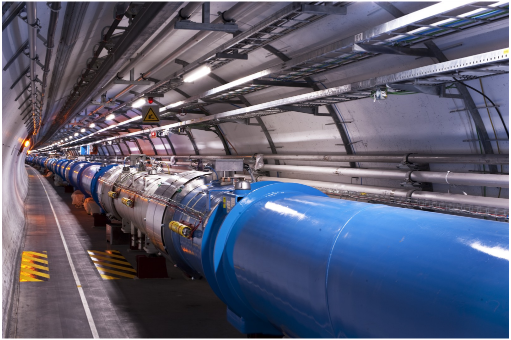
QCD Results from the LHC



Ringberg Castle, September 28, 2011

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Overview

Topics covered

- Inclusive jet production
- Exclusive jet production
- Rapidity gaps, BFKL signatures
- W/Z + n-jet production
- The $t\bar{t}$ cross-section
- The top-quark mass from the $t\bar{t}$ cross-section
- The charge asymmetry in $t\bar{t}$ production

Un-covered topics

- Underlying event structure, hadron production, jet shapes, track jets, jet fragmentation functions, W/Z+*b*-jet-production, direct photons, . . .
- Total pp cross-section
- QCD properties of Pb-Pb collisions

Sorry, the title should really be – Selected QCD Results from ATLAS and CMS –

Theoretical predictions and Monte Carlo tunings

The classes of predictions

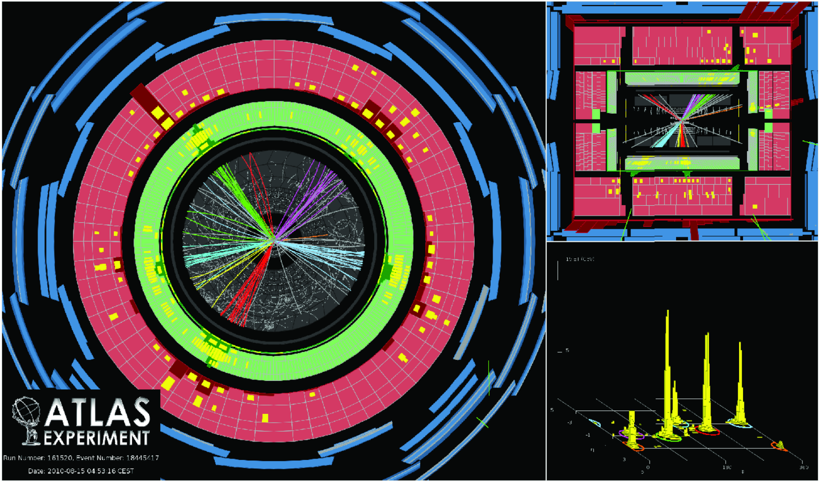
- Leading Order (LO) 2 $\rightarrow$ 2 Matrix Elements (ME) plus Parton Shower (PS). and underlying event (UE): Pythia, Herwig+Jimmy.
- LO 2 $\rightarrow$ n ME: Sherpa, MadGraph, Alpgen plus PS and UE via Pythia or Herwig(PS)+Jimmy(UE).
- NLO calculations for up to n=3 partons: MCFM and NLOJet++.
- NLO calculations plus parton showers: MC@NLO (plus Herwig+Jimmy) and Phoweg (plus Pythia or Herwig+Jimmy).
- All order prediction of wide-angle emissions: HEJ.

The Monte Carlo tunings to data

- ATLAS: Pythia (AMBT, MC09′), Herwig (AUET1), ...
- CMS: Pythia (D6T, Z2, 2C) and Herwig (2.3).

This is a variety of predictions, the data have been compared to all of them.

A six-jet event at the LHC - ATLAS

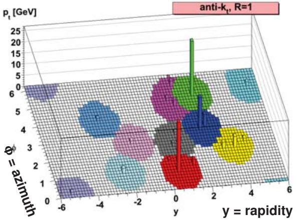


— A rich environment with many jets, underlying event and pile-up, $\langle \mu \rangle \approx 0.1 - 3$ in 2010.

A high performance jet algorithm is needed to get the physics out.

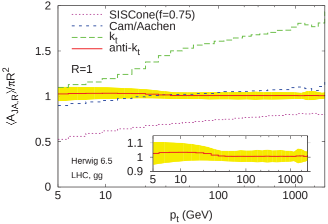
The anti-k_t algorithm - the present work horse

The jet shapes



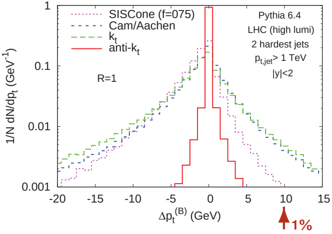
Herwig parton level, + 10^4 soft ghosts.

The average jet area as function of p_t



LHC $gg \to gg$, stable particle, di-jets, R=1

The back-reaction (BR)



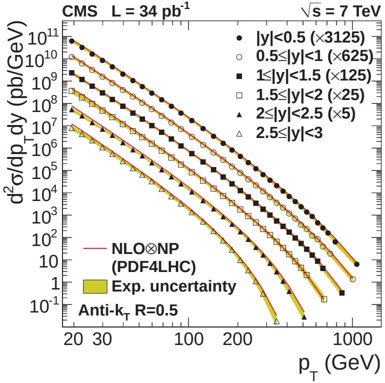
Some details on the algorithm

- $d_{ij} = \min(1/k_{t,i}^2, 1/k_{t,j}^2)\,\frac{\Delta_{ij}^2}{R^2}$, $\quad d_{iB} = 1/k_{t,i}^2$.
- $\Delta_{ij}^2 = (y_i - y_j)^2 + (\Phi_i - \Phi_j)^2$, $\quad R = 0.4 \ldots 1.0$
- For $\Delta_{ij} > R$ the jet with Max k_t stays alone.
- The resulting jet shapes are round and rigid.
- The area is flat with $p_t \to$ stable pile-up contribution.
- BR = Change in p_t due to re-assignment of non-pileup particles when adding 25 pile-up events.

