UE-sensitive data-sets: what ATLAS and CMS have used

Process Settings

Key parameters

Transverse $\langle \sum p_T^{ch}/\delta\eta\,\delta\phi \rangle$ vs. p_T^{lead} in $|\eta| < 2.5$ in incl jet events
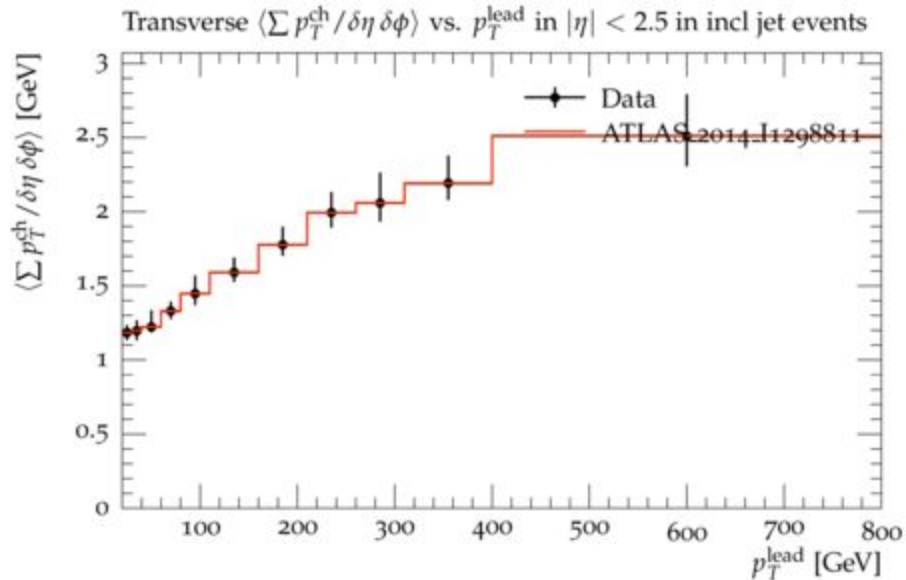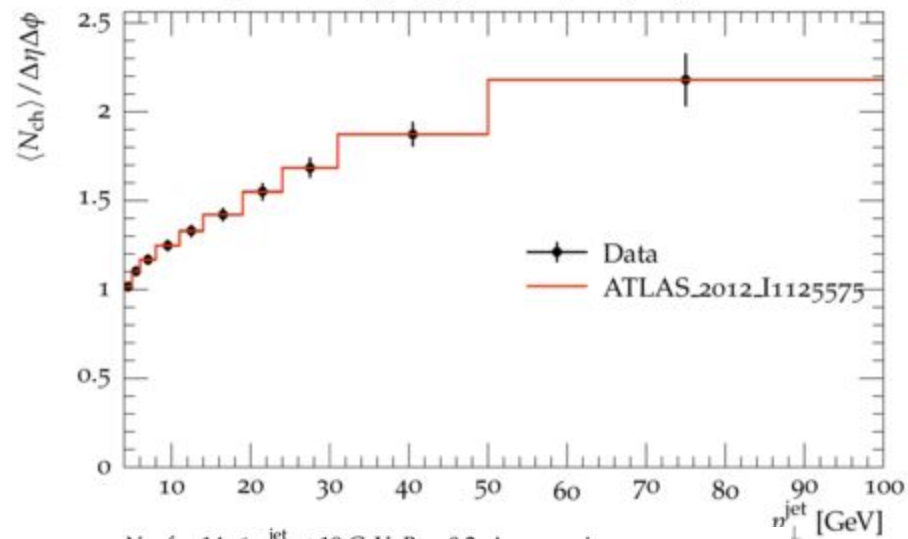
Trans-max $\langle \sum p_T^{ch}/\delta\eta\,\delta\phi \rangle$ vs. p_T^{lead} in $|\eta| < 2.5$ in incl jet events

