4ℓ + Met analysis update

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ATLAS EXPERIMENT

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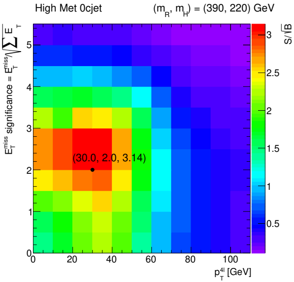
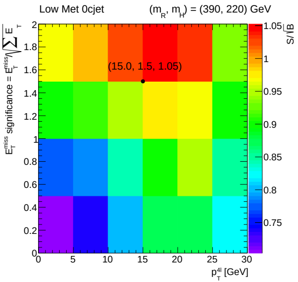
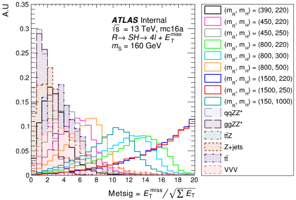
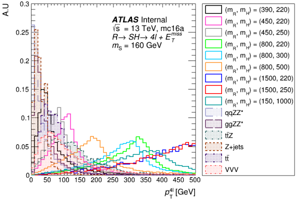
Signal optimisation

- Categorize event into 4 categories: Using $S/\sqrt{B}$ instead of $S/\sqrt{S+B}$ to avoid the cross-section dependency

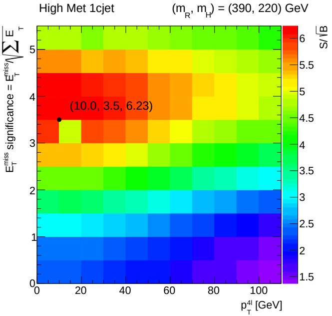


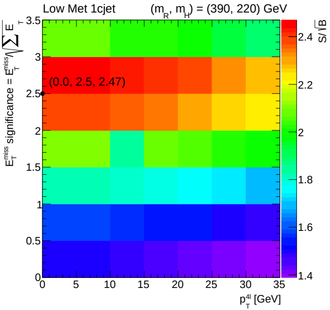


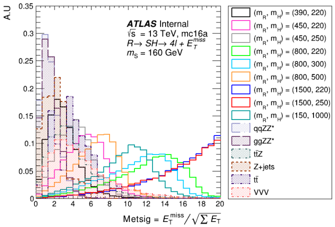


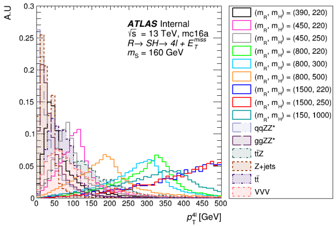


Signal optimisation







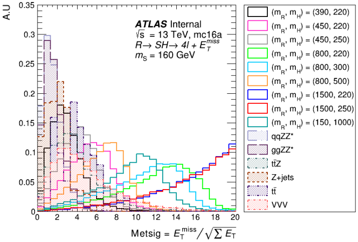


Signal optimisation

Summary

- We avoid the dependency of the cross-section by using $S/\sqrt{B}$. For the optimisation we used only $(m_R, m_H) = (390, 220)$ GeV mass point. So no need to use other mass points because the new categories cover the low and the high Met region.

- ☐ High met 0 central jet $\Rightarrow$ 30\2.0
- ☐ Low met 0 central jet $\Rightarrow$ 15\15
- ☐ High met 1 central jet $\Rightarrow$ 10\3.5
- ☐ Low met 1 central jet $\Rightarrow$ 0.0\2.5



See tables for the categories on backup slides.

Signal parametrisation

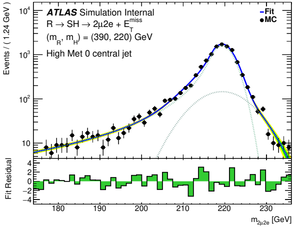
- The Crystal ball, CB, plus Gaussian, G, Pdf has the following form:

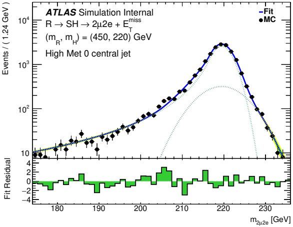
$$f(m_{4\ell}) = f_{\mathrm{CB}} \cdot \mathrm{CB}(m_{4\ell}; \mu, \sigma_{\mathrm{CB}}, \alpha_{\mathrm{CB}}, n_{\mathrm{CB}}) + (1 - f_{CB}) \cdot \mathrm{G}(m_{4\ell}; \mu, \sigma_G)$$

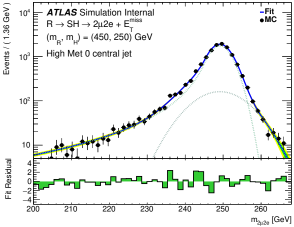
- σ_C and σ_G represent the invariant mass resolution;
- μ is the mean value fixed to same parameter for both Pdf;
- n_C and α_C model the shape and position of the non-Gaussian tail;
- Where n_C is the slop of the tail and α_C measures how far from the peak the distribution become non-Gaussian;
- f_C is the relative normalisation of the Pdf.

