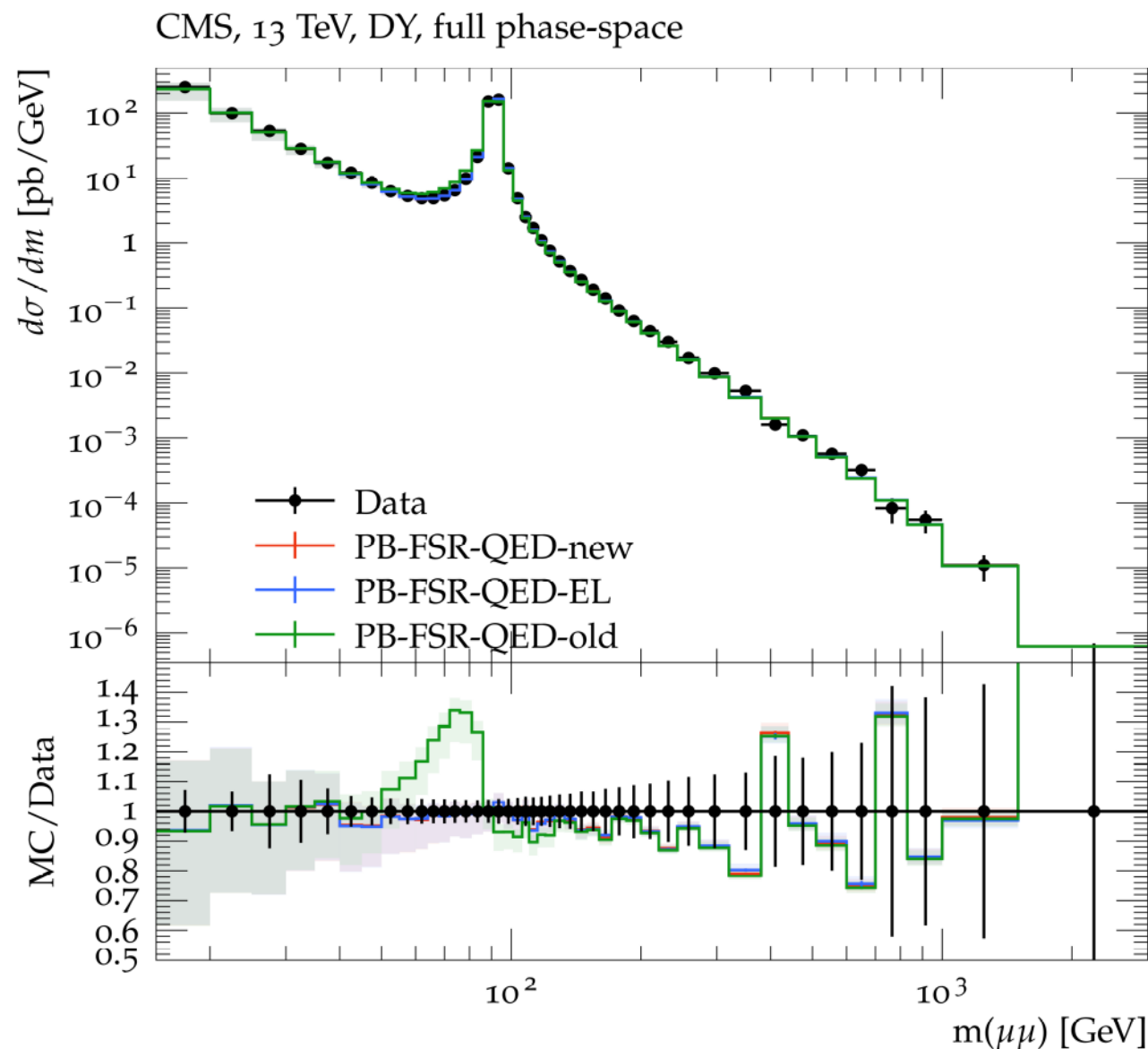# Cascade developer meeting

CASCADE news

- New version ready: 3.3.0
  - bug in version 3.3.0
    - reading steering file overwrote parameters → corrected now
  - timing and Maxfactor
    - new feature in test – beta release (optimized max-weight calculation, no need to apply external MaxFactor)

