

inclusive jets data vs fixed
order predictions: shower/
resummation and NP effects

ETH *zürich*

Les Houches

09 June 2017

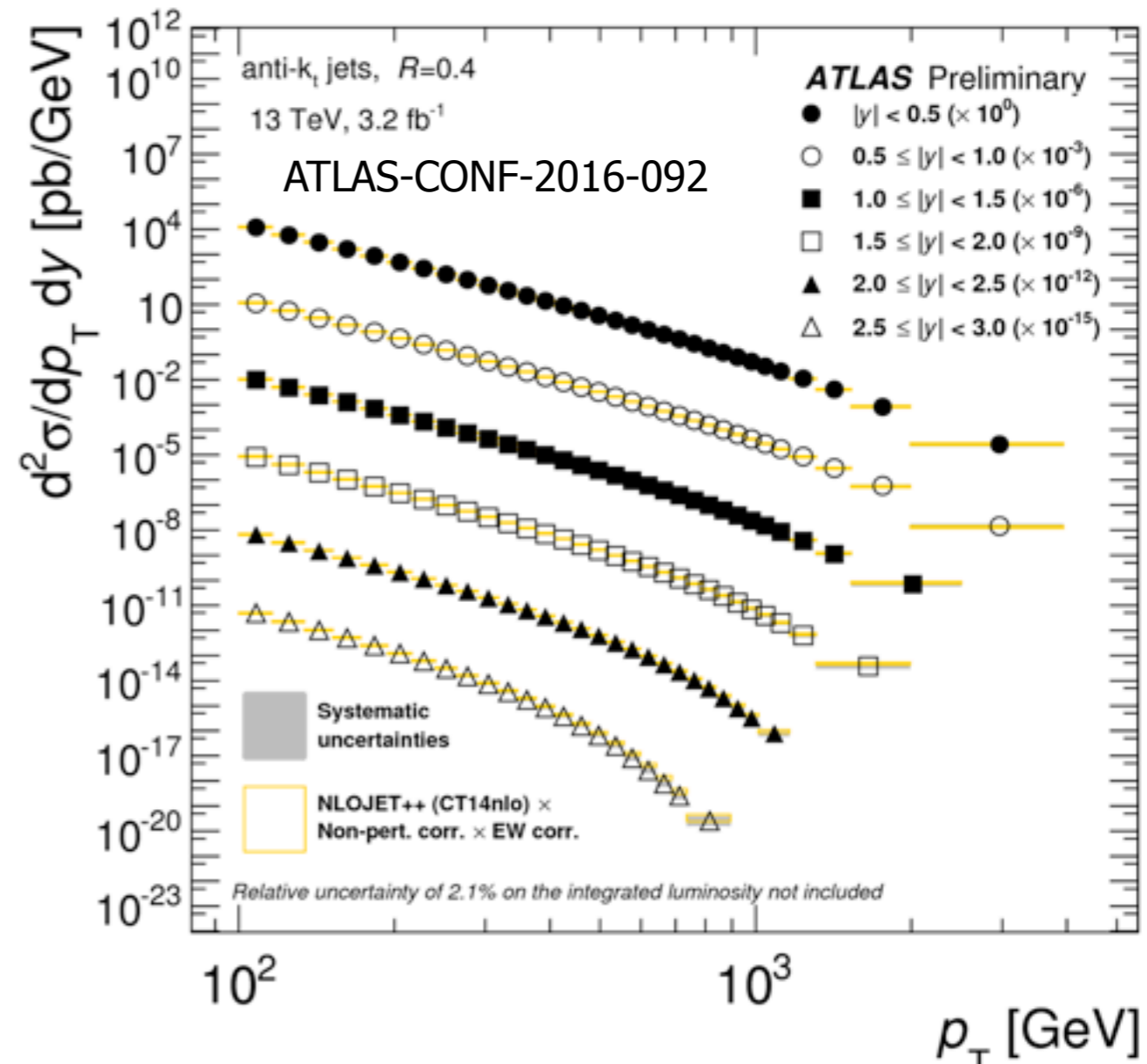
Kostas Theofilatos

Inclusive jet cross section

Data are measured at hadron level and compared to **Fixed Order**

- FO partonic xs is corrected for **Non-Perturbative** effects
- C_{NP} evaluated bin-by-bin with different MCs, (N)LO ME+PS, envelope is typically made