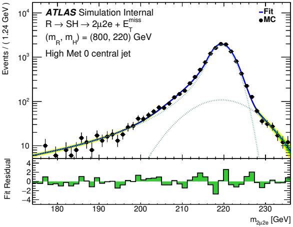
Signal parametrisation

High Met 0 central jet for $2\mu2e$ channel



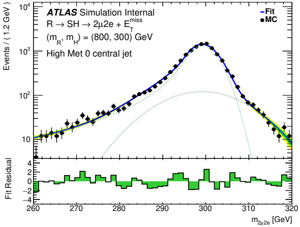


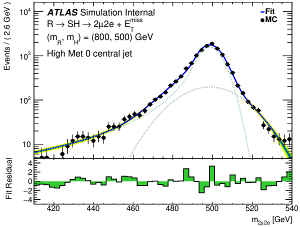


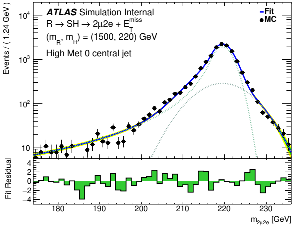


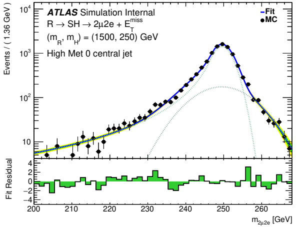
Signal parametrisation

High Met 0 central jet for $2\mu 2e$ channel



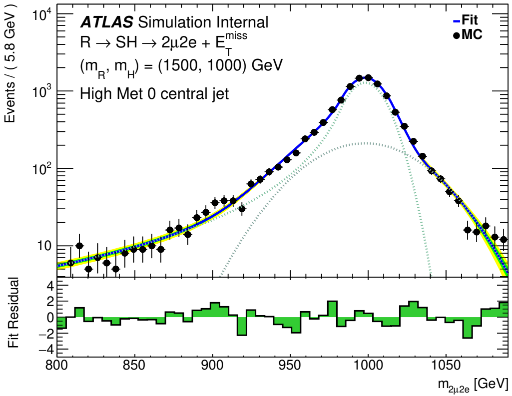






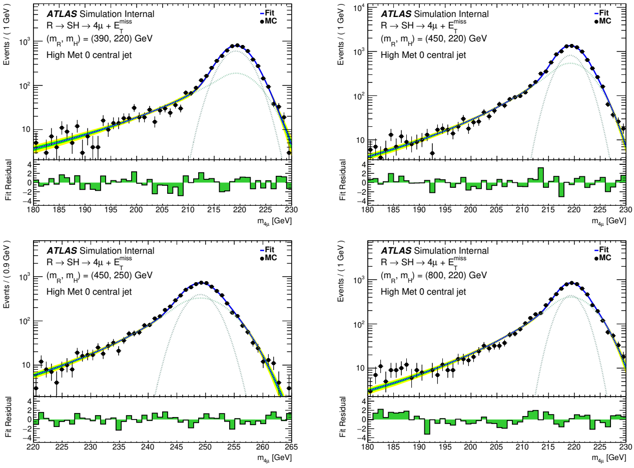
Signal parametrisation

High Met 0 central jet for $2\mu 2e$ channel



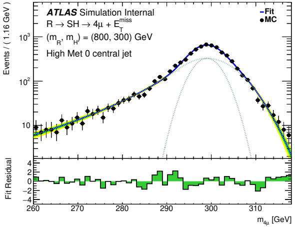
Signal parametrisation

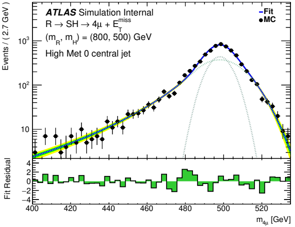
High Met 0 central jet for 4μ channel

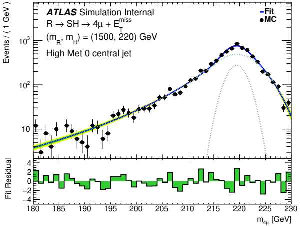


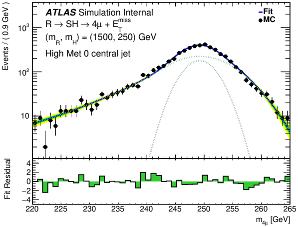
Signal parametrisation

High Met 0 central jet for 4μ channel



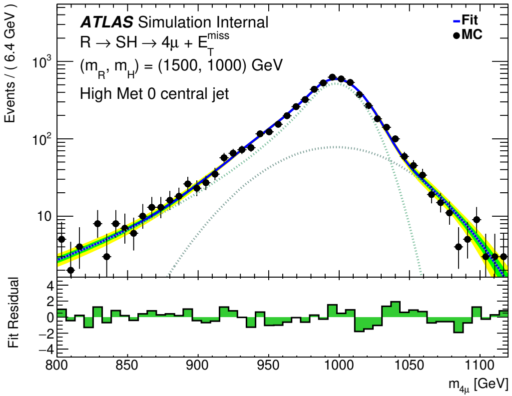






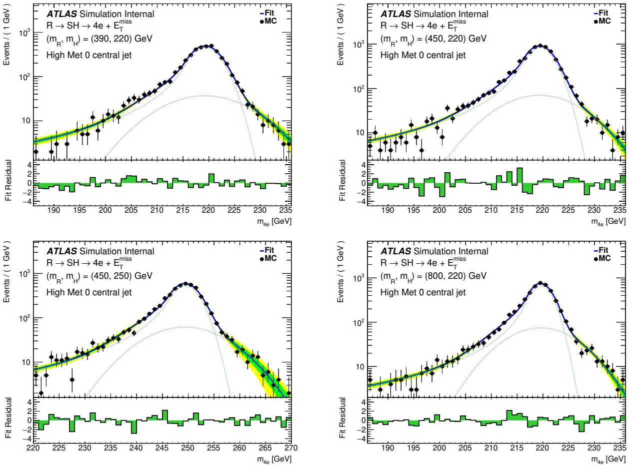
Signal parametrisation

High Met 0 central jet for 4μ channel



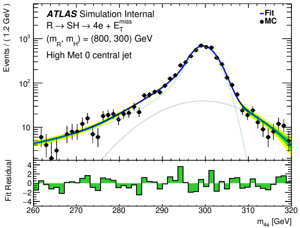
Signal parametrisation

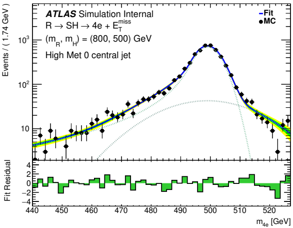
High Met 0 central jet for 4e channel

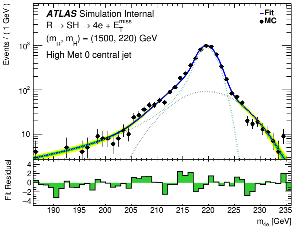


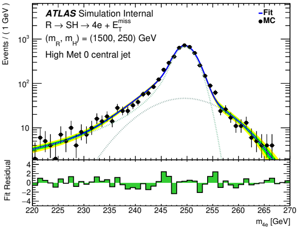
Signal parametrisation

High Met 0 central jet for 4*e* channel



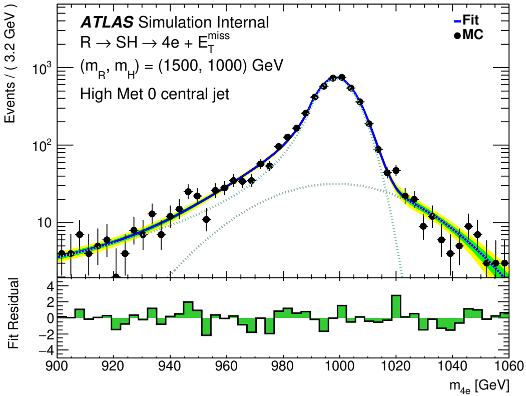






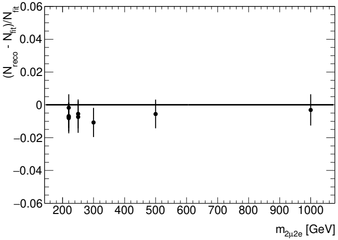
Signal parametrisation

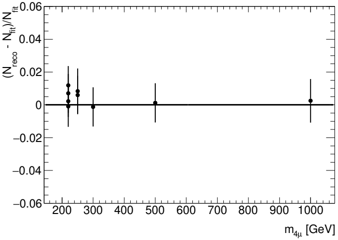
High Met 0 central jet for 4e channel

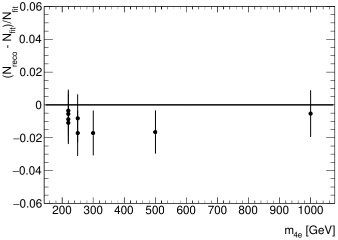


Study the bias inducted by the signal extraction

High Met 0 central jet for all the channels

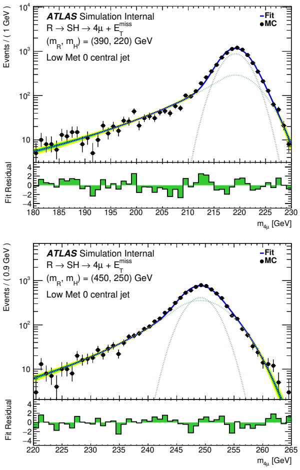






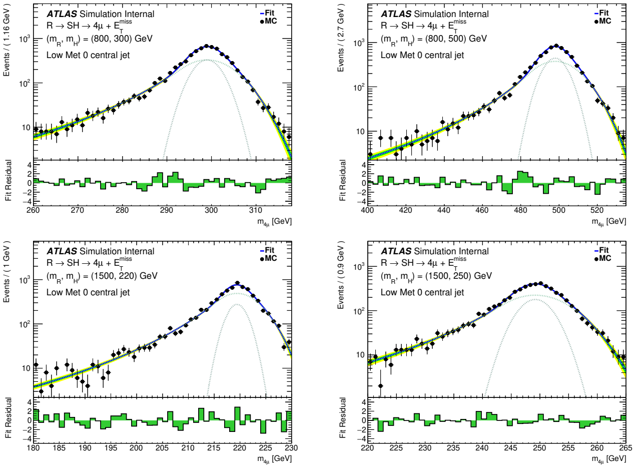
Signal parametrisation

Low Met 0 central jet for 4μ channel



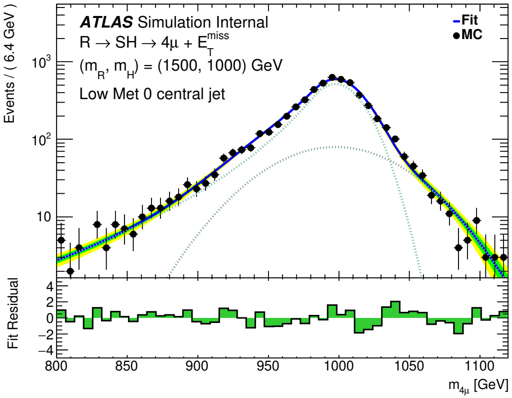
Signal parametrisation

Low Met 0 central jet for 4μ channel



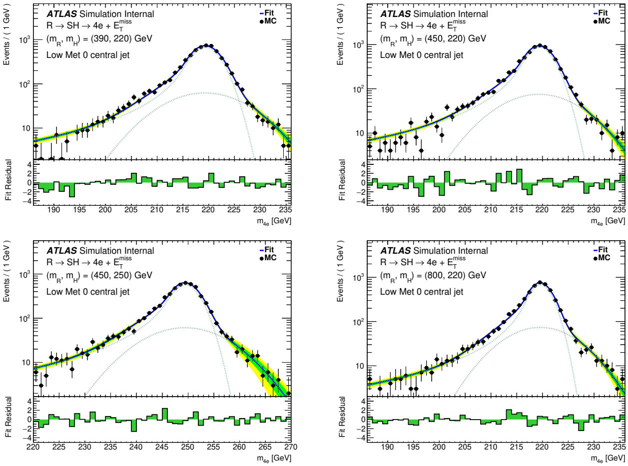
Signal parametrisation

Low Met 0 central jet for 4μ channel

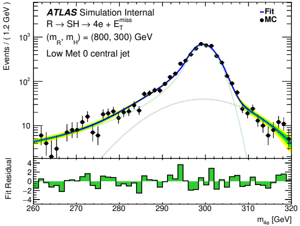


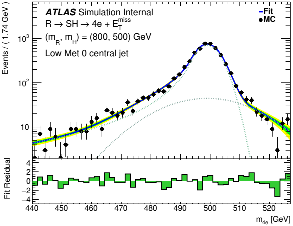
Signal parametrisation

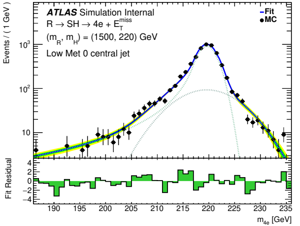
Low Met 0 central jet for 4*e* channel

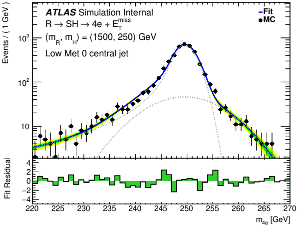


Signal parametrisation
Low Met 0 central jet for 4e channel



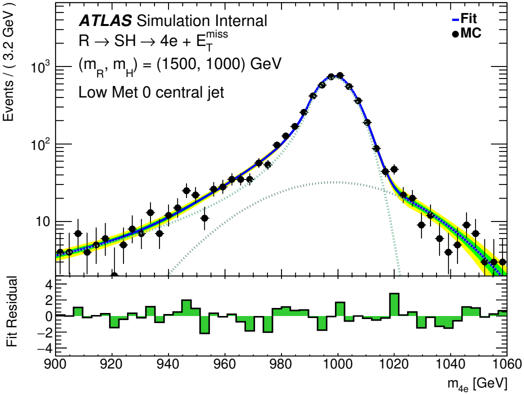






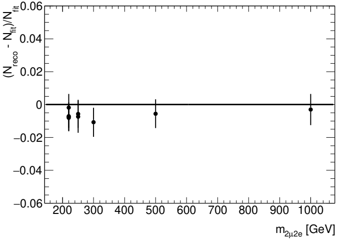
Signal parametrisation

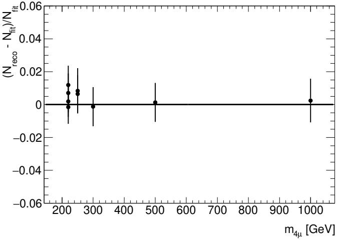
Low Met 0 central jet for 4e channel

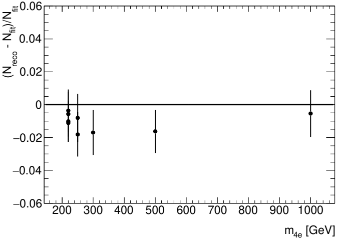


Study the bias inducted by the signal extraction

Low Met 0 central jet for all the channels

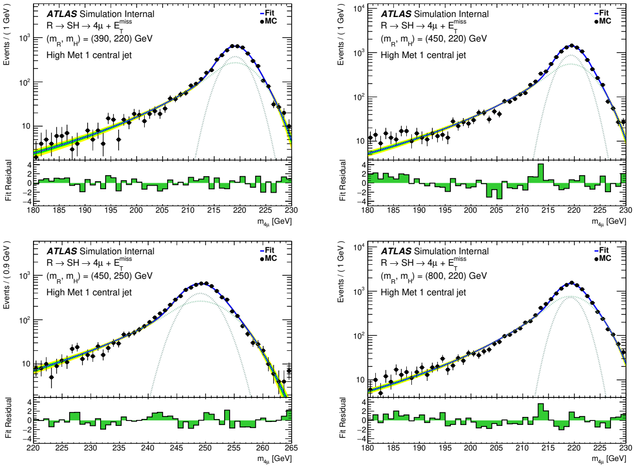






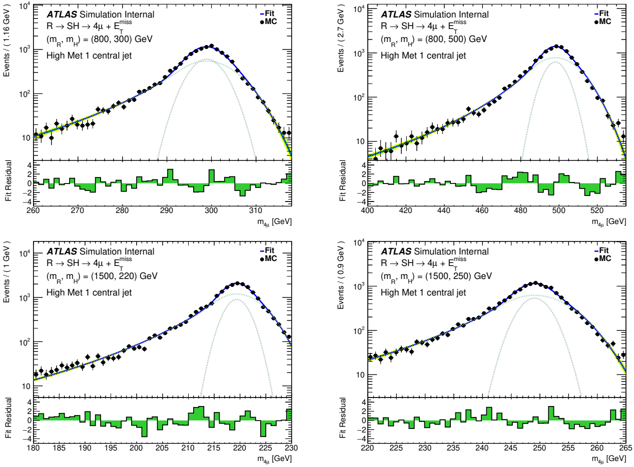
Signal parametrisation

High Met 1 central jet for 4μ channel



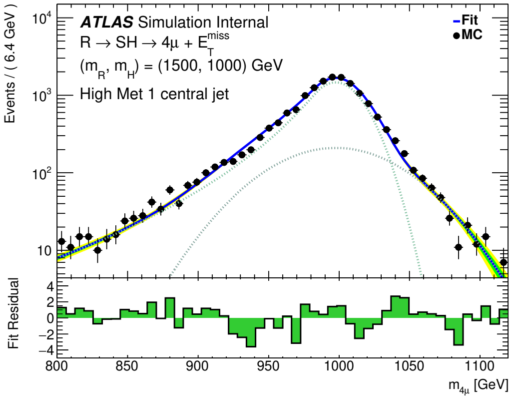
Signal parametrisation

High Met 1 central jet for 4μ channel



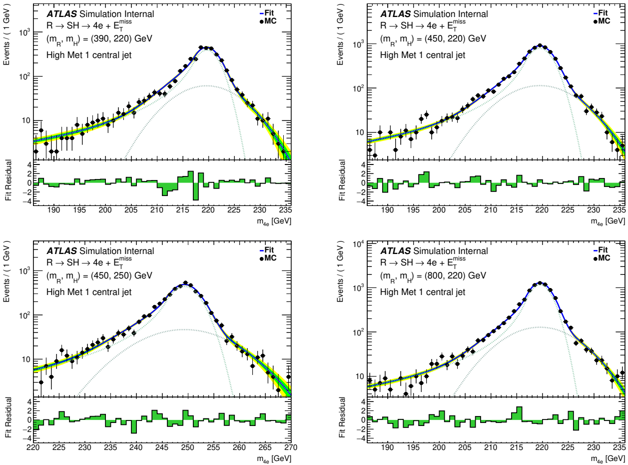
Signal parametrisation

High Met 1 central jet for 4μ channel



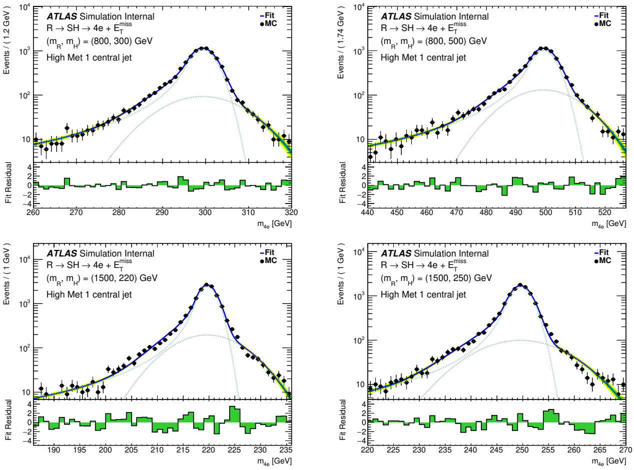
Signal parametrisation

High Met 1 central jet for 4e channel



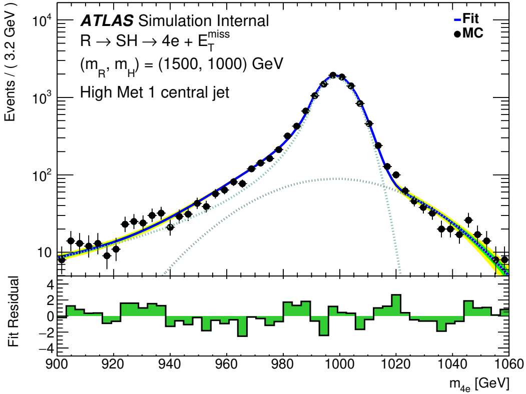
Signal parametrisation

High Met 1 central jet for 4e channel

