LOW PT ANALYSIS: UPDATE WITH 13 fb^{-1}

Lina Galtieri with Antonio Boveia and Corrinne Mills

ATLAS HSG3 LOWPT, $H \to WW \to \ell\nu\ell\nu$

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Status of the Low PT Analysis

- Outline
  - Reminder: 2011 excess
  - Status of Reanalysis of 2011 data
  - Cutflows and plots for 2012 13fb^{-1} for $e\mu$+μe 0-jet channel
  - **Summary and Conclusions**
- Looking at different sections:
  - Recap of 2011 excess page 4
  - Start of cutflows (blinded and unblinded MC) page 7
  - Blinded signal region: page 12
  - WW-0j control region: page 21
  - Summary and Conclusions: page 24

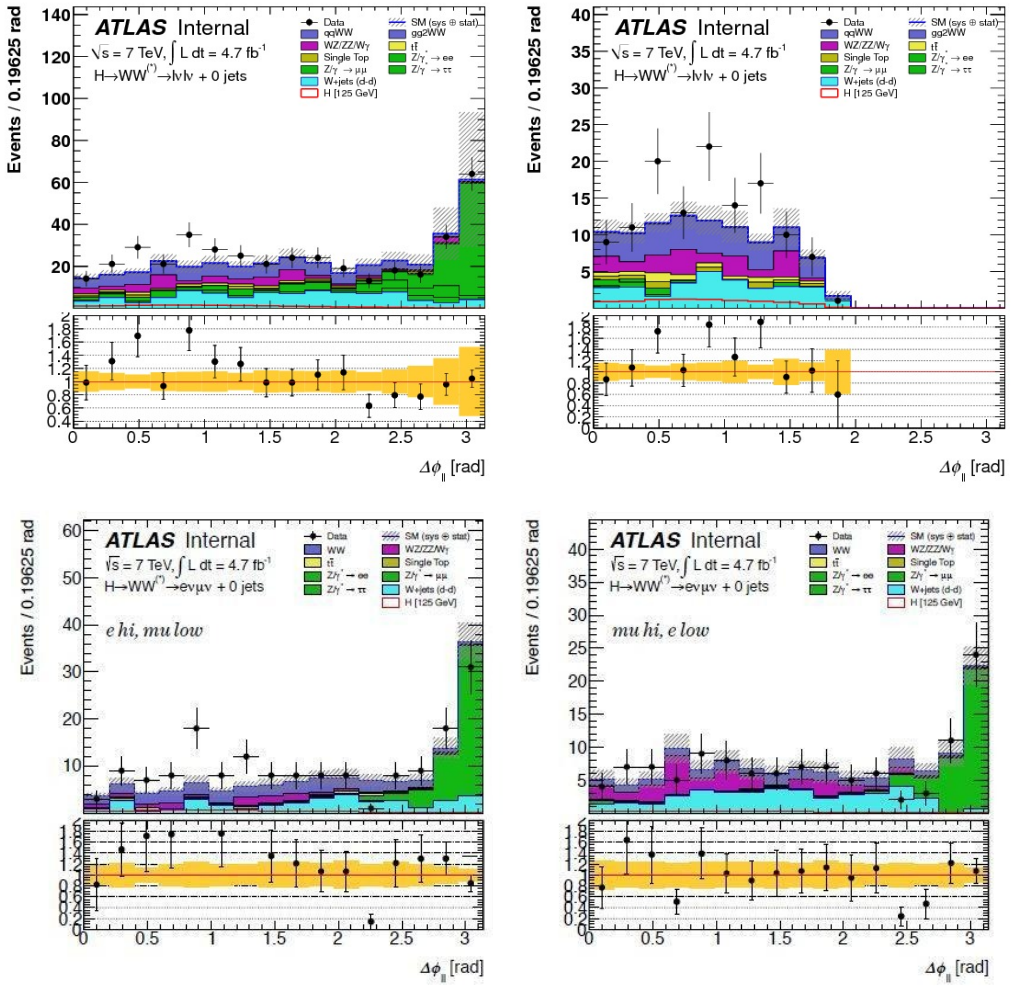
Analysis Details

- General Comment
  - Only zero jets results shown here (excess in 2011 data was only in Njets=0)
- Status of Reanalysis of 2011 data
  - Use Low PT 2012 lepton selection criteria.
  - Use ntuples made by Antonio (tag-35).
  - Job ready to go. Results will be shown soon.
- Analysis of 2012 data
  - Using -02-07 ntuples, v14.1 Tatsuya's W+jets ntuples, both 13.0 fb^{-1}
  - Blinded MC and Data are shown. Also unblinded Cutflow for MC
  - Normalization factors calculated with low PT events suffer from low statistics. Corrinne modified code to use the nominal analysis NF's. Results will be shown soon.
  - Normalization factors applied in CRs
  - Systematics not included in plots
  - Standard (0.90) $< \mu >$ rescaling

2011 Low PT Excess

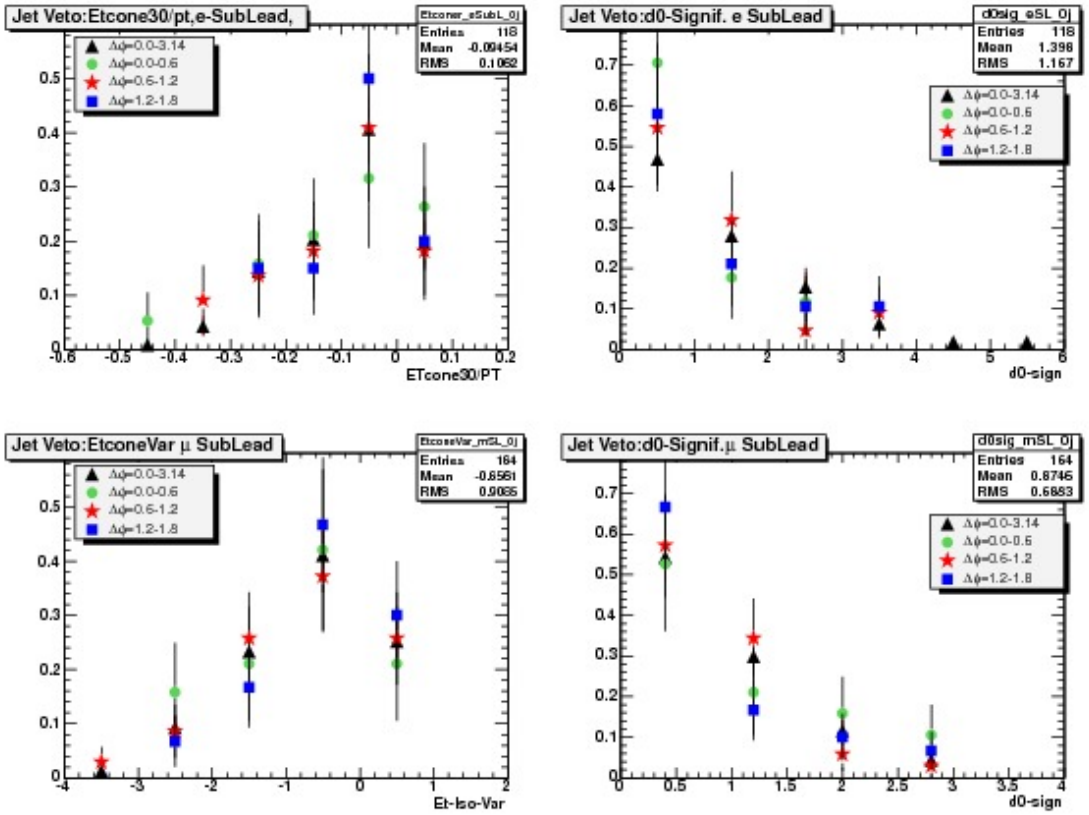
$\Delta\varphi(\ell\ell)$ distributions

- Top: $l\nu l\nu$ at Jet Veto (left), after $\Delta\varphi(\ell\ell)$ Cut (right)
- Bottom: at Jet Veto $e\mu$ (left) and μe (right)
- Excess is mostly in the $e\mu$ channel



$\Delta\varphi(\ell\ell)$ distributions

- Many checks were made on the data, reported by Corrinne and Antonio in many talks. No simple explanation found. Excess mostly in the $\Delta\varphi(\ell\ell) = 0.6\text{-}1.2$ bin.
- Isolation and impact parameter in bins of $\Delta\varphi(\ell\ell)$ show, within statistics, same trend for the four bins. Top: μe, bottom: $e\mu$.



