

QCD VBF+MET samples for Run II

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2015-05-12



Objectives

Obtain a representative sample (equivalent to 10 fb^{-1} or more) of QCD with our signal characteristics.

- 2 or more QCD jets with VBF characteristics
- Large MET

Strategy

Cut at Generator Level and after SIM (at Level 1 Trigger Quantities)

- Generator level cut over a AK4 GenJet pair
- Cut at L1 Trigger MET

Results events will have MET both from real (neutrinos) and fake (mis-measurement) sources

Current working point:

Generator level cut

- Jets: $p_{\perp} > 50$, $|\eta| < 4.75$,
- Dijet: $\Delta_{\eta} > 3.0$, $\Delta_{\phi} < 2.0$, $m_{jj} > 1000$

Events will pass if any dijet is found passing conditions of all.

Level-1 Trigger cut

- $L1_{ETM} > 70$

Generator Level Cut Statistics

Values obtained with CMSSW_7_2_0_patch1 over 1M events simulation with average PU 30 (50 ns separation).

Results:

pT hat	Generator Filter		Events 10fb-1	CPU Time		
	Passed	Filter Eff	Pass Filter	1 CPU (s)	5k CPU (h)	5k CPU (d)
30-50	3	3.00×10^{-6}	4.85×10^6	3.58×10^8	19.90	0.83
50-80	415	4.15×10^{-4}	9.18×10^7	9.88×10^9	548.98	22.87
80-120	3399	3.40×10^{-3}	1.02×10^8	1.30×10^{10}	721.71	30.07
120-170	9935	9.94×10^{-3}	4.90×10^7	4.03×10^9	223.68	9.32
170-300	21894	2.19×10^{-2}	2.63×10^7	3.81×10^9	211.82	8.83
300-470	48211	4.82×10^{-2}	3.60×10^6	4.15×10^8	23.07	0.96
470-600	68519	6.85×10^{-2}	4.02×10^5	5.40×10^7	3.00	0.12
600-800	77383	7.74×10^{-2}	1.29×10^5	2.03×10^7	1.13	0.05
Total			2.78×10^8	3.16×10^{10}	1753.29	73.05

- Sample could be produced with in about 75 days assuming usage of 5k CPU.
- This is equivalent of the processing of 280M events through SIM and DIGI.
- Not all events are stored since offline cuts will be in place.

Both Filter Statistics

Results here are for an offline cut of $L1_{ETM} \geq 70$ GeV. This is the current seed for our HLT Paths.

Results:

pT hat	Gen. Ev.	Generator Filter		Offline Filter		Both Filters	Events 10fb-1	
		Pass	Efficiency	Pass	Efficiency	Efficiency	Expected	Pass Both
30-50	88320000	3903	0.0000442	21	0.00538	2.38×10^{-7}	1.62×10^{12}	3.84×10^5
50-80	39500000	47391	0.0011998	2609	0.05505	6.61×10^{-5}	2.21×10^{11}	1.46×10^7
80-120	7562000	42508	0.0056213	8929	0.21005	1.18×10^{-3}	3.00×10^{10}	3.54×10^7
120-170	4788000	63982	0.0133630	24461	0.38231	5.11×10^{-3}	4.93×10^9	2.52×10^7
170-300	1400000	38240	0.0273143	17691	0.46263	1.26×10^{-2}	1.20×10^9	1.52×10^7
300-470	913100	52334	0.0573146	30077	0.57471	3.29×10^{-2}	7.48×10^7	2.46×10^6
470-600	632000	51615	0.0816693	32939	0.63817	5.21×10^{-2}	5.87×10^6	3.06×10^5
600-800	534600	49347	0.0923064	34382	0.69674	6.43×10^{-2}	1.67×10^6	1.07×10^5
Total								9.37×10^7

- Total amount of events passing cuts on all samples is 94M (average around 12M per pT hat).
- Biggest pT hat sample would be 80-120 with 35M events.
- L1T trigger algorithms and simulation have changed since CMSSW_7_2_0_patch1 (example PU subtraction and better resolution) this values “may have improved”.



Summary:

- A working point for producing QCD VBF-like + MET samples without a Generator MET cut was found.
- It includes a dijet delta phi cut but this was tuned to not cut into Run I published analysis signal region.
- Production is feasible with a reasonable number of CPU in less than 3 months.
- Similar to some of the large samples already made by central production
- Final sample size of around 94M events (About twice the Minimum Bias sample from Fall13-POSTLS162)
- New technique should allow for que first to study QCD contamination to this analysis (real and fake MET events).