Trans-min $\langle \sum p_T^{ch}/\delta\eta\,\delta\phi \rangle$ vs. p_T^{lead} in $|\eta| < 2.5$ in incl jet events
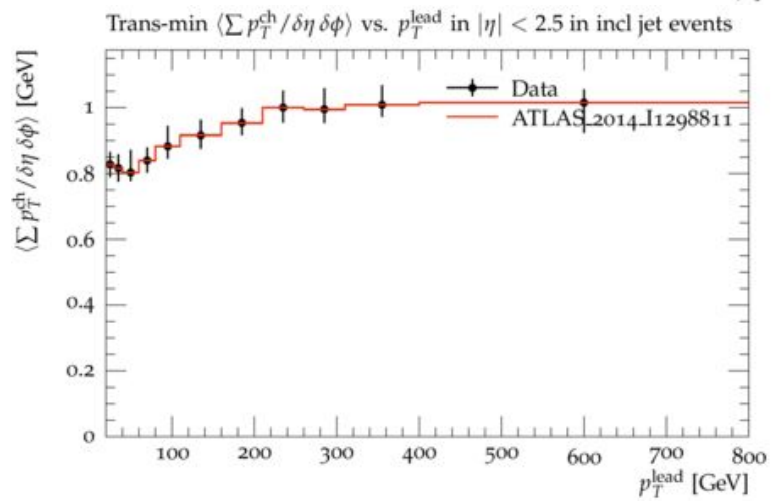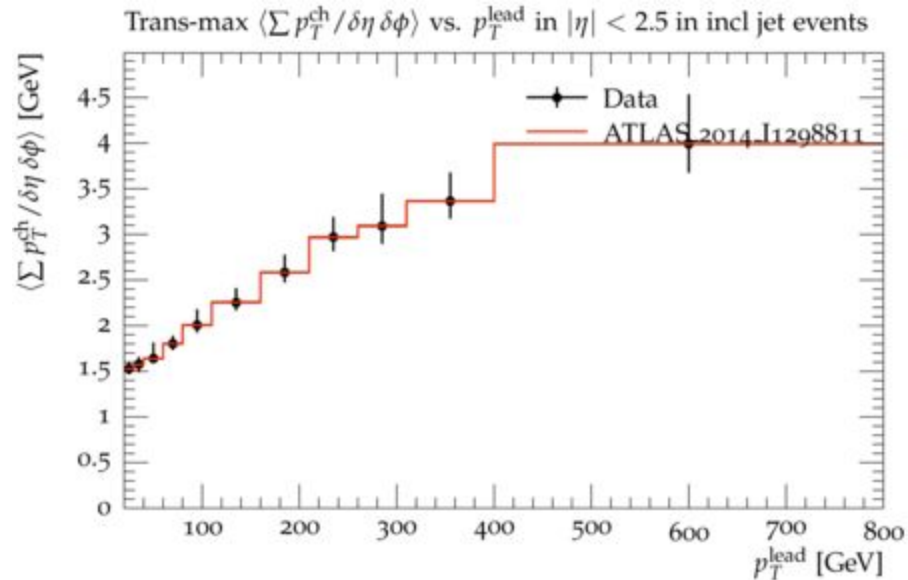
Underlying event measurements with the ATLAS detector at the LHC at a center-of-mass energy of 7 TeV, using the leading jet for event azimuthal orientation and constructing standard transverse region observables from both charged tracks and calorimeter clusters.

Mean N_{ch} vs. leading jet $p_\perp$, $R = 0.2$, Away region

$\langle N_{ch} \rangle / \Delta\eta\Delta\phi$

$n_\perp^{jet}$ [GeV]

Data
ATLAS_2012_I1125575

Mean N_{ch} vs. leading jet $p_\perp$, $R = 0.2$, Transverse region

$\langle N_{ch} \rangle / \Delta\eta\Delta\phi$

$p_\perp^{jet}$ [GeV]

