Run II - Trigger Update

João Pela

Imperial College London

2015-06-29

Introduction

- We were contacted by Pascal Vanlaer and David Sperka about a rate mismatch at 7E33 with PU20 and bunch separation 25 ns.
- They quoted the following "official" numbers for the rate:
  - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v1: 4.77 ± 0.17 versus our predicted 0.1
  - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v1: 0.26 ± 0.01 versus our predicted 4.5
- Our prediction were NOT made for this instantaneous luminosity and PU scenario.
- I was asked to reproduce this rates and re-optimised the thresholds and prescales.

Software used

With the help of Pascal, David and Jim I eventually got the CMSSW files produced with the latest HLT with characteristics:

- CMSSW_7_4_5
- HLT_dev_CMSSW_7_4_0_GRun_V79
- HCAL Methods 0 and 3.

For now just using QCD (which is dominant) for rate calculation.

Example: HCAL Method 0 - HLT_PFMET170_NoiseCleaned_v2

			HLT_PFMET170_NoiseCleaned_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	1	43422	0.0899200	0.0023459	0.0000113	0.4799
QCD_Pt-50to80	22110000	3366038	1	0	0.0000000	0.0000000	0.0000000	-
QCD_Pt-80to120	3000114.3	4777532	1	2	0.0000004	0.0087915	0.0062165	70.7107
QCD_Pt-120to170	493200	4821602	1	76	0.0000158	0.0544181	0.0062422	11.4708
QCD_Pt-170to300	120300	1423446	1	320	0.0002248	0.1893096	0.0105827	5.5902
QCD_Pt-300to470	7475	2283385	1	4208	0.0018429	0.0964286	0.0014865	1.5416
QCD_Pt-470to600	587.1	2925749	1	17998	0.0061516	0.0252812	0.0001884	0.7454
QCD_Pt-600to800	167	2796098	1	34271	0.0122567	0.0143281	0.0000774	0.5402
QCD_Pt-800to1000	28.25	499998	1	13607	0.0272141	0.0053816	0.0000461	0.8573
QCD_Pt-1000to1400	8.195	499986	1	20919	0.0418392	0.0024001	0.0000166	0.6914
QCD_Pt-1400to1800	0.7346	499994	1	41431	0.0828630	0.0004261	0.0000021	0.4913
QCD_Pt-1800	0.1091	488939	1	67211	0.1374630	0.0001050	0.0000004	0.3857
Total Rate						0.3968698	0.0248703	6.27%

Conclusions

- All the rates I obtained are for *_v2 of this paths while from TSG they are all *_v1 I am unsure of what changed.
- The rates obtained for HLT_PFMET170_NoiseCleaned_v2
  - HCAL Method 0: 0.397+/-0.025 Hz
  - HCAL Method 3: 0.261+/-0.020 Hz.
  - From TSG: 0.37+/-0.02 Hz, which matches well for HCAL Method 0.
- The rate obtained for HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2
  - HCAL Method 0: 0.441+/-0.035 Hz
  - HCAL Method 3: 0.242+/-0.024 Hz
  - From TSG: 0.26+/-0.01 Hz, which matches well for HCAL Method 3.
- The rate obtained for HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v2
  - HCAL Method 0: 13.355+/-0.370 Hz (assuming HLT prescale 3 like in like TSG)
  - HCAL Method 3: 5.150+/-0.200 Hz (assuming HLT prescale 3 like TSG)
  - From TSG is 4.77+/-0.17 Hz, which matches well for HCAL Method 3.
- Signal efficiency (mH=125 GeV) for HLT_PFMET170_NoiseCleaned_v2 + HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2 is:
  - HCAL Method 0: 10.60% here the dedicate HLT path added an additional 17.85% of signal
  - HCAL Method 3: 9.40% here the dedicate HLT path added an additional 17.96% of signal
- HCAL Method 3 reduces rate versus HCAL Method 0
  - HLT_PFMET170_NoiseCleaned_v2: -34%
  - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2: -45%
  - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v2: -61%

Summary

Summary:

- Have not the capability to obtain rates and efficiencies with the latest HLT code
- Efficiencies look reasonable but can be improved.

Next steps:

- Was asked to look at more recent samples with better QCD modelling and re-optimize.