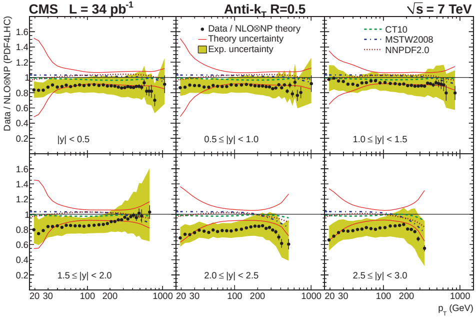
The anti-k_t algorithm has very good properties.

Inclusive jet cross-section - CMS

Double differential cross-section



Comparison to NLO in bins of rapidity



— CMS Particle Flow ($\ell, \gamma, h^{\pm}, h^0$) jets, Δ_{JES}=(3-4)% $\Delta\mathcal{L}_{int}$=4% and NP: Non.-Pert. Unc. = Pythia+Herwig.

— At high p_t the largest theoretical unc. is due to PDFs, i.e. the data start to constrain them.

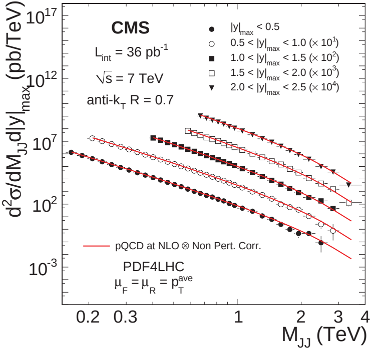
— Experimental uncertainty mainly from Jet Energy Scale (JES), which will decrease.

— The NLOJet++ description of the data is fair, but generally slightly high, esp. at large $|y|$.

Agreement is found within 20%, however deteriorating for larger rapidities.

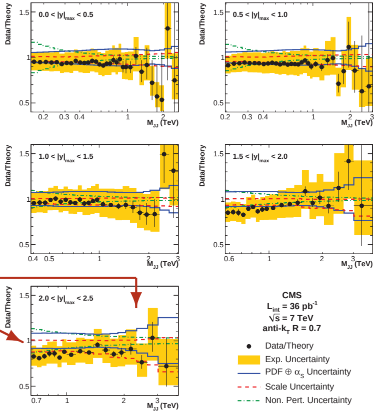
Inclusive di-jet cross-section - CMS

Double differential cross-section



$p_{t,1} > 60$ GeV
$p_{t,2} > 30$ GeV
$|y|_{max} = \max(|y_1|, |y_2|)$

Comparison to NLO in bins of $|y|_{max}$



PDF dominant

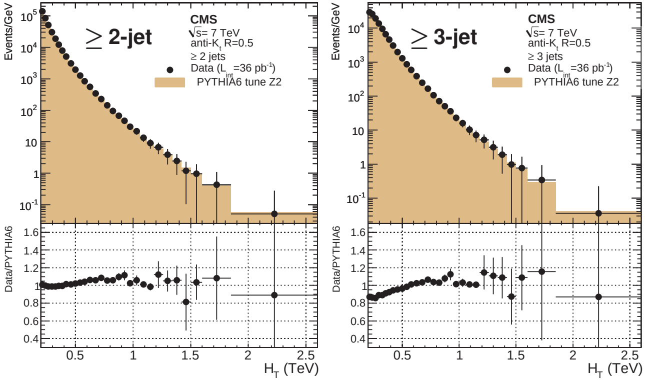
Non. Pert. dominant

- $M_{12}^2 = x_1 x_2 s \Rightarrow$ probing $0.0008 < x_1 x_2 < 0.25$.
- Theo: $\Delta\sigma(PDF) \approx 5\%(30\%)$ for 0.2 TeV(3 TeV)
  Exp: $\Delta\sigma(JES) \approx 15\%(60\%)$ for 0.2 TeV(3 TeV), $\Delta M_{jj} \approx 7\%(3\%)$ for 0.2 TeV(3 TeV).
- Sensitivity: $|y|_{max}$(large) $\Rightarrow$ s-channel, $|y|_{max}$(small) $\Rightarrow$ t-channel.

The di-jet cross-section is well described, but need smaller exp. unc. to constrain the PDFs.

The 3-jet to 2-jet ratio - CMS

The uncorrected H_T distribution for 2-jet and 3-jet inclusive



$p_t > 50$ GeV

$|y| < 2.5$

$H_T = \sum p_{t,i}$

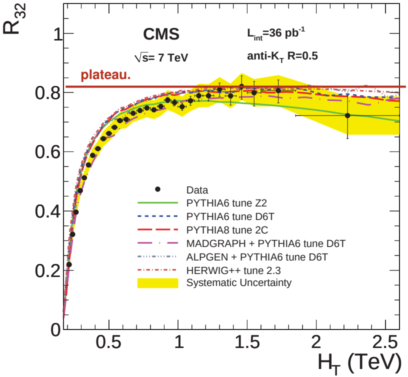
Monte Carlo normalized to $\sigma(\geq 2\text{-jet})$

- $\Delta p_t \approx 12\%(5\%)$ for 50 GeV(1 TeV) and $\Delta H_T \approx 6\%(3.5\%)$ for 50 GeV(1 TeV).
- The Pythia (MadGraph and Herwig) model describes the shapes to $\mathcal{O}(20\%)$.
- The Pythia corrections to the particle level amount to about 4%(2%) for $H_T < (>)$ 0.5 TeV.

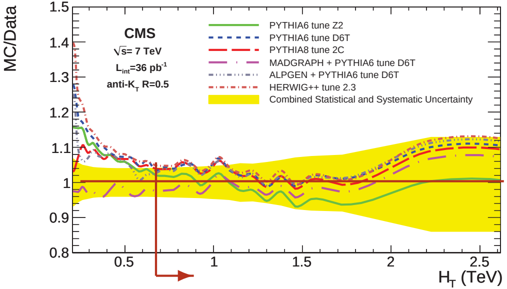
The corrected distributions will be compared to LO 2 $\rightarrow$ n-parton predictions.

