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MADGRAPH vs PYTHIA

modifying cross sections



analysis configuration

- ✗ CMSSW version: **CMSSW_2_2_6**
running on our GRID site, **T3_GR Ioannina**
- ✗ Data used are stored on the SE of T3_GR_Ioannina :
<https://cmsweb.cern.ch/phedex/prod/Data::Subscriptions?node=761>
- ✗ jet algorithm: **SC7**
- ✗ good jets: **$p_T \geq 50$ GeV**
- ✗ eta cut applied: **$|\eta| \leq 2.5$**
- ✗ CALO jet corrections: **L2L3JetCorrectorSC7Calo**
- ✗ definitions:
 $H_T = \sum p_T$ over all jets
 $R_{32} = \# \text{ events with } \geq 3 \text{ good jets} / \# \text{ events with } \geq 2 \text{ good jets}$



analysis plots

Modified the Madgraph cross sections, to study the effect on the various distributions.
For each XS configuration, different sets of plots were produced and were organized in different web pages.

- ✘ Madgraph XS **increased by 50%** for H_{τ} hat \in (100, 250) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_07.php
- ✘ Madgraph XS **decreased by 50%** for H_{τ} hat \in (100, 250) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_11.php
- ✘ Madgraph XS **increased by 50%** for H_{τ} hat \in (250, 500) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_08.php
- ✘ Madgraph XS **decreased by 50%** for H_{τ} hat \in (250, 500) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_12.php
- ✘ Madgraph XS **increased by 50%** for H_{τ} hat \in (500, 1000) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_09.php
- ✘ Madgraph XS **decreased by 50%** for H_{τ} hat \in (500, 1000) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_13.php
- ✘ Madgraph XS **increased by 50%** for H_{τ} hat \in (1000, ∞) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_10.php
- ✘ Madgraph XS **decreased by 50%** for H_{τ} hat \in (1000, ∞) GeV
http://pc139.physics.uoi.gr/madgraph-WWW/madgraph_14.php



MADGRAPH data

Datasets:

/QCD $nnnto$ nnn -madgraph/Fall08_IDEAL_V9_ $vnnn$ /GEN-SIM-RECO

(Used ~50 files per slice)

H_T -hat slice	nominal cross section (pb)	# of events
0100_0250	15000000.00	310155
0250_0500	400000.00	234160
0500_1000	14000.00	186032
1000_inf	370.00	167717



PYTHIA data

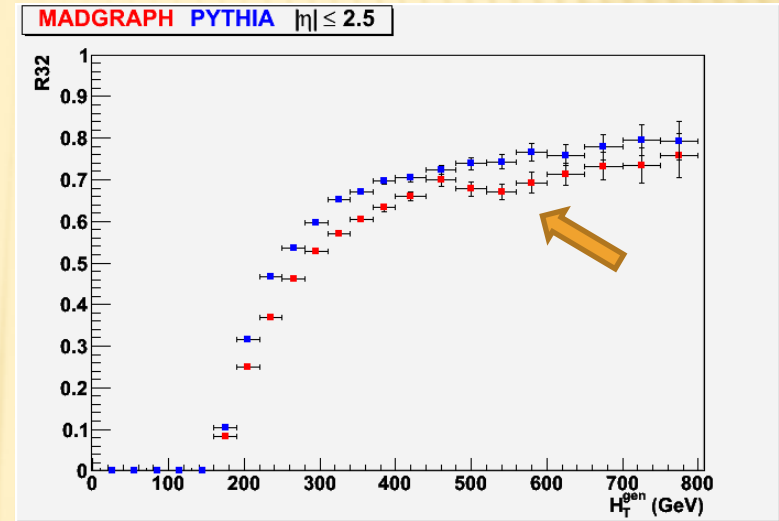
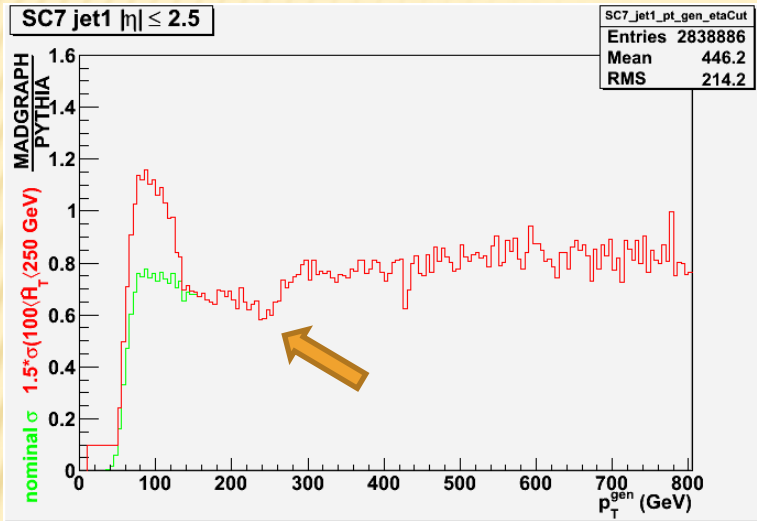
Datasets:

/QCDDiJetPt nn to nnn /Summer08_IDEAL_V9_v nnn /GEN-SIM-RECO

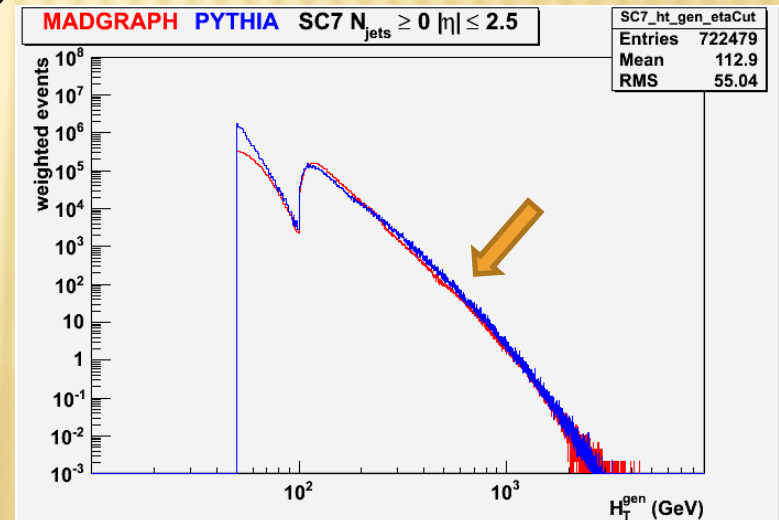
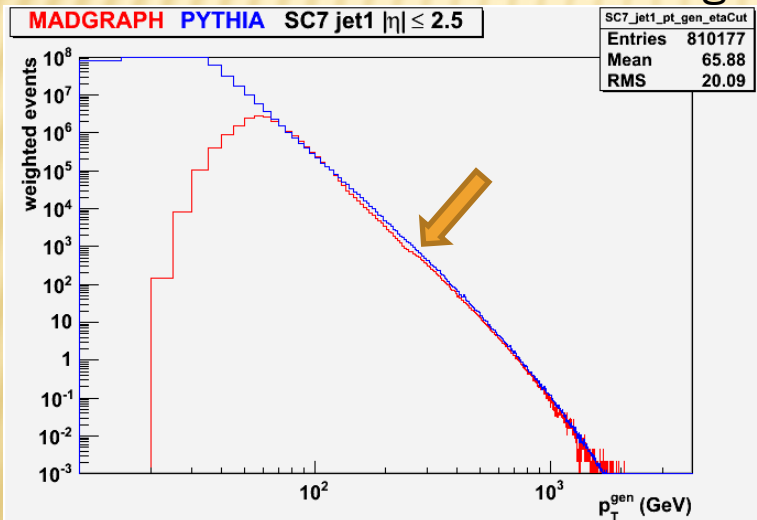
p_T -hat slice	cross section (pb)	# of events
0015_0020	949441000.000000000000	129600
0020_0030	400982000.000000000000	101880
0030_0050	94702500.000000000000	169200
0050_0080	12195900.000000000000	103545
0080_0120	1617240.000000000000	51300
0120_0170	255987.000000000000	50085
0170_0230	48325.000000000000	51840
0230_0500	10623.200000000000	54000
0300_0580	2634.940000000000	60048
0380_0470	722.099000000000	93312
0470_0600	240.983000000000	27648
0600_0800	62.492300000000	30348
0800_1000	9.420620000000	20880
1000_1400	2.343570000000	24640
1400_1800	0.156855000000	27744
1800_2200	0.013811000000	22848
2200_2600	0.001296080000	22560
2600_3000	0.000114040000	28800
3000_3500	0.00000843180	20880
3500_inf	0.00000018146	34320



MG XS +50% H_T cut $\in (100, 250)$ GeV

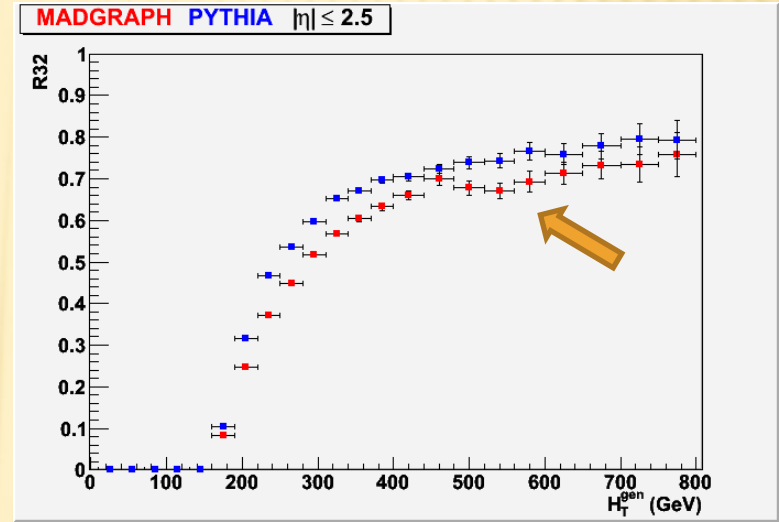
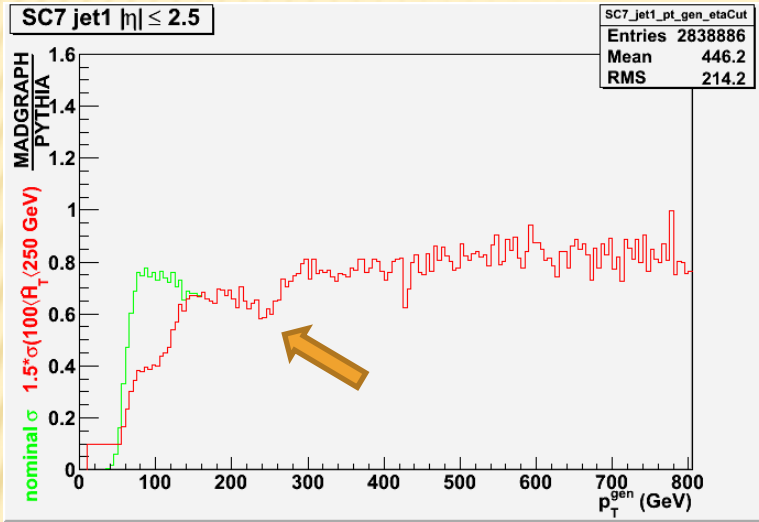


