Studies on p-p and p-Pb DY production

2019 Summer Student Program

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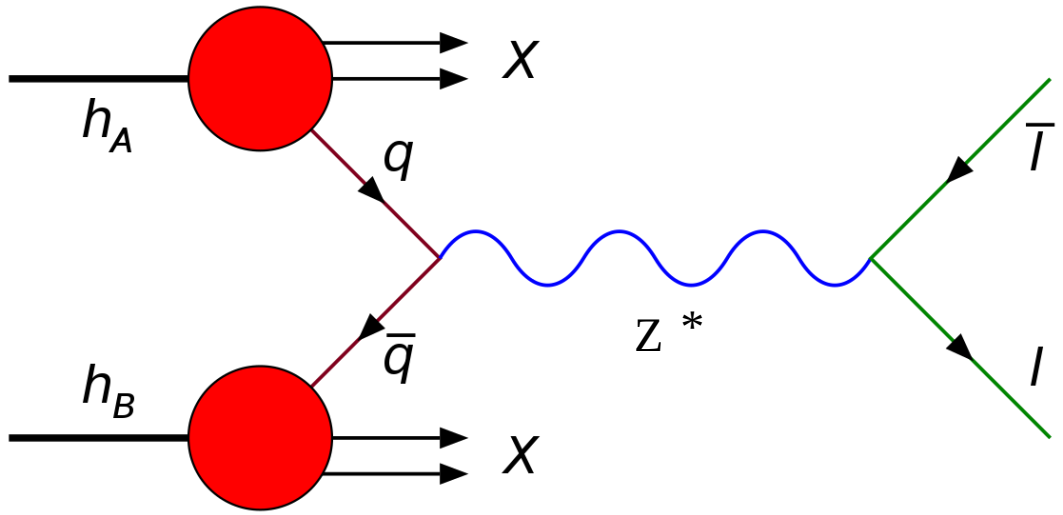
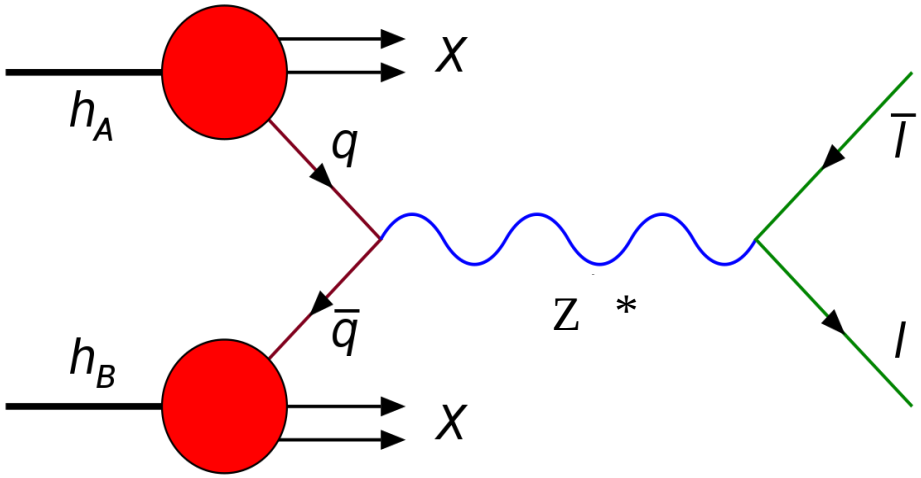
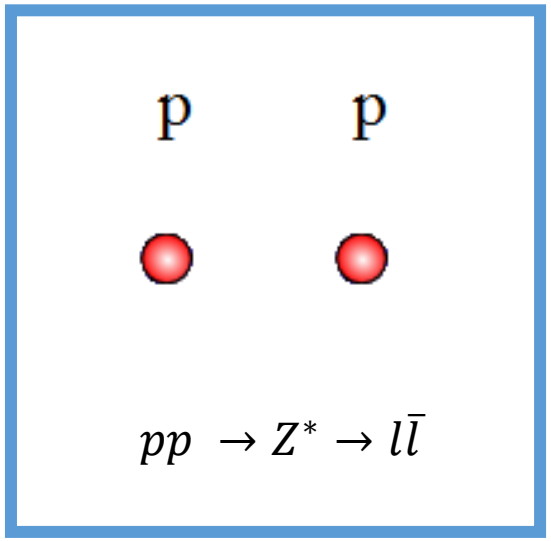
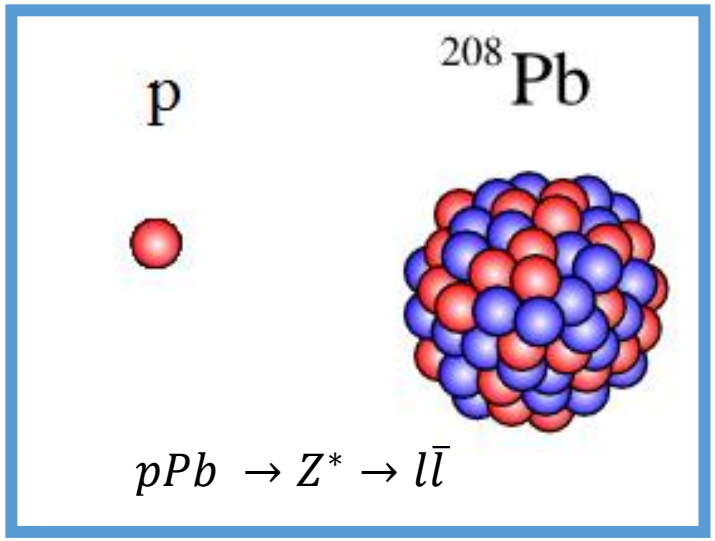


