STRONG-2020

Annual Meeting 2024

WP22-JRA4 TMD-neXt,
Alessandro Bacchetta, INFN and U. Pavia

Plan of presentation

01 Brief summary of WP

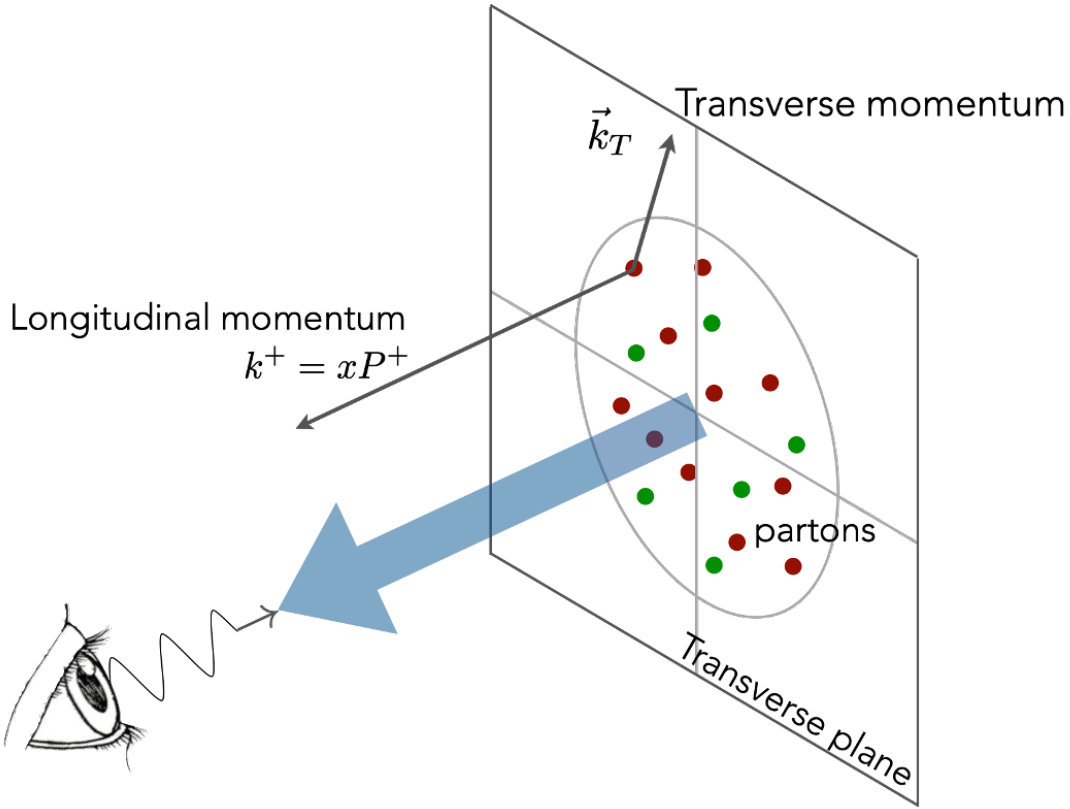
02 Important highlights of the performed work

