PB TMD meeting

- Hoping that you are all ok !

TMDlib manual

- Comments from Referee received !
- Please check also TMDplotter … it is important to check that it is working !
  - it was not good that the referee immediately picked out configurations which did not work ….

A new set of PDFs from Parton Branching

H. Jung
with
A. Bermudez Martinez, L.I. Estevez Banos, F. Hautmann, J. Lidrych, M. Mendizabal Morentin, S. Taheri Monfared, Q. Wang, K. Wichmann, H. Yang
DESY

proposed to discussion of
PDF4LHC21
recommendation

A new set of PDFs from Parton Branching

- Collinear PDFs are obtained from global fits with NLO or NNLO DGLAP splitting functions:

$$\frac{df_i(x,\mu^2)}{d\ln\mu^2} = \sum_{j=q,\bar{q},g} \int_x^1 \frac{dz}{z} P_{ij}\left(\frac{x}{z},\mu^2\right) f_j(z,\mu^2)$$

  with μ^2 being the factorization scale assumed equal to the renormalization scale μ_R^2

- Calculations treating emissions in initial parton cascade, like parton showers, or Collins Soper resummation for DY q_T spectra suggest:

  - angular ordering is appropriate → leading to $\mu_R^2 \neq \mu_F^2$

$$\mu_R^2 = q_T^2 = \mu_F^2(1-z)^2$$

First sets of pdfs with $\mu_F \neq \mu_R$

- PartonBranching Method allows to determine collinear (as well as TMD) parton densities. Proven to be identical to DGLAP in appropriate limits.
  - obtained from HERA I+II, similar to HERAPDF2.0 Bermudez Martinez, A., et al, Phys. Rev. D, 99(2019), 074008