Introduction

Drell Yan Process



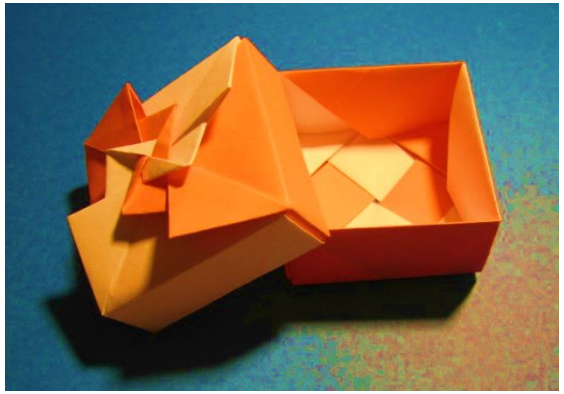




Introduction

The software

POWHEG BOX



NLO calculation

$< f|S|i >$

ptsqmin

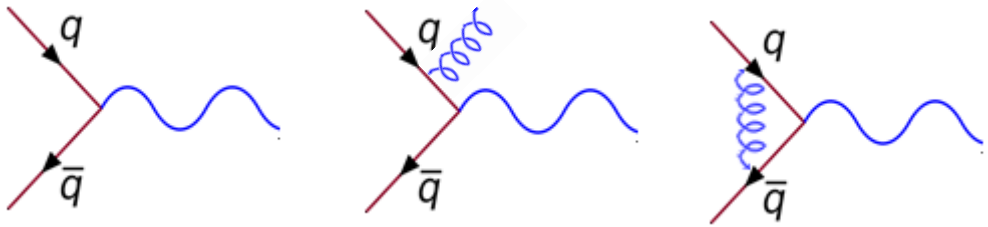
pdf set

hdamp

SHOWER MC PROGRAMS

CASCADE (TMD)

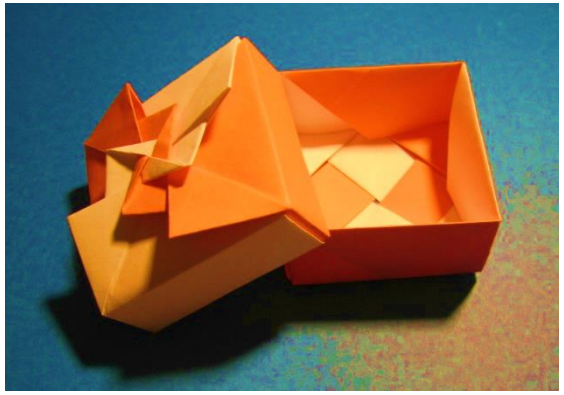
PYTHIA 6



Introduction

The software

POWHEG BOX



NLO calculation

$< f|S|i >$

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SHOWER MC PROGRAMS

CASCADE (TMD)

PYTHIA 6

TASK

- Validation of a rivet plugin for p-Pb DY production
- NLO + TMD calculations
- Compare results to other NLO calculations