03 Progress since November ‘23

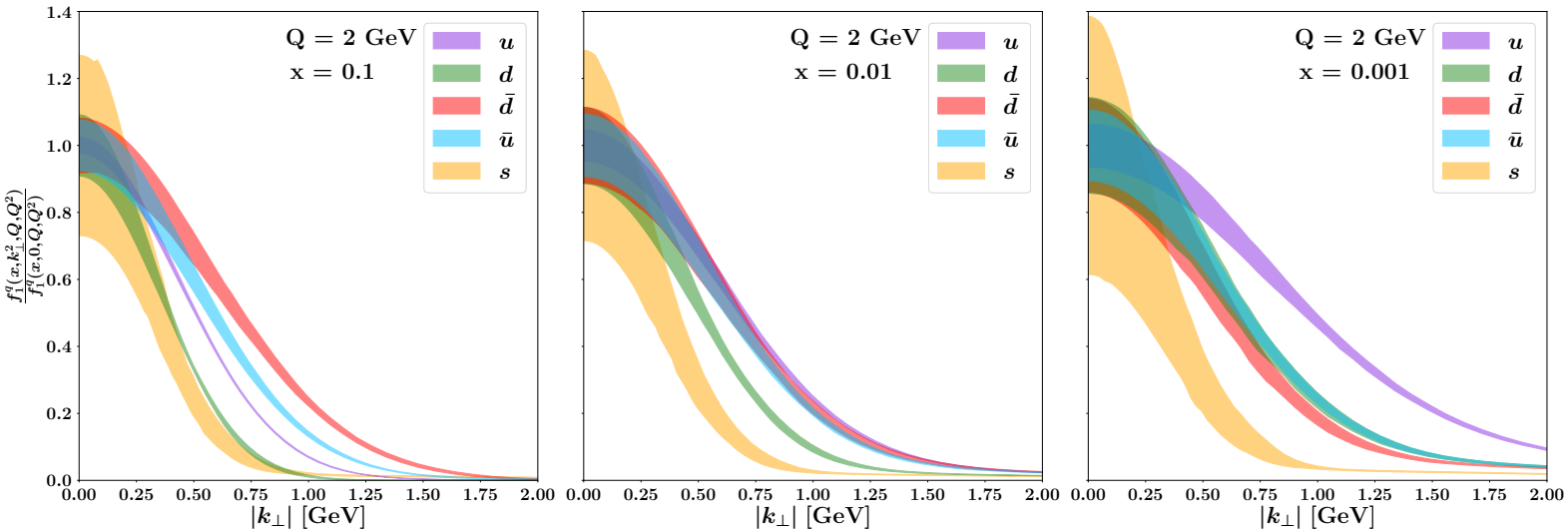
TMD-neXt network

1. INFN
    1. Frascati
    2. Cagliari
    3. Ferrara
    4. Pavia
    5. Torino
    6. Trieste
2. CEA/IRFU Saclay
3. CNRS/CPHT Palaiseau
4. University of the Basque Country, Bilbao
5. LIP, Lisbon
6. Universidad Complutense, Madrid
7. Rijksuniversiteit Groningen
8. University of Montenegro

TMD-neXt goal: Study of Transverse-Momentum Distributions (TMDs)



First extraction of flavor differences in TMDs from global fit of DY and SIDIS data



MAP24 TMD extraction https://arxiv.org/abs/2405.13833

TMD-neXt tasks

1. Analysis of Drell-Yan data
1.1 Analysis of Drell-Yan@COMPASS
1.2 Analysis of Drell-Yan@CMS
2. Analysis of semi-inclusive DIS data
2.1 Analysis of SIDIS@COMPASS (unpolarized)
2.1 Analysis of SIDIS@COMPASS (polarized deuteron)
2.2 Analysis of SIDIS@CLAS12 (polarized)
3. Analysis of electron-positron data
3.1 Analysis of multiplicities@BELLE
3.2 Analysis of azimuthal modulations@BABAR
4. Quark TMD extractions
4.1 Extraction of unpolarized and polarized TMD PDFs and FFs
5. Gluon TMD studies
5.1 Study of factorization in gluon-dominated processes
5.2 Identification of observables best sensitive to gluon TMDs
5.3 Estimates for quarkonium production in SIDIS

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Still possible before the end

Deliverables

Number	Title	Status	Notes
D22.1	TMD data from DY, SIDIS, e^+e^-	Delivered	Less data than expected for e^+e^-, but more than expected in the other experiments, also thanks to extension
D22.2	Parametrizations of TMD PDFs and FFs	Delivered	Many results with increasing degree of accuracy and increasing data
D22.3	Estimates of quarkonium production in SIDIS	Delivered	Several observables have been investigated

Progress since November 2023

Task 1: Drell-Yan data

Plans from last
Annual Meeting

Task 1 [Drell-Yan]

- [COMPASS] Article on transverse spin asymmetries for Drell-Yan high mass range (4.3 – 8.5 GeV/c2) close to completion

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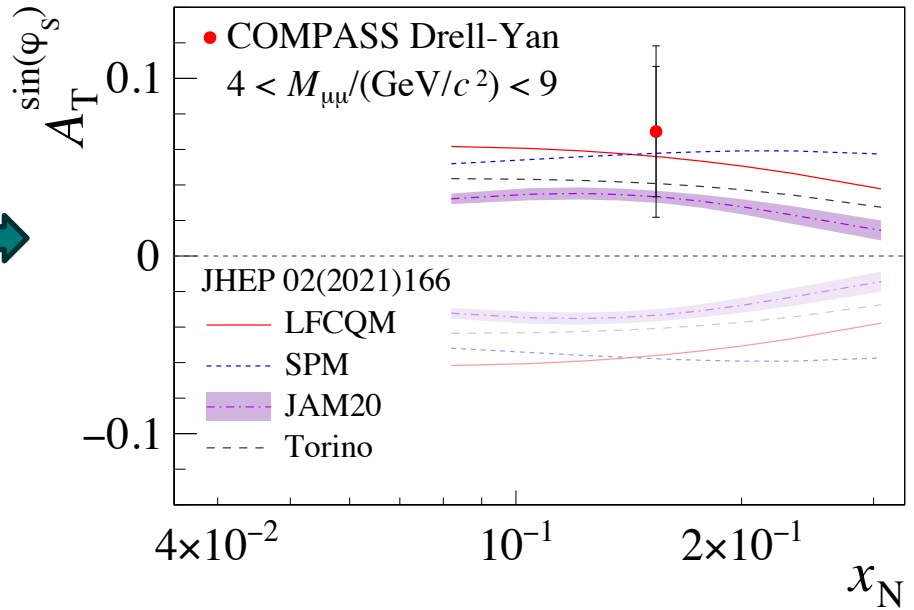
https://arxiv.org/abs/2312.17379



