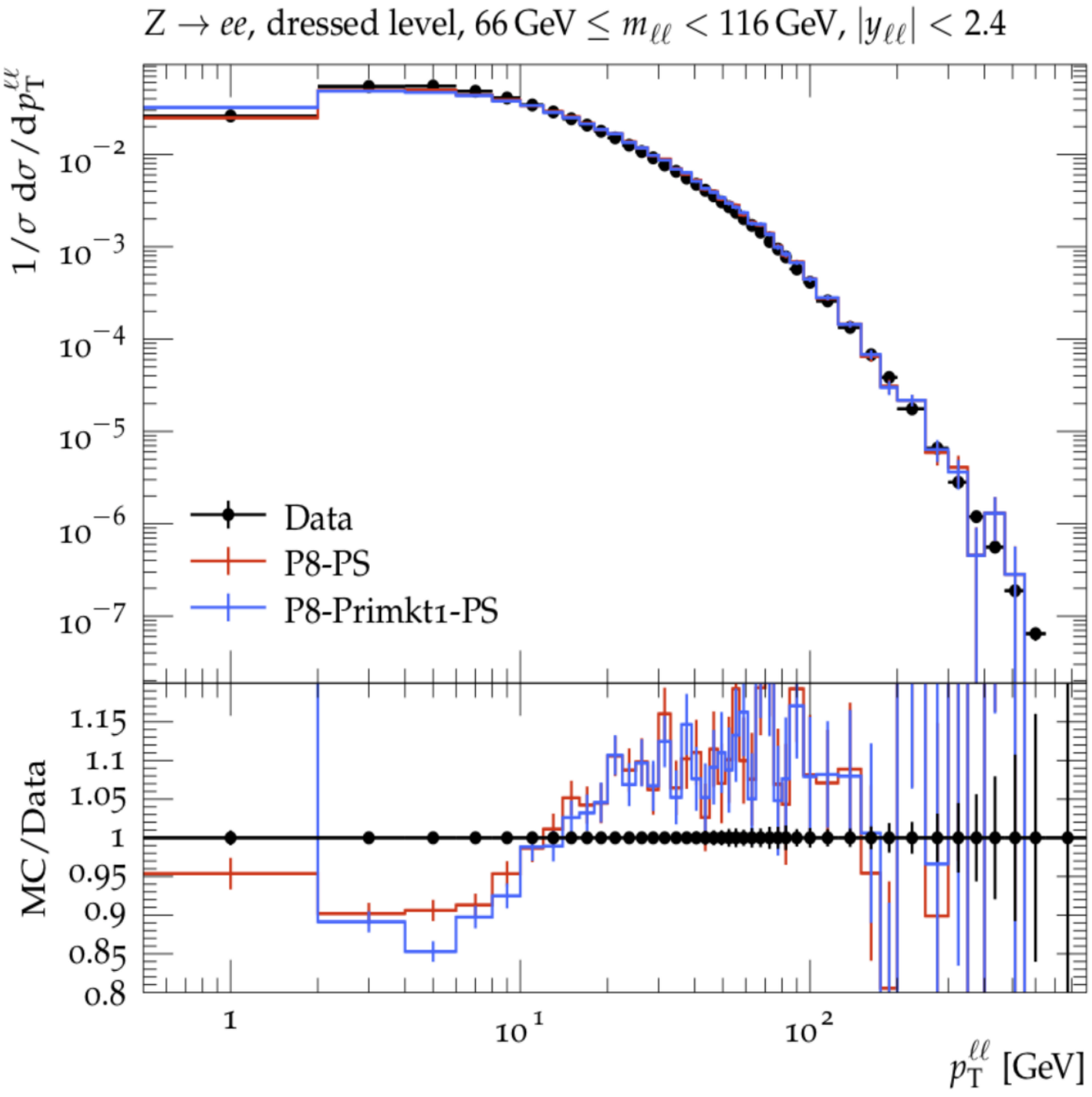
Determination of intrinsic k_T distribution in DY

- Where is intrinsic k_T important ?
  - which measurements exist ?
  - new Rivet plugins
    - validation ?
- Comparison with existing approaches
  - what can be tuned ?

Intrinsic k_T studies with PYTHIA: LHC data



- Interplay of intrinsic kt and Parton Shower
- Effect of intrinsic kt is small (only visible in 1st bin) at LHC energies and at Z_0 peak

- p_T spectrum of Z_0 at small p_T is very important for precision measurement of m_W