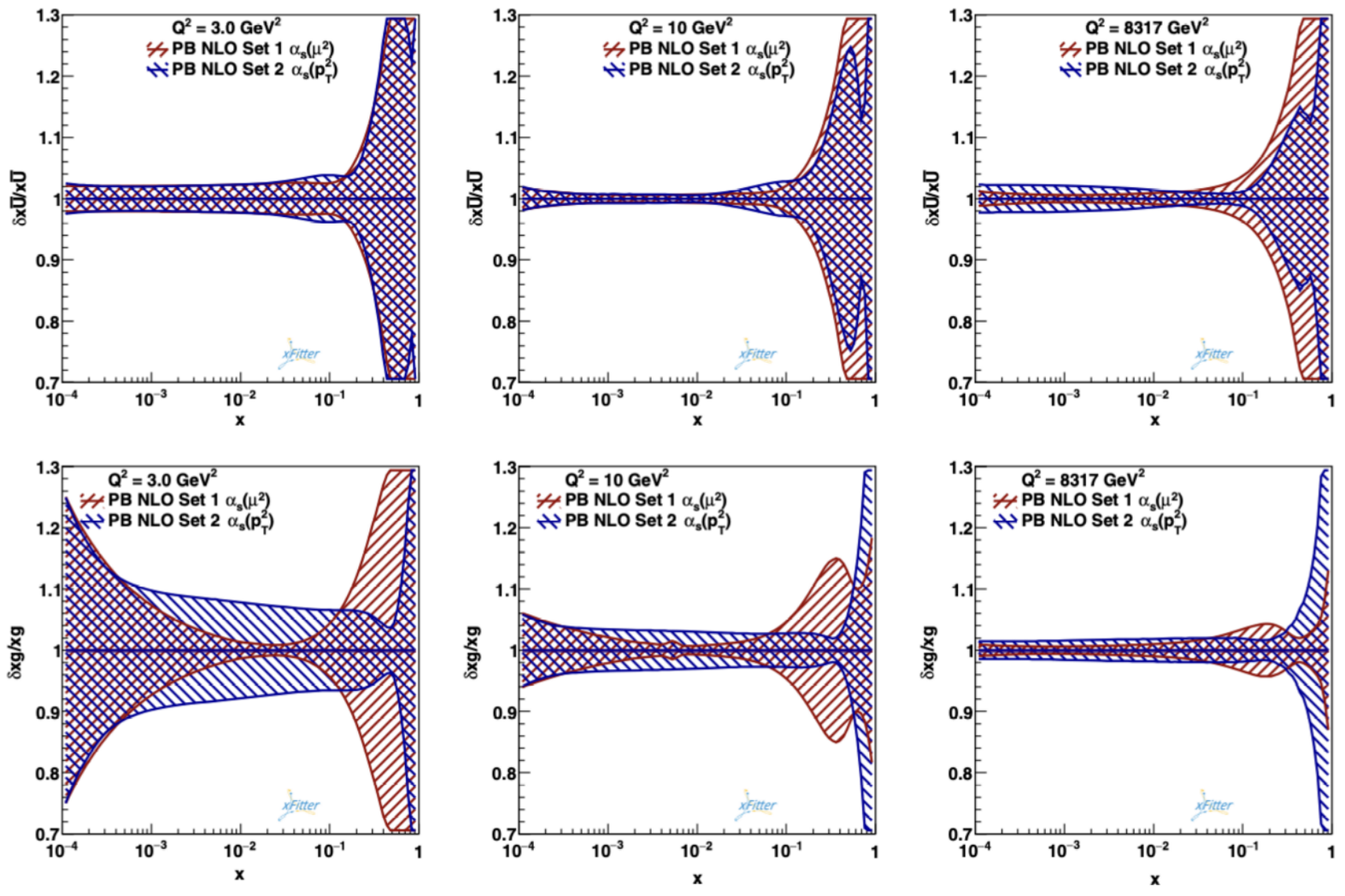


FIG. 4. Total uncertainties (experimental and model uncertainties) for the two different sets at different values of the evolution scale μ^2.

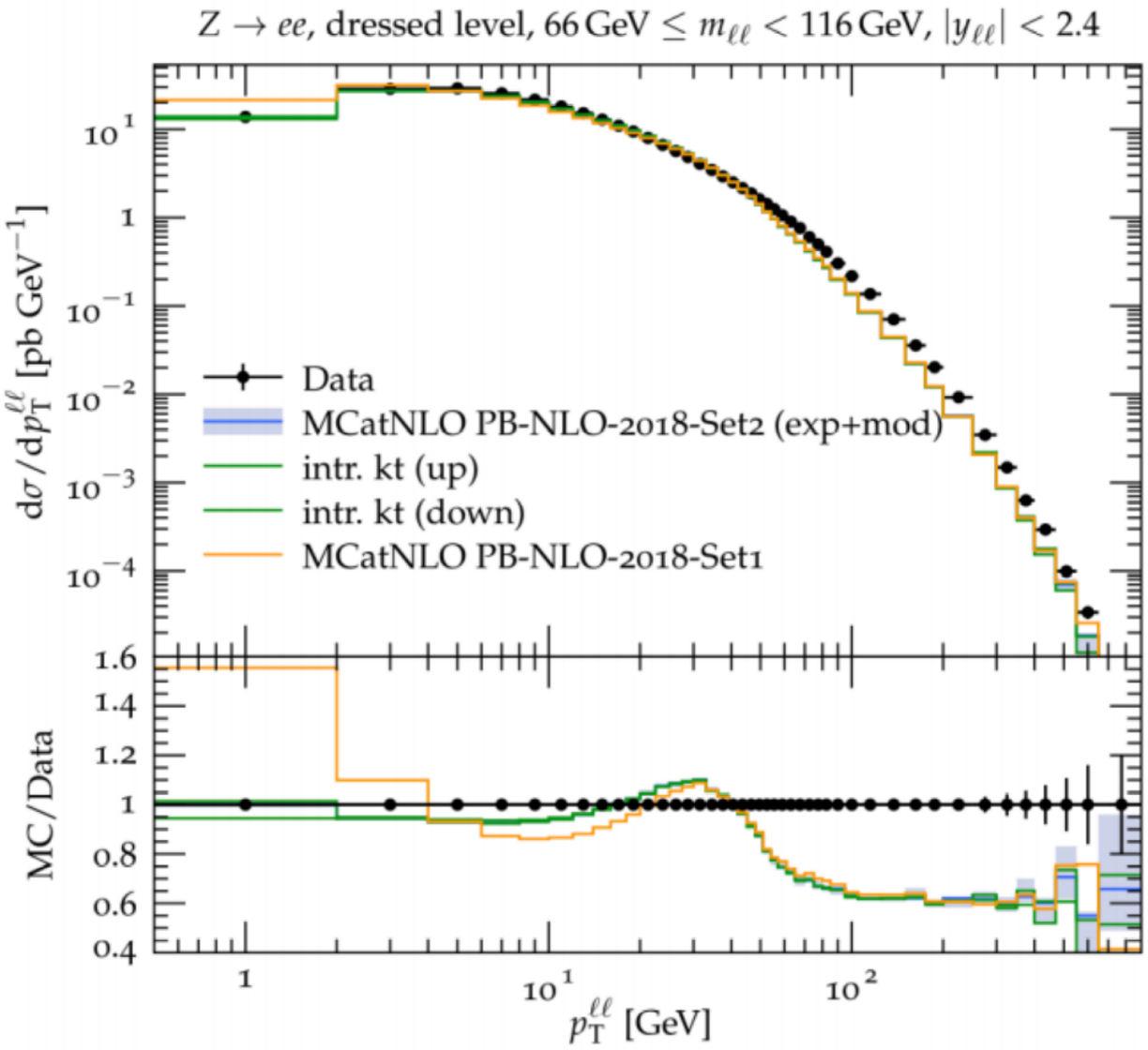
- BUT: uncertainties are different between different sets