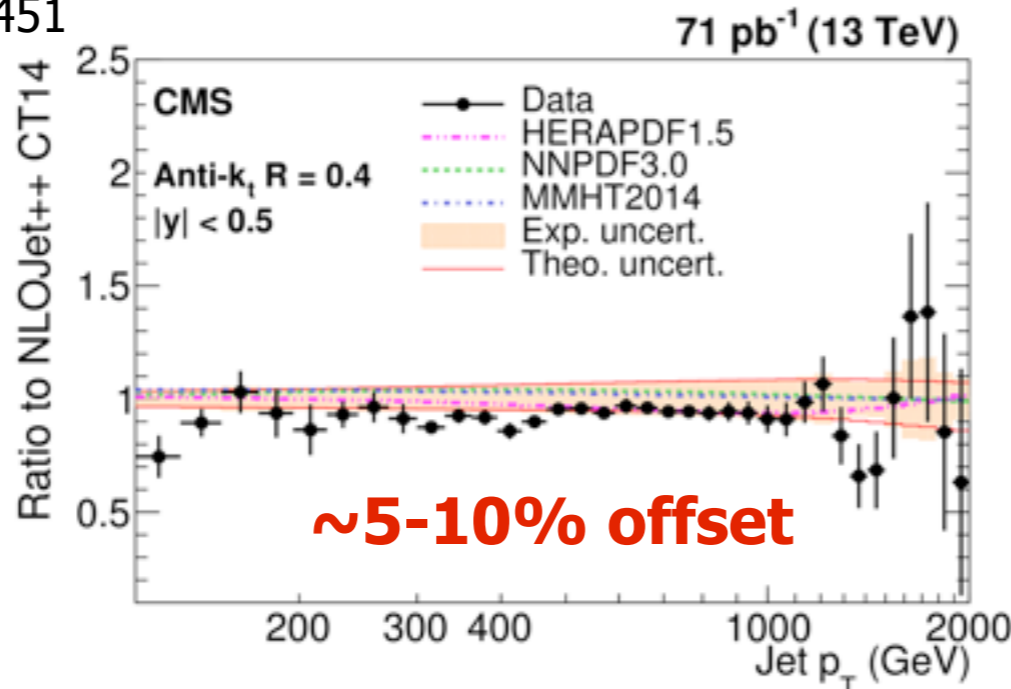
$$C_{NP} = \frac{d\sigma^{\text{ME+PS+HAD+MPI}}/dp_T}{d\sigma^{\text{ME+PS}}/dp_T}$$



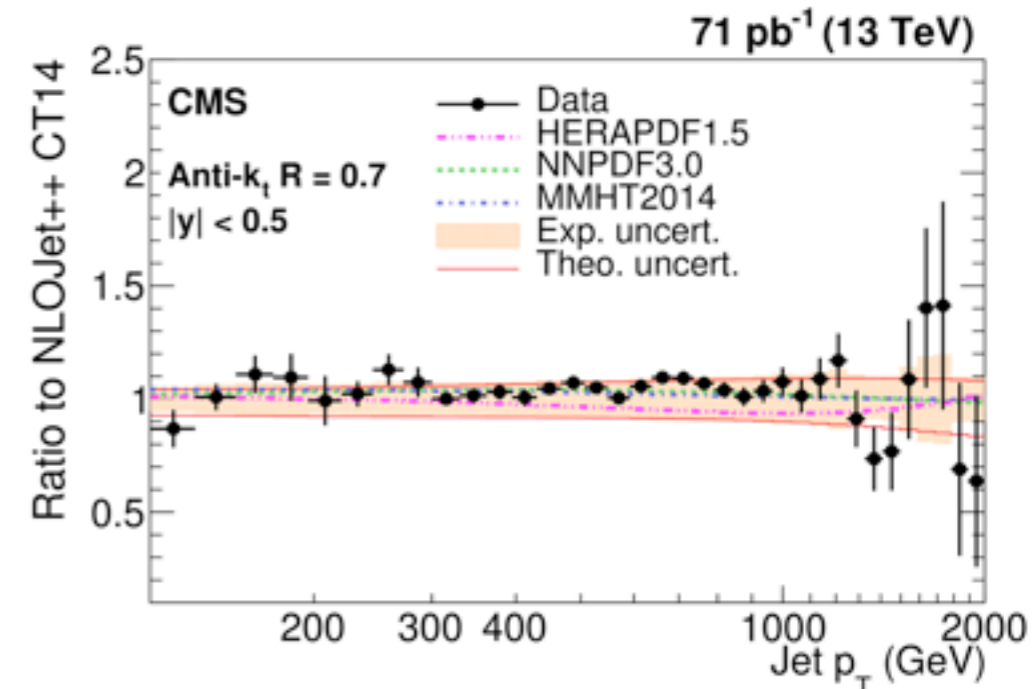
smaller cone size jets have in general smaller C_{NP} but is the smaller cone better for FO comparisons with DATA ?