generated jets

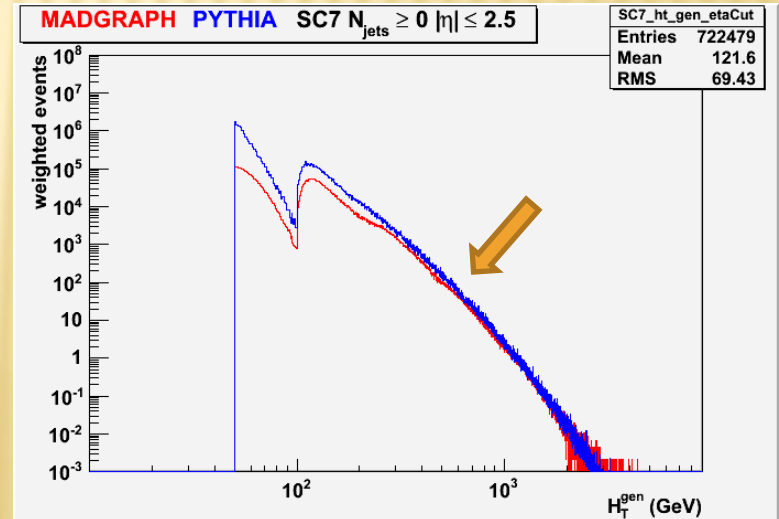
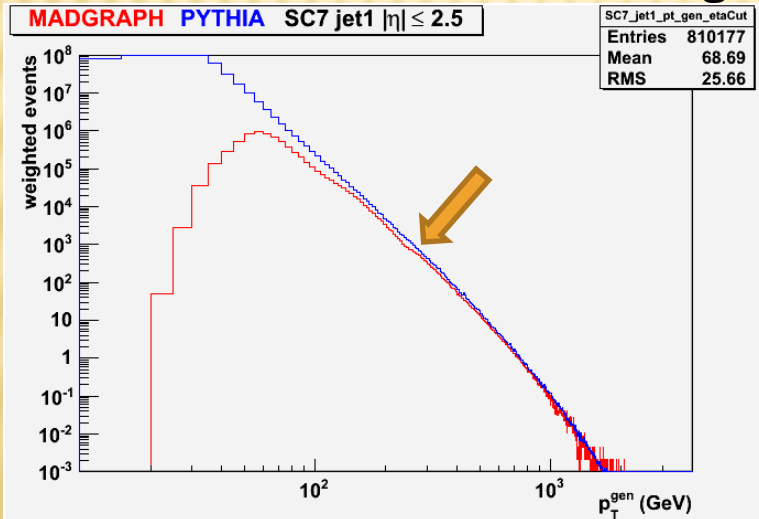




MG XS -50% H_T cut $\in (100, 250)$ GeV

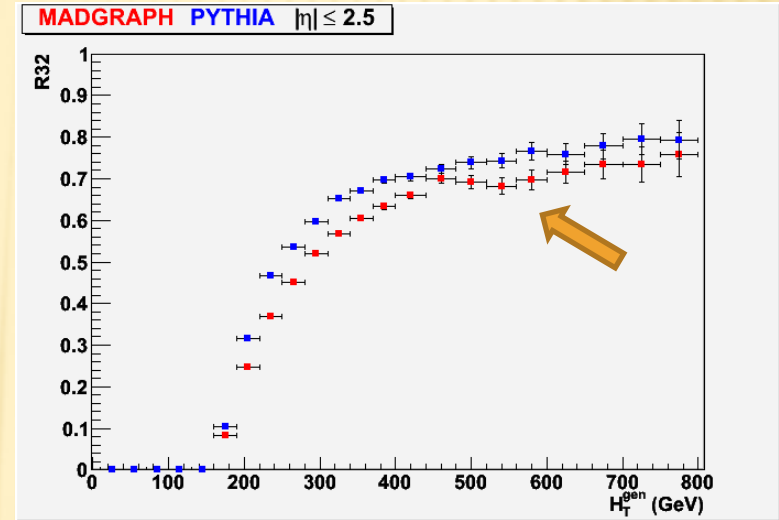
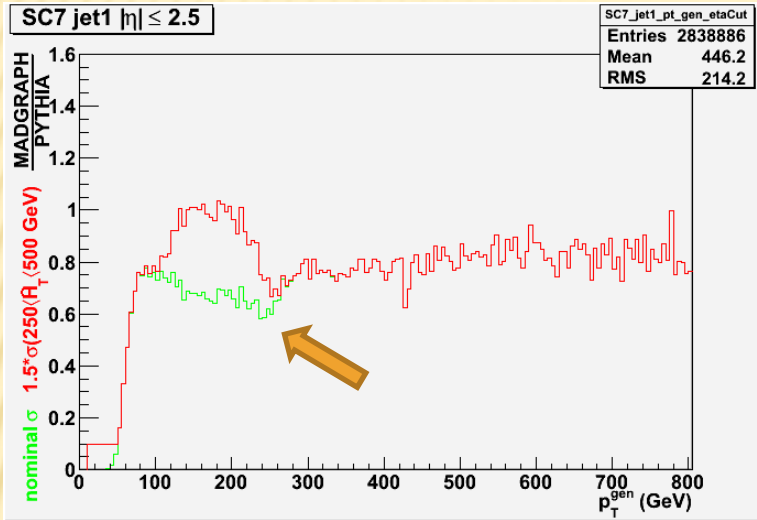