The 3-jet to 2-jet ratio - CMS

The corrected 3-jet to 2-jet ratio



Comparison to various predictions



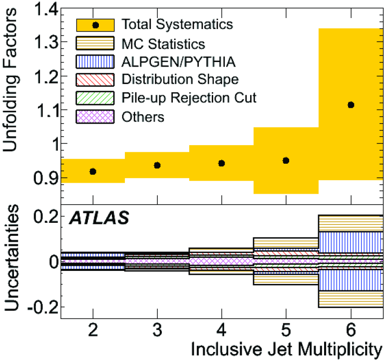
— **Alpgen: MLM matching $p_t = 20$ GeV, R=0.7.**
— **MadGraph: parton matching $p_t = 30$ GeV.**

— **Experimental unc. (4-10)% dominated by the knowledge of the p_t dependence in the MC.**
— **Good description at large H_T. Predictions overestimate data at low-H_T, but for MadGraph.**

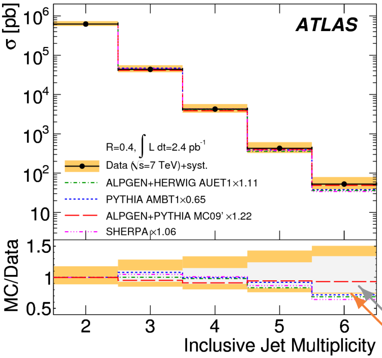
The low-H_T region needs further attention.

Inclusive multi-jet production - ATLAS

The corrections but for the JES



The inclusive jet cross-section



$p_{t,1} > 80$ GeV
$p_{t,i} > 60$ GeV
$|y| < 2.8$

Corrected to particle level, $\tau > 10ps$, including μ, ν.

Normalisations:

Alpgen+H	1.11
Alpgen+P	1.22
Pythia	0.65
Sherpa	1.06

fixed to $\sigma(\geq$ 2-jet)

shape

full -$\mathcal{L}_{int}$

- The corrections are based on Alpgen+(Herwig+Jimmy).
- $\Delta\sigma(JES) \approx +5\%(+2.5\%)$ for 60 GeV(1 TeV), and 'larger' -3% everywhere.
- Compare to LO for R=0.4 (less UE dependent) and to NLO for R=0.6 (less scale dep.).

The inclusive jet multiplicty is well described by the predictions.

Di-jet production with jet veto - ATLAS

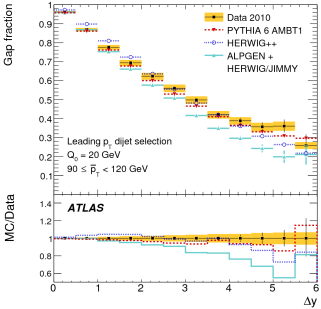
The strategy

— Study jet activity in gap between pair of jets with:
  A) highest $p_t \Rightarrow p_{t,1}, p_{t,2}$ similar
  B) largest $|\Delta y| \Rightarrow M_{12} > \overline{p}_t$.
— Study two observables within gap:
  I) Fraction of events f with no jet above $p_t = Q_0$.
  II) Average jet multiplicity $\langle N(p_t > Q_0 \gg \Lambda)\rangle$.
— This probes: wide angle soft gluon radiation for $Q_0 \ll \overline{p}_t$, BFKL dynamics for large $|\Delta y|_{max}$, and color singlet exchange if both are fulfilled.
— The distributions are corrected to particle level.
— $\Delta(JES)$ (2-5)% in barrel and 13 % for $|\eta| > 3.2$.
$\Rightarrow \Delta \approx 3\%(7\%), 3\%(6\%), 5\%$, for f, Δy and $\langle N\rangle$.

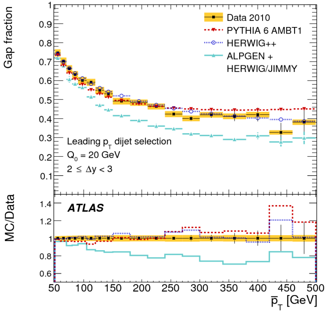
The findings

— Herwig and Pythia are ok, except for large Δy.
— Alpgen has too many jets, except for low scales.

Complicated interplay of various scales.



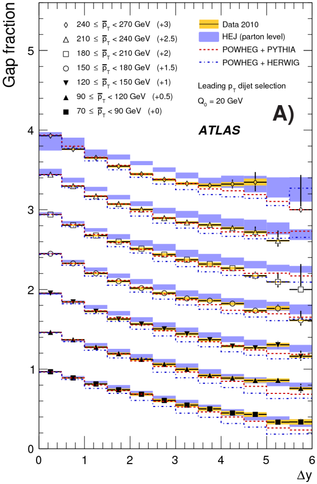
$p_t > 20$ GeV
$\overline{p}_t > 50$ GeV
$|y| < 4.4$
$Q_0 > 20$ GeV
$R = 0.6$



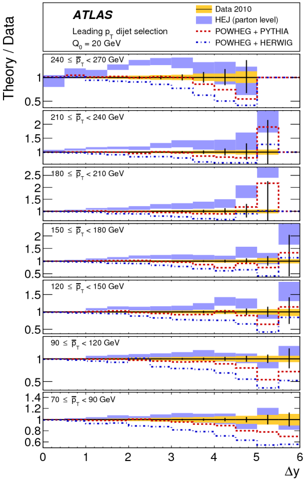
non pert. corrections (2-4)%

Di-jet production with jet veto - ATLAS

Gap-fraction f(Δy)



Ratios to predictions



The predictions

- HEJ = all order wide-angle.
- From Powheg = NLO di-jet, the Pythia-Herwig difference is smaller than the HEJ fact. scale, PDF, α_s uncertainties $\Rightarrow$ keep HEJ at parton level.