Cutflows

$m_H = 125$, $e\mu$ cutflows

blinded $e\mu$

	Signal [125 GeV]	WW	$WZ/ZZ/W\gamma$	$t\bar{t}$	Single Top	Z+jets	W+jets	Total Bkg.	Observed	Data/MC
blinding	142.10 ± 1.31	3302.45 ± 11.81	1384.10 ± 16.21	17930.73 ± 55.15	1816.89 ± 23.20	11788.61 ± 48.72	2511.66 ± 17.04	38734.44 ± 81.52	38985	1.01 ± 0.01
lepton p_T	22.07 ± 0.47	165.52 ± 2.67	247.33 ± 6.60	978.98 ± 12.90	95.15 ± 5.41	2411.12 ± 20.87	814.58 ± 7.04	4712.68 ± 27.05	4347	0.92 ± 0.01
OS leptons	21.67 ± 0.45	164.76 ± 2.66	114.98 ± 4.59	976.22 ± 12.88	91.93 ± 5.21	2374.48 ± 18.22	506.11 ± 5.82	4228.47 ± 24.23	4004	0.95 ± 0.02
$m_{\ell\ell} > 12, 10$ GeV	21.32 ± 0.44	163.89 ± 2.65	107.56 ± 4.45	972.48 ± 12.85	91.70 ± 5.21	2371.32 ± 18.21	499.21 ± 5.79	4206.16 ± 24.17	3979	0.95 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04					
Z veto (for $ee, \mu\mu$)	21.32 ± 0.44	135.27 ± 2.19	107.56 ± 4.45	1009.27 ± 13.34	95.17 ± 5.41	2371.32 ± 18.21	499.21 ± 5.79	4217.81 ± 24.43	3979	0.94 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04	NF = 0.73				
$E_{T,rel}^{miss} > 45, 25$ GeV	10.55 ± 0.32	76.91 ± 1.65	45.44 ± 3.04	661.68 ± 10.80	65.27 ± 4.37	243.04 ± 4.65	119.31 ± 2.96	1211.65 ± 13.34	1188	0.98 ± 0.03
Z validation region (incl)	21.32 ± 0.44	163.89 ± 2.65	107.56 ± 4.45	972.48 ± 12.85	91.70 ± 5.21	2371.32 ± 18.21	499.21 ± 5.79	4206.16 ± 24.17	3979	0.95 ± 0.02
Top validation region (incl)	1.31 ± 0.12	6.88 ± 0.58	2.39 ± 0.57	585.09 ± 10.17	46.69 ± 3.65	16.71 ± 1.23	20.52 ± 1.69	678.27 ± 11.04	658	0.97 ± 0.04
Scale factors		NF = 0.83				NF = 0.78				
0j: jet veto	5.32 ± 0.22	46.83 ± 1.29	33.04 ± 2.82	11.52 ± 1.38	6.78 ± 1.38	158.32 ± 4.10	69.91 ± 2.00	326.40 ± 5.85	328	1.00 ± 0.06
0j: $\Delta\phi_{\ell\ell,MET} > 1.57$										
0j: $p_{T,\ell\ell}$ >45,30 GeV	4.25 ± 0.20	39.28 ± 1.19	25.35 ± 2.43	9.83 ± 1.29	5.87 ± 1.29	13.86 ± 1.98	43.59 ± 1.46	137.79 ± 4.08	146	1.06 ± 0.09
0j: $m_{\ell\ell} < 50$ GeV	3.16 ± 0.18	13.05 ± 0.68	17.71 ± 2.04	4.10 ± 0.86	0.77 ± 0.53	7.90 ± 1.85	17.05 ± 0.94	60.57 ± 3.15	62	1.02 ± 0.14
0j: $\Delta\phi_{\ell\ell} < 1.8$	1.96 ± 0.14	8.40 ± 0.55	14.27 ± 1.86	3.61 ± 0.80	0.50 ± 0.45	1.96 ± 1.70	5.66 ± 0.57	34.40 ± 2.80	35	1.02 ± 0.19
0j: $0.75 \cdot m_H \leq m_T \leq m_H$	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0	nan ± nan
0j: Z validation region	10.14 ± 0.31	103.07 ± 2.11	69.87 ± 3.92	14.99 ± 1.56	7.48 ± 1.48	1690.46 ± 15.42	281.09 ± 4.23	2166.97 ± 16.74	2047	0.94 ± 0.02
0j: WW control region	0.00 ± 0.00	10.53 ± 0.61	2.69 ± 0.90	2.53 ± 0.62	2.26 ± 0.71	0.20 ± 0.13	7.17 ± 0.57	25.39 ± 1.56	23	0.91 ± 0.20
Scale factors		NF = 0.69		NF = 1.10	NF = 1.10	NF = 0.73				
1j: one jet	3.60 ± 0.20	17.72 ± 0.72	9.16 ± 0.94	115.28 ± 4.52	35.98 ± 3.25	69.45 ± 2.15	28.04 ± 1.46	275.64 ± 6.25	281	1.02 ± 0.07
1j: b-jet veto	2.79 ± 0.17	14.90 ± 0.65	7.81 ± 0.88	23.91 ± 2.16	8.41 ± 1.62	58.59 ± 1.94	22.32 ± 1.19	135.94 ± 3.69	145	1.07 ± 0.09
1j: $Z \to \tau\tau$ veto	1.59 ± 0.14	9.51 ± 0.52	4.43 ± 0.68	11.25 ± 1.52	5.13 ± 1.31	22.20 ± 1.20	10.15 ± 0.79	62.67 ± 2.61	70	1.12 ± 0.14
1j: $m_{\ell\ell} < 50$ GeV	1.22 ± 0.13	4.00 ± 0.34	2.98 ± 0.62	3.94 ± 0.87	1.62 ± 0.69	16.43 ± 1.02	4.13 ± 0.54	33.11 ± 1.75	41	1.24 ± 0.20
1j: $\Delta\phi_{\ell\ell} < 1.8$	0.46 ± 0.06	2.22 ± 0.25	2.54 ± 0.61	3.17 ± 0.74	1.34 ± 0.63	0.61 ± 0.17	1.49 ± 0.29	11.35 ± 1.22	13	1.15 ± 0.34
1j: $0.75 \cdot m_H \leq m_T \leq m_H$	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0	nan ± nan
1j: Z validation region	7.35 ± 0.27	43.90 ± 1.36	27.70 ± 1.79	146.75 ± 4.84	47.85 ± 3.59	504.46 ± 8.41	133.79 ± 2.92	904.45 ± 10.98	884	0.98 ± 0.03
1j: WW control region	0.00 ± 0.00	1.97 ± 0.24	0.34 ± 0.10	1.97 ± 0.58	1.71 ± 0.70	0.04 ± 0.04	2.18 ± 0.32	8.21 ± 1.00	9	1.10 ± 0.39
1j: Top control region	0.54 ± 0.09	1.34 ± 0.21	0.74 ± 0.21	39.65 ± 2.67	16.83 ± 2.28	3.11 ± 0.47	3.27 ± 0.56	64.95 ± 3.60	55	0.85 ± 0.12

unblinded $e\mu$

	Signal [125 GeV]	WW	$WZ/ZZ/W\gamma$	$t\bar{t}$	Single Top	Z+jets	W+jets	Total Bkg.	Observed	Data/MC
blinding	213.52 ± 1.53	3582.97 ± 12.30	1451.89 ± 16.55	18031.13 ± 55.32	1844.34 ± 23.37	11802.60 ± 48.90	2524.93 ± 17.15	39237.86 ± 81.96	38985	0.99 ± 0.01
lepton p_T	33.95 ± 0.57	198.52 ± 2.92	268.84 ± 6.82	987.87 ± 12.97	99.22 ± 5.53	2415.20 ± 21.06	848.72 ± 7.08	4818.37 ± 27.34	4347	0.90 ± 0.01
OS leptons	33.56 ± 0.55	197.75 ± 2.91	136.50 ± 4.89	985.11 ± 12.95	96.00 ± 5.34	2378.56 ± 18.44	538.14 ± 5.90	4332.06 ± 24.56	4004	0.92 ± 0.02
$m_{\ell\ell} > 12, 10$ GeV	33.21 ± 0.55	196.88 ± 2.91	129.07 ± 4.77	981.37 ± 12.92	95.78 ± 5.33	2375.40 ± 18.43	531.24 ± 5.87	4309.74 ± 24.51	3979	0.92 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04					
Z veto (for $ee, \mu\mu$)	33.21 ± 0.55	162.60 ± 2.40	129.07 ± 4.77	1016.42 ± 13.38	99.20 ± 5.52	2375.40 ± 18.43	531.24 ± 5.87	4313.93 ± 24.74	3979	0.92 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04	NF = 0.72				
$E_{T,rel}^{miss} > 45, 25$ GeV	22.43 ± 0.46	104.21 ± 1.92	66.95 ± 3.48	669.53 ± 10.86	69.36 ± 4.51	245.40 ± 5.07	146.58 ± 3.15	1302.03 ± 13.78	1188	0.91 ± 0.03
Z validation region (incl)	33.21 ± 0.55	196.88 ± 2.91	129.07 ± 4.77	981.37 ± 12.92	95.78 ± 5.33	2375.40 ± 18.43	531.24 ± 5.87	4309.74 ± 24.51	3979	0.92 ± 0.02
Top validation region (incl)	1.31 ± 0.12	6.88 ± 0.58	2.39 ± 0.57	583.90 ± 10.15	46.59 ± 3.65	16.67 ± 1.22	21.98 ± 1.67	678.40 ± 11.01	658	0.97 ± 0.04
Scale factors		NF = 0.83				NF = 0.77				
0j: jet veto	13.46 ± 0.35	68.24 ± 1.56	50.75 ± 3.25	12.15 ± 1.50	8.33 ± 1.52	158.39 ± 4.10	88.64 ± 2.20	386.49 ± 6.26	328	0.85 ± 0.05
0j: $\Delta\phi_{\ell\ell,MET} > 1.57$										
0j: $p_{T,\ell\ell}$ >45,30 GeV	12.35 ± 0.34	60.46 ± 1.47	42.64 ± 2.91	10.46 ± 1.41	7.42 ± 1.45	14.02 ± 1.98	61.66 ± 1.72	196.66 ± 4.64	146	0.74 ± 0.06
0j: $m_{\ell\ell} < 50$ GeV	11.26 ± 0.32	34.22 ± 1.10	34.99 ± 2.60	4.73 ± 1.03	2.32 ± 0.84	8.05 ± 1.85	35.02 ± 1.31	119.33 ± 3.85	62	0.52 ± 0.07
0j: $\Delta\phi_{\ell\ell} < 1.8$	10.05 ± 0.31	29.57 ± 1.02	31.56 ± 2.45	4.24 ± 0.98	2.05 ± 0.79	2.13 ± 1.70	23.61 ± 1.08	93.15 ± 3.57	35	0.38 ± 0.07
0j: $0.75 \cdot m_H \leq m_T \leq m_H$	5.42 ± 0.22	12.73 ± 0.67	7.67 ± 1.16	0.38 ± 0.53	1.29 ± 0.62	0.03 ± 0.03	10.16 ± 0.70	32.27 ± 1.71	0	0.00 ± nan
0j: Z validation region	18.28 ± 0.41	128.96 ± 2.36	87.59 ± 4.24	15.62 ± 1.66	9.03 ± 1.62	1690.70 ± 15.42	302.13 ± 4.32	2234.03 ± 16.89	2047	0.92 ± 0.02
0j: WW control region	0.00 ± 0.00	10.54 ± 0.62	2.69 ± 0.90	2.53 ± 0.62	2.26 ± 0.71	0.20 ± 0.13	7.17 ± 0.57	25.39 ± 1.56	23	0.91 ± 0.20
Scale factors		NF = 0.69		NF = 1.10	NF = 1.10	NF = 0.72				
1j: one jet	6.45 ± 0.25	21.48 ± 0.79	12.35 ± 1.07	118.34 ± 4.58	38.49 ± 3.38	69.69 ± 2.15	33.97 ± 1.54	294.31 ± 6.42	281	0.95 ± 0.06
1j: b-jet veto	5.51 ± 0.23	18.49 ± 0.72	10.82 ± 1.00	27.44 ± 2.35	11.14 ± 1.91	58.84 ± 1.94	27.84 ± 1.29	154.57 ± 4.01	145	0.94 ± 0.08
1j: $Z \to \tau\tau$ veto	3.26 ± 0.18	11.85 ± 0.58	6.77 ± 0.82	13.43 ± 1.67	6.76 ± 1.53	22.28 ± 1.20	12.69 ± 0.86	73.76 ± 2.88	70	0.95 ± 0.12
1j: $m_{\ell\ell} < 50$ GeV	2.89 ± 0.17	6.36 ± 0.43	5.32 ± 0.76	6.14 ± 1.12	3.27 ± 1.05	16.52 ± 1.02	6.59 ± 0.64	44.20 ± 2.14	41	0.93 ± 0.15
1j: $\Delta\phi_{\ell\ell} < 1.8$	2.14 ± 0.13	4.58 ± 0.36	4.88 ± 0.76	5.37 ± 1.02	2.98 ± 1.01	0.73 ± 0.19	3.88 ± 0.45	22.42 ± 1.74	13	0.58 ± 0.17
1j: $0.75 \cdot m_H \leq m_T \leq m_H$	1.17 ± 0.10	1.45 ± 0.21	1.19 ± 0.36	1.12 ± 0.51	1.22 ± 0.73	0.07 ± 0.07	1.29 ± 0.25	6.34 ± 1.02	0	0.00 ± nan
1j: Z validation region	10.19 ± 0.31	49.43 ± 1.45	30.88 ± 1.86	149.87 ± 4.90	50.24 ± 3.70	505.03 ± 8.41	140.85 ± 2.95	926.31 ± 11.08	884	0.95 ± 0.03
1j: WW control region	0.00 ± 0.00	1.96 ± 0.24	0.34 ± 0.10	1.96 ± 0.58	1.70 ± 0.69	0.04 ± 0.04	2.21 ± 0.32	8.22 ± 1.00	9	1.09 ± 0.39
1j: Top control region	0.54 ± 0.09	1.34 ± 0.21	0.74 ± 0.21	39.52 ± 2.67	16.78 ± 2.27	3.10 ± 0.47	3.53 ± 0.54	65.01 ± 3.59	55	0.85 ± 0.12