Validation of CMS Routine for p-Pb collision

The plugin

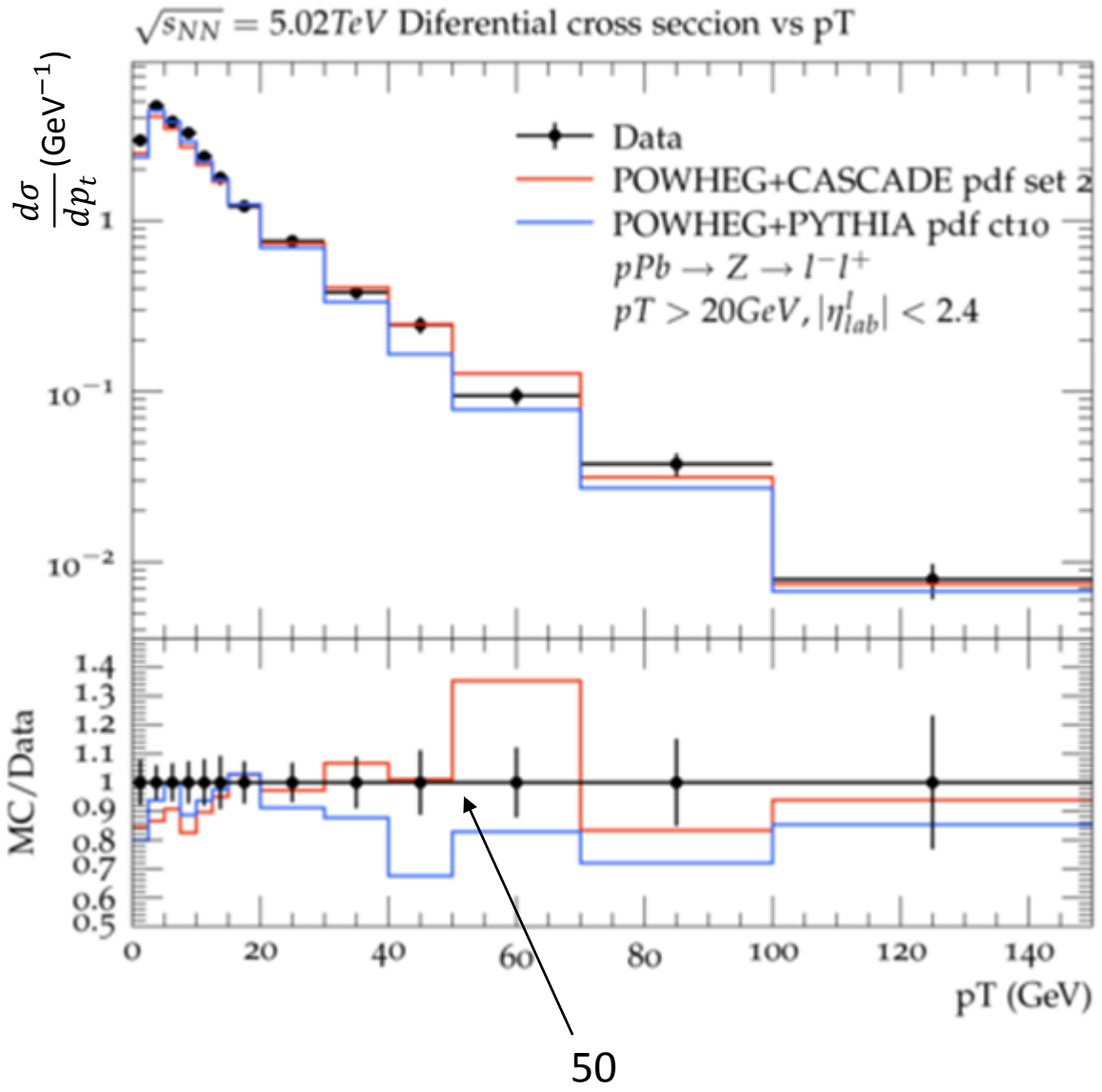
→ σ scaled to # nucleons in ^{208}Pb

The simulation

POWHEG
→ hdamp 0.5, ptsqmin 50
→ $\sqrt{s_{NN}} = 5.02$ TeV
→ Z → e-e+
→ pdf Set 2 for CASCADE
→ pdf CT10 for PYTHIA 6