QED radiation: bug in Rivet for P6

- look at mass distribution, independent of TMD and QCD parton shower
- Recall: differences between P6 and P8 FSR (for photon radiation from leptons) and differences to measurement
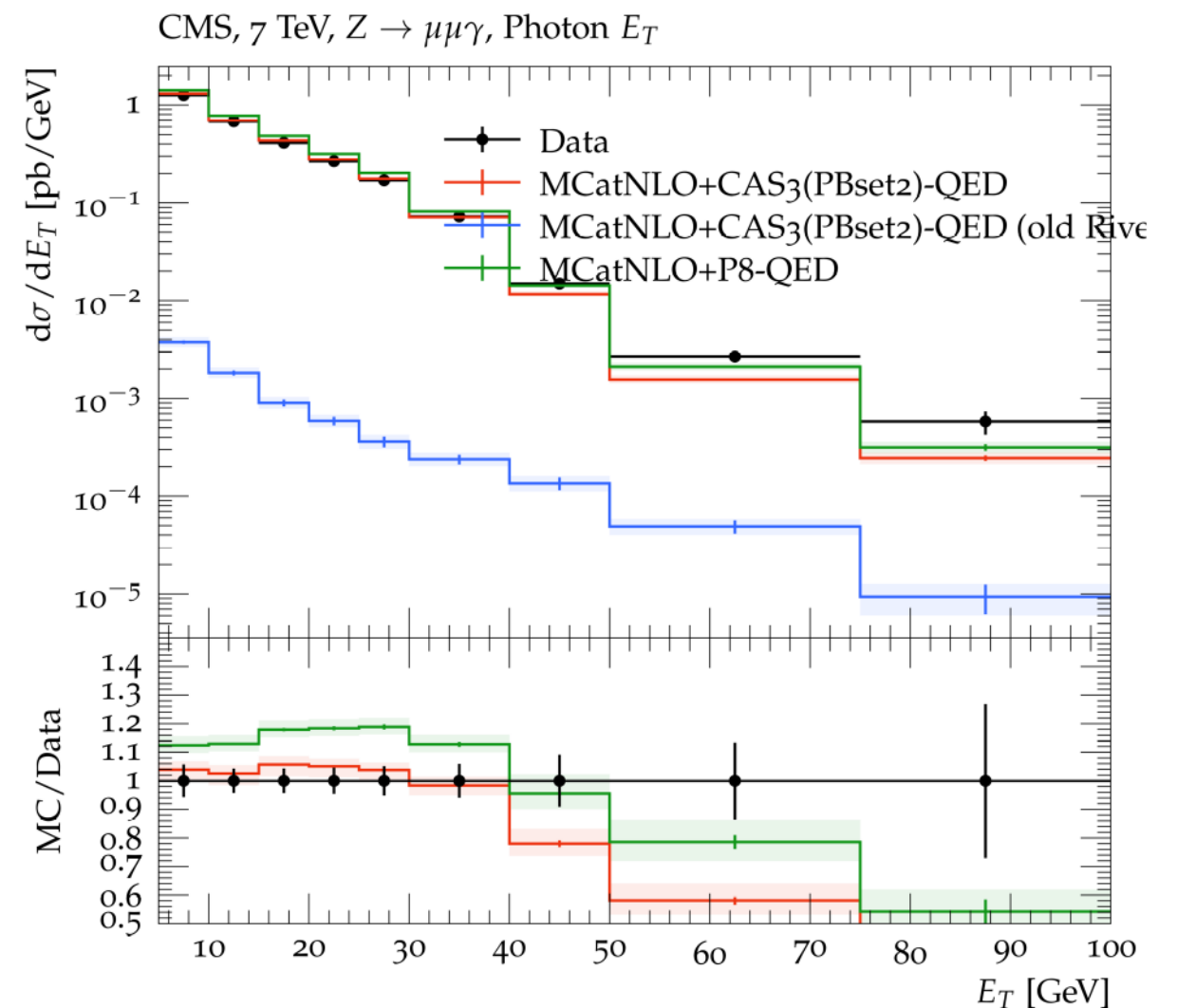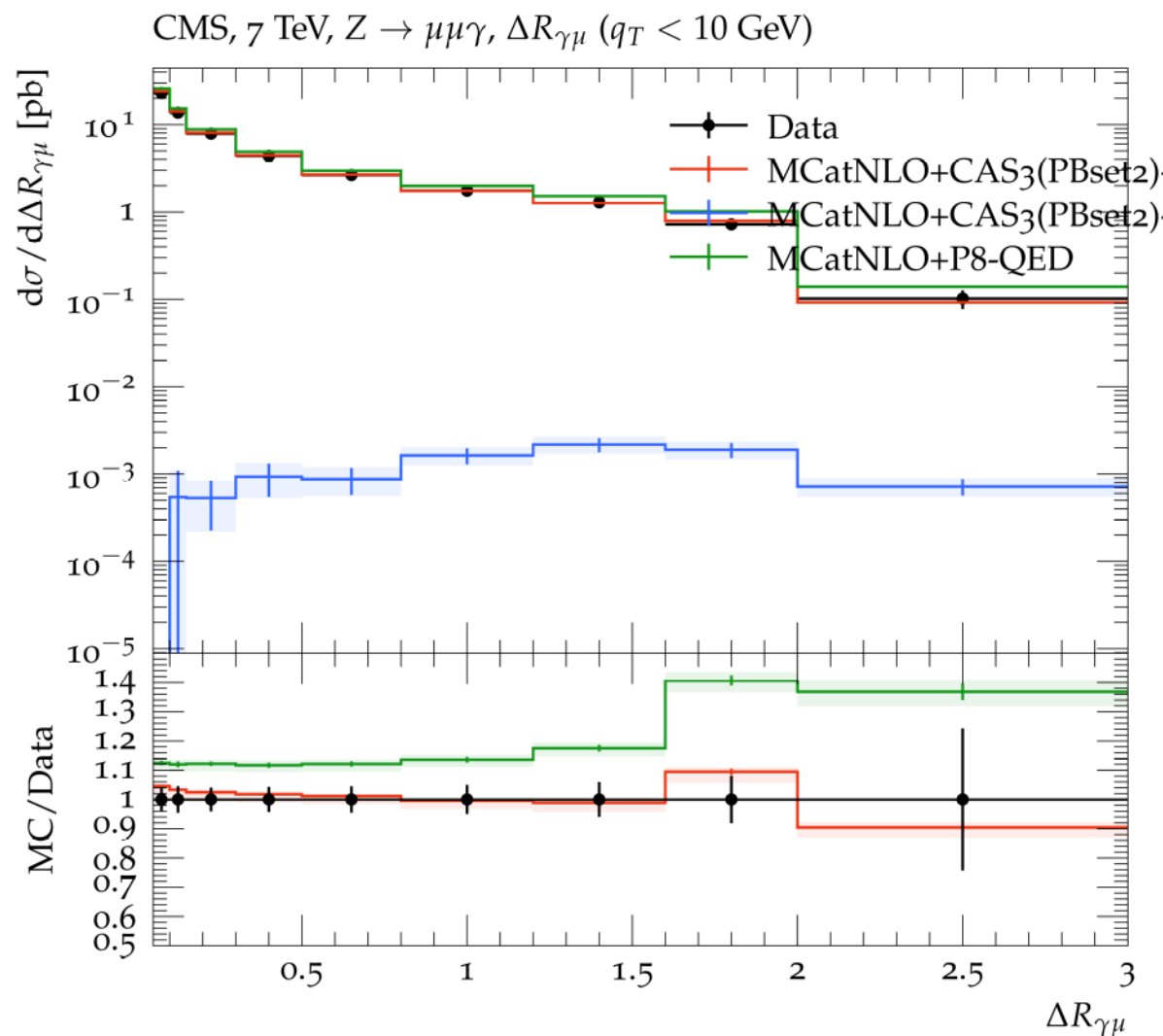

