1 Introduction

There are many reasons why events could have been selected or not in Gen4/Gen5.

Good run list The good run list is different now. Some runs were not process in Gen4 but they were process in Gen5. How much luminosity is this?

Energy scale The jet energy scale is different. Events can migrate from the 3-jet bin to the 2-jet bin and vice-versa.

Lepton selection I am not sure if this will actually be an issue, but the cuts are indeed slightly different.

B-Tagging There were several changes in the tagger so one would expect real changes of tags. More details below.

2 Good Run List

The good run lists used in Gen4 and Gen5 are not exactly the same even for the same run range. Here, I compare the good run list for the similar run ranges between Gen4 and Gen5. The Gen4 run list is version 4 from the good run list web page (. In addition, we have removed runs 163463 and 163474 due to bad beamlines. The Gen5 run list is version 7 from the same web page. The file used is the one with the CMX bit ignored for runs < 150145. This is the equivalent to the Gen4 file. The last run in the Gen4 good run list was 167715. Now that data taking period includes good runs up to 168889. We do not include those in this comparison.

The new runs in the Gen5 list are: 141989, ..., 148152, ..., 150010, 150063, 150066, 150067, 150070, 150079, 150080, 150086, 150087, 150088, 150108, 150109, 150110, 150112, 150113, 150117, 150118, 150139, 150140, 150141, 150145, 150149, 150287, 150288, 150289, 150291, 150340, 150395, 150415, 150416, 150418, 150419, 150420, 150421, 150422, 150427, 150428, 150432, 150433, 150435, 150443, 150444, ..., 151483, ..., 151515, ..., 154654, ..., 155299, ..., 155324, ..., 155368, ..., 155393, 155394, 155409, 155677, 155678, 155711, 155712, 155714, 155742, ..., 156458, ..., 164916, ..., 166374, ..., 166774, ..., 167445. The runs separated by commas are contiguous. The ones separated by (...) have intermediate runs that were alredy present in Gen4. These correspond to an increase of 9.3 pb^{-1}. Run 164844 is excluded by hand because of a problem with the CSL.

3 Gen5 Event Lists

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Electrons								
141618	1968597	232.60	3	58.47	1	1	CEM	y
144674	1782954	252.70	3	31.76	1	1	CEM	y
150395	98852	140.71	3	25.24	1	1	CEM	–
150418	1033033	112.93	3	23.66	1	1	CEM	–
151869	690782	177.95	3	38.37	1	1	CEM	n
155145	132579	270.88	3	43.62	2	2	CEM	y
155345	3194866	190.73	3	64.10	1	1	CEM	y
155793	4312618	260.83	3	40.71	1	1	CEM	n
156116	6116596	249.91	3	30.61	2	3	CEM	4
160599	129700	187.11	3	23.74	1	0	CEM	n
161678	1080224	197.91	3	70.49	2	2	CEM	n
162178	2690653	208.37	3	48.96	1	1	CEM	y
162663	80178	218.34	3	42.29	2	2	CEM	y
162837	433408	392.35	3	28.83	2	2	CEM	n
162857	4107280	258.47	3	31.66	1	1	CEM	n
164451	7530950	201.36	3	51.21	1	1	CEM	n
164989	1594353	318.25	3	28.79	1	1	CEM	n
165121	428911	382.55	3	50.98	1	2	CEM	y
165271	6116896	345.16	3	146.13	1	1	CEM	n
165836	566421	241.04	3	34.80	1	0	CEM	y
165902	1487424	260.04	3	66.67	1	1	CEM	y
166007	498553	275.42	3	56.55	1	2	CEM	4
166037	1912411	144.06	3	26.45	1	1	CEM	y
166479	4910255	192.16	3	58.11	1	1	CEM	n
166567	6377008	164.25	3	43.88	1	1	CEM	y
166615	6805282	178.08	3	23.55	1	2	CEM	y
166927	8307431	283.21	3	21.26	1	1	CEM	n
167053	5091995	301.44	3	21.95	1	1	CEM	n
167053	7442159	231.50	3	39.63	1	1	CEM	n

Table 1: Electron events in the $W + 3$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample. This table includes only the run-range common to the Gen4 analysis.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Electrons (continuation)								
167977	703804	251.95	3	50.28	1	1	CEM	–
167977	785542	418.22	3	44.87	2	2	CEM	–
168599	3427662	252.41	3	34.91	2	2	CEM	–
168889	12039476	318.83	3	34.78	2	2	CEM	–
176651	297931	164.63	3	40.77	1	1	CEM	–
177314	4056160	252.16	3	99.80	1	1	CEM	–
177927	3216152	362.10	3	83.00	1	1	CEM	–
178389	322702	308.72	3	43.68	1	1	CEM	–
178738	10453838	324.96	3	38.00	1	1	CEM	–
178759	1601160	200.22	3	58.35	2	2	CEM	–
178882	1300078	317.17	3	54.58	2	2	CEM	–
183209	281684	206.42	3	21.03	1	1	CEM	–
183557	1258104	170.59	3	25.91	1	1	CEM	–
183785	3862531	229.93	3	56.47	1	2	CEM	–
184068	2338573	233.57	3	40.04	1	2	CEM	–
184377	11014941	258.20	3	25.83	1	1	CEM	–
184495	1152315	619.12	3	35.04	1	1	CEM	–
184495	4025111	402.34	3	79.13	1	1	CEM	–
184832	7457593	221.32	3	30.65	1	1	CEM	–
185037	3988707	179.62	3	32.35	1	1	CEM	–
185249	1839747	163.48	3	42.86	1	1	CEM	–
185249	5691924	307.63	3	118.10	1	2	CEM	–
185260	4464842	537.14	3	37.93	2	2	CEM	–
185281	18790239	254.42	3	61.40	1	1	CEM	–
185332	11657514	183.96	3	47.58	1	1	CEM	–
185332	12612503	154.27	3	29.76	1	1	CEM	–
185332	14950478	250.48	3	26.78	1	1	CEM	–
185332	16515484	204.32	3	38.84	1	1	CEM	–
185634	6538828	189.44	3	49.79	1	1	CEM	–
186084	3182017	158.16	3	35.81	1	1	CEM	–

Table 2: Electron events in the $W + 3$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample. This table includes only the runs after the Gen4 analysis data taking period.