**NLOJet++
fixed-order**

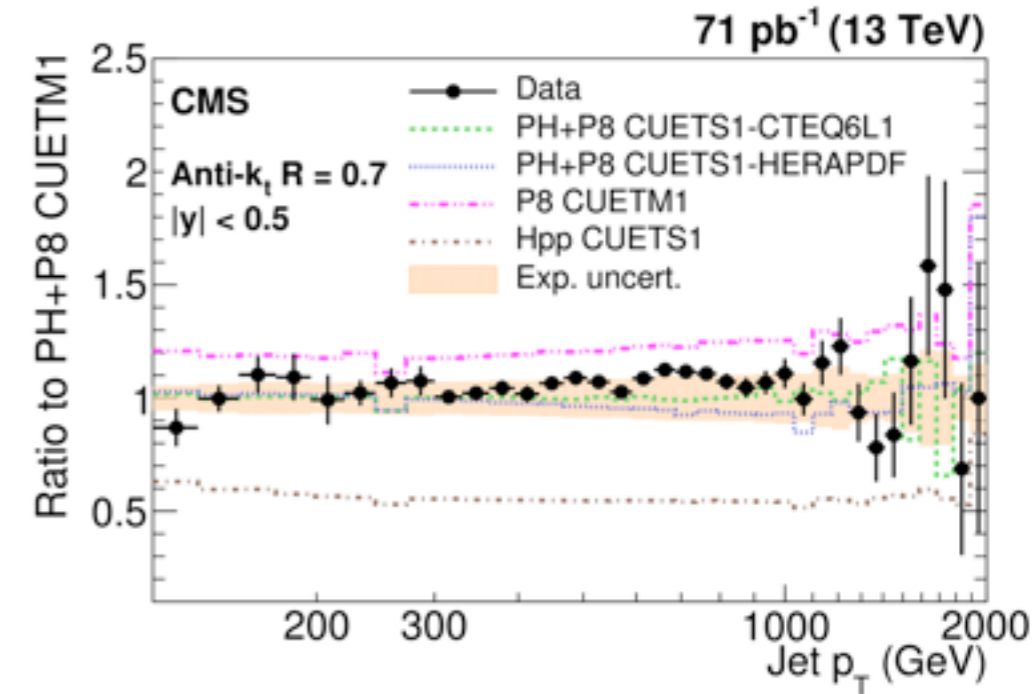
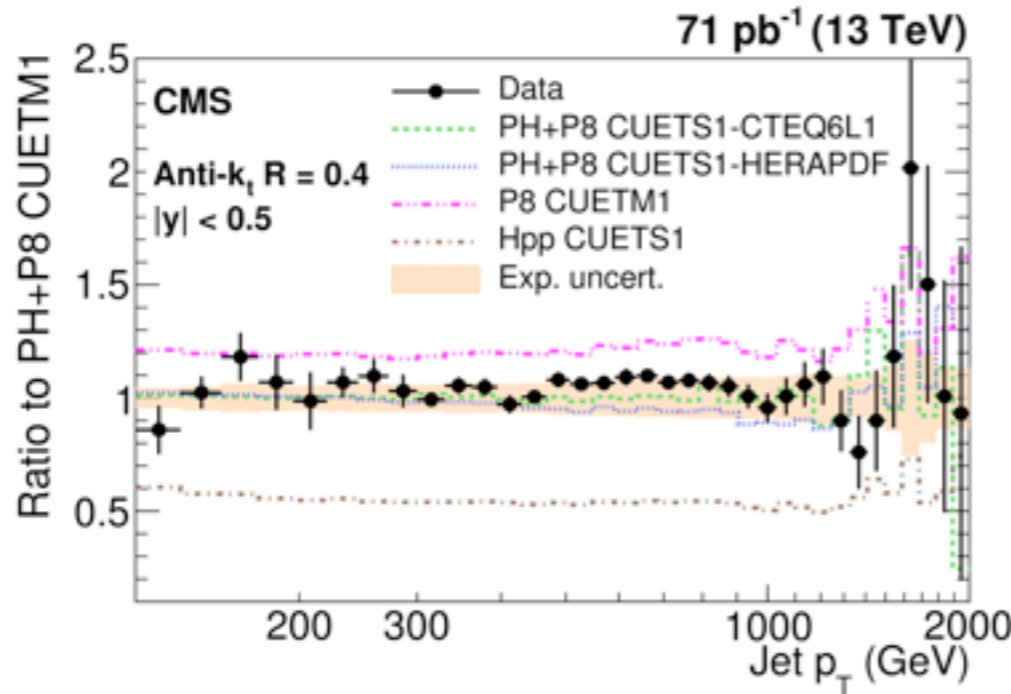
AK4 jets



