LEGENDA

- https://chiodini.web.cern.ch/chiodini/JII/2L-PROVAAll-GC-HISTOS-UFO_PFlow_runII/index.html
    - GABRIELE 33-08 UFO-Pflow
        - 30 regions: 15 SR and 15 ZCR (mc16a or full stat ??)

- Martino on /nfs/kloe/einstein4/HDBS/ReaderOutput/reader_mc16a_VV_2lep_PFlow_UFO/fetch/
    - Latest EJS run 33-22 UFO-Pflow —— ONLY a few SR, 140ifb is misleading

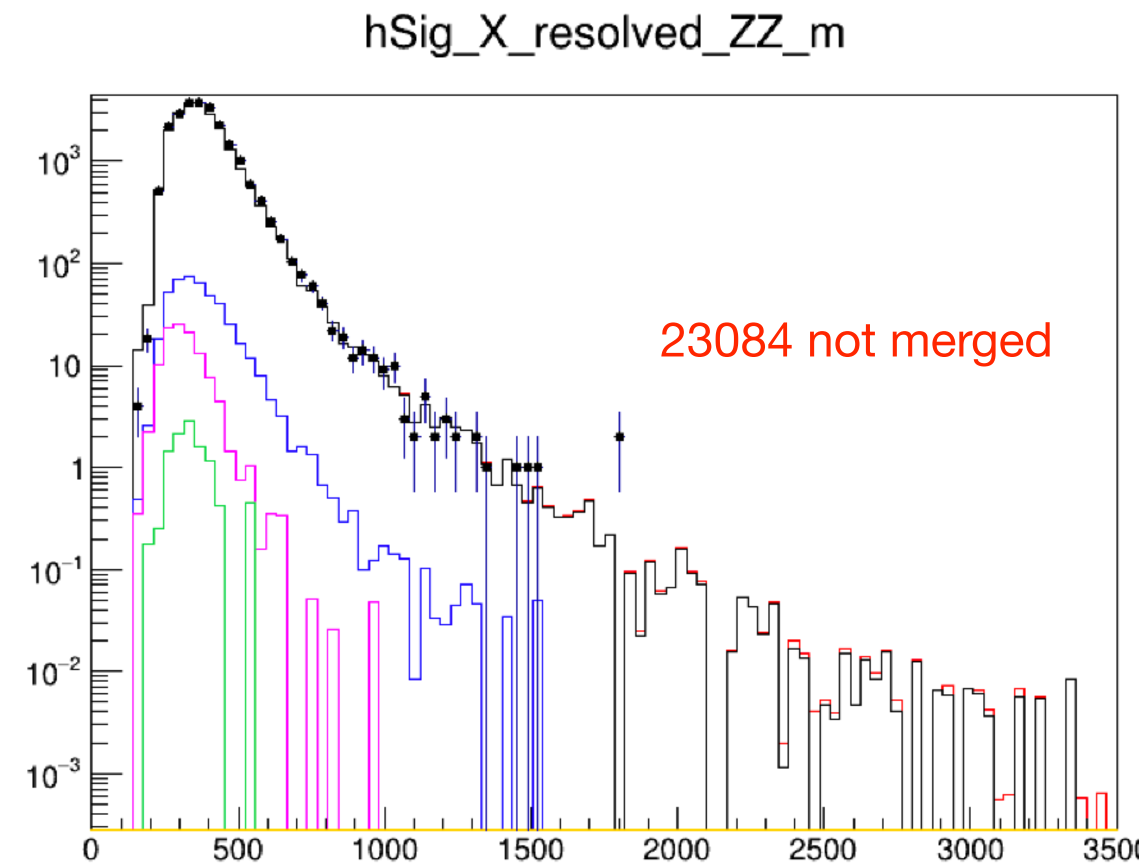
LEGENDA

- https://chiodini.web.cern.ch/chiodini/JII/2L-PROVAAll-GC-HISTOS-UFO_PFlow_runII/index.html
  - GABRIELE 33-08 UFO-Pflow
    - 30 regions: 15 SR and 15 ZCR (mc16a or full stat ??)

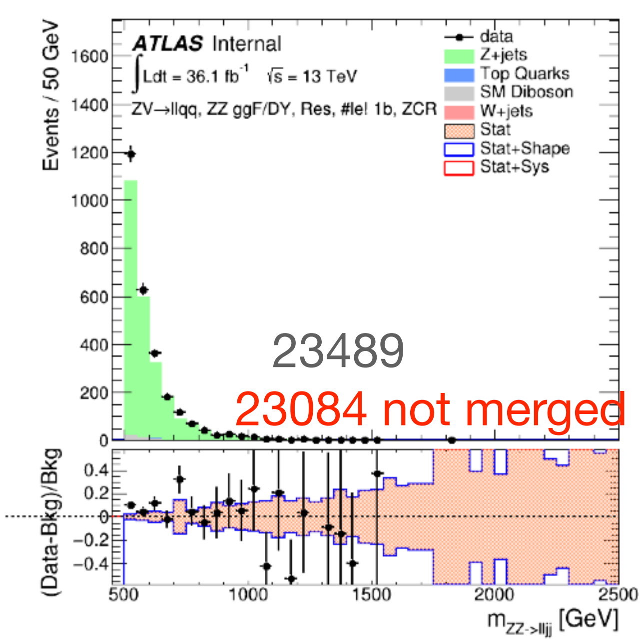
- Stefania's plots are done from trees in /nfs/kloe/einstein4/HDBS/ReaderOutput/reader_mc16a_VV_2lep_PFlow_UFO/fetch/ with MC16a only and corresponding data
  - Latest EJS run 33-22 UFO-Pflow ——— 30 regions: 15 SR and 15 ZCR, M>500 GeV
  - # of events are independent on the lower limit on M
  - # of events in red for Resolved regions are "pass_Res_… && (NOT(pass any merged …))"

I MIEI PLOT

- Mie macro
  - /afs/le.infn.it/user/s/spagnolo/atlas/Physics/DBLexot/CxAODReader2021/somePlotsMSC
    - Root
      - .x initChains_33_22.C
      - makeMyQuickPlot2022.C



- Easytreeplotter from Reader
  - /afs/le.infn.it/user/s/spagnolo/atlas/Physics/DBLexot/CxAODReader2021/CxAODReader_VVSemileptonic/CxAODReader_VVSemileptonic/macros
    - runCxAODPlots_Syst.cxx (using makePlotsSSfromTree.cxx)



Resolved

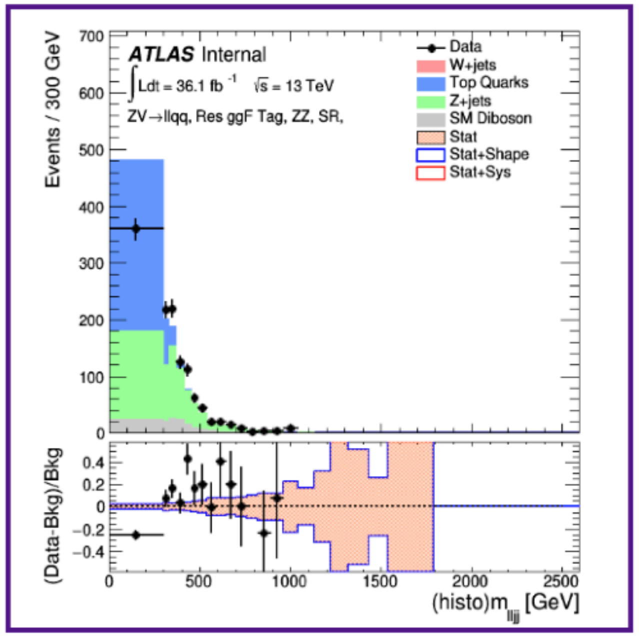
ggF and VBF

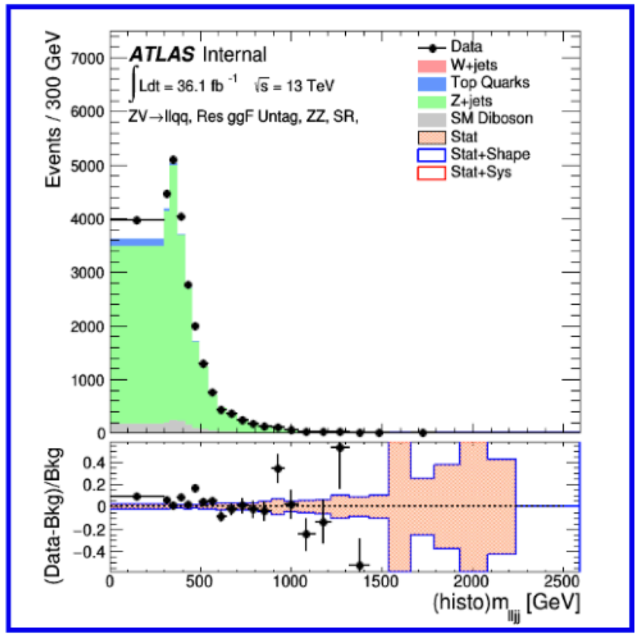
Resolved

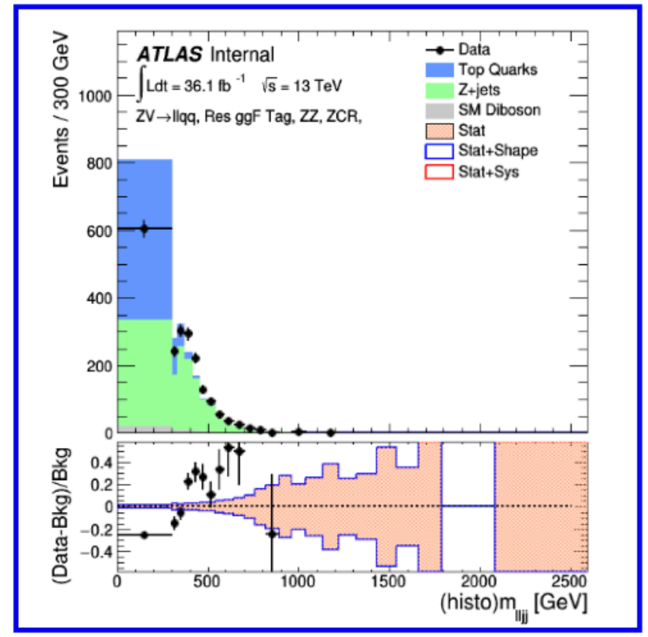
ggF

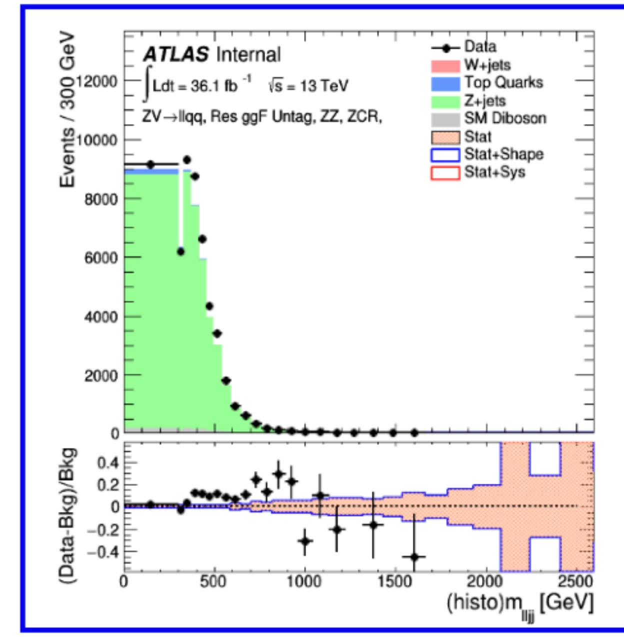
RESOLVED GGF ALL ZZ SR AND CR

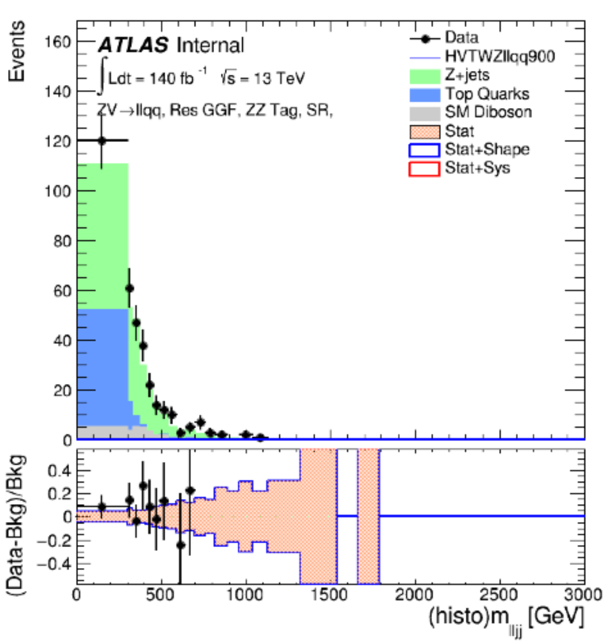
Res_GGF_ZZ: SR tag, SR Untag, ZCR tag, ZCR Untag

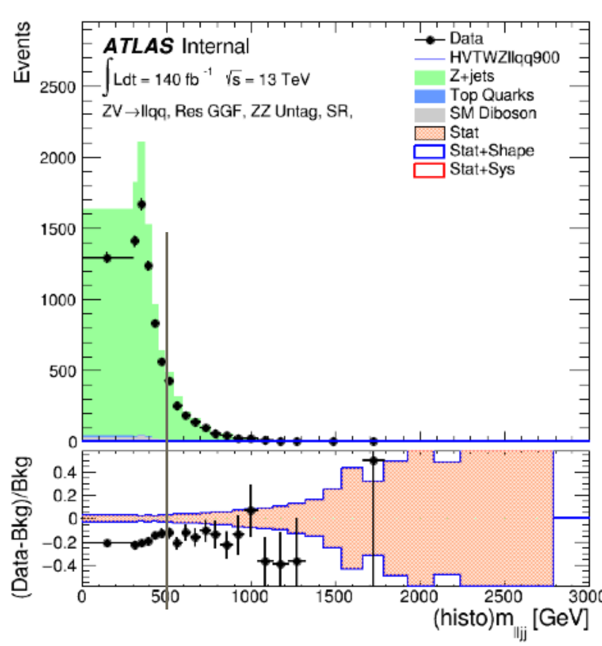








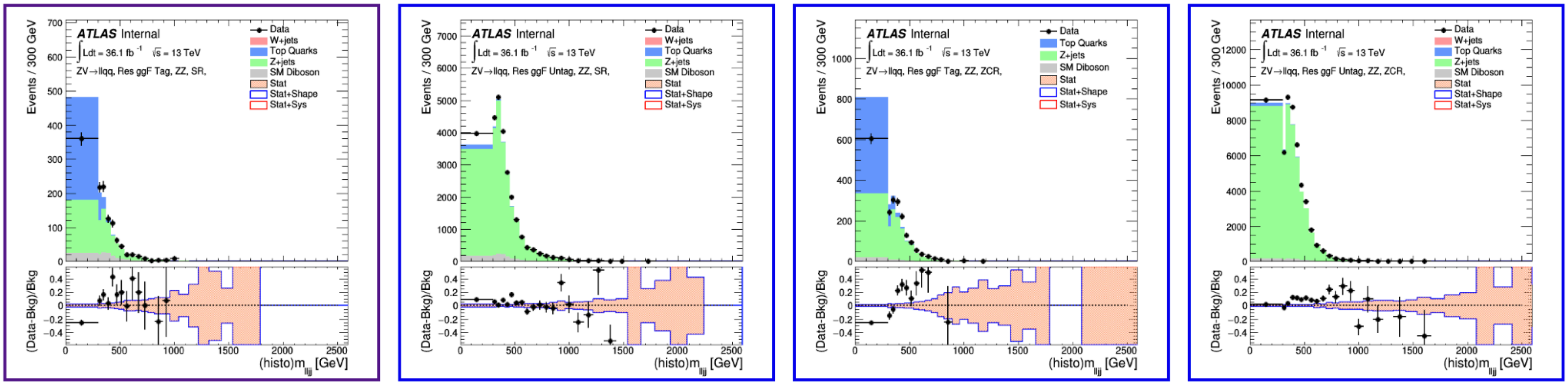




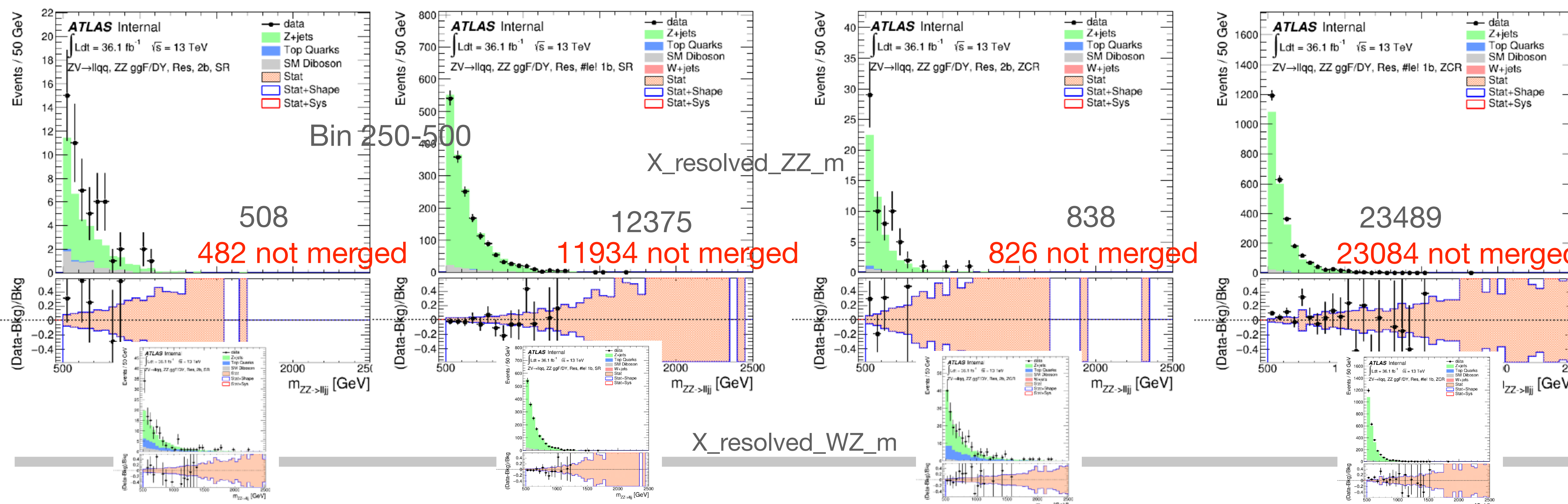
Martino's plots are done with MC16a only and corresponding data, *the label 140 fb-1 is misleading*

