SPRACE Group

Graviton Analysis Update

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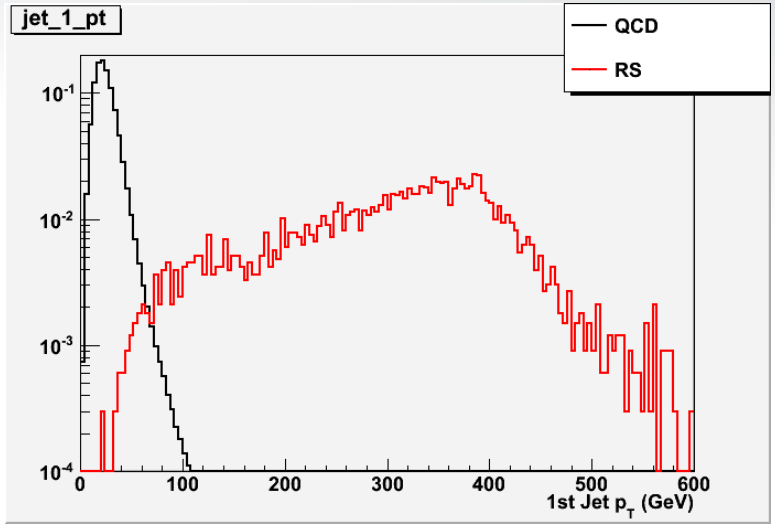
Samples Used

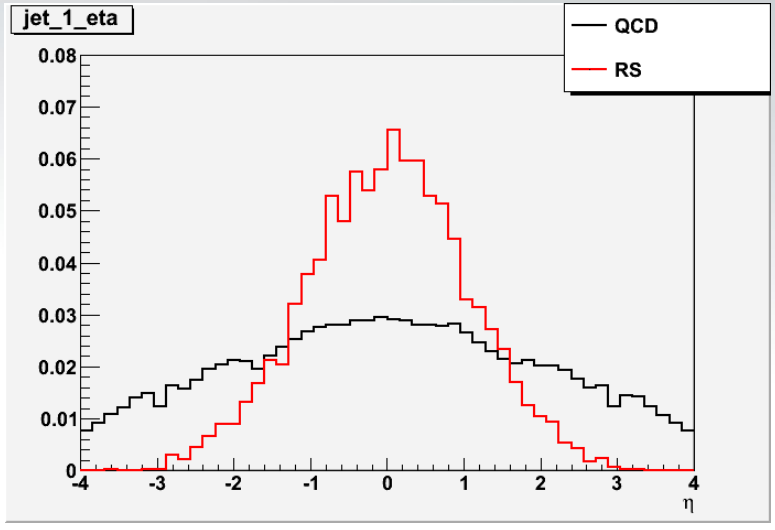
- Official Summer 2009 Production Pythia6 QCD Sample
  - /QCD_Pt15/Summer09-MC_31X_V3_7TeV-v1/GEN-SIM-RECO
  - 6.5M events, pthat > 15 GeV, event weight ~ 14000.
- Private-produced RS → ZZ → q qbar nu nubar → jets + MET
  - 5145 events, σ = 0.119 pb (Z decay fully inclusive)
  - M_G = 800 GeV, (k / M_P) = c = 0.05
  - 28% chance of Z → q q bar nu nubar
  - Cross-section for signal = 0.0397 pb
- What makes signal different from background?
  - Presence of real MET
  - Presence of a single, high-momentum, FAT jet.