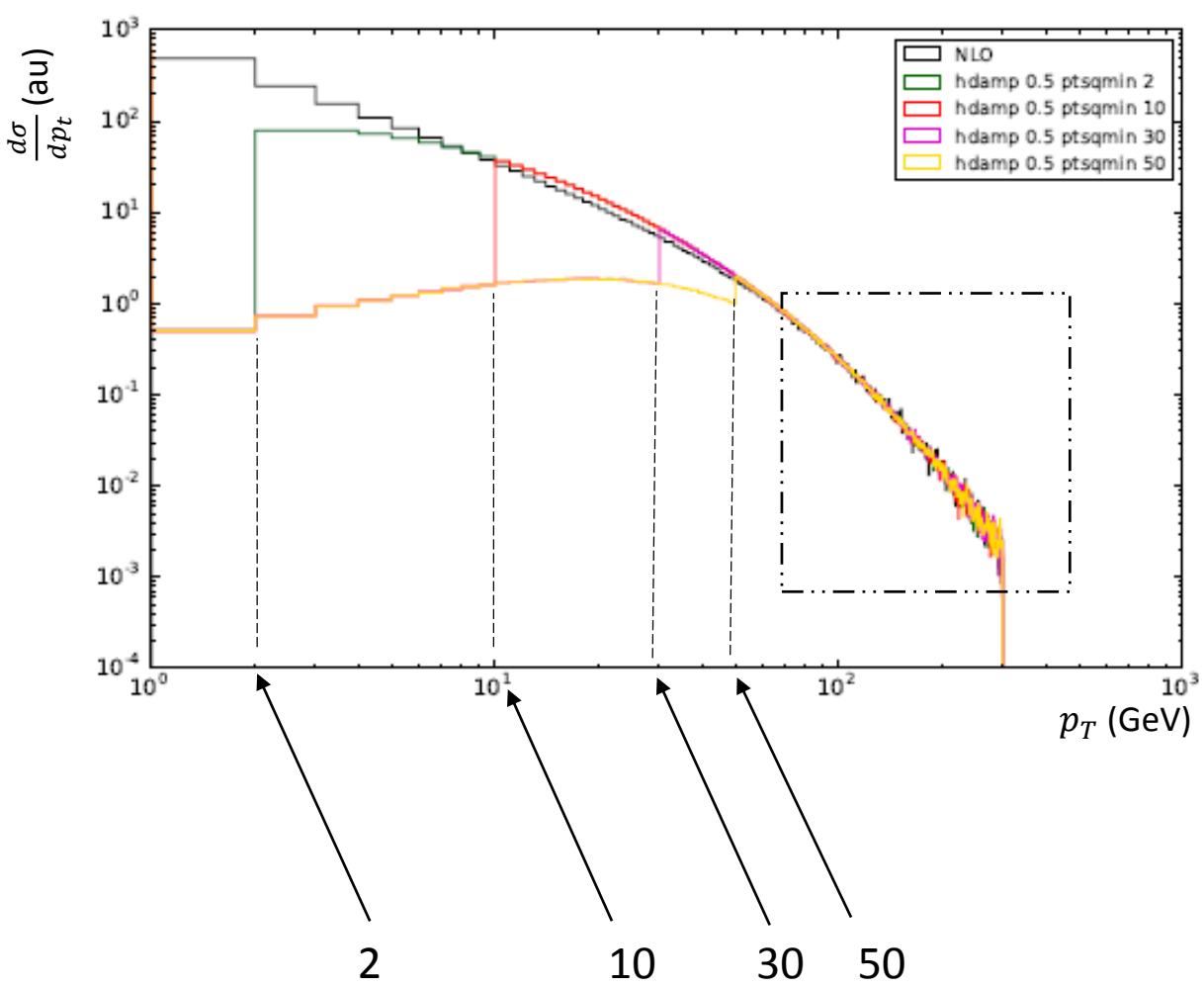
CASCADE
→ TMD Set 2 for CASCADE

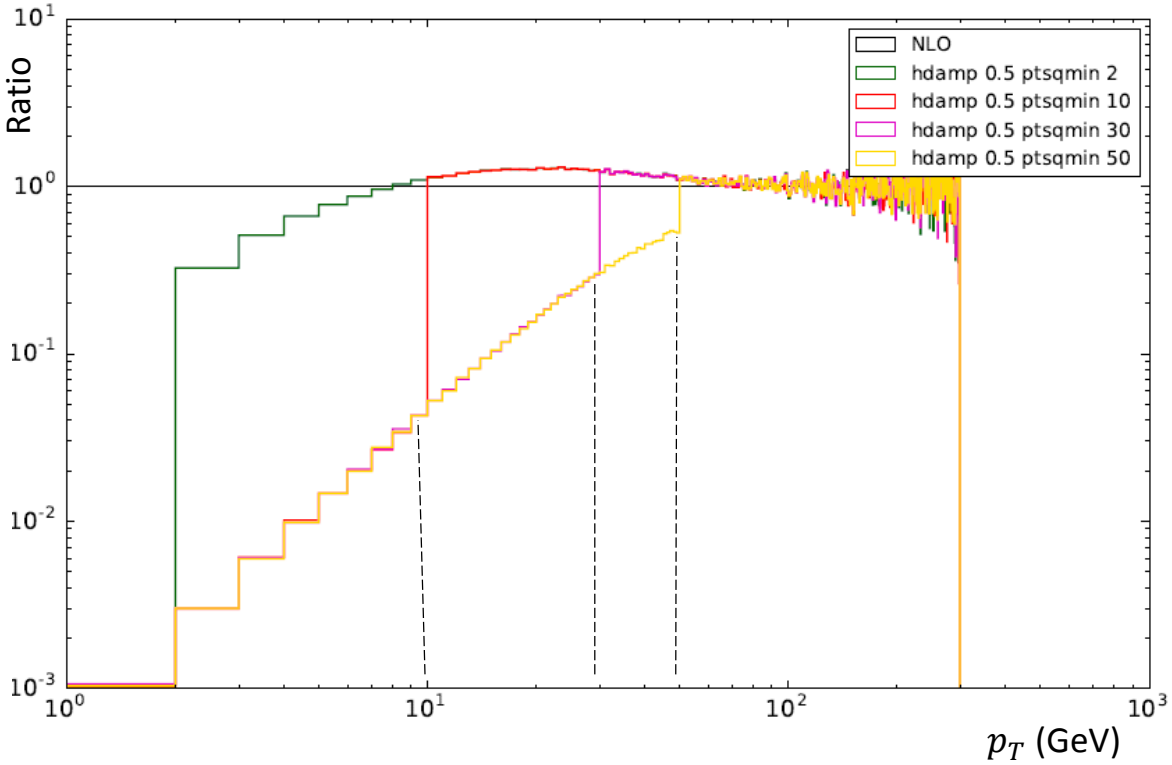
"Study of Z boson production in pPb collisions at $\sqrt{s_{NN}} = 5,02\ TeV$",
The CMS collaboration



