Powheg+Pythia8 Studies (and everything else ATLAS wants before Run II)

Deepak Kar
(partially with Stefan Prestel, and
many discussions with ATLAS MC gang)

PSR14
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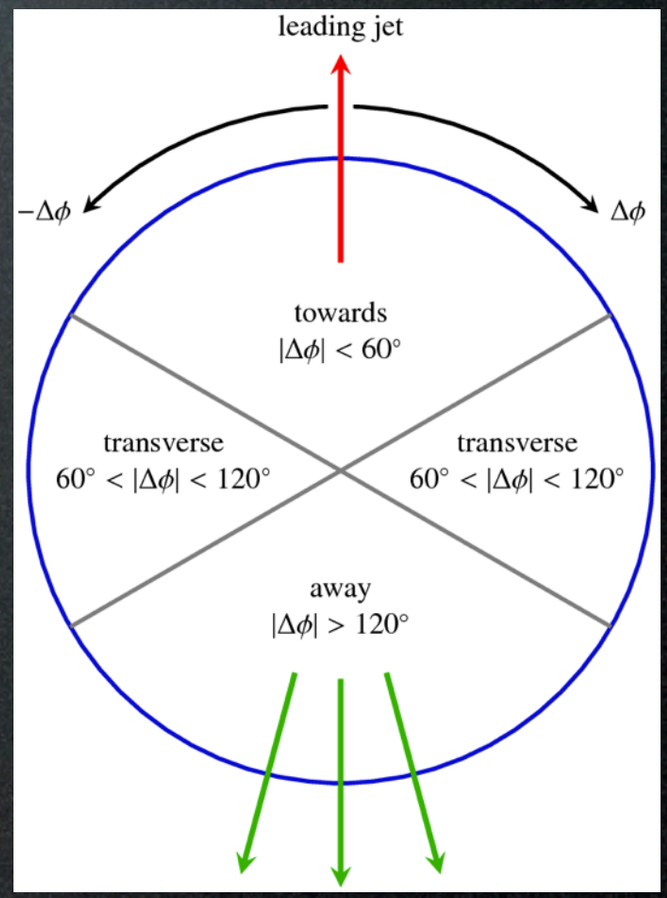
ATLAS Wishlist

- Powheg+Pythia8 setup for dijet, ttbar and Z events.
- Prescription on how to calculate PS systematic uncertainties in each cases.
- aMC@NLO+Pythia8 setup

Leading log and all that

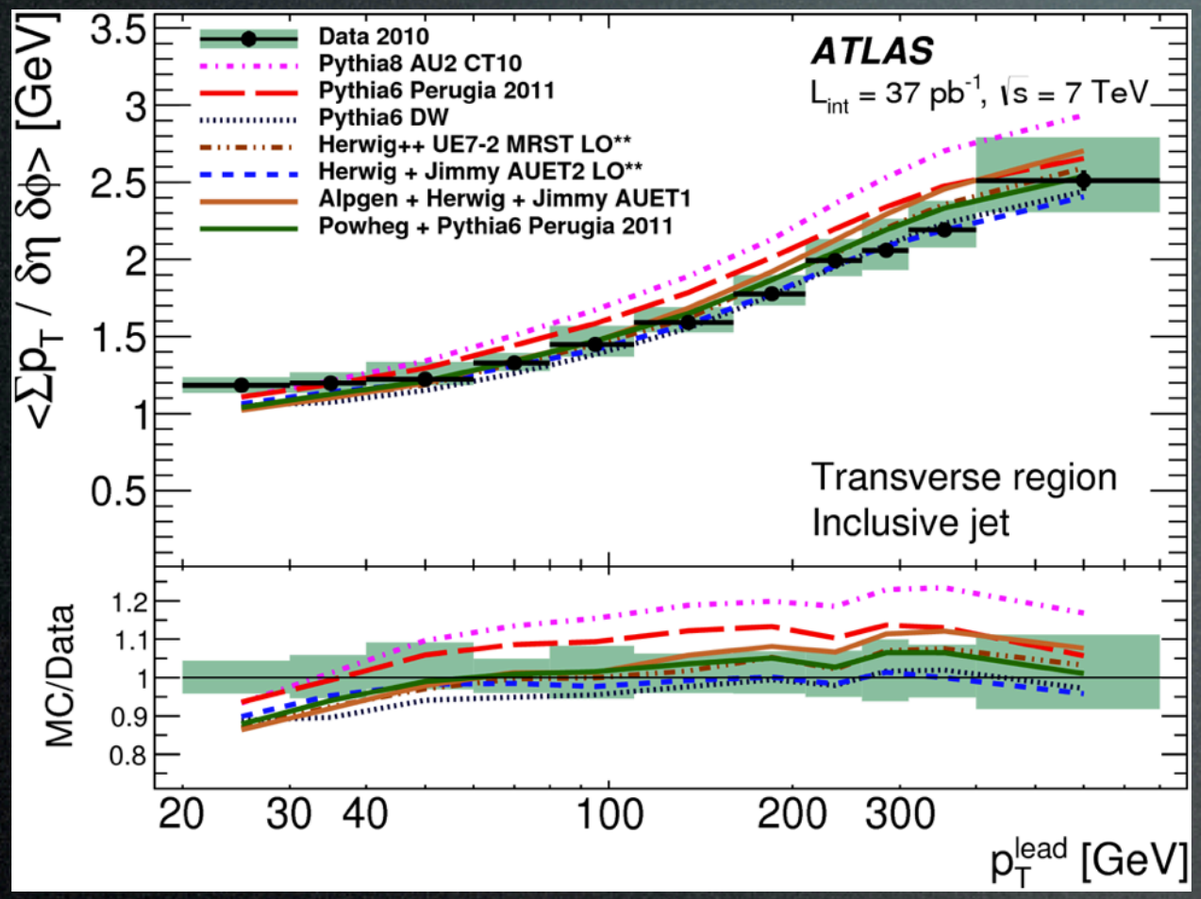
New ATLAS Result!