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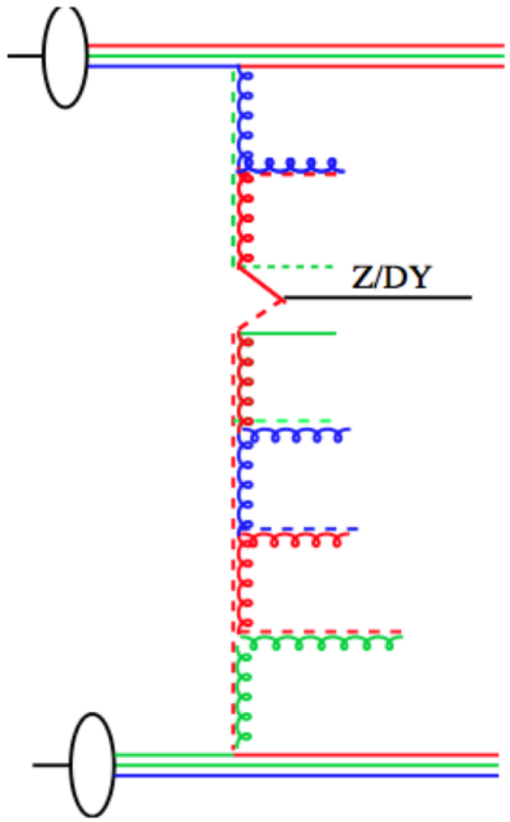
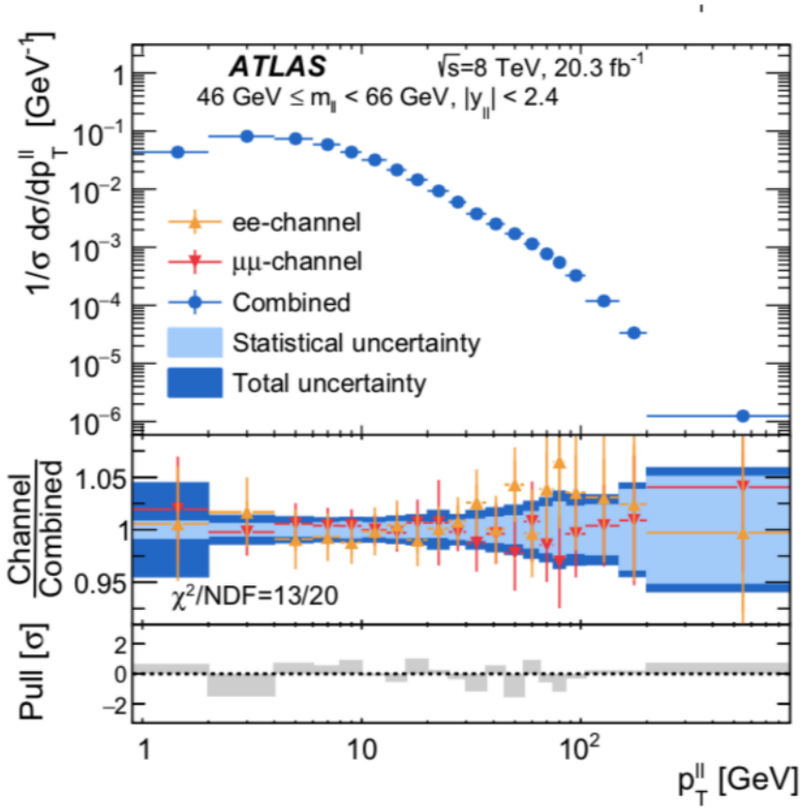
Where can intrinsic k_T be constrained ?

- need to go to low DY mass:
  - at low mass, little room for QCD evolution (parton shower)
    - p_T of DY is dominated by intrinsic k_T

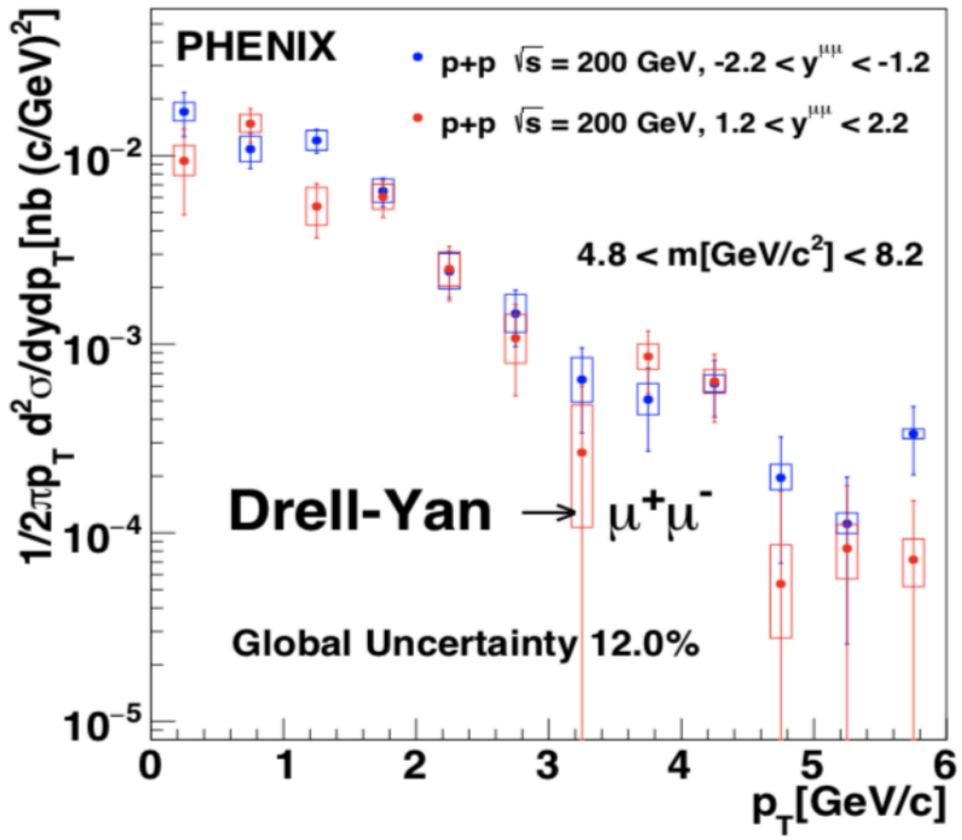
- at LHC no low mass DY measurements available:
  - ATLAS 8 TeV: p_T spectrum for mass $46 \leq m_{DY} \leq 66$ GeV





Where can intrinsic k_T be constrained ?

