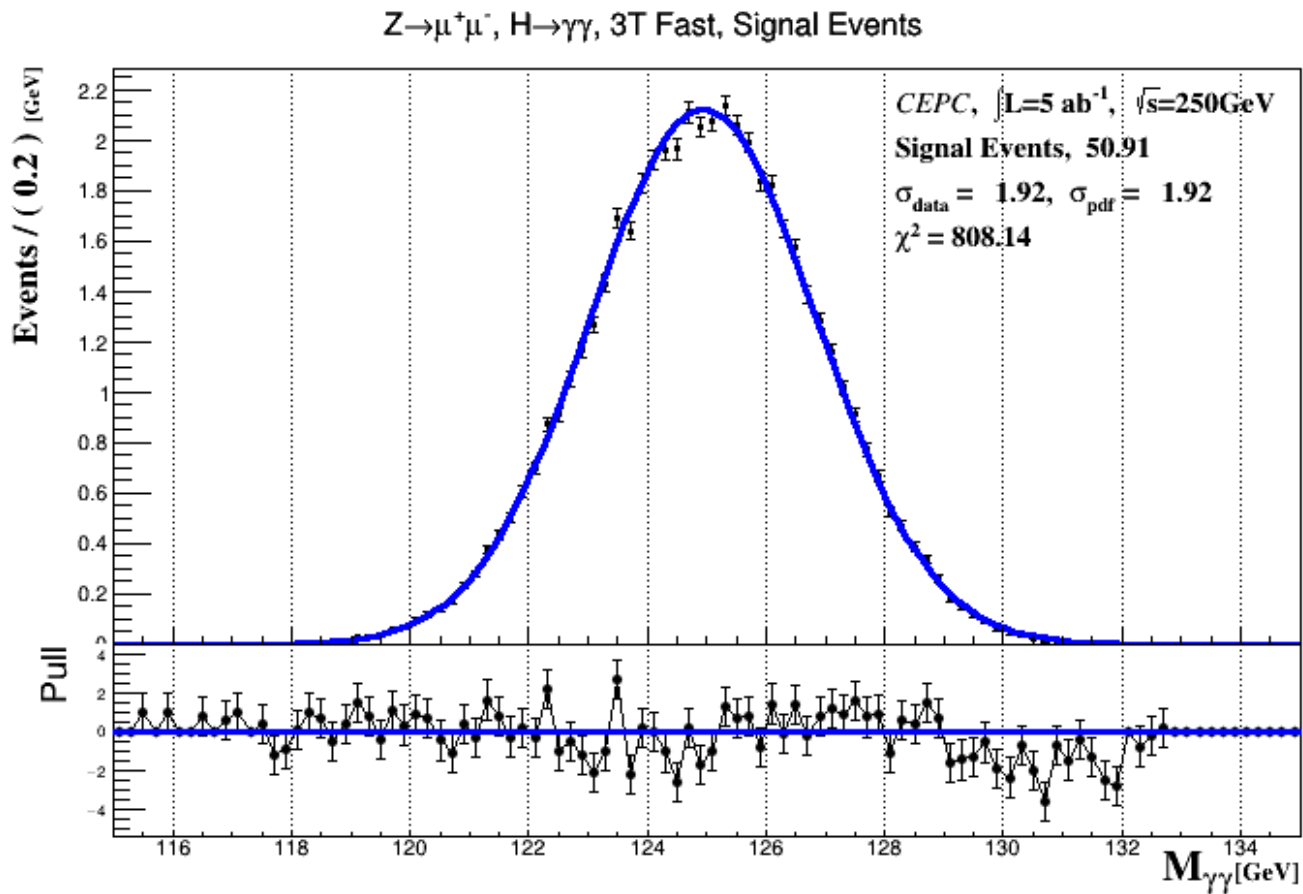
Follow plan

- qqyy channel:
  - Working on 3T fast simulation
  - Recent results:

	signal		background	
Generated	100000		200000	
Final	53086	53.09%	14	0.007%
Weight to 5 ab-1	824.3		18937.4	

- Need more background statistics
- Need to see the m_yy distribution

Channel	Generate	cut1	cut2	cut3	cut4	cut5	cut6
qqH_aa	Efficiency	100%	89.41%	75.81%	54.38%	34.78%	34.78%
qqH_aa	1633	1633	1460	1238	888	568	568
qqaa	11011914	2027271	803856	228018	93878	24390	19184

Follow plan

- Analysis:
  - $ee \rightarrow ZH \rightarrow ll\gamma\gamma$
  - $ee \rightarrow ZH \rightarrow qq\gamma\gamma$
  - $ee \rightarrow ZH \rightarrow \nu\nu\gamma\gamma$
  - 3T, $\sqrt{s}$=240GeV, fast simulation
- Comparison
  - Magnetic:
    - llyy channel, fast simulation, 3T vs. 3,5T
    - qqyy channel, full simulation, 3T(present) vs. 3.5T(Yitian)
  - Simulation:
    - qqyy channel, 3T, fast sim. Vs. full sim.