RESOLVED GGF ALL ZZ SR AND CR

Res_GGF_ZZ: SR tag, SR Untag, ZCR tag, ZCR Untag



Stefania's plots are done from trees with MC16a only and corresponding data



Bin 250-500

X_resolved_ZZ_m

508
482 not merged

12375
11934 not merged

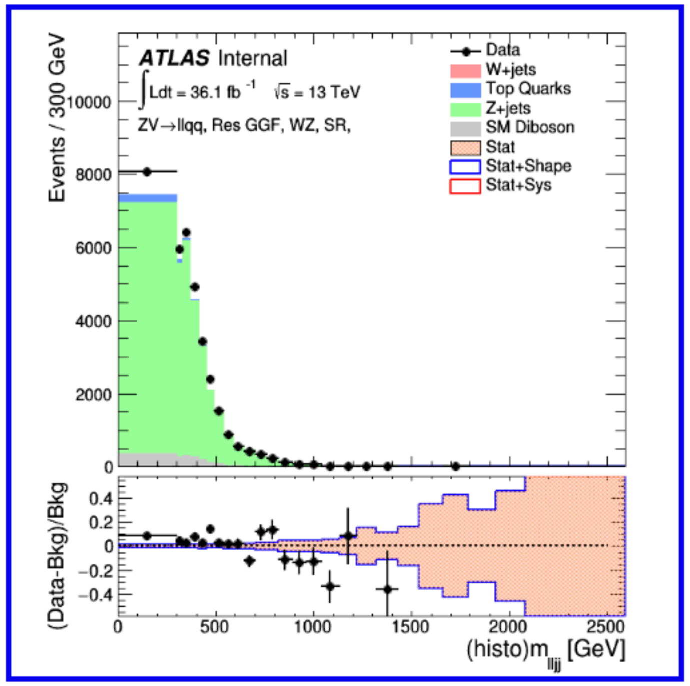
838
826 not merged

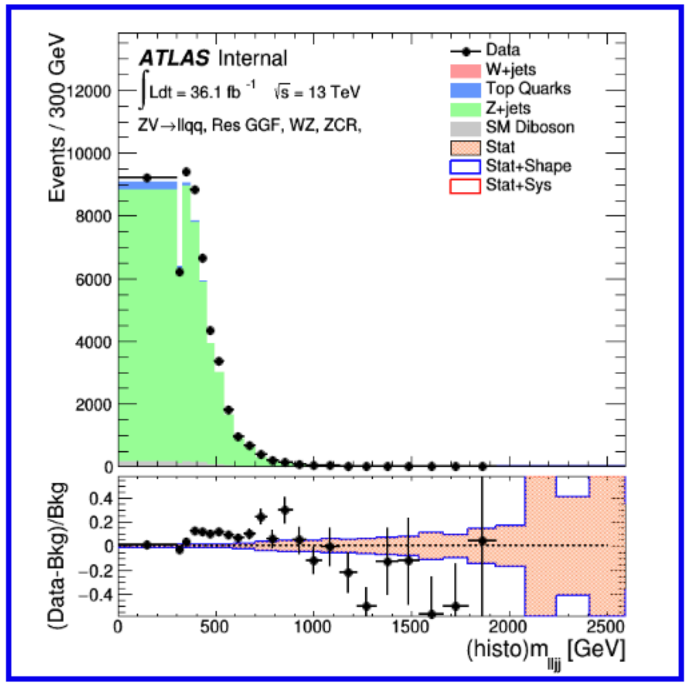
23489
23084 not merged

X_resolved_WZ_m

RESOLVED GGF ALL WZ SR AND CR

Res_GGF_WZ: SR, ZCR

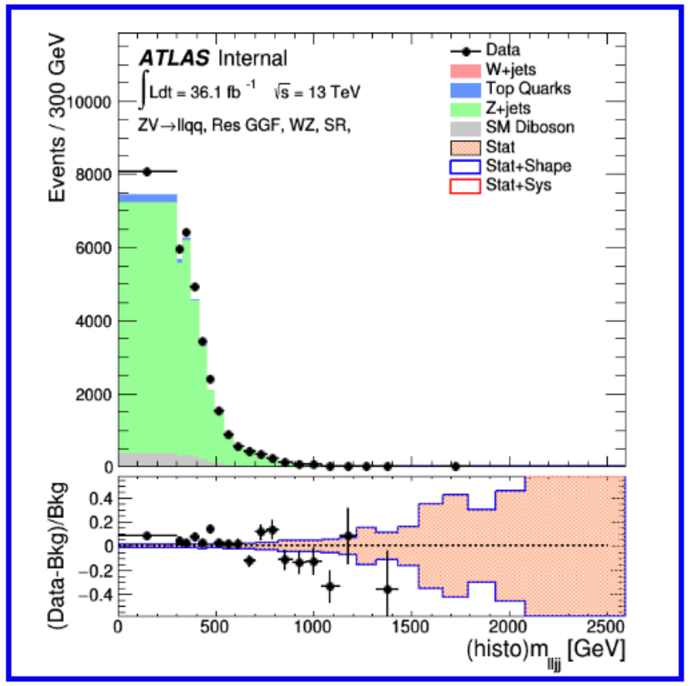


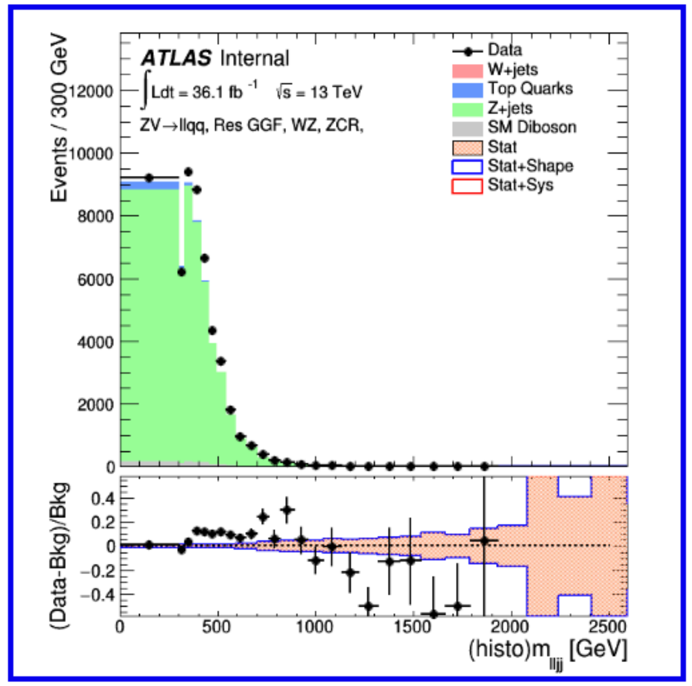


Martino's plots are done with MC16a only and corresponding data

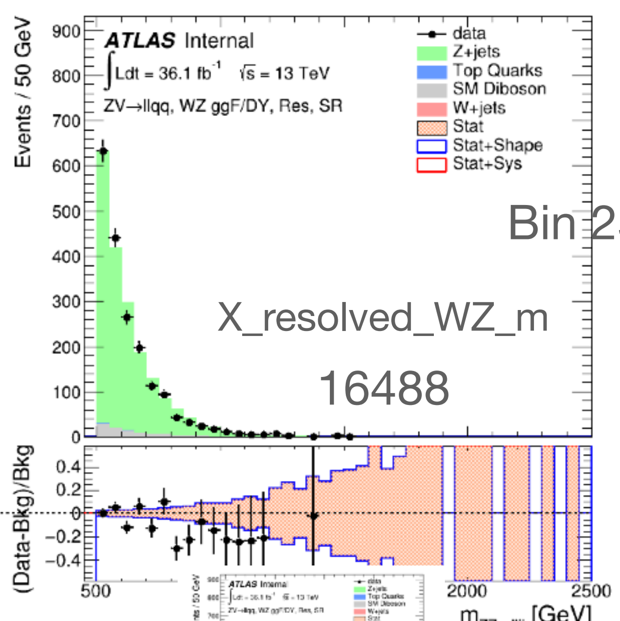
RESOLVED GGF ALL WZ SR AND CR

Res_GGF_WZ: SR, ZCR





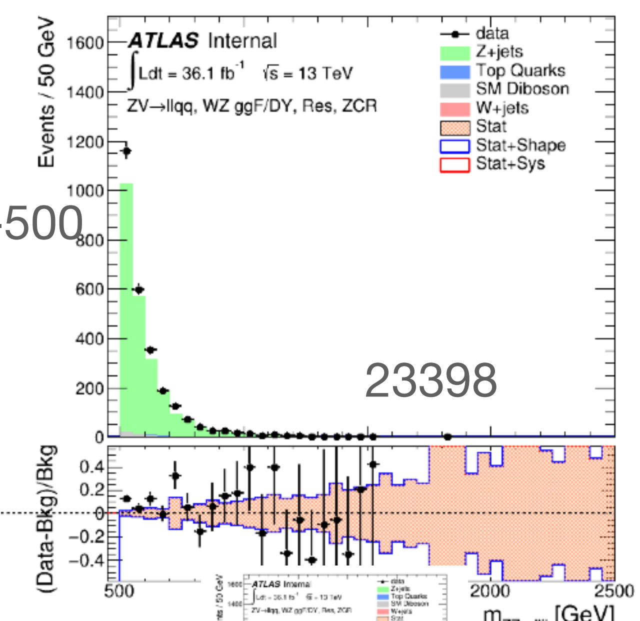
Stefania’s plots are done from trees with MC16a only and corresponding data



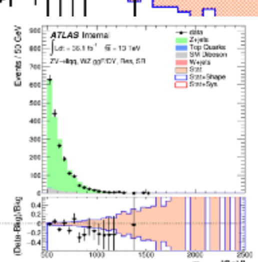
Bin 250-500

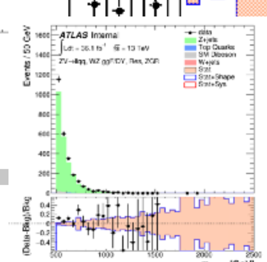
X_resolved_WZ_m

16488



23398





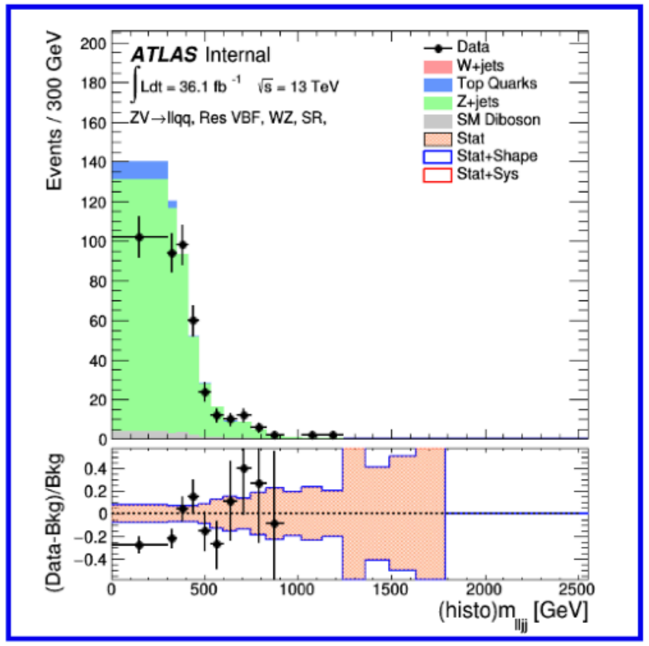
X_resolved_ZZ_m

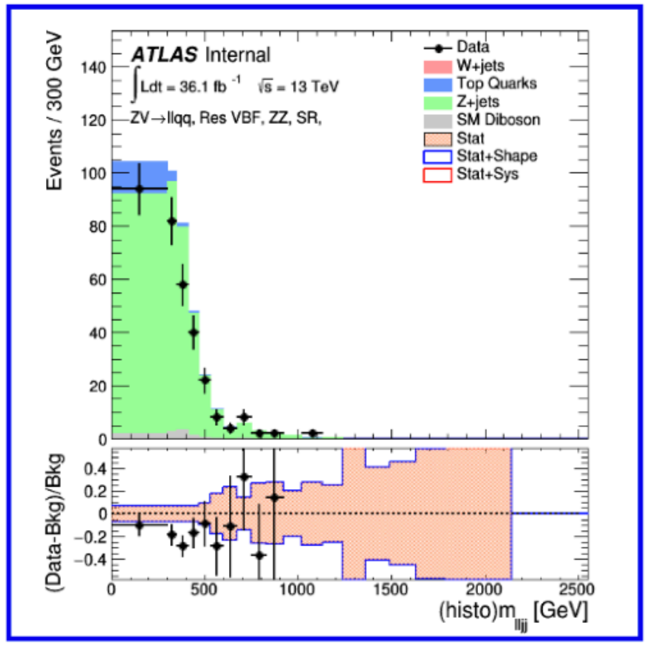
Resolved

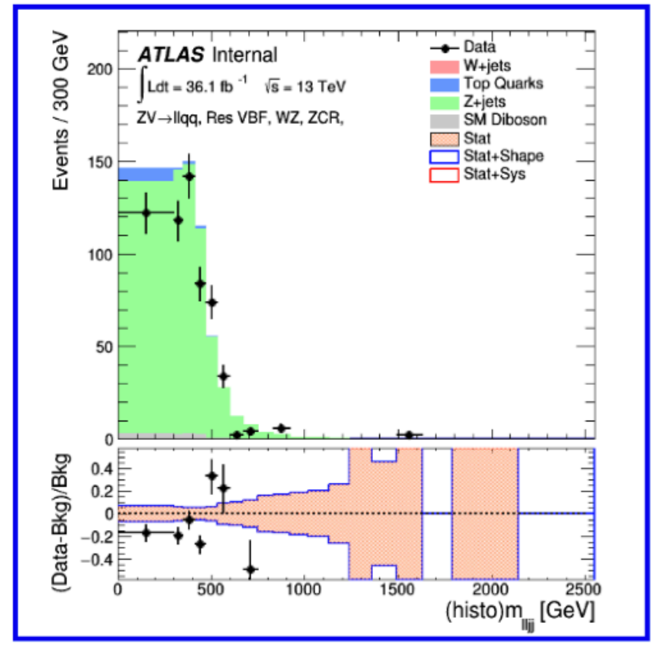
VBF

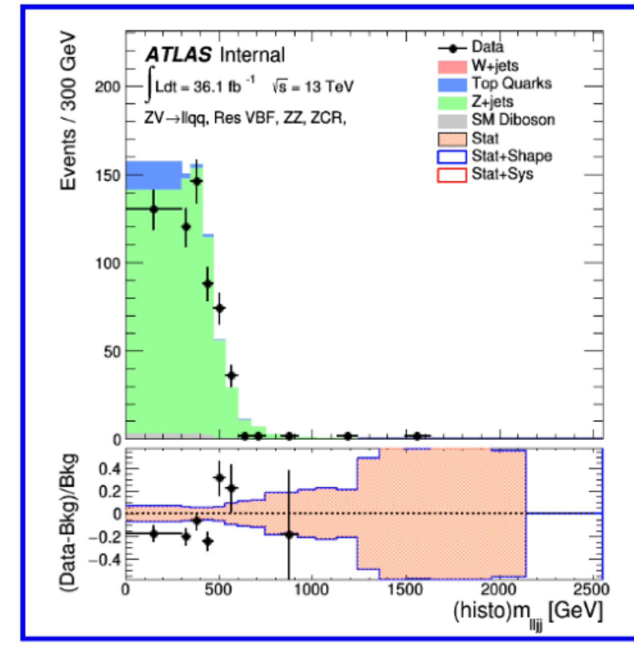
RESOLVED VBF ALL ZZ AND WZ SR AND CR

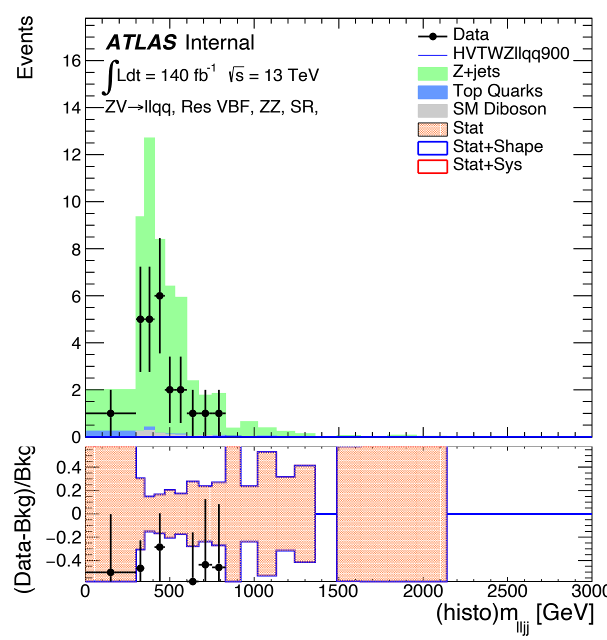
Res_VBF: WZ SR, ZZ SR, WZ ZCR, ZZ ZCR







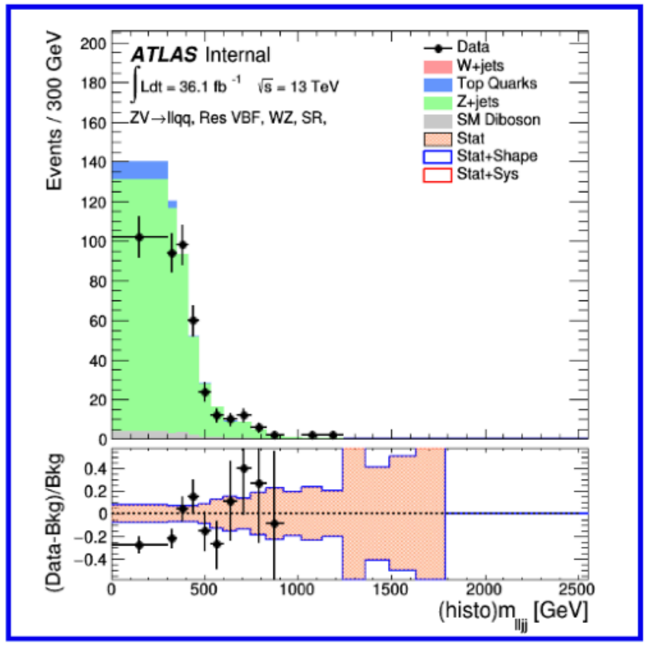


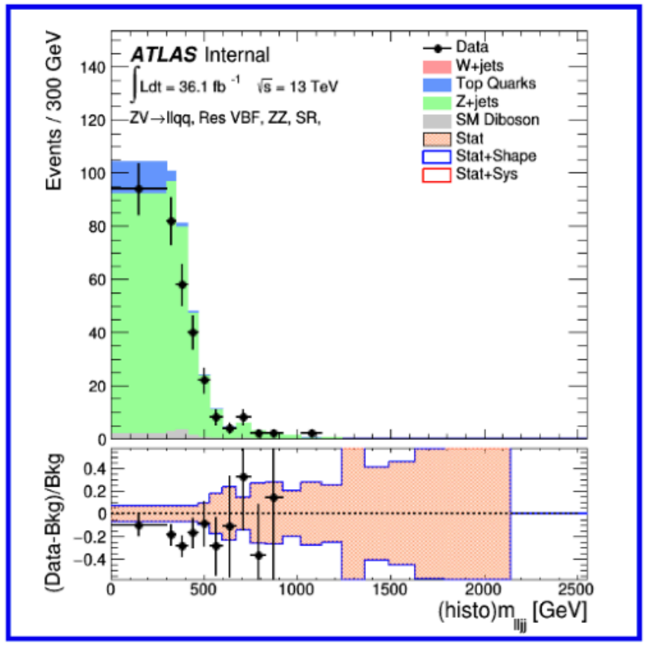


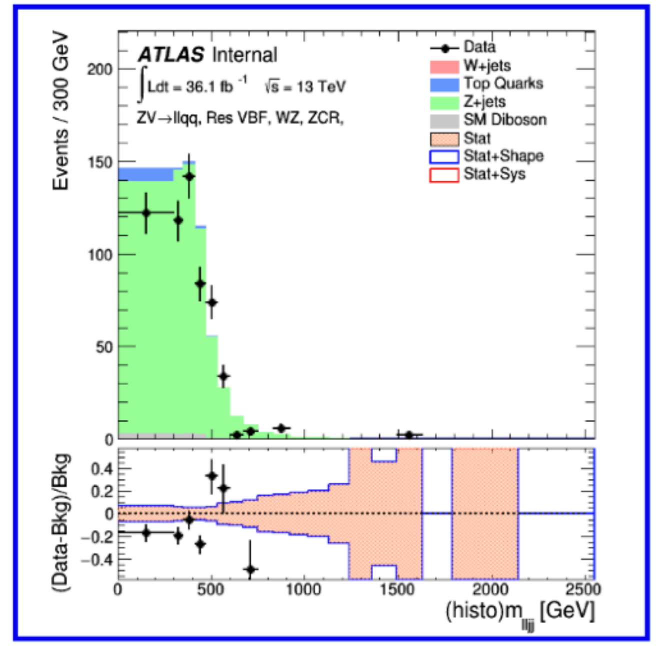
Martino's plots are done with MC16a only and corresponding data