CMS, 13 TeV, DY, full phase-space

Data
PB-FSR-QED-new
PB-FSR-QED-EL
PB-FSR-QED-old

Bug in Rivet for P6 event record:
- decay photons from leptons not properly included (thanks to M. Seidel)
- need to change: !p.isDirect(true, true) (Switches to *allow_from_direct_tau/mu*)
- after this change, distributions look ok
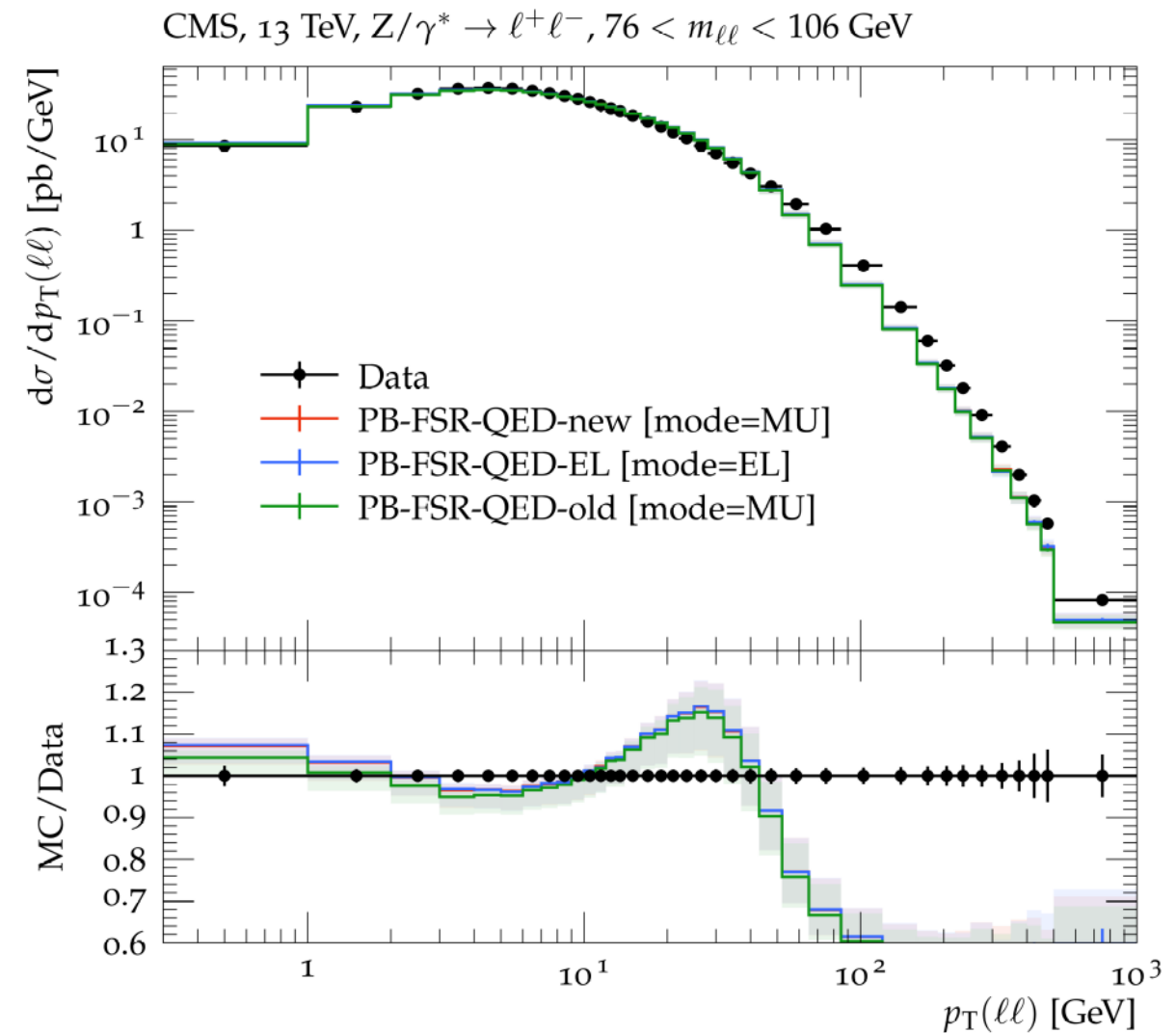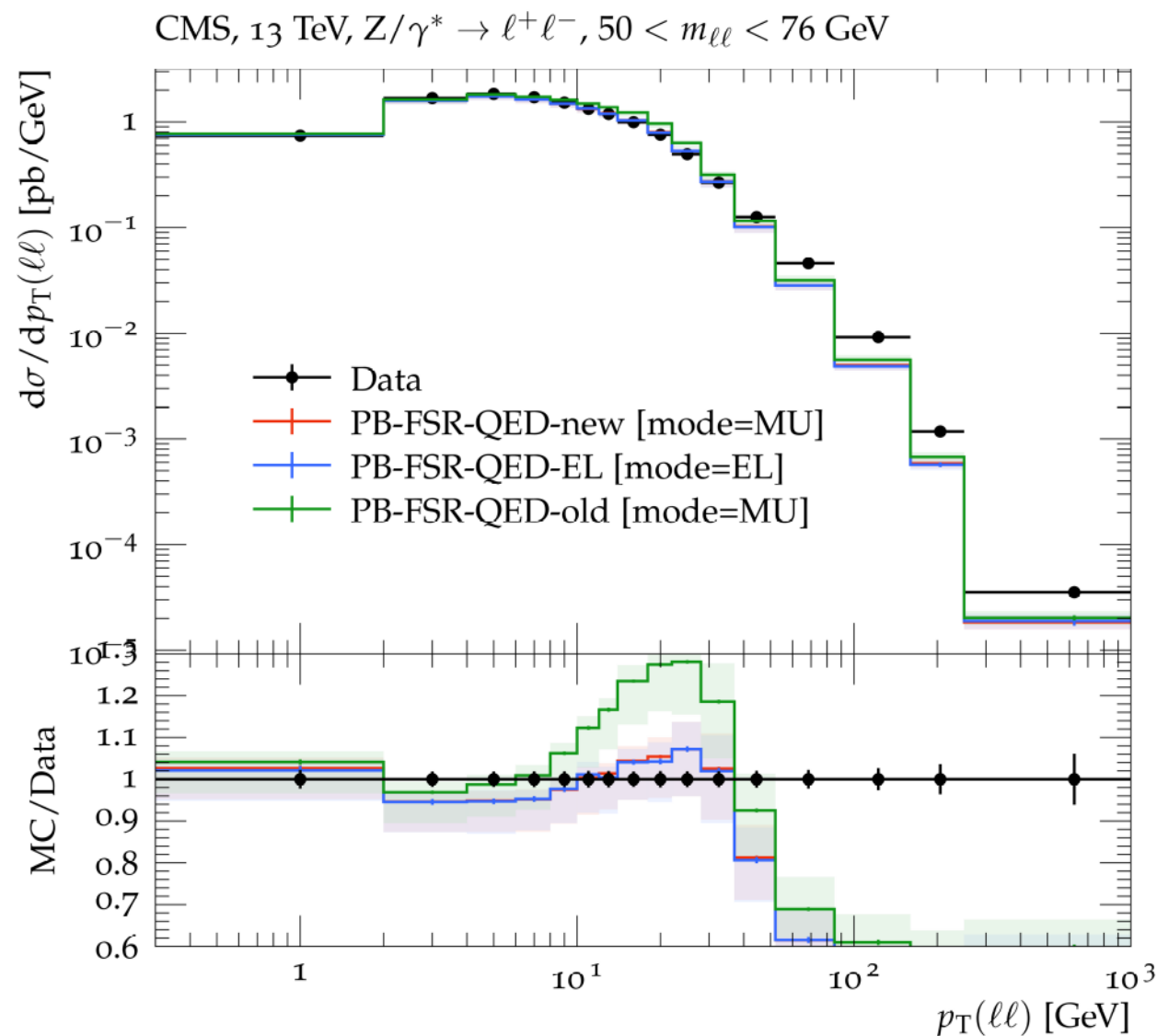
FSR in Z boson decays