The runs 161678 (1.16 pb-1)and 165949 (0.19 pb-1) are still in the good run list. It is interesting to note that run 165949 had only 0.19 pb-1 but two candidate top events. Well, they are gone now!

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Muons								
141597	1353293	204.84	3	28.11	2	2	CMUP	y
152615	1274128	163.68	3	50.47	1	1	CMUP	n
154021	1352107	316.89	3	24.82	2	2	CMUP	n
160406	154621	207.42	3	25.39	1	1	CMX	y
161171	1163361	352.68	3	26.13	1	1	CMX	n
162631	7109631	221.78	3	24.69	1	1	CMX	4
164274	2932602	208.22	3	33.95	1	1	CMUP	y
165121	7186180	140.54	3	44.43	1	1	CMUP	n
166325	1249548	151.31	3	25.75	1	1	CMX	n
166567	490760	256.12	3	95.47	2	2	CMX	y
166771	846042	135.04	3	33.19	1	1	CMUP	n
166779	3800533	245.84	3	82.34	1	1	CMUP	n
166927	5822870	266.57	3	33.87	1	1	CMX	y
167259	1142209	175.03	3	34.06	1	1	CMUP	n
167297	535675	187.23	3	34.35	1	1	CMUP	n
167954	4519267	204.69	3	21.77	1	2	CMUP	–
177628	1517364	159.33	3	45.93	1	1	CMUP	–
178071	282015	199.48	3	23.55	1	1	CMX	–
178390	3929243	294.18	3	66.92	1	1	CMUP	–
178738	5844388	224.45	3	46.58	1	1	CMUP	–
178852	2167379	326.92	3	47.07	1	1	CMUP	–
178881	10612822	153.49	3	23.91	1	1	CMUP	–
182874	78353	168.86	3	33.98	1	1	CMUP	–
183530	4037862	221.11	3	75.88	1	1	CMUP	–
183557	1288983	337.56	3	44.08	2	2	CMUP	–
183965	4462113	311.72	3	82.03	1	1	CMX	–
183965	7773800	183.12	3	25.06	1	1	CMUP	–
184015	737953	199.02	3	33.48	1	2	CMUP	–
184377	11678359	243.27	3	37.19	1	1	CMUP	–
184445	609320	220.84	3	71.56	1	1	CMUP	–
184762	2561196	344.00	3	63.20	2	2	CMUP	–
184765	405764	325.20	3	88.12	1	1	CMX	–
184802	3421801	199.31	3	24.79	2	2	CMUP	–
185037	4098975	247.51	3	66.07	1	1	CMX	–
185848	10192934	175.58	3	61.90	1	1	CMX	–
186145	6729198	365.15	3	36.75	1	1	CMUP	–

Table 3: Muon events in the $W + 3$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Electrons								
153694	1694029	301.30	4	31.45	2	2	CEM	y
153738	205803	302.74	4	83.74	2	2	CEM	n
153738	2083102	333.13	4	64.16	1	1	CEM	y
154175	1630925	336.15	4	122.47	1	1	CEM	y
155320	480816	243.58	4	29.26	1	1	CEM	y
155919	2689969	269.26	4	47.42	1	2	CEM	n
156457	13182	236.68	4	66.04	1	1	CEM	n
160153	1270879	333.64	4	55.81	1	1	CEM	y
160230	805211	342.60	4	84.39	2	2	CEM	n
160441	3910866	422.07	4	53.87	1	2	CEM	n
160594	290458	275.33	4	42.15	1	1	CEM	n
161633	1571961	269.39	4	32.75	1	1	CEM	y
161792	391660	235.38	4	55.87	1	1	CEM	n
162423	261933	218.59	4	33.50	1	1	CEM	y
164110	954852	224.00	4	41.33	2	2	CEM	n
164274	1449940	215.86	4	23.99	1	1	CEM	n
164819	1242550	404.16	4	42.76	1	1	CEM	n
165314	236898	295.43	4	32.41	1	2	CEM	n
166614	804529	356.98	4	28.56	2	2	CEM	y
166653	1499964	325.57	4	37.63	2	2	CEM	n
166715	357810	190.13	4	41.59	1	1	CEM	n
166717	3530653	217.54	4	44.08	1	1	CEM	n
167053	12401969	275.33	4	24.12	1	1	CEM	n
168563	2395692	253.72	4	49.81	1	1	CEM	n
177314	2950396	256.78	4	68.64	1	2	CEM	–
177345	3135596	296.53	4	55.09	1	0	CEM	–
178258	782935	264.97	4	65.80	1	1	CEM	–
178677	4378990	338.87	4	65.07	1	1	CEM	–
183209	1059754	204.01	4	21.27	1	1	CEM	–
183631	31445	168.80	4	26.79	1	1	CEM	–
183752	3562502	281.63	4	75.19	1	1	CEM	–
184419	291129	335.62	4	52.72	1	1	CEM	–
184453	19917	396.54	4	104.07	1	1	CEM	–
184782	2170277	297.84	4	75.81	1	1	CEM	–
185075	4388549	331.42	4	36.75	1	1	CEM	–
185332	1622825	354.65	4	34.99	1	1	CEM	–
185349	57399	326.66	4	22.38	2	2	CEM	–
185777	5392044	191.18	4	20.89	1	1	CEM	–
186145	9795252	263.58	4	21.14	1	1	CEM	–