$m_H = 125$, μe cutflows

blinded μe

	Signal [125 GeV]	WW	$WZ/ZZ/W\gamma$	$t\bar{t}$	Single Top	Z+jets	W+jets	Total Bkg.	Observed	Data/MC
blinding	122.52 ± 1.31	3009.11 ± 11.27	1505.86 ± 17.29	15690.52 ± 51.47	1606.01 ± 21.93	11371.51 ± 62.70	1927.81 ± 10.78	35110.81 ± 87.19	35738	1.02 ± 0.01
lepton p_T	19.31 ± 0.48	140.01 ± 2.39	401.67 ± 9.31	767.59 ± 11.25	84.97 ± 5.45	2357.99 ± 21.22	761.36 ± 5.52	4513.59 ± 27.01	4525	1.00 ± 0.02
OS leptons	18.55 ± 0.43	139.81 ± 2.39	171.47 ± 5.92	764.43 ± 11.23	79.08 ± 4.90	2308.92 ± 18.24	457.38 ± 4.76	3921.09 ± 23.37	4049	1.03 ± 0.02
$m_{\ell\ell} > 12, 10$ GeV	17.98 ± 0.43	138.58 ± 2.38	152.22 ± 5.52	761.17 ± 11.21	79.08 ± 4.90	2306.38 ± 18.23	450.53 ± 4.73	3887.96 ± 23.25	4020	1.03 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04					
Z veto (for $ee, \mu\mu$)	17.98 ± 0.43	114.38 ± 1.97	152.22 ± 5.52	789.96 ± 11.64	82.07 ± 5.09	2306.38 ± 18.23	450.53 ± 4.73	3895.55 ± 23.46	4020	1.03 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04	NF = 0.73				
$E_{T,rel}^{miss} > 45, 25$ GeV	8.79 ± 0.29	66.28 ± 1.49	66.48 ± 3.54	514.60 ± 9.32	55.90 ± 4.30	244.22 ± 5.15	154.36 ± 2.16	1101.84 ± 12.30	1140	1.03 ± 0.03
Z validation region (incl)	17.98 ± 0.43	138.58 ± 2.38	152.22 ± 5.52	761.17 ± 11.21	79.08 ± 4.90	2306.38 ± 18.23	450.53 ± 4.73	3887.96 ± 23.25	4020	1.03 ± 0.02
Top validation region (incl)	1.04 ± 0.10	5.69 ± 0.51	2.49 ± 0.44	457.39 ± 8.79	42.14 ± 3.71	16.92 ± 2.60	13.09 ± 0.93	537.73 ± 9.96	558	1.04 ± 0.05
Scale factors		NF = 0.83				NF = 0.78				
0j: jet veto	4.47 ± 0.19	41.32 ± 1.18	50.69 ± 3.31	6.48 ± 0.92	4.02 ± 1.31	166.87 ± 4.10	107.02 ± 1.55	376.40 ± 5.84	389	1.03 ± 0.05
0j: $\Delta\phi_{\ell\ell,MET} > 1.57$										
0j: $p_{T,\ell\ell}$ >45,30 GeV	3.57 ± 0.17	33.75 ± 1.07	38.63 ± 2.94	6.04 ± 0.87	3.09 ± 1.13	12.58 ± 1.02	75.82 ± 1.08	169.91 ± 3.74	171	1.01 ± 0.08
0j: $m_{\ell\ell} < 50$ GeV	2.69 ± 0.15	12.50 ± 0.65	27.40 ± 2.60	2.34 ± 0.59	0.96 ± 0.45	7.83 ± 0.81	29.06 ± 0.67	80.07 ± 2.97	71	0.89 ± 0.11
0j: $\Delta\phi_{\ell\ell} < 1.8$	1.57 ± 0.12	8.40 ± 0.54	23.81 ± 2.49	2.06 ± 0.57	0.96 ± 0.45	0.52 ± 0.17	10.14 ± 0.41	45.89 ± 2.69	42	0.92 ± 0.15
0j: $0.75 \cdot m_H \leq m_T \leq m_H$	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0	nan ± nan
0j: Z validation region	8.62 ± 0.27	88.80 ± 1.91	104.70 ± 4.94	9.20 ± 1.10	5.30 ± 1.42	1686.07 ± 15.92	264.72 ± 3.35	2158.79 ± 17.20	2257	1.05 ± 0.02
0j: WW control region	0.02 ± 0.02	7.98 ± 0.52	4.08 ± 0.90	1.27 ± 0.38	1.50 ± 0.91	0.23 ± 0.17	16.54 ± 0.46	31.61 ± 1.51	34	1.08 ± 0.19
Scale factors		NF = 0.69		NF = 1.10	NF = 1.10	NF = 0.73				
1j: one jet	2.88 ± 0.19	15.74 ± 0.67	11.83 ± 1.15	91.27 ± 3.93	28.97 ± 2.82	62.73 ± 2.01	31.08 ± 1.07	241.62 ± 5.50	271	1.12 ± 0.07
1j: b-jet veto	2.31 ± 0.17	12.87 ± 0.59	10.01 ± 1.05	19.95 ± 1.92	5.91 ± 1.28	52.56 ± 1.80	25.76 ± 0.95	127.08 ± 3.31	150	1.18 ± 0.10
1j: $Z \to \tau\tau$ veto	1.44 ± 0.14	8.00 ± 0.47	6.19 ± 0.84	7.80 ± 1.23	2.73 ± 0.89	18.27 ± 1.10	14.09 ± 0.62	57.09 ± 2.20	76	1.33 ± 0.16
1j: $m_{\ell\ell} < 50$ GeV	1.09 ± 0.12	2.94 ± 0.28	4.35 ± 0.76	2.95 ± 0.74	1.30 ± 0.67	14.12 ± 0.95	6.37 ± 0.50	32.01 ± 1.68	45	1.41 ± 0.22
1j: $\Delta\phi_{\ell\ell} < 1.8$	0.45 ± 0.06	1.29 ± 0.18	2.69 ± 0.65	1.83 ± 0.61	1.30 ± 0.67	0.91 ± 0.23	2.09 ± 0.24	10.11 ± 1.17	12	1.19 ± 0.37
1j: $0.75 \cdot m_H \leq m_T \leq m_H$	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0	nan ± nan
1j: Z validation region	5.84 ± 0.27	37.13 ± 1.24	36.94 ± 2.33	113.71 ± 4.22	37.97 ± 3.13	454.72 ± 6.72	124.18 ± 2.68	804.64 ± 9.32	894	1.11 ± 0.04
1j: WW control region	0.00 ± 0.00	1.46 ± 0.20	0.64 ± 0.23	1.89 ± 0.59	0.73 ± 0.43	0.25 ± 0.15	2.83 ± 0.19	7.79 ± 0.83	7	0.90 ± 0.35
1j: Top control region	0.31 ± 0.06	1.49 ± 0.22	0.96 ± 0.28	32.99 ± 2.32	13.38 ± 1.91	2.88 ± 0.45	3.09 ± 0.33	54.80 ± 3.08	66	1.20 ± 0.16

unblinded μe

	Signal [125 GeV]	WW	$WZ/ZZ/W\gamma$	$t\bar{t}$	Single Top	Z+jets	W+jets	Total Bkg.	Observed	Data/MC
blinding	181.40 ± 1.49	3254.38 ± 11.72	1601.34 ± 17.86	15775.50 ± 51.62	1631.91 ± 22.11	11383.07 ± 62.78	2138.02 ± 12.67	35784.21 ± 87.82	35738	1.00 ± 0.01
lepton p_T	29.69 ± 0.57	170.36 ± 2.65	443.00 ± 9.76	776.23 ± 11.32	88.23 ± 5.53	2363.21 ± 21.35	837.24 ± 6.10	4678.27 ± 27.46	4525	0.97 ± 0.02
OS leptons	28.94 ± 0.53	170.16 ± 2.65	212.79 ± 6.61	773.08 ± 11.30	82.34 ± 4.99	2314.15 ± 18.40	528.32 ± 5.30	4080.83 ± 23.87	4049	0.99 ± 0.02
$m_{\ell\ell} > 12, 10$ GeV	28.36 ± 0.52	168.93 ± 2.64	193.55 ± 6.26	769.81 ± 11.28	82.34 ± 4.99	2311.61 ± 18.39	521.28 ± 5.27	4047.51 ± 23.75	4020	0.99 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04					
Z veto (for $ee, \mu\mu$)	28.36 ± 0.52	139.51 ± 2.18	193.55 ± 6.26	797.30 ± 11.69	85.28 ± 5.17	2311.61 ± 18.39	521.28 ± 5.27	4048.53 ± 23.94	4020	0.99 ± 0.02
Scale factors		NF = 0.83		NF = 1.04	NF = 1.04	NF = 0.72				
$E_{T,rel}^{miss} > 45, 25$ GeV	19.17 ± 0.42	91.38 ± 1.76	107.81 ± 4.60	522.50 ± 9.40	59.16 ± 4.40	247.40 ± 5.42	215.12 ± 2.57	1243.36 ± 12.96	1140	0.92 ± 0.03
Z validation region (incl)	28.36 ± 0.52	168.93 ± 2.64	193.55 ± 6.26	769.81 ± 11.28	82.34 ± 4.99	2311.61 ± 18.39	521.28 ± 5.27	4047.51 ± 23.75	4020	0.99 ± 0.02
Top validation region (incl)	1.04 ± 0.10	5.69 ± 0.51	2.49 ± 0.44	456.46 ± 8.78	42.06 ± 3.70	16.88 ± 2.60	14.02 ± 1.14	537.60 ± 9.96	558	1.04 ± 0.05
Scale factors		NF = 0.83				NF = 0.77				
0j: jet veto	11.59 ± 0.32	60.06 ± 1.43	86.24 ± 4.35	7.71 ± 1.03	4.70 ± 1.35	169.51 ± 4.48	154.85 ± 1.78	483.07 ± 6.86	389	0.81 ± 0.04
0j: $\Delta\phi_{\ell\ell,MET} > 1.57$										
0j: $p_{T,\ell\ell}$ >45,30 GeV	10.62 ± 0.30	52.20 ± 1.34	73.13 ± 4.03	7.12 ± 0.98	3.77 ± 1.18	15.34 ± 2.08	122.61 ± 1.37	274.17 ± 5.16	171	0.62 ± 0.05
0j: $m_{\ell\ell} < 50$ GeV	9.75 ± 0.29	30.94 ± 1.03	61.90 ± 3.79	3.42 ± 0.74	1.63 ± 0.55	10.58 ± 1.99	75.70 ± 1.05	184.18 ± 4.62	71	0.39 ± 0.05
0j: $\Delta\phi_{\ell\ell} < 1.8$	8.62 ± 0.27	26.84 ± 0.97	58.32 ± 3.72	3.14 ± 0.72	1.63 ± 0.55	3.29 ± 1.83	56.87 ± 0.89	150.09 ± 4.44	42	0.28 ± 0.04
0j: $0.75 \cdot m_H \leq m_T \leq m_H$	4.75 ± 0.20	11.08 ± 0.63	18.44 ± 2.05	0.45 ± 0.34	0.54 ± 0.29	2.52 ± 1.80	31.03 ± 0.64	64.07 ± 2.90	0	0.00 ± nan
0j: Z validation region	15.74 ± 0.37	111.47 ± 2.14	140.25 ± 5.69	10.43 ± 1.19	5.97 ± 1.45	1689.64 ± 16.09	313.14 ± 3.52	2270.90 ± 17.66	2257	0.99 ± 0.02
0j: WW control region	0.02 ± 0.02	7.99 ± 0.52	4.08 ± 0.90	1.27 ± 0.38	1.50 ± 0.91	0.23 ± 0.17	16.53 ± 0.46	31.61 ± 1.51	34	1.08 ± 0.19
Scale factors		NF = 0.69		NF = 1.10	NF = 1.10	NF = 0.72				
1j: one jet	5.22 ± 0.25	19.85 ± 0.75	16.49 ± 1.36	94.97 ± 4.02	31.26 ± 2.95	63.16 ± 2.01	40.40 ± 1.28	266.13 ± 5.74	271	1.02 ± 0.07
1j: b-jet veto	4.54 ± 0.22	16.80 ± 0.68	14.46 ± 1.25	23.97 ± 2.16	8.69 ± 1.66	52.98 ± 1.80	34.84 ± 1.14	151.74 ± 3.74	150	0.99 ± 0.08
1j: $Z \to \tau\tau$ veto	2.87 ± 0.17	10.69 ± 0.55	8.92 ± 1.01	9.31 ± 1.38	4.22 ± 1.26	18.40 ± 1.10	19.55 ± 0.76	71.10 ± 2.57	76	1.07 ± 0.13
1j: $m_{\ell\ell} < 50$ GeV	2.52 ± 0.16	5.65 ± 0.39	7.08 ± 0.95	4.47 ± 0.97	2.80 ± 1.11	14.26 ± 0.96	11.71 ± 0.64	45.97 ± 2.13	45	0.98 ± 0.15
1j: $\Delta\phi_{\ell\ell} < 1.8$	1.88 ± 0.12	4.01 ± 0.33	5.42 ± 0.86	3.36 ± 0.87	2.80 ± 1.11	1.08 ± 0.26	7.28 ± 0.41	23.95 ± 1.75	12	0.50 ± 0.15
1j: $0.75 \cdot m_H \leq m_T \leq m_H$	1.07 ± 0.09	1.85 ± 0.23	1.74 ± 0.50	1.38 ± 0.48	1.16 ± 0.60	0.13 ± 0.10	2.86 ± 0.19	9.12 ± 0.97	0	0.00 ± nan
1j: Z validation region	8.18 ± 0.31	43.16 ± 1.34	41.61 ± 2.44	117.34 ± 4.30	40.15 ± 3.24	455.51 ± 6.72	138.44 ± 3.06	836.21 ± 9.56	894	1.07 ± 0.04
1j: WW control region	0.00 ± 0.00	1.45 ± 0.20	0.64 ± 0.23	1.88 ± 0.59	0.73 ± 0.43	0.25 ± 0.15	2.83 ± 0.19	7.78 ± 0.83	7	0.90 ± 0.35
1j: Top control region	0.31 ± 0.06	1.49 ± 0.22	0.96 ± 0.28	32.89 ± 2.31	13.34 ± 1.91	2.87 ± 0.45	3.18 ± 0.37	54.73 ± 3.08	66	1.21 ± 0.16

