

Run 2 Trigger Study and VBF QCD samples

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Topics

- Update on L1 and HLT efficiencies for 13 TeV for the 3 TSG proposed scenarios
- Update Comparison between 8 TeV and 13 TeV samples (now including all L1 seeds).
- Attempt to use QCD VBF samples to estimate QCD contribution in data

Last time I presented the pythia6 signal samples. For this presentation I have re-run the L1+HLT code (frozen 8E33v2 version) over the POWHEG signal samples. Had to start from GEN-SIM since this is not possible over AODSIM.

8 TeV Dataset

Sample
/VBF_HToInvisible_M-125_8TeV-powheg-pythia6/Summer12-START53_V7C-v1/GEN-SIM

Now both sides (8 TeV and 13 TeV) can be directly compared since they were made using same generator and higgs mass.

13 TeV Dataset

Sample	Events
/VBF_HToInv_M-125_13TeV_powheg-pythia6/Fall13dr-tsg_PU20bx25_POSTLS162_V2-v1/AODSIM	484096
/VBF_HToInv_M-125_13TeV_powheg-pythia6/Fall13dr-tsg_PU40bx50_POSTLS162_V2-v1/AODSIM	482996
/VBF_HToInv_M-125_13TeV_powheg-pythia6/Fall13dr-tsg_PU40bx25_POSTLS162_V2-v1/AODSIM	483696

Lets review our HLT paths and their corresponding seeds:

HLT Paths vs. Seeds

HLT Path	Seeds
HLT_DiPFJet40PFMETnoMu65MJJ600VBFLeadingJets HLT_DiPFJet40PFMETnoMu65MJJ800VBFAllJets	L1.ETM40 L1.ETM40
HLT_DiJet20_MJJ650_AllJets.DEta3p5_VBF HLT_DiJet30_MJJ700_AllJets.DEta3p5_VBF HLT_DiJet35_MJJ650_AllJets.DEta3p5_VBF HLT_DiJet35_MJJ700_AllJets.DEta3p5_VBF HLT_DiJet35_MJJ750_AllJets.DEta3p5_VBF	L1.HTT200 OR L1.HTT175 OR L1.ETM40 OR L1.ETM50 L1.HTT200 OR L1.HTT175 OR L1.ETM40 OR L1.ETM50 L1.HTT200 OR L1.HTT175 OR L1.HTT150 OR L1.ETM40 L1.HTT200 OR L1.HTT175 OR L1.ETM40 L1.HTT200 OR L1.HTT175 OR L1.ETM40

Even though we only use L1.ETM seeded events parked data paths have L1.HTT seeds too.

Efficiencies

Trigger	8 TeV	13 TeV		
	POWHEG	PU40bx50	PU20bx25	PU40bx25
Events	96286	483696	484096	482996
Level 1				
L1.ETM40	0.4508 ± 0.0022	0.4983 ± 0.0010	0.4808 ± 0.0010	0.5268 ± 0.0010
L1.ETM50	0.3584 ± 0.0019	0.4019 ± 0.0009	0.3893 ± 0.0009	0.4268 ± 0.0009
L1.HTT150	0.0518 ± 0.0007	0.2701 ± 0.0007	0.1467 ± 0.0006	0.4804 ± 0.0010
L1.HTT175	0.0349 ± 0.0006	0.1989 ± 0.0006	0.1025 ± 0.0005	0.3907 ± 0.0009
L1.HTT200	0.0238 ± 0.0005	0.1453 ± 0.0005	0.0718 ± 0.0004	0.3136 ± 0.0008
HLT - Prompt Data				
HLT_DiPFJet40_PFMETnoMu65_MJJ600VBF_LeadingJets_v	0.0798 ± 0.0009	0.1092 ± 0.0005	0.1079 ± 0.0005	0.1168 ± 0.0005
HLT_DiPFJet40_PFMETnoMu65_MJJ800VBF_AllJets_v	0.0575 ± 0.0008	0.0879 ± 0.0004	0.0850 ± 0.0004	0.0920 ± 0.0004
HLT - Parked Data				
HLT_DiJet35_MJJ650_AllJets.DEta3p5.VBF_v	0.1125 ± 0.0011	0.1199 ± 0.0005	0.1249 ± 0.0005	0.0793 ± 0.0004
HLT_DiJet35_MJJ700_AllJets.DEta3p5.VBF_v	0.1023 ± 0.0010	0.1100 ± 0.0005	0.1148 ± 0.0005	0.0692 ± 0.0004
HLT_DiJet35_MJJ750_AllJets.DEta3p5.VBF_v	0.0936 ± 0.0010	0.1020 ± 0.0005	0.1062 ± 0.0005	0.0620 ± 0.0004
HLT_DiJet20_MJJ650_AllJets.DEta3p5.HT120.VBF_v	0.1014 ± 0.0010	0.1376 ± 0.0005	0.1498 ± 0.0006	0.1054 ± 0.0005
HLT_DiJet30_MJJ700_AllJets.DEta3p5.VBF_v	0.1125 ± 0.0011	0.1250 ± 0.0005	0.1280 ± 0.0005	0.0776 ± 0.0004

Since last week:

- I did find that 2 of the columns were swapped.
- Included statistical error on the measurement of efficiency.
- Included all L1 triggers that are used to seed out HLT paths.

Note:

- ETM seeds increase in efficiency slowly with PU.
- HTT seeds increase in efficiency with increase of PU (inversely with bunch spacing). Strangely 2X efficiency from PU40bx50 to PU40bx25
- All prompt triggers increase efficiency with PU, but parked (with no MET) seem to decrease efficiency.

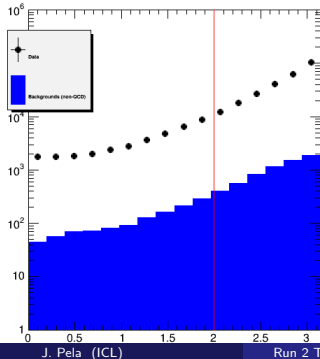


Study of QCD VBF samples to estimate QCD contribution in data

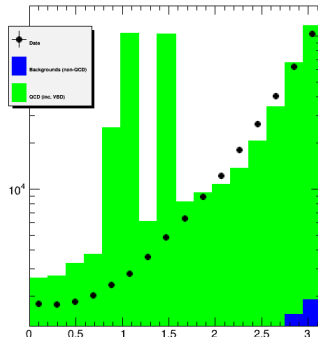
Method

- Select events that pass BDT just under threshold ($0.1 > BDT_{score} > 0.3$)
- Count event on High Delta Phi of data, subtract non QCD bkg and use that number to normalise QCD
- Compare plots

Without QCD



With QCD



Summary:

- Trigger study almost finished only HLT candidates study remains. Offline selection analysis would be the next step.
- Looks like there are some significant differences in shape in Delta Phi from VBF QCD to data.

Next Steps:

- More plots coming soon.
- For discussion.

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