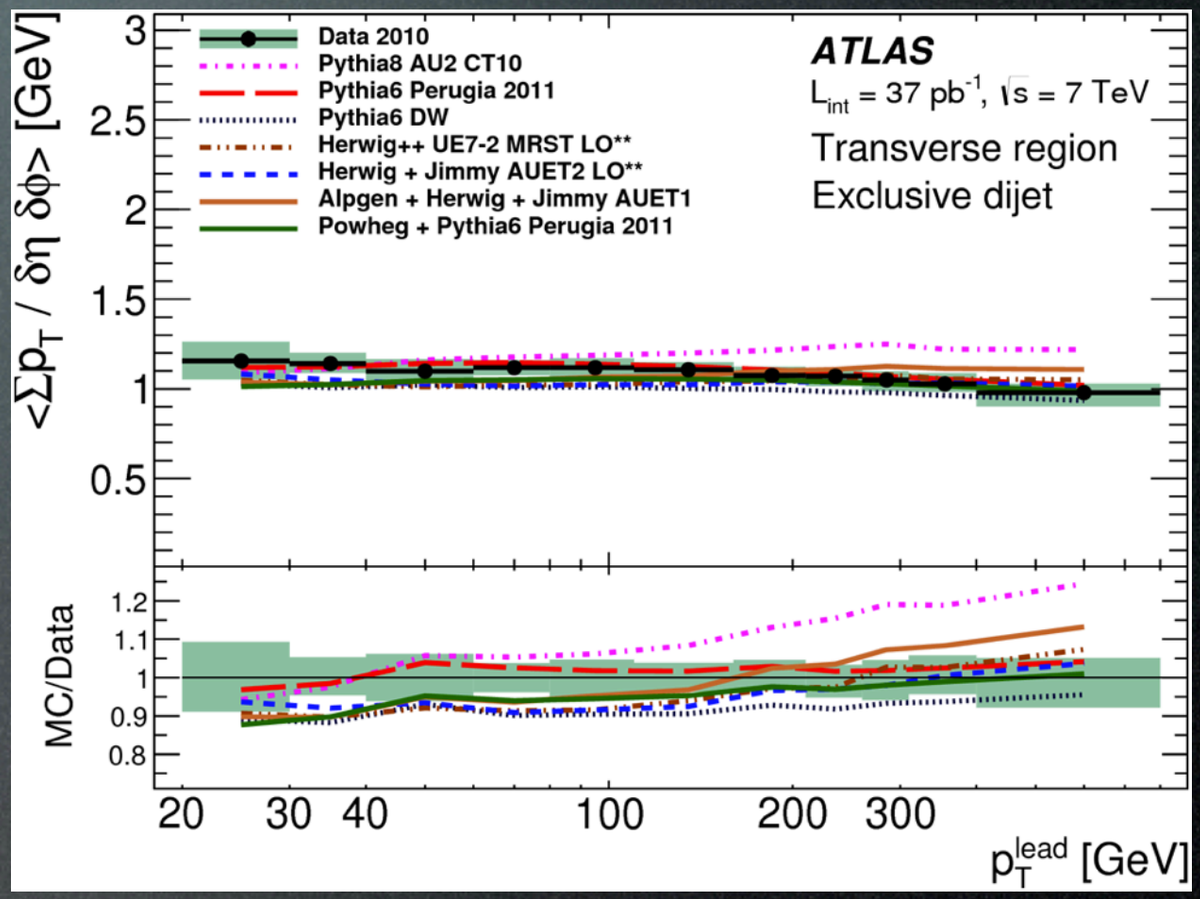
- The underlying event with jets analysis (using 2010 data no less) is finally public.
- First time looked upto p_T scale of 800 GeV, and exclusive dijet topology.