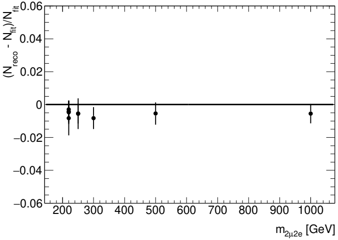


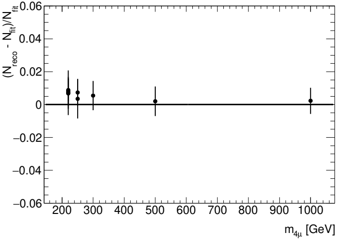
Signal parametrisation

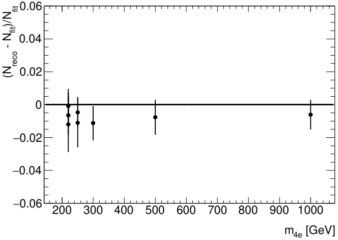
High Met 1 central jet for 4*e* channel



Study the bias inducted by the signal extraction
High Met 1 central jet for all the channels

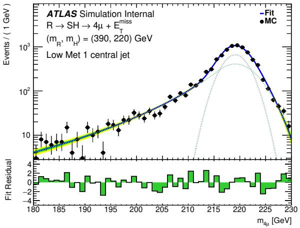


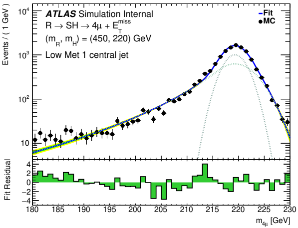


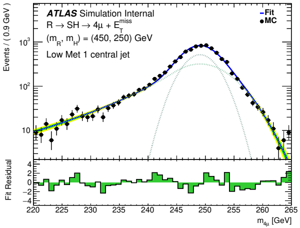


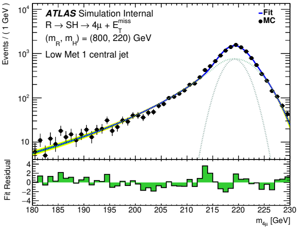
Signal parametrisation

Low Met 1 central jet for 4μ channel



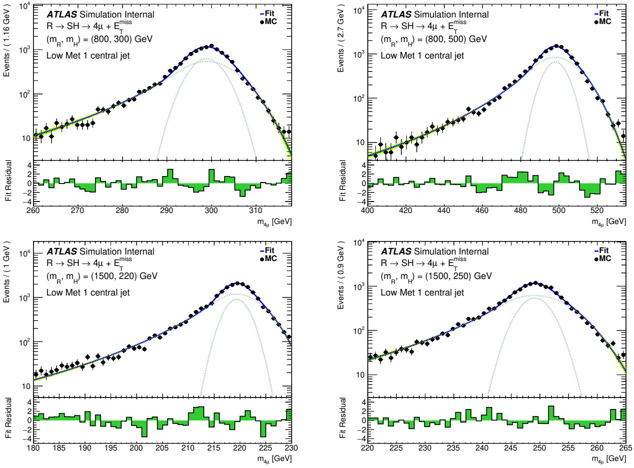






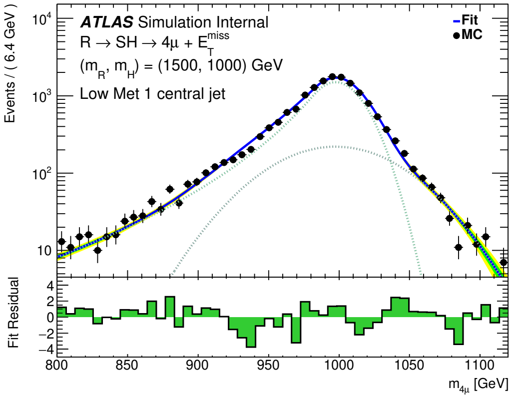
Signal parametrisation

Low Met 1 central jet for 4μ channel



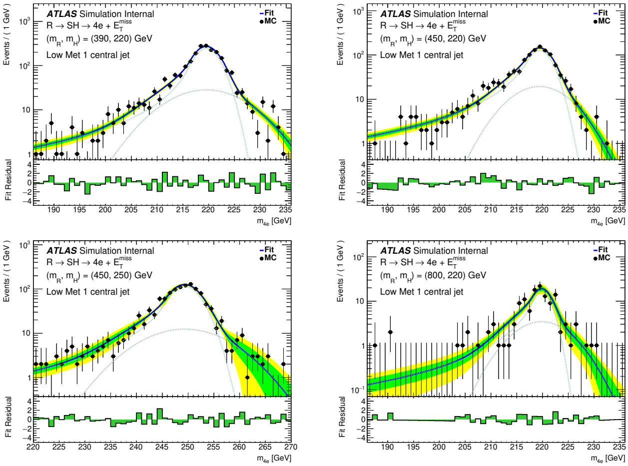
Signal parametrisation

Low Met 1 central jet for 4μ channel



Signal parametrisation

Low Met 1 central jet for 4e channel



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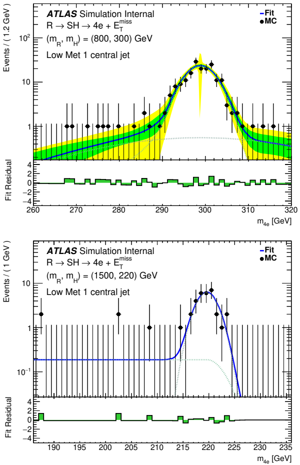
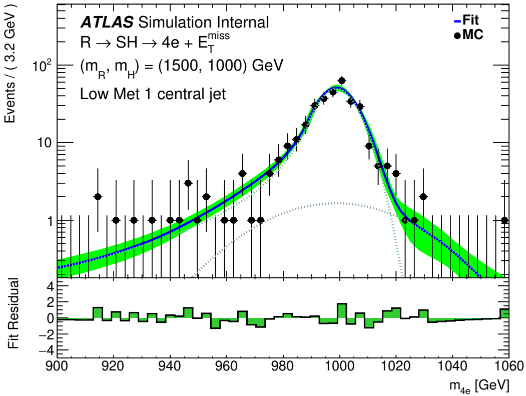


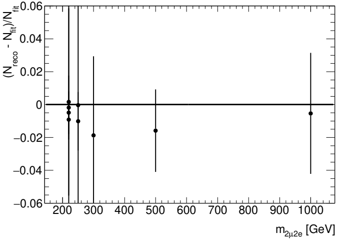
Signal parametrisation

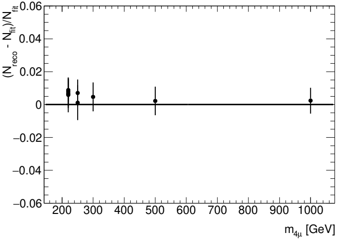
Low Met 1 central jet for 4e channel

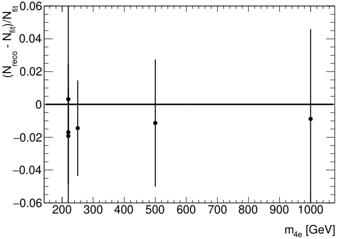


Study the bias inducted by the signal extraction

Low Met 1 central jet for all the channels







Summary

- Signal optimisation is done;
- A good fit quality is obtained in the whole mass points;
- The extraction of signal yields using the analytical function introduces about 1.5% bias;
- And can be included with the systematics uncertainty in the final fit.

Next

- Interpolation of μ, f_C, σ_G, σ_C and α_C parameters;
- Update the background parametrisation for the new categories;
- Check what is the problem with Low Met 1 central jet category; and
- I'm sure there's something went wrong.

Thank you!

Signal samples have already been produced, JIRA, as follows:

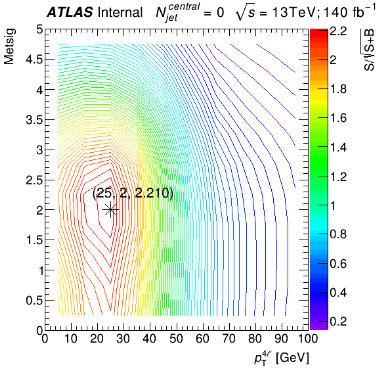
- ☐ The mass of S is fixed to 160 GeV;
- ☐ The masses of R are 390 GeV, 450 GeV, 800 GeV and 1500 GeV:
  - $m_R = 390$ GeV: $m_H = 220$ GeV
  - $m_R = 450$ GeV: $m_H = 220$ GeV and 250 GeV
  - $m_R = 800$ GeV: $m_H = 220$ GeV, 300 GeV and 500 GeV
  - $m_R = 1500$ GeV:$m_H = 220$ GeV, 250 GeV and 1000 GeV
- ☐ Requested HIGG2D1 derivation with cache: 21.2.55 and p-tag: p3782. All jobs are finished see here; and
- ☐ The mini-tree production is done using HZZAnalRun2Code.

Background samples

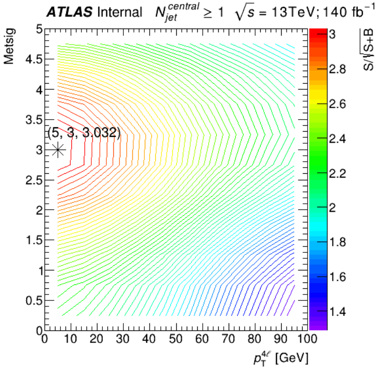
- ☐ $qqZZ^*$, $ggZZ^*$, $t\bar{t}Z$, $Z + jets$, $t\bar{t}$ and VVV.

- Signal and background are mc16a, mc16d and mc16e combined;
- The signal cross section (xsection$\times$BR) is 1 fb^{-1} (set by hand);
- The significance is calculated using $S/\sqrt{S+B}$ and $S/\sqrt{B}$;
- S, and B are the signal and background event, respectively;
- Background events are normalised to cross section for the $m_{4\ell} > 200$ GeV;
- Scaling background events by 20.3% uncertainty. It's calculated as follow:

The background scaled by a number extracted as follows: For instance, for $m_H = 220$, and $m_R = 390$: events in $m_{4\ell}(210 - 230)$ GeV over the full range of $m_{4\ell}(> 200)$ GeV.