- Measurement of differential cross-section of FSR photons in *Z* decays (CMS_2015_I1346843) arXiv:1502.07940

  The differential cross sections for the production of photons in Z to mu+ mu- gamma decays are presented as a function of the transverse energy of the photon and its separation from the nearest muon. The data for these measurements were collected with the CMS detector and correspond to an integrated luminosity of 4.7 inverse femtobarns of pp collisions at sqrt(s) = 7 TeV delivered by the CERN LHC.

FSR is relevant for Z pt spectrum

- QED radiation very important for m_DY region below Z-peak

- Effects of a few %, but very important in the larger pt region
- With the new corrections, we can proceed with the paper on intrinsic kt

New papers:

- new papers in pipeline:

  - The small k_T region in the parton branching approach and relation to CSS

    - *non-pert Sudakov*

  - The small k_T region in Drell-Yan production at next-to-leading order with the parton branching method

    - *pheno applications, determination of intrinsic kt*

- Both papers are open:

  Please reply to me if you want to be co-author, after reading and commenting the paper

Paper on non-perturbative region

- Paper draft includes everything
  - text needs some adjustments to keep focus
  - Paper draft ready: next week, submit to arXiv: end of this year/early next year

Plots for intrinsic kt paper

"The small kT region in Drell-Yan production at next-to-leading order with the Parton Branching Method"
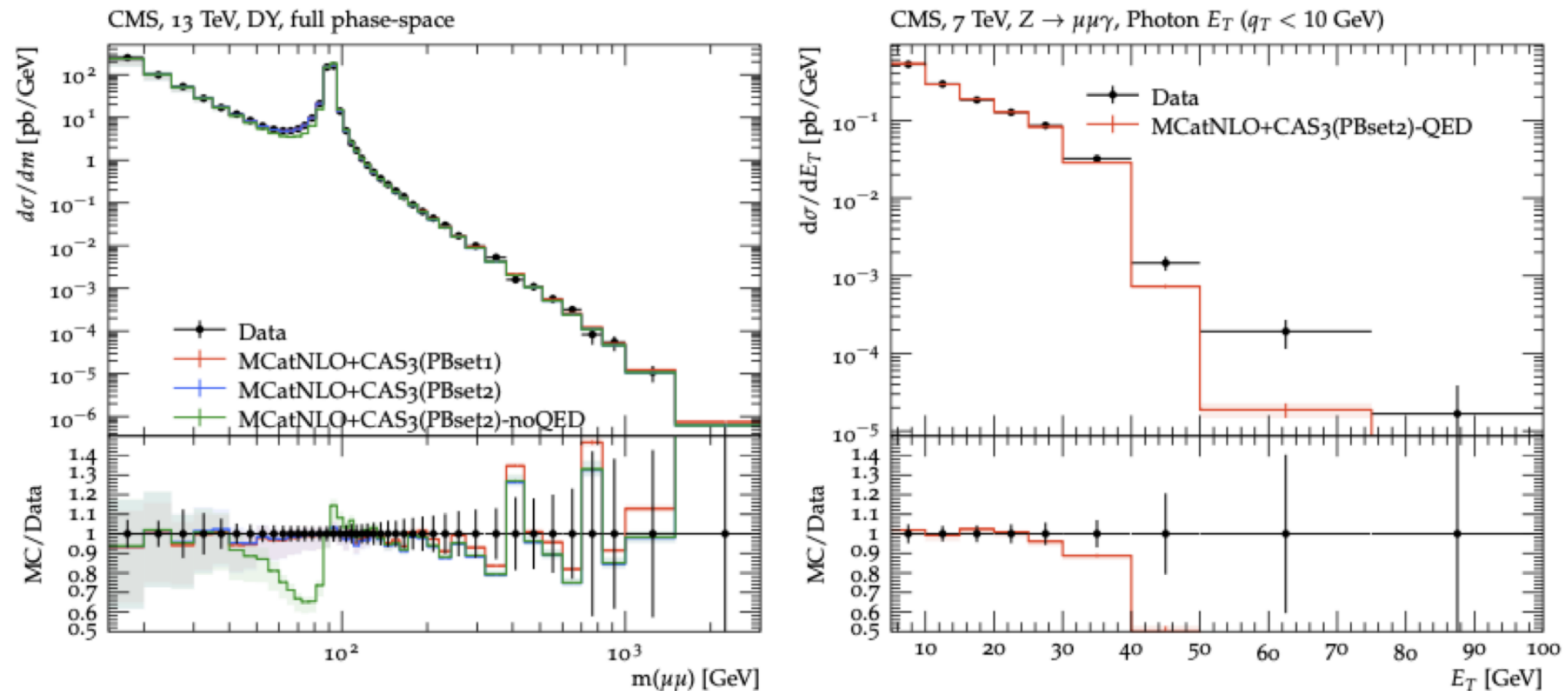

Figure 3: (Left): The mass distribution of DY lepton pairs at 13 TeV [21] compared to predictions of MCatNLO+CAS3 with PB-NLO-2018 set1, PB-NLO-2018 set2 and without QED corrections. (Right): The spectrum of photons in $Z \to \mu^+ \mu^- \gamma$ at 7 TeV [23] compared to MCatNLO+CAS3 including QED radiation. The bands show the scale uncertainty.