$m_H = 125$, $e\mu + \mu e$ cutflows

blinded $e\mu + \mu e$

	Signal [125 GeV]	WW	$WZ/ZZ/W\gamma$	$t\bar{t}$	Single Top	Z+jets	W+jets	Total Bkg.	Observed	Data/MC
blinding	264.62 ± 1.85	6311.55 ± 16.32	2889.96 ± 23.70	33621.25 ± 75.44	3422.91 ± 31.92	23160.12 ± 79.40	4439.47 ± 20.16	73845.25 ± 119.37	74723	1.01 ± 0.00
lepton p_T	41.37 ± 0.67	305.54 ± 3.58	649.00 ± 11.41	1746.57 ± 17.11	180.12 ± 7.68	4769.11 ± 29.77	1575.94 ± 8.95	9226.27 ± 38.22	8872	0.96 ± 0.01
OS leptons	40.23 ± 0.62	304.57 ± 3.58	286.45 ± 7.49	1740.65 ± 17.09	171.01 ± 7.16	4683.40 ± 25.78	963.49 ± 7.52	8149.56 ± 33.67	8053	0.99 ± 0.01
$m_{\ell\ell} > 12, 10$ GeV	39.30 ± 0.62	302.47 ± 3.57	259.78 ± 7.10	1733.65 ± 17.06	170.78 ± 7.15	4677.70 ± 25.77	949.74 ± 7.47	8094.12 ± 33.54	7999	0.99 ± 0.01
Scale factors										
Z veto (for $ee, \mu\mu$)	39.30 ± 0.62	249.65 ± 2.94	259.78 ± 7.10	1799.24 ± 17.70	177.25 ± 7.43	4677.70 ± 25.77	949.74 ± 7.47	8113.36 ± 33.87	7999	0.99 ± 0.01
Scale factors										
$E_{T,rel}^{miss} > 45, 25$ GeV	19.34 ± 0.43	143.19 ± 2.22	111.92 ± 4.66	1176.27 ± 14.26	121.17 ± 6.13	487.27 ± 6.94	273.67 ± 3.67	2313.49 ± 18.15	2328	1.01 ± 0.02
Z validation region (incl)	39.30 ± 0.62	302.47 ± 3.57	259.78 ± 7.10	1733.65 ± 17.06	170.78 ± 7.15	4677.70 ± 25.77	949.74 ± 7.47	8094.12 ± 33.54	7999	0.99 ± 0.01
Top validation region (incl)	2.35 ± 0.16	12.57 ± 0.77	4.88 ± 0.72	1042.48 ± 13.45	88.83 ± 5.20	33.63 ± 2.88	33.61 ± 1.93	1216.00 ± 14.87	1216	1.00 ± 0.03
Scale factors										
0j: jet veto	9.80 ± 0.30	88.15 ± 1.75	83.72 ± 4.35	18.00 ± 1.66	10.80 ± 1.90	325.19 ± 5.80	176.93 ± 2.53	702.80 ± 8.27	717	1.02 ± 0.04
0j: $\Delta\phi_{\ell\ell,MET} > 1.57$										
0j: $p_{T,\ell\ell}$ >45,30 GeV	7.82 ± 0.27	73.03 ± 1.60	63.98 ± 3.81	15.86 ± 1.56	8.97 ± 1.72	26.45 ± 2.22	119.41 ± 1.81	307.70 ± 5.54	317	1.03 ± 0.06
0j: $m_{\ell\ell} < 50$ GeV	5.85 ± 0.23	25.54 ± 0.94	45.10 ± 3.30	6.43 ± 1.04	1.73 ± 0.69	15.72 ± 2.02	46.11 ± 1.15	140.64 ± 4.33	133	0.95 ± 0.09
0j: $\Delta\phi_{\ell\ell} < 1.8$	3.52 ± 0.18	16.80 ± 0.77	38.09 ± 3.11	5.67 ± 0.98	1.45 ± 0.63	2.49 ± 1.71	15.79 ± 0.70	80.30 ± 3.88	77	0.96 ± 0.12
0j: $0.75 \cdot m_H \leq m_T \leq m_H$	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0	nan ± nan
0j: Z validation region	18.77 ± 0.41	191.87 ± 2.85	174.57 ± 6.30	24.19 ± 1.91	12.78 ± 2.05	3376.53 ± 22.17	545.81 ± 5.39	4325.76 ± 24.00	4304	0.99 ± 0.02
0j: WW control region	0.02 ± 0.02	18.52 ± 0.80	6.77 ± 1.27	3.80 ± 0.73	3.76 ± 1.16	0.43 ± 0.22	23.71 ± 0.73	57.00 ± 2.17	57	1.00 ± 0.14
Scale factors										
1j: one jet	6.49 ± 0.28	33.46 ± 0.98	20.99 ± 1.48	206.55 ± 5.99	64.95 ± 4.30	132.19 ± 2.94	59.12 ± 1.81	517.26 ± 8.33	552	1.07 ± 0.05
1j: b-jet veto	5.10 ± 0.24	27.77 ± 0.88	17.82 ± 1.37	43.86 ± 2.89	14.33 ± 2.07	111.16 ± 2.64	48.09 ± 1.52	263.02 ± 4.96	295	1.12 ± 0.07
1j: $Z \to \tau\tau$ veto	3.03 ± 0.19	17.51 ± 0.70	10.62 ± 1.09	19.05 ± 1.95	7.86 ± 1.58	40.48 ± 1.63	24.25 ± 1.01	119.76 ± 3.41	146	1.22 ± 0.11
1j: $m_{\ell\ell} < 50$ GeV	2.31 ± 0.18	6.94 ± 0.44	7.32 ± 0.98	6.89 ± 1.14	2.92 ± 0.96	30.55 ± 1.39	10.49 ± 0.74	65.12 ± 2.42	86	1.32 ± 0.15
1j: $\Delta\phi_{\ell\ell} < 1.8$	0.91 ± 0.09	3.50 ± 0.31	5.23 ± 0.89	5.00 ± 0.96	2.64 ± 0.91	1.52 ± 0.28	3.57 ± 0.37	21.46 ± 1.69	25	1.16 ± 0.25
1j: $0.75 \cdot m_H \leq m_T \leq m_H$	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0	nan ± nan
1j: Z validation region	13.19 ± 0.38	81.03 ± 1.84	64.64 ± 2.94	260.46 ± 6.42	85.82 ± 4.77	959.18 ± 10.76	257.96 ± 3.97	1709.09 ± 14.41	1778	1.04 ± 0.03
1j: WW control region	0.00 ± 0.00	3.43 ± 0.32	0.98 ± 0.26	3.86 ± 0.83	2.44 ± 0.82	0.29 ± 0.15	5.01 ± 0.37	16.00 ± 1.30	16	1.00 ± 0.26
1j: Top control region	0.85 ± 0.10	2.84 ± 0.31	1.70 ± 0.35	72.64 ± 3.54	30.21 ± 2.98	5.99 ± 0.65	6.37 ± 0.65	119.75 ± 4.74	121	1.01 ± 0.10