H. Jung et al , SMP meeting, A new set of PDFs from Parton Branching, 25. May 2021

Applications to DY q_T spectra

- Application to Z production at LHC

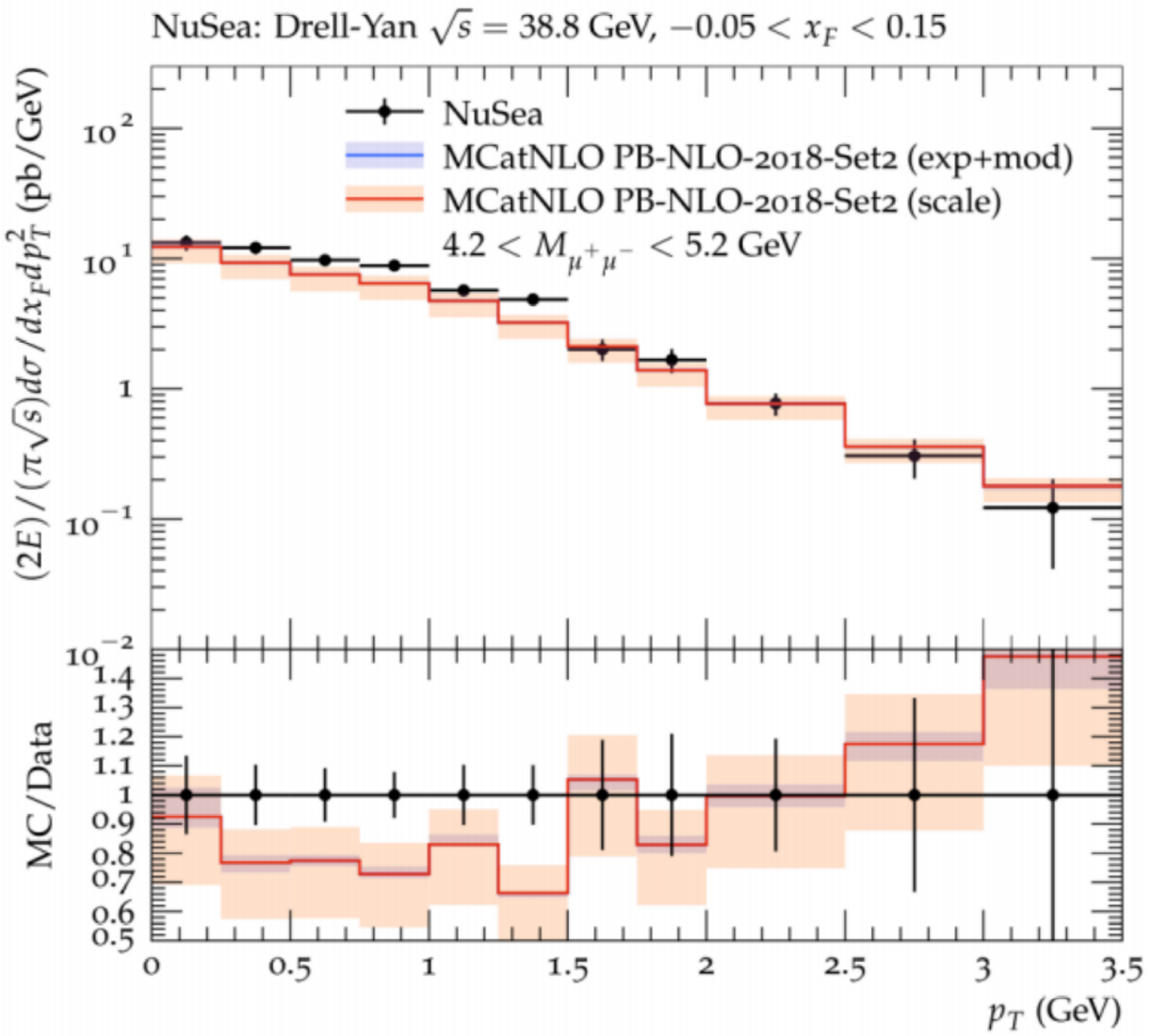
Bermudez Martinez et al, Phys. Rev. D, 100 (2019), 074027



- Preference for set2: $\mu_R \neq \mu_F$

- DY at low energies ($\sqrt{s} = 38.8\,GeV$)