ATLAS Internal $N_{jet}^{central} = 0$ $\sqrt{s}$ = 13TeV; 140 fb^{-1}
Metsig
$p_T^{4\ell}$ [GeV]
S/$\sqrt{S+B}$
(25, 2, 2.210)



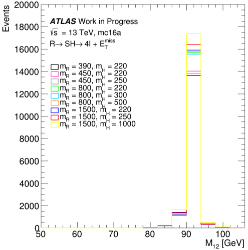
ATLAS Internal $N_{jet}^{central} \geq 1$ $\sqrt{s}$ = 13TeV; 140 fb^{-1}
Metsig
$p_T^{4\ell}$ [GeV]
S/$\sqrt{S+B}$
(5, 3, 3.032)

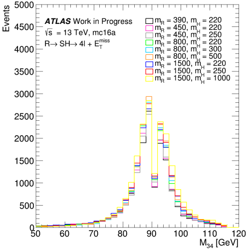
Additional slides

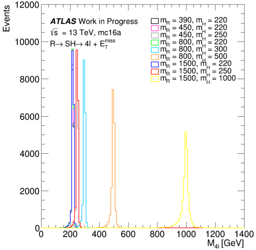
Event Selection	
Quadruplet Selection	- Require at least one quadruplet of leptons consisting of two pairs of same-flavour opposite-charge leptons fulfilling the following requirements: - p_T thresholds for three leading leptons in the quadruplet: 20, 15 and 10 GeV - At most 1 calo-tagged, stand-alone or silicon-associated muon per quadruplet - Leading di-lepton mass requirement: $50 < m_{12} < 106$ GeV - Sub-leading di-lepton mass requirement: $m_{\text{threshold}} < m_{34} < 115$ GeV - $\Delta R(\ell, \ell') > 0.10$ for all lepton pairs in the quadruplet - Remove quadruplet if alternative same-flavour opposite-charge di-lepton gives $m_{\ell\ell} < 5$ GeV - Keep all quadruplets passing the above selection
Isolation Needs updating	- Contribution from the other leptons of the quadruplet is subtracted - Muon track isolation ($\Delta R = 0.30$): $\Sigma p_T / p_T < 0.15$ - Muon calorimeter isolation ($\Delta R = 0.20$): $\Sigma E_T / p_T < 0.30$ - Electron track isolation ($\Delta R = 0.20$) : $\Sigma E_T / E_T < 0.15$ - Electron calorimeter isolation ($\Delta R = 0.20$) : $\Sigma E_T / E_T < 0.20$
Impact Parameter Significance	- Apply impact parameter significance cut to all leptons of the quadruplet - For electrons: $d_0/\sigma_{d_0} < 5$ - For muons: $d_0/\sigma_{d_0} < 3$
Best Quadruplet	- If more than one quadruplet has been selected, choose the quadruplet with highest Higgs decay ME according to channel: 4μ, $2e2\mu$, $2\mu2e$ and $4e$
Vertex Selection	- Require a common vertex for the leptons: - χ^2/ndof < 5 for 4μ and < 9 for others decay channels

Additional slides

Kinematic distributions for the signal

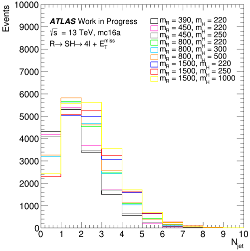


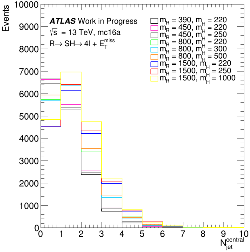


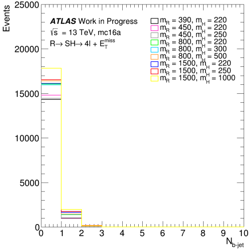


Additional slides

Kinematic distributions for the signal

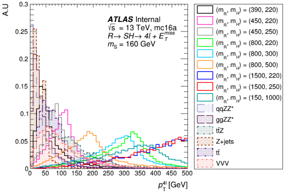


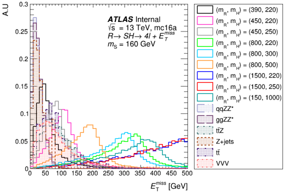


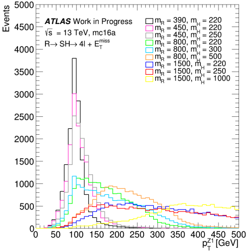


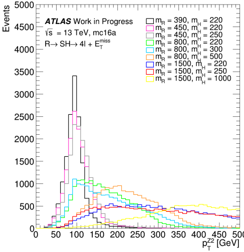
Additional slides

Kinematic distributions for the signal









Additional slides

Kinematic distributions for signal & background

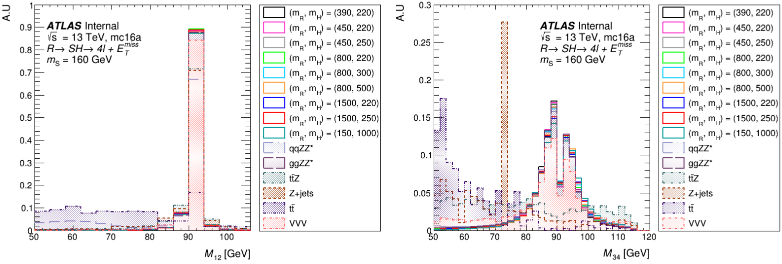
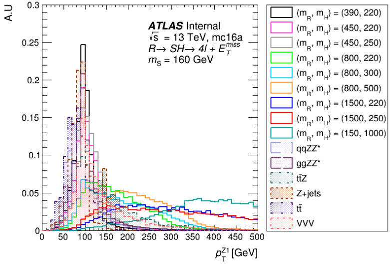


Figure: The invariant mass of the first (left) and the second (right) lepton pairs.



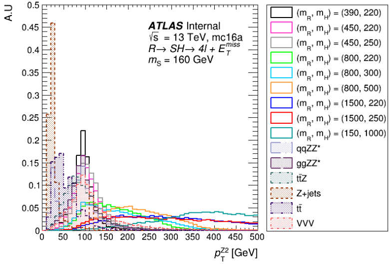
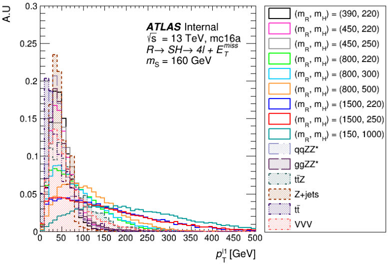
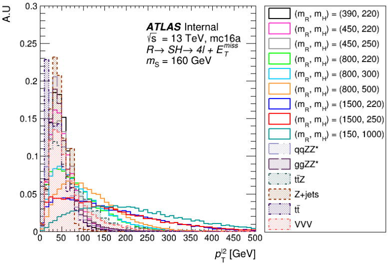


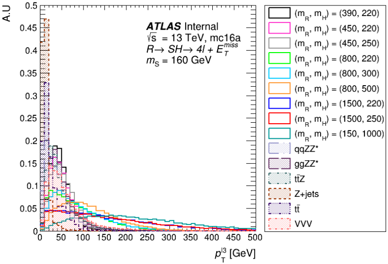
Figure: The invariant mass of the first (left) and the second (right) lepton pairs.