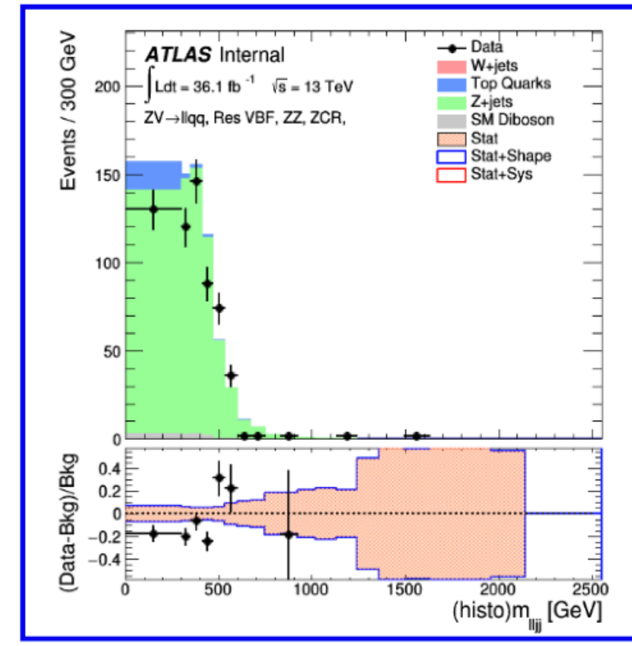
Resolved VBF all ZZ and WZ SR and CR

Res_VBF: WZ SR, ZZ SR, WZ ZCR, ZZ ZCR

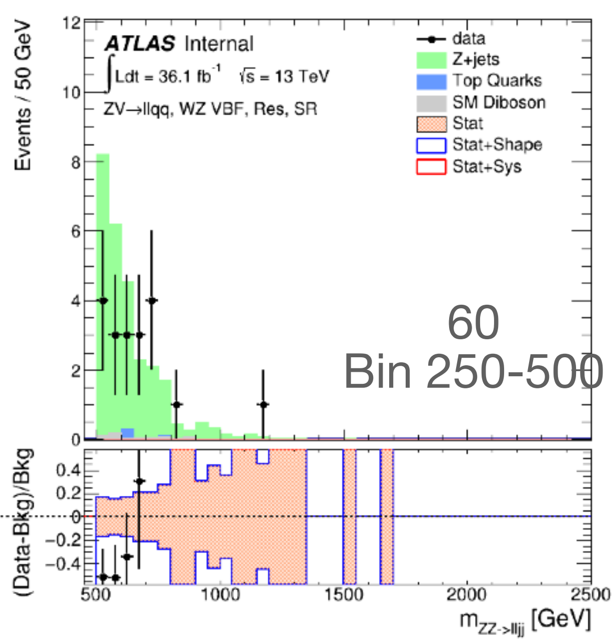


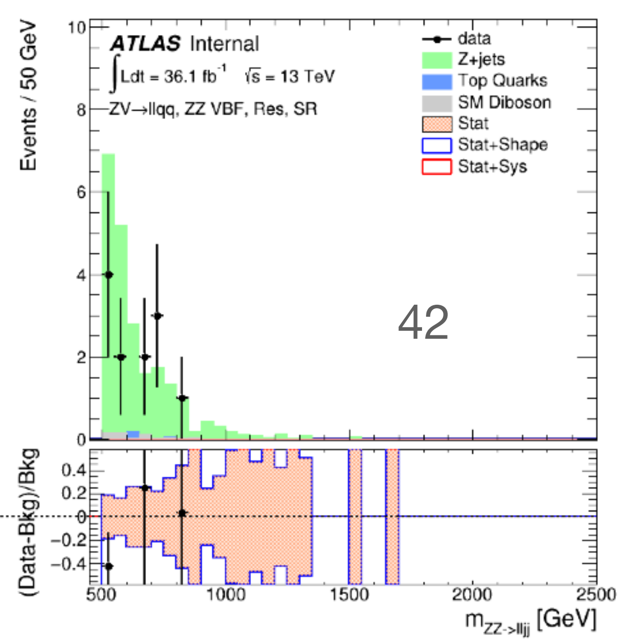


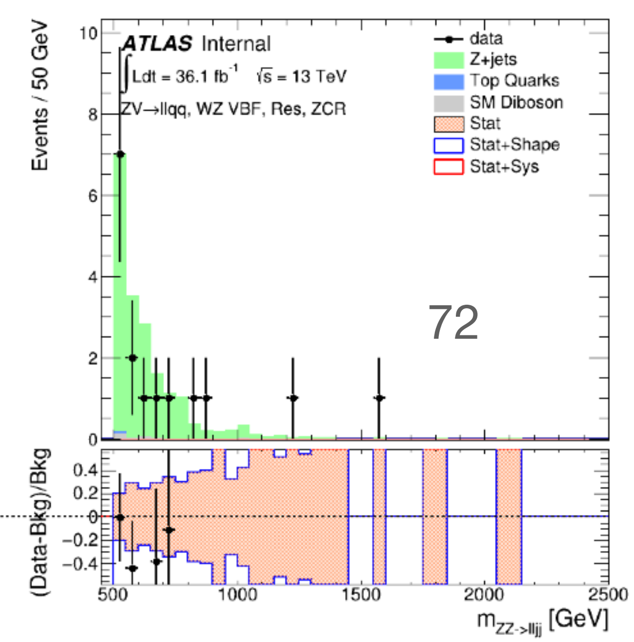


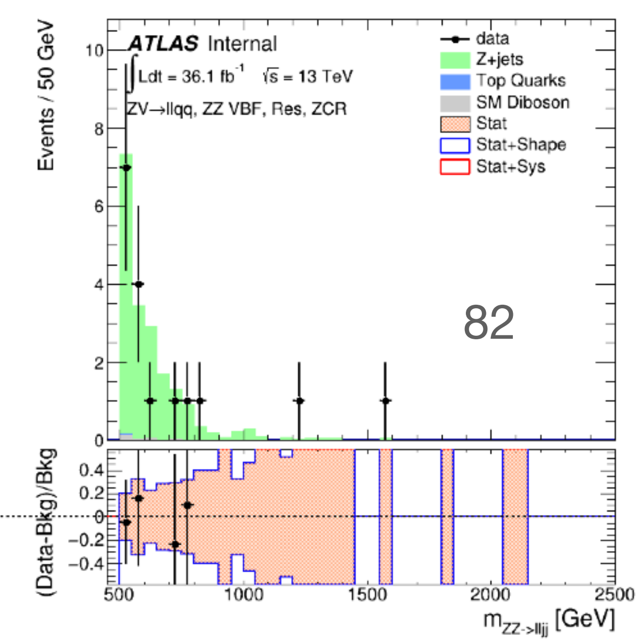


Stefania's plots are done from trees with MC16a only and corresponding data









Merged

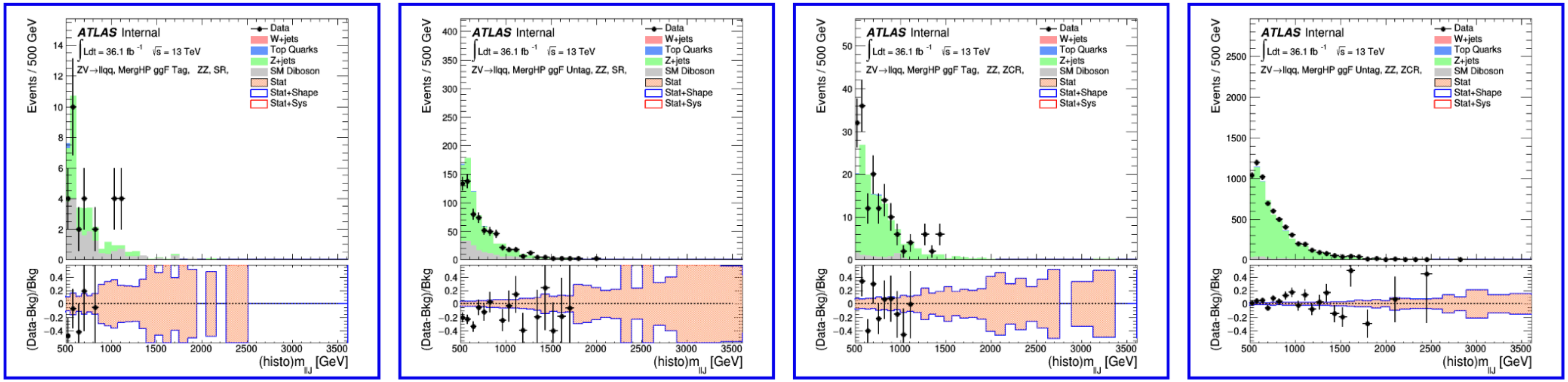
ggF and VBF

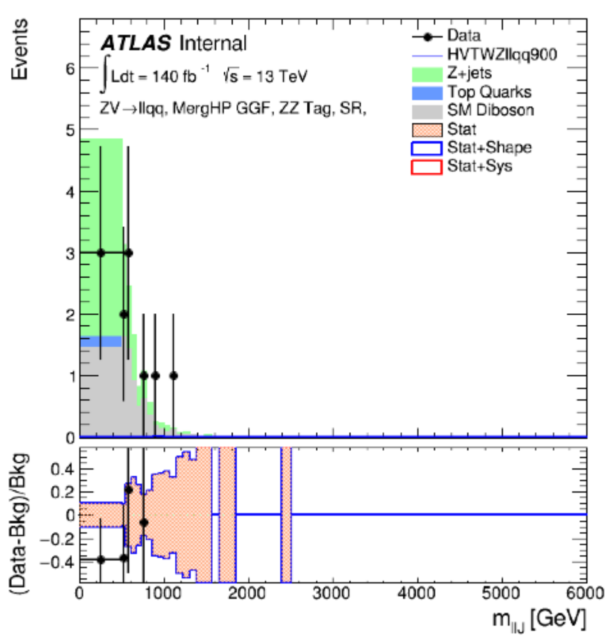
Merged

ggF

MERGED GGF ALL HP ZZ SR AND CR

MergHP_GGF_ZZ: SR tag, SR Untag, ZCR tag, ZCR Untag

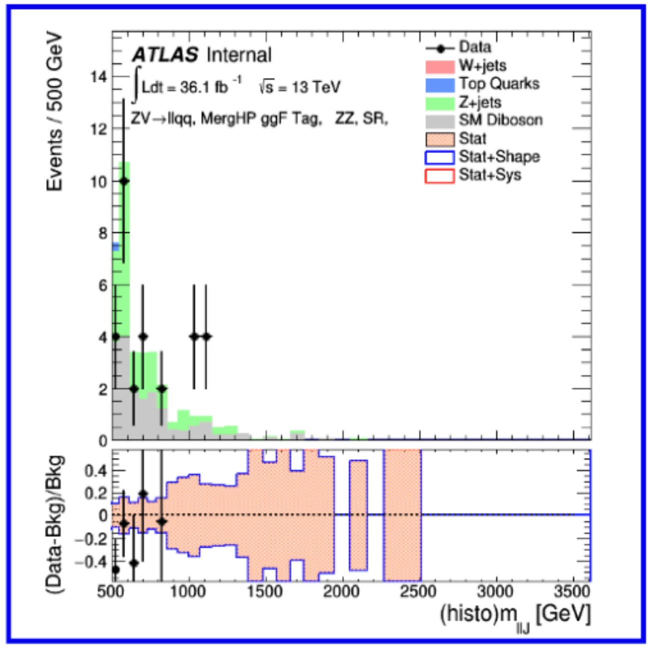


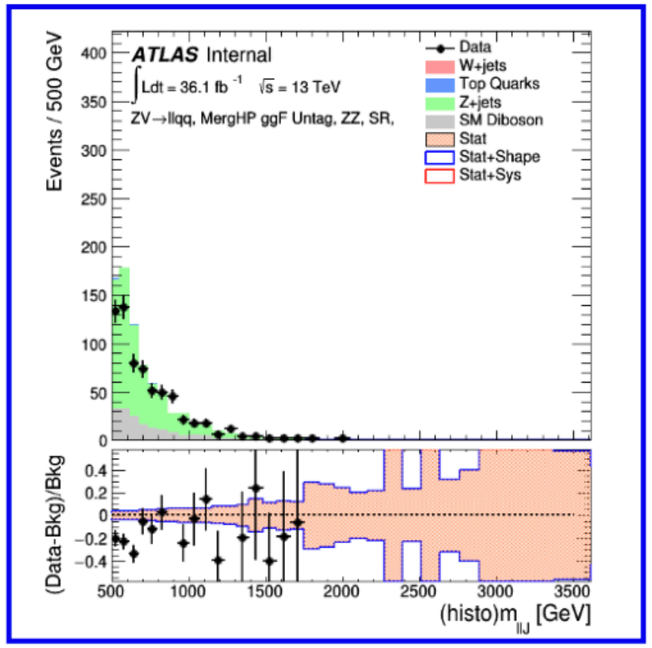


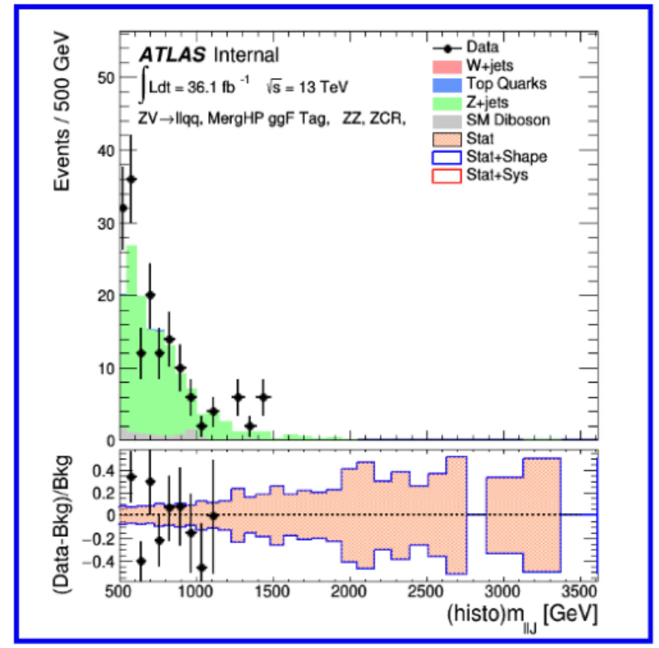
Martino's plots are done with MC16a only and corresponding data