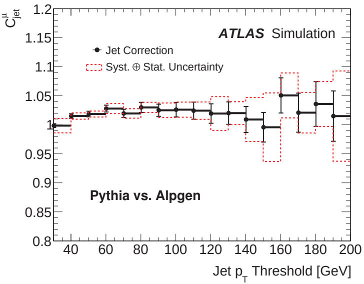
The findings

- The NLO prediction has too much jet activity.
- Phoweg + Pythia is closer to data than with Herwig.
- HEJ has too few jets, especially for large Δy and at large $\overline{p}_t/Q_0$ for all Δy.

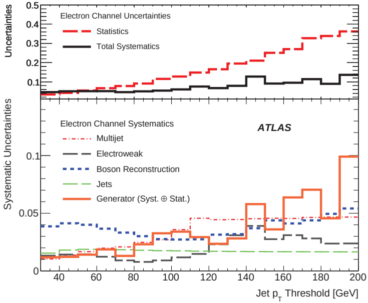
The largest deviations are seen at large $\overline{p}_t/Q_0$ and/or large Δy.

W/Z + 1-jet production - ATLAS

The remaining jet-level corrections



Breakdown of systematics



$\mathcal{L}_{int} = 33$/pb
now 3.6/fb on tape

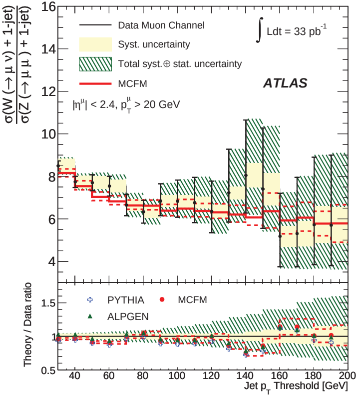
syst. $\mathcal{O}(5 - 10)\%$
large stat component

- Determining the ratio $\frac{W(\to \ell\nu) + 1\text{-jet}}{Z(\to \ell^+\ell^-) + 1\text{-jet}}(p_t > p_t^0)$ constitutes a precision test of QCD.
- Use $p_t > 30$ GeV, $|\eta| < 2.8$, veto events with additional jets with $p_t > 30$ GeV.
- All EW background estimated from MC, QCD background is taken from data side-bands.
- Bgd in % for W(Z): EW: 3.4(1) e, 5(1) μ QCD: 19(0.3) e, 3.2(0.3) μ.
- Data corrected to particle level. Most uncertainties cancel in the ratio.

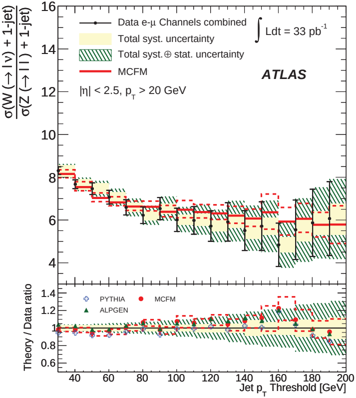
First analysis of a potentially very precise challenge for QCD.

W/Z + 1-jet production - ATLAS

The muon channel result



The combined result



Pythia: LO 2 $\rightarrow$ 2
Alpgen: LO 2 $\rightarrow$ n
MCFM: NLO 2 $\rightarrow$ 2
corrected with Pythia

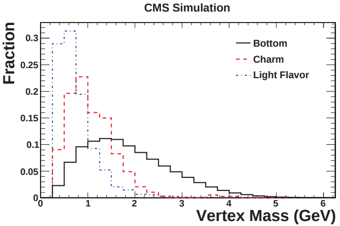
MCFM uncertainties
PDF + scales

Muon: 8.49 $\pm$ 0.23 $\pm$ 0.33 — Combined: 8.29 $\pm$ 0.18 $\pm$ 0.28, corrected to a common
Electron: 8.73 $\pm$ 0.30 $\pm$ 0.40 phase space, (e and μ have slightly different acceptances).

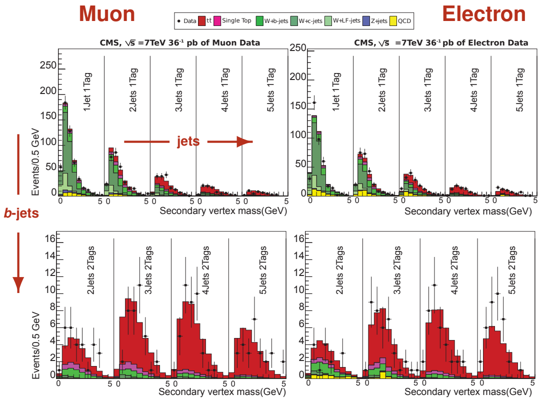
Good agreement at low p_t, at large p_t the data is statistically limited.

The $t\bar{t}$ cross-section - CMS

The sensitive distribution



The combined fit



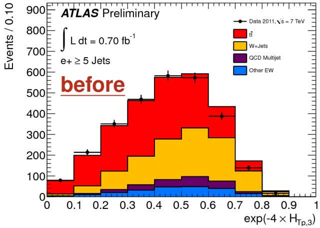
Some analysis details

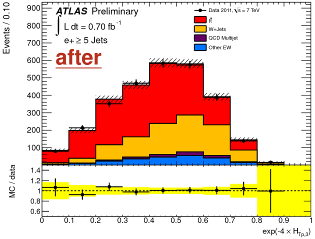
- Use one discriminative variable.
- Combine lepton channels.
- Exploit a number of statistically independent sub-sets of data with different signal to background compositions.
- The analysis is already systematics limited for the 2010 data with $\mathcal{L}_{\text{int}} = 36\text{pb}^{-1}$.
- Use profile likelihood, i.e. allow systematics to cancel each other, within bounds.

The analyses explores one observable for different jet and *b*-jet multiplicities.