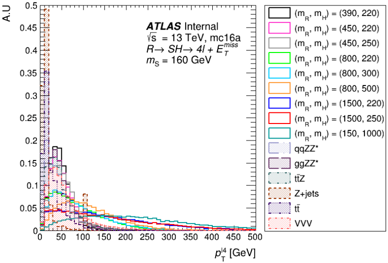
Additional slides

Kinematic distributions









Additional slides

High Met 0 central jet

	$(m_R, m_H) = (390, 220)$	$qqZZ^*$	$ggZZ^*$	$t\bar{t}Z$	$Z + jets$	$t\bar{t}$	VVV	$s/\sqrt{b}$
4ℓ	64.51±0.24	2510.45±5.75	349.64±0.71	8.94±0.05	3.87±0.84	3.55±0.23	19.08±0.11	2.661
B-veto	60.07±0.23	2394.48±5.70	334.96±0.69	1.72±0.02	3.63±0.84	2.27±0.16	17.79±0.11	2.540
$N_{jet}^{central} = 0$	28.02±0.16	1607.35±5.06	211.64±0.55	0.42±0.01	2.10±0.15	0.99±0.10	9.30±0.07	1.453
$p_T^{4\ell} > 0.00$ & Metsig > 0.00	28.02±0.00	1607.35±0.00	211.64±0.00	0.42±0.00	2.10±0.00	0.99±0.00	9.30±0.00	1.453
$p_T^{4\ell} > 0.00$ & Metsig > 0.50	27.47±0.00	1236.12±0.00	180.35±0.00	0.41±0.00	1.98±0.00	0.94±0.00	9.16±0.00	1.613
$p_T^{4\ell} > 0.00$ & Metsig > 1.00	25.61±0.00	685.37±0.00	117.69±0.00	0.40±0.00	1.62±0.00	0.90±0.00	8.77±0.00	1.991
$p_T^{4\ell} > 0.00$ & Metsig > 1.50	22.60±0.00	346.29±0.00	66.12±0.00	0.38±0.00	1.27±0.00	0.79±0.00	8.19±0.00	2.439
$p_T^{4\ell} > 0.00$ & Metsig > 2.00	18.26±0.00	172.22±0.00	34.04±0.00	0.35±0.00	0.79±0.00	0.68±0.00	7.50±0.00	2.761
$p_T^{4\ell} > 0.00$ & Metsig > 2.50	12.83±0.00	83.44±0.00	16.71±0.00	0.33±0.00	0.53±0.00	0.60±0.00	6.77±0.00	2.736
$p_T^{4\ell} > 0.00$ & Metsig > 3.00	7.52±0.00	39.01±0.00	8.01±0.00	0.29±0.00	0.30±0.00	0.55±0.00	6.02±0.00	2.267
$p_T^{4\ell} > 0.00$ & Metsig > 3.50	3.71±0.00	18.93±0.00	3.77±0.00	0.26±0.00	0.17±0.00	0.46±0.00	5.32±0.00	1.533
$p_T^{4\ell} > 0.00$ & Metsig > 4.00	1.74±0.00	9.25±0.00	1.79±0.00	0.22±0.00	0.08±0.00	0.38±0.00	4.66±0.00	0.954
$p_T^{4\ell} > 0.00$ & Metsig > 4.50	0.81±0.00	4.19±0.00	0.79±0.00	0.18±0.00	0.06±0.00	0.26±0.00	4.02±0.00	0.583
$p_T^{4\ell} > 0.00$ & Metsig > 5.00	0.39±0.00	2.29±0.00	0.38±0.00	0.16±0.00	0.05±0.00	0.22±0.00	3.47±0.00	0.336
$p_T^{4\ell} > 10.00$ & Metsig > 0.00	27.17±0.00	1063.48±0.00	180.22±0.00	0.42±0.00	1.82±0.00	0.95±0.00	9.15±0.00	1.702
$p_T^{4\ell} > 10.00$ & Metsig > 0.50	26.74±0.01	913.21±1.03	159.88±0.12	0.41±0.00	1.76±0.02	0.93±0.02	9.04±0.00	1.802
$p_T^{4\ell} > 10.00$ & Metsig > 1.00	25.12±0.02	567.10±1.44	109.46±0.18	0.40±0.00	1.49±0.04	0.89±0.02	8.69±0.01	2.125
$p_T^{4\ell} > 10.00$ & Metsig > 1.50	22.26±0.02	291.10±1.55	62.42±0.20	0.38±0.00	1.20±0.05	0.78±0.02	8.14±0.01	2.590
$p_T^{4\ell} > 10.00$ & Metsig > 2.00	18.03±0.02	142.89±1.60	32.18±0.21	0.35±0.00	0.77±0.05	0.67±0.02	7.47±0.01	2.947
$p_T^{4\ell} > 10.00$ & Metsig > 2.50	12.67±0.02	68.91±1.62	15.83±0.21	0.32±0.00	0.52±0.05	0.59±0.02	6.75±0.01	2.918
$p_T^{4\ell} > 10.00$ & Metsig > 3.00	7.43±0.03	31.91±1.64	7.58±0.21	0.29±0.00	0.29±0.05	0.54±0.02	6.00±0.01	2.414
$p_T^{4\ell} > 10.00$ & Metsig > 3.50	3.65±0.03	15.05±1.64	3.53±0.21	0.26±0.00	0.17±0.05	0.45±0.02	5.31±0.01	1.627
$p_T^{4\ell} > 10.00$ & Metsig > 4.00	1.71±0.03	7.19±1.64	1.66±0.21	0.22±0.00	0.08±0.05	0.37±0.02	4.65±0.01	1.008
$p_T^{4\ell} > 10.00$ & Metsig > 4.50	0.79±0.03	3.09±1.65	0.73±0.21	0.18±0.00	0.06±0.05	0.25±0.02	4.02±0.01	0.611
$p_T^{4\ell} > 10.00$ & Metsig > 5.00	0.38±0.03	1.84±1.65	0.35±0.21	0.16±0.00	0.05±0.05	0.21±0.02	3.47±0.01	0.345
$p_T^{4\ell} > 20.00$ & Metsig > 0.00	24.47±0.00	571.61±0.00	118.61±0.00	0.40±0.00	1.25±0.00	0.93±0.00	8.72±0.00	2.051
$p_T^{4\ell} > 20.00$ & Metsig > 0.50	24.17±0.02	510.65±1.31	107.98±0.17	0.40±0.00	1.22±0.03	0.91±0.03	8.64±0.01	2.138
$p_T^{4\ell} > 20.00$ & Metsig > 1.00	23.06±0.03	368.70±3.95	81.82±0.29	0.39±0.00	1.08±0.06	0.87±0.03	8.39±0.01	2.383
$p_T^{4\ell} > 20.00$ & Metsig > 1.50	20.91±0.04	217.03±4.13	51.37±0.33	0.37±0.00	0.96±0.07	0.77±0.03	7.97±0.01	2.781
$p_T^{4\ell} > 20.00$ & Metsig > 2.00	17.13±0.05	110.51±4.19	27.50±0.35	0.34±0.00	0.68±0.08	0.66±0.03	7.38±0.02	3.136
$p_T^{4\ell} > 20.00$ & Metsig > 2.50	12.10±0.05	53.17±4.22	13.63±0.36	0.32±0.00	0.45±0.09	0.59±0.03	6.69±0.02	3.103
$p_T^{4\ell} > 20.00$ & Metsig > 3.00	7.05±0.05	24.27±4.23	6.54±0.36	0.28±0.00	0.27±0.10	0.54±0.03	5.98±0.02	2.544
$p_T^{4\ell} > 20.00$ & Metsig > 3.50	3.41±0.05	11.15±4.24	3.03±0.36	0.25±0.00	0.17±0.10	0.45±0.03	5.30±0.02	1.678
$p_T^{4\ell} > 20.00$ & Metsig > 4.00	1.59±0.06	5.22±4.24	1.41±0.37	0.21±0.00	0.07±0.10	0.37±0.03	4.65±0.02	1.019
$p_T^{4\ell} > 20.00$ & Metsig > 4.50	0.73±0.06	2.19±4.24	0.62±0.37	0.18±0.00	0.05±0.10	0.25±0.03	4.01±0.02	0.598
$p_T^{4\ell} > 20.00$ & Metsig > 5.00	0.36±0.06	1.40±4.24	0.29±0.37	0.15±0.00	0.04±0.10	0.21±0.03	3.47±0.02	0.336
$p_T^{4\ell} > 30.00$ & Metsig > 0.00	19.78±0.00	312.75±0.00	70.36±0.00	0.39±0.00	0.85±0.00	0.80±0.00	8.07±0.00	2.214
$p_T^{4\ell} > 30.00$ & Metsig > 0.50	19.56±0.02	280.94±1.50	64.29±0.19	0.38±0.00	0.84±0.03	0.78±0.03	8.00±0.01	2.304
$p_T^{4\ell} > 30.00$ & Metsig > 1.00	18.79±0.04	211.83±4.16	50.32±0.32	0.37±0.00	0.77±0.06	0.77±0.03	7.82±0.01	2.529
$p_T^{4\ell} > 30.00$ & Metsig > 1.50	17.41±0.05	140.82±4.48	34.97±0.40	0.36±0.00	0.69±0.08	0.69±0.03	7.54±0.02	2.840
$p_T^{4\ell} > 30.00$ & Metsig > 2.00	14.87±0.07	80.74±4.61	20.88±0.43	0.33±0.00	0.55±0.10	0.63±0.04	7.13±0.02	3.143
$p_T^{4\ell} > 30.00$ & Metsig > 2.50	10.87±0.07	41.23±4.66	10.95±0.44	0.31±0.00	0.39±0.10	0.55±0.04	6.57±0.02	3.114
$p_T^{4\ell} > 30.00$ & Metsig > 3.00	6.35±0.08	19.35±4.69	5.36±0.45	0.28±0.00	0.24±0.11	0.51±0.04	5.91±0.03	2.507
$p_T^{4\ell} > 30.00$ & Metsig > 3.50	3.06±0.08	9.12±4.70	2.49±0.45	0.24±0.00	0.13±0.11	0.44±0.04	5.26±0.03	1.614
$p_T^{4\ell} > 30.00$ & Metsig > 4.00	1.41±0.08	4.58±4.70	1.15±0.45	0.21±0.00	0.07±0.11	0.36±0.04	4.63±0.03	0.942
$p_T^{4\ell} > 30.00$ & Metsig > 4.50	0.65±0.08	2.17±4.71	0.50±0.45	0.18±0.00	0.04±0.11	0.24±0.04	4.01±0.03	0.538
$p_T^{4\ell} > 30.00$ & Metsig > 5.00	0.32±0.09	1.10±4.74	0.22±0.45	0.15±0.00	0.03±0.11	0.21±0.04	3.46±0.03	0.312
$p_T^{4\ell} > 40.00$ & Metsig > 0.00	13.20±0.00	167.47±0.00	40.51±0.00	0.37±0.00	0.49±0.00	0.67±0.00	7.29±0.00	1.989
$p_T^{4\ell} > 40.00$ & Metsig > 0.50	13.04±0.02	150.71±1.61	37.07±0.20	0.36±0.00	0.47±0.03	0.67±0.03	7.24±0.01	2.065
$p_T^{4\ell} > 40.00$ & Metsig > 1.00	12.49±0.04	114.34±4.25	29.04±0.34	0.35±0.00	0.44±0.06	0.65±0.03	7.09±0.01	2.249
$p_T^{4\ell} > 40.00$ & Metsig > 1.50	11.61±0.06	78.22±4.60	20.74±0.42	0.34±0.00	0.39±0.08	0.58±0.03	6.89±0.02	2.490
$p_T^{4\ell} > 40.00$ & Metsig > 2.00	10.18±0.08	49.60±4.77	13.39±0.46	0.31±0.00	0.32±0.10	0.56±0.04	6.63±0.03	2.686
$p_T^{4\ell} > 40.00$ & Metsig > 2.50	8.04±0.09	28.94±4.84	7.88±0.48	0.29±0.00	0.26±0.11	0.49±0.05	6.30±0.03	2.684
$p_T^{4\ell} > 40.00$ & Metsig > 3.00	5.10±0.11	14.89±4.88	4.14±0.49	0.27±0.00	0.17±0.12	0.46±0.05	5.79±0.03	2.232
$p_T^{4\ell} > 40.00$ & Metsig > 3.50	2.55±0.11	7.20±4.90	1.97±0.49	0.24±0.00	0.11±0.13	0.44±0.06	5.20±0.03	1.452
$p_T^{4\ell} > 40.00$ & Metsig > 4.00	1.18±0.11	3.55±4.90	0.93±0.49	0.20±0.00	0.04±0.13	0.36±0.06	4.60±0.03	0.845
$p_T^{4\ell} > 40.00$ & Metsig > 4.50	0.55±0.11	1.75±4.90	0.40±0.50	0.17±0.00	0.02±0.13	0.24±0.06	3.99±0.03	0.472
$p_T^{4\ell} > 40.00$ & Metsig > 5.00	0.27±0.11	0.89±4.94	0.18±0.50	0.15±0.00	0.02±0.13	0.21±0.06	3.45±0.03	0.275
$p_T^{4\ell} > 50.00$ & Metsig > 0.00	7.20±0.00	93.28±0.00	23.52±0.00	0.34±0.00	0.29±0.00	0.58±0.00	6.55±0.00	1.431
$p_T^{4\ell} > 50.00$ & Metsig > 0.50	7.09±0.02	83.38±1.64	21.41±0.20	0.33±0.00	0.28±0.03	0.58±0.03	6.50±0.01	1.485
$p_T^{4\ell} > 50.00$ & Metsig > 1.00	6.72±0.04	63.17±4.28	16.71±0.35	0.32±0.00	0.26±0.06	0.58±0.03	6.38±0.01	1.596
$p_T^{4\ell} > 50.00$ & Metsig > 1.50	6.16±0.06	43.20±4.64	12.00±0.44	0.31±0.00	0.23±0.09	0.50±0.03	6.23±0.02	1.729
$p_T^{4\ell} > 50.00$ & Metsig > 2.00	5.31±0.08	27.89±4.82	7.92±0.48	0.29±0.00	0.19±0.11	0.48±0.05	6.04±0.03	1.800
$p_T^{4\ell} > 50.00$ & Metsig > 2.50	4.27±0.10	17.28±4.90	4.93±0.50	0.27±0.00	0.17±0.12	0.46±0.06	5.83±0.03	1.760
$p_T^{4\ell} > 50.00$ & Metsig > 3.00	3.05±0.12	9.99±4.95	2.85±0.51	0.25±0.00	0.13±0.13	0.44±0.06	5.50±0.04	1.545
$p_T^{4\ell} > 50.00$ & Metsig > 3.50	1.82±0.13	5.36±4.96	1.49±0.52	0.22±0.00	0.09±0.13	0.42±0.07	5.06±0.04	1.135
$p_T^{4\ell} > 50.00$ & Metsig > 4.00	0.91±0.13	2.72±4.97	0.74±0.52	0.19±0.00	0.04±0.13	0.34±0.07	4.53±0.04	0.687
$p_T^{4\ell} > 50.00$ & Metsig > 4.50	0.43±0.14	1.39±4.97	0.33±0.52	0.17±0.00	0.02±0.13	0.24±0.07	3.96±0.04	0.389
$p_T^{4\ell} > 50.00$ & Metsig > 5.00	0.21±0.14	0.73±5.00	0.14±0.52	0.14±0.00	0.02±0.14	0.20±0.07	3.44±0.04	0.221
$p_T^{4\ell} > 60.00$ & Metsig > 0.00	3.81±0.00	56.14±0.00	14.19±0.00	0.31±0.00	0.17±0.00	0.47±0.00	5.75±0.00	0.963
$p_T^{4\ell} > 60.00$ & Metsig > 0.50	3.73±0.02	49.33±1.65	12.79±0.21	0.30±0.00	0.16±0.03	0.47±0.03	5.70±0.01	1.000
$p_T^{4\ell} > 60.00$ & Metsig > 1.00	3.46±0.04	36.45±4.29	9.82±0.36	0.30±0.00	0.14±0.07	0.47±0.03	5.61±0.02	1.057
$p_T^{4\ell} > 60.00$ & Metsig > 1.50	3.09±0.06	24.45±4.66	7.01±0.44	0.28±0.00	0.13±0.09	0.41±0.04	5.48±0.02	1.117
$p_T^{4\ell} > 60.00$ & Metsig > 2.00	2.59±0.09	15.88±4.84	4.62±0.49	0.27±0.00	0.12±0.11	0.39±0.05	5.35±0.03	1.115
$p_T^{4\ell} > 60.00$ & Metsig > 2.50	2.05±0.11	10.04±4.92	2.89±0.51	0.25±0.00	0.11±0.12	0.38±0.06	5.21±0.03	1.045
$p_T^{4\ell} > 60.00$ & Metsig > 3.00	1.49±0.13	6.08±4.97	1.72±0.52	0.23±0.00	0.09±0.13	0.37±0.06	5.01±0.04	0.898
$p_T^{4\ell} > 60.00$ & Metsig > 3.50	1.01±0.14	3.61±4.99	1.02±0.53	0.21±0.00	0.05±0.14	0.35±0.07	4.74±0.04	0.712
$p_T^{4\ell} > 60.00$ & Metsig > 4.00	0.58±0.14	2.05±4.99	0.55±0.53	0.18±0.00	0.03±0.14	0.30±0.07	4.36±0.04	0.474
$p_T^{4\ell} > 60.00$ & Metsig > 4.50	0.31±0.15	1.14±5.00	0.25±0.53	0.16±0.00	0.02±0.14	0.21±0.07	3.89±0.04	0.289
$p_T^{4\ell} > 60.00$ & Metsig > 5.00	0.17±0.15	0.64±5.03	0.11±0.53	0.14±0.00	0.02±0.14	0.18±0.07	3.40±0.04	0.174