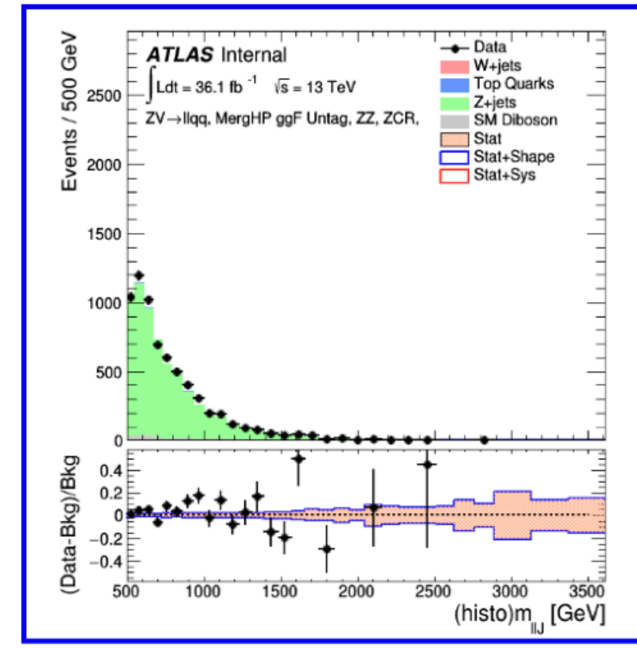
MERGED GGF ALL HP ZZ SR AND CR

MergHP_GGF_ZZ: SR tag, SR Untag, ZCR tag, ZCR Untag

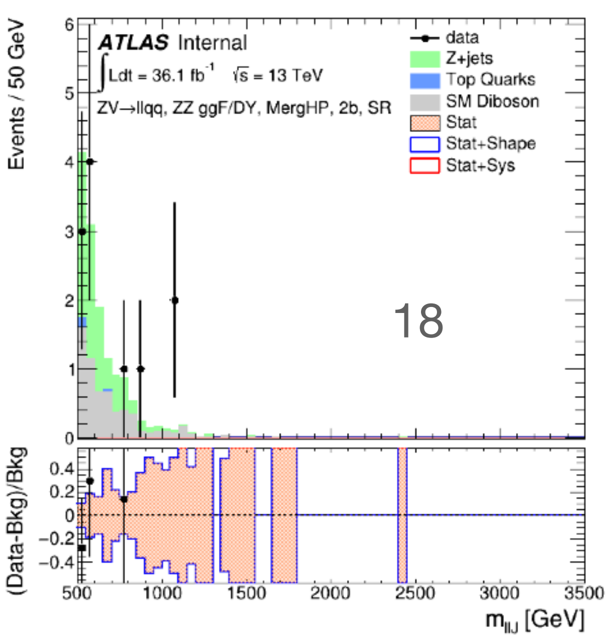


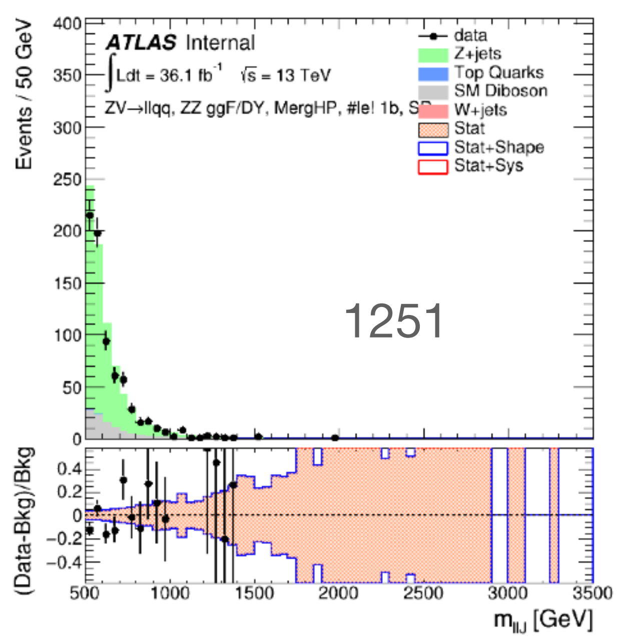


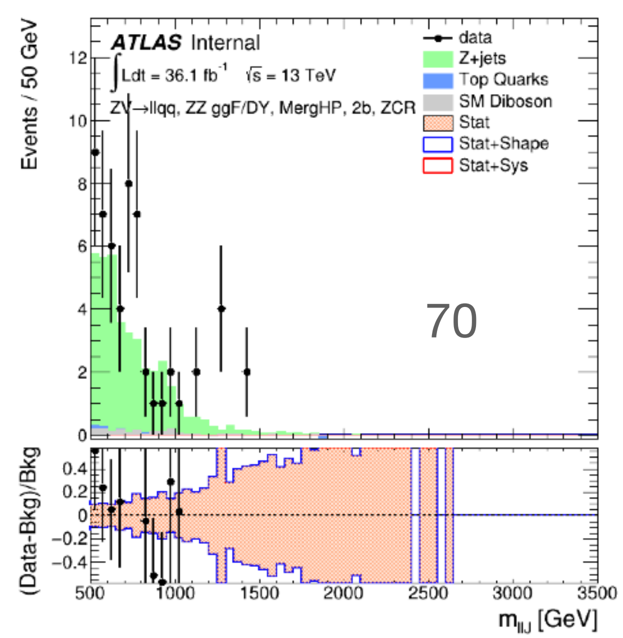


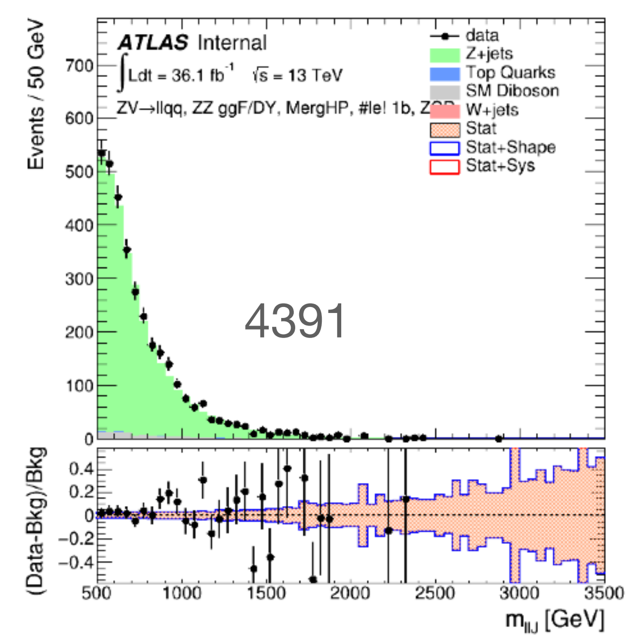


Stefania's plots are done from trees with MC16a only and corresponding data



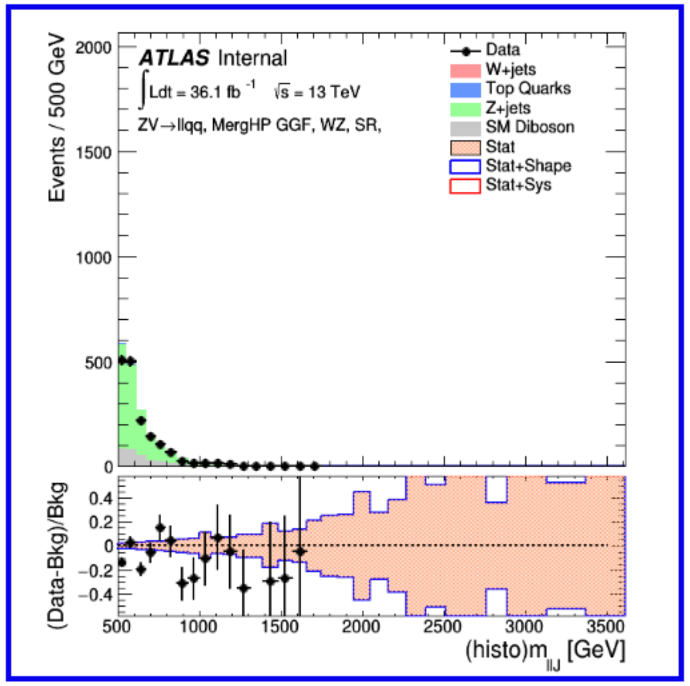


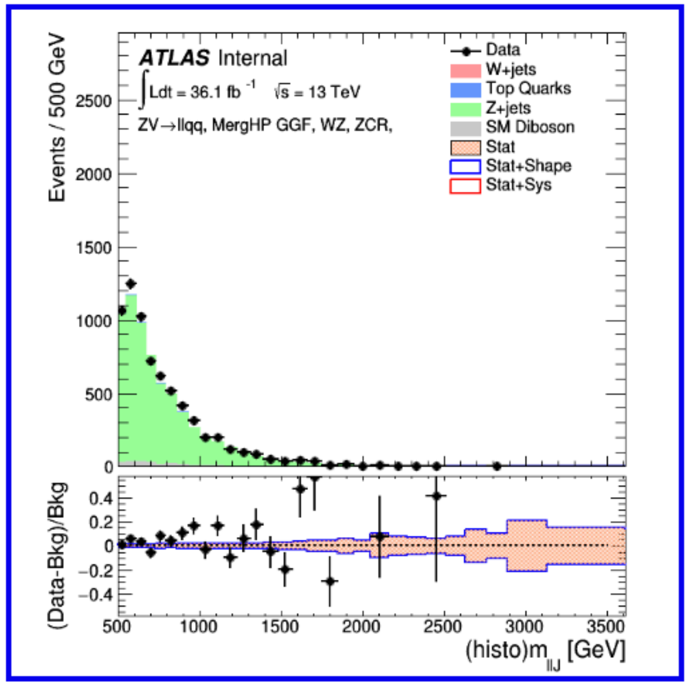




MERGED GGF ALL HP WZ SR AND CR

MergHP_GGF_WZ: SR, ZCR

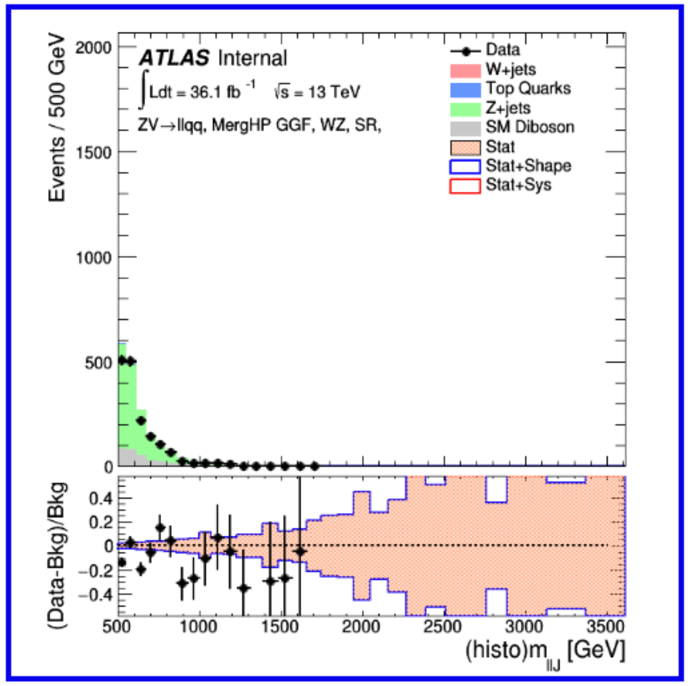


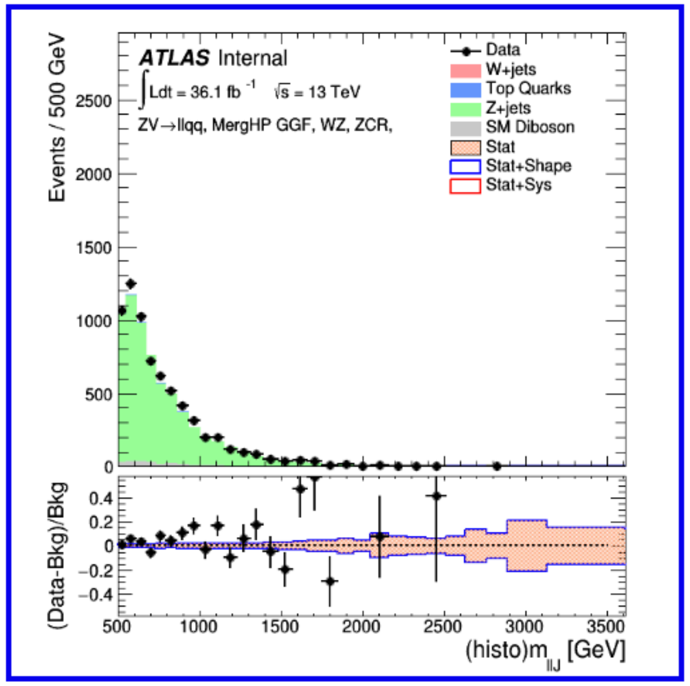


Martino's plots are done with MC16a only and corresponding data

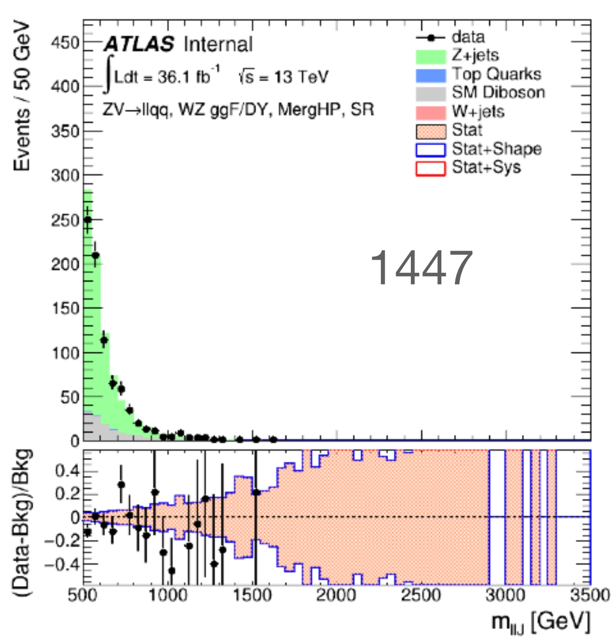
MERGED GGF ALL HP WZ SR AND CR

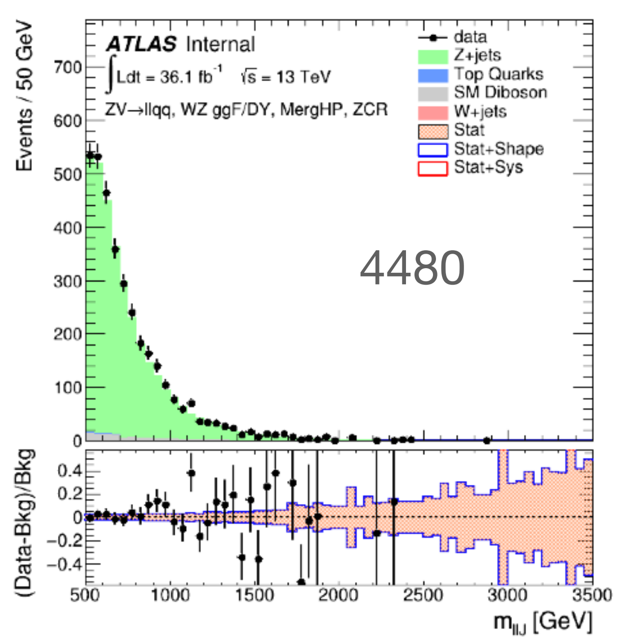
MergHP_GGF_WZ: SR, ZCR





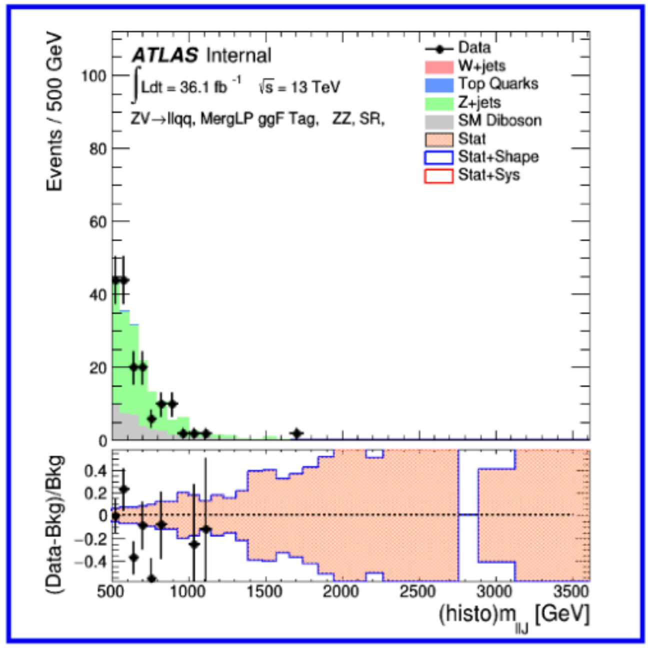
Stefania's plots are done from trees with MC16a only and corresponding data

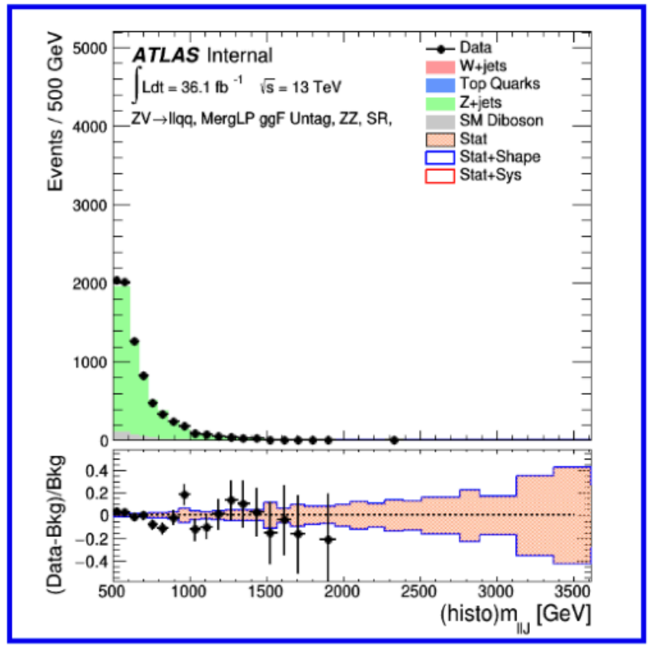


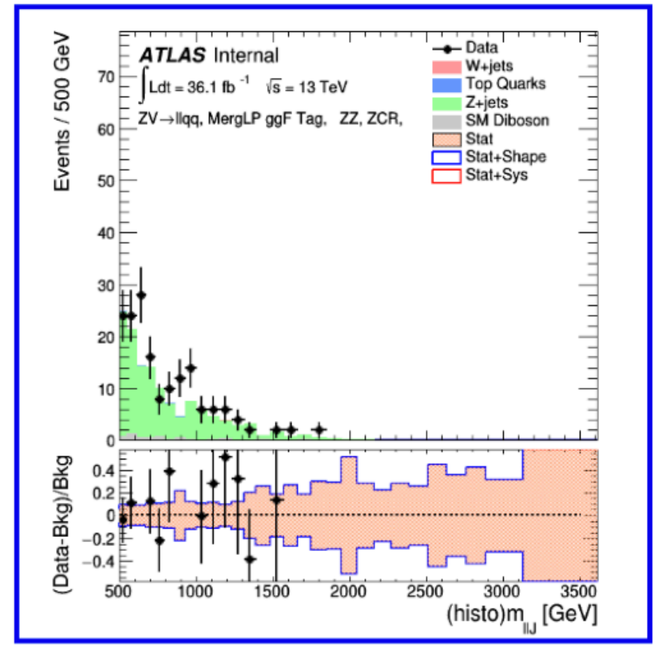


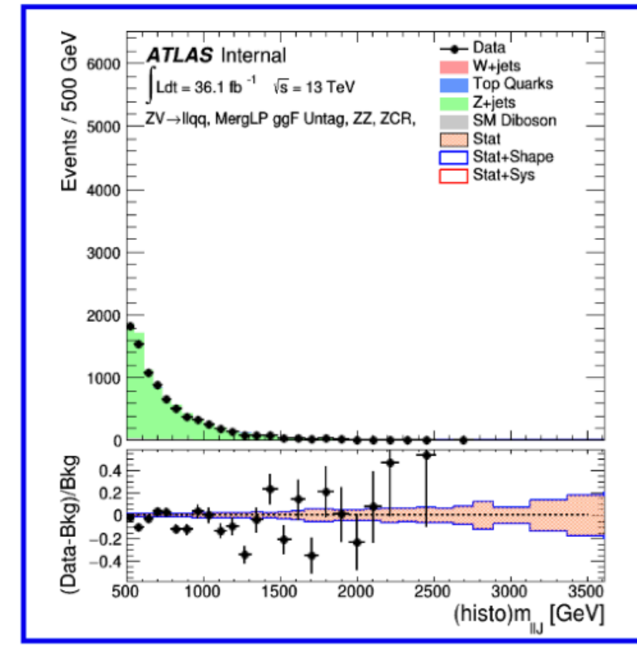
MERGED GGF ALL LP ZZ SR AND CR

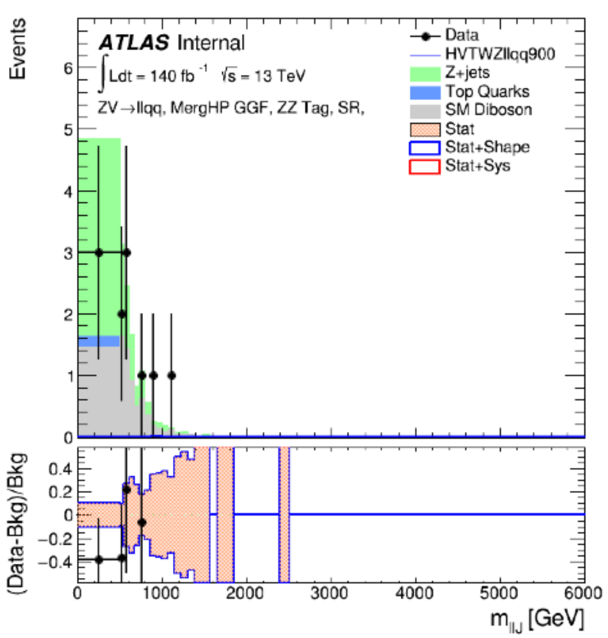
MergLP_GGF_ZZ: SR tag, SR Untag, ZCR tag, ZCR Untag