generated jets

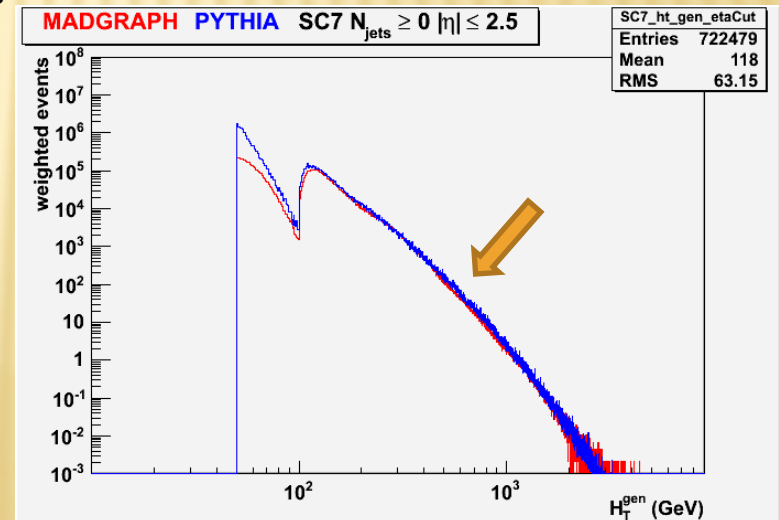
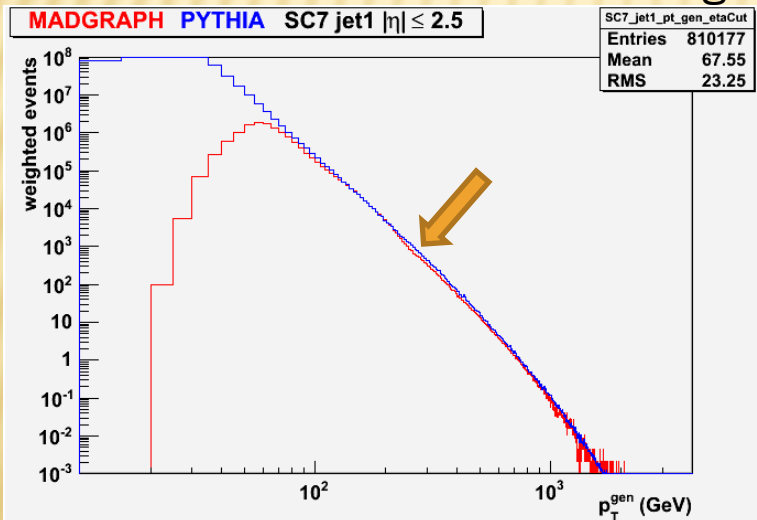




MG XS +50% H_T hat $\in (250, 500)$ GeV

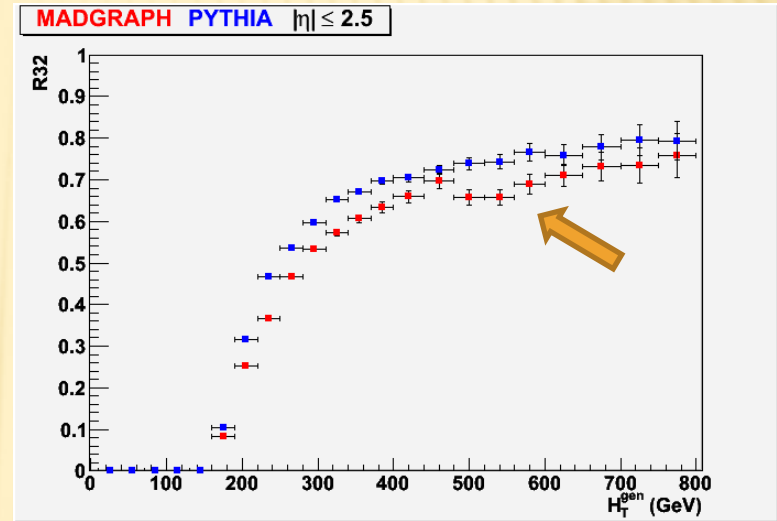
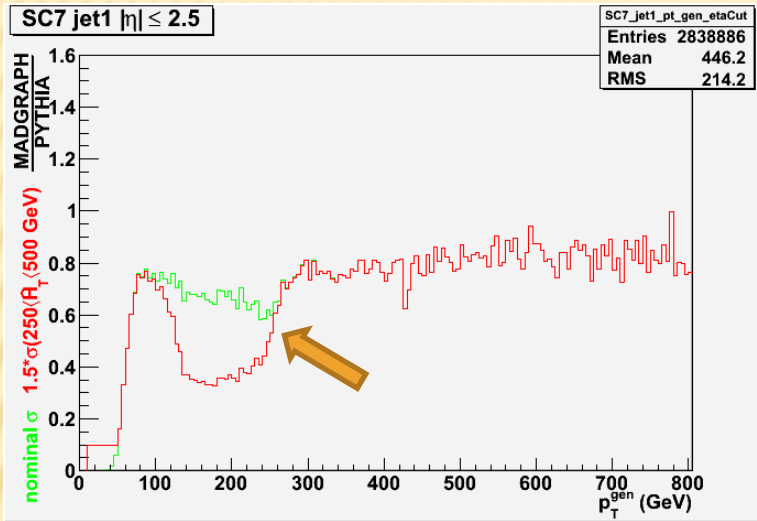


generated jets

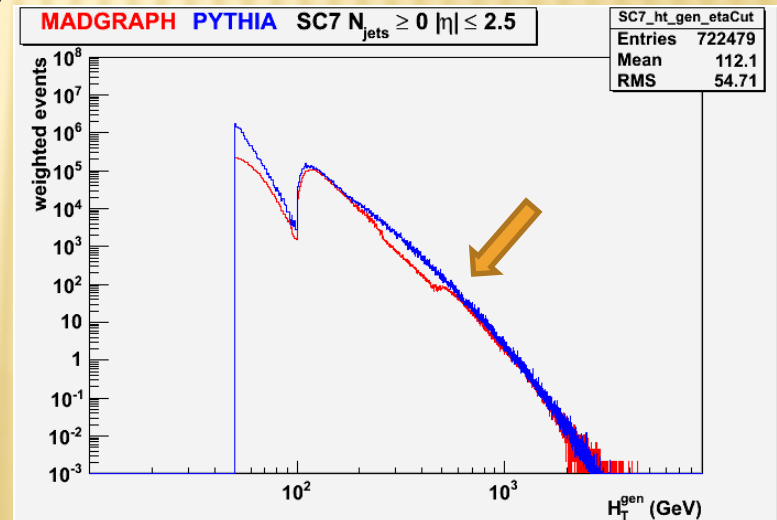
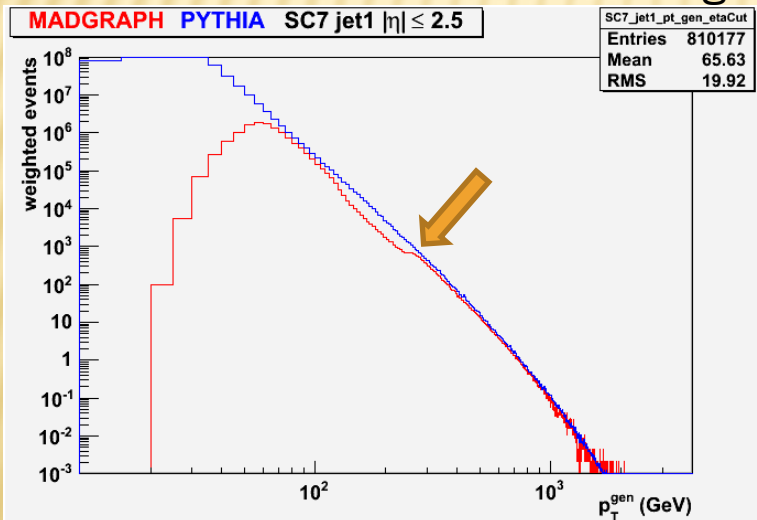