	$(m_R, m_H) = (390, 220)$	$qqZZ^*$	$ggZZ^*$	$t\bar{t}Z$	$Z + jets$	$t\bar{t}$	VVV	$s/\sqrt{b}$
4ℓ	64.51±0.24	2510.45±5.75	349.64±0.71	8.94±0.05	3.87±0.84	3.55±0.23	19.08±0.11	2.661
B-veto	60.07±0.23	2394.48±5.70	334.96±0.69	1.72±0.02	3.63±0.84	2.27±0.16	17.79±0.11	2.540
$N_{\text{jet}}^{\text{central}} = 0$	28.02±0.16	1607.35±5.06	211.64±0.55	0.42±0.01	2.10±0.15	0.99±0.10	9.30±0.07	1.453
$p_T^{4\ell} > 0.00$ & Metsig > 0.00	13.15±0.00	1526.61±0.00	190.77±0.00	0.09±0.00	1.55±0.00	0.36±0.00	2.17±0.00	0.703
$p_T^{4\ell} > 0.00$ & Metsig > 0.50	12.60±0.00	1155.38±0.00	159.47±0.00	0.08±0.00	1.43±0.00	0.31±0.00	2.03±0.00	0.770
$p_T^{4\ell} > 0.00$ & Metsig > 1.00	10.74±0.00	604.62±0.00	96.81±0.00	0.07±0.00	1.07±0.00	0.27±0.00	1.64±0.00	0.898
$p_T^{4\ell} > 0.00$ & Metsig > 1.50	7.73±0.00	265.55±0.00	45.24±0.00	0.05±0.00	0.73±0.00	0.16±0.00	1.06±0.00	0.970
$p_T^{4\ell} > 10.00$ & Metsig > 0.00	12.30±0.00	982.74±0.00	159.35±0.00	0.08±0.00	1.27±0.00	0.32±0.00	2.03±0.00	0.807
$p_T^{4\ell} > 10.00$ & Metsig > 0.50	11.88±0.01	832.47±1.03	139.00±0.12	0.08±0.00	1.21±0.02	0.30±0.02	1.91±0.00	0.844
$p_T^{4\ell} > 10.00$ & Metsig > 1.00	10.25±0.02	486.36±1.44	88.59±0.18	0.07±0.00	0.94±0.04	0.26±0.02	1.56±0.01	0.946
$p_T^{4\ell} > 10.00$ & Metsig > 1.50	7.39±0.02	210.36±1.55	41.54±0.20	0.05±0.00	0.65±0.05	0.15±0.02	1.01±0.01	1.030
$p_T^{4\ell} > 15.00$ & Metsig > 0.00	11.22±0.00	689.13±0.00	128.27±0.00	0.08±0.00	0.96±0.00	0.31±0.00	1.83±0.00	0.869
$p_T^{4\ell} > 15.00$ & Metsig > 0.50	10.86±0.01	600.82±1.18	113.76±0.15	0.07±0.00	0.91±0.03	0.30±0.03	1.74±0.01	0.900
$p_T^{4\ell} > 15.00$ & Metsig > 1.00	9.49±0.02	386.30±1.79	76.84±0.25	0.06±0.00	0.73±0.05	0.26±0.03	1.45±0.01	0.976
$p_T^{4\ell} > 15.00$ & Metsig > 1.50	6.89±0.03	172.44±1.98	36.85±0.28	0.04±0.00	0.53±0.06	0.15±0.03	0.95±0.01	1.052
$p_T^{4\ell} > 20.00$ & Metsig > 0.00	9.60±0.00	490.87±0.00	97.73±0.00	0.07±0.00	0.70±0.00	0.30±0.00	1.59±0.00	0.877
$p_T^{4\ell} > 20.00$ & Metsig > 0.50	9.31±0.02	429.91±1.31	87.10±0.17	0.07±0.00	0.67±0.03	0.28±0.03	1.51±0.01	0.906
$p_T^{4\ell} > 20.00$ & Metsig > 1.00	8.19±0.03	287.96±3.95	60.95±0.29	0.06±0.00	0.53±0.06	0.24±0.03	1.26±0.01	0.970
$p_T^{4\ell} > 20.00$ & Metsig > 1.50	6.04±0.04	136.29±4.13	30.49±0.33	0.04±0.00	0.41±0.07	0.14±0.03	0.84±0.01	1.033
$p_T^{4\ell} > 25.00$ & Metsig > 0.00	7.54±0.00	345.05±0.00	70.89±0.00	0.07±0.00	0.53±0.00	0.25±0.00	1.29±0.00	0.818
$p_T^{4\ell} > 25.00$ & Metsig > 0.50	7.29±0.02	300.51±1.44	62.89±0.18	0.06±0.00	0.51±0.03	0.23±0.03	1.21±0.01	0.846
$p_T^{4\ell} > 25.00$ & Metsig > 1.00	6.37±0.03	202.95±4.09	44.15±0.31	0.05±0.00	0.38±0.06	0.22±0.03	1.00±0.01	0.896
$p_T^{4\ell} > 25.00$ & Metsig > 1.50	4.64±0.05	98.43±4.36	22.49±0.37	0.03±0.00	0.28±0.08	0.13±0.03	0.66±0.02	0.932
$p_T^{4\ell} > 5.00$ & Metsig > 0.00	12.94±0.00	1333.50±0.00	182.83±0.00	0.09±0.00	1.45±0.00	0.36±0.00	2.14±0.00	0.737
$p_T^{4\ell} > 5.00$ & Metsig > 0.50	12.42±0.01	1058.18±0.68	154.94±0.07	0.08±0.00	1.34±0.01	0.31±0.00	2.00±0.00	0.791
$p_T^{4\ell} > 5.00$ & Metsig > 1.00	10.61±0.01	568.66±0.88	95.02±0.09	0.07±0.00	1.01±0.02	0.27±0.00	1.62±0.00	0.912
$p_T^{4\ell} > 5.00$ & Metsig > 1.50	7.64±0.01	247.18±0.93	44.36±0.10	0.05±0.00	0.69±0.02	0.16±0.00	1.05±0.00	0.990