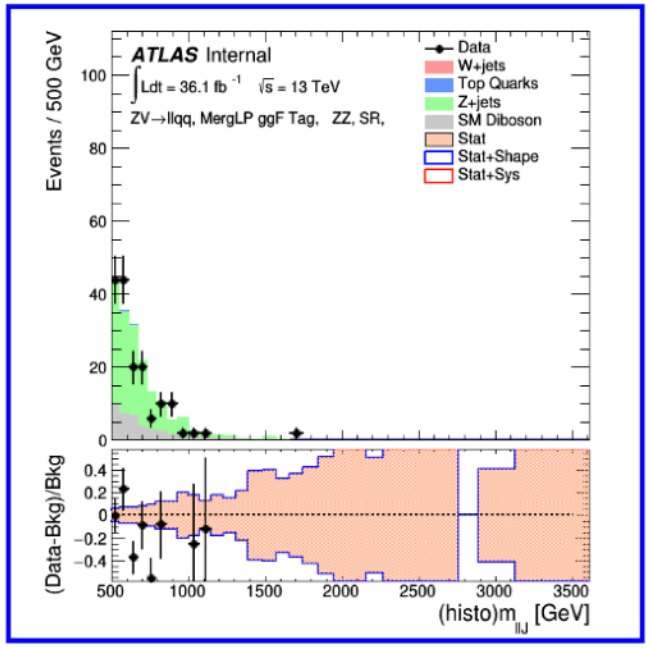


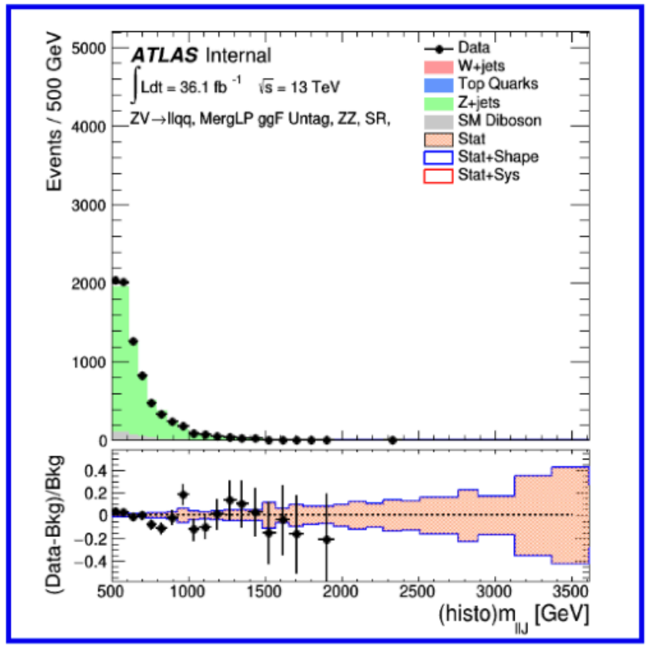


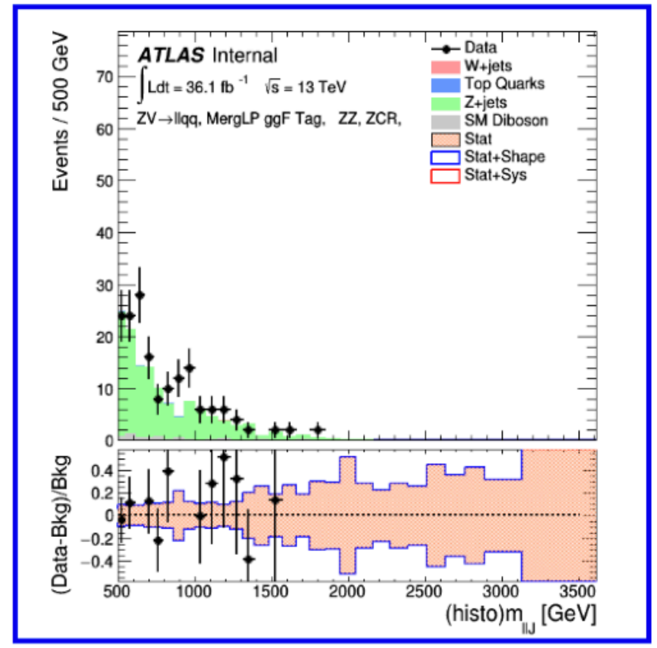
Martino's plots are done with MC16a only and corresponding data