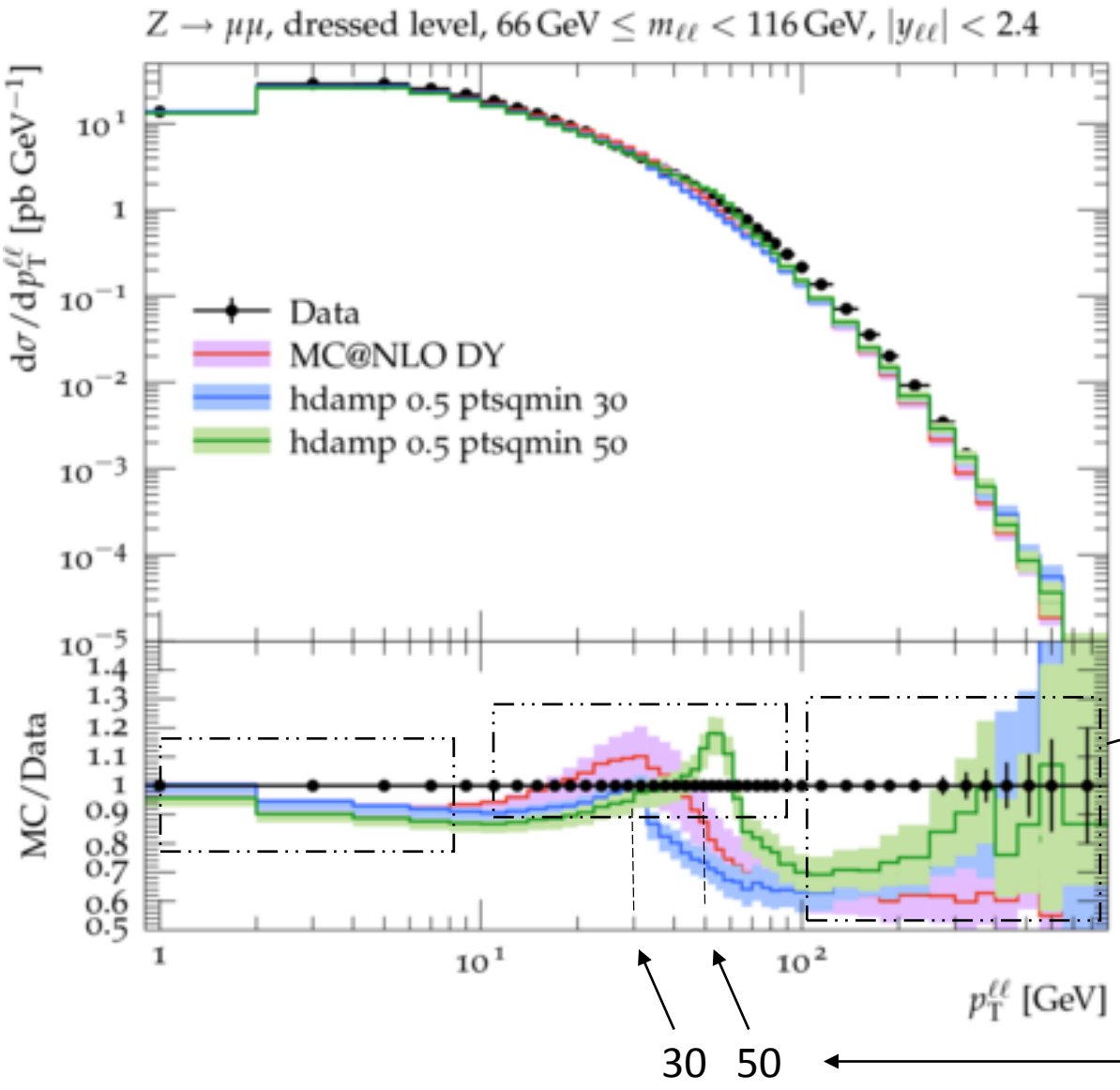
Comparing POWHEG with NLO $d\sigma/dp_T$