Table 4: Electron events in the $W + 4$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Muons								
145036	245760	288.95	4	64.53	1	1	CMUP	y
152266	3554	214.01	4	41.46	1	1	CMUP	y
153693	799494	345.11	4	40.97	2	2	CMUP	y
154654	6534372	317.83	4	44.32	1	1	CMX	–
160437	280173	262.51	4	33.16	1	1	CMUP	y
161788	361577	439.65	4	71.54	2	2	CMUP	y
162837	921871	255.08	4	37.06	1	1	CMUP	n
163012	2249546	300.07	4	26.19	1	2	CMUP	y
166367	516271	213.21	4	36.89	2	2	CMX	n
166529	4938	216.12	4	42.61	1	1	CMUP	n
166567	11615607	323.65	4	58.83	1	2	CMUP	y
166717	2288892	350.42	4	60.49	2	2	CMUP	n
166805	2534588	308.46	4	48.87	1	1	CMUP	y
167139	1191211	254.76	4	63.83	2	2	CMX	y
168889	1456443	247.66	4	32.98	1	2	CMUP	–
178120	86683	244.69	4	21.23	1	1	CMUP	–
178785	1428968	291.83	4	63.03	1	1	CMX	–
178855	5504617	326.53	4	45.73	2	3	CMUP	–
179039	2128943	318.58	4	69.53	2	3	CMX	–
184832	12978334	249.42	4	59.41	1	1	CMX	–
185248	8569330	280.83	4	23.89	2	2	CMUP	–
185332	4430084	357.69	4	53.99	1	2	CMUP	–
185518	330101	355.39	4	21.03	1	1	CMUP	–
186087	17361	249.65	4	51.82	2	2	CMUP	–

Table 5: Muon events in the $W + 4$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Electrons								
161013	111162	416.53	5	82.76	1	1	CEM	y
161414	68227	352.63	5	65.27	1	1	CEM	n
162986	1538897	389.02	5	56.99	2	2	CEM	y
163519	1262057	256.79	5	68.12	1	1	CEM	n
167551	7969376	311.52	5	63.31	1	2	CEM	y
178761	1716435	402.16	5	62.93	1	1	CEM	–
178761	2861250	342.78	7	33.41	1	1	CEM	–
184519	377410	303.93	5	36.32	1	1	CEM	–
Muons								
155409	1291806	544.16	7	63.99	1	1	CMUP	–
162837	1447297	322.62	5	44.32	1	2	CMX	n
166779	3652540	463.46	5	135.87	1	1	CMUP	n
167551	3626393	256.73	5	48.07	3	3	CMUP	y
183126	45329	530.31	5	149.31	1	1	CMUP	–
185172	2492855	359.10	6	29.63	1	1	CMX	–
185377	5133539	310.35	5	40.66	2	2	CMUP	–
185379	300012	300.01	5	21.48	1	1	CMUP	–
185594	10091587	249.88	6	42.83	1	1	CMX	–
185848	7195410	337.37	5	52.57	1	1	CMUP	–
186145	4971965	263.24	5	36.71	1	2	CMX	–

Table 6: Events in the $W+ \geq 5$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample.

Type	$W+1$ jet	$W+2$ jets	$W+3$ jets	$W \geq 4$ jets	Total
Electrons					
Gen4	–	–	19	16	+35=xxx
Gen5 (w/ Gen4 GRL)	121	63	27	23+5+0+0=28	184+55=239
Gen5 (run $\leq$ 167715)	129	66	29	23+5+0+0=28	195+57=252
Gen5 (318.5 pb−1)	249	142	59	39+7+0+1=47	391+106=497
Muons					
Gen4	–	–	10	12	+22=xxx
Gen5 (w/ Gen4 GRL)	83	41	15	13+3+0+0=16	124+31=155
Gen5 (run $\leq$ 167715)	87	41	15	14+3+0+1=18	128+33=161
Gen5 (318.5 pb−1)	183	100	36	24+8+2+1=35	283+71=354
Total					
Gen4	160	73	29	28	233+57 = 290
Gen5 (w/ Gen4 GRL)	204	104	42	36+8+0+0=44	308+86 = 394
Gen5 (run $\leq$ 167715)	216	106	44	37+8+0+1=46	320+90 = 410
Gen5 (318.5 pb−1)	432	242	95	63+15+2+2=82	674+177 = 851

Table 7: Number of events passing the $W+$ jets selection in Gen4 and Gen5. The Gen5 numbers are given for different run ranges: 1) Using the same good run list as in Gen4; 2) Using the new run list up to the last run in the Gen4 good run list. This includes an extra 9.3 pb^{-}1 in the same run range as in Gen4. This is here only to show that we should NOT compare the numbers this way; 3) Using the full dataset currently available. The summation in the $W \geq 4$ jets is over the included jet bins (4,5,6 and 7). The summation in the "total" column is over $W + 1, 2$ jets and $W \geq 3$ jets.

Missing Events Relative to Gen4				
Type	$W+2$ jets	$W+3$ jets	$W \geq 4$ jets	Total
Electrons	–	7	5+1dtag	12
Muons	–	5	2+1dtag	7
Total	–	12	6	19
Extra Events Relative to Gen4				
Electrons	–	15	16+2=17	33
Muons	–	10	4+2=6	16
Total	–	25	23	49
Events Migrated to this Bin Relative to Gen4				
Electrons	2	2	0	2
Muons	2	1	0	1
Total	4	3	0	3
Actual Missing Signal Events				
Electrons	–	7	3+1dtag	10
Muons	–	5	1	6
Total	–	12	4	16

Table 8: Number of events sloshing in the Gen5 dataset relative to Gen4, using the same good run list. There are 16 events that were present in Gen4 signal sample but are not in Gen5. Four of these have migrate to the $W+2$ jets bin, and they are still counted as missing from the signal region. In reality, we only have 11-4=7 events missing from the tagged sample.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Electrons								
161678	7014539	362.44	2	27.43	1	1	CEM	3-jet
164354	1842551	139.00	2	41.27	1	1	CEM	3-jet
Muons								
165313	1770456	273.38	2	28.54	1	1	CMUP	3-jet
165314	1155563	128.96	2	21.74	1	2	CMUP	3-jet

Table 9: Events from the 3-jet bin that migrated to the $W+2$ jets bin. There are no events that migrated to the $W+1$ jet bin.

