PB TMD meeting

The difficulties at small q_T and small $\sqrt{s}$

Difficulties in the description of Drell-Yan processes at moderate invariant mass and high transverse momentum

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Both regimes, $q_T \ll Q$ and $q_T \sim Q$, as well as their matching, must be under theoretical control in order to have a proper understanding of the physics of the Drell-Yan process. In the present work, we study the process at fixed-target energies for moderate values of the invariant mass Q and in the region $q_T \lesssim Q$. We focus on the predictions based on collinear factorization and examine their ability to describe the experimental data in this regime. We find, in fact, that the predicted cross sections fall significantly short of the available data even at the highest accessible values of q_T. We investigate possible sources of uncertainty in the predictions based on collinear factorization, and two extensions of the collinear framework: the resummation of high-q_T threshold logarithms, and transverse-momentum smearing. None of these appear to lead to a satisfactory agreement with the data. We argue that these findings also imply that the Drell-Yan cross section in the "matching regime" $q_T \lesssim Q$ is presently not fully understood at fixed-target energies.
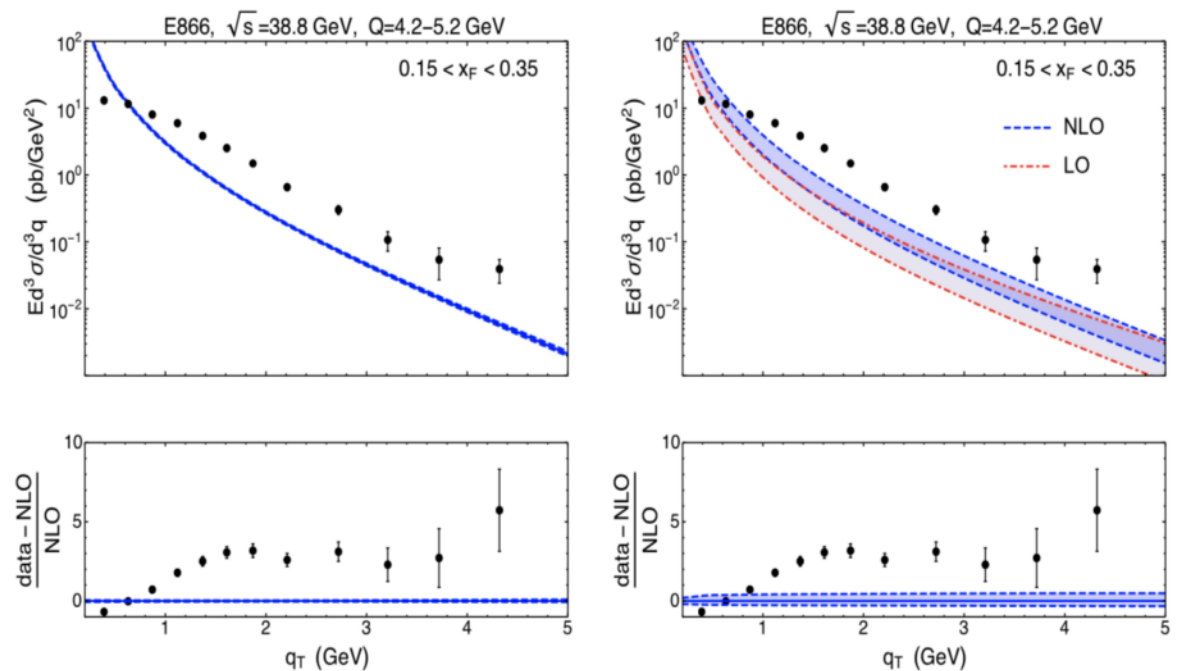

FIG. 2. Transverse-momentum distribution of Drell-Yan dimuon pairs at $\sqrt{s} = 38.8$ GeV in a selected invariant mass range and Feynman-x range: experimental data from Fermilab E866 (hydrogen target) [41] compared to LO QCD and NLO QCD results. (Left panels) NLO QCD $[\mathcal{O}(\alpha_s^2)]$ calculation with central values of the scales $\mu_R = \mu_F = Q = 4.7$ GeV, including a 90% confidence interval from the CT14 PDF set [39]. (Right panels) LO QCD and NLO QCD theoretical uncertainty bands obtained by varying the renormalization and factorization scales independently in the range $Q/2 < \mu_R, \mu_F < 2Q$.

Is there a q_T crisis ?