AK7 jets



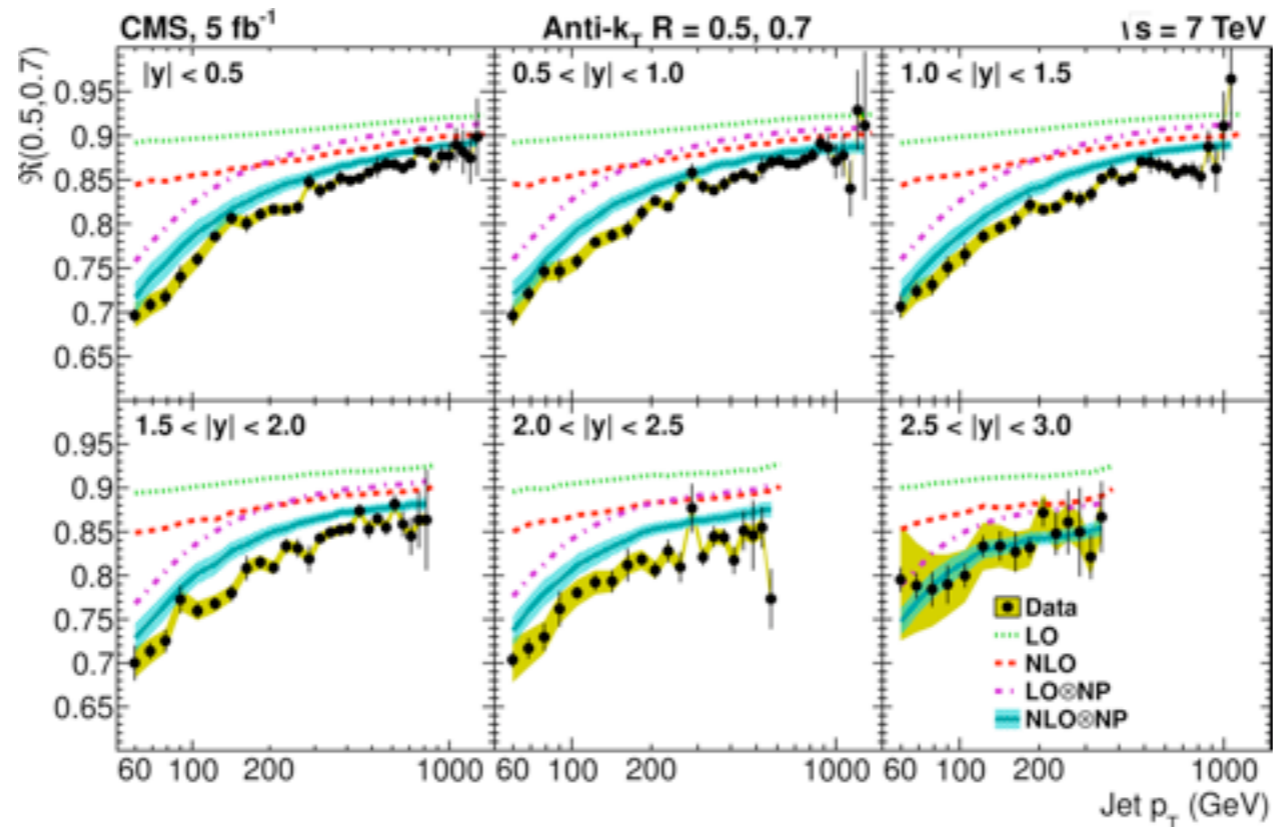
**Powheg
NLO ME+PS**



- NLOJet++ / Powheg / Data **agree for large R (0.7)**
- NLOJet++ / Data **some tension for small R (0.4)**
- Effect is attributed to the lack of **parton shower/resummation** from the FO