Run	Event	# Jets	Lepton	Tight tags	Reason
Electrons					
148153	6088	3	CEM	1	Pass2: Fails LxySig ¿7.5
149387	2551061	3	CEM	1	Pass1: Lxy=1.2, LxySig = 225
160541	3336609	3	CEM	1	Pass1: Lxy = 2.64
161379	494836	4	CEM	1	Pass2: Vtx Chi2 = 699, Lxy=1.44
161678	5912849	4	CEM	1	Not pretag
161678	7014539	3	CEM	1	2-jet bin
164354	1842551	3	CEM	1	2-jet bin
164819	2297394	4	CEM	1	Pass1
165949	434475	3	CEM	1	Diff Z-Vertex? (not in the gen4 loose) Pass2: LxySig= 3.19 Now it is mistagged
165949	1239675	3	CEM	1	Not pretag (not in the gen4 loose)
Muons					
151978	507773	3	?	1	Not pretag (dilepton in Gen4?)
160591	894406	4	?	1	Pass2: Lxy=1.1
160796	2445318	3	?	1	Pass2: LxySig= 6.2
162519	931923	3	?	1	Pass2: LxySig= 5.9
165313	1770456	3	CMUP	1	2-jet bin
165314	1155563	3	CMUP	1	2-jet bin

Table 10: Missing events. Signal events present in the Gen4 analysis but missing in the Gen5. The information presented in this table is for the Gen4 analysis. In addition to these, one tagged jet in electron event 167551, 7969378 was lost; and one tagged jet in the muon event 166567, 11615607 was also lots. The only double events from the same run that we had in Gen4 are all missing! Are the runs still present?

148153,6088 CEM event

- Event is in the pretag sample
- 16 primevtx tracks
- Only 3 displaced pass1 tracks
- Not enough pass 2 tracks.

149387,2551061 CEM event

- Event is in the pretag sample
- Only 2 displaced tracks. Could be pass2.

160541,3336609 CEM event

- Event is in the pretag sample

161379,494836 CEM event

- Event is in the pretag sample

164819,2297394 CEM event

- Event is in the pretag sample

165949,434475 CEM event

- Event is in the pretag sample
- Beam location has changed slightly: x,y= -0.199606, 0.5074733 ==> -0.202407,0.5021491
- PrimeVtx has changed slightly in x,y also x,y= -0.207973, 0.5046001 ==> -0.205249,0.4978077
- PrimeVtx Z moved alot: -15.74980 to -13.23964
- Vxprim didn't find a vertex in gen4. Now, it found a vertex similar to primevtx -13.23509
- There are 10 tracks in the primary vertex now. We can't check how many there were before.
- ZVertex gen4: -15.74980, quality= 60, 13 tracks, sum pt = 117.7605.
- ZVertex gen5: -13.23551, quality= 214, 44 tracks, sum pt = 184.1340 (off by 2.5 cm!)
- Electron track Z0: -14.03278. The Zvertex -13.23551 was already in gen4 and it was the highest sumPt.
- fprimZV: very similar in both cases: -13.27254 ==> -13.23551

- Jet1: used to be tagged Lxy = 0.175 is now mistagged Lxy = -0.361057
- Now: Lxy= -0.854041 LxySig= 0.223922