Data
ATLAS_2012_I1125575
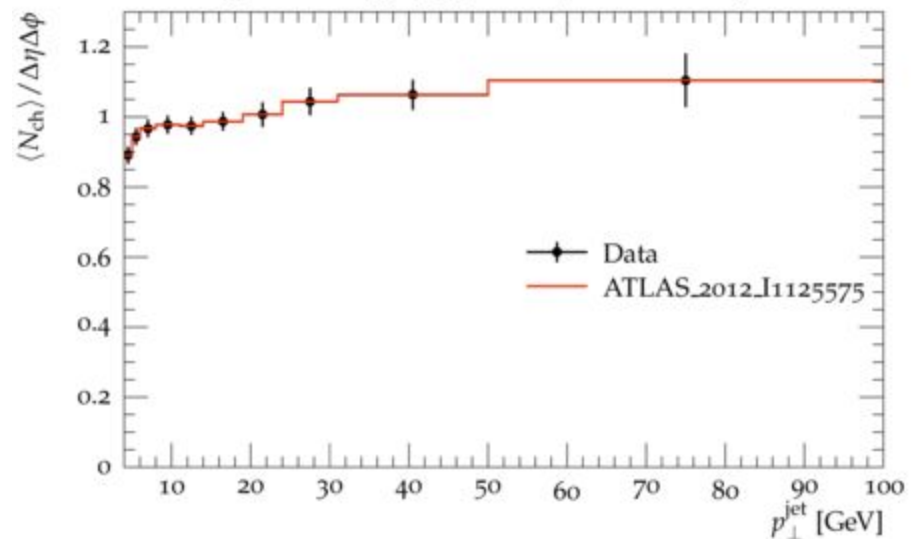
N_{ch} for $14 \leq p_\perp^{jet} < 19$ GeV, $R = 0.2$, Away region

$1 / N_{ev} \, dN_{ev} / dN_{ch}$
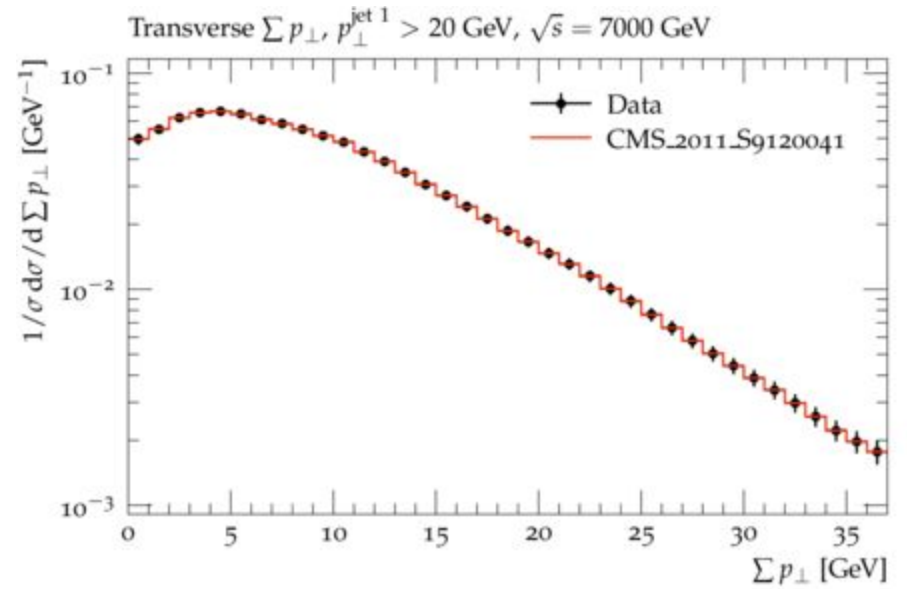
N_{ch}