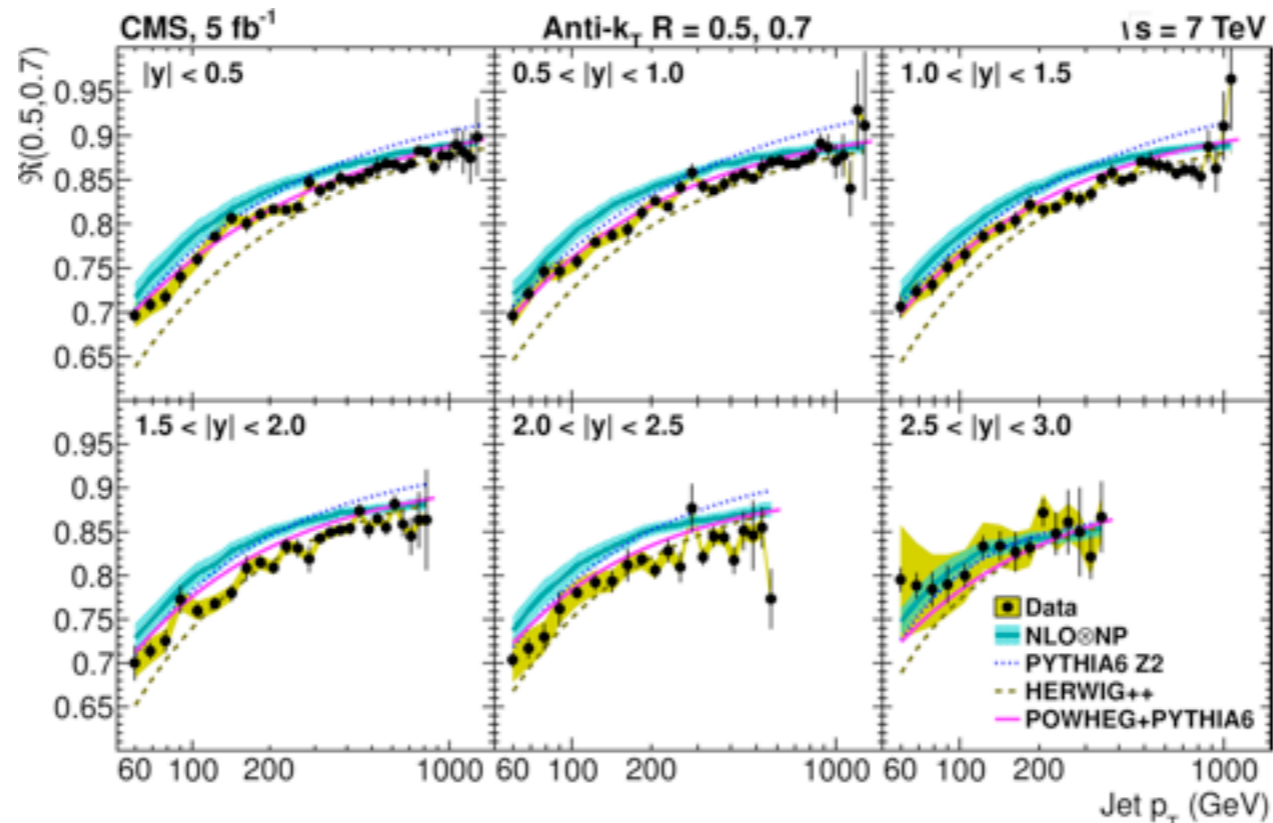
Cross section ratio $R = \sigma_{AK5} / \sigma_{AK7}$

**NLOJet++
fixed-order**



Dependence
Data/NLOJet++
agreement as
function of R, is
consistent with
earlier CMS
measurements at
 $\sqrt{s} = 7, 8$ TeV