165949,1239675 CEM event

- Event is NOT in the pretag sample

151978,507773 Muon event

- Event is NOT in the pretag sample

160591,894406 Muon event

- Event is in the pretag sample

160796,2445318 Muon event

- Event is in the pretag sample
- Enough tracks for pass2

162519,931923 Muon event

- Event is in the pretag sample
- Not enough displaced tracks. 2 Pass1, 1 Pass2

The following missing events 161678, 7014539; 160796, 2445318; 162519, 931923; 165313, 1770456; 165314, 1155563; are in the pretag sample but have the variable summary.fnTightJet set to less than 3. Out of these, there are 3 of the events that are now in the 2-jet bin. The others seem to have survived due to the jet corrections.

```
================================================================
Found Event: Run= 148153  Event= 6088  Entry= 4679
================================================================
====== Jets information =====
4: Et= 68.9706 Eta= 0.184636 Phi= 0.15113
Tag= 0 Pass= 0 Chi2= -999 Lxy= 0 LxySig= 99
Ntrk= 9 NtrkDispl= 3 NtrkPass1= 3 NtrkPass2= 1 NtrkVtx= 0

================================================================
Found Event: Run= 149387  Event= 2551061  Entry= 4961
================================================================
====== Jets information =====
3: Et= 32.1386 Eta= 0.701835 Phi= 3.04544
Tag= 0 Pass= 0 Chi2= -999 Lxy= 0 LxySig= 99
Ntrk= 3 NtrkDispl= 2 NtrkPass1= 2 NtrkPass2= 2 NtrkVtx= 0
```

```
================================================================
Found Event: Run= 160541  Event= 3336609  Entry= 4260
================================================================
====== Jets information =====
4: Et= 123.466 Eta= -0.0646871 Phi= 3.80183
Tag= 0 Pass= 2 Chi2= 1.6002 Lxy= 15.9565 LxySig= 0.914946
Ntrk= 5 NtrkDispl= 3 NtrkPass1= 3 NtrkPass2= 3 NtrkVtx= 0

================================================================
Found Event: Run= 161379  Event= 494836  Entry= 8179
================================================================
====== Jets information =====
8: Et= 31.3669 Eta= 0.357414 Phi= 4.41549
Tag= 0 Pass= 0 Chi2= -999 Lxy= 0 LxySig= 99
Ntrk= 7 NtrkDispl= 1 NtrkPass1= 1 NtrkPass2= 0 NtrkVtx= 0


================================================================
Found Event: Run= 164819  Event= 2297394  Entry= 10805
================================================================
====== Jets information =====
4: Et= 34.6404 Eta= 0.654018 Phi= 4.06925
Tag= 0 Pass= 2 Chi2= 11.6716 Lxy= -0.854041 LxySig= 0.223922
Ntrk= 6 NtrkDispl= 3 NtrkPass1= 3 NtrkPass2= 2 NtrkVtx= 0


================================================================
Found Event: Run= 165949  Event= 434475  Entry= 12043
================================================================
====== Jets information =====
Num= 94
3: Et= 112.717 Eta= 0.815313 Phi= 2.76773
Tag= -1 Pass= 2 Chi2= 27.3093 Lxy= -0.361057 LxySig= 0.0369011
Ntrk= 5 NtrkDispl= 4 NtrkPass1= 4 NtrkPass2= 3 NtrkVtx= 2

================================================================
Found Event: Run= 160591  Event= 894406  Entry= 26862
================================================================
====== Jets information =====
5: Et= 70.4305 Eta= -0.537269 Phi= 2.36491
Tag= 0 Pass= 2 Chi2= 60.7806 Lxy= 1.10385 LxySig= 0.0533766
Ntrk= 6 NtrkDispl= 4 NtrkPass1= 4 NtrkPass2= 3 NtrkVtx= 0
```

```
================================================================
Found Event: Run= 160796  Event= 2445318  Entry= 27079
================================================================
====== Jets information =====
5: Et= 13.5529 Eta= 1.19444 Phi= 5.90348
Tag= 0 Pass= 2 Chi2= 0.258247 Lxy= 0.374799 LxySig= 0.0509655
Ntrk= 6 NtrkDispl= 2 NtrkPass1= 2 NtrkPass2= 2 NtrkVtx= 0


================================================================
Found Event: Run= 162519  Event= 931923  Entry= 28076
================================================================
====== Jets information =====
4: Et= 39.5519 Eta= 0.0182969 Phi= 0.389886
Tag= 0 Pass= 0 Chi2= -999 Lxy= 0 LxySig= 99
Ntrk= 5 NtrkDispl= 2 NtrkPass1= 2 NtrkPass2= 0 NtrkVtx= 0


These have moved to the 2-jet bin

================================================================
Found Event: Run= 161678  Event= 7014539  Entry= 8607
================================================================
====== Jets information =====
Num= 63
3: Et= 177.974 Eta= -0.273974 Phi= 5.68696
Tag= 1 Pass= 1 Chi2= 5.85643 Lxy= 0.25395 LxySig= 0.0132975
Ntrk= 11 NtrkDispl= 3 NtrkPass1= 3 NtrkPass2= 2 NtrkVtx= 3
```

The Gen4 tags information:

```
================================================================
Found Event: Run= 148153  Event= 6088  Entry= 2574
================================================================
====== Jets information =====
Num= 26
4: Et= 67.4873 Eta= 0.184107 Phi= 0.151561
Tag= 1 Pass= 2 Chi2= 255.133 Lxy= 0.587188 LxySig= 4.45721
Ntrk= 8 NtrkDispl= 2 NtrkVtx= 2

================================================================
Found Event: Run= 149387  Event= 2551061  Entry= 5429
================================================================
====== Jets information =====
Num= 32
3: Et= 34.3537 Eta= 0.700927 Phi= 3.04406
Tag= 1 Pass= 1 Chi2= 13.7338 Lxy= 1.1859 LxySig= 225.126
Ntrk= 5 NtrkDispl= 4 NtrkVtx= 4

================================================================
Found Event: Run= 160541  Event= 3336609  Entry= 43341
================================================================
====== Jets information =====
4: Et= 124.289 Eta= -0.0646956 Phi= 3.80199
Tag= 1 Pass= 1 Chi2= 1.89965 Lxy= 2.64821 LxySig= 15.6716
Ntrk= 6 NtrkDispl= 3 NtrkVtx= 3


================================================================
Found Event: Run= 161379  Event= 494836  Entry= 30228
================================================================
====== Jets information =====
10: Et= 30.843 Eta= 0.355498 Phi= 4.414
Tag= 1 Pass= 2 Chi2= 699.148 Lxy= 1.43787 LxySig= 48.713
Ntrk= 7 NtrkDispl= 2 NtrkVtx= 2

================================================================
Found Event: Run= 164819  Event= 2297394  Entry= 65768
================================================================
====== Jets information =====
Num= 29
4: Et= 35.8508 Eta= 0.640204 Phi= 4.06939
```

```
Tag= 1 Pass= 1 Chi2= 18.0443 Lxy= 0.40178 LxySig= 28.1173
Ntrk= 7 NtrkDispl= 5 NtrkVtx= 3

================================================================
Found Event: Run= 165949  Event= 434475  Entry= 74602
================================================================
====== Jets information =====
3: Et= 111.582 Eta= 0.81694 Phi= 2.77023
Tag= 1 Pass= 2 Chi2= 81.1383 Lxy= 0.175908 LxySig= 3.19005
Ntrk= 5 NtrkDispl= 3 NtrkVtx= 2




================================================================
Found Event: Run= 160591  Event= 894406  Entry= 22016
================================================================
====== Jets information =====
5: Et= 67.6022 Eta= -0.537394 Phi= 2.36592
Tag= 1 Pass= 2 Chi2= 45.7844 Lxy= 1.09902 LxySig= 19.8428
Ntrk= 5 NtrkDispl= 3 NtrkVtx= 3


================================================================
Found Event: Run= 160796  Event= 2445318  Entry= 31317
================================================================
====== Jets information =====
5: Et= 13.279 Eta= 1.19179 Phi= 5.90518
Tag= 1 Pass= 2 Chi2= 1.23577 Lxy= 0.350889 LxySig= 6.16872
Ntrk= 6 NtrkDispl= 2 NtrkVtx= 2

================================================================
Found Event: Run= 162519  Event= 931923  Entry= 23946
================================================================
====== Jets information =====
4: Et= 38.4814 Eta= 0.013553 Phi= 0.386276
Tag= 1 Pass= 2 Chi2= 0.00147536 Lxy= 0.246949 LxySig= 5.87979
Ntrk= 4 NtrkDispl= 2 NtrkVtx= 2
```