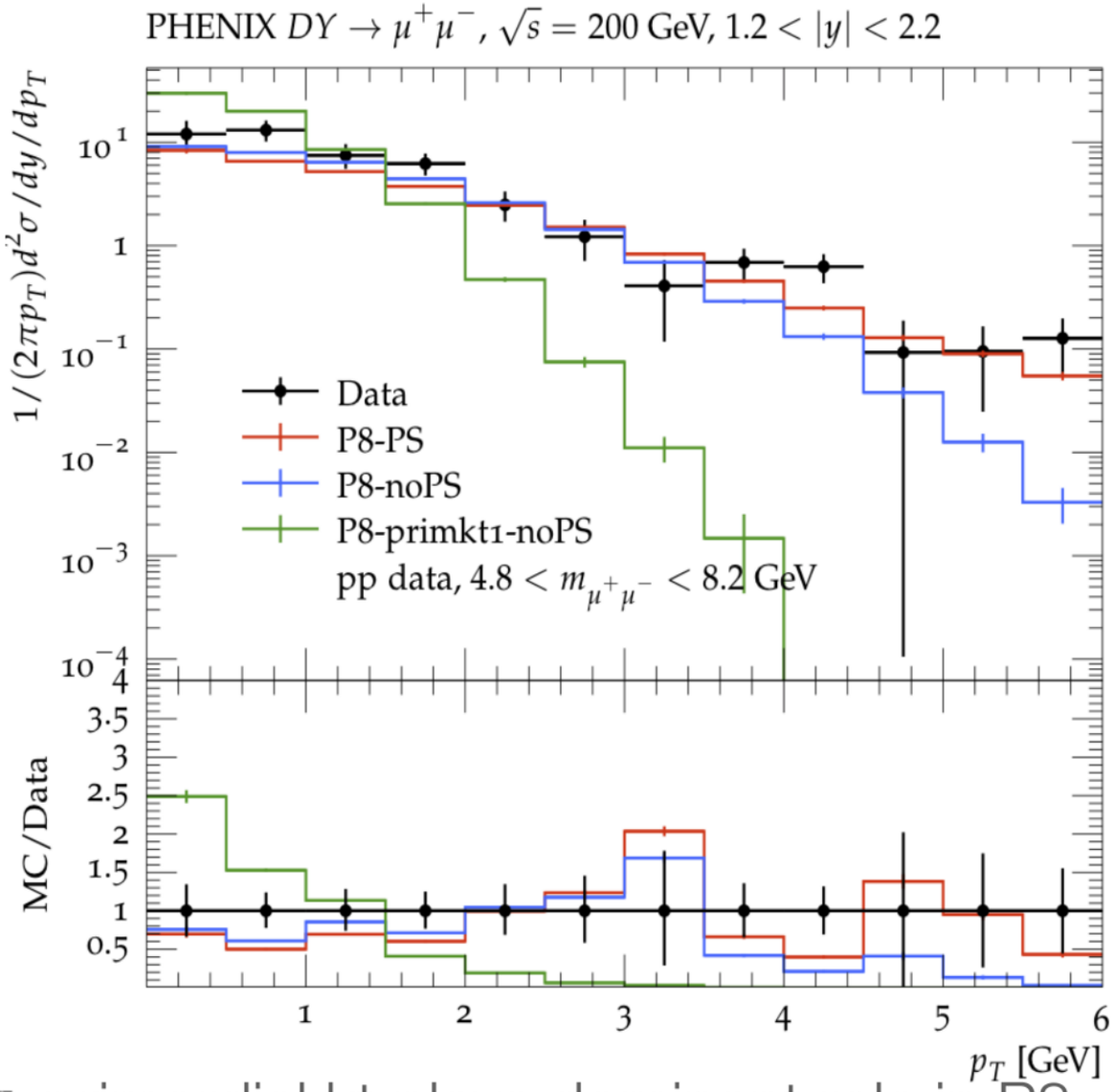
- latest measurement: PHENIX (PhysRevD.99.072003) at $\sqrt{s} = 200$ GeV for $4.6 \leq m_{DY} \leq 8.2$ GeV
- other measurements (older)
  - R209 (1982) PhysRevLett.48.302 (data read from plot in paper)
  - E288 (1981) PhysRevD.23.604
  - E605 (1992) PhysRevD.43.2815
  - NUSEA (2003) hep-ex/0301031 (unpublished)