ATLAS_2015_I1408516 routine for p-p DY production, $\sqrt{s_{NN}} = 8\ TeV$





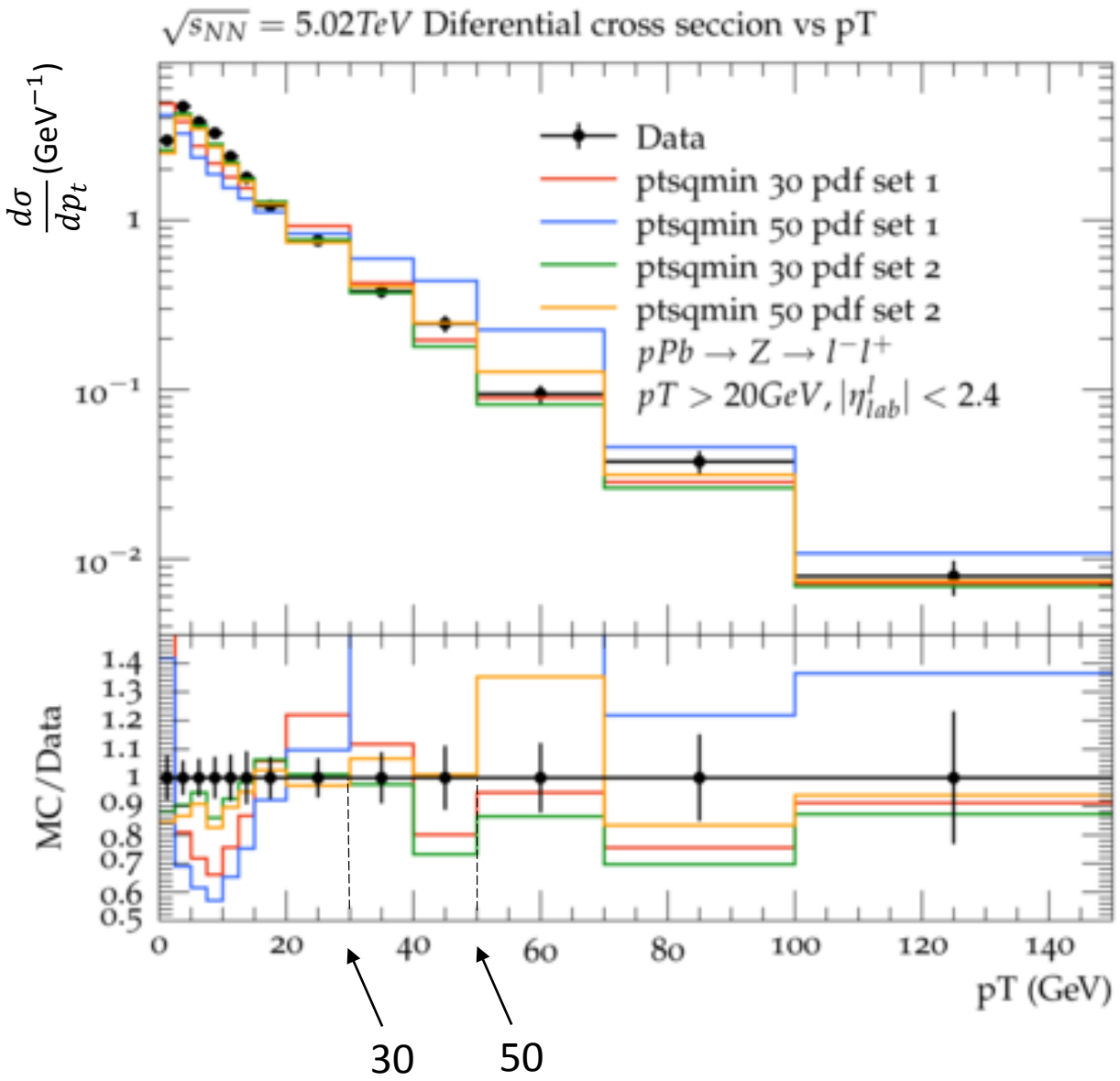
Comparing to data from p-p ATLAS analysis and MC@NLO POWHEG+TMD



Effect of the scale of the process:
MC@NLO employs a higher Q^2
α_s decreases when Q^2 increases
$\sigma \sim \alpha$