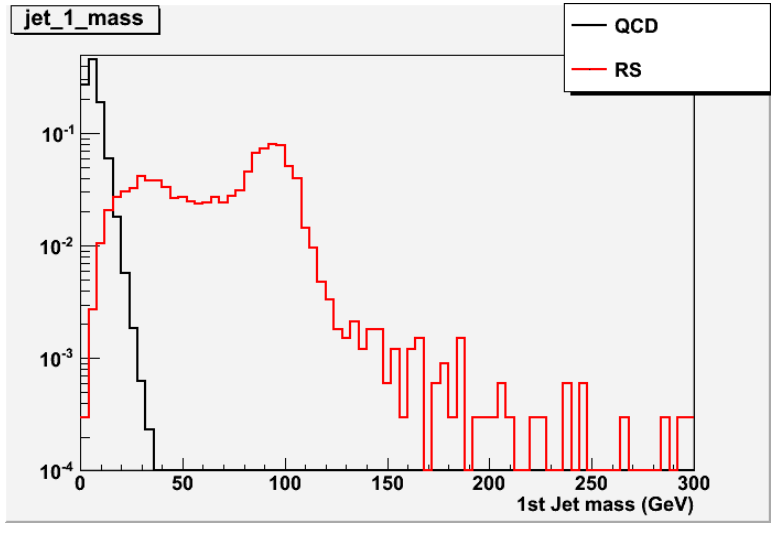
Definition of Objects

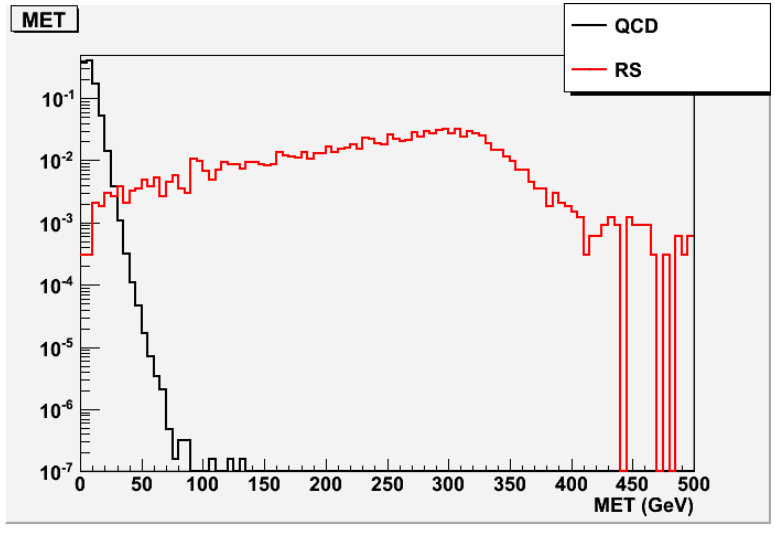
- Jet: calorimeter-based jet (made from standard calorimetric towers)
  - SISCone algorithm, $\Delta R = 0.7$
  - Subject to standard CMS L2 and L3 corrections (according to eta and pT of the jet).
  - Subject to the minimal jet ID cut (|eta| > 2.6 OR EMF > 0.01)
- MET: absolute value of the vectorial sum (in the transverse plane) of all calorimeter cells.
  - Corrected for the presence of globalMuons in the event (corMetGlobalMuons)

Distributions of Interest









Cut-based Analysis

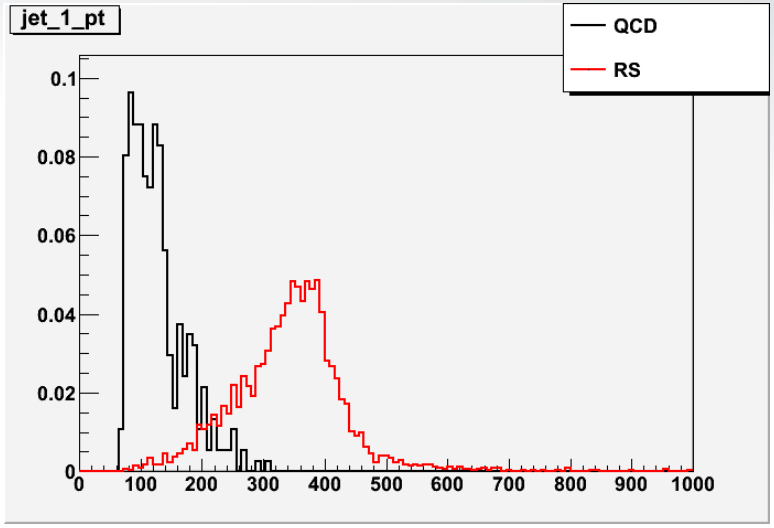
- First approximation: select events where the variables of interest are in the signal dominated region (namely, the crossing points in the distributions).
  - MET > 30 GeV
  - pT of the leading jet > 70 GeV
  - |eta| of the leading jet < 1.2
  - Mass of the leading jet > 20 GeV
- We also cut on the presence of anomalous HCAL noise in the event.