Additional slides

High Met 1 central jet

	$(m_R, m_H) = (390, 220)$	$qqZZ^*$	$ggZZ^*$	$t\bar{t}Z$	$Z + jets$	$t\bar{t}$	VVV	$s/\sqrt{b}$
4ℓ	64.51±0.24	2510.45±5.75	349.64±0.71	8.94±0.05	3.87±0.84	3.55±0.23	19.08±0.11	2.661
B-veto	60.07±0.23	2394.48±5.70	334.96±0.69	1.72±0.02	3.63±0.84	2.27±0.16	17.79±0.11	2.540
$N_{jet}^{central} \geq 1$	32.05±0.17	787.13±2.63	123.31±0.42	1.30±0.02	1.53±0.83	1.27±0.13	8.49±0.08	2.341
$p_T^{4\ell} > 0.00$ GeV & Metsig > 0.00	32.05±0.17	787.13±2.63	123.31±0.42	1.30±0.02	1.53±0.83	1.27±0.13	8.49±0.08	2.341
$p_T^{4\ell} > 0.00$ GeV & Metsig > 0.50	31.46±0.17	657.01±2.45	106.88±0.39	1.28±0.02	1.49±0.83	1.27±0.13	8.32±0.08	2.506
$p_T^{4\ell} > 0.00$ GeV & Metsig > 1.00	29.70±0.16	409.28±1.53	72.34±0.32	1.23±0.02	1.43±0.83	1.21±0.12	7.89±0.08	2.968
$p_T^{4\ell} > 0.00$ GeV & Metsig > 1.50	26.92±0.16	217.56±1.12	41.32±0.25	1.15±0.02	1.29±0.82	1.15±0.12	7.29±0.08	3.638
$p_T^{4\ell} > 0.00$ GeV & Metsig > 2.00	23.40±0.15	104.71±0.82	21.23±0.18	1.04±0.02	0.25±0.05	1.04±0.12	6.55±0.07	4.473
$p_T^{4\ell} > 0.00$ GeV & Metsig > 2.50	19.58±0.13	48.63±0.61	10.13±0.12	0.93±0.02	0.18±0.04	0.95±0.11	5.79±0.07	5.324
$p_T^{4\ell} > 0.00$ GeV & Metsig > 3.00	15.63±0.12	22.57±0.33	4.78±0.08	0.81±0.01	0.09±0.03	0.86±0.11	5.06±0.06	5.932
$p_T^{4\ell} > 0.00$ GeV & Metsig > 3.50	11.99±0.10	10.40±0.23	2.21±0.06	0.69±0.01	0.05±0.03	0.67±0.09	4.40±0.06	6.198
$p_T^{4\ell} > 0.00$ GeV & Metsig > 4.00	8.99±0.09	4.83±0.15	0.98±0.04	0.58±0.01	0.03±0.02	0.55±0.08	3.78±0.05	6.079
$p_T^{4\ell} > 0.00$ GeV & Metsig > 4.50	6.61±0.08	2.36±0.10	0.45±0.03	0.49±0.01	0.01±0.02	0.43±0.07	3.25±0.05	5.553
$p_T^{4\ell} > 0.00$ GeV & Metsig > 5.00	4.74±0.07	1.14±0.07	0.18±0.02	0.40±0.01	-0.01±0.01	0.39±0.07	2.77±0.05	4.769
$p_T^{4\ell} > 10.00$ GeV & Metsig > 0.00	31.54±0.17	768.05±2.61	121.50±0.42	1.29±0.02	1.51±0.83	1.26±0.13	8.42±0.08	2.331
$p_T^{4\ell} > 10.00$ GeV & Metsig > 0.50	30.95±0.17	639.68±2.43	105.22±0.39	1.27±0.02	1.48±0.83	1.26±0.13	8.26±0.08	2.496
$p_T^{4\ell} > 10.00$ GeV & Metsig > 1.00	29.20±0.16	395.34±1.51	71.01±0.32	1.22±0.02	1.42±0.83	1.20±0.12	7.83±0.08	2.965
$p_T^{4\ell} > 10.00$ GeV & Metsig > 1.50	26.44±0.16	207.68±1.10	40.38±0.24	1.14±0.02	1.29±0.82	1.14±0.12	7.24±0.07	3.647
$p_T^{4\ell} > 10.00$ GeV & Metsig > 2.00	22.97±0.14	99.05±0.80	20.70±0.17	1.04±0.02	0.25±0.05	1.03±0.12	6.50±0.07	4.496
$p_T^{4\ell} > 10.00$ GeV & Metsig > 2.50	19.23±0.13	46.06±0.60	9.89±0.12	0.92±0.02	0.18±0.04	0.94±0.11	5.75±0.07	5.345
$p_T^{4\ell} > 10.00$ GeV & Metsig > 3.00	15.35±0.12	21.45±0.32	4.67±0.08	0.81±0.01	0.09±0.03	0.86±0.11	5.03±0.06	5.940
$p_T^{4\ell} > 10.00$ GeV & Metsig > 3.50	11.80±0.10	9.81±0.22	2.15±0.06	0.69±0.01	0.05±0.03	0.66±0.09	4.37±0.06	6.221
$p_T^{4\ell} > 10.00$ GeV & Metsig > 4.00	8.88±0.09	4.54±0.15	0.95±0.04	0.58±0.01	0.03±0.02	0.54±0.08	3.76±0.05	6.107
$p_T^{4\ell} > 10.00$ GeV & Metsig > 4.50	6.56±0.08	2.24±0.10	0.44±0.03	0.48±0.01	0.01±0.02	0.43±0.07	3.24±0.05	5.563
$p_T^{4\ell} > 10.00$ GeV & Metsig > 5.00	4.72±0.06	1.06±0.06	0.18±0.02	0.40±0.01	-0.01±0.01	0.39±0.07	2.76±0.05	4.789
$p_T^{4\ell} > 20.00$ GeV & Metsig > 0.00	30.03±0.17	727.67±2.20	115.32±0.41	1.27±0.02	1.49±0.83	1.24±0.13	8.24±0.08	2.279
$p_T^{4\ell} > 20.00$ GeV & Metsig > 0.50	29.45±0.16	602.83±1.99	99.52±0.38	1.25±0.02	1.45±0.83	1.24±0.13	8.08±0.08	2.446
$p_T^{4\ell} > 20.00$ GeV & Metsig > 1.00	27.75±0.16	368.32±1.43	66.64±0.31	1.20±0.02	1.39±0.83	1.18±0.12	7.67±0.08	2.915
$p_T^{4\ell} > 20.00$ GeV & Metsig > 1.50	25.08±0.15	190.63±1.02	37.62±0.23	1.12±0.02	1.27±0.82	1.12±0.12	7.09±0.07	3.601
$p_T^{4\ell} > 20.00$ GeV & Metsig > 2.00	21.75±0.14	89.86±0.76	19.19±0.17	1.02±0.02	0.23±0.05	1.02±0.12	6.39±0.07	4.449
$p_T^{4\ell} > 20.00$ GeV & Metsig > 2.50	18.20±0.13	41.70±0.58	9.15±0.12	0.91±0.02	0.15±0.04	0.93±0.11	5.65±0.07	5.282
$p_T^{4\ell} > 20.00$ GeV & Metsig > 3.00	14.59±0.11	19.25±0.30	4.33±0.08	0.79±0.01	0.08±0.03	0.85±0.11	4.95±0.06	5.885
$p_T^{4\ell} > 20.00$ GeV & Metsig > 3.50	11.28±0.10	8.85±0.21	1.99±0.05	0.67±0.01	0.05±0.03	0.66±0.09	4.32±0.06	6.154
$p_T^{4\ell} > 20.00$ GeV & Metsig > 4.00	8.56±0.09	4.09±0.14	0.88±0.04	0.57±0.01	0.03±0.02	0.54±0.08	3.72±0.05	6.062
$p_T^{4\ell} > 20.00$ GeV & Metsig > 4.50	6.40±0.08	2.02±0.09	0.41±0.02	0.47±0.01	0.01±0.02	0.43±0.07	3.21±0.05	5.549
$p_T^{4\ell} > 20.00$ GeV & Metsig > 5.00	4.64±0.06	0.95±0.06	0.16±0.01	0.39±0.01	-0.01±0.01	0.39±0.07	2.74±0.05	4.788
$p_T^{4\ell} > 30.00$ GeV & Metsig > 0.00	27.84±0.16	669.92±2.06	104.23±0.39	1.23±0.02	1.44±0.83	1.18±0.12	7.97±0.08	2.204
$p_T^{4\ell} > 30.00$ GeV & Metsig > 0.50	27.29±0.16	552.48±1.85	89.67±0.36	1.21±0.02	1.41±0.83	1.18±0.12	7.82±0.08	2.369
$p_T^{4\ell} > 30.00$ GeV & Metsig > 1.00	25.66±0.15	335.10±1.31	59.69±0.29	1.16±0.02	1.36±0.83	1.12±0.12	7.42±0.07	2.827
$p_T^{4\ell} > 30.00$ GeV & Metsig > 1.50	23.14±0.15	172.38±0.93	33.51±0.22	1.08±0.02	1.24±0.82	1.06±0.12	6.87±0.07	3.493
$p_T^{4\ell} > 30.00$ GeV & Metsig > 2.00	20.02±0.13	80.88±0.69	17.03±0.16	0.99±0.02	0.21±0.05	0.97±0.11	6.20±0.07	4.310
$p_T^{4\ell} > 30.00$ GeV & Metsig > 2.50	16.73±0.12	37.05±0.54	8.04±0.11	0.88±0.02	0.14±0.04	0.89±0.11	5.50±0.07	5.126
$p_T^{4\ell} > 30.00$ GeV & Metsig > 3.00	13.43±0.11	16.77±0.26	3.79±0.07	0.77±0.01	0.07±0.03	0.81±0.10	4.82±0.06	5.736
$p_T^{4\ell} > 30.00$ GeV & Metsig > 3.50	10.47±0.10	7.70±0.18	1.74±0.05	0.66±0.01	0.04±0.02	0.61±0.09	4.22±0.06	6.010
$p_T^{4\ell} > 30.00$ GeV & Metsig > 4.00	8.08±0.09	3.56±0.12	0.77±0.03	0.56±0.01	0.02±0.02	0.53±0.08	3.65±0.05	5.951
$p_T^{4\ell} > 30.00$ GeV & Metsig > 4.50	6.13±0.07	1.77±0.08	0.36±0.02	0.46±0.01	-0.00±0.01	0.42±0.07	3.16±0.05	5.476
$p_T^{4\ell} > 30.00$ GeV & Metsig > 5.00	4.52±0.06	0.79±0.05	0.14±0.01	0.38±0.01	-0.01±0.01	0.39±0.07	2.70±0.05	4.784
$p_T^{4\ell} > 40.00$ GeV & Metsig > 0.00	25.03±0.15	591.10±1.71	90.10±0.36	1.17±0.02	1.34±0.82	1.16±0.12	7.60±0.07	2.111
$p_T^{4\ell} > 40.00$ GeV & Metsig > 0.50	24.54±0.15	488.41±1.53	77.71±0.33	1.15±0.02	1.32±0.82	1.16±0.12	7.46±0.07	2.267
$p_T^{4\ell} > 40.00$ GeV & Metsig > 1.00	23.06±0.14	296.51±1.17	51.80±0.27	1.11±0.02	1.28±0.82	1.10±0.12	7.08±0.07	2.702
$p_T^{4\ell} > 40.00$ GeV & Metsig > 1.50	20.77±0.14	151.47±0.84	29.01±0.21	1.03±0.02	1.17±0.82	1.05±0.12	6.56±0.07	3.342
$p_T^{4\ell} > 40.00$ GeV & Metsig > 2.00	17.93±0.13	70.10±0.63	14.65±0.15	0.94±0.02	0.19±0.04	0.96±0.11	5.94±0.07	4.131
$p_T^{4\ell} > 40.00$ GeV & Metsig > 2.50	15.04±0.12	31.61±0.50	6.90±0.10	0.84±0.02	0.13±0.03	0.88±0.11	5.28±0.06	4.941
$p_T^{4\ell} > 40.00$ GeV & Metsig > 3.00	12.17±0.10	14.29±0.23	3.22±0.07	0.74±0.01	0.08±0.03	0.79±0.10	4.64±0.06	5.542
$p_T^{4\ell} > 40.00$ GeV & Metsig > 3.50	9.61±0.09	6.49±0.16	1.47±0.05	0.63±0.01	0.05±0.02	0.61±0.09	4.08±0.06	5.840
$p_T^{4\ell} > 40.00$ GeV & Metsig > 4.00	7.53±0.08	2.96±0.10	0.65±0.03	0.53±0.01	0.03±0.01	0.52±0.08	3.54±0.05	5.824
$p_T^{4\ell} > 40.00$ GeV & Metsig > 4.50	5.83±0.07	1.53±0.07	0.30±0.02	0.45±0.01	0.01±0.01	0.42±0.07	3.08±0.05	5.376
$p_T^{4\ell} > 40.00$ GeV & Metsig > 5.00	4.37±0.06	0.69±0.04	0.12±0.01	0.37±0.01	0.00±0.00	0.39±0.07	2.65±0.05	4.720
$p_T^{4\ell} > 50.00$ GeV & Metsig > 0.00	22.01±0.14	507.48±1.49	74.79±0.33	1.11±0.02	0.42±0.06	1.02±0.12	7.22±0.07	2.008
$p_T^{4\ell} > 50.00$ GeV & Metsig > 0.50	21.57±0.14	421.04±1.33	64.74±0.31	1.10±0.02	0.39±0.06	1.02±0.12	7.08±0.07	2.151
$p_T^{4\ell} > 50.00$ GeV & Metsig > 1.00	20.25±0.14	256.89±1.04	43.40±0.25	1.05±0.02	0.35±0.06	0.97±0.11	6.74±0.07	2.556
$p_T^{4\ell} > 50.00$ GeV & Metsig > 1.50	18.23±0.13	130.96±0.76	24.23±0.19	0.99±0.02	0.26±0.05	0.92±0.11	6.26±0.07	3.164
$p_T^{4\ell} > 50.00$ GeV & Metsig > 2.00	15.78±0.12	60.20±0.58	12.23±0.13	0.90±0.02	0.18±0.04	0.84±0.11	5.68±0.07	3.914
$p_T^{4\ell} > 50.00$ GeV & Metsig > 2.50	13.29±0.11	26.95±0.47	5.79±0.09	0.81±0.01	0.12±0.03	0.77±0.10	5.07±0.06	4.691
$p_T^{4\ell} > 50.00$ GeV & Metsig > 3.00	10.83±0.10	12.23±0.20	2.70±0.06	0.70±0.01	0.08±0.03	0.70±0.10	4.47±0.06	5.260
$p_T^{4\ell} > 50.00$ GeV & Metsig > 3.50	8.69±0.09	5.56±0.14	1.24±0.04	0.60±0.01	0.05±0.02	0.53±0.08	3.93±0.06	5.591
$p_T^{4\ell} > 50.00$ GeV & Metsig > 4.00	6.94±0.08	2.62±0.09	0.53±0.03	0.51±0.01	0.03±0.01	0.44±0.07	3.43±0.05	5.599
$p_T^{4\ell} > 50.00$ GeV & Metsig > 4.50	5.45±0.07	1.36±0.06	0.24±0.02	0.43±0.01	0.01±0.01	0.36±0.07	2.99±0.05	5.211
$p_T^{4\ell} > 50.00$ GeV & Metsig > 5.00	4.17±0.06	0.60±0.04	0.10±0.01	0.36±0.01	0.00±0.00	0.33±0.06	2.58±0.04	4.650
$p_T^{4\ell} > 60.00$ GeV & Metsig > 0.00	18.99±0.13	431.79±1.28	60.82±0.30	1.04±0.02	0.30±0.05	0.89±0.11	6.79±0.07	1.882
$p_T^{4\ell} > 60.00$ GeV & Metsig > 0.50	18.62±0.13	358.85±1.13	52.82±0.28	1.03±0.02	0.29±0.05	0.89±0.11	6.67±0.07	2.016
$p_T^{4\ell} > 60.00$ GeV & Metsig > 1.00	17.51±0.13	219.69±0.87	35.56±0.23	0.99±0.02	0.25±0.05	0.84±0.11	6.35±0.07	2.393
$p_T^{4\ell} > 60.00$ GeV & Metsig > 1.50	15.81±0.12	112.76±0.60	19.94±0.17	0.93±0.02	0.17±0.04	0.81±0.11	5.91±0.07	2.959
$p_T^{4\ell} > 60.00$ GeV & Metsig > 2.00	13.76±0.11	51.85±0.41	10.05±0.12	0.85±0.02	0.12±0.03	0.73±0.10	5.38±0.06	3.678
$p_T^{4\ell} > 60.00$ GeV & Metsig > 2.50	11.70±0.10	23.52±0.28	4.75±0.08	0.76±0.01	0.07±0.03	0.66±0.10	4.82±0.06	4.417
$p_T^{4\ell} > 60.00$ GeV & Metsig > 3.00	9.68±0.09	10.50±0.18	2.25±0.06	0.67±0.01	0.04±0.02	0.59±0.09	4.26±0.06	5.022
$p_T^{4\ell} > 60.00$ GeV & Metsig > 3.50	7.91±0.08	4.80±0.12	1.02±0.04	0.57±0.01	0.02±0.01	0.43±0.07	3.75±0.05	5.395
$p_T^{4\ell} > 60.00$ GeV & Metsig > 4.00	6.42±0.08	2.27±0.08	0.44±0.03	0.49±0.01	0.01±0.01	0.36±0.07	3.28±0.05	5.443
$p_T^{4\ell} > 60.00$ GeV & Metsig > 4.50	5.14±0.07	1.15±0.05	0.19±0.02	0.41±0.01	0.01±0.01	0.33±0.06	2.88±0.05	5.113
$p_T^{4\ell} > 60.00$ GeV & Metsig > 5.00	4.00±0.06	0.51±0.03	0.07±0.01	0.34±0.01	0.00±0.00	0.31±0.06	2.50±0.04	4.599