unblinded $e\mu + \mu e$

	Signal [125 GeV]	WW	$WZ/ZZ/W\gamma$	$t\bar{t}$	Single Top	Z+jets	W+jets	Total Bkg.	Observed	Data/MC
blinding	394.92 ± 2.14	6837.35 ± 16.99	3053.23 ± 24.35	33806.63 ± 75.66	3476.25 ± 32.17	23185.67 ± 79.58	4662.94 ± 21.32	75022.08 ± 120.12	74723	1.00 ± 0.00
lepton p_T	63.64 ± 0.81	368.88 ± 3.94	711.85 ± 11.91	1764.10 ± 17.22	187.45 ± 7.82	4778.41 ± 29.99	1685.96 ± 9.34	9496.64 ± 38.75	8872	0.93 ± 0.01
OS leptons	62.50 ± 0.76	367.91 ± 3.94	349.29 ± 8.22	1758.19 ± 17.19	178.34 ± 7.31	4692.71 ± 26.05	1066.46 ± 7.93	8412.89 ± 34.25	8053	0.96 ± 0.01
$m_{\ell\ell} > 12, 10$ GeV	61.56 ± 0.76	365.81 ± 3.93	322.62 ± 7.87	1751.18 ± 17.16	178.11 ± 7.30	4687.01 ± 26.03	1052.52 ± 7.88	8357.25 ± 34.13	7999	0.96 ± 0.01
Scale factors										
Z veto (for $ee, \mu\mu$)	61.56 ± 0.76	302.10 ± 3.24	322.62 ± 7.87	1813.73 ± 17.77	184.48 ± 7.56	4687.01 ± 26.03	1052.52 ± 7.88	8362.45 ± 34.43	7999	0.96 ± 0.01
Scale factors										
$E_{T,rel}^{miss} > 45, 25$ GeV	41.61 ± 0.62	195.59 ± 2.61	174.76 ± 5.77	1192.03 ± 14.36	128.51 ± 6.30	492.80 ± 7.42	361.70 ± 4.06	2545.39 ± 18.91	2328	0.91 ± 0.02
Z validation region (incl)	61.56 ± 0.76	365.81 ± 3.93	322.62 ± 7.87	1751.18 ± 17.16	178.11 ± 7.30	4687.01 ± 26.03	1052.52 ± 7.88	8357.25 ± 34.13	7999	0.96 ± 0.01
Top validation region (incl)	2.35 ± 0.16	12.57 ± 0.77	4.88 ± 0.72	1040.35 ± 13.42	88.65 ± 5.19	33.54 ± 2.87	36.00 ± 2.02	1216.00 ± 14.85	1216	1.00 ± 0.03
Scale factors										
0j: jet veto	25.05 ± 0.47	128.30 ± 2.11	136.99 ± 5.44	19.86 ± 1.82	13.03 ± 2.03	327.89 ± 6.07	243.49 ± 2.83	869.56 ± 9.29	717	0.82 ± 0.03
0j: $\Delta\phi_{\ell\ell,MET} > 1.57$										
0j: $p_{T,\ell\ell}$ >45,30 GeV	22.97 ± 0.45	112.67 ± 1.98	115.77 ± 4.97	17.58 ± 1.72	11.19 ± 1.87	29.35 ± 2.87	184.28 ± 2.20	470.84 ± 6.94	317	0.67 ± 0.04
0j: $m_{\ell\ell} < 50$ GeV	21.01 ± 0.44	65.15 ± 1.51	96.90 ± 4.60	8.14 ± 1.27	3.96 ± 1.00	18.64 ± 2.72	110.72 ± 1.68	303.51 ± 6.02	133	0.44 ± 0.04
0j: $\Delta\phi_{\ell\ell} < 1.8$	18.68 ± 0.41	56.41 ± 1.41	89.88 ± 4.46	7.38 ± 1.22	3.68 ± 0.96	5.41 ± 2.50	80.48 ± 1.40	243.25 ± 5.70	77	0.32 ± 0.04
0j: $0.75 \cdot m_H \leq m_T \leq m_H$	10.18 ± 0.30	23.82 ± 0.92	26.11 ± 2.35	0.84 ± 0.62	1.83 ± 0.68	2.55 ± 1.80	41.19 ± 0.94	96.33 ± 3.37	0	0.00 ± nan
0j: Z validation region	34.02 ± 0.55	240.43 ± 3.19	227.84 ± 7.10	26.05 ± 2.05	15.00 ± 2.17	3380.34 ± 22.29	615.27 ± 5.57	4504.93 ± 24.44	4304	0.96 ± 0.02
0j: WW control region	0.02 ± 0.02	18.53 ± 0.80	6.77 ± 1.27	3.80 ± 0.73	3.76 ± 1.16	0.43 ± 0.22	23.70 ± 0.73	57.00 ± 2.17	57	1.00 ± 0.14
Scale factors										
1j: one jet	11.66 ± 0.35	41.33 ± 1.10	28.84 ± 1.73	213.31 ± 6.10	69.75 ± 4.49	132.85 ± 2.95	74.36 ± 2.00	560.44 ± 8.61	552	0.98 ± 0.04
1j: b-jet veto	10.05 ± 0.32	35.29 ± 0.99	25.28 ± 1.60	51.41 ± 3.19	19.83 ± 2.54	111.82 ± 2.64	62.68 ± 1.72	306.31 ± 5.49	295	0.96 ± 0.06
1j: $Z \to \tau\tau$ veto	6.13 ± 0.25	22.54 ± 0.80	15.69 ± 1.30	22.74 ± 2.16	10.98 ± 1.98	40.68 ± 1.63	32.24 ± 1.15	144.87 ± 3.86	146	1.01 ± 0.09
1j: $m_{\ell\ell} < 50$ GeV	5.41 ± 0.24	12.01 ± 0.58	12.40 ± 1.21	10.61 ± 1.48	6.06 ± 1.53	30.78 ± 1.40	18.30 ± 0.90	90.16 ± 3.02	86	0.95 ± 0.11
1j: $\Delta\phi_{\ell\ell} < 1.8$	4.01 ± 0.18	8.59 ± 0.49	10.30 ± 1.14	8.73 ± 1.35	5.78 ± 1.50	1.82 ± 0.32	11.15 ± 0.61	46.37 ± 2.47	25	0.54 ± 0.11
1j: $0.75 \cdot m_H \leq m_T \leq m_H$	2.24 ± 0.14	3.30 ± 0.31	2.93 ± 0.62	2.50 ± 0.70	2.38 ± 0.95	0.20 ± 0.13	4.15 ± 0.32	15.46 ± 1.41	0	0.00 ± nan
1j: Z validation region	18.37 ± 0.44	92.59 ± 1.97	72.49 ± 3.07	267.22 ± 6.52	90.39 ± 4.92	960.55 ± 10.77	279.29 ± 4.25	1762.53 ± 14.63	1778	1.01 ± 0.03
1j: WW control region	0.00 ± 0.00	3.41 ± 0.32	0.98 ± 0.26	3.85 ± 0.83	2.43 ± 0.82	0.29 ± 0.15	5.04 ± 0.37	16.00 ± 1.30	16	1.00 ± 0.26
1j: Top control region	0.85 ± 0.10	2.83 ± 0.30	1.70 ± 0.35	72.41 ± 3.53	30.12 ± 2.97	5.97 ± 0.65	6.71 ± 0.66	119.74 ± 4.73	121	1.01 ± 0.10

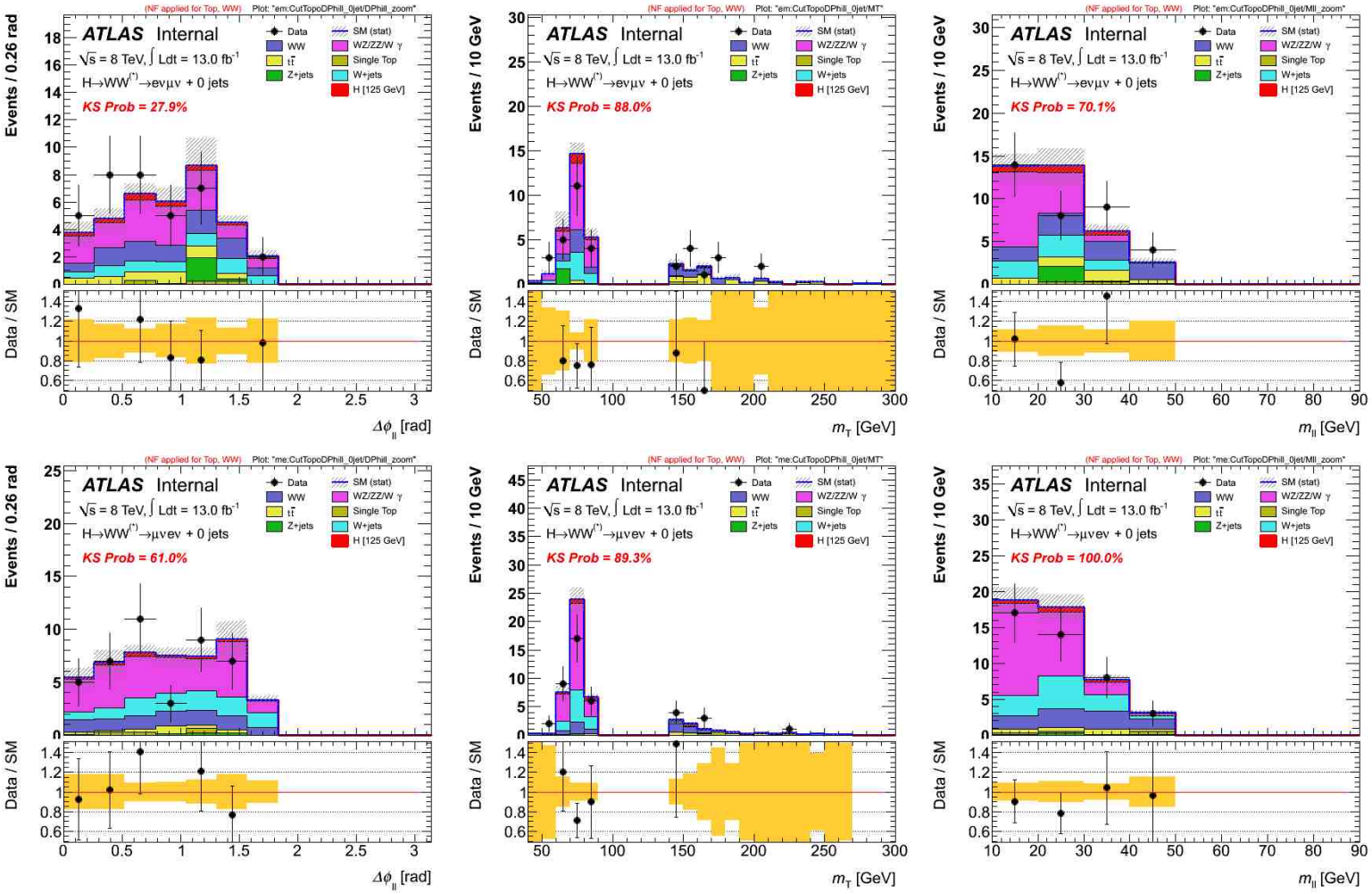
Expected Signal

- Expect 18.7+-0.4 events with a background of 243+-6 in the 0 jet sample
- The nominal analysis found 76 events with a background of 774 events.
- **Low PT adds 19 events to the 76, but with a larger background.**
- Need to assess sensitivity gain, taking into account all the systematic uncertanties (Corrinne working on this).

Blinded signal region

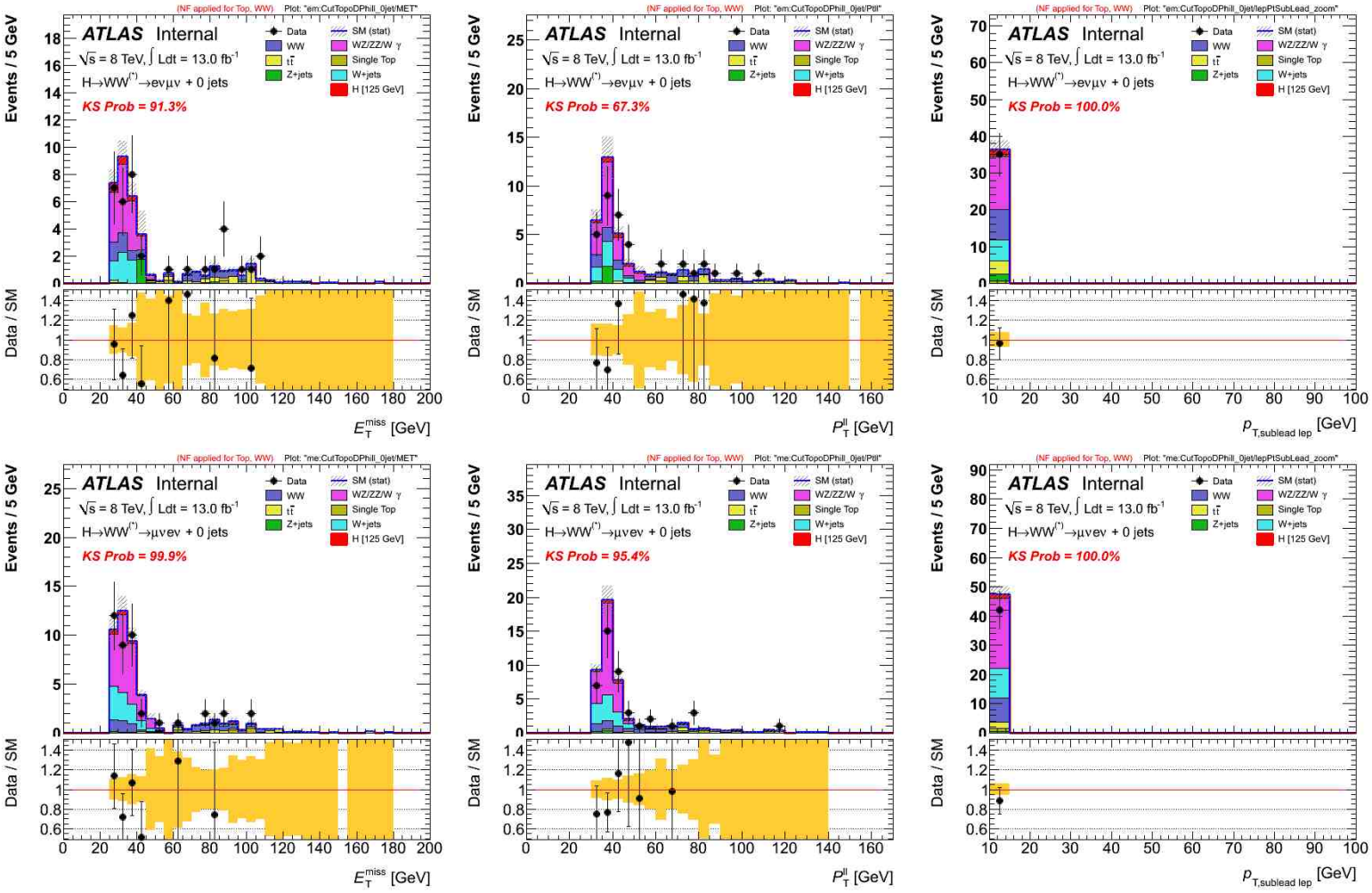
Blinded SR, $\Delta\varphi(\ell\ell) < 1.8$): $\Delta\varphi(\ell\ell)$,M_T,M_{ll}