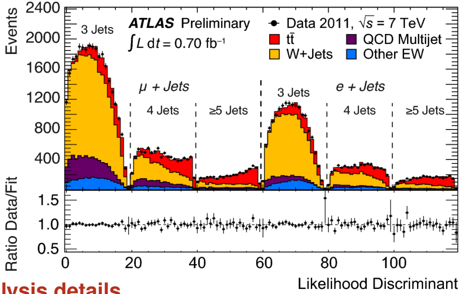
The $t\bar{t}$ cross-section - ATLAS

A discriminating distribution





The combined fit



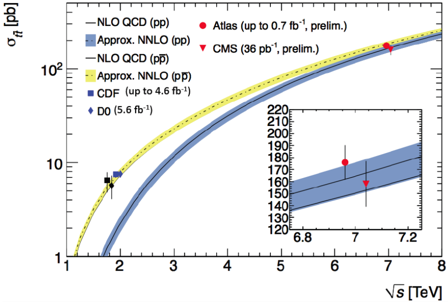
Some analysis details

- Very similar to CMS, however, uses four distributions and no *b*-tagging (was largest syst. for ATLAS).
- QCD and W+jets (normalization) from data, other from MC.
- Example: $H_{\mathrm{Tp},3} = \frac{p_t(3)+p_t(4)}{p_t(1\ldots4)+p_t(\ell)+p_t(\nu)}$, η^ℓ, $p_{t,\max}$, aplanarity.
- Likelihood fit gives fractions and nuissance parameters.
- The fit improves on the data description.

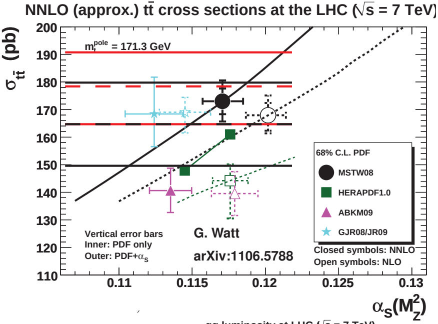
The analyses explores various observables for different jet multiplicities.

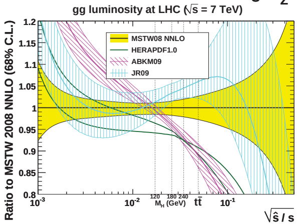
The $t\bar{t}$ cross-section - Results

Latest LHC combined figure



Theoretical predictions





R.S.Thorne, G. Watt arXiv:1106.5789

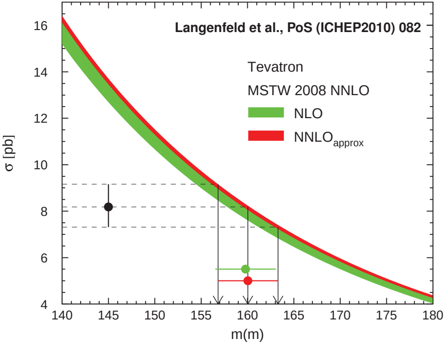
Latest prel. LHC measurements ($\sigma_{t\bar{t}}$ in pb)

Exp(Lumi)	Value	stat.+sys.	lumi
CMS (0.8-1.1/fb)	164.4	12.2	7.4
ATLAS (0.7/fb)	179.0	9.8	6.6

The experimental precision challenges the predictions.

Measure m_{top} from the $\sigma_{t\bar{t}}$ - general considerations

The cross-section $\sigma_{t\bar{t}}(m_{top}(\overline{MS}))$



Theory predictions

The strategy

- $\sigma_{t\bar{t}}(m_{top})$ is known at NLO, NLO+(N)NLL or approx. NNLO.
- Measure $\sigma_{t\bar{t}}(m_{top})$, profit from $\frac{\Delta\, m_{top}}{m_{top}} \approx \frac{1}{5}\frac{\Delta\, \sigma_{t\bar{t}}}{\sigma_{t\bar{t}}}$
- So: $\sigma_{t\bar{t}}(m_{top}) = (8.2 \pm 0.8)$ pb (10%)
  $\Rightarrow m_{top} = (163 \pm 3)$ GeV (2%).

The caveat

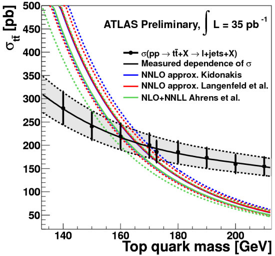
- This is only true if the measurement of $\sigma_{t\bar{t}}$ does not depend on m_{top} itself.
- However, the acceptance is not flat, but a function of the m_{top} (MC) parameter used. in the LO (NLO) Monte Carlo.

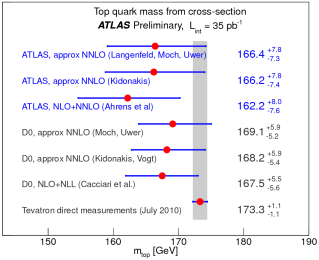
- Use m_{top} (pole): Treat quark as free and long lived, or m_{top} ($\overline{MS}$): Treat mass as a coupling.
- Relate m_{top} ($\overline{MS}$) and m_{top} (pole), i.e. $m_{top}(\text{pole}) = 172$ GeV $\Rightarrow$ $m_{top}(\overline{MS}) = 162$ GeV.
- The difference of m_{top} (MC), m_{top} (pole) is expected to be $\mathcal{O}(1$ GeV) so: Where to put the data

The dependence on the mass definition is significant.

Measure m_{top} from the $\sigma_{t\bar{t}}$ - results

The ATLAS measurement





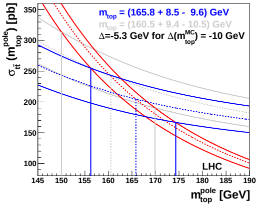
Interprete the result

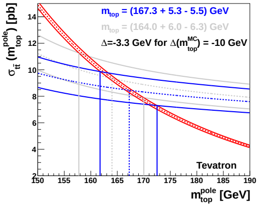
$m_{top}(\text{direct}) = (173.18 \pm 0.56 \pm 0.76)$ GeV
< 1 GeV (0.6%)

— $\Delta\, \sigma_{t\bar{t}}(\text{exp}) = 13\% \Rightarrow \Delta\, m_{top}(\text{exp}) = 3\%$,

But: $\frac{\sigma_{t\bar{t}}(160) - \sigma_{t\bar{t}}(172.5)}{\sigma_{t\bar{t}}(172.5)} = 18\%$

$\Rightarrow$ Need to find an m_{top} independent !? selection.