Data
ATLAS_2012_I1125575
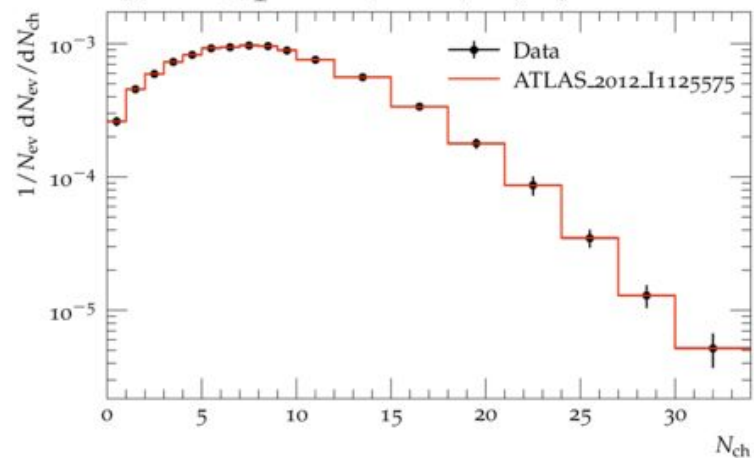
Distributions sensitive to the underlying event are studied in events containing one or more charged particles. Jets are reconstructed using the anti-k_t algorithm with radius parameter R varying between 0.2 and 1.0. Distributions of the charged-particle multiplicity, the scalar sum of the transverse momentum of charged particles, and the average charged-particle pT are measured as functions of $p_{jet\perp}$ in regions transverse to and opposite the leading jet for 4GeV<$p_{jet\perp}$<100GeV. In addition, the R-dependence of the mean values of these observables is studied.

F(z) for 25 GeV < $p_{T\,jet}$ < 40 GeV
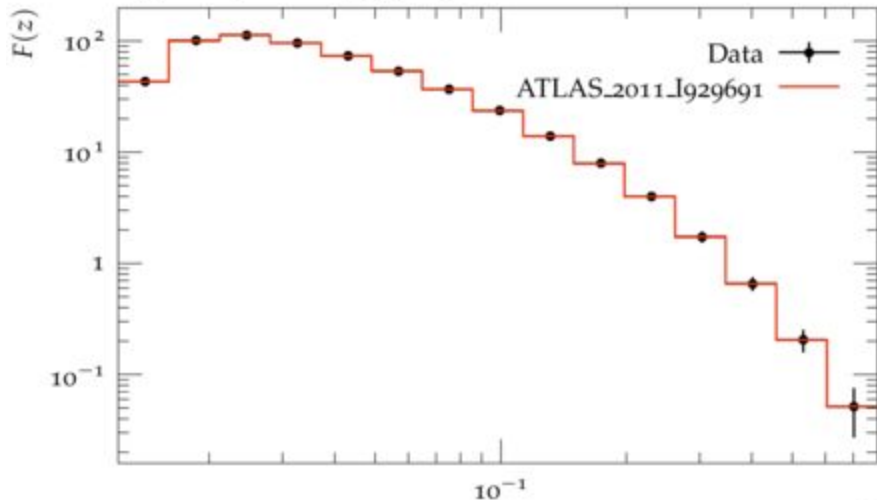
Density of charged particles for 25 GeV < $p_{T\,jet}$ < 40 GeV
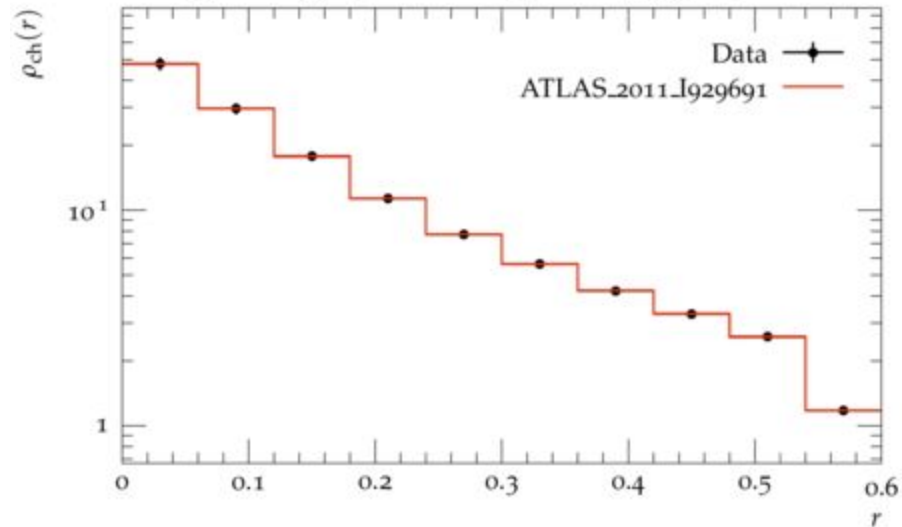
f(p_T^{rel}) for 25 GeV < $p_{T\,jet}$ < 40 GeV
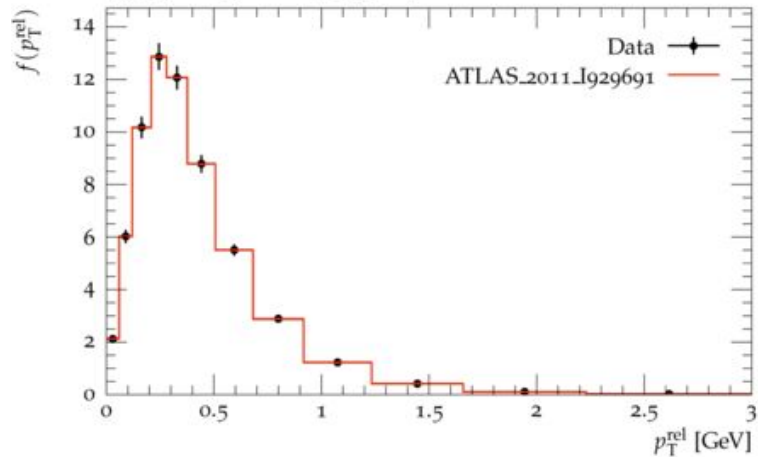
The jet fragmentation function and transverse profile for jets with 25 GeV < p_{Tjet} < 500 GeV and $|\eta_{jet}|$ < 1.2 produced in proton-proton collisions with a center-of-mass energy of 7 TeV are presented. The measurement is performed using data with an integrated luminosity of 36 pb^-1. Jets are reconstructed and their momentum measured using calorimetric information. The momenta of the charged particle constituents are measured using the tracking system. The distributions corrected for detector effects are compared with various Monte Carlo event generators and generator tunes. Several of these choices show good agreement with the measured fragmentation function. None of these choices reproduce both the transverse profile and fragmentation function over the full kinematic range of the measurement.