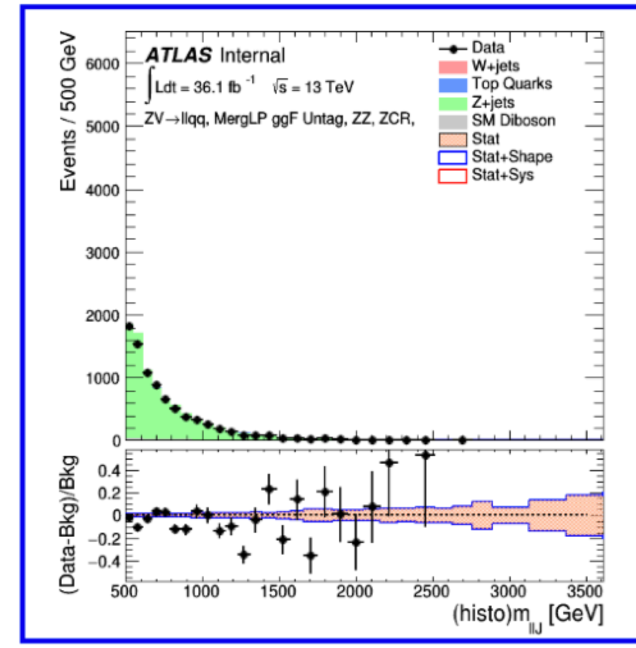
MERGED GGF ALL LP ZZ SR AND CR

MergLP_GGF_ZZ: SR tag, SR Untag, ZCR tag, ZCR Untag

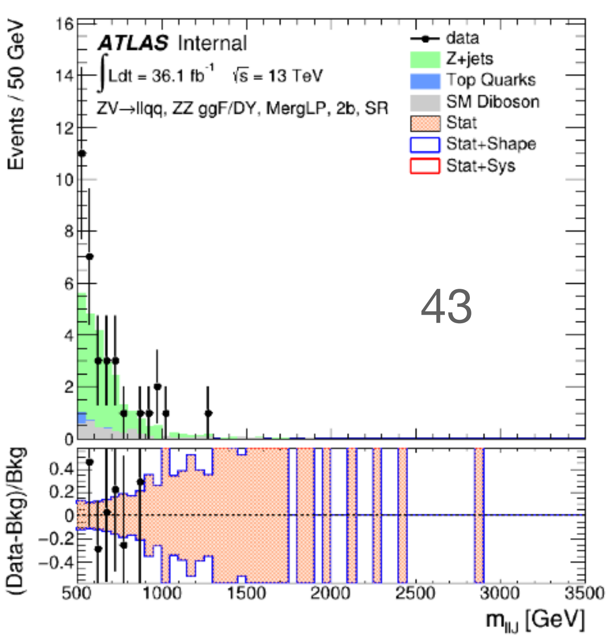


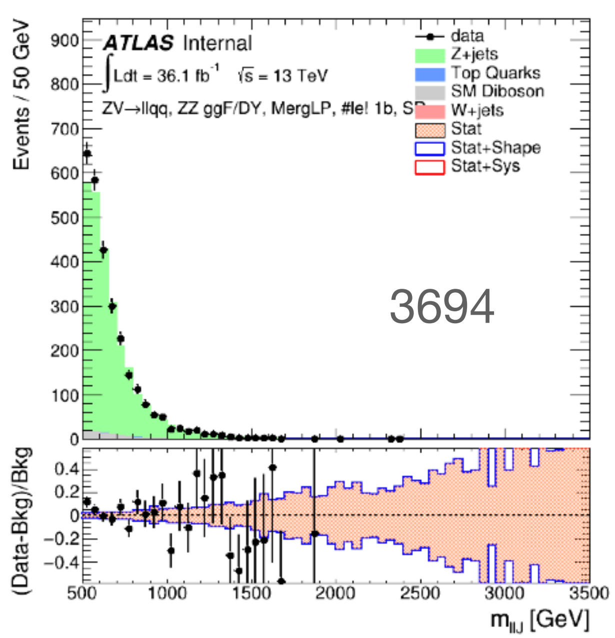


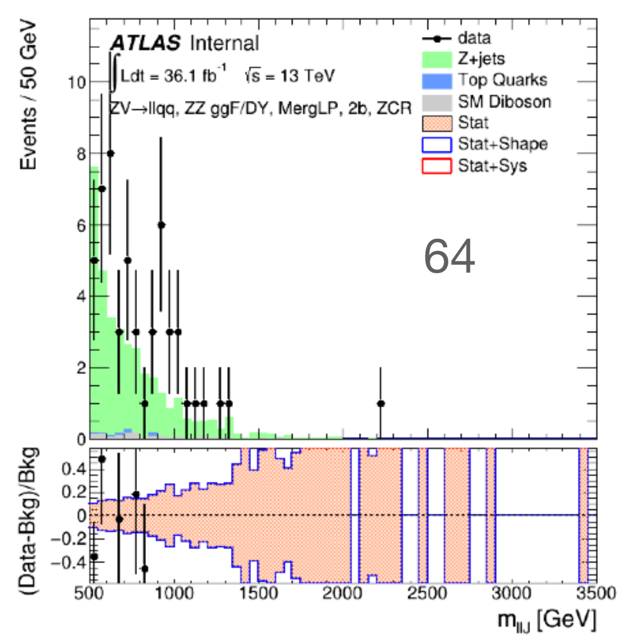


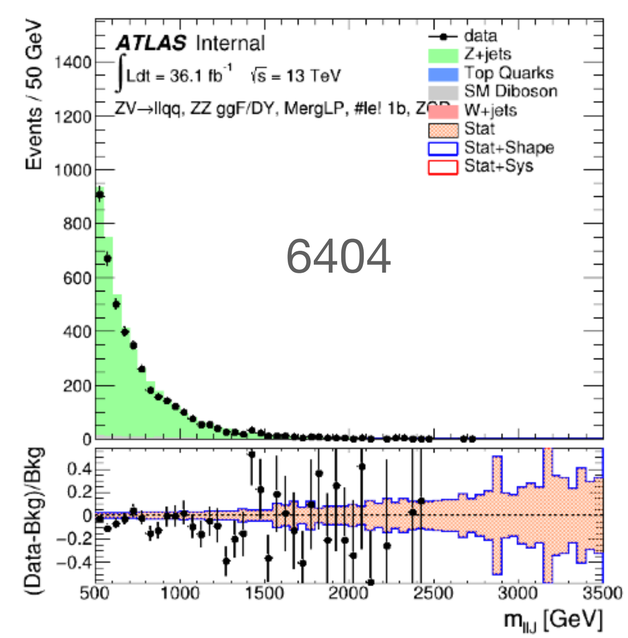


Stefania's plots are done from trees with MC16a only and corresponding data



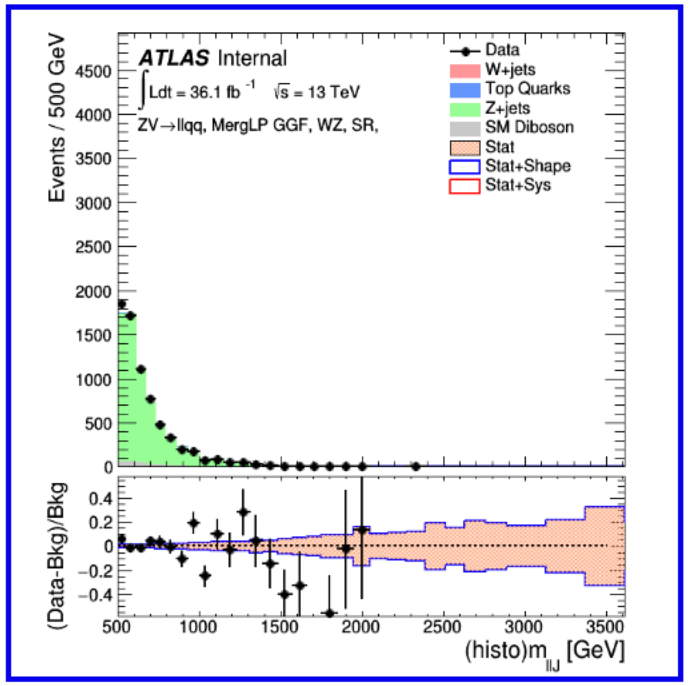


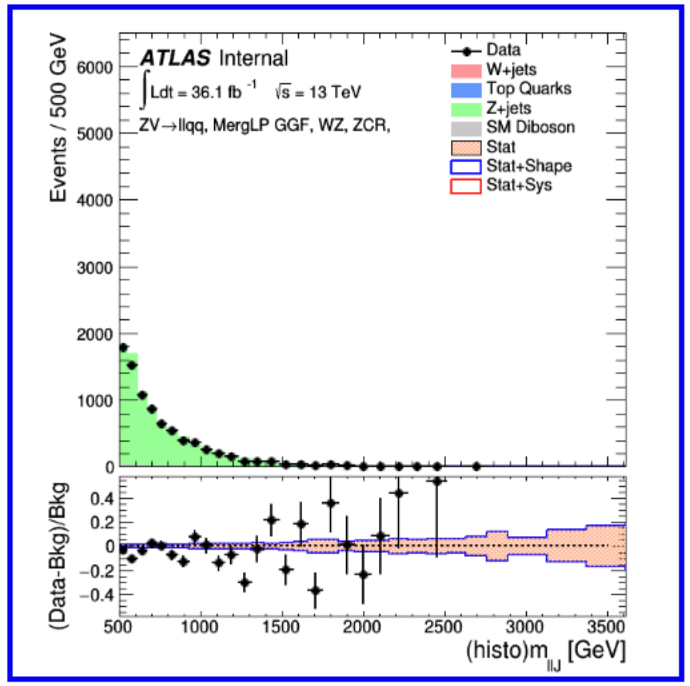




MERGED GGF ALL LP WZ SR AND CR

MergLP_GGF_WZ: SR, ZCR

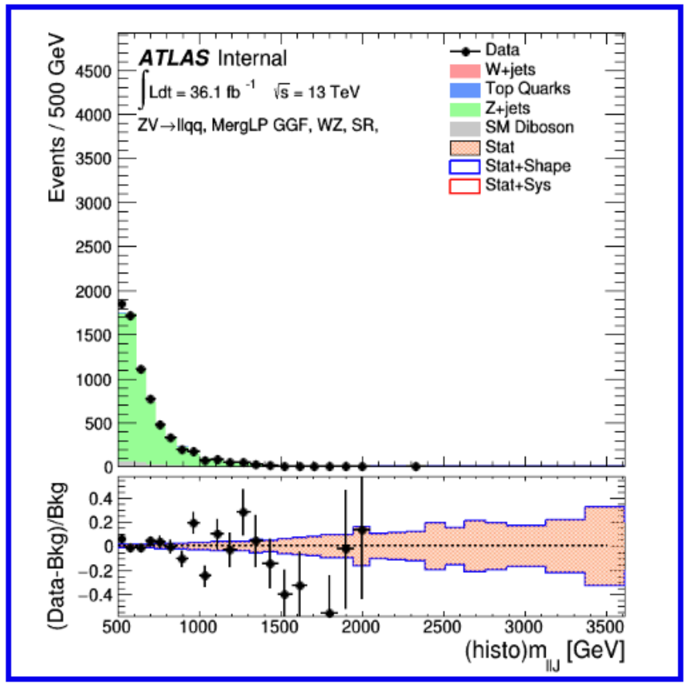


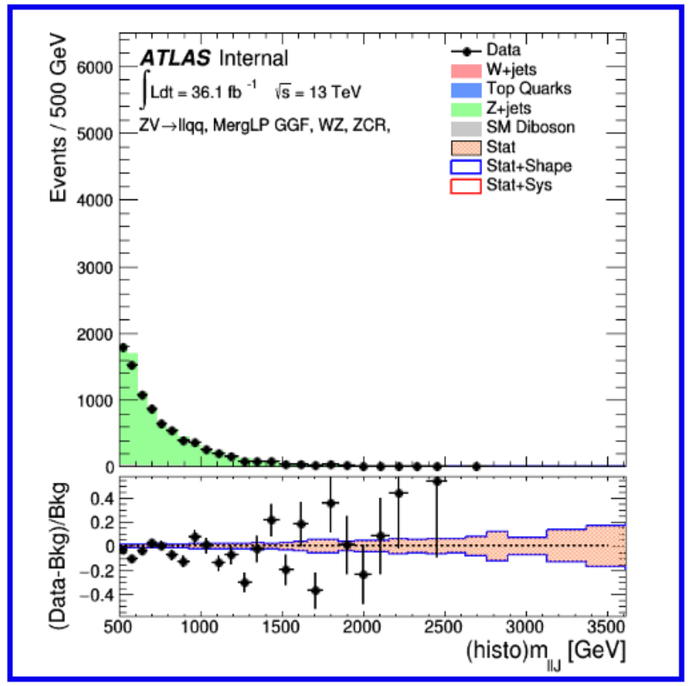


Martino's plots are done with MC16a only and corresponding data

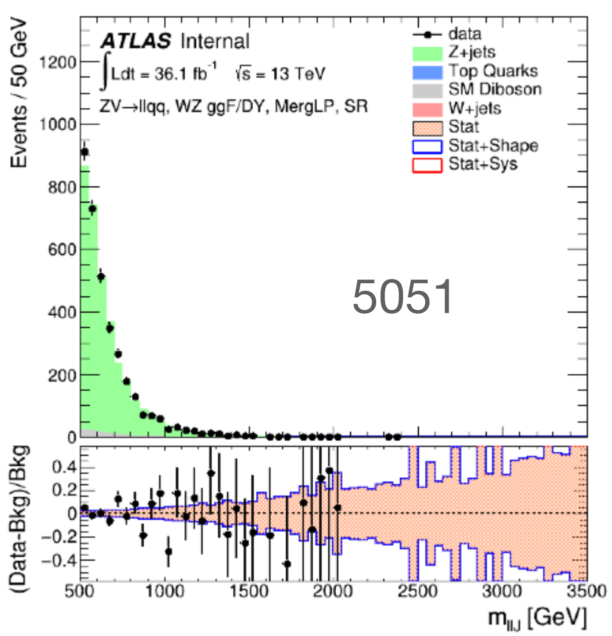
MERGED GGF ALL LP WZ SR AND CR

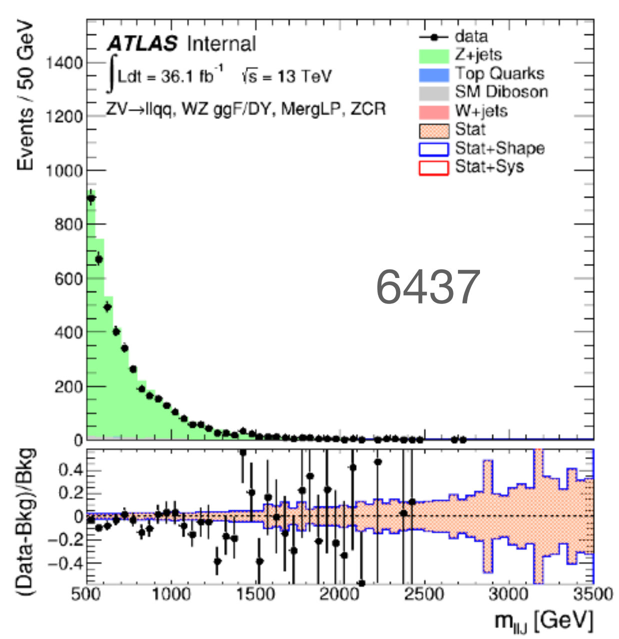
MergLP_GGF_WZ: SR, ZCR





Stefania's plots are done from trees with MC16a only and corresponding data



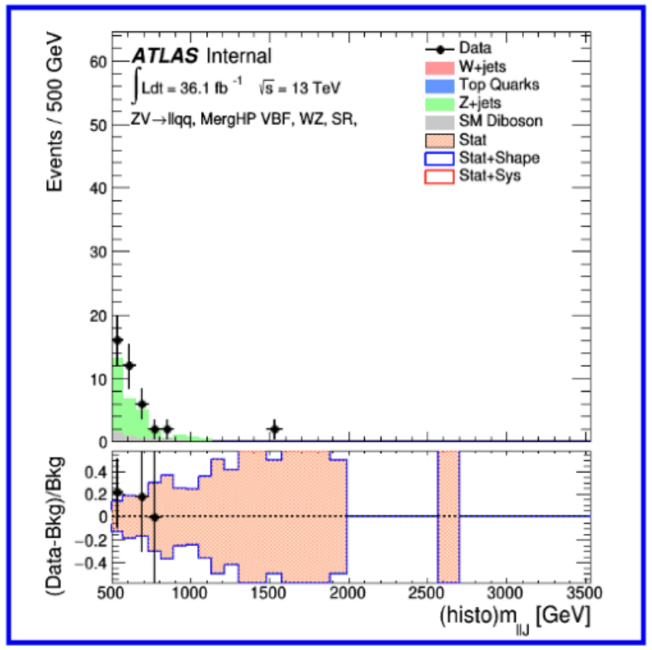


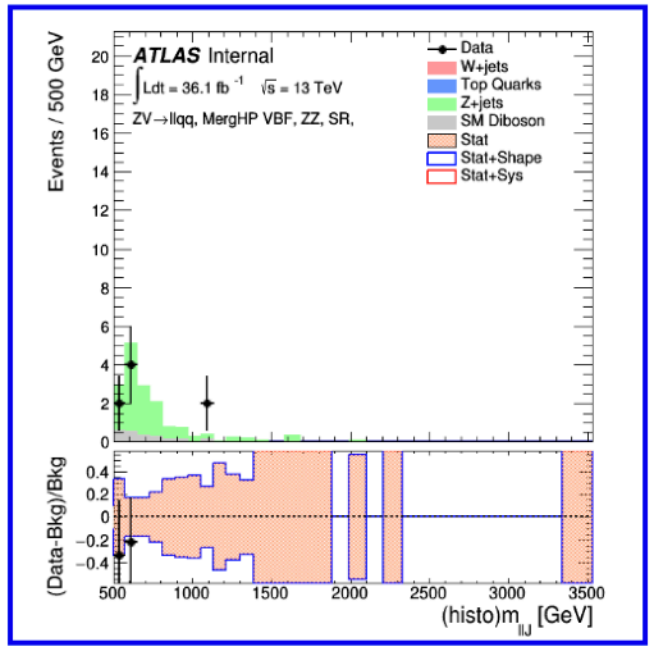
Merged

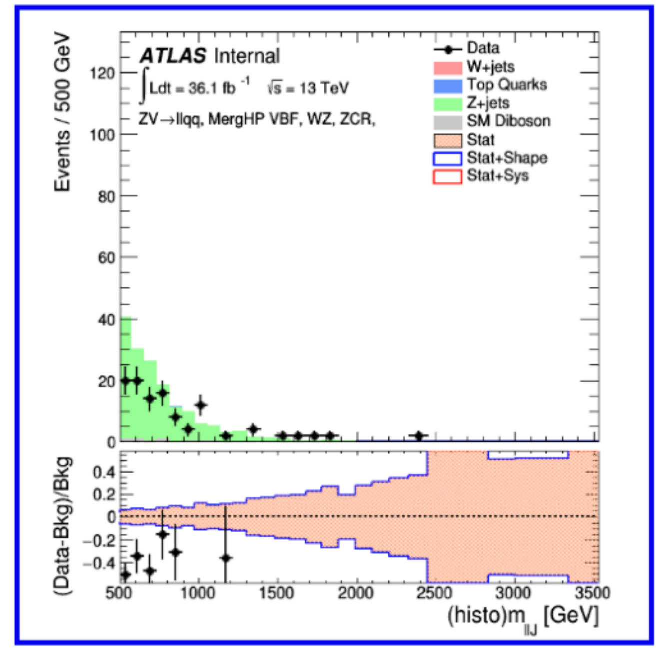
VBF

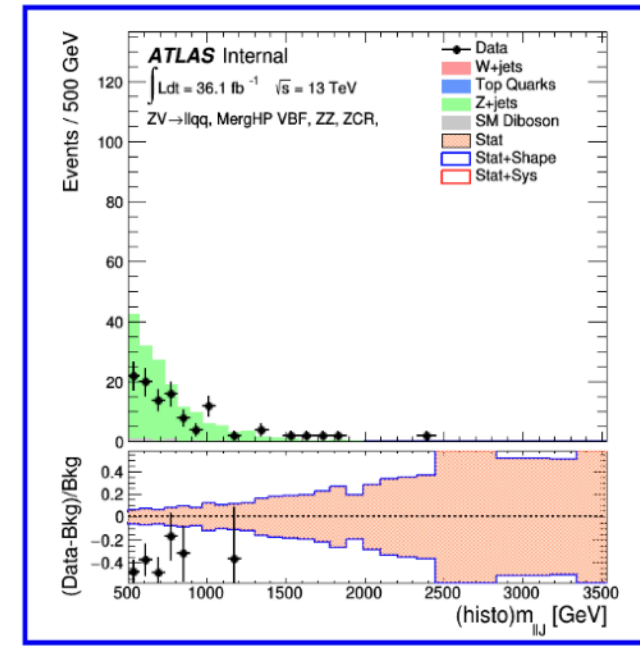
MERGED VBF ALL HP ZZ AND WZ SR AND CR

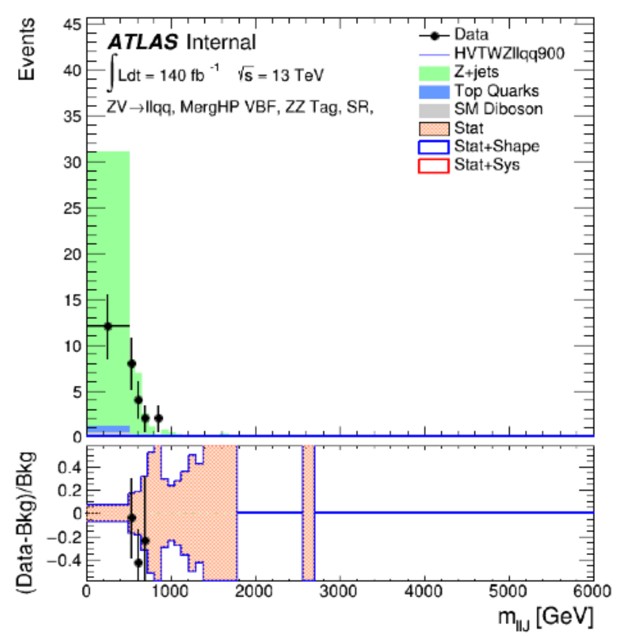
MergHP_VBF: WZ SR, ZZ SR, WZ ZCR, ZZ ZCR







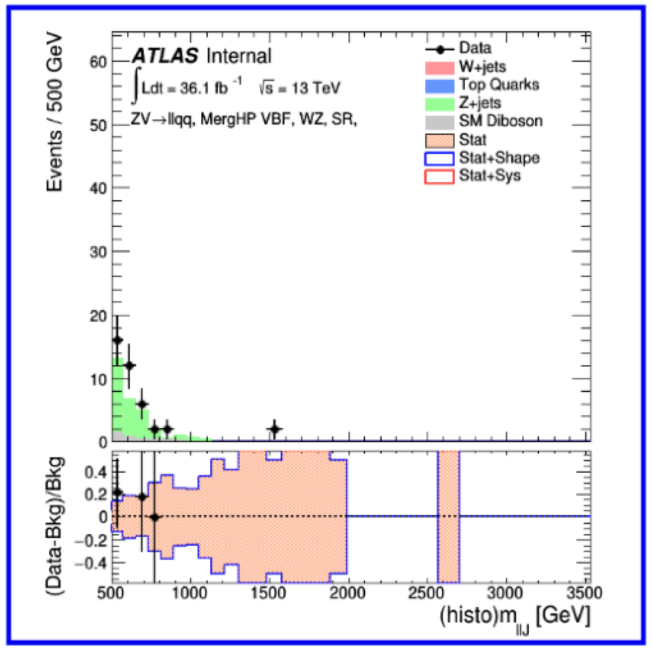


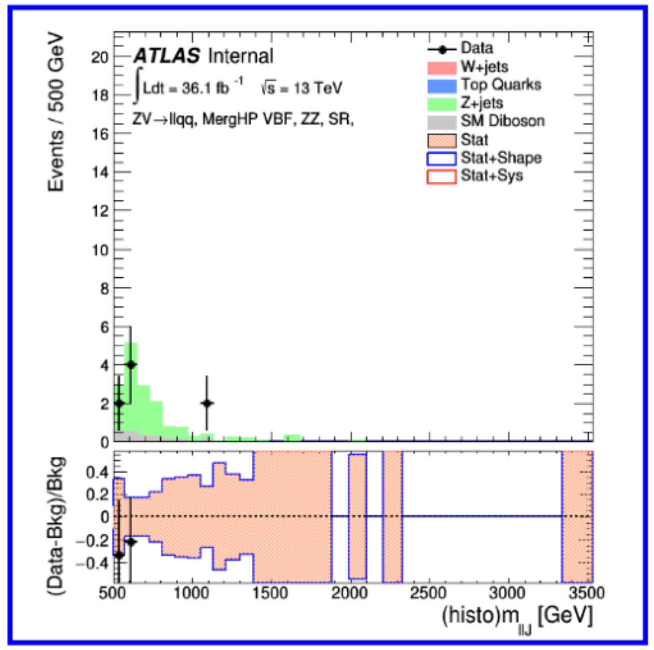


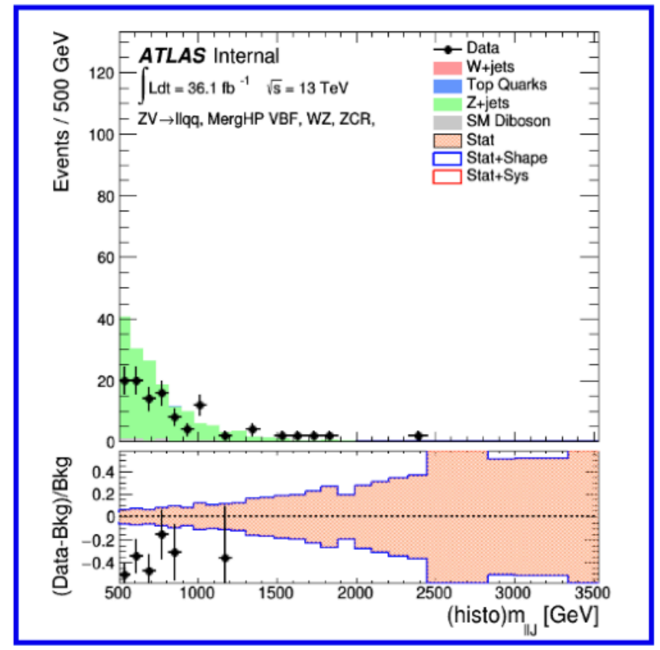
Martino's plots are done with MC16a only and corresponding data