**Powheg
NLO ME+PS**



Jets radius parameter

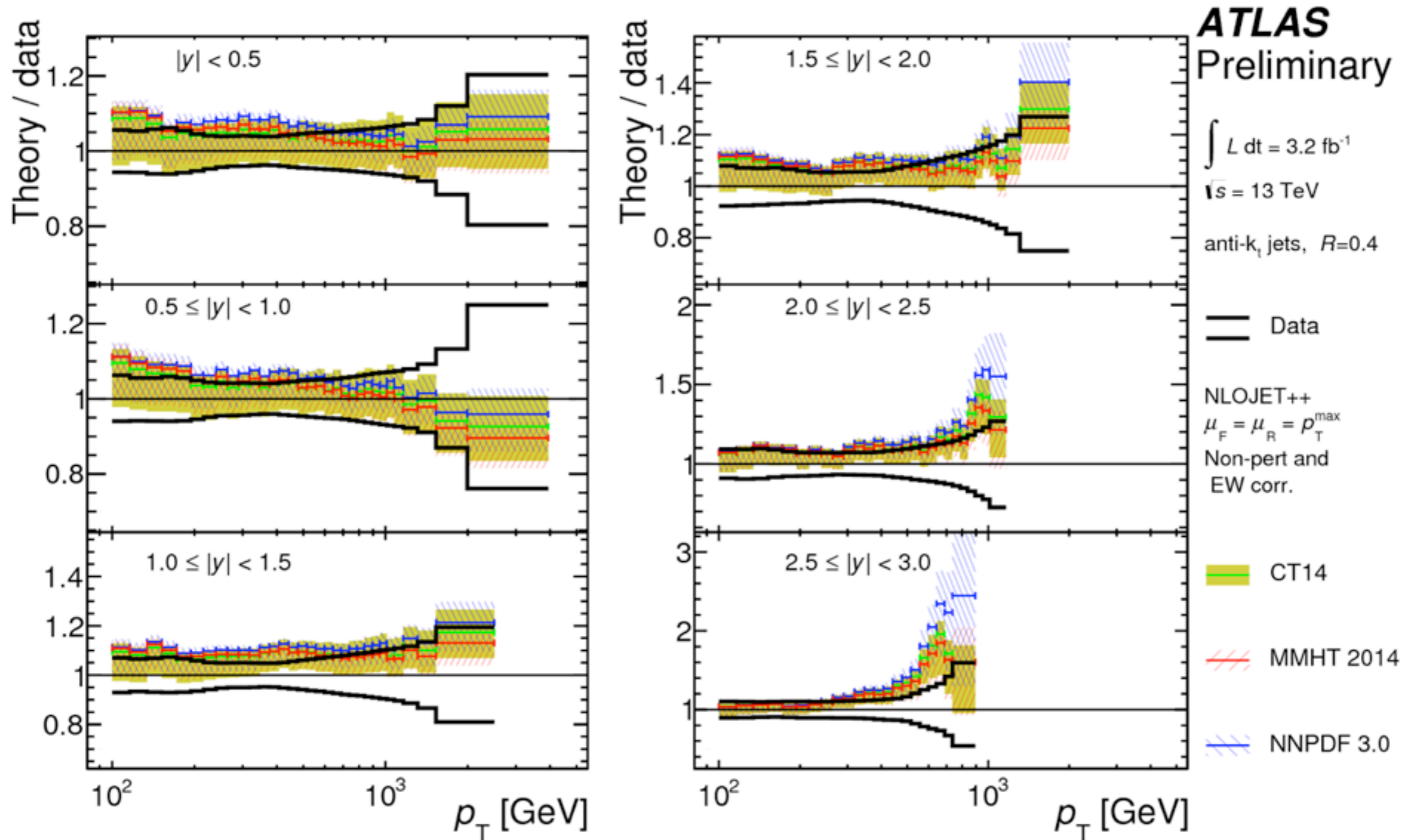
- Large cone size is more suitable for comparing FO partonic cross sections to data
 - AK7 should be more robust compared to AK4 for what regards shower/resummation effects
 - related to the scale choice discussion: differences between p_{T_lead} and p_T should be less of an issue for larger cone than the AK4 that's used so far
- AK4 have small $C_{NP} \sim 1-2\%$ and somehow preferred due to that in some cases
 - But note that what matters is the uncertainty on the C_{NP} and not its size
 - there is (so far) no rigorous procedure to assess the central value of C_{NP} and its uncertainty