MG XS -50% H_T cut $\in (250, 500)$ GeV

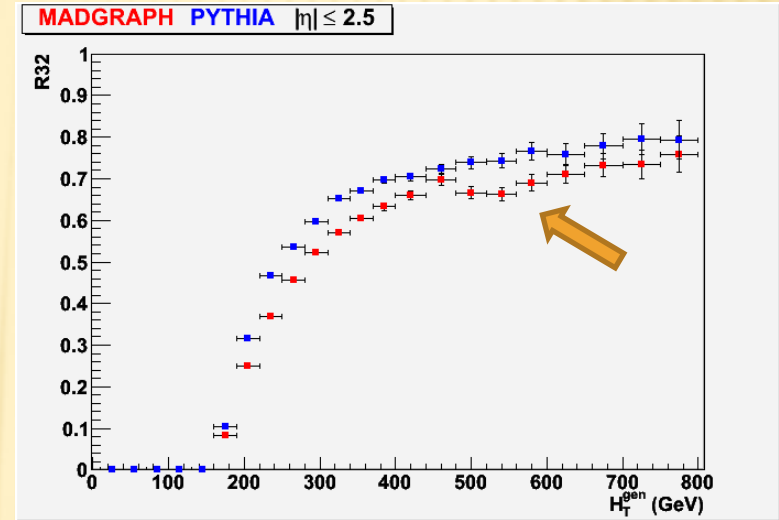
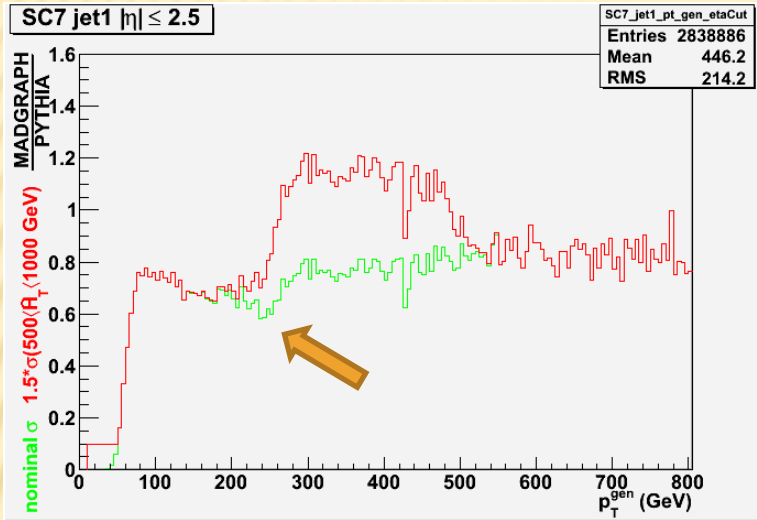


generated jets

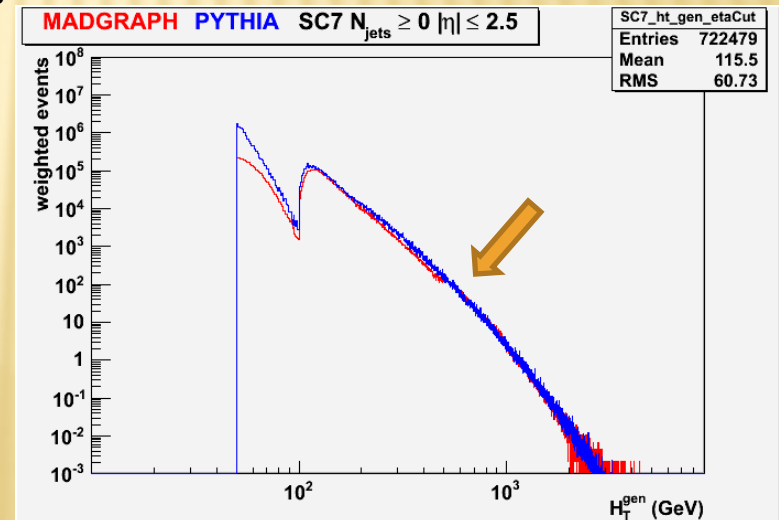
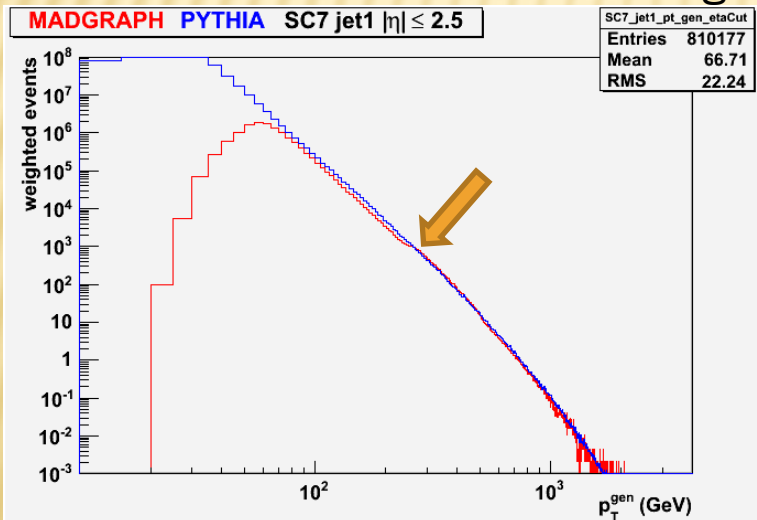