4 Extra events in more detail

Here, we do not consider the events that have moved from the 4-jet bin to the 4-jet bin. This is a total of 46 extra events: 31 electron events, 15 muon events.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Electrons								
151869	690782	177.95	3	38.37	1	1	CEM	n
155793	4312618	260.83	3	40.71	1	1	CEM	n
160599	129700	187.11	3	23.74	1	0	CEM	n
161678	1080224	197.91	3	70.49	2	2	CEM	n
162837	433408	392.35	3	28.83	2	2	CEM	n
162857	4107280	258.47	3	31.66	1	1	CEM	n
164451	7530950	201.36	3	51.21	1	1	CEM	n
164989	1594353	318.25	3	28.79	1	1	CEM	n
165271	6116896	345.16	3	146.13	1	1	CEM	n
166479	4910255	192.16	3	58.11	1	1	CEM	n
166927	8307431	283.21	3	21.26	1	1	CEM	n
167053	5091995	301.44	3	21.95	1	1	CEM	n
167053	7442159	231.50	3	39.63	1	1	CEM	n
$W \geq 4$ jets								
153738	205803	302.74	4	83.74	2	2	CEM	n
155919	2689969	269.26	4	47.42	1	2	CEM	n
156457	13182	236.68	4	66.04	1	1	CEM	n
160230	805211	342.60	4	84.39	2	2	CEM	n
160441	3910866	422.07	4	53.87	1	2	CEM	n
160594	290458	275.33	4	42.15	1	1	CEM	n
161792	391660	235.38	4	55.87	1	1	CEM	n
164110	954852	224.00	4	41.33	2	2	CEM	n
164274	1449940	215.86	4	23.99	1	1	CEM	n
164819	1242550	404.16	4	42.76	1	1	CEM	n
165314	236898	295.43	4	32.41	1	2	CEM	n
166653	1499964	325.57	4	37.63	2	2	CEM	n
166715	357810	190.13	4	41.59	1	1	CEM	n
166717	3530653	217.54	4	44.08	1	1	CEM	n
167053	12401969	275.33	4	24.12	1	1	CEM	n
168563	2395692	253.72	4	49.81	1	1	CEM	n
$W \geq 5$ jets								
161414	68227	352.63	5	65.27	1	1	CEM	n
163519	1262057	256.79	5	68.12	1	1	CEM	n

Table 11: Electron events in the $W \geq 3$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample. This table includes only the run-range common to the Gen4 analysis.

Run	Event	H_T	# Jets	MET	Tight tags	Loose Tags	Lepton	Gen4
Muons								
152615	1274128	163.68	3	50.47	1	1	CMUP	n
154021	1352107	316.89	3	24.82	2	2	CMUP	n
161171	1163361	352.68	3	26.13	1	1	CMX	n
165121	7186180	140.54	3	44.43	1	1	CMUP	n
166325	1249548	151.31	3	25.75	1	1	CMX	n
166771	846042	135.04	3	33.19	1	1	CMUP	n
166779	3800533	245.84	3	82.34	1	1	CMUP	n
167259	1142209	175.03	3	34.06	1	1	CMUP	n
167297	535675	187.23	3	34.35	1	1	CMUP	n
$W \geq 4$ jets								
162837	921871	255.08	4	37.06	1	1	CMUP	n
166367	516271	213.21	4	36.89	2	2	CMX	n
166529	4938	216.12	4	42.61	1	1	CMUP	n
166717	2288892	350.42	4	60.49	2	2	CMUP	n
$W \geq 5$ jets								
162837	1447297	322.62	5	44.32	1	2	CMX	n
166779	3652540	463.46	5	135.87	1	1	CMUP	n

Table 12: Muon events in the $W + 3$ sample with at least one tight SecVtx tagged jet. The last column indicates if the event was already present in the Gen4 sample.