arXiv:1406.0392

Transverse Sum p_T

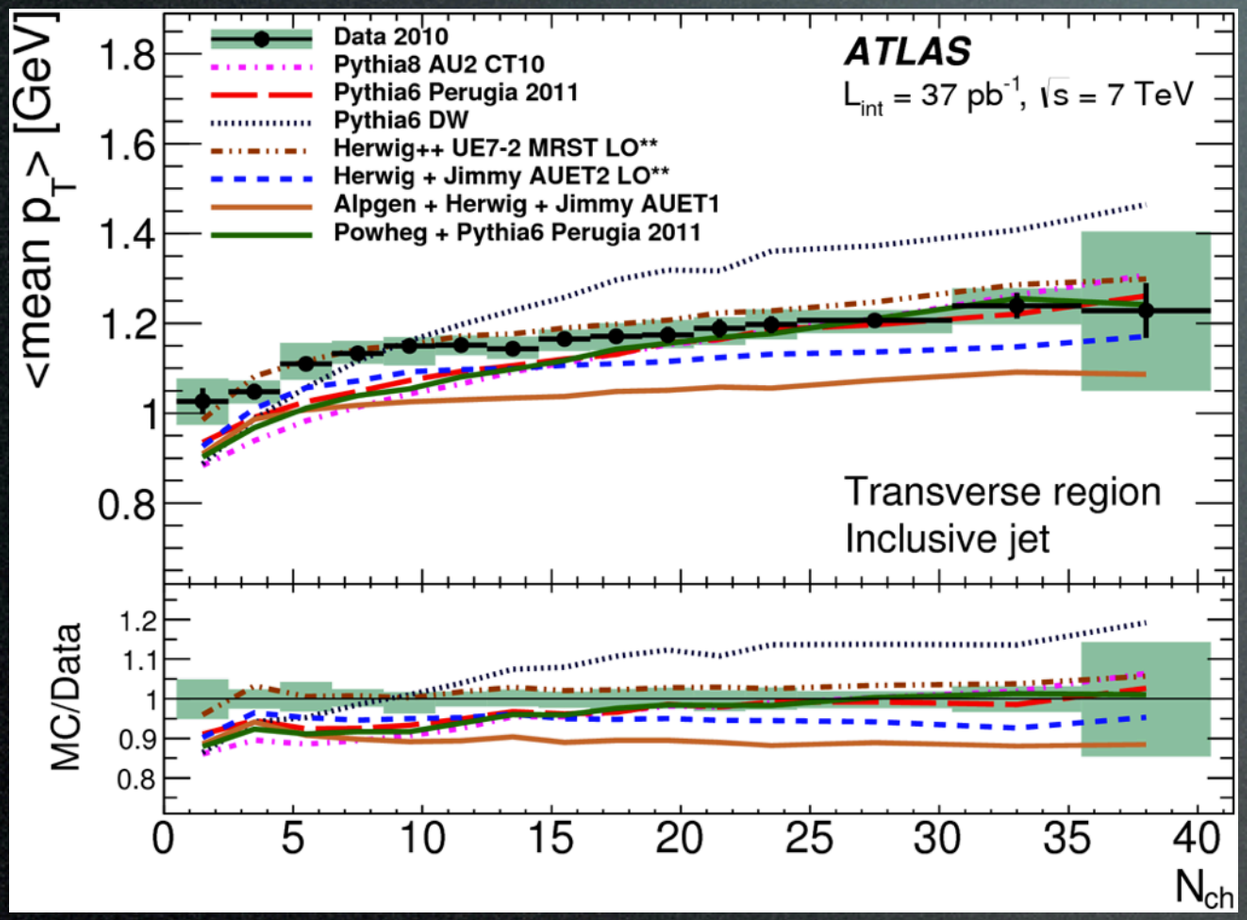


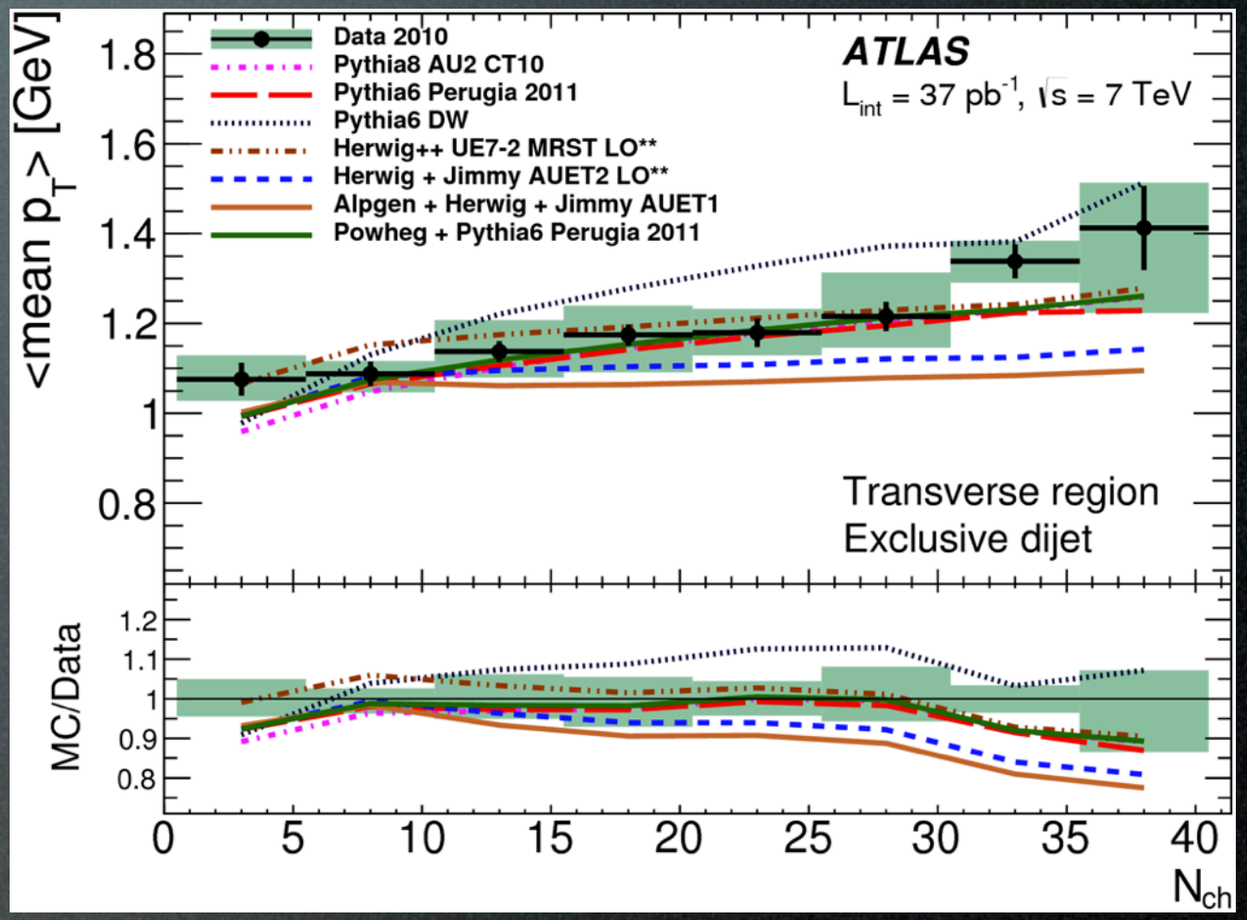


Exclusive topology: cutting out event with MPI jets?

Powheg+Pythia6 seems to be doing good!