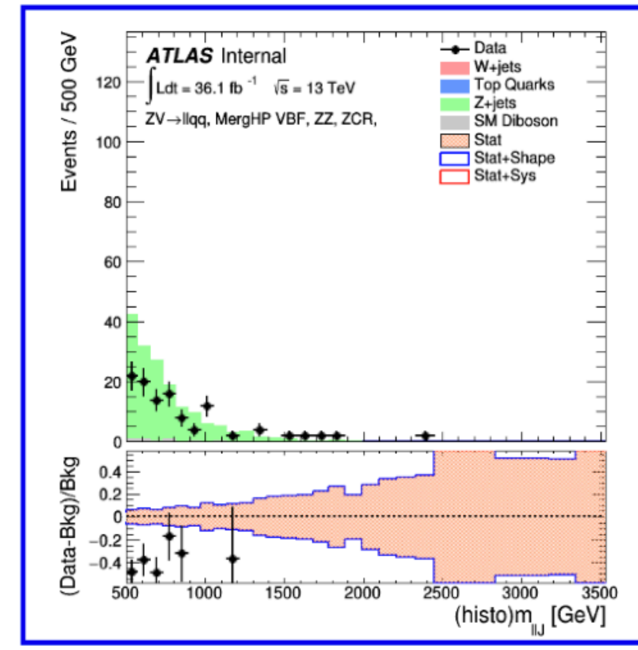
MERGED VBF ALL HP ZZ AND WZ SR AND CR

MergHP_VBF: WZ SR, ZZ SR, WZ ZCR, ZZ ZCR

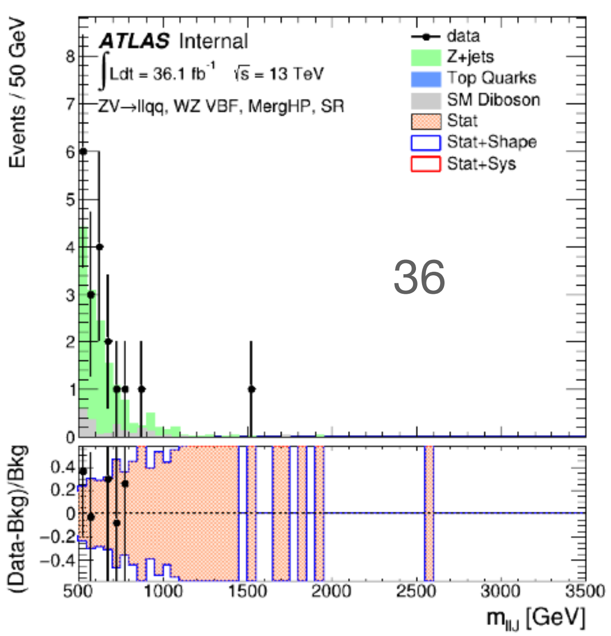


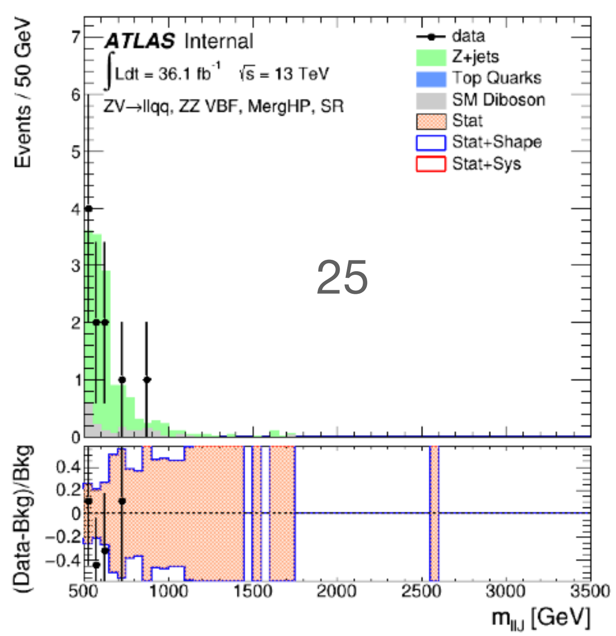


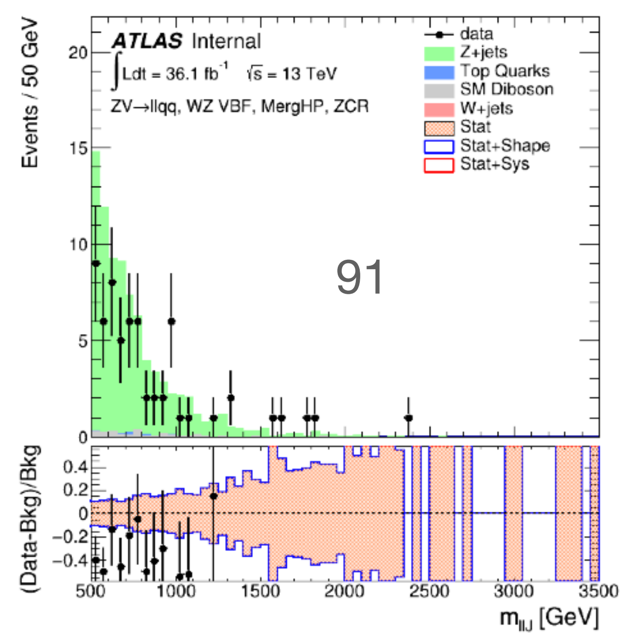


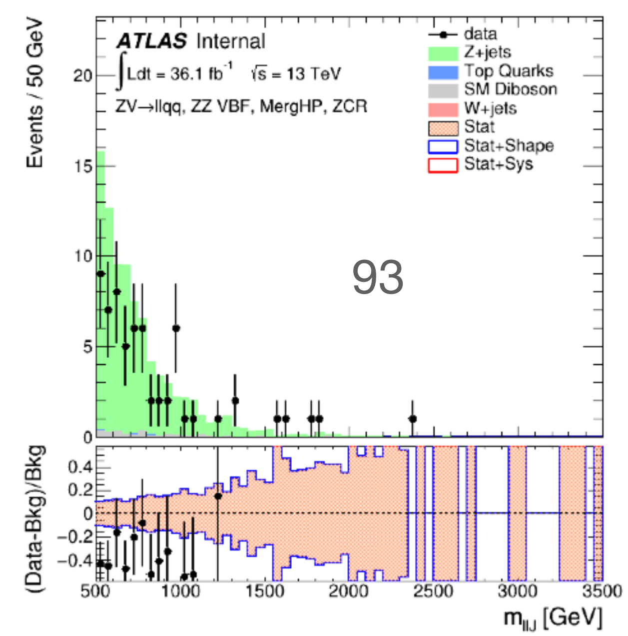


Stefania's plots are done from trees with MC16a only and corresponding data



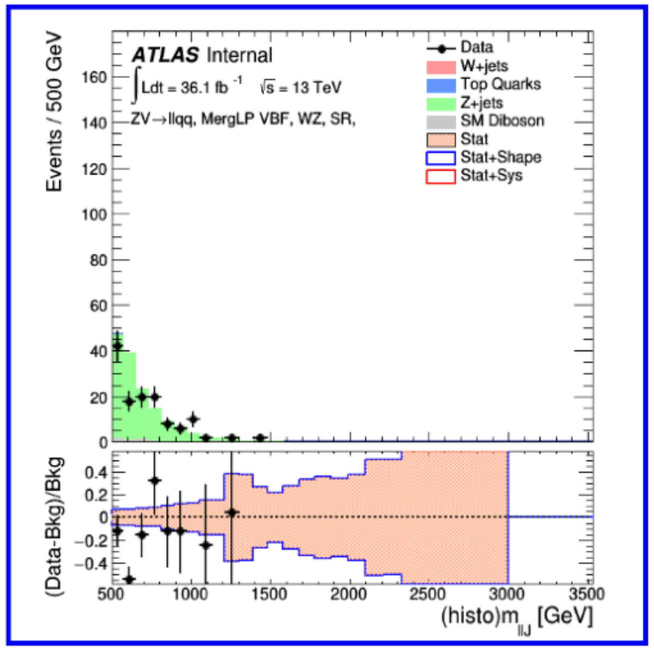


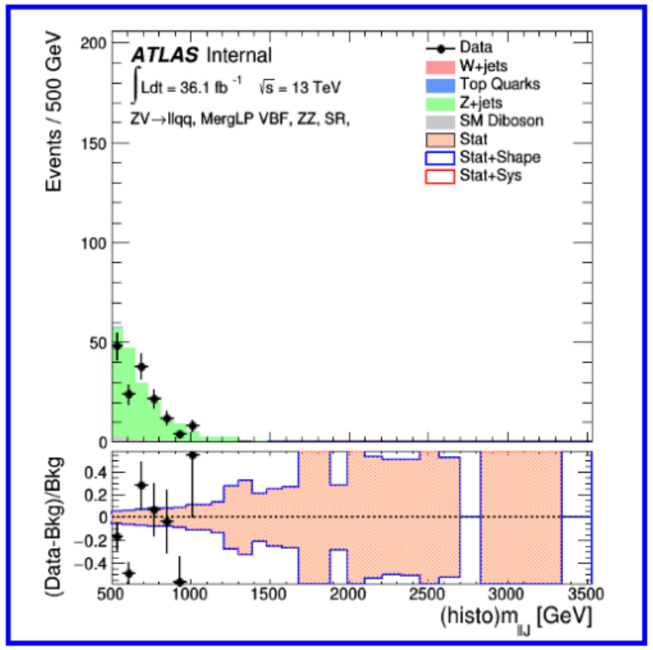


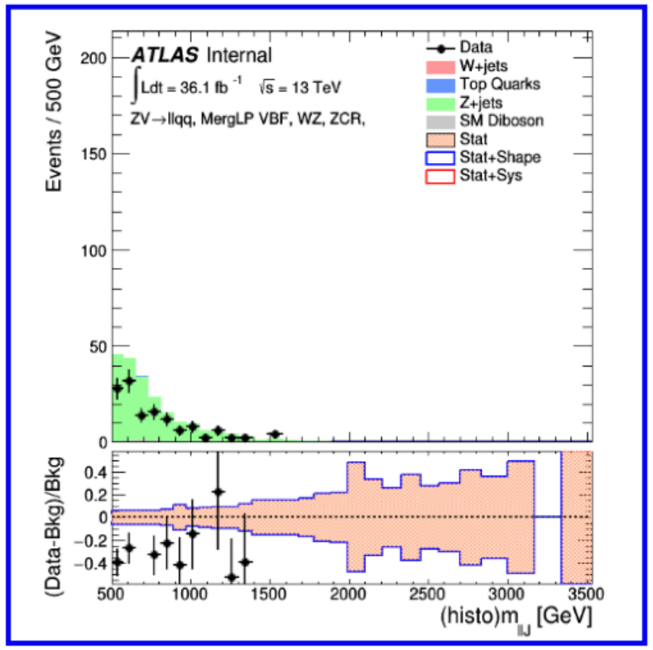


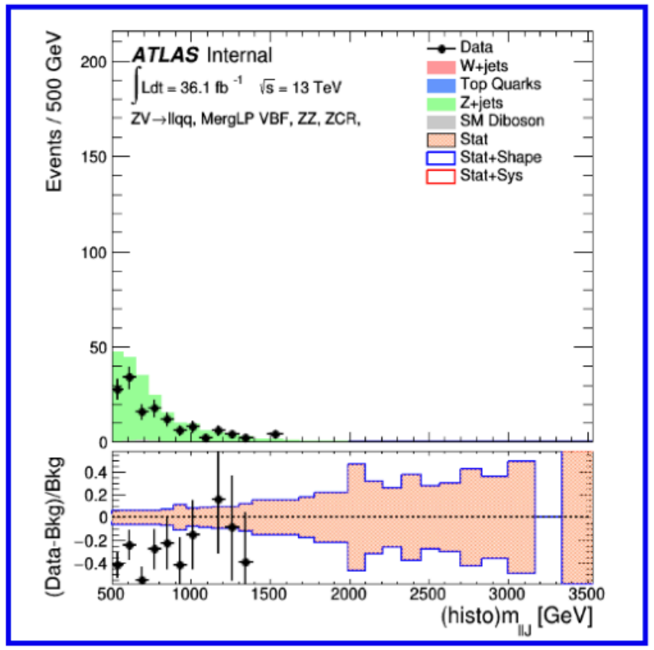
MERGED VBF ALL LP ZZ AND WZ SR AND CR

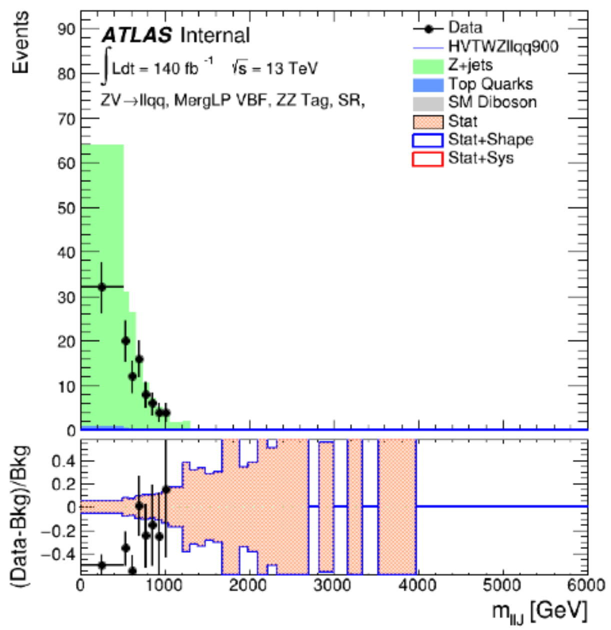
MergLP_VBF: WZ SR, ZZ SR, WZ ZCR, ZZ ZCR







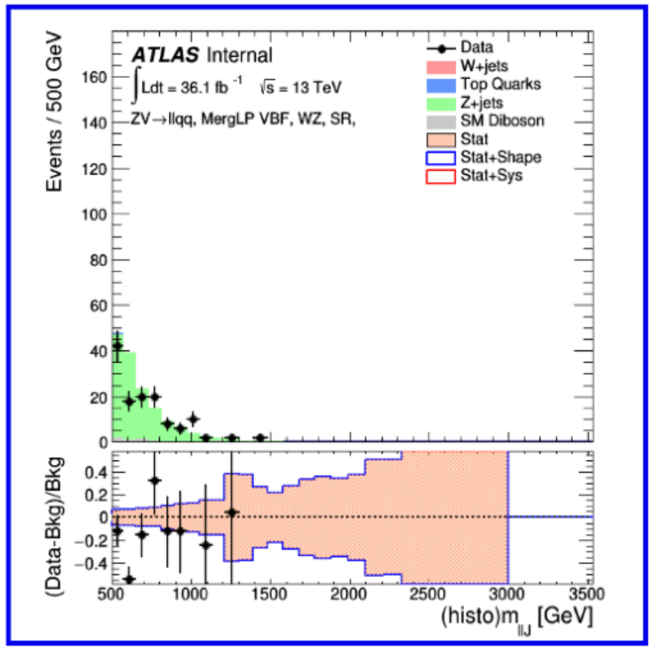


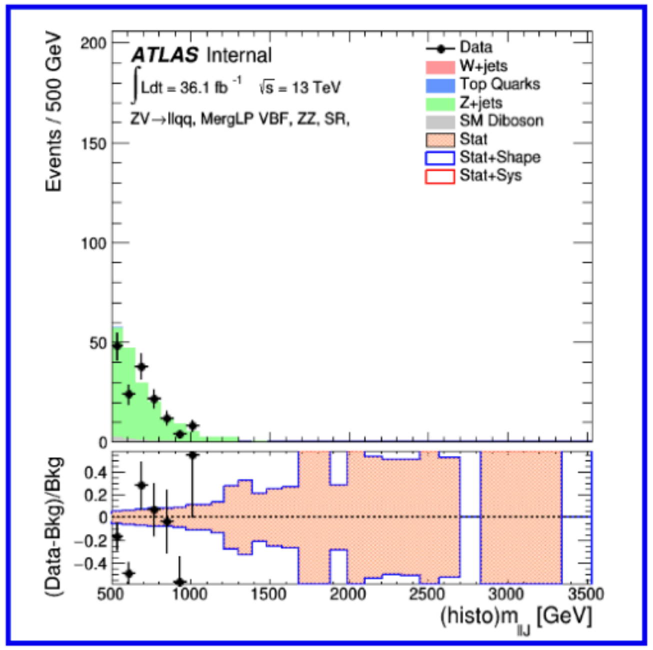


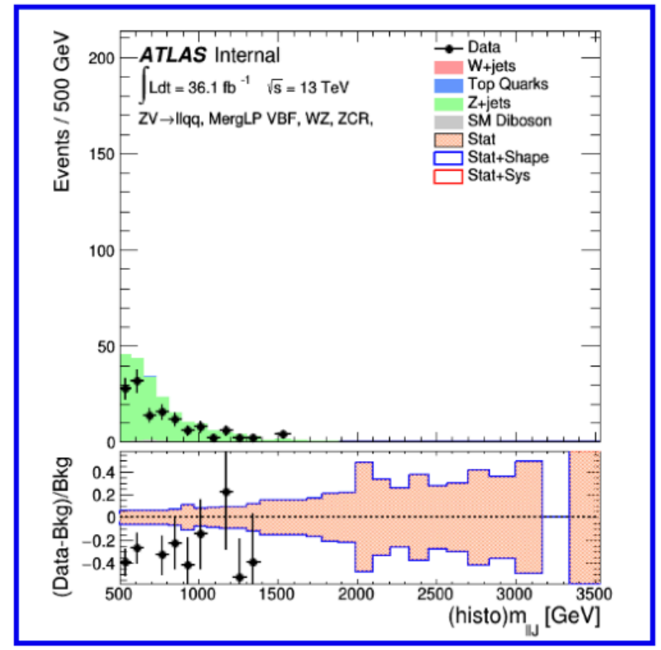
Martino's plots are done with MC16a only and corresponding data

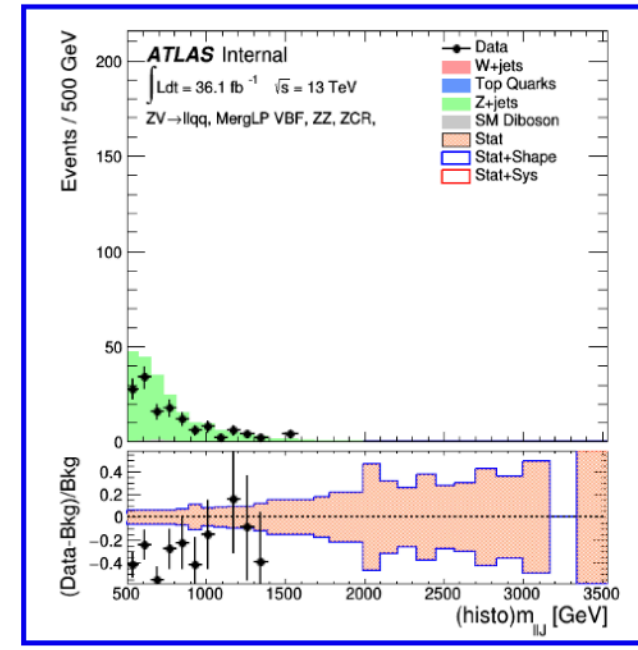
MERGED VBF ALL LP ZZ AND WZ SR AND CR

MergLP_VBF: WZ SR, ZZ SR, WZ ZCR, ZZ ZCR

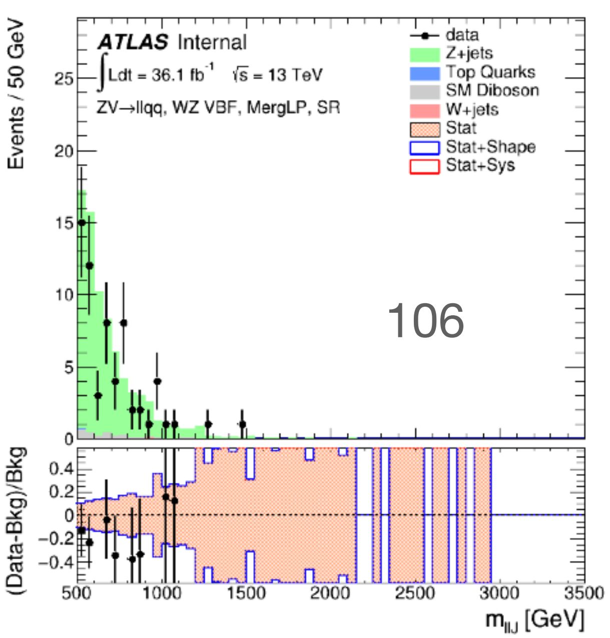


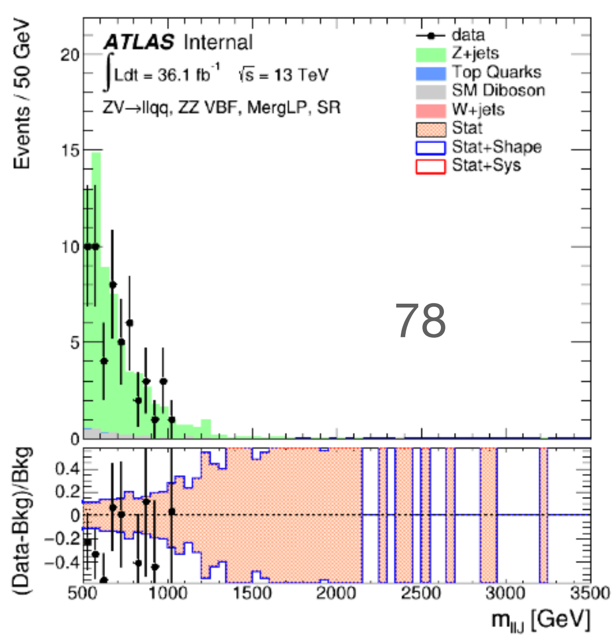


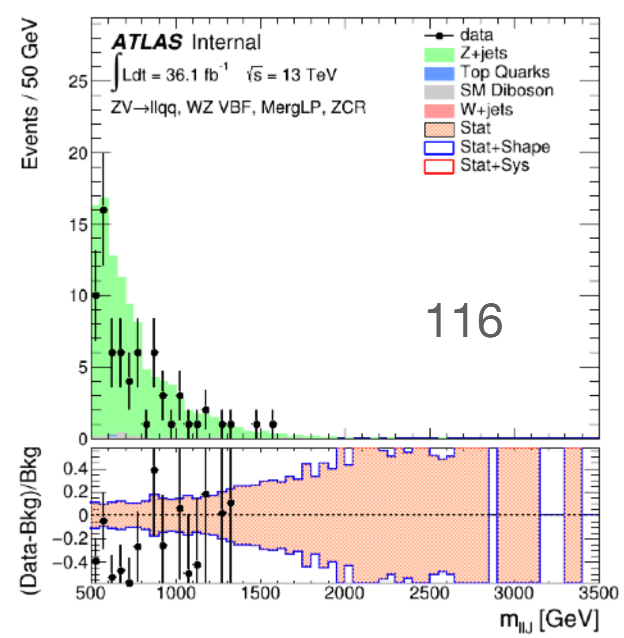


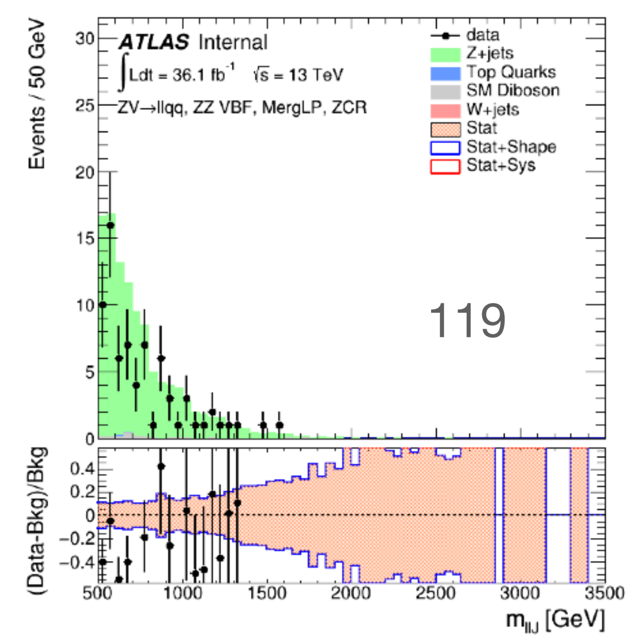


Stefania's plots are done from trees with MC16a only and corresponding data









5.7 Strategy to the SR orthogonalization

In each of 0-, 1- and 2-lepton channel, both in VBF and DY/ggF categories, for events which satisfy both the resolved and the merged analyses the following is used to classify events. When an event fails a given selection, it is tested on the next according to its priority; this is termed "recycling". Only upon failing all selections is an event discarded. The order of selections is as follows:

- VBF categories
  - Merged high-purity signal region(s)
  - Merged low-purity signal region(s)
  - Resolved signal region(s)
  - Merged high-purity control region(s)
  - Merged low-purity control region(s)
  - Resolved control region(s)
- ggF/DY categories
  - Merged high-purity signal region(s)
  - Merged low-purity signal region(s)
  - Resolved signal region(s)
  - Merged high-purity control region(s)
  - Merged low-purity control region(s)
  - Resolved control region(s)

FROM ATL-COM-PHYS-2018-1549

The order of "recycling" is studied in the previous analysis[55] and the way to maximize the overall sensitivity is chosen.

The phase space considered in this search where the recycling strategy is most important is roughly in the transition region from $500 \leq m_X \leq 800$GeV. Above and below these signal masses hadronic decays of the $Z \to q\bar{q}/W \to q\bar{q}$ are reconstructed primarily as either merged or resolved, respectively. The prioritization was studied in the previous analysis and we found this "merged-then-resolved" scheme can maximize the sensitivity in the intermediate mass region.