Comparison to D0 measurement

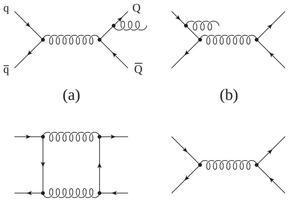
— $\sigma_{t\bar{t}}(\text{exp}) = 8.13 {}^{+1.02}_{-0.90}$ pb yields $\Delta\, m_{top} = \mathcal{O}(5)$ GeV.

— Use $\sigma_{t\bar{t}}(m^{pole}_{top})$ and $\sigma_{t\bar{t}}(\overline{\text{MS}})$ while assuming $m^{MC}_{top} = m^{pole}_{top}$ or $m^{MC}_{top} = m^{\overline{MS}}_{top} \Rightarrow \Delta\, m_{top} = \mathcal{O}(3)$ GeV.

The measurement is hampered by its interpretation.

The charge (forward-backward) asymmetry

The two sources of the asymmetry



(a) (b) (c) (d)

1) < 0

$|2| > |1|$

2) > 0

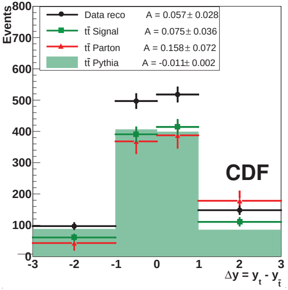
The formulas

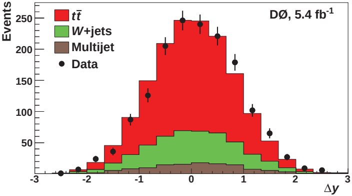
- Rapidity: $y = \frac{1}{2} \ln \frac{E+p_z}{E-p_z}$.
- Single Asymmetry: $A^{p\bar{p}} = \frac{N_t(y \geq 0) - N_{\bar{t}}(y \geq 0)}{N_t(y \geq 0) + N_{\bar{t}}(y \geq 0)}$.
- Difference: $\Delta y = y_t - y_{\bar{t}} = q_\ell (y_\ell - y_{had})$.
- Pair Asymmetry: $A^{t\bar{t}} = \frac{N(\Delta y \geq 0) - N(\Delta y \leq 0)}{N(\Delta y \geq 0) + N(\Delta y \leq 0)}$.
- $A^{t\bar{t}} / A^{p\bar{p}}(QCD, \%) = 8/5 (\approx 1)$ TeV (LHC).
- CP-Invariance: $CP|\, N_t(y) \,\rangle = |\, N_{\bar{t}}(-y) \,\rangle$.
  Charge $\leftrightarrow$ forward-backward, if defined.

- Only caused by quark initiated processes, i.e. gluon initiated processes dilute $A^{f\bar{f}}$.
  $\Rightarrow A^{f\bar{f}}$ (Tevatron) $> A^{f\bar{f}}$(LHC) because $q\bar{q}/gg \approx 90/10$ $(15/85)$ for Tevatron (LHC).
- $A^{f\bar{f}} > 0$, however selecting 1) or 2) could help to look for consistency.
- The asymmetry is NLO in $\sigma_{t\bar{t}}$, i.e. it is only known at LO! $A^{f\bar{f}}$ depends on $p_t(t\bar{t}), \Delta y, M_{t\bar{t}}, \ldots$
- $A^{t\bar{t}} > A^{p\bar{p}}$ because all pairs contribute, i.e. $A^{t\bar{t}}$ is theoretically preferred.
- The channel $t\bar{t} \rightarrow$ lepton+jets is used. $A^{p\bar{p}}$ only needs $y_{had} = y(qqb)$. In contrast, $A^{t\bar{t}}$ also needs $y_\ell = y(b\ell\nu)$ which has a worse angular resolution, i.e. experimentally $A^{p\bar{p}}$ is easier.

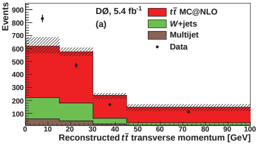
The asymmetry values measured at Tevatron created some excitement.

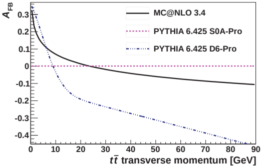
The charge asymmetry - Tevatron results





Beware!





Results on $A^{t\bar{t}}$ in (%)

both high!

Exp/Theo	all	$A^{t\bar{t}}(\Delta y < 1)$	$A^{t\bar{t}}(\Delta y > 1)$	
CDF	15.8 ± 7.4	$2.6 \pm 10.4 \pm 5.6$	$61.1 \pm 21.0 \pm 14.7$	rise
MCFM	5.8 ± 0.9	3.9 ± 0.6	12.3 ± 1.8	
D0	19.6 ± 6.5	6.1 ± 4.1	21.3 ± 9.7	not sign.
MC@NLO	5.0 ± 0.1	1.4 ± 0.6	6.3 ± 1.6	

Exp/Theo	$A^{t\bar{t}}(M_{t\bar{t}} < 450$ GeV$)$	$A^{t\bar{t}}(M_{t\bar{t}} > 450$ GeV$)$	
CDF	$-11.6 \pm 14.6 \pm 4.7$	$47.5 \pm 10.1 \pm 4.9$	rise
MCFM	4.0 ± 0.6	8.8 ± 1.3	
D0	7.8 ± 4.8	11.5 ± 6.0	not sign.
MC@NLO	1.3 ± 0.6	4.3 ± 1.3	

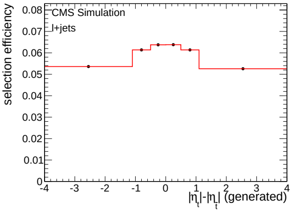
- $A^{t\bar{t}} \nearrow$ by $\mathcal{O}(20\%)$ relative with EW corrections.
- The NLO corrections to $A^{f\bar{f}}$ are not fully known.

$\Rightarrow$ need to wait.

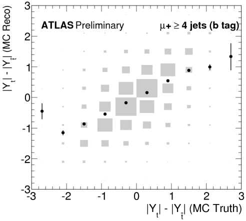
The asymmetries are all larger than expected - lets see what LHC finds.