Mean p_T vs Nchg



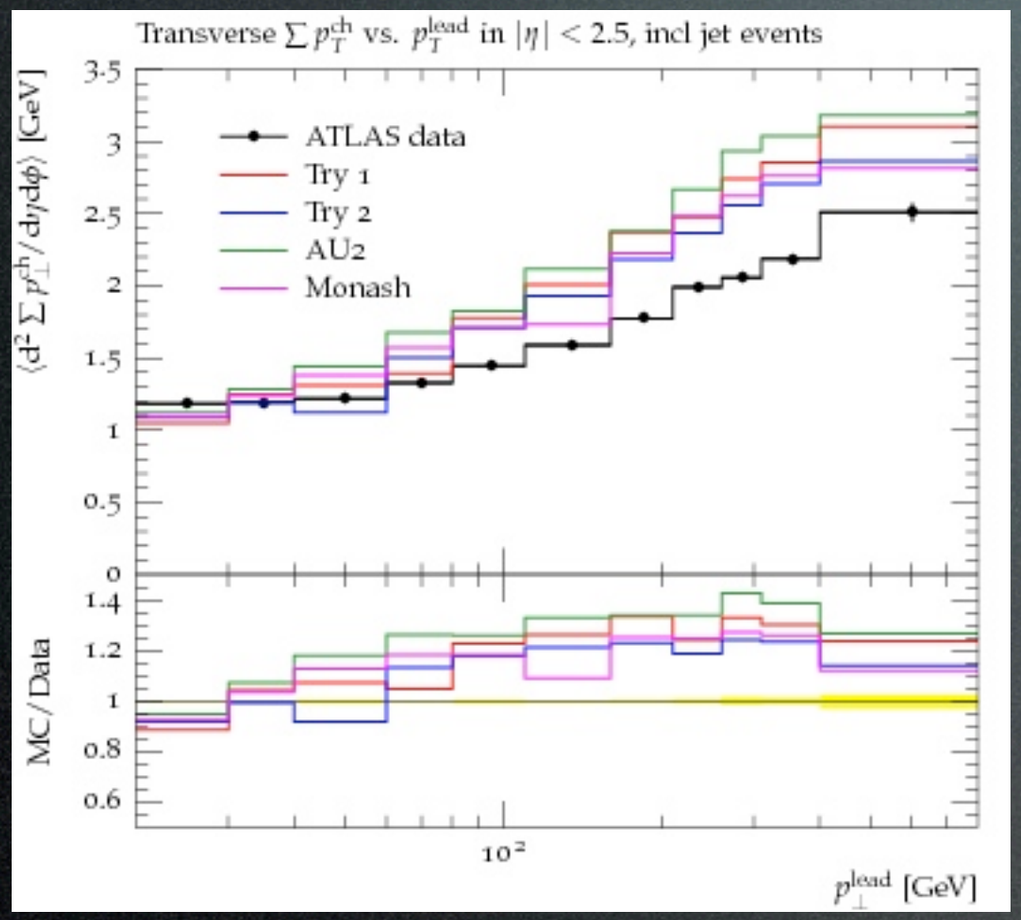


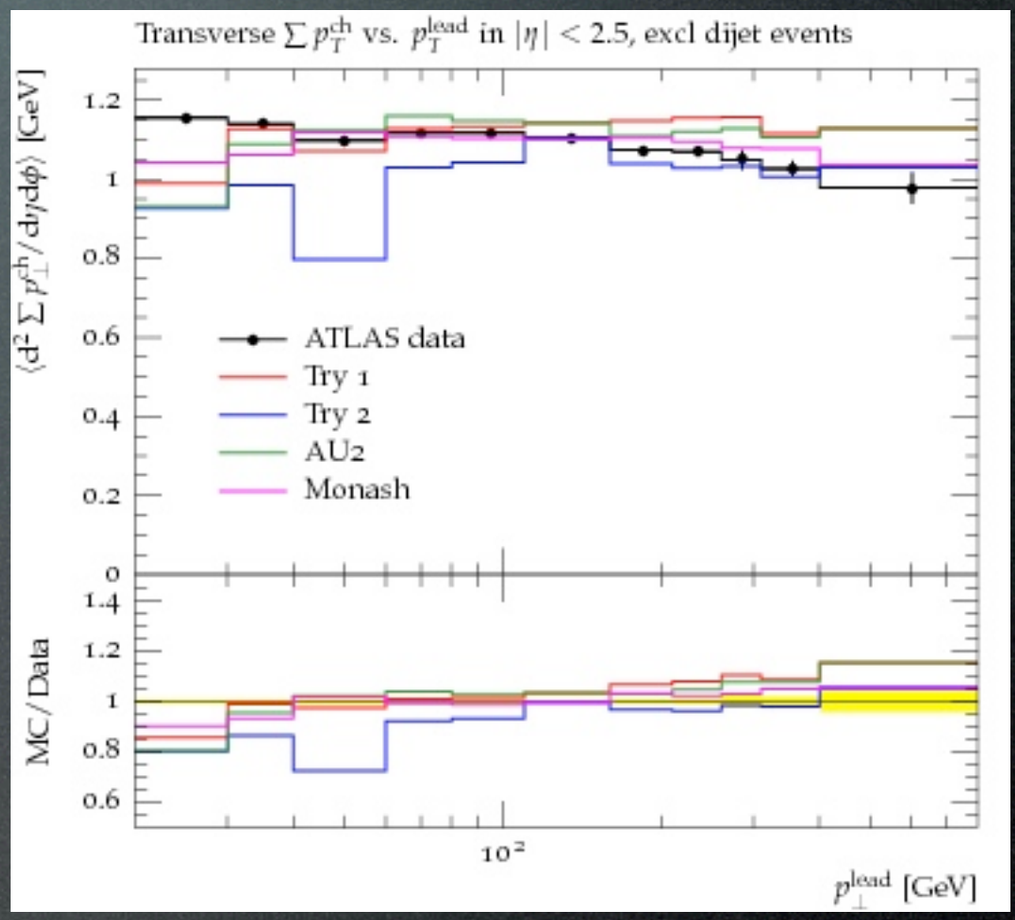
Inclusive topology: Herwig++ is the best!

(Dijet) Powheg+Pythia8

- Using (main31) vetoed shower.
- Setting ISR/FSR alpha_S to 0.118.
- Varying ISR/BBR/MPI parameters.
- Monash used NNPDF2.3LO

Jet UE





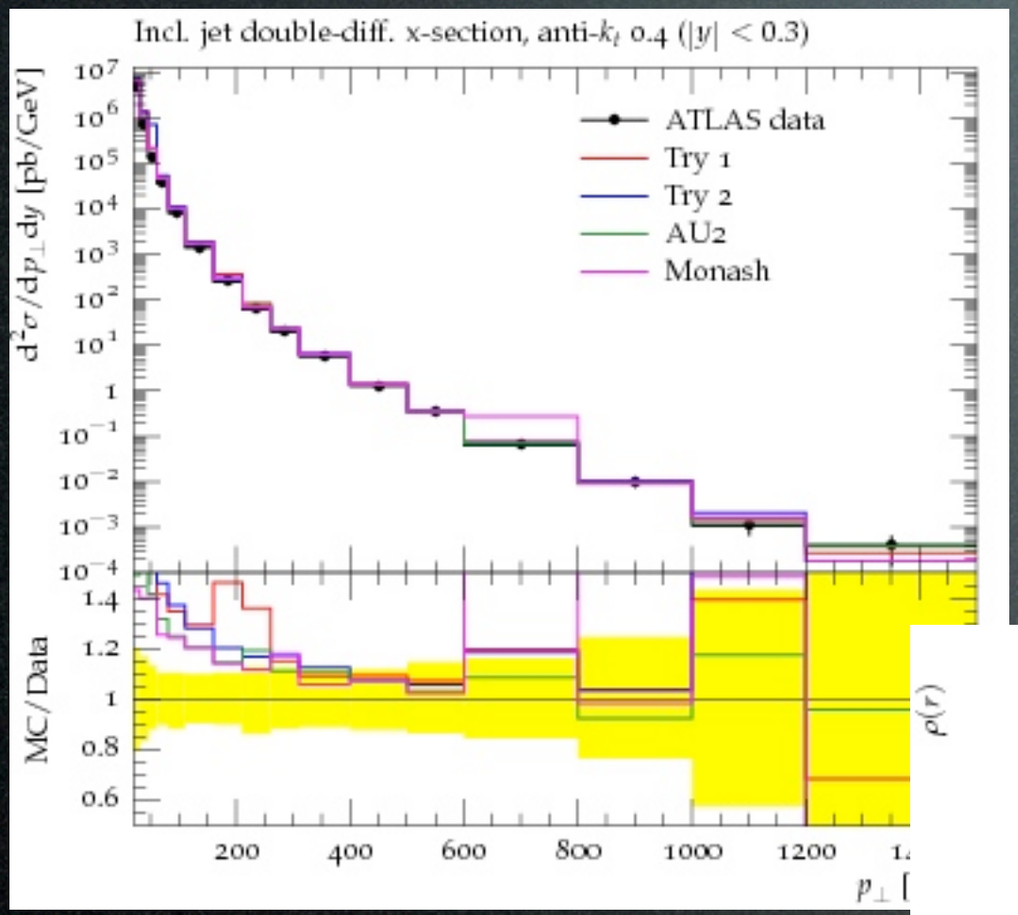
Not as good as we had with Pythia6...