		Jet				Secondary Vertex								
										Number of tracks				
Run	Event	idx	E_T	η	ϕ	Pass	χ^2	Lxy	LxySig	jet	displ	p1	p2	vtx
151869	690782	5	26.3	-0.494214	3.19783	2	0.17	0.49	33.9	2	2	2	2	2
153738	205803	5	101.	-0.305889	6.28265	1	11.5	0.43	22.0	5	3	3	2	3
153738	205803	6	44.4	-0.071410	1.54548	1	13.9	0.35	52.0	7	6	6	4	5
155793	4312618	5	35.5	0.263284	4.47936	2	0.13	1.24	106.	5	4	4	3	2
155919	2689969	5	69.7	-0.009003	2.94737	1	8.73	0.43	43.6	11	6	6	5	3
156457	13182	8	34.2	-0.217008	2.55901	1	15.5	0.33	16.8	9	6	6	6	4
160230	805211	5	57.2	-0.65478	0.75219	2	6.23	0.26	8.47	11	2	2	2	2
160230	805211	7	20.1	0.916495	1.8792	2	2.17	0.31	27.9	6	3	3	2	2
160441	3910866	5	82.1	0.718331	4.58207	2	4.19	0.27	16.8	5	4	4	4	2
160594	290458	4	49.5	0.551487	0.53118	2	0.03	0.21	13.4	8	3	3	3	2
160599	129700	4	55.8	-0.433641	1.34146	2	0.21	1.33	10.6	12	4	4	3	2
161414	68227	8	25.6	-0.436576	3.35654	2	3.30	0.14	12.5	4	2	2	2	2
161678	1080224	5	21.5	-0.618683	0.19061	2	0.03	0.53	31.0	5	3	3	3	2
161678	1080224	6	17.9	1.41134	5.74781	1	25.2	0.47	15.1	3	3	3	3	3
161792	391660	6	24.7	1.20195	0.83742	2	44.2	0.42	40.9	6	3	3	3	3
162837	433408	6	59.2	-0.739988	2.29418	2	16.5	1.35	20.8	3	3	3	2	2
162837	433408	7	58.4	-0.0683032	4.2597	1	21.6	0.24	23.1	6	4	4	2	4
162857	4107280	5	42.1	1.19838	3.24932	1	22.3	0.11	8.71	7	7	7	3	3
163519	1262057	7	61.2	-0.0171039	5.31611	1	21.4	0.09	10.0	10	7	7	5	4
164110	954852	6	44.8	-0.658387	6.26494	1	4.17	0.64	31.0	4	4	4	4	3
164110	954852	8	31.3	-1.39318	5.90306	1	26.3	0.11	11.5	10	5	5	3	5
164274	1449940	5	44.9	-0.880104	4.40265	2	1.55	0.96	14.8	8	2	2	2	2
164451	7530950	6	19.2	0.8931	1.41851	2	44.6	0.51	37.9	4	3	3	3	3
164819	1242550	6	23.0	0.558484	1.65297	1	1.14	0.35	47.4	6	3	3	3	3
164989	1594353	5	95.8	-0.242758	2.6333	1	7.77	0.23	16.6	7	4	4	4	3
165271	6116896	3	90.7	0.14185	5.93874	1	29.3	1.47	69.3	15	4	4	2	3
165314	236898	11	25.97	-0.129144	5.30054	1	4.40	0.65	30.9	4	3	3	3	3
166479	4910255	3	44.6	0.039988	3.02835	2	1.04	0.30	10.8	9	3	3	2	2
166653	1499964	4	71.5	-1.30927	1.16576	1	33.1	0.08	7.8	6	3	3	1	3
166653	1499964	7	18.1	-0.647846	4.04118	1	0.93	0.36	16.4	4	3	3	2	3
166715	357810	5	22.1	-0.786389	2.70088	2	0.20	0.32	14.4	5	2	2	2	2
166717	3530653	7	16.2	0.49322	2.24831	1	8.45	0.49	74.5	3	3	3	2	3
166927	8307431	4	51.5	0.663055	2.55646	1	10.7	0.31	12.5	8	3	3	2	3
167053	12401969	5	47.4	0.29795	0.42193	2	1.23	0.22	33.4	4	2	2	2	2
167053	5091995	5	30.5	-0.735473	5.46205	1	37.4	0.97	67.4	6	5	5	4	4
167053	7442159	4	60.5	1.35534	6.074	1	28.5	0.54	37.2	5	4	4	4	3
168563	2395692	8	23.5	1.27158	4.81596	1	16.1	0.28	8.66	5	4	4	2	3
168563	2395692	9	10.5	-0.852081	5.24277	1	9.03	0.34	40.1	7	5	5	3	3
152615	1274128	4	35.4	-1.4724	5.42122	1	14.5	0.10	8.04	6	3	3	1	3
154021	1352107	5	88.1	0.905786	3.4458	2	26.2	1.68	52.8	8	4	4	3	2
154021	1352107	6	30.8	0.278365	2.57125	1	5.34	0.09	7.53	5	3	3	1	3
161171	1163361	5	104.	1.28402	5.6164	1	33.5	0.19	18.4	11	4	4	2	3
162837	1447297	5	61.6	-1.2276	2.11376	1	9.22	0.69	13.9	9	7	7	3	4
162837	921871	7	38.6	-0.569554	2.68988	1	22.7	1.35	91.7	5	4	4	3	3
165121	7186180	4	17.7	-0.670447	5.91117	2	1.55	0.58	15.9	4	2	2	2	2
166325	1249548	4	58.3	-1.27281	1.75846	2	0.23	0.54	33.8	6	3	3	2	2
166367	516271	6	23.3	-1.14417	2.58843	1	34.9	0.56	22.0	4	4	4	3	3
166367	516271	7	21.4	-0.672581	2.39342	1	5.00	0.43	43.4	3	3	3	3	3
166529	4938	5	57.7	0.327399	4.7408	2	15.6	0.40	8.85	3	2	2	2	2
166717	2288892	6	51.5	0.226334	4.77596	1	4.71	0.21	9.91	7	3	3	2	3
166717	2288892	7	31.7	-0.0775326	0.04219	2	6.30	1.25	67.3	5	3	3	2	2
166771	846042	4	25.0	0.617346	1.65589	2	1.90	0.15	10.8	9	5	5	2	2
166779	3652540	8	44.4	-0.126184	3.12429	1	12.6	1.19	100.	8	7	7	6	5
166779	3800533	3	55.9	0.424904	1.96989	2	24.7	0.23	24.9	5	3	3	3	3
167259	1142209	4	33.9	1.14537	2.93664	2	6.57	1.14	20.5	5	4	4	2	2
167297	535675	3	41.1	-1.2608	5.6062	1	45.7	2.79	94.7	9	5	5	3	3

Table 13: Tagged jets in the extra Gen5 events. There are a total of 38 jets in the electron sample and new tagged 18 in the muon sample.