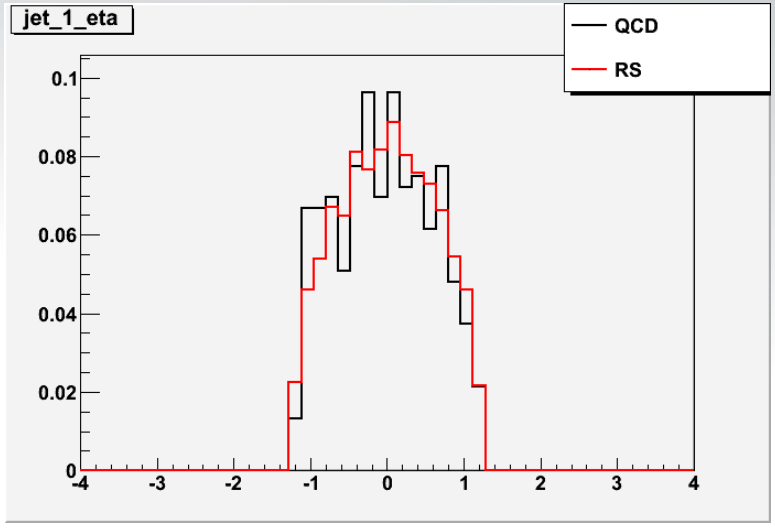
Cut-based Analysis

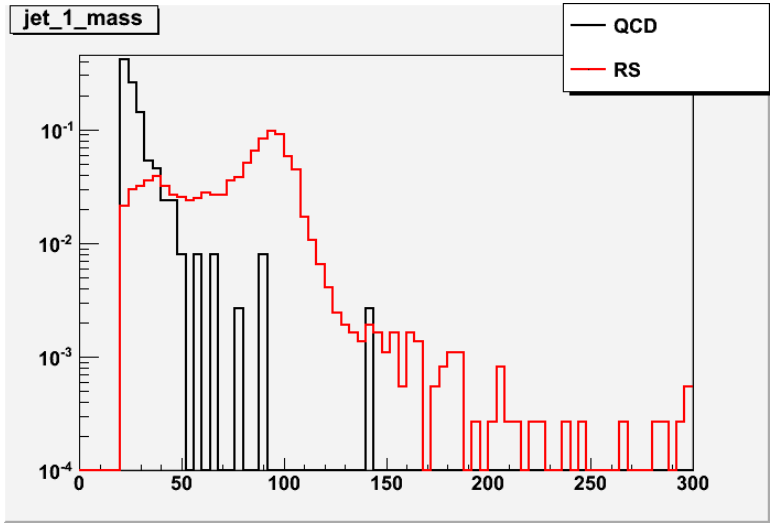
Cut	QCD	RS
No cuts	6256300	5145
Noise cut	6256300	5033
>= 1 jet (w/ ID)	6106643	5033
jet pT > 70 GeV	30064	4978
|eta| < 1.2	16620	3804
jet mass > 20 GeV	3588	3694
MET > 30 GeV	374	3687
Total efficiency	5.97E-05	0.717

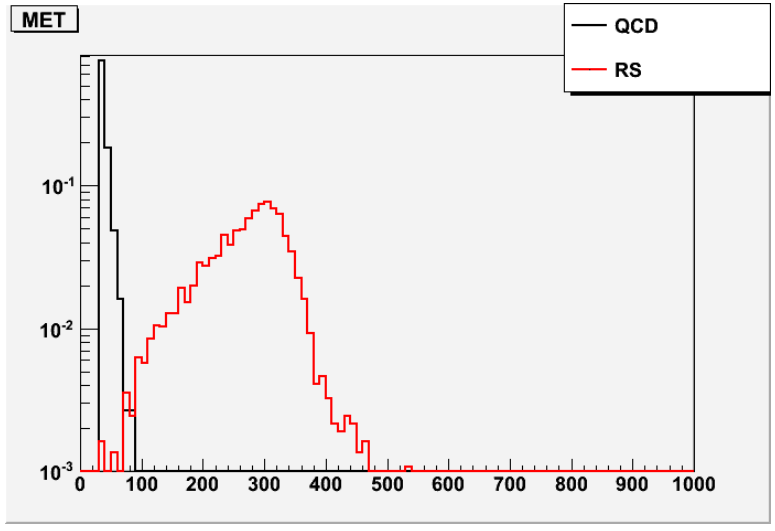
- Efficiency is very good for the signal, and very bad (which is GOOD) for the background.
- But the sheer cross-section of QCD means that we still have to deal with ~ 5.3 M events that pass those cuts.

Distributions of Interest









Some Remarks

- It seems to me that I can cut harder on some variables (jet pT, jet mass and MET).
- On the other hand, the eta cut doesn't seem to be useful.
- Check the existence of correlations in between the variables.
- Notice that I get the mass of the Z boson more correct now! That is because I am using corrected jets.
  - I have done some back of the envelope calculations that show that the shift in the mass of a jet due to the mismeasurements of the constituents' energy is ~ proportional to the energy of the constituents → proportionality to the energy of the jet.
- Perhaps I should cut on a ratio mass / energy of the jet, instead of pure mass?

Some Remarks

- Perhaps I should veto on the presence of extra jets?
  - Perhaps veto jets back to back with my fat jet? That would probably kill the rest of QCD.
  - In this sense, the analysis becomes much like the monojet analysis pushed by Albert de Roeck.
- Other variables?
- No possible full kinematic construction. Ideas?
- Other tools? Compound Jets?

Some Remarks

- It seems to me that I can cut harder on some variables (jet pT, jet mass and MET).
- On the other hand, the eta cut doesn't seem to be useful.
- Clearly there are some correlations in between the variables.
  - Notice that I cut at 30 GeV jet pt, but I get almost a 60 GeV threshold in the distribution!
- Notice that I get the mass of the Z boson correct now(