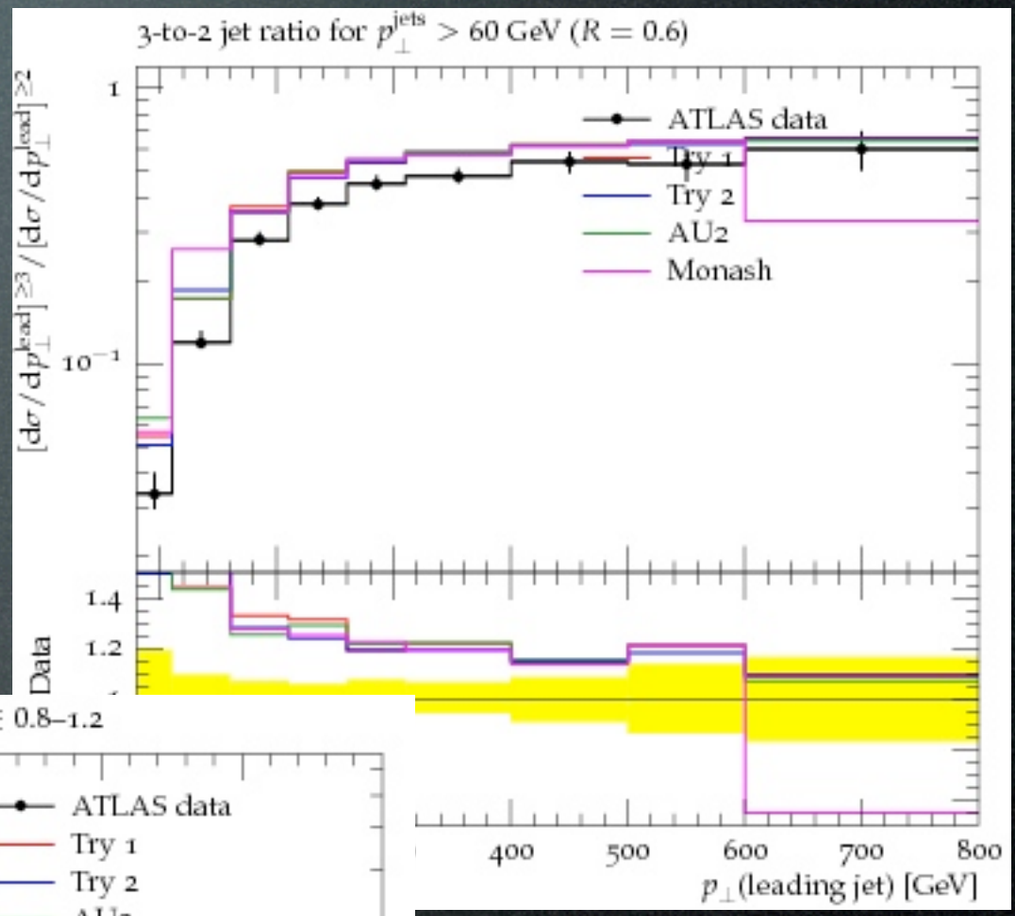
Parameters

	SpaceShower:pTmaxFudge	SpaceShower:pT0Ref	SpaceShower:alphaSvalue	TimeShower:alphaSvalue	BeamRemnants:primordialKThard
AU2 with CTEQ6L1/4C	1.0	2.0	0.137	0.1383	2.0
Try 1	1.0	1.5	0.118	0.118	1.0
Try 2	1.0	2.0	0.118	0.118	1.75

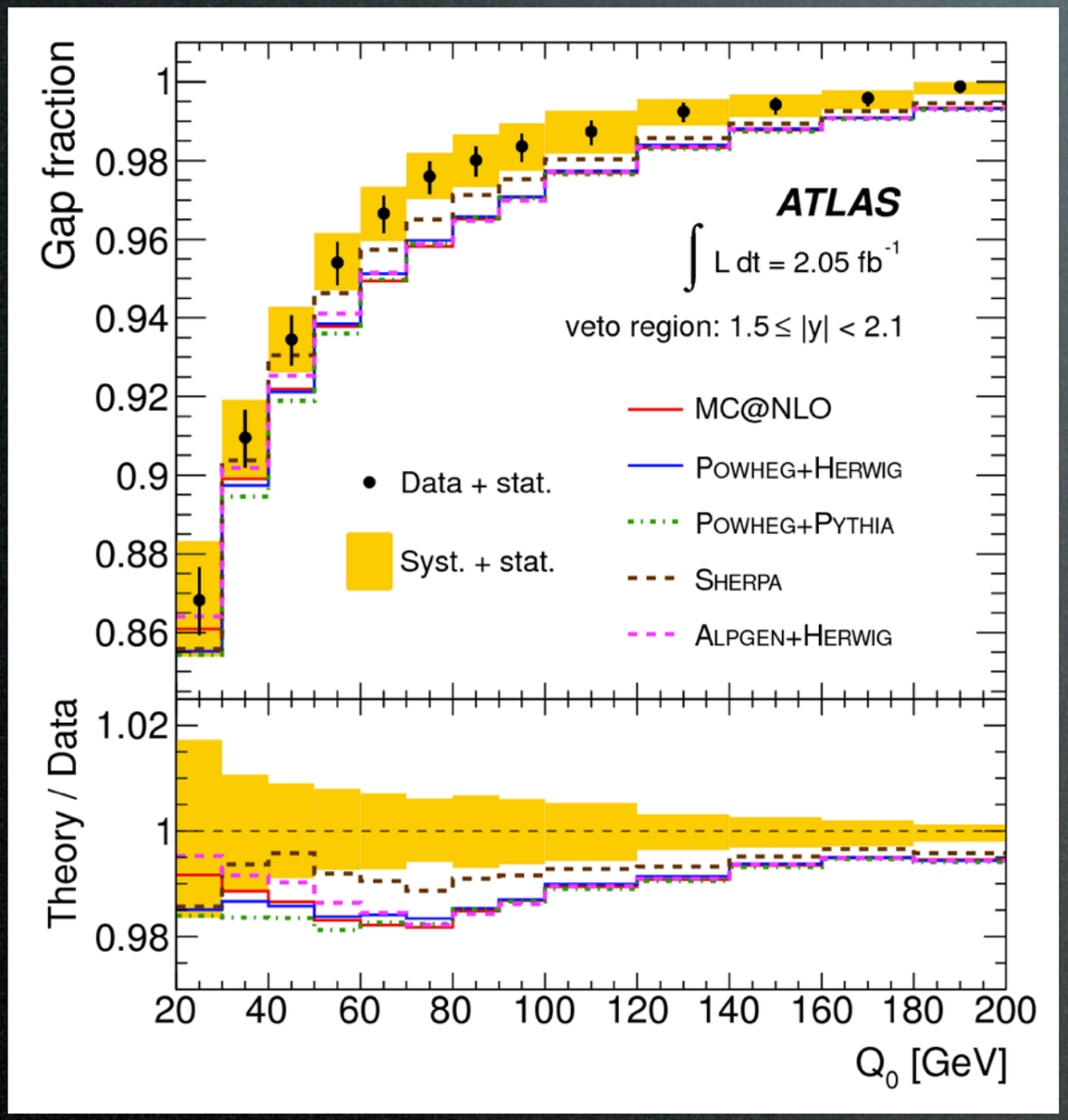
	MultipleInteractions:a1	MultipleInteractions:pT0Ref	MultipleInteractions:ecmPow	BeamRemnants:reconnectRange
AU2 with CTEQ6L1/4C	0.0	2.13	0.21	2.21
Try 1	0.1	2.0	0.25	3.0
Try 2	0.001	2.0	0.21	3.0

