

CMS Drell-Yan for TMDs

Results and prospects

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Resummation, Evolution, Factorization

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Universität Hamburg

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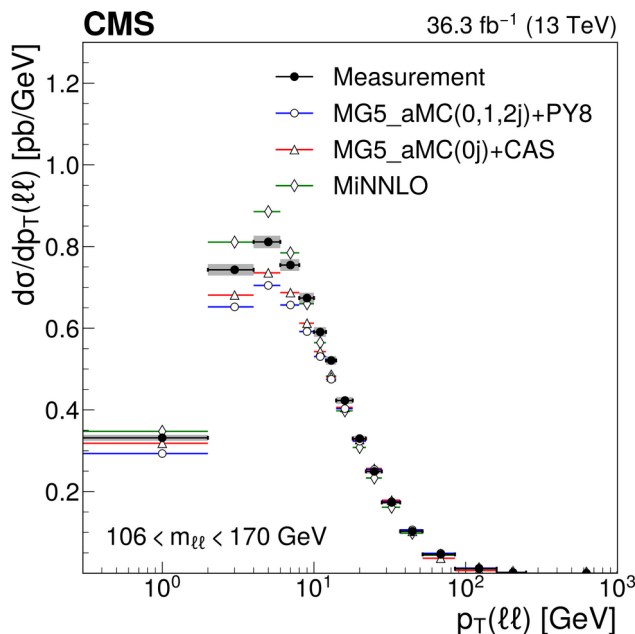
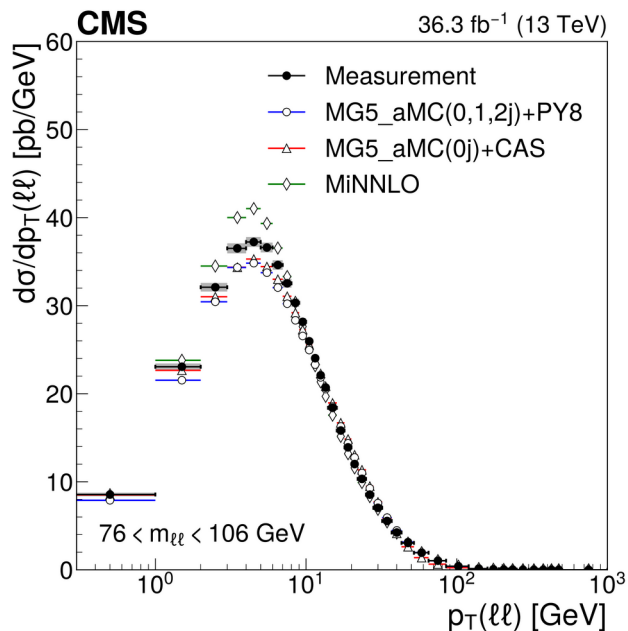
Federal Ministry
of Research, Technology
and Space

Existing results

CMS measures Drell-Yan in 1D and 2D:

dm ■ dy ■ dq_T ■ $dydq_T$ ■ $dmdq_T$ ■ $d\varphi^*$ ■ $dyd\varphi^*$ ■ $dmd\varphi^*$ ■ Z+jets...

0.2% precision for relative cross sections (1–2% for absolute)

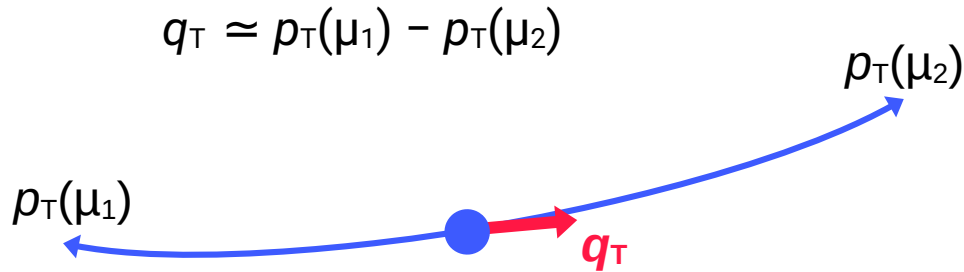


Selected links:

- Total [[2503.09742](#)] **13.6 TeV!**
- dy , $dy dX$ [[1909.04133](#)]
- dq_T , $d\varphi^*$, $dm dX$ [[2205.04897](#)]
- Z + jets [[2205.02872](#)]
- More: [results search page](#)