MG XS +50% H_T cut $\in (500, 1000)$ GeV

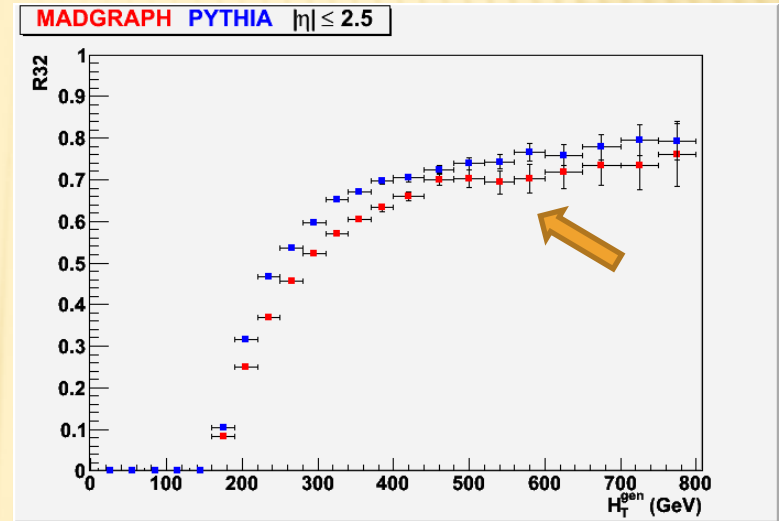
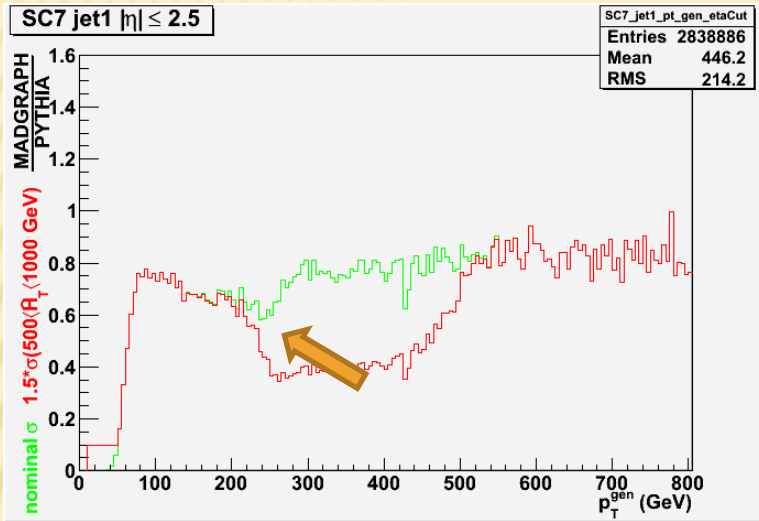


generated jets

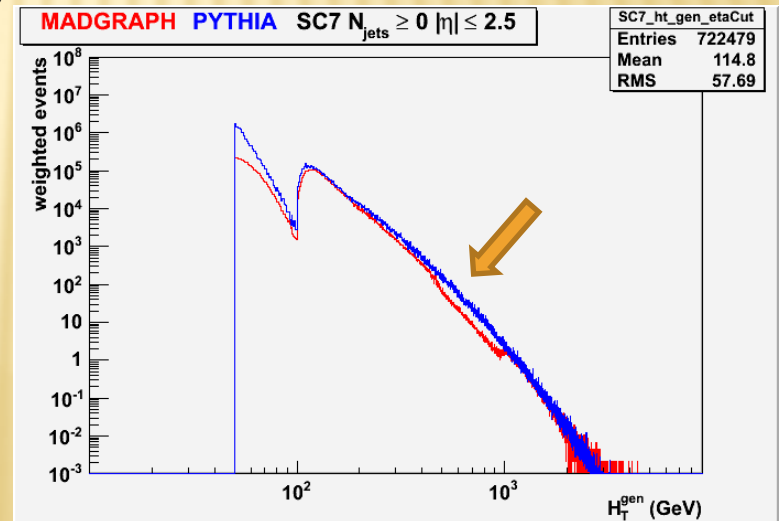
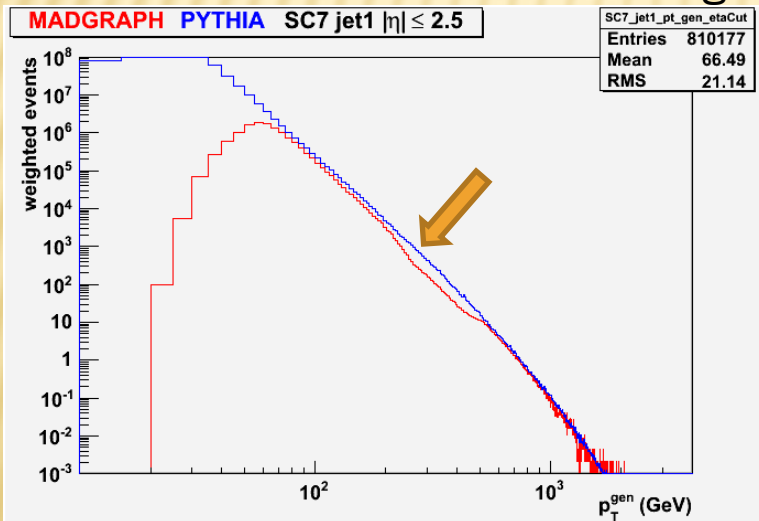