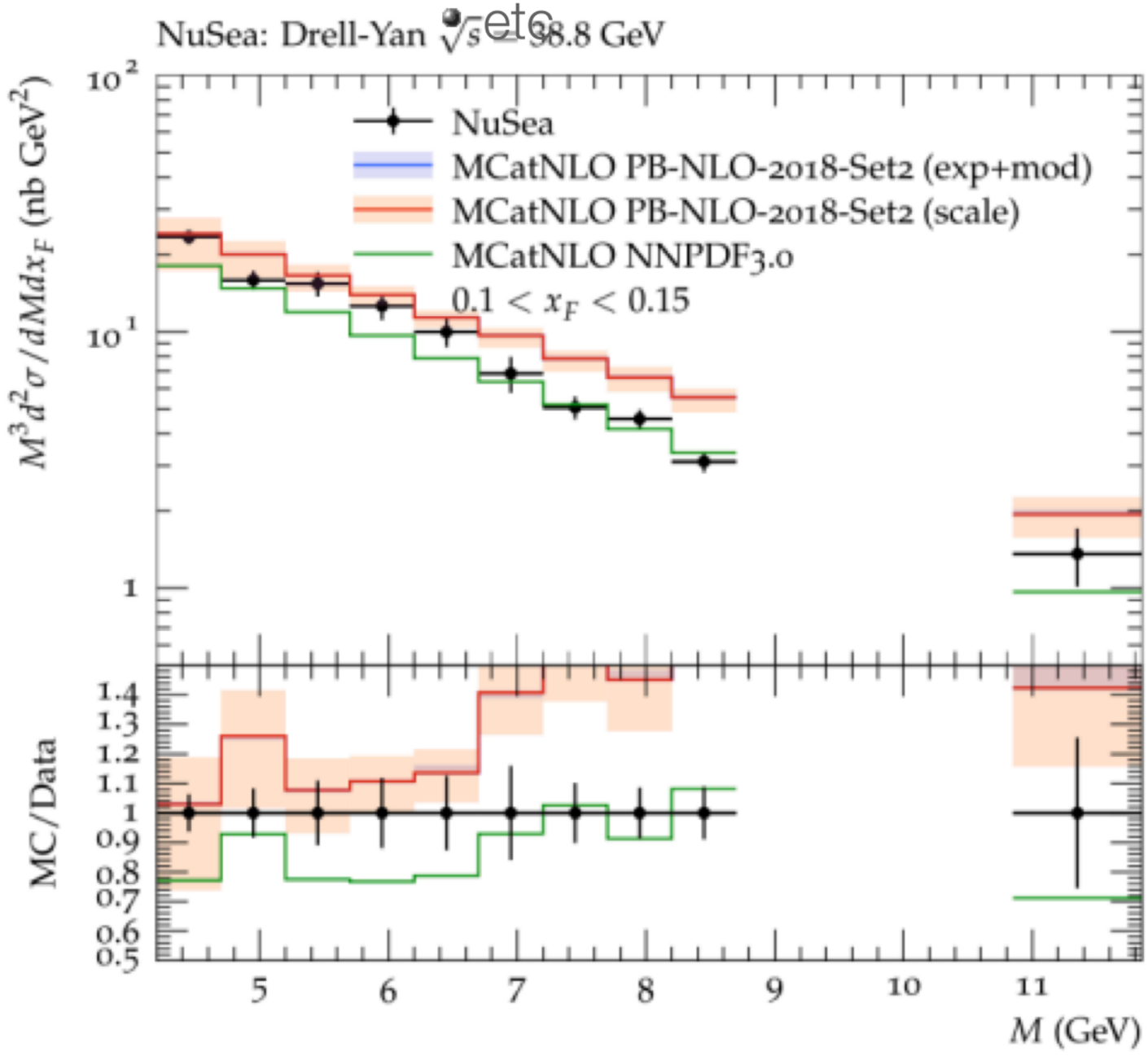
Bermudez Martinez, A. et al. Eur. Phys. J. C, 80(2020), 598



- Works well at low energies

Where are the issues ?

- PB pdfs use only HERA data:
  - high x partons not well constrained
    Bermudez Martinez, A. et al. Eur. Phys. J. C, 80(2020), 598
  - etc.



H. Jung et al , SMP meeting, A new set of PDFs from Parton Branching, 25. May 2021

What is needed ?

- Need a global fit:
  - tools are available in xfitter
    - can be used in any other fitting tool as well :)
  - need general effort to perform global fit and produce collinear pdfs at LO, NLO and NNLO
  - needs also CMS person-power :)

- Benefits
  - pdf with a different treatment of scale in α_s
  - important for uncertainty estimates
  - important for all ME+PS calculations, since PS uses $\alpha_s(q_T)$

  - and automatically obtain PB - TMDs needed for
    - DY q_T spectra
    - final state predictions with consistent PS