Correlations in Partonic and Hadronic Interactions 2020 (CPHI-2020)

3-7 February 2020
CERN
Europe/Zurich timezone

Overview

Bulletins

Poster

Committees

Timetable

Participant List

Registration

Conference Fee

Call for Abstracts

Venue

⌐ How to get to CERN

⌐ Visa information

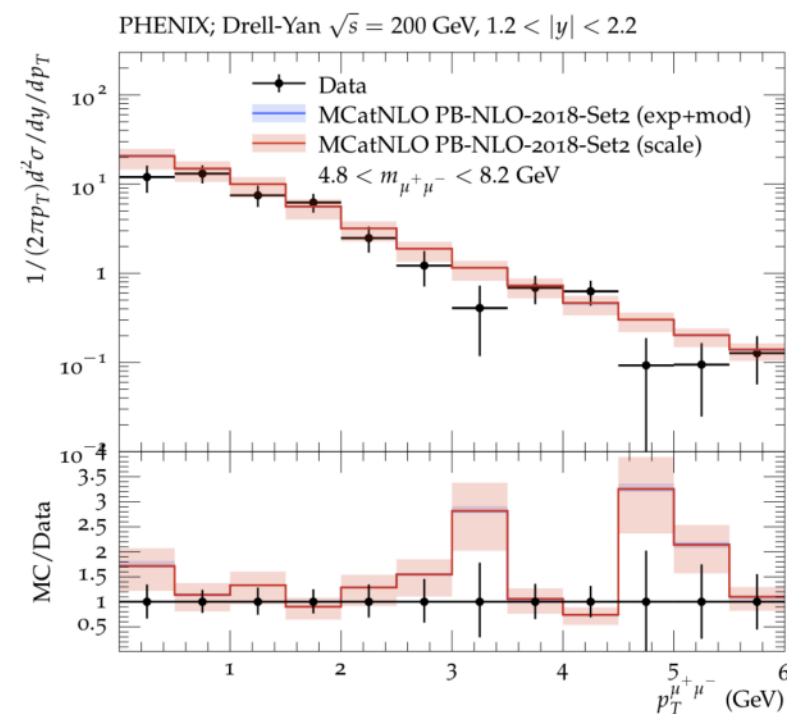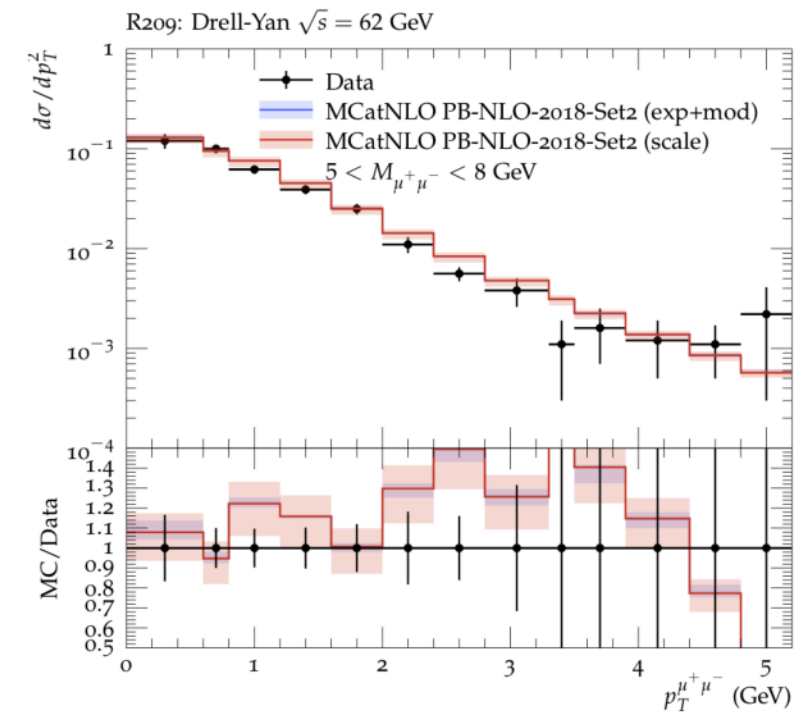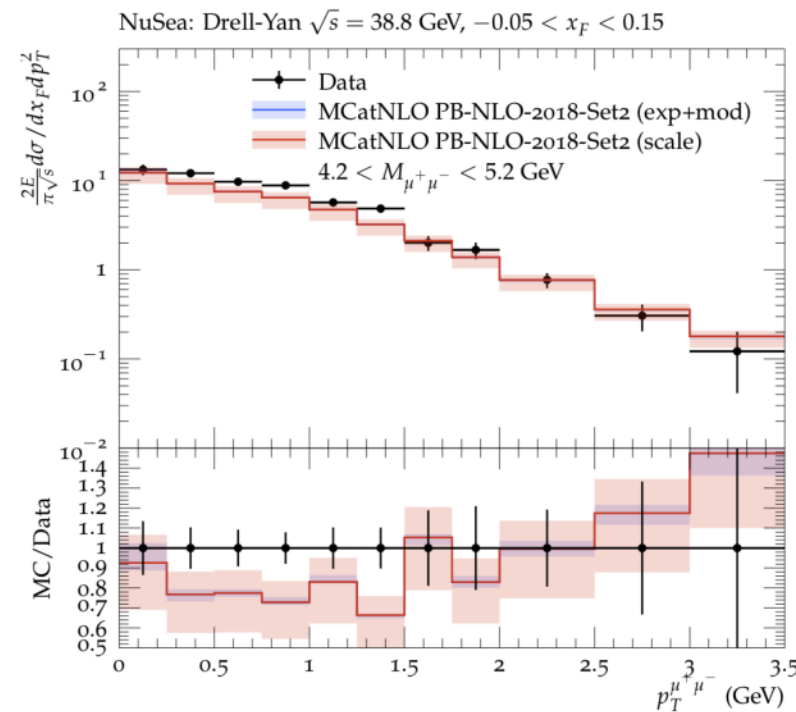⌐ Accomodation