Summary

- Should **AK4** data be used in PDF fits or used to judge the theory agreement with **(N)NLO x NP x EW** without accounting for shower/resummation effects ? Is **AK7** completely immune and safe for comparing with FO?
 - A theoretical study as function of jet cone size might be needed to conclude on these by means and resummation corrections and NLO MCs
- Can we make rigorous the C_{NP} and its uncert. calculation ?
 - In principle there should be no reason for different needs between ATLAS and CMS for a given cone size, $[p_T, Y]$ bins

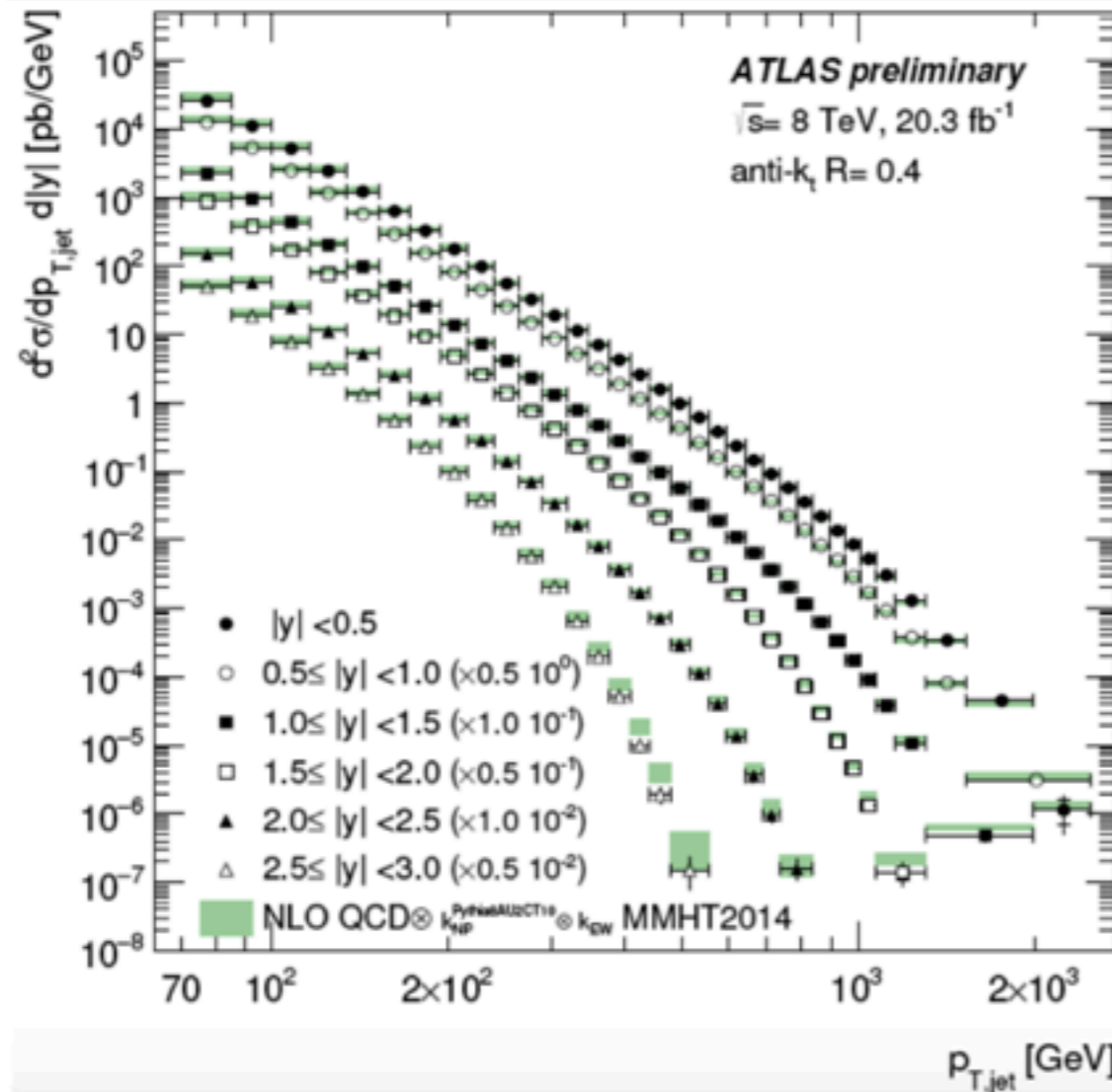
Would be nice to have an accord on these coming out from **Les Houches 2017**