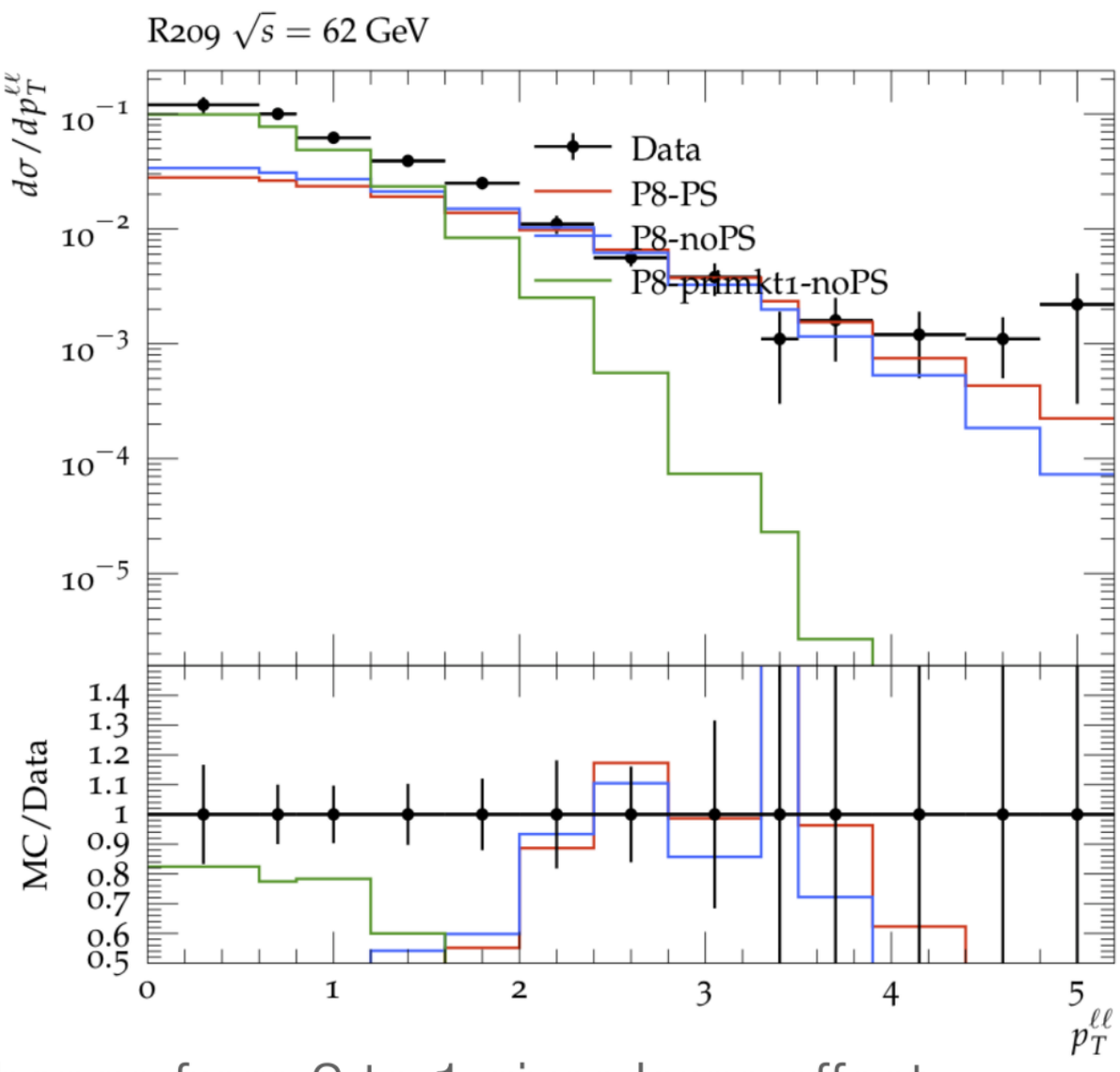


For all measurements, now Rivet plugins prepared and validated

First results at 200 and 62 GeV

- P8-PS: CUETP8M1, standard parton shower
- P8-noPS: noPS, primordialKThard=2
- P8-primkt-noPS: noPS, primordialKThard=1





- primordial kt plays dominant role in P8: change from 2 to 1 gives large effect
- Parton Shower has little effect