Backup Slides

HCAL Method 0 - HLT_PFMET170_NoiseCleaned_v2

			HLT_PFMET170_NoiseCleaned_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	1	43422	0.0899200	0.0023459	0.0000113	0.4799
QCD_Pt-50to80	22110000	3366038	1	0	0.0000000	0.0000000	0.0000000	-
QCD_Pt-80to120	3000114.3	4777532	1	2	0.0000004	0.0087915	0.0062165	70.7107
QCD_Pt-120to170	493200	4821602	1	76	0.0000158	0.0544181	0.0062422	11.4708
QCD_Pt-170to300	120300	1423446	1	320	0.0002248	0.1893096	0.0105827	5.5902
QCD_Pt-300to470	7475	2283385	1	4208	0.0018429	0.0964286	0.0014865	1.5416
QCD_Pt-470to600	587.1	2925749	1	17998	0.0061516	0.0252812	0.0001884	0.7454
QCD_Pt-600to800	167	2796098	1	34271	0.0122567	0.0143281	0.0000774	0.5402
QCD_Pt-800to1000	28.25	499998	1	13607	0.0272141	0.0053816	0.0000461	0.8573
QCD_Pt-1000to1400	8.195	499986	1	20919	0.0418392	0.0024001	0.0000166	0.6914
QCD_Pt-1400to1800	0.7346	499994	1	41431	0.0828630	0.0004261	0.0000021	0.4913
QCD_Pt-1800	0.1091	488939	1	67211	0.1374630	0.0001050	0.0000004	0.3857
Total Rate						0.3968698	0.0248703	6.27%

HCAL Method 0 - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2

			HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	1	24112	0.0499321	0.0013027	0.0000084	0.6440
QCD_Pt-50to80	22110000	3366038	1	0	0.0000000	0.0000000	0.0000000	-
QCD_Pt-80to120	3000114.3	4777532	1	10	0.0000021	0.0439574	0.0139006	31.6228
QCD_Pt-120to170	493200	4821602	1	140	0.0000290	0.1002439	0.0084722	8.4515
QCD_Pt-170to300	120300	1423446	1	362	0.0002543	0.2141565	0.0112558	5.2559
QCD_Pt-300to470	7475	2283385	1	2929	0.0012827	0.0671196	0.0012402	1.8477
QCD_Pt-470to600	587.1	2925749	1	6696	0.0022886	0.0094056	0.0001149	1.2221
QCD_Pt-600to800	167	2796098	1	10232	0.0036594	0.0042778	0.0000423	0.9886
QCD_Pt-800to1000	28.25	499998	1	3001	0.0060020	0.0011869	0.0000217	1.8254
QCD_Pt-1000to1400	8.195	499986	1	4502	0.0090043	0.0005165	0.0000077	1.4904
QCD_Pt-1400to1800	0.7346	499994	1	6354	0.0127082	0.0000653	0.0000008	1.2545
QCD_Pt-1800	0.1091	488939	1	6993	0.0143024	0.0000109	0.0000001	1.1958
Total Rate						0.4409406	0.0350647	7.95%

HCAL Method 0 - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v2

			HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	3	43410	0.0898951	0.0007818	0.0000038	0.4800
QCD_Pt-50to80	22110000	3366038	3	248	0.0000737	3.8010028	0.2413639	6.3500
QCD_Pt-80to120	3000114.3	4777532	3	3038	0.0006359	4.4514218	0.0807616	1.8143
QCD_Pt-120to170	493200	4821602	3	13007	0.0026977	3.1044569	0.0272206	0.8768
QCD_Pt-170to300	120300	1423446	3	9107	0.0063979	1.7958777	0.0188187	1.0479
QCD_Pt-300to470	7475	2283385	3	22836	0.0100009	0.1744331	0.0011543	0.6617
QCD_Pt-470to600	587.1	2925749	3	39642	0.0135494	0.0185613	0.0000932	0.5023
QCD_Pt-600to800	167	2796098	3	50254	0.0179729	0.0070034	0.0000312	0.4461
QCD_Pt-800to1000	28.25	499998	3	11561	0.0231221	0.0015241	0.0000142	0.9300
QCD_Pt-1000to1400	8.195	499986	3	14678	0.0293568	0.0005614	0.0000046	0.8254
QCD_Pt-1400to1800	0.7346	499994	3	15996	0.0319924	0.0000548	0.0000004	0.7907
QCD_Pt-1800	0.1091	488939	3	14455	0.0295640	0.0000075	0.0000001	0.8317
Total Rate						13.3549049	0.3694666	2.77%