Transverse charged multiplicity, $p_\perp^{\text{jet 1}} > 20$ GeV, $\sqrt{s} = 7000$ GeV

Transverse $\sum p_\perp$, $p_\perp^{\text{jet 1}} > 20$ GeV, $\sqrt{s} = 7000$ GeV
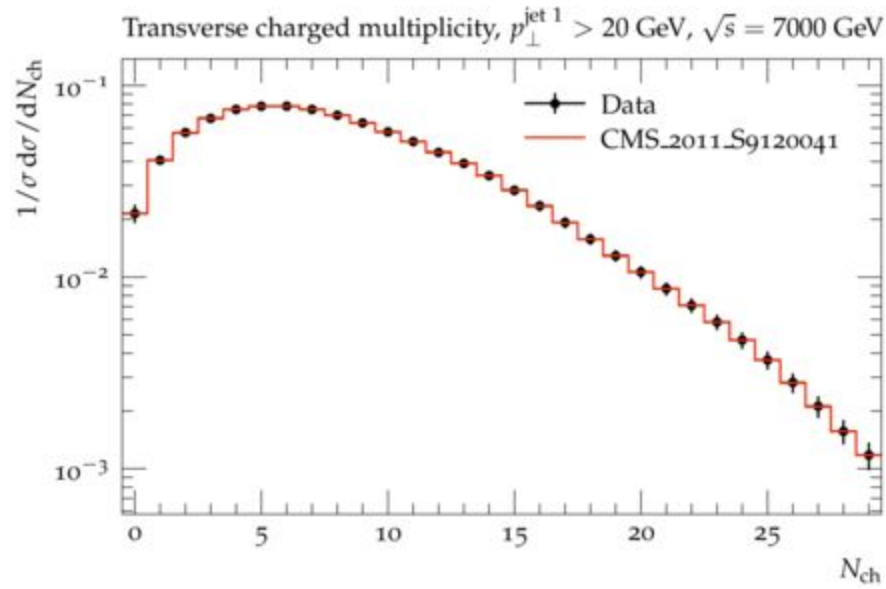
A measurement of the underlying activity in scattering processes with a hard scale in the several-GeV region is performed in proton-proton collisions at Energies of 0.9 and 7 TeV, using data collected by the CMS experiment at the LHC. The production of charged particles with pseudorapidity |eta| < 2 and transverse momentum $p_\perp > 0.5$ GeV/c is studied in the azimuthal region transverse to that of the leading set of charged particles forming a track-jet. Various comparisons are made between the two different energies and also beteen two sets of cuts on p_\perp for leading track jet p_\perp-leading >3 GeV and pT-leading>20 GeV. The activity is studied using 5 types of plots. Two profile plots for the multiplicity of charged particles and the scalar sum of p_\perp. and three distributions for the two previous quantities as well as p_\perp for all the particles in the transverse region. Beam energy must be specified (in GeV) as analysis option "ENERGY" when rivet-merging samples.

```
PDF:pSet = lhagrid1:NNPDF40MC_lo_rc_0000.dat

HardQCD:all = on
PhaseSpace:bias2Selection = on
SpaceShower:rapidityOrder = on

PhaseSpace:bias2SelectionRef = 10.0
PhaseSpace:pTHatMin = 10.0




# Minimum Bias process (as taken from one of pythia8 example)
SoftQCD:nonDiffractive = on          ! minimum bias QCD processes
SoftQCD:singleDiffractive = on
SoftQCD:doubleDiffractive = on
```