Additional slides

Low Met 1 central jet

	$(m_R, m_H) = (390, 220)$	$qqZZ^*$	$ggZZ^*$	$t\bar{t}Z$	$Z+jets$	$t\bar{t}$	VVV	$s/\sqrt{b}$
4ℓ	64.51±0.24	2510.45±5.75	349.64±0.71	8.94±0.05	3.87±0.84	3.55±0.23	19.08±0.11	2.661
B-veto	60.07±0.23	2394.48±5.70	334.96±0.69	1.72±0.02	3.63±0.84	2.27±0.16	17.79±0.11	2.540
$N_{\text{jet}}^{\text{central}} \geq 1$	32.05±0.17	787.13±2.63	123.31±0.42	1.30±0.02	1.53±0.83	1.27±0.13	8.49±0.08	2.341
$p_T^{4\ell} > 0.00$ GeV & Metsig > 0.00	20.25±0.14	777.32±2.62	121.16±0.42	0.61±0.01	1.47±0.83	0.61±0.09	4.12±0.05	1.494
$p_T^{4\ell} > 0.00$ GeV & Metsig > 0.50	19.66±0.13	647.21±2.44	104.73±0.39	0.59±0.01	1.44±0.83	0.61±0.09	3.96±0.05	1.584
$p_T^{4\ell} > 0.00$ GeV & Metsig > 1.00	17.90±0.13	399.48±1.52	70.19±0.32	0.54±0.01	1.37±0.83	0.54±0.08	3.52±0.05	1.822
$p_T^{4\ell} > 0.00$ GeV & Metsig > 1.50	15.12±0.12	207.75±1.10	39.17±0.24	0.46±0.01	1.24±0.82	0.49±0.08	2.92±0.05	2.114
$p_T^{4\ell} > 0.00$ GeV & Metsig > 2.00	11.60±0.10	94.91±0.79	19.08±0.17	0.36±0.01	0.20±0.04	0.37±0.07	2.18±0.04	2.379
$p_T^{4\ell} > 0.00$ GeV & Metsig > 2.50	7.78±0.08	38.83±0.57	7.99±0.11	0.24±0.01	0.12±0.03	0.28±0.06	1.42±0.03	2.469
$p_T^{4\ell} > 0.00$ GeV & Metsig > 3.00	3.83±0.06	12.77±0.25	2.64±0.06	0.13±0.01	0.04±0.02	0.20±0.06	0.69±0.02	2.093
$p_T^{4\ell} > 5.00$ GeV & Metsig > 0.00	20.12±0.14	771.50±2.61	120.76±0.42	0.61±0.01	1.47±0.83	0.61±0.09	4.10±0.05	1.490
$p_T^{4\ell} > 5.00$ GeV & Metsig > 0.50	19.54±0.13	641.99±2.43	104.36±0.39	0.59±0.01	1.43±0.83	0.61±0.09	3.94±0.05	1.580
$p_T^{4\ell} > 5.00$ GeV & Metsig > 1.00	17.78±0.13	395.31±1.51	69.90±0.32	0.54±0.01	1.37±0.83	0.54±0.08	3.51±0.05	1.818
$p_T^{4\ell} > 5.00$ GeV & Metsig > 1.50	15.01±0.12	204.76±1.09	38.96±0.24	0.46±0.01	1.23±0.82	0.49±0.08	2.91±0.05	2.112
$p_T^{4\ell} > 5.00$ GeV & Metsig > 2.00	11.50±0.10	93.23±0.79	18.94±0.17	0.36±0.01	0.19±0.04	0.37±0.07	2.17±0.04	2.377
$p_T^{4\ell} > 5.00$ GeV & Metsig > 2.50	7.70±0.08	38.05±0.57	7.92±0.11	0.24±0.01	0.12±0.03	0.28±0.06	1.41±0.03	2.464
$p_T^{4\ell} > 5.00$ GeV & Metsig > 3.00	3.76±0.06	12.47±0.25	2.60±0.06	0.12±0.01	0.04±0.02	0.20±0.06	0.68±0.02	2.081
$p_T^{4\ell} > 10.00$ GeV & Metsig > 0.00	19.74±0.13	758.25±2.60	119.35±0.41	0.60±0.01	1.46±0.83	0.60±0.09	4.05±0.05	1.473
$p_T^{4\ell} > 10.00$ GeV & Metsig > 0.50	19.15±0.13	629.87±2.42	103.07±0.39	0.59±0.01	1.42±0.83	0.60±0.09	3.89±0.05	1.563
$p_T^{4\ell} > 10.00$ GeV & Metsig > 1.00	17.40±0.13	385.54±1.49	68.86±0.32	0.53±0.01	1.36±0.83	0.54±0.08	3.46±0.05	1.800
$p_T^{4\ell} > 10.00$ GeV & Metsig > 1.50	14.64±0.12	197.87±1.07	38.24±0.24	0.45±0.01	1.23±0.82	0.48±0.08	2.87±0.05	2.092
$p_T^{4\ell} > 10.00$ GeV & Metsig > 2.00	11.17±0.10	89.24±0.77	18.55±0.16	0.35±0.01	0.19±0.04	0.37±0.07	2.13±0.04	2.354
$p_T^{4\ell} > 10.00$ GeV & Metsig > 2.50	7.43±0.08	36.26±0.56	7.75±0.11	0.24±0.01	0.12±0.03	0.28±0.06	1.38±0.03	2.430
$p_T^{4\ell} > 10.00$ GeV & Metsig > 3.00	3.55±0.06	11.65±0.24	2.52±0.06	0.12±0.01	0.04±0.02	0.19±0.06	0.66±0.02	2.023
$p_T^{4\ell} > 15.00$ GeV & Metsig > 0.00	19.32±0.13	740.77±2.58	116.98±0.41	0.60±0.01	1.45±0.83	0.59±0.09	4.01±0.05	1.458
$p_T^{4\ell} > 15.00$ GeV & Metsig > 0.50	18.73±0.13	613.95±2.40	100.89±0.38	0.58±0.01	1.41±0.83	0.59±0.09	3.85±0.05	1.548
$p_T^{4\ell} > 15.00$ GeV & Metsig > 1.00	17.01±0.13	373.09±1.46	67.16±0.31	0.53±0.01	1.35±0.83	0.53±0.08	3.42±0.05	1.787
$p_T^{4\ell} > 15.00$ GeV & Metsig > 1.50	14.28±0.11	189.70±1.04	37.14±0.23	0.45±0.01	1.23±0.82	0.47±0.08	2.83±0.05	2.081
$p_T^{4\ell} > 15.00$ GeV & Metsig > 2.00	10.87±0.10	84.88±0.76	17.98±0.16	0.35±0.01	0.18±0.04	0.37±0.07	2.11±0.04	2.345
$p_T^{4\ell} > 15.00$ GeV & Metsig > 2.50	7.21±0.08	34.46±0.55	7.49±0.10	0.24±0.01	0.11±0.03	0.28±0.06	1.36±0.03	2.413
$p_T^{4\ell} > 15.00$ GeV & Metsig > 3.00	3.45±0.06	10.96±0.23	2.45±0.06	0.12±0.01	0.04±0.02	0.19±0.06	0.65±0.02	2.015
$p_T^{4\ell} > 20.00$ GeV & Metsig > 0.00	18.75±0.13	718.82±2.19	113.33±0.40	0.59±0.01	1.43±0.83	0.58±0.09	3.93±0.05	1.437
$p_T^{4\ell} > 20.00$ GeV & Metsig > 0.50	18.18±0.13	593.98±1.98	97.53±0.37	0.58±0.01	1.39±0.83	0.58±0.09	3.77±0.05	1.527
$p_T^{4\ell} > 20.00$ GeV & Metsig > 1.00	16.47±0.12	359.47±1.42	64.65±0.31	0.52±0.01	1.33±0.83	0.52±0.08	3.35±0.05	1.763
$p_T^{4\ell} > 20.00$ GeV & Metsig > 1.50	13.80±0.11	181.78±1.00	35.63±0.23	0.45±0.01	1.21±0.82	0.46±0.08	2.77±0.05	2.054
$p_T^{4\ell} > 20.00$ GeV & Metsig > 2.00	10.47±0.10	81.00±0.73	17.20±0.16	0.35±0.01	0.17±0.04	0.37±0.07	2.07±0.04	2.310
$p_T^{4\ell} > 20.00$ GeV & Metsig > 2.50	6.92±0.08	32.84±0.54	7.16±0.10	0.24±0.01	0.10±0.03	0.28±0.06	1.34±0.03	2.373
$p_T^{4\ell} > 20.00$ GeV & Metsig > 3.00	3.31±0.06	10.40±0.22	2.34±0.06	0.12±0.01	0.03±0.02	0.19±0.06	0.63±0.02	1.981
$p_T^{4\ell} > 25.00$ GeV & Metsig > 0.00	18.08±0.13	693.64±2.13	108.53±0.39	0.58±0.01	1.42±0.83	0.58±0.09	3.85±0.05	1.411
$p_T^{4\ell} > 25.00$ GeV & Metsig > 0.50	17.51±0.13	571.60±1.92	93.22±0.37	0.57±0.01	1.39±0.83	0.58±0.09	3.69±0.05	1.501
$p_T^{4\ell} > 25.00$ GeV & Metsig > 1.00	15.84±0.12	344.28±1.36	61.60±0.30	0.52±0.01	1.32±0.83	0.51±0.08	3.28±0.05	1.733
$p_T^{4\ell} > 25.00$ GeV & Metsig > 1.50	13.24±0.11	173.81±0.96	33.86±0.22	0.44±0.01	1.20±0.82	0.45±0.08	2.71±0.05	2.017
$p_T^{4\ell} > 25.00$ GeV & Metsig > 2.00	10.01±0.10	77.39±0.70	16.32±0.15	0.34±0.01	0.17±0.04	0.37±0.07	2.02±0.04	2.261
$p_T^{4\ell} > 25.00$ GeV & Metsig > 2.50	6.59±0.08	31.16±0.52	6.76±0.10	0.23±0.01	0.10±0.03	0.28±0.06	1.31±0.03	2.319
$p_T^{4\ell} > 25.00$ GeV & Metsig > 3.00	3.13±0.05	9.72±0.20	2.21±0.06	0.12±0.01	0.03±0.02	0.19±0.06	0.62±0.02	1.938
$p_T^{4\ell} > 30.00$ GeV & Metsig > 0.00	17.36±0.13	662.22±2.06	102.50±0.38	0.57±0.01	1.40±0.83	0.56±0.09	3.76±0.05	1.388
$p_T^{4\ell} > 30.00$ GeV & Metsig > 0.50	16.81±0.12	544.79±1.85	87.93±0.36	0.55±0.01	1.38±0.83	0.56±0.09	3.60±0.05	1.477
$p_T^{4\ell} > 30.00$ GeV & Metsig > 1.00	15.19±0.12	327.41±1.30	57.95±0.29	0.50±0.01	1.32±0.83	0.50±0.08	3.20±0.05	1.705
$p_T^{4\ell} > 30.00$ GeV & Metsig > 1.50	12.66±0.11	164.68±0.91	31.77±0.21	0.43±0.01	1.20±0.82	0.45±0.08	2.65±0.04	1.982
$p_T^{4\ell} > 30.00$ GeV & Metsig > 2.00	9.54±0.09	73.18±0.66	15.29±0.15	0.33±0.01	0.17±0.04	0.36±0.07	1.98±0.04	2.216
$p_T^{4\ell} > 30.00$ GeV & Metsig > 2.50	6.26±0.08	29.35±0.50	6.30±0.10	0.22±0.01	0.10±0.03	0.28±0.06	1.28±0.03	2.268
$p_T^{4\ell} > 30.00$ GeV & Metsig > 3.00	2.96±0.05	9.07±0.19	2.05±0.05	0.11±0.01	0.03±0.02	0.19±0.06	0.61±0.02	1.891