4.1 Where were they in Gen4?

Electron events in gen4 pretag that were found in gen5 with a new tag. There is a total of 21 events that were present in the pretag in gen4. That means that 10 new tagged events found in Gen5 where not in the pretag sample in Gen4!

Run	Event	Ntuple entry
151869	690782	10335
155793	4312618	20050
155919	2689969	22116
156457	13182	25368
161414	68227	31356
161678	1080224	32728
161792	391660	34737
160230	805211	40504
160441	3910866	42649
160594	290458	43535
160599	129700	43663
162857	4107280	49833
153738	205803	61675
164110	954852	62838
164451	7530950	64781
164819	1242550	65704
165271	6116896	69453
166479	4910255	79175
166653	1499964	82163
166717	3530653	84541
167053	7442159	87410

Table 14: Electron events in gen4 pretag that were found in gen5 with a new tag.

Muon events in gen4 pretag that were found in gen5 with a new tag. There is a total of 21 events that were present in the pretag in gen4. That means that 4 new tagged events found in Gen5 where not in the pretag sample in Gen4!

Run	Event	Ntuple entry
154021	1352107	8481
162837	1447297	26472
152615	1274128	41634
165121	7186180	51680
166325	1249548	56192
166529	4938	58016
166717	2288892	61803
166771	846042	62010
166779	3800533	62255
167259	1142209	65311
167297	535675	65491

Table 15: Muon events in gen4 pretag that were found in gen5 with a new tag.

		Jet				Secondary Vertex							
											Number of tracks		
Run	Event	idx	E_T	η	ϕ	Tag	Pass	χ^2	Lxy	LxySig	jet	displ	vtx
151869	690782	5	25.778	-0.49585	3.19824	0	0	-999	0	0	1	1	0
153738	205803	5	103.476	-0.305135	6.28179	0	0	-999	0	0	4	2	0
155793	4312618	5	35.2455	0.26417	4.47963	-1	2	33.7	-0.94	-17.2	5	3	2
155919	2689969	5	67.489	-0.009322	2.94627	0	0	-999	0	0	6	3	0
160230	805211	5	59.1265	-0.655387	0.752685	0	0	-999	0	0	11	1	0
160230	805211	7	19.8573	0.916555	1.878	0	0	-999	0	0	5	2	0
160441	3910866	5	80.5372	0.71487	4.57905	0	0	-999	0	0	3	2	0
160594	290458	4	49.0041	0.550111	0.529532	0	0	-999	0	0	5	1	0
160599	129700	4	55.5466	-0.434184	1.34189	0	0	-999	0	0	13	2	0
161414	68227	8	25.2304	-0.435605	3.35793	0	0	-999	0	0	1	0	0
161678	1080224	5	22.4769	-0.618297	0.192424	0	0	-999	0	0	3	2	0
161678	1080224	6	16.7231	1.41058	5.74782	0	0	-999	0	0	0	0	0
161792	391660	6	24.1757	1.20213	0.83828	0	0	-999	0	0	3	1	0
162857	4107280	5	41.2564	1.19697	3.24968	0	0	-999	0	0	3	1	0
164110	954852	5	45.9151	-0.656625	6.26581	0	0	-999	0	0	1	0	0
164110	954852	8	29.9375	-1.39328	5.90196	0	0	-999	0	0	5	1	0
164451	7530950	6	19.0299	0.892818	1.41765	0	0	-999	0	0	4	3	0
164819	1242550	6	23.5631	0.559425	1.65372	0	0	-999	0	0	6	2	0
166479	4910255	3	43.1904	0.0404154	3.03028	0	0	-999	0	0	10	2	0
166653	1499964	5	18.4389	-0.647111	4.04303	0	2	9.20	-0.042	-0.92	3	3	0
166717	3530653	7	14.9911	0.491466	2.24834	0	0	-999	0	0	3	2	0
167053	7442159	4	56.021	1.35516	6.0746	0	0	-999	0	0	0	0	0

Table 16: Tagged jets in the extra Gen5 electron events that were present in the pretag Gen4 sample but were not tagged by SecVtx in Gen4. These are 22 jets. There are 16 jets that were not found in the pretag sample.

		Jet				Secondary Vertex							
											Number of tracks		
Run	Event	idx	E_T	η	ϕ	Tag	Pass	χ^2	Lxy	LxySig	jet	displ	vtx
152615	1274128	4	35.6629	-1.47233	5.42129	0	0	-999	0	0	1	1	0
154021	1352107	5	88.2947	0.906464	3.4452	0	0	-999	0	0	7	3	0
154021	1352107	6	30.3745	0.279195	2.56957	0	0	-999	0	0	5	1	0
162837	1447297	5	59.8259	-1.22735	2.11377	0	0	-999	0	0	2	1	0
165121	7186180	4	18.711	-0.66982	5.91438	0	0	-999	0	0	4	1	0
166325	1249548	4	56.8376	-1.27266	1.75899	0	0	-999	0	0	3	2	0
166529	4938	5	55.1595	0.328259	4.73787	0	0	-999	0	0	1	1	0
166717	2288892	6	48.7728	0.226663	4.77474	0	2	1.94	0.1622	1.248	7	2	0
166717	2288892	7	32.7223	-0.0831	0.04313	0	0	-999	0	0	5	3	0
166771	846042	4	25.4118	0.617307	1.6552	0	2	29.40	0.0013	0.073	7	4	0
166779	3800533	3	55.302	0.42483	1.96911	0	0	-999	0	0	4	2	0
167259	1142209	4	32.8863	1.14265	2.93742	0	0	-999	0	0	3	1	0

Table 17: Tagged jets in the extra Gen5 events that were present in the pretag Gen4 sample but were not tagged by SecVtx in Gen4. There are 6 jets that were not found in the pretag sample.