MG XS -50% H_T that $\in (500, 1000)$ GeV

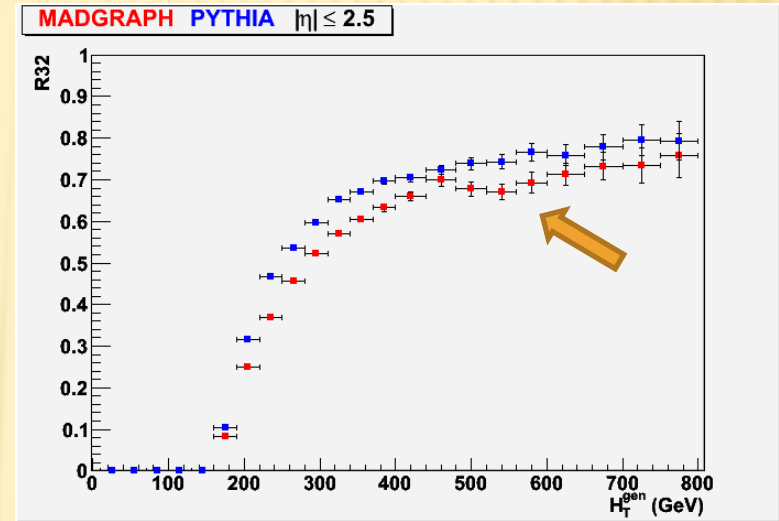
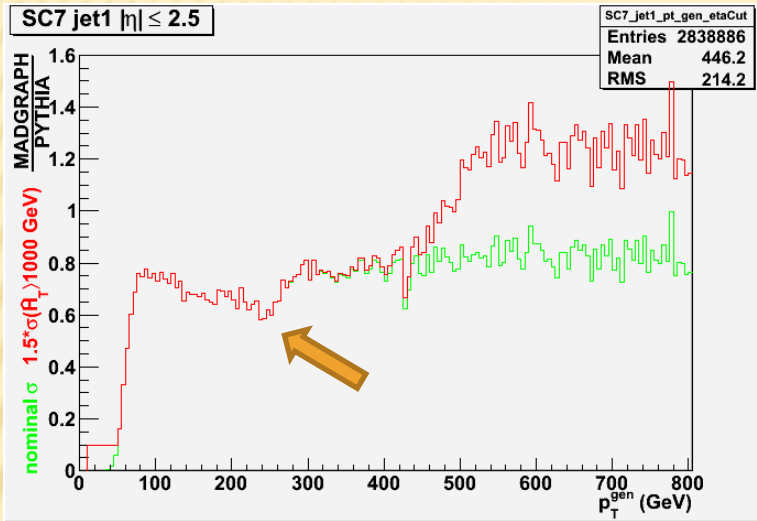


generated jets

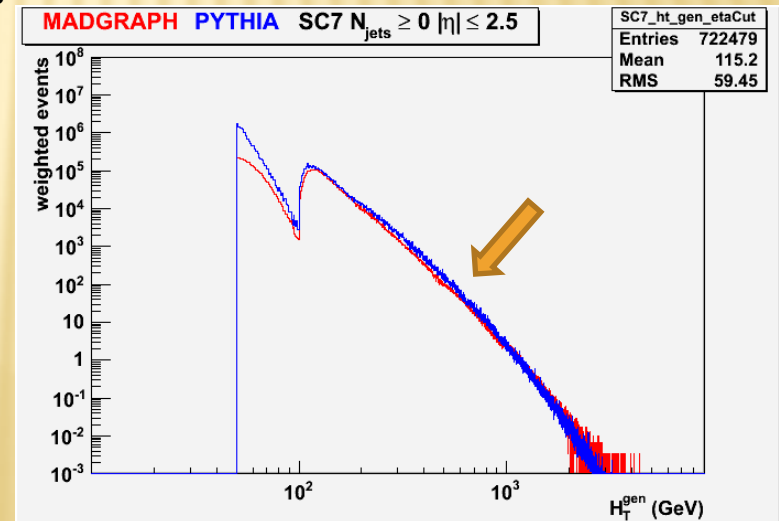
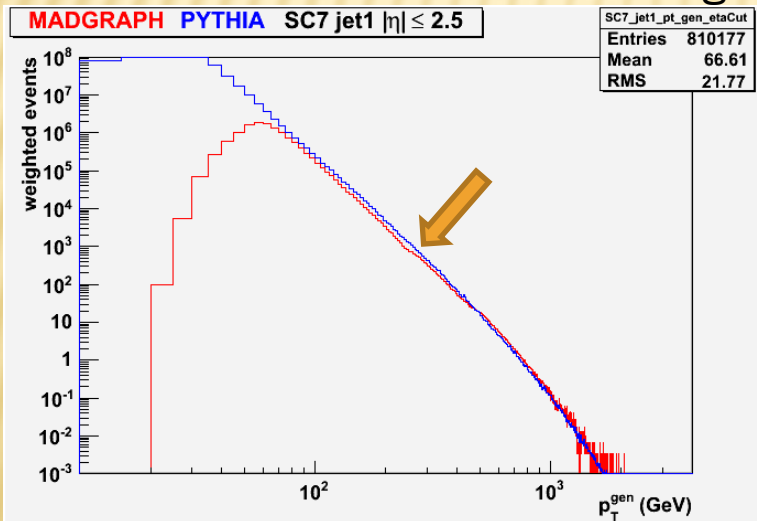