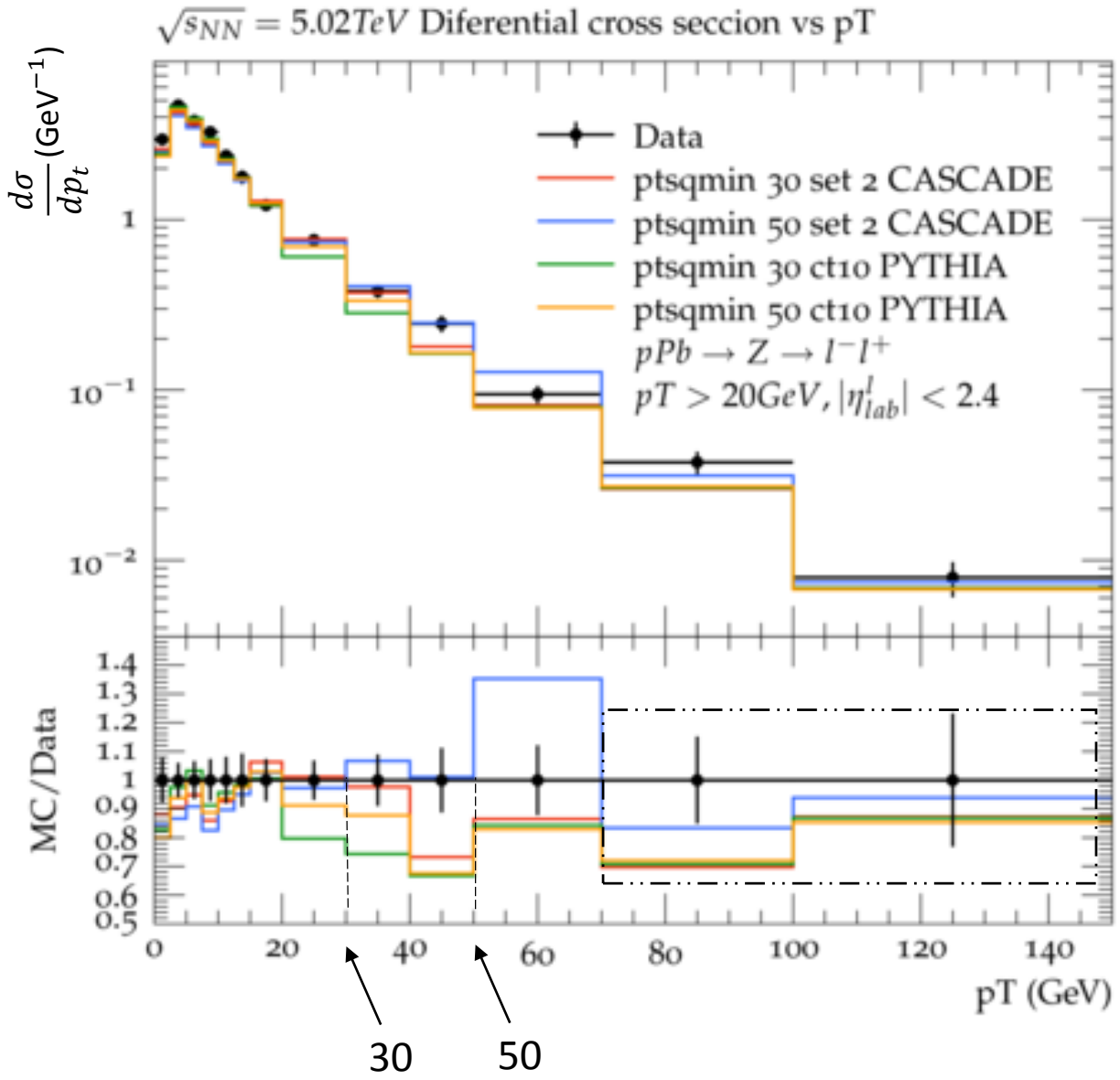
Choosing ptsqmin the bump can be more or less pronunciated

Comparing two PDF/TMD Sets in p-Pb collisions



- Comparing the pdf Sets, Set 2 results are more accurate
- The effects of matching TMD-NLO can be seen, but much less, due the binning used

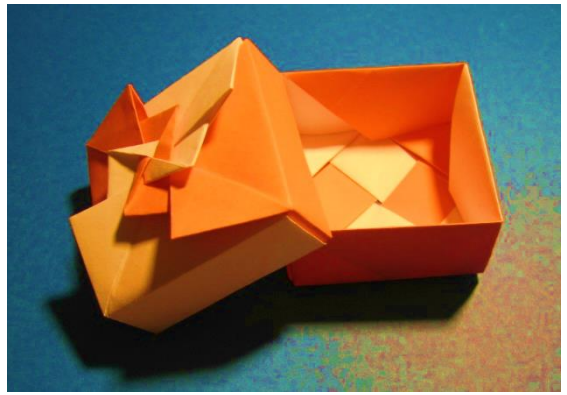
Comparing two PDF/TMD Sets in p-Pb collisions



- For pT 20 - 50, better results using CASCADE
- At high pT using PYTHIA 6 and CASCADE show the same behavior.