Binning = Resolution

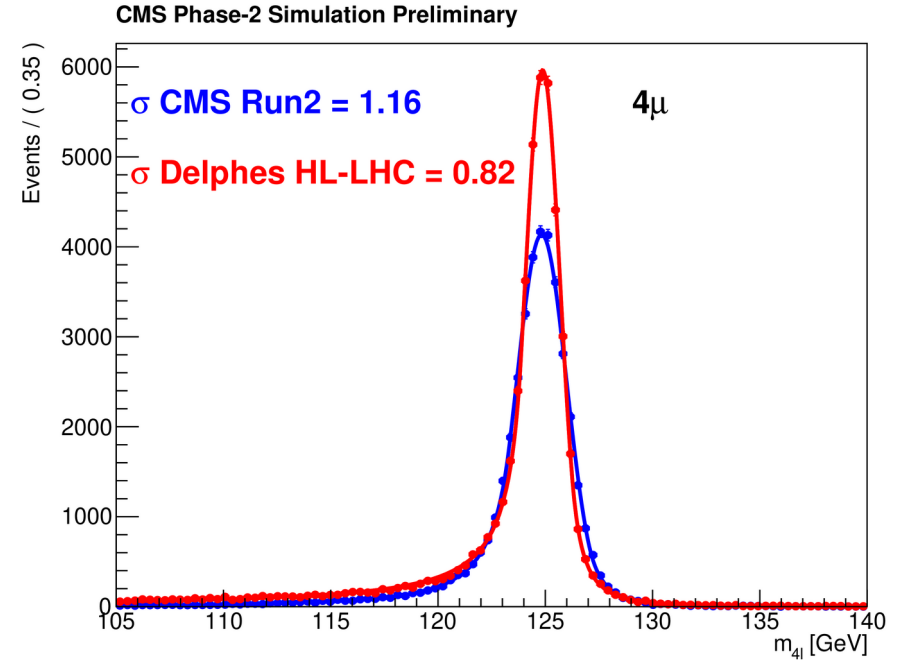
The low- q_T binning is driven by the resolution.
Experimentally:



$$\Delta q_T \approx \Delta p_T(\mu_1) \oplus \Delta p_T(\mu_2)$$

$$\approx Q/\sqrt{2} \cdot \Delta p_T/p_T \quad 1\%$$

$$\approx Q \times 0.7\%$$



New tracker for the HL-LHC:

- Projected resolution is 30% better
- Possibly 0.5 GeV bin width at m_Z
- Not before 2030...

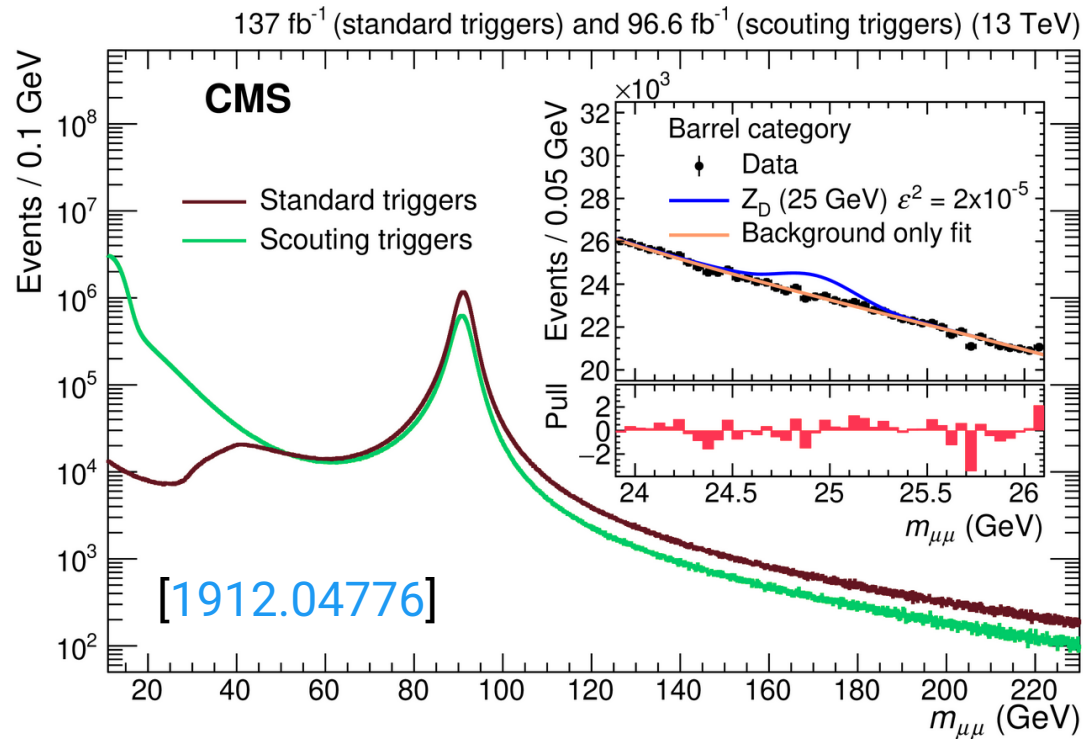
Extreme masses

At low mass (< 50 GeV):

- Limited by trigger thresholds
- Alternative: “scouting” data
- Large statistics, good resolution
- But *huge* QCD background

At high mass (TeV scale):

- Decreasing statistical errors, more differential
- Reduced TMD sensitivity
- Focus on collinear PDFs?



Background processes

QED radiative corrections ($Z \rightarrow \ell\ell\gamma$):

- Percent-level effect a priori
- Changes the apparent $\ell\ell$ mass
- Dramatic contribution below Z peak (50%)
- How to best publish our results?

Photon-initiated $\ell^+\ell^-$ (diffractive or not):

- Small but concentrated at low q_T
- Can mimic TMD effects
- Are there good predictions?
- *Watch out when fitting!*