- Top: $e\mu$. Bottom: μe
- **Agreement between data and MC is reasonable.**



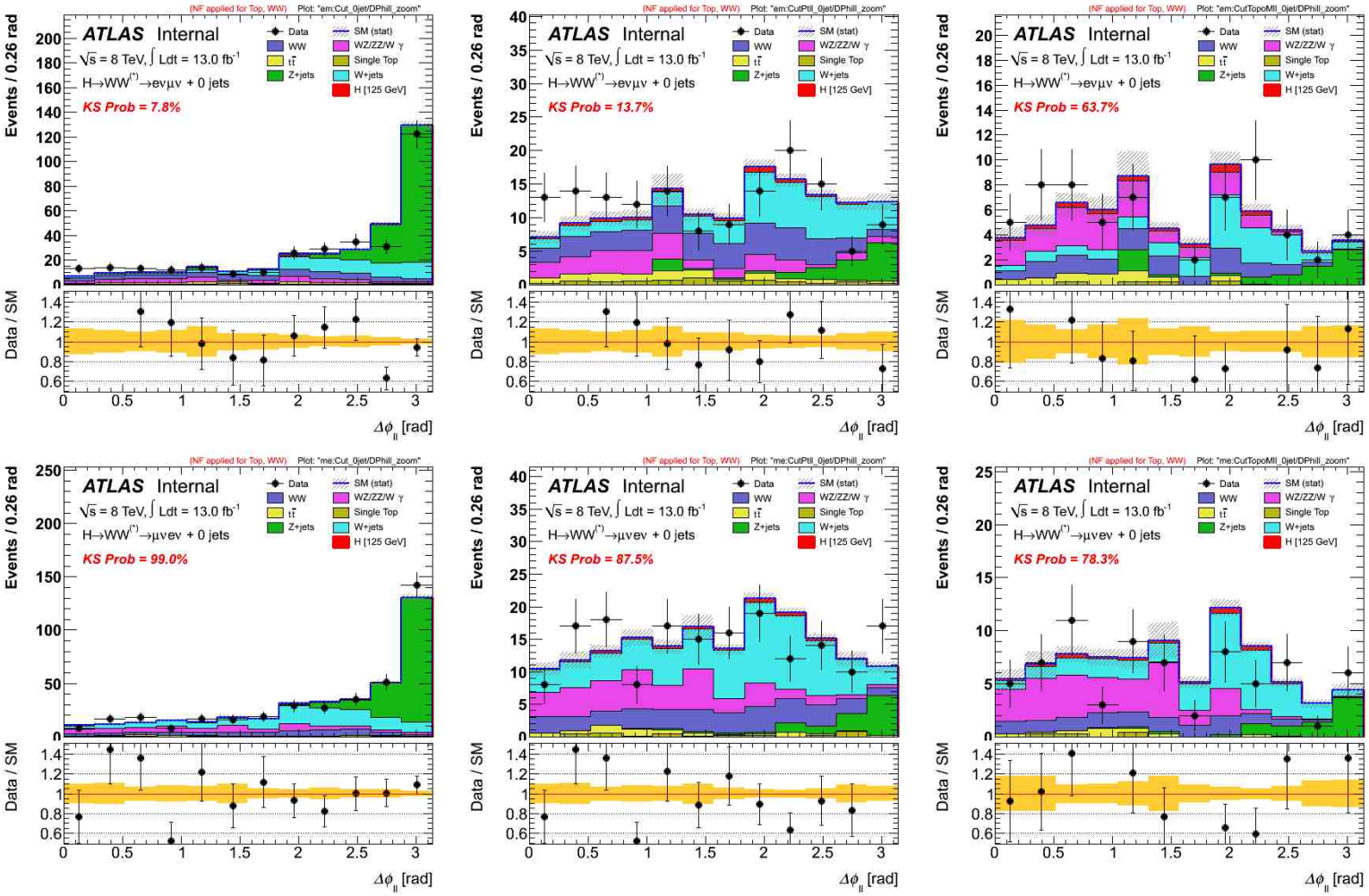
Blinded SR, $\Delta\varphi(\ell\ell) < 1.8$: $E_{\mathrm{T}}^{\mathrm{miss}}$,$p_T^{\ell\ell}$, P_T Sublead lepton

- Top: $e\mu$, Bottom: μe
- **Agreement between data and MC is reasonable.**



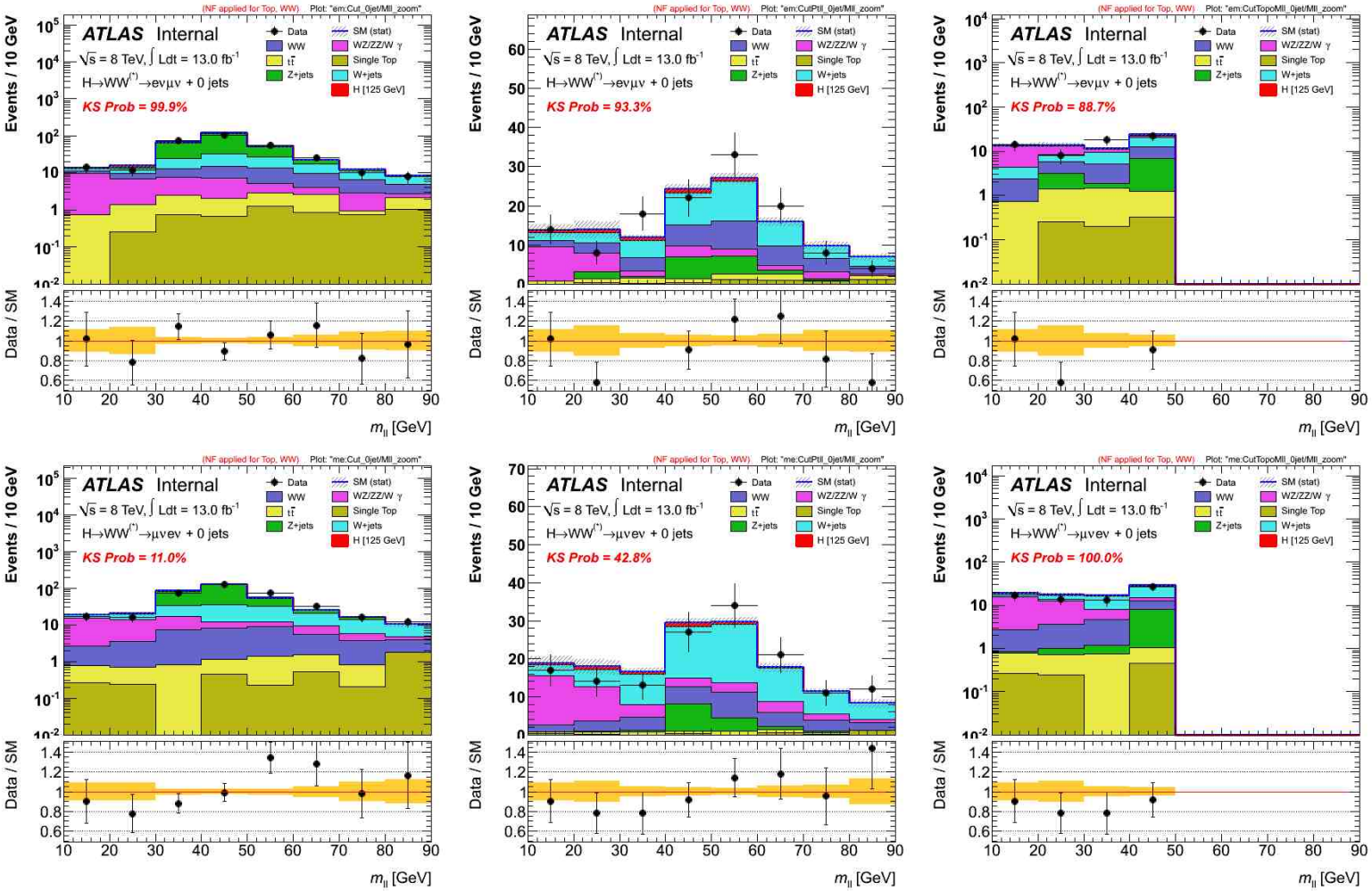
$\Delta\varphi(\ell\ell)$: at Jet Veto, after $p_T^{\ell\ell}$, after $M_{\ell\ell}$ Cuts