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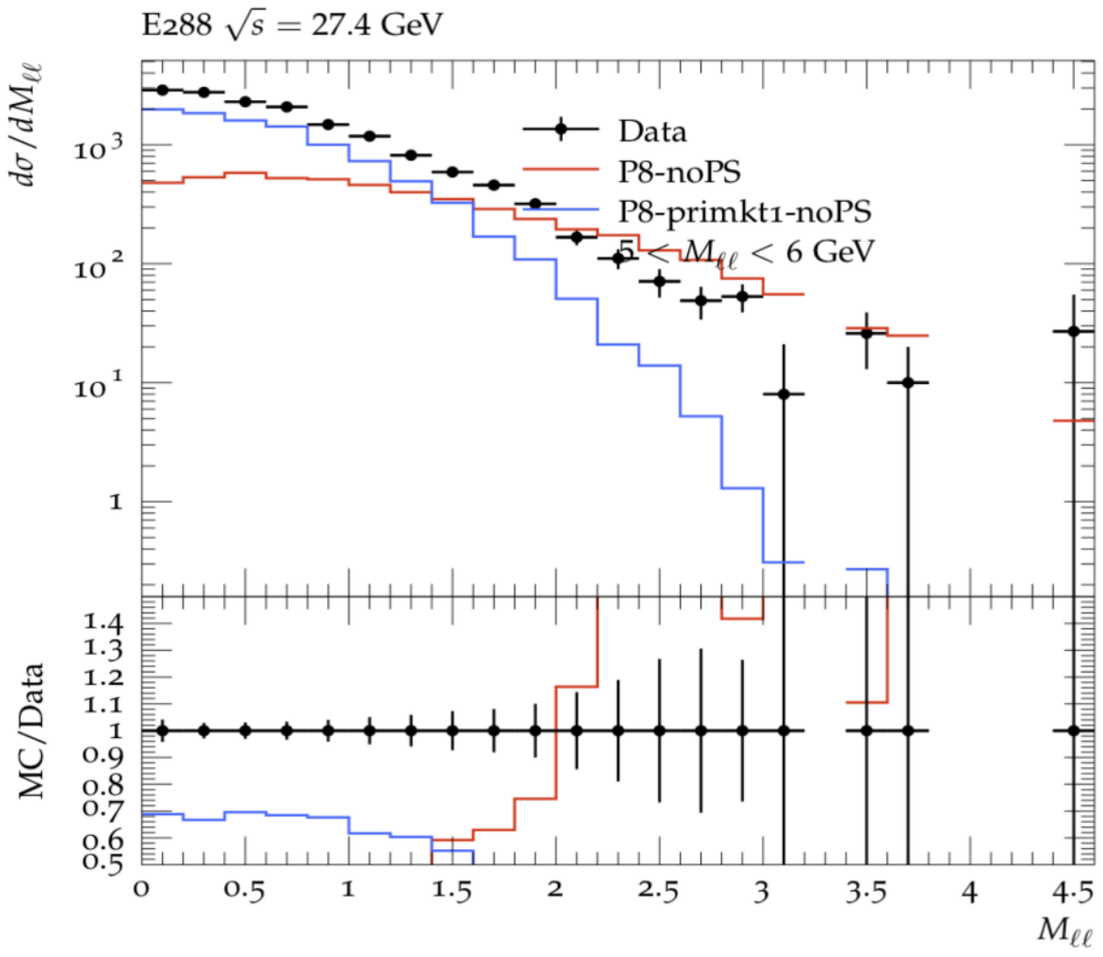
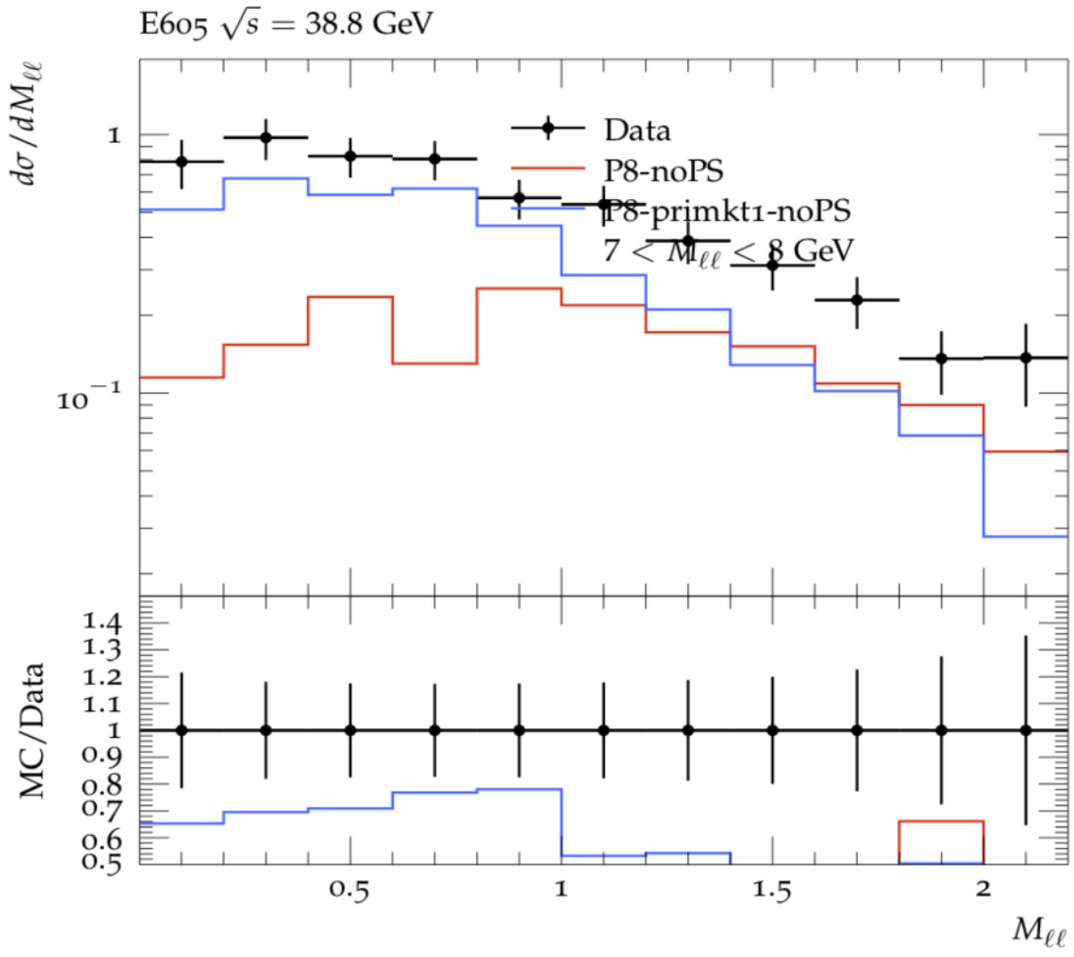
First results at 38.8 and 28.3 GeV

- P8-PS: CUETP8M1, standard parton shower
- P8-noPS: noPS, primordialKThard=2
- P8-primkt-noPS: noPS, primordialKThard=1





- primordial kt plays dominant role in P8: change from 2 to 1 gives large effect
- Parton Shower has little effect