Conclusions

POWHEG BOX



+ TMD =

Good description of DY spectra

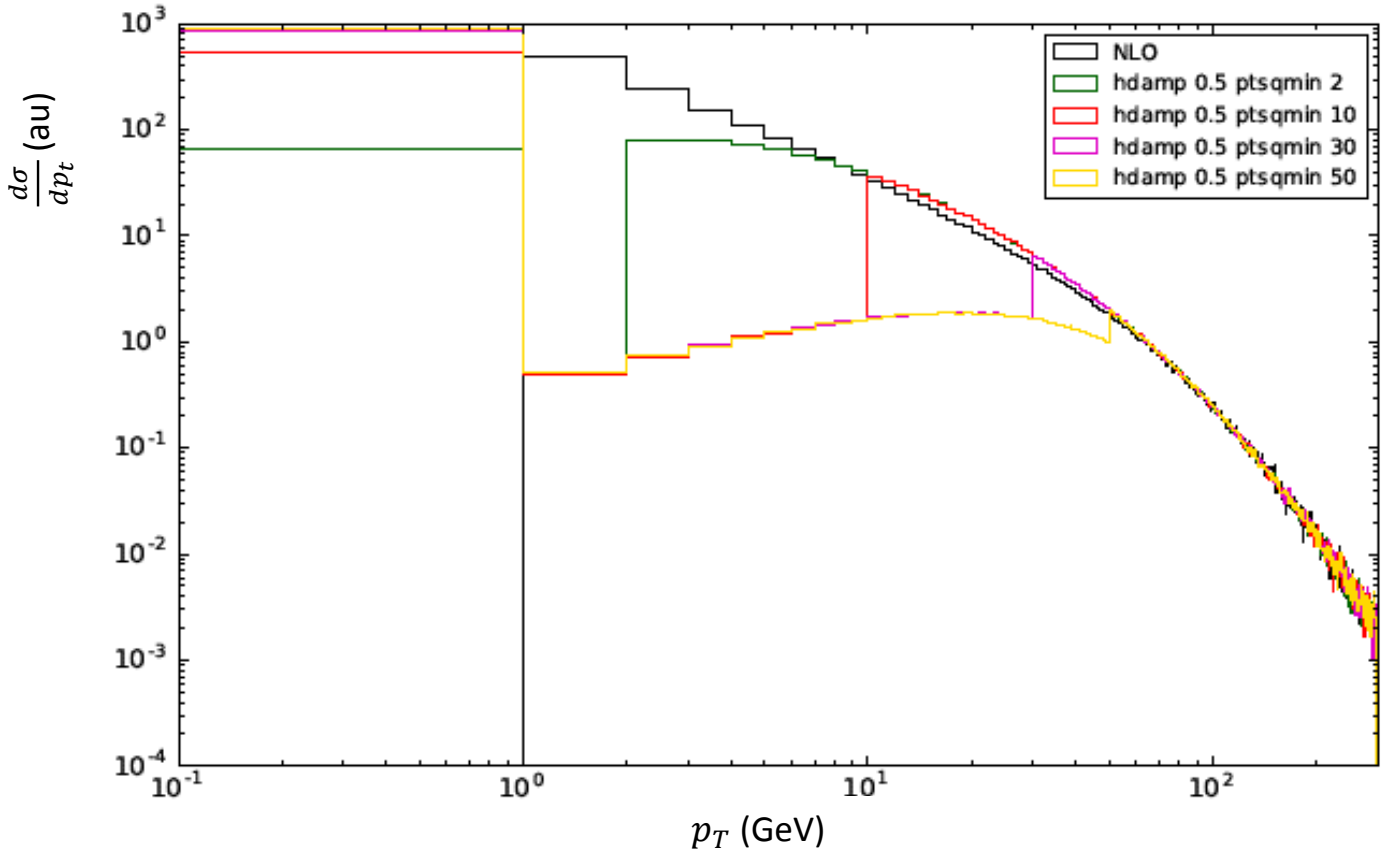
Appropriate for p-p and p-Pb collisions

Works at different Energy

Description similar to other NLO calculations

Thank you

Back up


NLO
hdamp 0.5 ptsqmin 2
hdamp 0.5 ptsqmin 10
hdamp 0.5 ptsqmin 30
hdamp 0.5 ptsqmin 50
$\frac{d\sigma}{dp_t}$ (au)
p_T (GeV)

Back up

hdamp

$$D = \frac{h^2 M_z^2}{p_T^2 + h^2 M_z^2}$$

$$\frac{d\sigma^{PH}}{dp_t} = DR\, e^{-\int D\frac{R}{B} dp_T} + (1 - D)R$$