MC VBF+MET QCD Samples

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Introduction and Motivation

Motivation

- Create a set of QCD MC samples that would model adequately events passing our selection.
- Generate enough statistics to represent 2012 dataset (20 fb^{-1})

Caveats:

- Huge cross section of QCD
- We cannot do post RECO selection since this would too time consuming.
- Need to define a QCD Hard scattering minimum to avoid rising cross section of low p_T interactions where VBF+MET type events are not likely anyway

Methodology

We will be looking at gen level particles only to avoid the RECO process

MET

- Select all produced neutrinos and add them vectorially.
- Determine their p_T.

VBF Jets

- Run AK5 genJets (without neutrinos) over gen-particles.
- Select all jets with a given p_T and $|\eta|$.
- Calculate $\Delta\eta$ and M_{jj} for all possible dijet combinations.
- Accept event if one of combinations passes all requirements.

Caveats:

- Thresholds must be set carefully and low enough to represent the QCD that actually passes the analysis (at some cut L1+HLT, dijet, etc).
- Trigger/variable turn on and efficiency should be taken into account.

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QCD Cross Sections and event predictions for 20 fb^{-1}

From the current samples and cross sections we can easily extrapolate what would be the expected number of events for each p_T hat for an integrated luminosity of 20 fb^{-1}.

Sample	Cross Section (pb)	Events for 20 fb^{-1}
QCD-Pt-30to50-pythia6	66285328	1325706560000
QCD-Pt-50to80-pythia6	8148778	162975560000
QCD-Pt-80to120-pythia6	1033680	20673600000
QCD-Pt-120to170-pythia6	156293,3	3125866000
QCD-Pt-170to300-pythia6	34138,15	682763000
QCD-Pt-300to470-pythia6	1759,549	35190980
QCD-Pt-470to600-pythia6	113,8791	2277582
QCD-Pt-600to800-pythia6	26,9921	539842
QCD-Pt-800to1000-pythia6	3,550036	71000,72
QCD-Pt-1000to1400-pythia6	0,737844	14756,88
QCD-Pt-1400to1800-pythia6	0,03352235	670,45
QCD-Pt-1800-pythia6	0,001829005	36,58

If we consider a minimum p_T for hard scattering of 80 GeV the total cross section for 1226016 pb which implies we need a a rejection factor of 10000 to be able to produce a 20 fb^{-1} sample with 2.5M events.

Filter Efficiency per p_T hat

I tested a working point similar to trigger thresholds:

Filter conditions:

- $MET(neutrinos) > 40\ GeV$
- Jets $p_T > 20\ GeV$ and $|\eta| < 5.0$
- $\Delta\eta > 3.2$ and $M_{jj} > 700\ GeV$

Efficiency:

Cross Sections					
Sample	Gen. Ev	Pass MET	Pass Dijet	Factor	Sample
QCD-Pt-50to80-pythia6	1000000	127	3	0,000003	488927
QCD-Pt-80to120-pythia6	1000000	1172	41	0,000041	847618
QCD-Pt-120to170-pythia6	1000000	4276	293	0,000293	915879
QCD-Pt-170to300-pythia6	1000000	9315	1012	0,001012	690956
QCD-Pt-300to470-pythia6	1000000	17956	2598	0,002598	91426
QCD-Pt-470to600-pythia6	1000000	23913	4187	0,004187	9536

With the obtained rejection factor we can generate the equivalent of 20 fb^{-1} with 3M events I will have to generate at least twice that.

Steps for production

I am replicating the production process of Summer 2012 QCD samples Production so they match the currently used QCD samples. Samples are produced over 3 steps:

Step 1 - Hard process

- Made with CMSSW_5_0_0_patch2.
- Using Pythia6 QCD normal configuration fragments with 2 additional filters over GEN level.

Step 2 - Pileup addition

- Made with CMSSW_5_3_2_patch4
- Doing REDIGI using frontier tags START53_V7A and for pileup 2012_Summer_50ns_PoissonOOTPU

Step 1 - RECO

- Made with CMSSW_5_3_2_patch4
- RECO process and output of AODSIM output

Production Status

Step I - Status

Sample	Jobs	Done	Events	Target	Int. Lumi (fb^{-1})
QCD-Pt-80to120	5000	206	?	847618	
QCD-Pt-120to170	3500	3500	1985505	915879	43.36
QCD-Pt-170to300	5000	5000	3465175	690956	100.30
QCD-Pt-300to470	400	400	214621	91426	46.95
QCD-Pt-470to600	250	250	104264	9536	218.67

All samples except QCD-Pt-80to120 (had to be resubmitted) have finished step 1 and have been published on cms_dbs_ph_analysis_01.

Conclusions

Status and next steps

- Working point with the necessary rejection factor was determined and samples are now under production
- Currently stuck at step 1 since PU samples are needed for the mixing (in contact with experts)
- Validation in start in parallel to production.
- To note the this samples will simulated events with real MET and real genJets, and not events where full MET or jets are faked.