Task 2: SIDIS data

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- [CLAS12] Release of preliminary data for CLAS12 longitudinally polarized SIDIS

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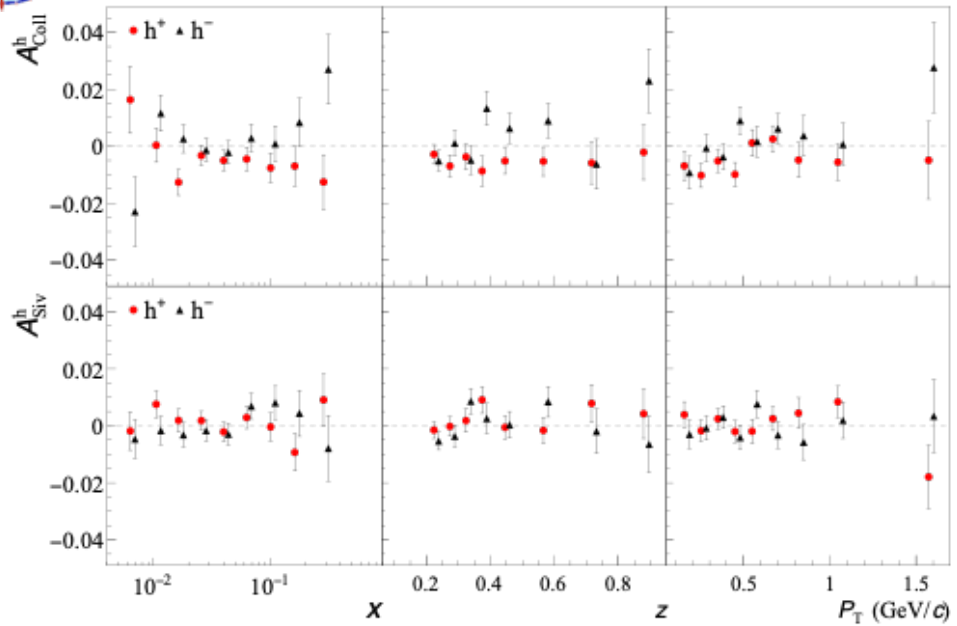
https://arxiv.org/abs/2401.00309



Plans from last Annual Meeting

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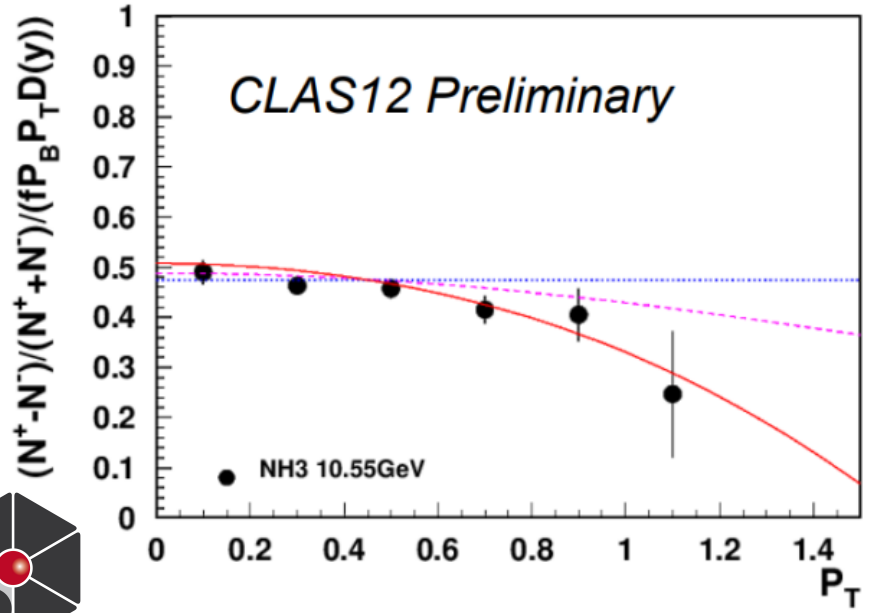
S. Diehl's talk at Transversity 2024
https://agenda.infn.it/event/38132/contributions/234391/



Task 3: e^+e^- data

Plans from last
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Task 3 [e^+e^-]