ATLAS incl. jets data/NLOJET++



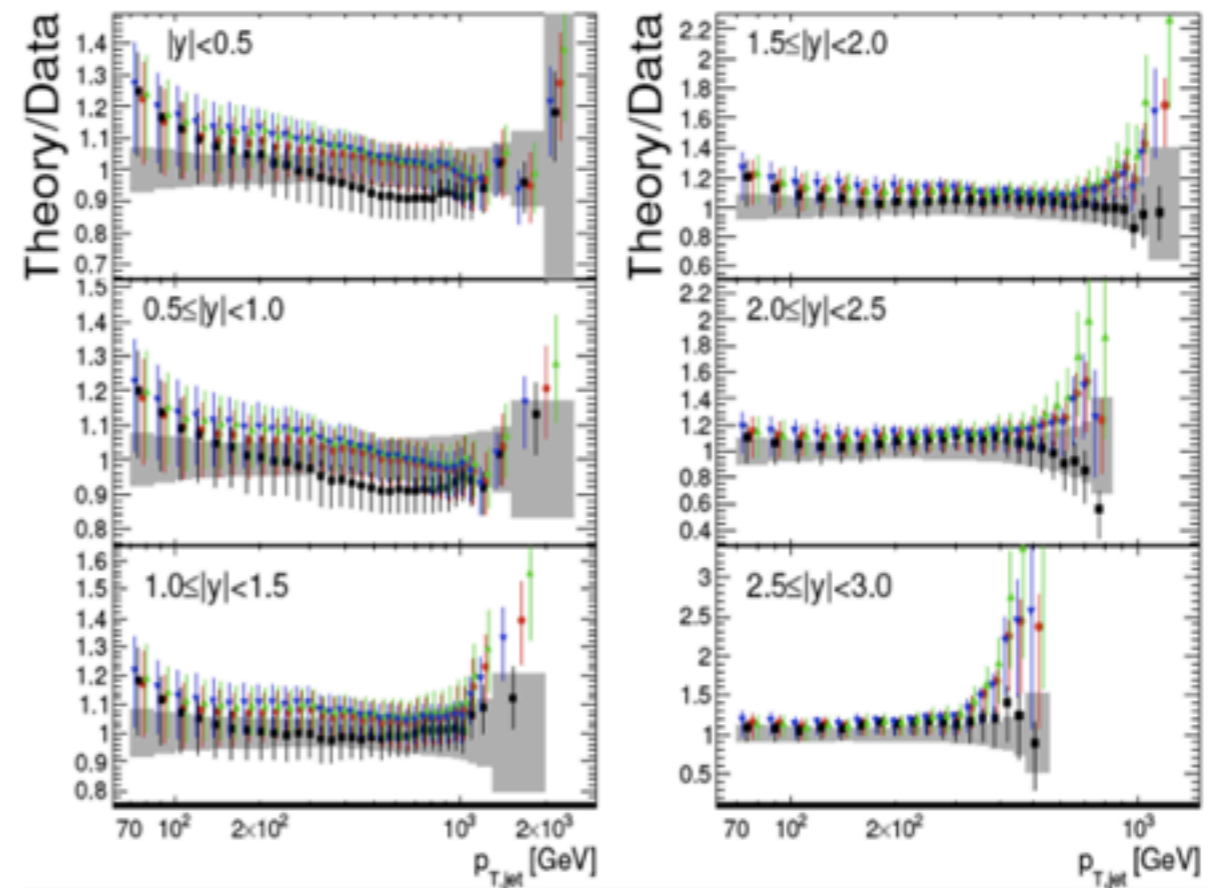
- NLOJet++ in agreement within uncert. with data (**AK4**) for $|y| < 2.5$

Inclusive Jet production at 8 TeV



Data compared to the NLO QCD prediction with the MMHT2014 PDF set, corrected for non-perturbative and EW effects

ATLAS – STDM-2015-01



Data compared with various PDF sets and used to constrain the PDFs.

These theory/data trends are consistently observed in ATLAS data at different \sqrt{s} energies.

NLO pQCD

$\otimes k_{EW} \otimes k_{NP}^{\text{Pythia8 AL2CT10}}$

$\mu_R = \mu_F = p_{T, \text{jet}}^{\text{max}}$

\blacklozenge CT14

\blacksquare HERAPDF20

\blacktriangleup NNPDF30

\blacktriangledown MMHT14