- Top: $e\mu$, Bottom: μe
- **Agreement between data and MC is reasonable.**



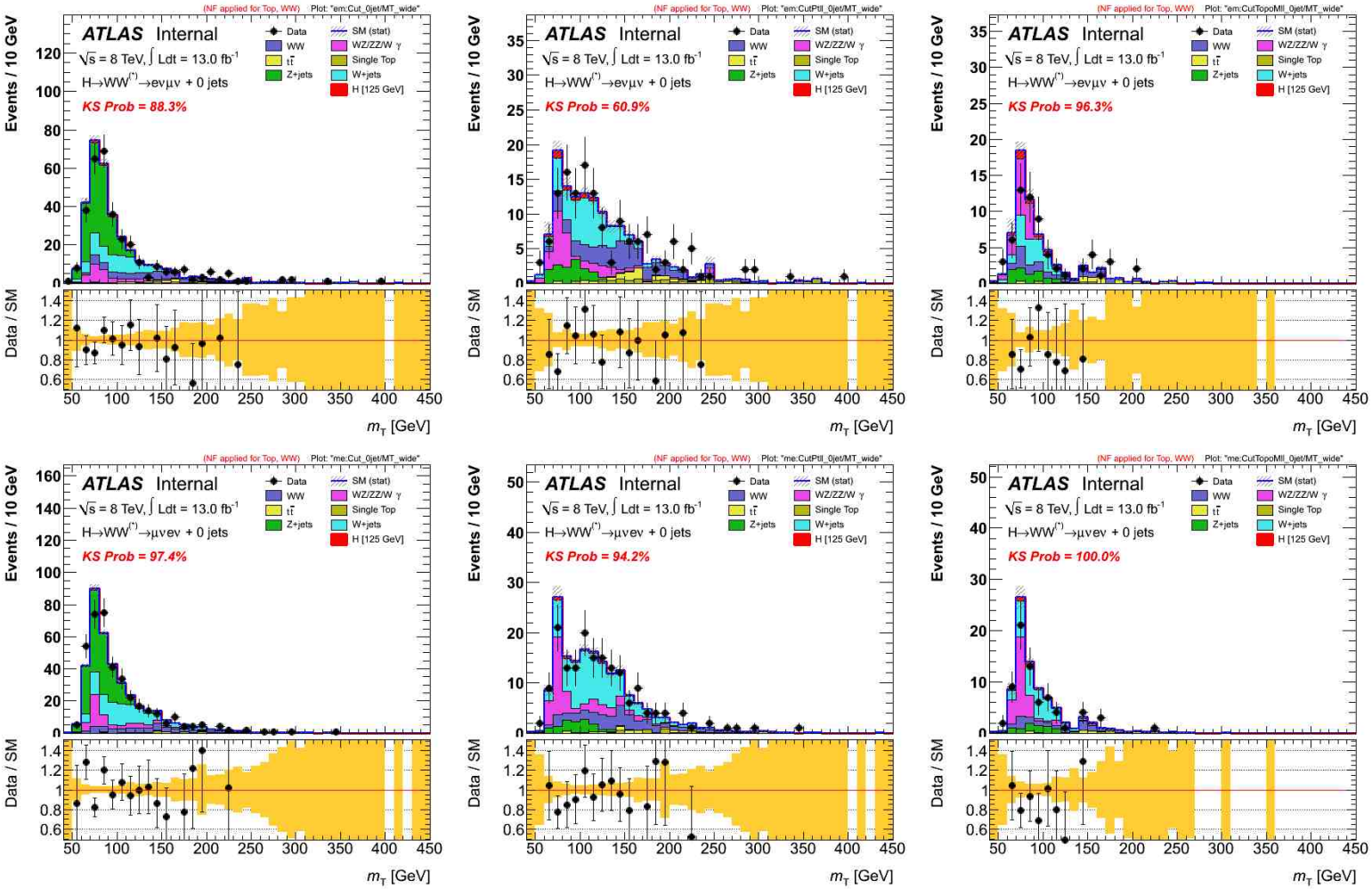
Mll: at Jet Veto, after $p_T^{\ell\ell}$, after $M_{\ell\ell}$ Cuts

- Top: $e\mu$
- Bottom: μe



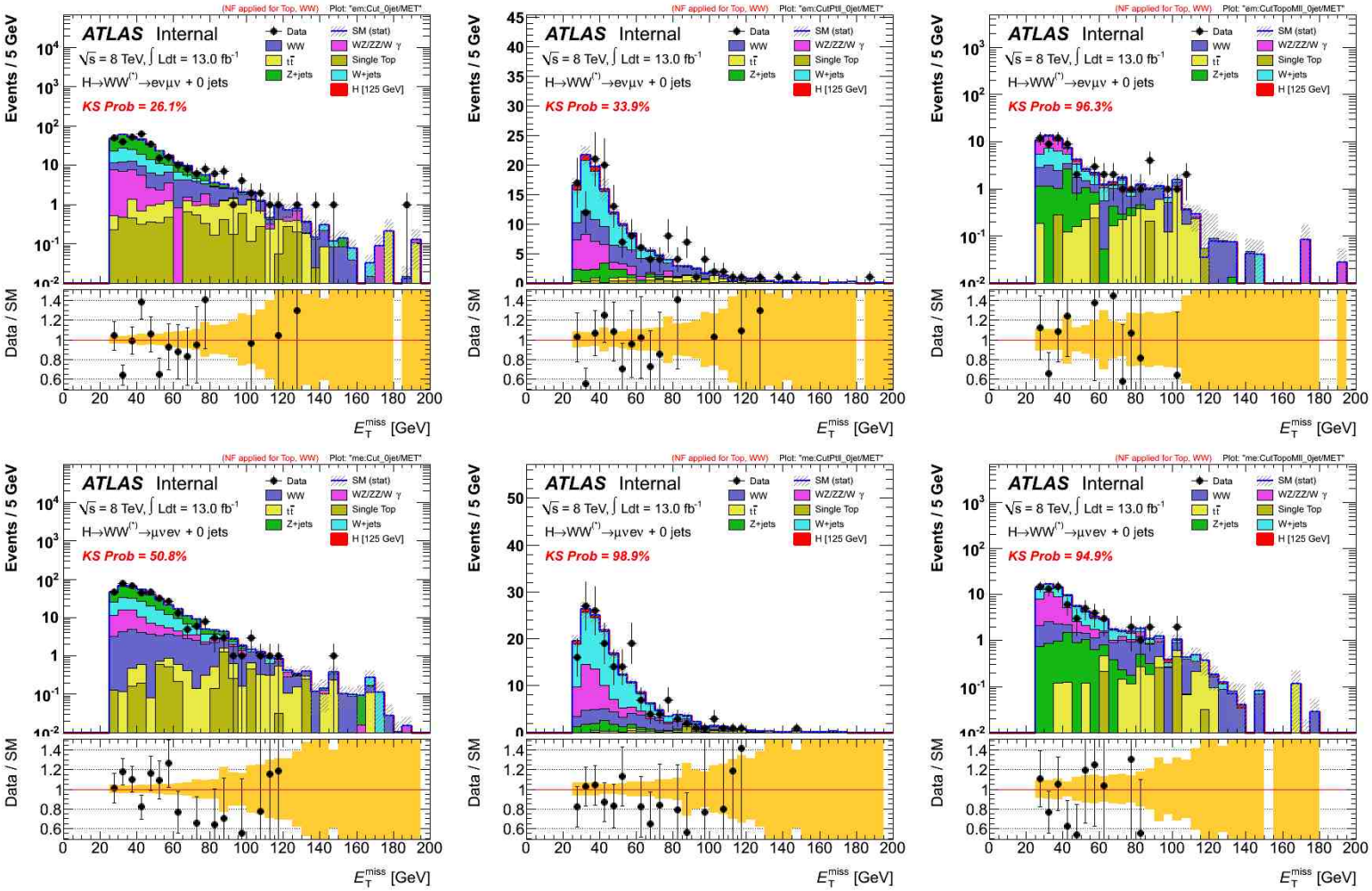
M_T: at Jet Veto, after $p_T^{\ell\ell}$, after $M_{\ell\ell}$ Cuts

- Top: $e\mu$
- Bottom: μe



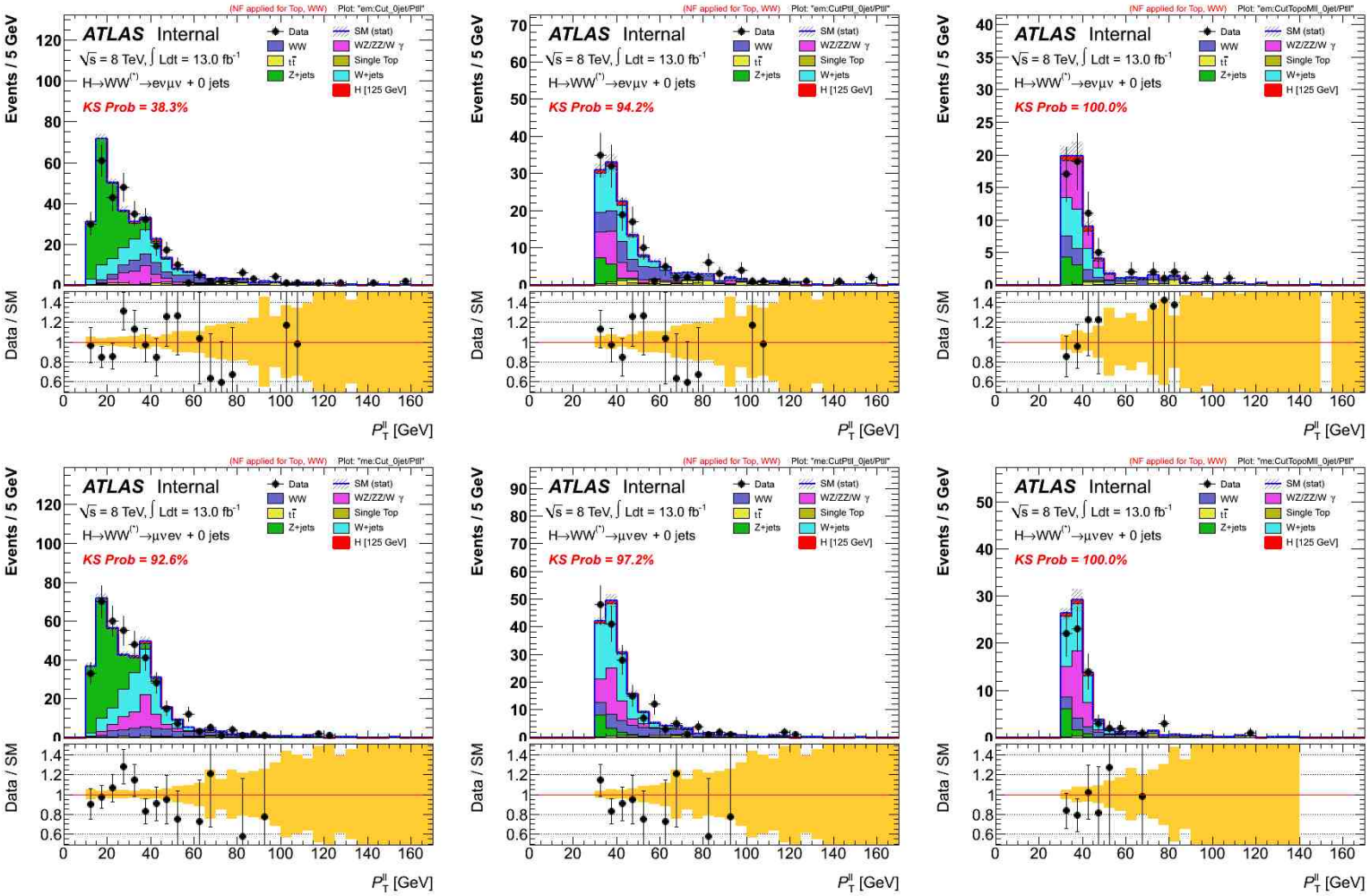
$E_{\mathrm{T}}^{\mathrm{miss}}$: at Jet Veto, after $p_T^{\ell\ell}$, after $M_{\ell\ell}$ Cuts