HCAL Method 3 - HLT_PFMET170_NoiseCleaned_v2

			HLT_PFMET170_NoiseCleaned_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	1	38491	0.0797087	0.0020795	0.0000106	0.5097
QCD_Pt-50to80	22110000	3484212	1	0	0.0000000	0.0000000	0.0000000	-
QCD_Pt-80to120	3000114.3	4777411	1	2	0.0000004	0.0087917	0.0062167	70.7107
QCD_Pt-120to170	493200	4821602	1	31	0.0000064	0.0221969	0.0039867	17.9605
QCD_Pt-170to300	120300	1423446	1	194	0.0001363	0.1147689	0.0082399	7.1796
QCD_Pt-300to470	7475	2247929	1	3292	0.0014645	0.0766278	0.0013355	1.7429
QCD_Pt-470to600	587.1	2925749	1	16705	0.0057096	0.0234649	0.0001816	0.7737
QCD_Pt-600to800	167	2925749	1	16705	0.0057096	0.0066746	0.0000516	0.7737
QCD_Pt-800to1000	28.25	499998	1	13607	0.0272141	0.0053816	0.0000461	0.8573
QCD_Pt-1000to1400	8.195	499986	1	28225	0.0564516	0.0032383	0.0000193	0.5952
QCD_Pt-1400to1800	0.7346	488314	1	58626	0.1200580	0.0006174	0.0000025	0.4130
QCD_Pt-1800	0.1091	488939	1	97091	0.1985749	0.0001517	0.0000005	0.3209
Total Rate						0.2619138	0.0200911	7.67%

HCAL Method3 - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2

			HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu140_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	1	20799	0.0430714	0.0011237	0.0000078	0.6934
QCD_Pt-50to80	22110000	3484212	1	0	0.0000000	0.0000000	0.0000000	-
QCD_Pt-80to120	3000114.3	4777411	1	4	0.0000008	0.0175834	0.0087917	50.0000
QCD_Pt-120to170	493200	4821602	1	64	0.0000133	0.0458258	0.0057282	12.5000
QCD_Pt-170to300	120300	1423446	1	198	0.0001391	0.1171353	0.0083244	7.1067
QCD_Pt-300to470	7475	2247929	1	2103	0.0009355	0.0489515	0.0010674	2.1806
QCD_Pt-470to600	587.1	2925749	1	5755	0.0019670	0.0080839	0.0001066	1.3182
QCD_Pt-600to800	167	2925749	1	5755	0.0019670	0.0022994	0.0000303	1.3182
QCD_Pt-800to1000	28.25	499998	1	3001	0.0060020	0.0011869	0.0000217	1.8254
QCD_Pt-1000to1400	8.195	499986	1	4868	0.0097363	0.0005585	0.0000080	1.4333
QCD_Pt-1400to1800	0.7346	488314	1	7039	0.0144149	0.0000741	0.0000009	1.1919
QCD_Pt-1800	0.1091	488939	1	7929	0.0162167	0.0000124	0.0000001	1.1230
Total Rate						0.2417112	0.0240872	9.97%

HCAL Method 3 - HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v2

			HLT_DiPFJet40_DEta3p5_MJJ600_PFMETNoMu80_v2					
Sample	X Sec [pb]	Ev. Processed	Prescale	Ev Pass	Efficiency	Rate [Hz]	Rate Error [Hz]	Rate Error [%]
VBF_HToInv_M-125	3.727	482896	3	38721	0.0801850	0.0006973	0.0000035	0.5082
QCD_Pt-50to80	22110000	3484212	3	64	0.0000184	0.9476346	0.1184543	12.5000
QCD_Pt-80to120	3000114.3	4777411	3	1045	0.0002187	1.5312224	0.0473675	3.0934
QCD_Pt-120to170	493200	4821602	3	5966	0.0012373	1.4239402	0.0184353	1.2947
QCD_Pt-170to300	120300	1423446	3	5523	0.0038800	1.0891218	0.0146551	1.3456
QCD_Pt-300to470	7475	2247929	3	17525	0.0077961	0.1359764	0.0010272	0.7554
QCD_Pt-470to600	587.1	2925749	3	34115	0.0116603	0.0159734	0.0000865	0.5414
QCD_Pt-600to800	167	2925749	3	34115	0.0116603	0.0045436	0.0000246	0.5414
QCD_Pt-800to1000	28.25	499998	3	11561	0.0231221	0.0015241	0.0000142	0.9300
QCD_Pt-1000to1400	8.195	499986	3	14383	0.0287668	0.0005501	0.0000046	0.8338
QCD_Pt-1400to1800	0.7346	488314	3	15332	0.0313978	0.0000538	0.0000004	0.8076
QCD_Pt-1800	0.1091	488939	3	14073	0.0287827	0.0000073	0.0000001	0.8430
Total Rate						5.1505478	0.2000732	3.88%