Plots for intrinsic kt paper

"The small k_T region in Drell-Yan production at next-to-leading order with the Parton Branching Method"
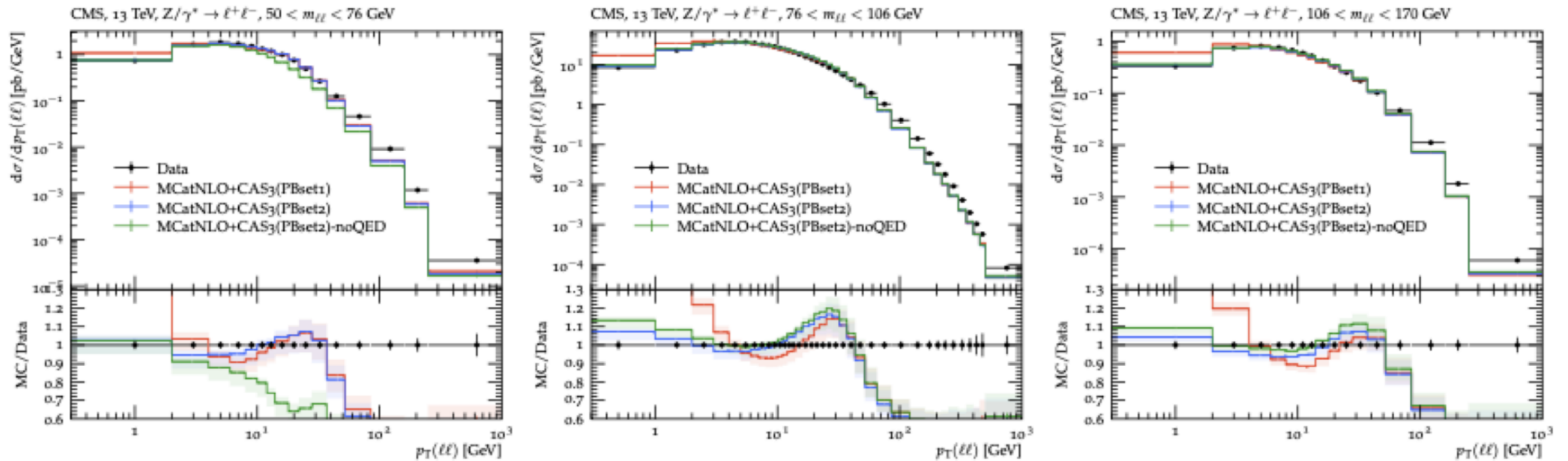

Figure 4: The $p_T(\ell^+\ell^-)$ dependent DY cross section for different m_{DY} regions as measured by CMS [17] compared to MCatNLO+CAS3 predictions based on PB-NLO-2018 set 1 and set 2. Also show are predictions without inclusion of final state QED radiation off the leptons. The band shows the 7-point variation of the renormalization and factorization scale.

Plots for intrinsic kt paper

"The small k_T region in Drell-Yan production at next-to-leading order with the Parton Branching Method"
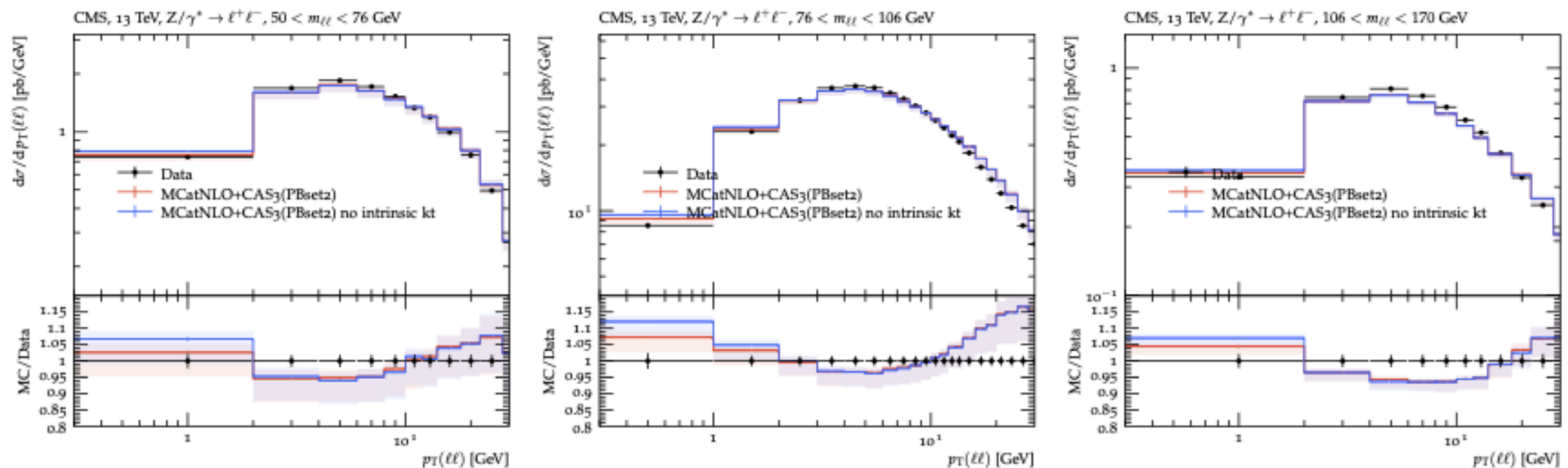

Figure 5: The $p_T(\ell^+\ell^-)$ dependent DY cross section for different m_{DY} regions as measured by CMS [17] compared to MCatNLO+CAS3 predictions based on PB-NLO-2018 set 2 with default gauss as well as with no-intrinsic k_T-distribution.