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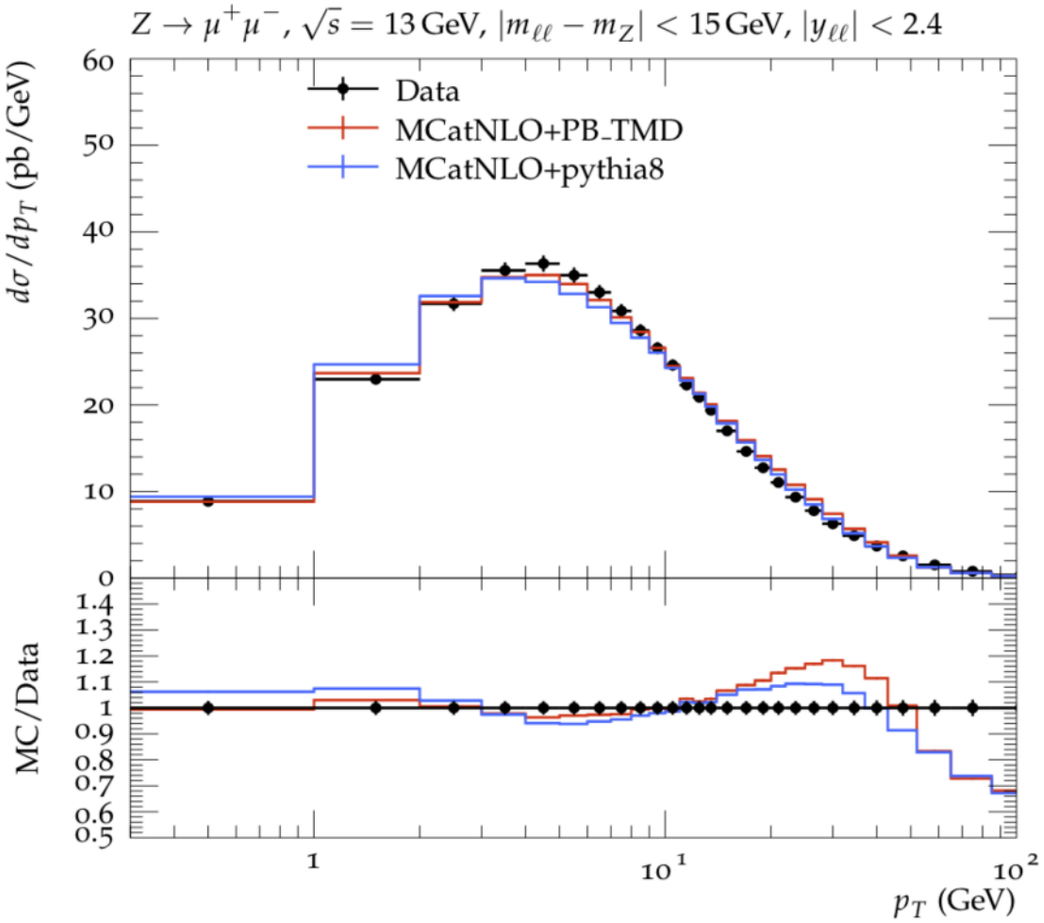
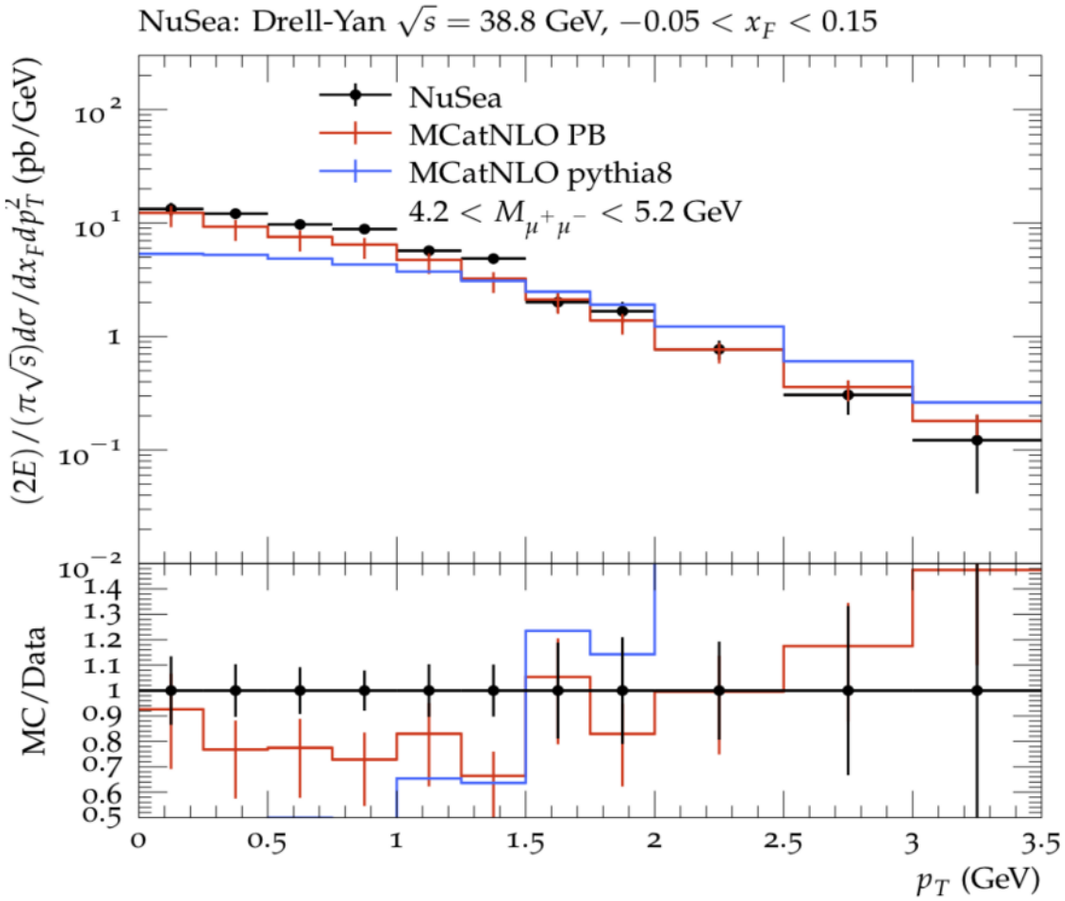
Predictions from MCatNLO+PYTHIA8





- differences observed with McatNLO using Monash tune in P8
  - too high at high energy
  - too low at low energy
    - can it be tuned ?