MC16A

Expected according HDBS-2018-10
Martino's Histograms from Reader

- Cut is = weight*(**Pass_MergHP_GGF_ZZ_Untag_SR** == 1)
- Zjet events = 23480 1134.12
- DiBoson events = 14208 163.574
- ttbar events = 158 7.04605
- single t events = 14 1.48344
- DATA events = 1251 **1251** **837** 951
- Signal events = 119951 53.2062
- Cut is = weight*(**Pass_MergHP_GGF_ZZ_Tag_SR** == 1)
- Zjet events = 522 12.5912
- DiBoson events = 1050 7.33398
- ttbar events = 12 0.538646
- single t events = 0 0
- DATA events = 18 **18** **11** 24.3
- Signal events = 14739 6.91269

- Cut is = weight*(**Pass_MergLP_GGF_ZZ_Untag_SR** == 1)
- Zjet events = 92639 3508.96
- DiBoson events = 8554 124.736
- ttbar events = 308 12.9344
- single t events = 6 1.58891
- DATA events = 3694 **3694** **2433** 1578
- Signal events = 44944 19.267
- Cut is = weight*(**Pass_MergLP_GGF_ZZ_Tag_SR** == 1)
- Zjet events = 1330 28.6997
- DiBoson events = 597 4.43183
- ttbar events = 20 0.740925
- single t events = 1 0.394047
- DATA events = 43 **43** **29** 36.5
- Signal events = 5418 2.49398

FROM HDBS-2018-10/TAB_04.PNG

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-10/tab_04.png
    - Tab 58 of ATL-COM-PHYS-2018-1549

Channel	$V \to qq$ recon.	Signal regions		W+jets	Z+jets	$t\bar{t}$	Diboson	Single-t	Multijet	Total	Data
				Background estimates							
				VBF category							
2-lepton (ZZ)	Merged	HP		0	87 ± 6	0.081 ± 0.009	9.6 ± 1.2	0	-	97 ± 6	101
		LP		0.133 ± 0.011	170 ± 8	0.85 ± 0.07	9.9 ± 1.2	0.43 ± 0.07	-	181 ± 8	162
	Resolved			0.272 ± 0.012	1566 ± 29	17.0 ± 0.7	72 ± 10	0.48 ± 0.32	-	1656 ± 31	1685
				ggF/DY category							
	Merged	HP	Tag	0.0135 ± 0.0043	85 ± 6	0.283 ± 0.035	21.1 ± 2.3	0.34 ± 0.05	-	107 ± 7	94
			Untag	0.772 ± 0.010	3300 ± 40	4.27 ± 0.08	361 ± 32	0.58 ± 0.11	-	3670 ± 50	3671
		LP	Tag	0.0135 ± 0.0043	138 ± 8	0.313 ± 0.034	12.8 ± 1.4	0.30 ± 0.04	-	152 ± 8	141
			Untag	2.341 ± 0.017	5920 ± 50	10.16 ± 0.16	278 ± 26	2.03 ± 0.29	-	6220 ± 60	6095
	Resolved	Tag		-	1323 ± 26	110 ± 10	159 ± 12	4.7 ± 0.8	-	1600 ± 30	1583
		Untag		4.681 ± 0.026	42 750 ± 160	110.6 ± 1.5	1800 ± 100	13.4 ± 2.0	-	44 650 ± 190	44 604

Postfit yield in the *WW*/*ZZ* signal regions from a simultaneous fit in all *WW*/*ZZ* regions.

- **ZZ signal regions**

FROM HDBS-2018-10/TAB_04.PNG

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-10/tab_04.png
  - Tab 58 of ATL-COM-PHYS-2018-1549

Channel	$V \to qq$ recon.	Signal regions		Total	Data	Total Bkg 33-22	Data 33-22	Total Bkg 33-22	Data 33-22
		VBF							
2-lepton (ZZ)	Merged	HP		97 ± 6	101	140	127	140	127
		LP		181 ± 8	162	490	348	490	348
	Resolved			1656 ± 31	1685	321	278	321	278
		ggF/DY							
	Merged	HP	Tag	107 ± 7	94	76	75	76	75
			Untag	3670 ± 50	3671	4801	4611	4801	4611
		LP	Tag	152 ± 8	141	141	175	141	175
			Untag	6220 ± 60	6095	15452	15000	15452	15000
	Resolved	Tag		1600 ± 30	1583	1655	1915	1668	1930
		Untag		44 650 ± 190	44 604	45905	47267	46467	47857

630 Mer ZZ VBF SR 475

321 Res ZZ VBF SR 278

20818 Mer ZZ GGF SR 20333

48135 Res ZZ GGF SR 49787

Postfit yield in the *WW*/*ZZ* signal regions from a simultaneous fit in all *WW*/*ZZ* regions.

Without enforcing orthogonality

- **ZZ signal regions**

FROM HDBS-2018-10

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-10/tab_04.png
  - Tab 58 of ATL-COM-PHYS-2018-1549

Region	Normalization
W+jets GGF Merg HP	0.934 ± 0.00788
W+jets GGF Merg LP	0.886 ± 0.00455
W+jets GGF Res	1.02 ± 0.00562
Z+jets GGF Merg HP	0.963 ± 0.0118
Z+jets GGF Merg LP	0.889 ± 0.00714
Z+jets GGF Res	1.06 ± 0.00361
$t\bar{t}$ GGF Merg HP	0.942 ± 0.019
$t\bar{t}$ GGF Merg LP	0.908 ± 0.00162
$t\bar{t}$ GGF Res	0.949 ± 0.0146

Table 59: Fitted values of background normalization factors in the GGF $WWZZ$ region.

Region	Normalization
W+jets VBF Merg HP	0.934 ± 0.0599
W+jets VBF Merg LP	0.905 ± 0.0369
W+jets VBF Res	0.929 ± 0.0195
Z+jets VBF Merg HP	0.909 ± 0.0605
Z+jets VBF Merg LP	0.85 ± 0.0378
Z+jets VBF Res	0.928 ± 0.017
$t\bar{t}$ VBF Merg HP	0.847 ± 0.0644
$t\bar{t}$ VBF Merg LP	0.767 ± 0.0675
$t\bar{t}$ VBF Res	0.973 ± 0.0361

Table 60: Fitted values of background normalization factors in the VBF $WWZZ$ region.

- **ZZ signal regions - bkg scale factors from CR**

FROM HDBS-2018-10. ZCR

- Tab 66 of
  - ATL-COM-PHYS-2018-1549

ZZ GGF Untagged ZCR	Merged HP	Merged LP	Resolved
Diboson	206.58 ± 21.18	392.37 ± 39.55	1119.49 ± 83.85
Single-top	1.21 ± 0.28	2.25 ± 0.48	21.11 ± 4.04
$t\bar{t}$	7.43 ± 0.15	19.29 ± 0.34	181.46 ± 2.79
W+jets	1.51 ± 0.01	8.25 ± 0.04	10.86 ± 0.06
Z+jets	5647.09 ± 69.24	13715.71 ± 110.25	82747.66 ± 281.74
Total	5863.83 ± 72.41	14137.85 ± 117.13	84080.58 ± 294.00
Data	5876.00	14236.00	84128.00

ZZ GGF Tagged ZCR	Merged HP	Merged LP	Resolved
Diboson	5.17 ± 0.69	9.94 ± 1.24	55.55 ± 6.54
Single-top	0.12 ± 0.02	0.19 ± 0.03	10.18 ± 2.71
$t\bar{t}$	0.37 ± 0.04	1.48 ± 0.15	203.02 ± 20.08
W+jets	0.04 ± 0.00	0.32 ± 0.03	0.14 ± 0.01
Z+jets	154.35 ± 10.74	257.94 ± 13.74	2495.09 ± 50.08
Total	160.05 ± 10.77	269.87 ± 13.80	2763.98 ± 54.42
Data	171.00	280.00	2788.00

ZZ VBF ZCR	Merged HP	Merged LP	Resolved
Diboson	6.03 ± 1.25	13.60 ± 2.65	74.72 ± 13.10
Single-top	0.00 ± 0.00	0.63 ± 0.12	5.34 ± 1.47
$t\bar{t}$	0.48 ± 0.04	1.23 ± 0.11	47.00 ± 1.85
W+jets	0.03 ± 0.00	0.19 ± 0.01	0.26 ± 0.01
Z+jets	157.60 ± 10.34	383.59 ± 16.59	3677.06 ± 57.53
Total	164.13 ± 10.41	399.23 ± 16.80	3804.38 ± 59.05
Data	154.00	404.00	3777.00

Table 66: Postfit yield in the $\ell\ell qq$ $WWZZ$ ZCR in the (top) GGF Untagged, (middle) GGF Tagged and (bottom) VBF regions from a simultaneous fit in all $WWZZ$ regions

- **ZZ selection ZCR yield**

FROM HDBS-2018-10. ZCR

- Tab 66 of ATL-COM-PHYS-2018-1549

91502 Res ZZ GGF ZCR 95003
3809 Res ZZ VBF ZCR 3777
44832 Mer ZZ GGF ZCR 43753
1365 Mer ZZ VBF ZCR 1018

ZZ GGF Untagged ZCR	Merged HP	Merged LP	Resolved
Diboson	206.58 ± 21.18	392.37 ± 39.55	1119.49 ± 83.85
Single-top	1.21 ± 0.28	2.25 ± 0.48	21.11 ± 4.04
$t\bar{t}$	7.43 ± 0.15	19.29 ± 0.34	181.46 ± 2.79
W+jets	1.51 ± 0.01	8.25 ± 0.04	10.86 ± 0.06
Z+jets	5647.09 ± 69.24	13715.71 ± 110.25	82747.66 ± 281.74
Total	5863.83 ± 72.41	14137.85 ± 117.13	84080.58 ± 294.00
Data	5876.00	14236.00	84128.00

ZZ GGF Tagged ZCR	Merged HP	Merged LP	Resolved
Diboson	5.17 ± 0.69	9.94 ± 1.24	55.55 ± 6.54
Single-top	0.12 ± 0.02	0.19 ± 0.03	10.18 ± 2.71
$t\bar{t}$	0.37 ± 0.04	1.48 ± 0.15	203.02 ± 20.08
W+jets	0.04 ± 0.00	0.32 ± 0.03	0.14 ± 0.01
Z+jets	154.35 ± 10.74	257.94 ± 13.74	2495.09 ± 50.08
Total	160.05 ± 10.77	269.87 ± 13.80	2763.98 ± 54.42
Data	171.00	280.00	2788.00

ZZ VBF ZCR	Merged HP	Merged LP	Resolved
Diboson	6.03 ± 1.25	13.60 ± 2.65	74.72 ± 13.10
Single-top	0.00 ± 0.00	0.63 ± 0.12	5.34 ± 1.47
$t\bar{t}$	0.48 ± 0.04	1.23 ± 0.11	47.00 ± 1.85
W+jets	0.03 ± 0.00	0.19 ± 0.01	0.26 ± 0.01
Z+jets	157.60 ± 10.34	383.59 ± 16.59	3677.06 ± 57.53
Total	164.13 ± 10.41	399.23 ± 16.80	3804.38 ± 59.05
Data	154.00	404.00	3777.00

Table 66: Postfit yield in the $\ell\ell qq$ $WWZZ$ ZCR in the (top) GGF Untagged, (middle) GGF Tagged and (bottom) VBF regions from a simultaneous fit in all $WWZZ$ regions

16061	27155	87075	Total Bkg 33-22	
16211	25844	90076	Data 33-22	
16628	27826	88721		
16782	26458	91617		
190	184	2746	Total Bkg 33-22	
272	238	3333	Data 33-22	
192	186	2781		
273	240	3386		
522	809	505	Total Bkg 33-22	
388	607	436	Data 33-22	
538	827	533		
397	621	459		

Same counters as for WZ ZCR

Without enforcing orthogonality

- **ZZ selection ZCR yield**

DA CONFRONTARE CON I PANDADATAFRAME

1995 2294	630 Mer ZZ VBF SR 475 1365 Mer ZZ VBF ZCR 1018	1493
4130 ~900	321 Res ZZ VBF SR 278 3809 Res ZZ VBF ZCR 3777	4055
65650 76713	20818 Mer ZZ GGF SR 20333 44832 Mer ZZ GGF ZCR 43753	64086
139637 ~163000	48135 Res ZZ GGF SR 49787 91502 Res ZZ GGF ZCR 95003	144790
MC MC from Panda DF		Dati

FROM HDBS-2018-10/TABAUX_02.PNG

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-10/tabaux_02.png (not well formatted)
  - Original in ATL-COM-PHYS-2018-1549, tab.49
    - Postfit yield in the *W Z* signal regions from a simultaneous fit in all *W Z* regions.

Channel	$V \to qq$ recon.	Signal regions	Background estimates: W + jets	Z + jets	$t\bar{t}$	Diboson	Single-t	Multi-jet	Total	Data
			VBF category							
2-lepton	Merged	HP	0	101 ± 7	0.22 ± 0.02	8.92 ± 1.92	0	-	110 ± 7	118
		LP	0.31 ± 0.02	247 ± 11	0.76 ± 0.07	10.6 ± 2	0.27 ± 0.06	-	259 ± 11	243
	Resolved		0.19 ± 0.01	1714 ± 32	12.7 ± 0.6	56.8 ± 9.6	0.84 ± 0.3	-	1784 ± 33	1831
			ggF/DY category							
	Merged	HP	0.73 ± 0.01	3788 ± 49	5.16 ± 0.1	445 ± 43	1.38 ± 0.23	-	4240 ± 66	4197
		LP	2.98 ± 0.02	8751 ± 71	13.6 ± 0.2	388 ± 37	2.89 ± 0.51	-	9159 ± 80	9088
	Resolved		8.57 ± 0.06	50005 ± 184	116 ± 2	1705 ± 133	13.7 ± 2.2	-	51848 ± 227	51655

- **WZ signal regions**

FROM HDBS-2018-10/TABAUX_02.PNG

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-10/tabaux_02.png (not well formatted)
  - Original in ATL-COM-PHYS-2018-1549, tab.49
    - Postfit yield in the $W Z$ signal regions from a simultaneous fit in all $W Z$ regions.

Channel	$V \to qq$ recon.	Signal regions	Total	Data	Total Bkg 33-22	Data 33-22	Total Bkg 33-22	Data 33-22
2-lepton	Merged	HP	110 ± 7	118	160	155	160	155
		LP	259 ± 11	243	647	470	647	470
	Resolved		1784 ± 33	1831	406	338	429	357
	Merged	HP	4240 ± 66	4197	5554	5235	5554	5235
		LP	9159 ± 80	9088	21263	20729	21263	20729
	Resolved		51848 ± 227	51655	61944	63570	63040	64563

- **WZ signal regions**

Without enforcing orthogonality

FROM HDBS-2018-10/TABAUX_02.PNG

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-10/tabaux_02.png (not well formatted)
  - Original in ATL-COM-PHYS-2018-1549, tab.49
    - Postfit yield in the WZ signal regions from a simultaneous fit in all WZ regions.

Region	Normalization
W+jets GGF Merg HP Tag	0.92 ± 0.114
W+jets GGF Merg HP Untag	0.95 ± 0.00753
W+jets GGF Merg LP Tag	0.915 ± 0.0694
W+jets GGF Merg LP Untag	0.879 ± 0.00462
W+jets GGF Res Tag	1.21 ± 0.0859
W+jets GGF Res Untag	1.01 ± 0.0061
Z+jets GGF Merg HP	0.962 ± 0.0118
Z+jets GGF Merg LP	0.893 ± 0.00698
Z+jets GGF Res	1.06 ± 0.0035
$t\bar{t}$ GGF Merg HP Tag	0.955 ± 0.0272
$t\bar{t}$ GGF Merg HP Untag	0.896 ± 0.0147
$t\bar{t}$ GGF Merg LP Tag	0.976 ± 0.0329
$t\bar{t}$ GGF Merg LP Untag	0.896 ± 0.0128
$t\bar{t}$ GGF Res Tag	1.0 ± 0.0102
$t\bar{t}$ GGF Res Untag	0.968 ± 0.0169

Table 50: Fitted values of background normalization factors in the GGF WZ region.

Region	Normalization
W+jets VBF Merg HP	0.911 ± 0.0618
W+jets VBF Merg LP	0.915 ± 0.0398
W+jets VBF Res	0.945 ± 0.0211
Z+jets VBF Merg HP	0.942 ± 0.0593
Z+jets VBF Merg LP	0.879 ± 0.0366
Z+jets VBF Res	0.936 ± 0.0166
$t\bar{t}$ VBF Merg HP	0.931 ± 0.0665
$t\bar{t}$ VBF Merg LP	0.693 ± 0.0643
$t\bar{t}$ VBF Res	0.991 ± 0.0404

Table 51: Fitted values of background normalization factors in the VBF WZ region.

- **WZ signal regions - bkg scale factors from CR**

FROM HDBS-2018-10. ZCR

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  - ATL-COM-PHYS-2018-1549

WZ GGF ZCR	Merged HP	Merged LP	Resolved
Diboson	212.73 ± 21.22	383.79 ± 37.93	1095.52 ± 84.04
Single-top	1.20 ± 0.25	2.58 ± 0.48	20.25 ± 3.36
$t\bar{t}$	7.67 ± 0.13	20.41 ± 0.29	181.37 ± 3.17
W+jets	1.53 ± 0.01	7.79 ± 0.04	10.43 ± 0.06
Z+jets	5982.12 ± 73.54	13013.78 ± 101.77	82819.46 ± 273.03
Total	6205.25 ± 76.54	13428.35 ± 108.61	84127.03 ± 285.71
Data	6210.00	13531.00	84316.00

WZ VBF ZCR	Merged HP	Merged LP	Resolved
Diboson	5.08 ± 1.05	10.41 ± 2.08	61.41 ± 10.05
Single-top	0.00 ± 0.00	0.59 ± 0.12	2.75 ± 0.80
$t\bar{t}$	0.57 ± 0.04	1.09 ± 0.10	28.92 ± 1.23
W+jets	0.02 ± 0.00	0.20 ± 0.01	0.32 ± 0.01
Z+jets	171.13 ± 10.56	368.89 ± 15.12	3635.61 ± 55.51
Total	176.80 ± 10.62	381.18 ± 15.27	3729.02 ± 56.44
Data	163.00	374.00	3685.00

Table 57: Postfit yield in the $\ell\ell qq$ WZ CR in the (top) GGF and (bottom) VBF regions from a simultaneous fit in all WZ regions

- **WZ selection ZCR yield**

FROM HDBS-2018-10. ZCR

- Tab 57 of
  - ATL-COM-PHYS-2018-1549

WZ GGF ZCR	Merged HP	Merged LP	Resolved
Diboson	212.73 ± 21.22	383.79 ± 37.93	1095.52 ± 84.04
Single-top	1.20 ± 0.25	2.58 ± 0.48	20.25 ± 3.36
$t\bar{t}$	7.67 ± 0.13	20.41 ± 0.29	181.37 ± 3.17
W+jets	1.53 ± 0.01	7.79 ± 0.04	10.43 ± 0.06
Z+jets	5982.12 ± 73.54	13013.78 ± 101.77	82819.46 ± 273.03
Total	6205.25 ± 76.54	13428.35 ± 108.61	84127.03 ± 285.71
Data	6210.00	13531.00	84316.00

WZ VBF ZCR	Merged HP	Merged LP	Resolved
Diboson	5.08 ± 1.05	10.41 ± 2.08	61.41 ± 10.05
Single-top	0.00 ± 0.00	0.59 ± 0.12	2.75 ± 0.80
$t\bar{t}$	0.57 ± 0.04	1.09 ± 0.10	28.92 ± 1.23
W+jets	0.02 ± 0.00	0.20 ± 0.01	0.32 ± 0.01
Z+jets	171.13 ± 10.56	368.89 ± 15.12	3635.61 ± 55.51
Total	176.80 ± 10.62	381.18 ± 15.27	3729.02 ± 56.44
Data	163.00	374.00	3685.00

Table 57: Postfit yield in the $\ell\ell qq$ WZ CR in the (top) GGF and (bottom) VBF regions from a simultaneous fit WZ regions

Total Bkg 33-22
16251 27339 87674
Data 33-22
16483 26082 90788
17043 27867 88170
17211 26594 91341

Total Bkg 33-22
522 809 488
Data 33-22
388 607 415
538 827 497
397 621 424

- **WZ selection ZCR yield**

Without enforcing orthogonality