Transverse $\langle N_{ch}/\delta\eta\,\delta\phi \rangle$ vs. p_T^{lead} in $|\eta| < 2.5$ in incl jet events

Data
predictions_tnc_1_1, $\chi^2/n = 1.66$
tune_nn, $\chi^2/n = 1.23$
tune_mhst, $\chi^2/n = 1.50$

$\langle N_{ch}/\delta\eta\,\delta\phi \rangle$
(MC − data)
p_T^{lead} [GeV]

Trans-min $\langle \sum p_T^{ch}/\delta\eta\,\delta\phi \rangle$ vs. p_T^{lead} in $|\eta| < 2.5$ in incl jet events

Data
predictions_tnc_1_1, $\chi^2/n = 0.93$
tune_nn, $\chi^2/n = 0.59$
tune_mhst, $\chi^2/n = 1.00$

$\langle \sum p_T^{ch}/\delta\eta\,\delta\phi \rangle$ [GeV]
(MC − data)
p_T^{lead} [GeV]

Trans-max $\langle N_{ch}/\delta\eta\,\delta\phi \rangle$ vs. p_T^{lead} in $|\eta| < 2.5$ in incl jet events

Data
predictions_tnc_1_1, $\chi^2/n = 1.21$
tune_nn, $\chi^2/n = 0.82$
tune_mhst, $\chi^2/n = 1.14$

$\langle N_{ch}/\delta\eta\,\delta\phi \rangle$
(MC − data)
p_T^{lead} [GeV]

Mean N_{ch} vs. leading jet $p_\perp$, $R = 0.2$, Transverse region

Mean N_{ch} vs. leading jet $p_\perp$, $R = 0.2$, Away region

Mean N_{ch} vs. leading jet $p_\perp$, $R = 0.8$, Away region

Data

predictions_tnc_1_1, $\chi^2/n = 2.10$

tune_nn, $\chi^2/n = 3.35$

tune_mhst, $\chi^2/n = 2.01$

Data

predictions_tnc_1_1, $\chi^2/n = 4.46$

tune_nn, $\chi^2/n = 9.13$

tune_mhst, $\chi^2/n = 4.68$

Data

predictions_tnc_1_1, $\chi^2/n = 2.61$

tune_nn, $\chi^2/n = 1.52$

tune_mhst, $\chi^2/n = 2.52$

$\langle N_{ch} \rangle / \Delta\eta\Delta\phi$

$(MC - data)$

$p_\perp^{jet}$ [GeV]