The charge asymmetry - LHC analyses

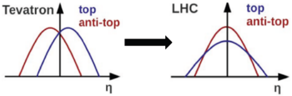
The efficiency



The transfer matrix



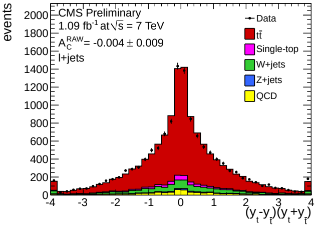
Tevatron vs. LHC

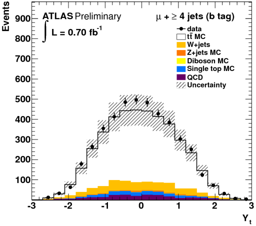


- The LHC is FB-symmetric, and valence quarks have larger *x*,

$\Rightarrow$ forward regions counts most.

The raw distributions





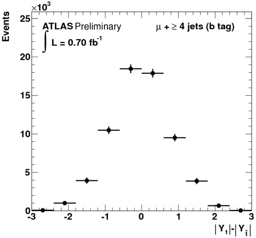
Some analyses details

- The efficiencies are symmetric.
- The transfer matrix calls for unfolding of the data distributions.
- Good description of the data by combination of MC models and data driven estimates.

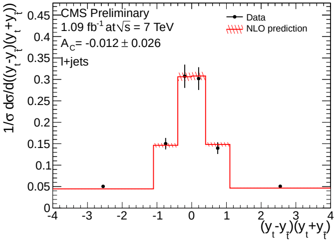
Controlling all effects that may be asymmetric is essential.

The charge asymmetry - LHC results

Unfolded results on $A^{t\bar{t}}$

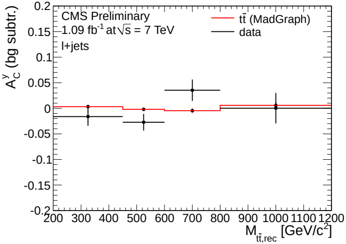


$\mathcal{L}_{\rm int} = 0.7 \rm fb^{-1}$



$\mathcal{L}_{\rm int} = 1.09 \rm fb^{-1}$

The raw $M_{t\bar{t}}$ dependence



The preliminary results

ATLAS: $A^{t\bar{t}}(|y_t| - |y_{\bar{t}}|) = (-2.4 \pm 1.6 \pm 2.3)\%$.

CMS: $A^{t\bar{t}}(y_t^2 - y_{\bar{t}}^2) = (-1.3 \pm 2.6 ^{+2.6}_{-2.1})\%$.

The predictions

0.6% (MC@NLO).

$(1.1 \pm 0.1)\%$ (Rodriguez).

— In addition, CMS does not find any significant dependence on $M_{t\bar{t}}$.

At LHC the asymmetry is found to be independent of $M_{t\bar{t}}$, and the SM decribes the data.

Conclusions and Outlook

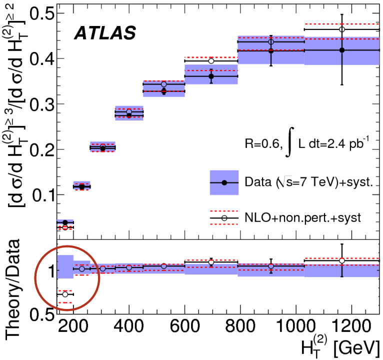
- The LHC is a QCD machine and it performs beautifully $\mathcal{L} = 3.3\,10^{33}/\mathrm{cm}^2/\mathrm{s}$, $\mathcal{L}_{\mathrm{int}} = 3.6\mathrm{fb}$. However, the ever increasing number of pile-up events is a continuous challenge.
- Statistics is plentiful, and the key to success is reducing the systematics, either by an even better detector understanding, or by optimizing observables.
- Jet physics is a very rich field with many predictions up to NLO. Here, reducing the jet energy scale uncertainty is the key to precision.
- The W/Z + jets processes offer some precision NLO QCD tests.
- Also top-quark physics offers many QCD observables and challenges to theory. Some interesting features of the Tevatron data could not be confirmed.
- As always, the close collaboration and interplay between theorists and experimentalists pays off in designing the analyses.
- Finally, my apologies to those interested in UE, soft QCD, track jets, *b*-jets, ...

There is lot more to come in the next years, stay tuned.

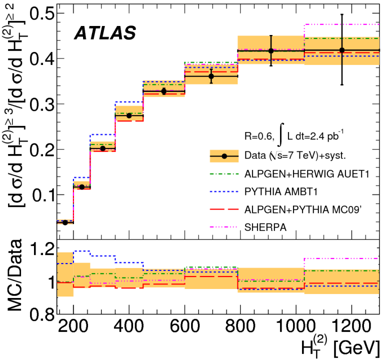
Backup - Transparencies

Inclusive multi-jet production - ATLAS

Comparison to NLO + Non.-Pert.



Comparison to LO Monte Carlo

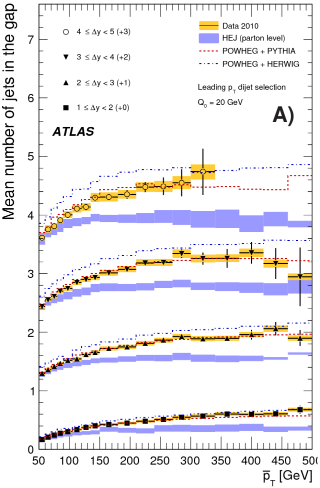


- $H_T^{(2)} = p_{t,1} + p_{t,2}$ has smallest scale uncertainty and mainly probes PDF and α_s.
- Non.-Pert. effects taken from Pythia (LO ME $\leftrightarrow$ LO ME+PS+UE) are about 5%.
- NLOJet++ prediction shows an overall good description, but for low $H_T^{(2)}$.