The week-long workshop on Correlations in Partonic and Hadronic Interactions (CPHI-2020) will take place at CERN in Geneva, Switzerland, from February 3rd to 7th, 2020.

Recently, significant disagreements have been reported in comparison of theoretical predictions, based on combination of TMD factorization and collinear factorization and experimental measurements for various transverse momentum distributions of hadrons in lepton-nucleon, electron-positron, and dileptons in DY process. Those observations emerge into a new crisis, the "qT -crisis". Correlations in partonic and hadronic interactions, which may be responsible for observed disagreements, provide important information on underlying dynamics, manifesting themselves in variety of observables widely recognized as key objectives of the forthcoming COMPASS (CERN) polarized deuteron run in 2021, JLab 12 GeV upgrade and a driving force behind construction of the Electron Ion Collider (EIC).

The workshop will focus on the steps needed for development of theory and phenomenology involved in the extraction of TMDs and GPDs from existing and future data from lepton-nucleon, electron-positron and hadron-hadron facilities at BNL, CERN, DESY, FNAL, JLab, and KEK, with controlled systematics over various assumptions involved in the process.

Transverse momentum distributions: q_T crisis ?

NuSea: Drell-Yan $\sqrt{s} = 38.8$ GeV, $-0.05 < x_F < 0.15$

- Data
- MCatNLO PB-NLO-2018-Set2 (exp+mod)
- MCatNLO PB-NLO-2018-Set2 (scale)

$4.2 < M_{\mu^+\mu^-} < 5.2$ GeV

R209: Drell-Yan $\sqrt{s} = 62$ GeV

- Data
- MCatNLO PB-NLO-2018-Set2 (exp+mod)
- MCatNLO PB-NLO-2018-Set2 (scale)

$5 < M_{\mu^+\mu^-} < 8$ GeV

PHENIX; Drell-Yan $\sqrt{s} = 200$ GeV, $1.2 < |y| < 2.2$

- Data
- MCatNLO PB-NLO-2018-Set2 (exp+mod)
- MCatNLO PB-NLO-2018-Set2 (scale)

$4.8 < m_{\mu^+\mu^-} < 8.2$ GeV

- How good is description ?

χ^2/ndf

Qs	NuSea	R209	PHENIX
0.5	1.08	1.27	1.04

Is there " q_T – crisis" ?

- data are perfectly well described by NLO calculation with PB TMDs

New ideas

- CMS workshop on Drell-Yan, Z+jet beginning of this week in Brussels
  - interesting prospects for new measurements:
    - DY pt spectrum at different masses, 45 < M < 600 GeV
    - Z pt spectrum at 5 TeV for pp
      - very interesting for comparison with pA – what can be learned ?
    - Z+multijets
      - up to ~ 10 Jets with pt > 30 GeV
      - can one do multi-leg (madgraph, KaTie) calculation for Z+10 jets ?
      - perspectives for parton shower ? something different ?
      - investigate jet resummation ?
      - High luminosity:
        - extreme limit > largest number of jets ever observed up to how many jets one can go ?

Next workshops

- CPHI Workshop at CERN: 2-7 Feb 2020 call for abstracts open
  - Francesco ?
- xfitter workshop DESY: 26-28 Feb
  - Sara
- DIS 2020 NY: 23-27 March 2020 (Deadline for abstracts: 31. Jan 2020)
  - Sara
  - Olek ?
- LHPC 2020 25-30 May 2020 Paris (Deadline abstract: 13 April 2020)

Agenda

PB TMD discussion

Thursday, 16 January 2020 from **15:30** to **17:30** (Europe/Berlin)
at **CMS meeting room**

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and enter the meeting extension 1010403749 in order to join.

Thursday, 16 January 2020

15:30 - 15:50	Intro *20'*
15:50 - 16:10	PB-TMD distributions and soft resolution scale *20'* Speaker: Dr. Sara Taheri Monfared (DESY)
16:10 - 16:30	Updates on TMD splitting funcions *20'* Speaker: Lissa Keersmaekers