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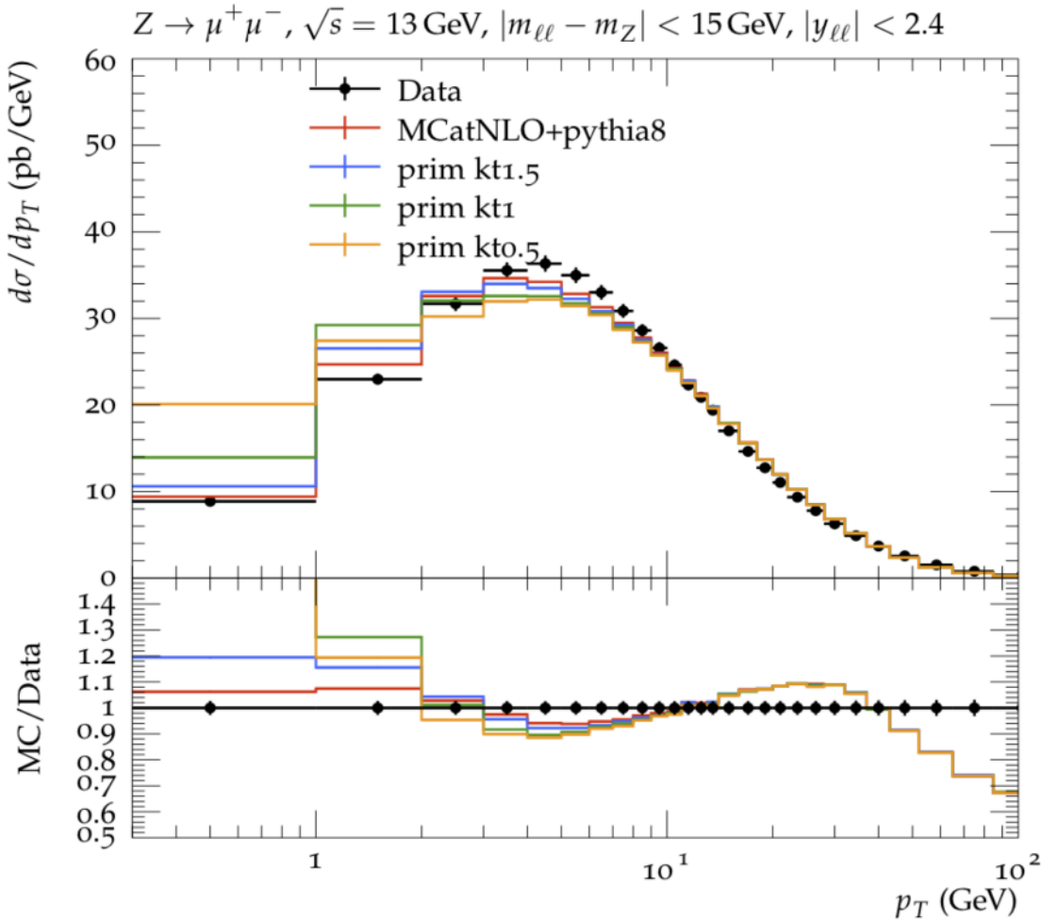
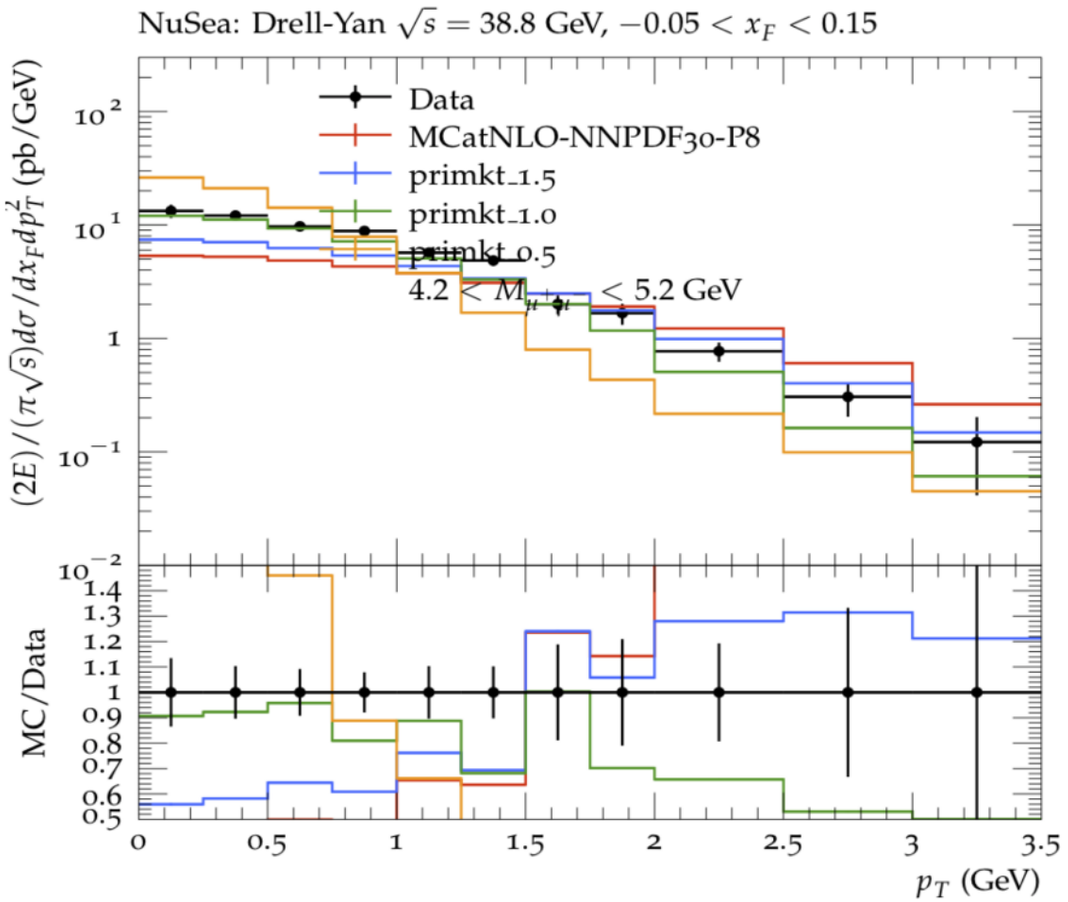
Predictions from MCatNLO+PYTHIA8