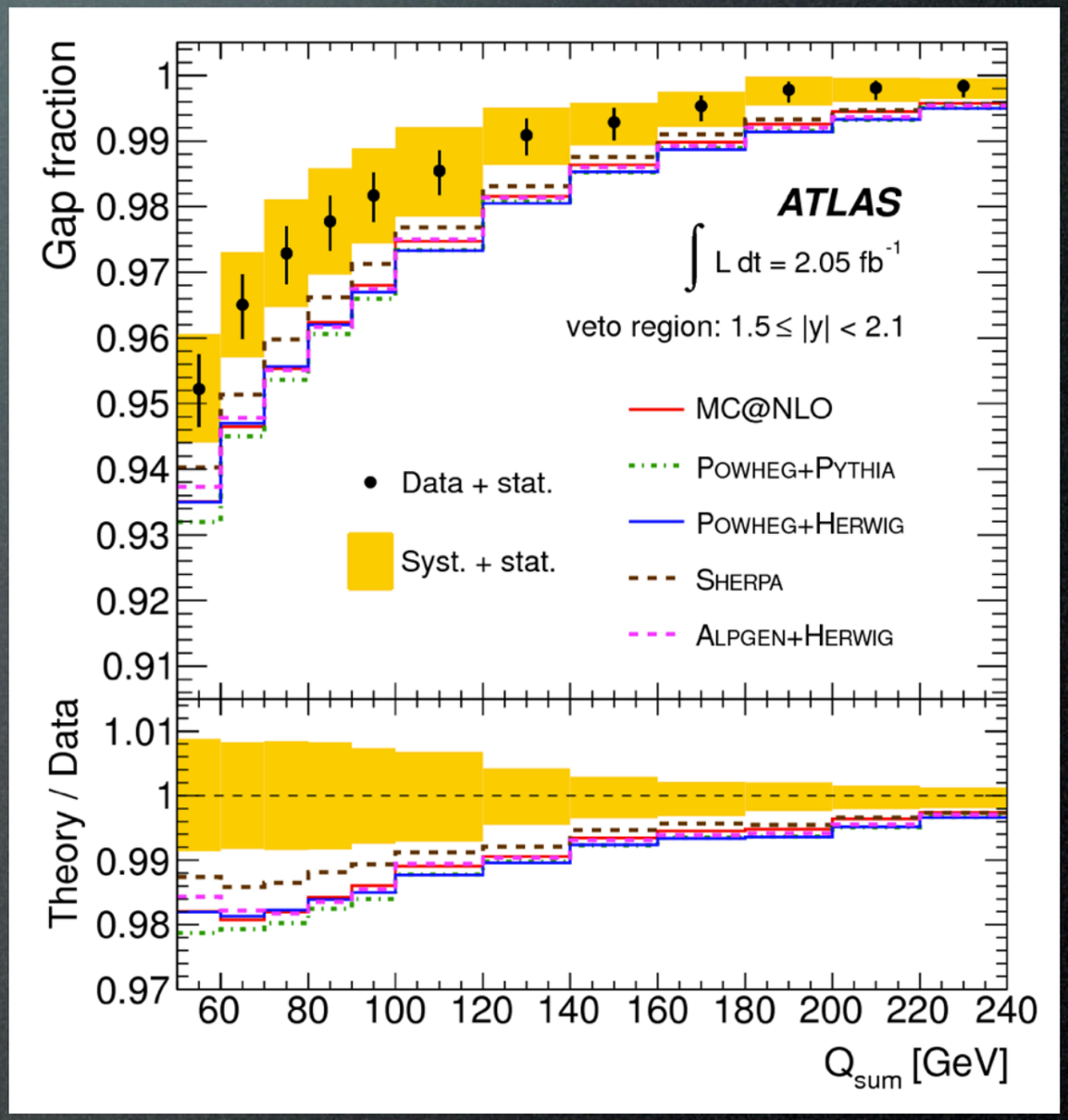
Some other observables





Moving to TTbar



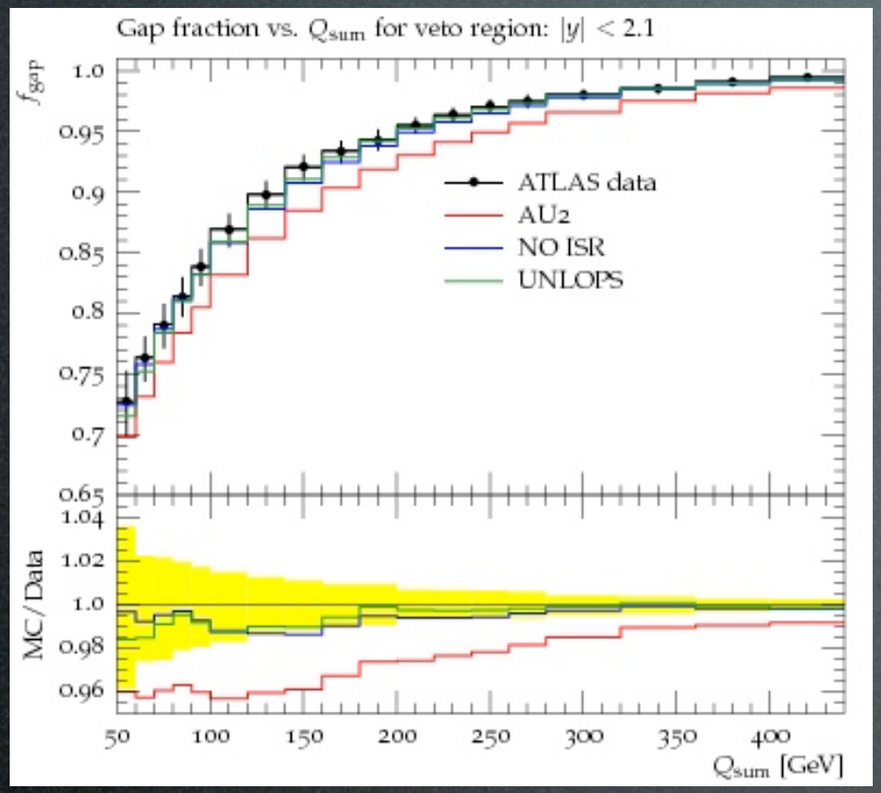


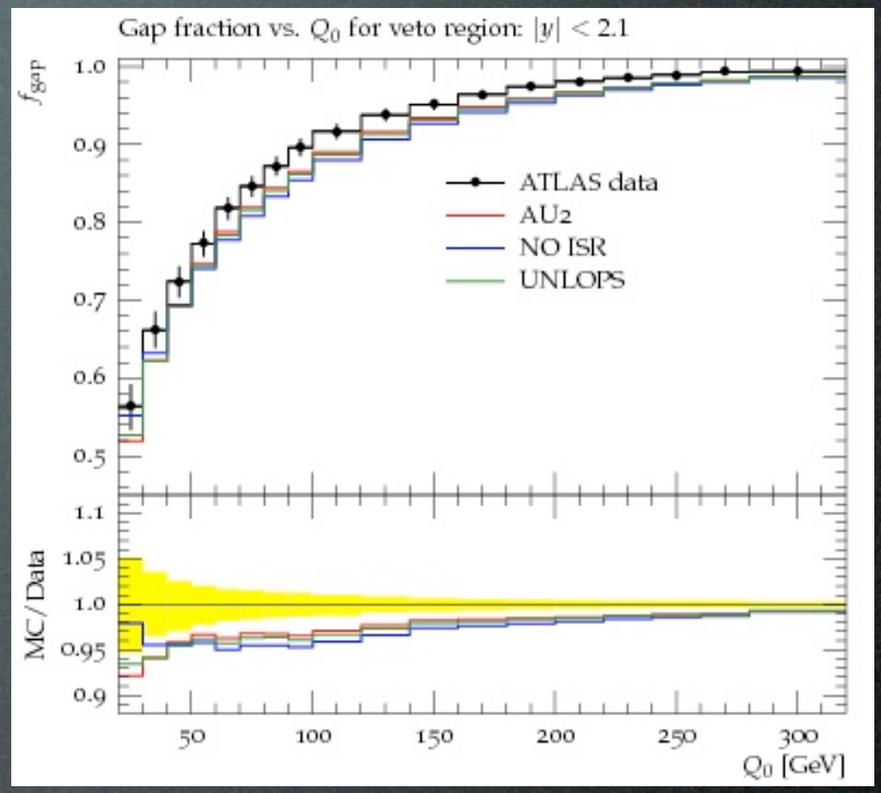
https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/TOPQ-2011-21/