MG XS +50% H_T $\in (1000, \infty)$ GeV

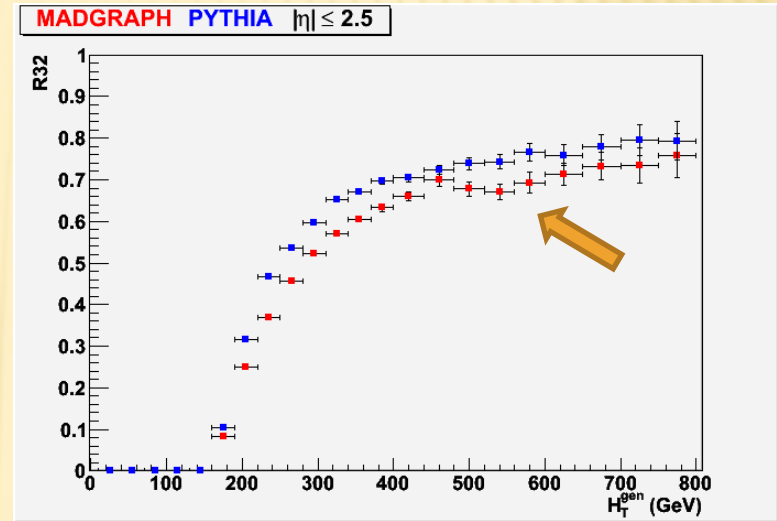
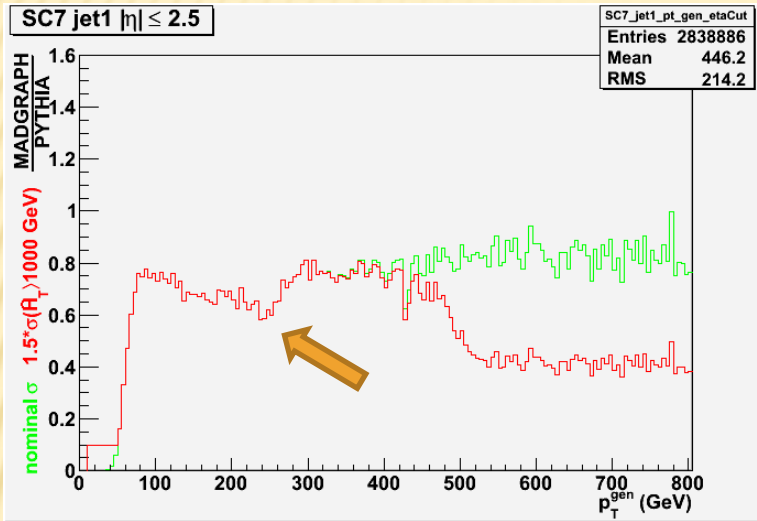


generated jets

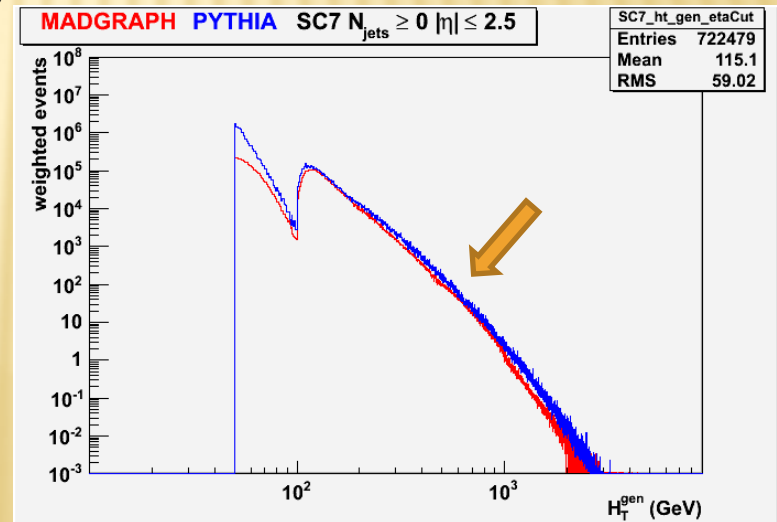
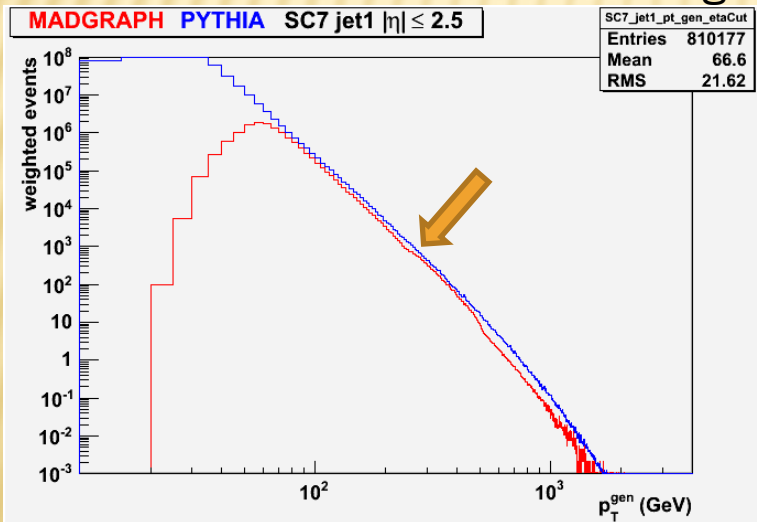




MG XS -50% H_T hat $\in (1000, \infty)$ GeV



generated jets





conclusions

- ✗ Plots shown were only for generated jets (for all plots refer to the web pages shown in slide 3)
- ✗ The Madgraph cross section was dramatically changed by $\pm 50\%$ for each H_T slice, **but**
 - + 1st jet p_T distribution ratio Madgraph/Pythia:
There is always a problem around $p_T \sim 200$ GeV
 - + R32 using Madgraph
There is always a problem around $H_T \sim 550$ GeV
- ✗ The *problem* does not come from an overall slice XS normalization
- ✗ The attempt to compare Madgraph vs Pythia triggered some e-mail exchange:
 - + ... It seems like there is a bug in the calculation of the Matrix Element cross section ...
(*Stephen Mrenna*)
 - + It will be good to fix the Λ_{QCD} in Pythia to the appropriate one,
so MG and PY cross sections agree. The problem is to find a good starting point to do this change.
(*Nikos Varelas*)
 - + ... So somewhere in our CMSSW framework, as Steve found, we are setting wrong values of α_s ! ...
(*Klaus Rabbertz*)
 - + ...
- ✗ No reason to continue further with this kind of Madgraph vs Pythia comparison
- ✗ When bugs are fixed and new MC datasets are available, this analysis may be repeated.