- Top: $e\mu$
- Bottom: μe



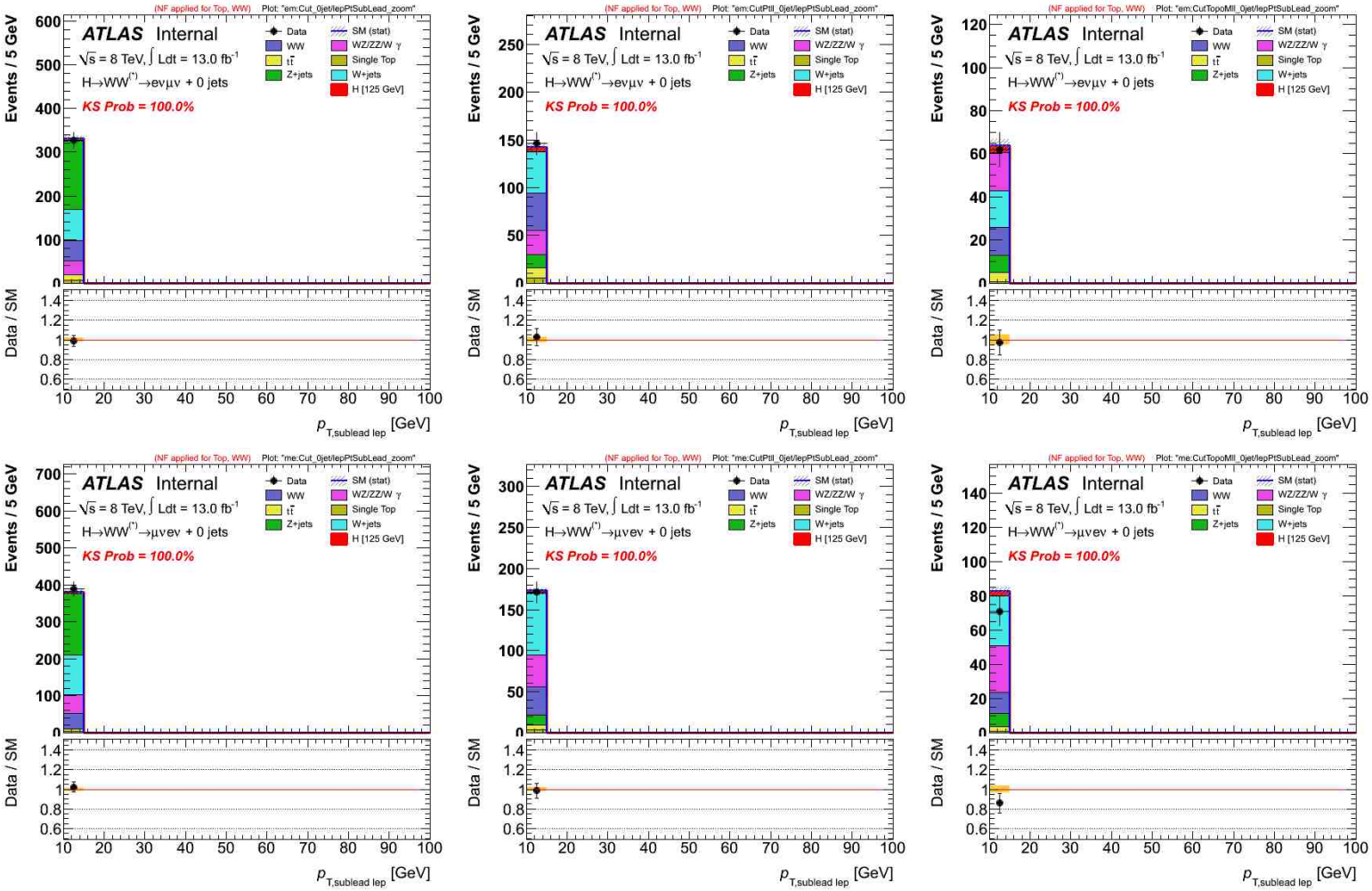
$p_T^{\ell\ell}$: at Jet Veto, after $p_T^{\ell\ell}$, after $M_{\ell\ell}$ Cuts

- Top: $e\mu$
- Bottom: μe



P_T(SubLead): at Jet Veto, after $p_T^{\ell\ell}$, after $M_{\ell\ell}$ Cuts

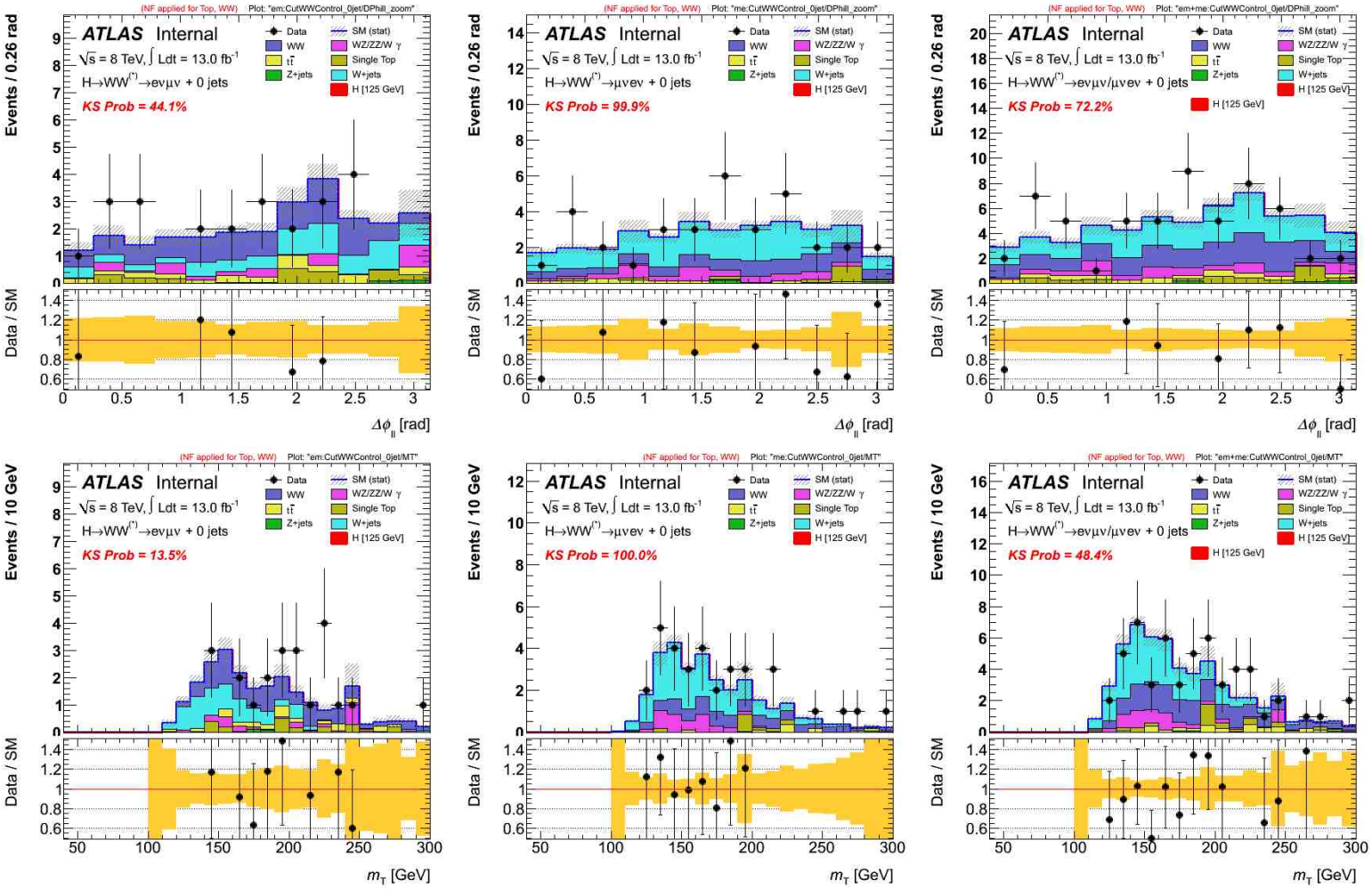
- Top: $e\mu$
- Bottom: μe



WW 0 jet CR

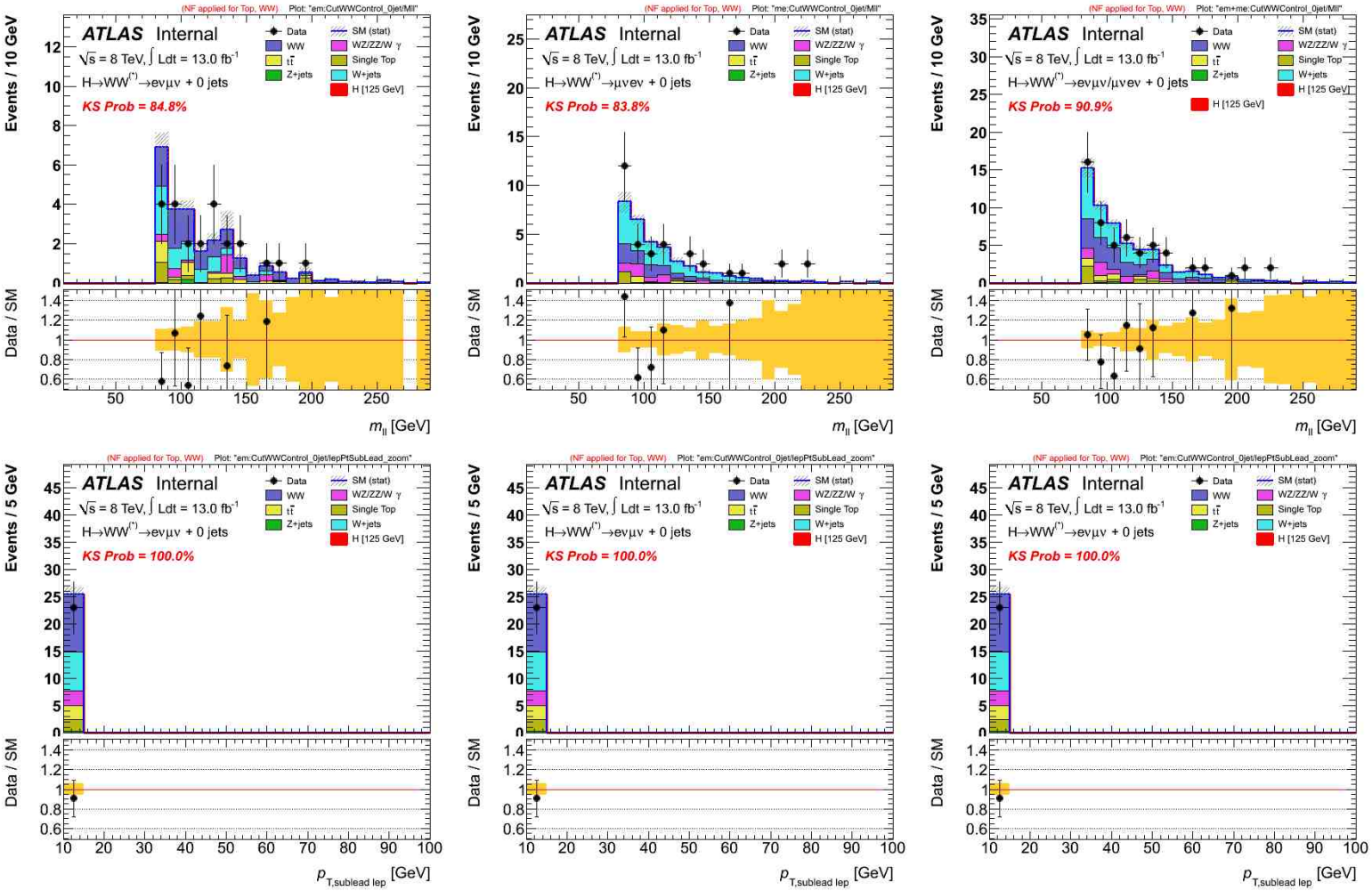
$\Delta\varphi(\ell\ell)$ and M_T in WW 0-jet CR

- $\Delta\varphi(\ell\ell)$ (top), M_T(bottom). $e\mu$, μe and sum (right).
- NF included in all plots. $e\mu$ shows mismodeling at large $\Delta\varphi(\ell\ell)$ as the nominal analysis.



$M_{\ell\ell}$ and P_T Sublead in WW 0-jet CR

- $M_{\ell\ell}$ (top) and P_T Sublead (bottom). $e\mu$, μe and sum (right)
- N0rmqlization Factor included in all plots.



Summary

Summary and Conclusions

- Many checks and tests done on the 2011 data found no explanation for the excess observed in the $\Delta\varphi(\ell\ell)$ distribution.
- Will have soon the reanalysis of that data with more stringent lepton selection requirements.
- Comparison of 2012 low PT data with expectation, shows no excess in several distributions
- **Low Pt data would add 19 events to the 76 of the nominal analysis in the zero jets DF sample**
- **Need to assess the added sensitivity with realistic systematic uncertainties and correlations.**

Backup