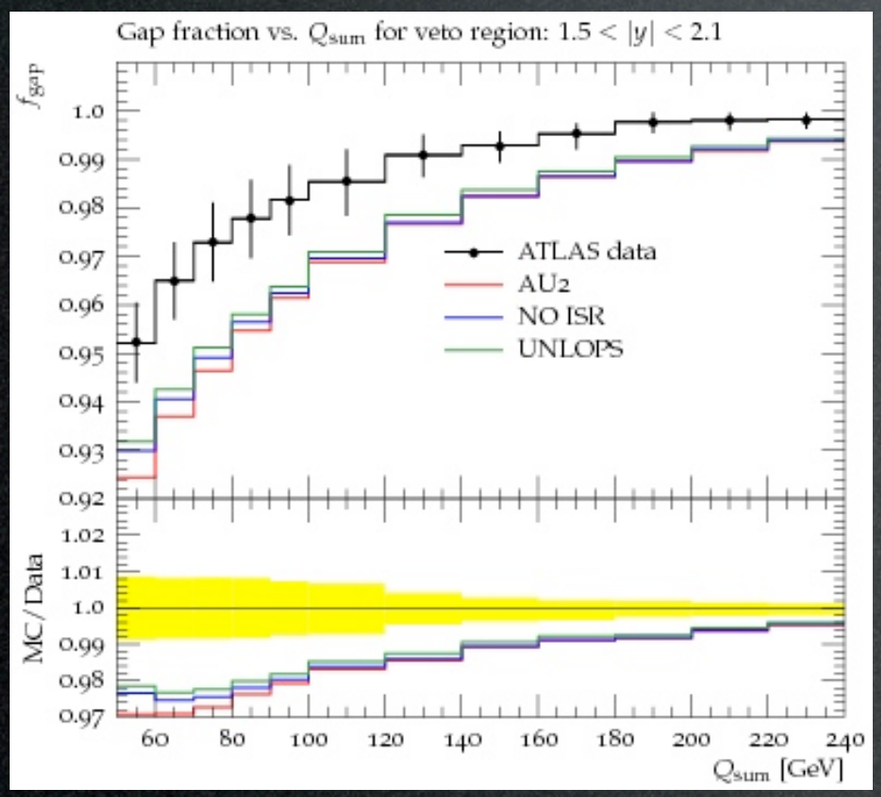
Definitions

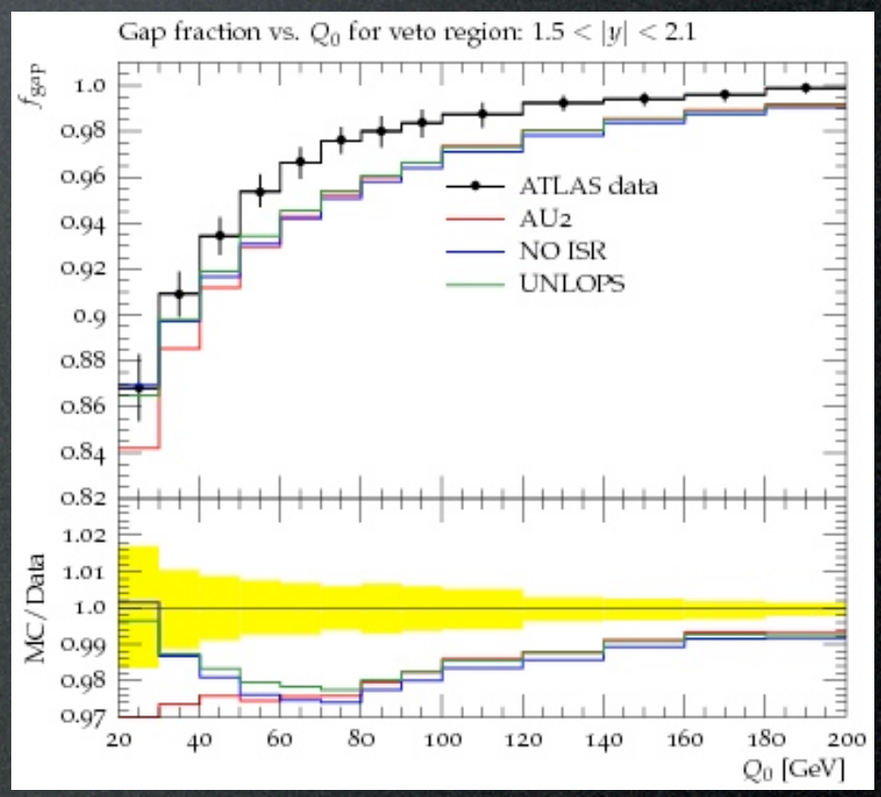
- Gap fraction defined either as a ratio of crosssection with absence of additional jets produced having $Q_0 > p_T$, or with $p_T sum < Q_{sum}$ in the rapidity interval to the total cross section.
- Former sensitive to leading pT emission accompanying the ttbar system, while the latter to all hard emisson.

Can we fix it?


Gap fraction vs. Q_{sum} for veto region: $|y| < 2.1$
f_{gap}
ATLAS data
AU2
NO ISR
UNLOPS
MC/Data
Q_{sum} [GeV]


Gap fraction vs. Q_0 for veto region: $|y| < 2.1$
f_{gap}
ATLAS data
AU2
NO ISR
UNLOPS
MC/Data
Q_0 [GeV]


Gap fraction vs. Q_{sum} for veto region: $1.5 < |y| < 2.1$
f_{gap}
ATLAS data
AU2
NO ISR
UNLOPS
MC/Data
Q_{sum} [GeV]


Gap fraction vs. Q_0 for veto region: $1.5 < |y| < 2.1$
f_{gap}
ATLAS data
AU2
NO ISR
UNLOPS
MC/Data
Q_0 [GeV]

Finally, Z Events

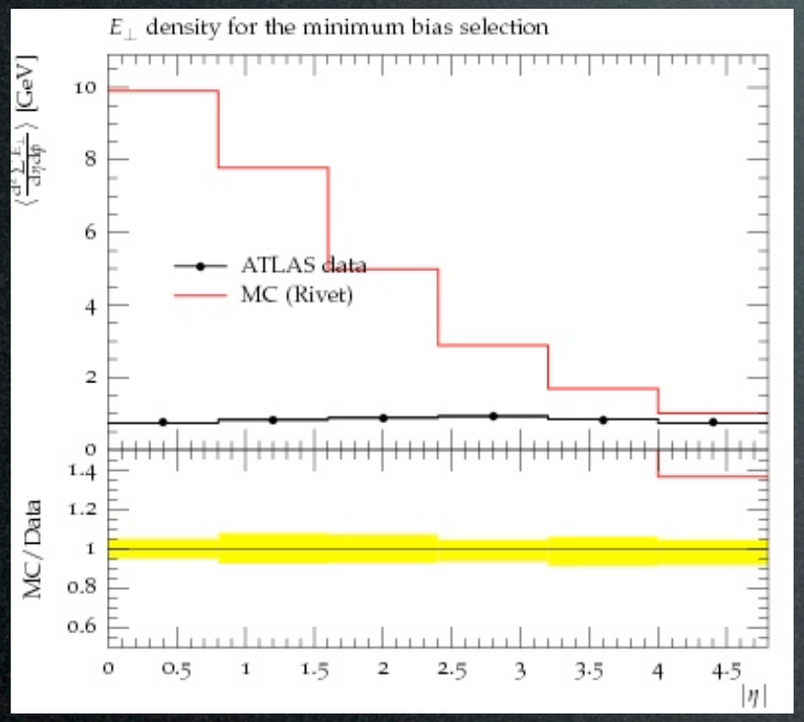
- ATLAS has a new tune AZNLO.
- ATLAS would also have a new Z UE analysis.
- While the tune describes the low Z pT first bin, not so great for the higher Z pT range.