- differences observed with McatNLO using Monash tune in P8
  - intrinsic k_T in P8 cannot be simply tuned to describe both high and low energy data

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Low mass DY - herwig

- Gieseke, S., Seymour, M. H., and Siodmok, A. (2008). A Model of non-perturbative gluon emission in an initial state parton shower, JHEP, 06(), 001
  e-Print: 0712.1199

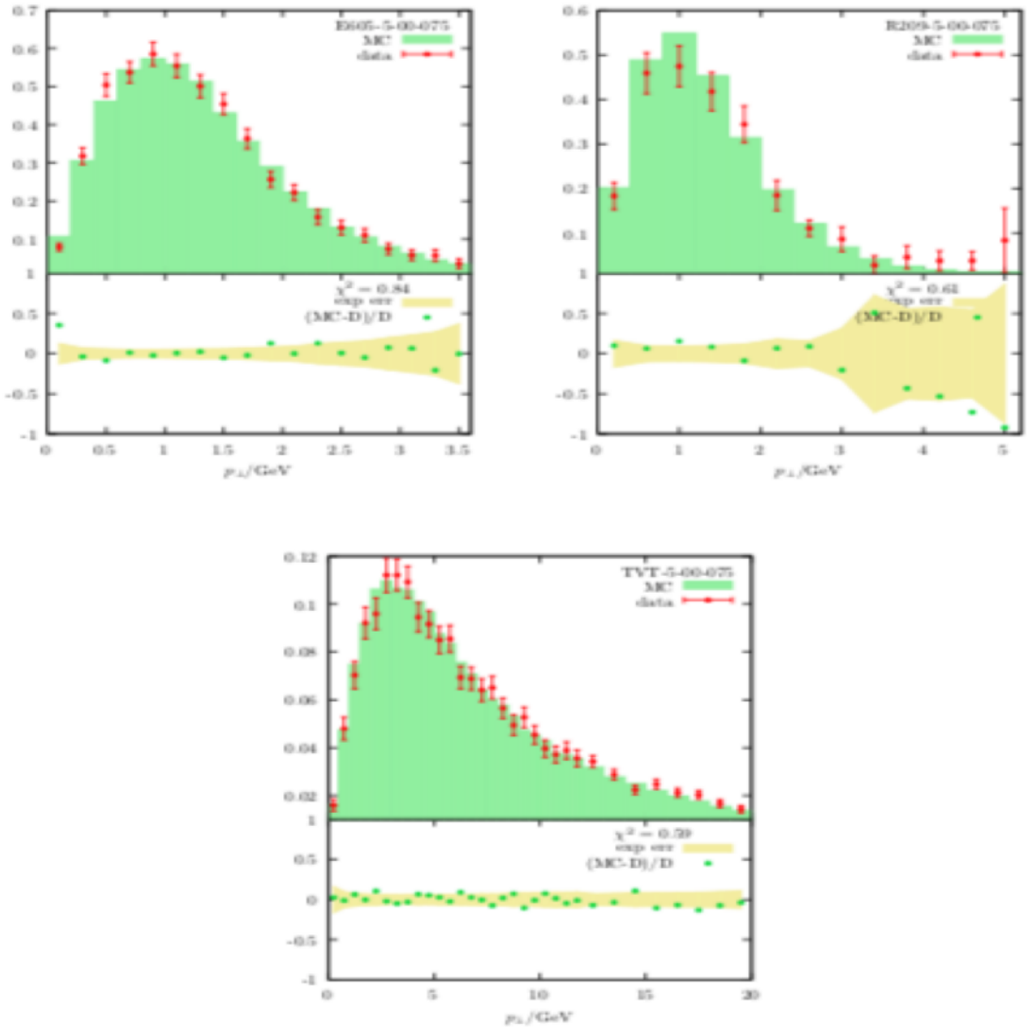

Figure 3: Comparison of the parton level results from the non-perturbative model with data from E605 (top left), R209 (top right) and CDF (bottom). The Monte Carlo results are from our parameter set with $\varphi_0 = 0.0, p_{\perp_0} = 0.75\,\text{GeV}$. Each panel includes two plots. The upper plot compares MC to data directly, whereas the lower plot shows the ratio (MC-Data)/Data against the relative data error.

- to achieve good description:
  - need adjustment of intrinsic kt
  - need adjustment of shower starting scale

JHEP06(2008)001

Conclusions

- Low mass DY measurements at low energies are very sensitive to intrinsic kt distributions
  - Rivet plugins for low energy measurements exist (not yet in official release)
    - need further validation … volunteers ?
  - Can be used for tuning:
    - intrinsic kt and shower paramters ?
    - start with standalone MC generators
    - then with NLO generators