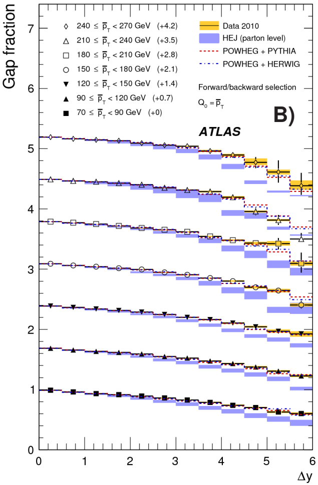
Overall good description by NLO, but for low $H_T^{(2)}$. LO predictions are further away.

Di-jet production with jet veto - ATLAS

$\langle N(p_t > Q_0)\rangle$ as function of $\overline{p}_t$



$f(\Delta y)$ for $Q_0 = \overline{p}_t$



Largest deviations at large $\overline{p}_t/Q_0$ and/or large Δy.

The findings for $\langle N\rangle$

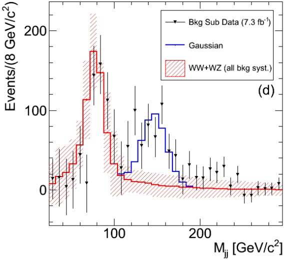
- Deviations are enhanced when using $\langle N\rangle$.
- Phoweg + Pythia describes the data well.
- Phoweg + Herwig is far off especially at large Δy .
- HEJ has too little activity especially for large $\overline{p}_t/Q_0$

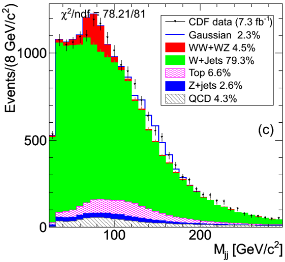
The findings for $f(\Delta y)$ f

- Case B) $|\Delta y|_{max}$ ($M_{ij} > \overline{p}_t$), and $Q_0 = \overline{p}_t$ not fixed.
- Phoweg describes the data well with Pythia and Herwig.
- HEJ describes the data at low Δy, but has too many jets for large Δy.

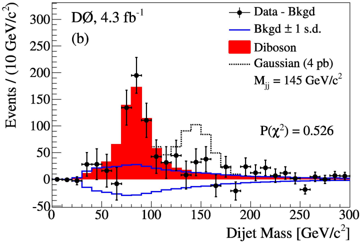
The production of a W-Boson + 2-jets - Tevatron

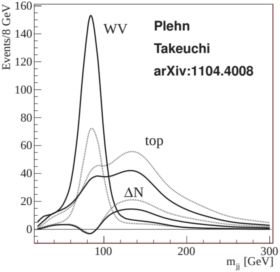
The CDF result





The D0 result





The experimental facts

- Can not describe shoulder in M_{jj} distribution.
- Use additional Gauss to describe the difference.
- Subtract all background.
- Not confirmed by D0, set limit $\sigma(145\ \mathrm{GeV}) < 1.9\mathrm{pb}$ with 95%C.L.

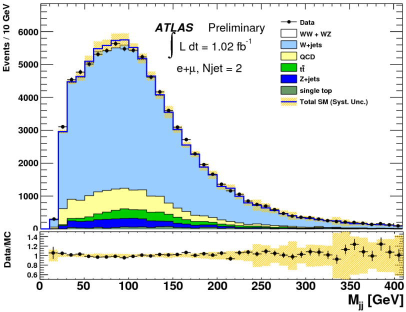
Possible explanation

- Mis-reconstructed top-quarks peak at $\sqrt{m^2_{\mathrm{top}} - m^2_{\mathrm{W}}}$!
- Shift in single top + $t\bar{t}$ background wrt. WV can solve this.
- CDF sees to many single top events, but D0 does not!

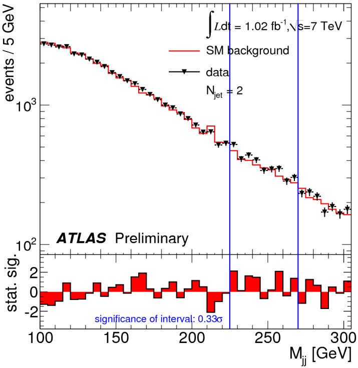
An inconclusive situation.

The production of a W-Boson + 2-jets - ATLAS

The invariant mass distribution



In search for a bump

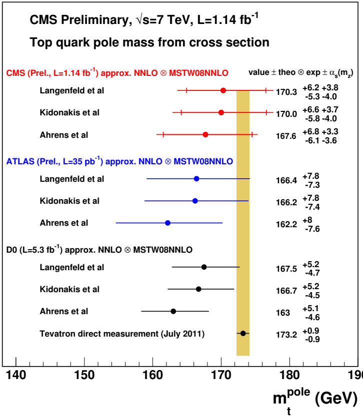


- Try to mimic the CDF analysis, but: $\frac{WW}{W+n>2-jets}$ decreases by factor 5, i.e. $\frac{3.7}{22} \rightarrow \frac{15.3}{440}$.
- Jet selection: $p_t > 30$ GeV, $|\eta| < 2.8$, $|\Delta\eta| < 2.5$, $M_{jj} > 40$ GeV, $\Delta\Phi_{jet,E_T^{miss}} > 0.4$.
- Estimate background for QCD and the W+jets (normalization) from data.

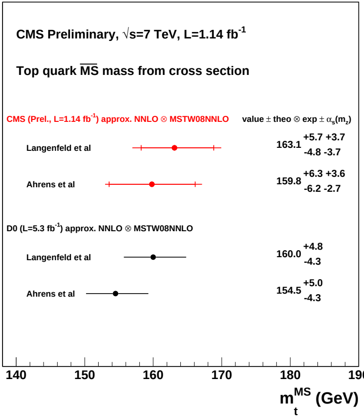
There is no sign of an excess, the CDF result can not be confirmed.

The measured m_{top} from the $\sigma_{t\bar{t}}$ - CMS

The m_{top}^{pole} mass



The $m_{top}^{\overline{MS}}$ mass



Brand new - Write-up not yet available.