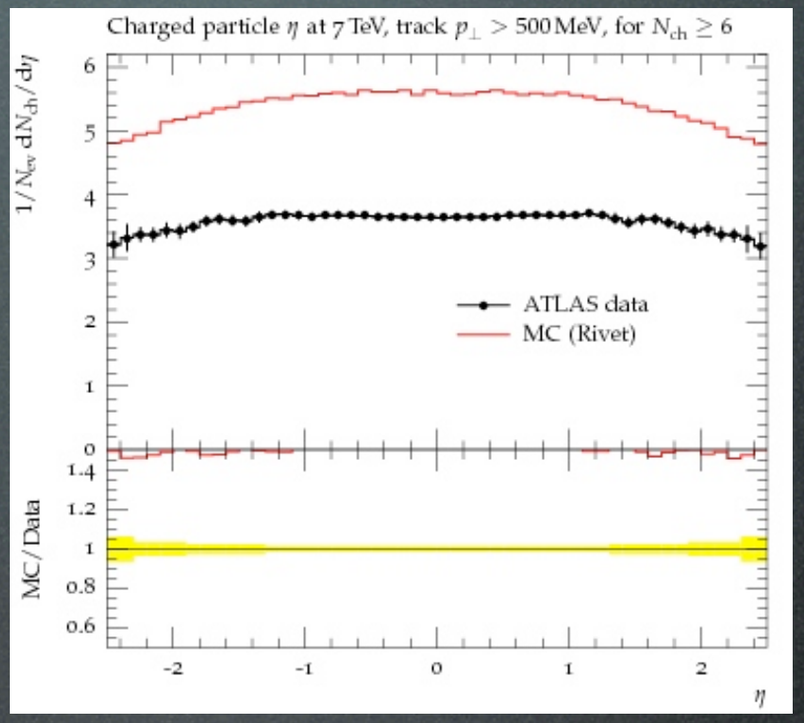
Bonus: aMC@NLO +Pythia8 Problem

Recommended settings:

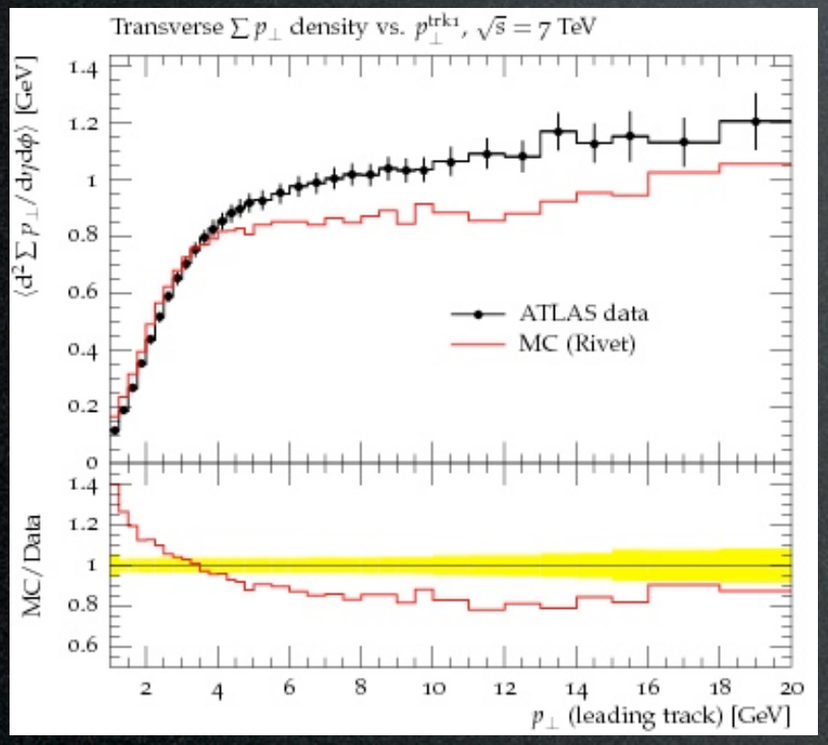
- PYTHIA8 (use version 8.180 or later): SpaceShower:pTmaxMatch = 1, SpaceShower:pTmaxFudge = 1, SpaceShower:MEcorrections = off, TimeShower:pTmaxMatch = 1, TimeShower:pTmaxFudge = 1, TimeShower:MEcorrections = off, TimeShower:globalRecoil = on, TimeShower:limitPTmaxGlobal = on, TimeShower:nMaxGlobalRecoil = 1, TimeShower:globalRecoilMode = 2, TimeShower:nMaxGlobalBranch = 1.

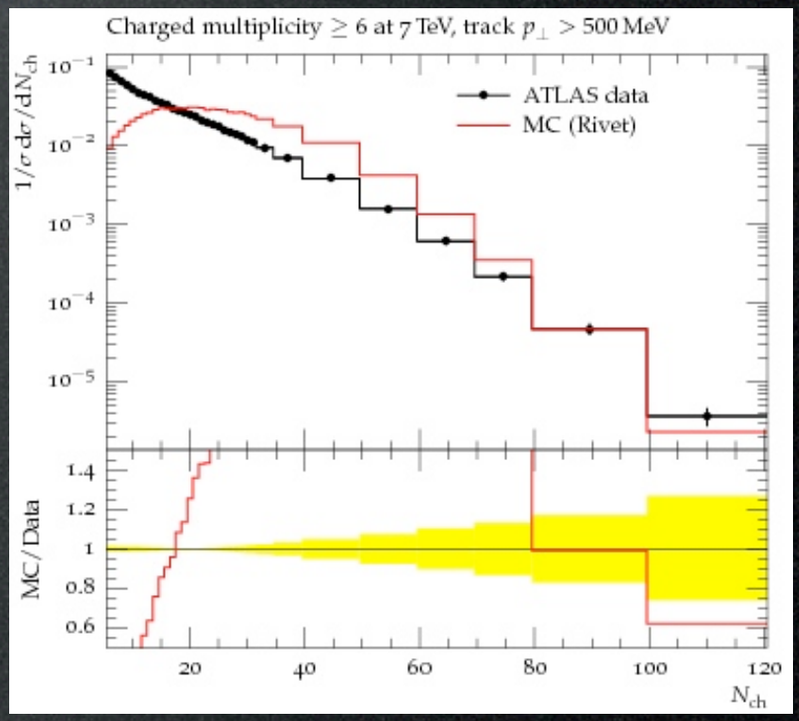
But, then...





Possibly Untunable!





Looking forward

- Some way to go before a consistent Powheg+Pythia8 setup.
- Uncertanties have been calculated by varying mu_fact/renorm scale with arbitrary combination of Perugia low/high-rad tunes.
- Can we/do we want tunes for all variations?