Plots for intrinsic kt paper

"The small kᴛ region in Drell-Yan production at next-to-leading order with the Parton Branching Method"
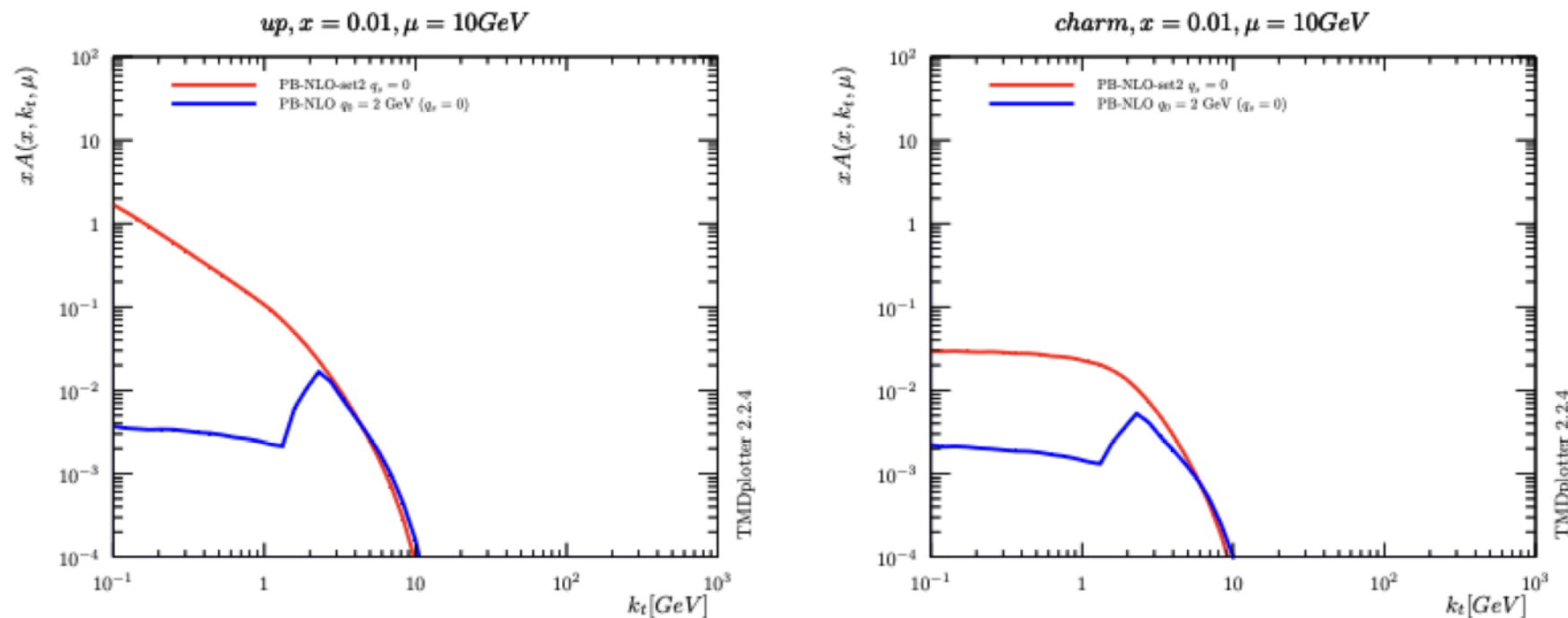

Figure 6: The $p_T(\ell^+\ell^-)$ dependent DY cross section for different m_{DY} regions as measured by CMS [17] compared to MCatNLO+CAS3 predictions based on PB-NLO-2018 set 2 with default gauss as well as with no-intrinsic k_T-distribution.

- To do:
  - perform fits to determine width of intrinsic kt
  - check consistency with pPb
- Time scale: 1-2 weeks
- Paper draft ready: end of this year, submit to arXiv early next year

AOB

- Further news ?