- [BELLE] Release of unpolarized cross-section of pseudo-scalar and vector mesons
- [BELLE] Publication of results concerning framework for tuning Pythia MC generator

Task 4: quark TMd extractions

Plans from last
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Task 4

- Improved extractions of TMDs and better uncertainty estimates
- Benchmarking of available codes, especially for Drell-Yan precision physics
- Extraction of a purely soft factor and related studies
- Global reweighting of Sivers, transversity, and Collins functions from azimuthal asymmetries
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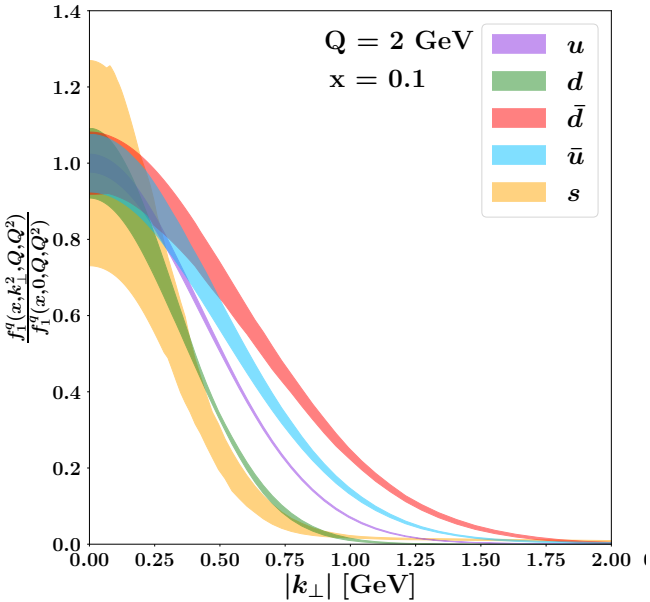

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S. Mukherjee's talk at QCD Evolution 2024
https://agenda.infn.it/event/38747/contributions/233163/

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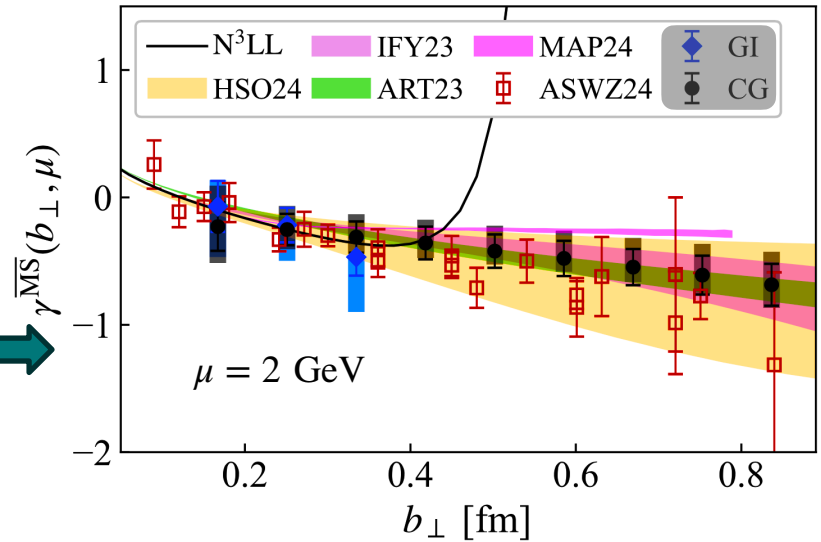

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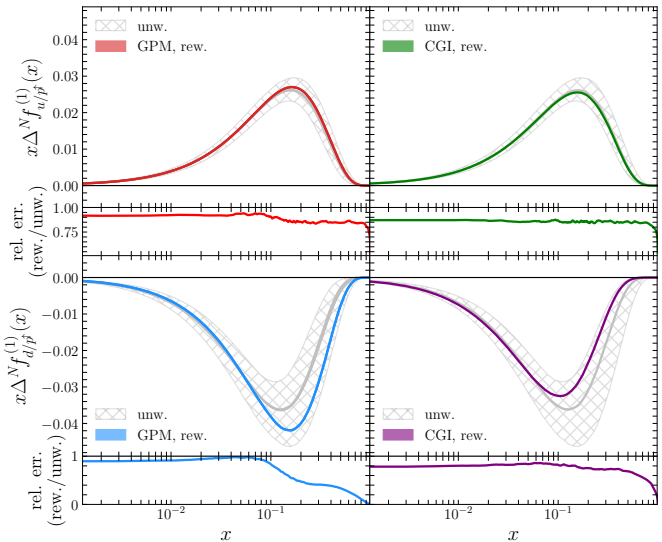
https://arxiv.org/abs/2402.12322



Task 5: gluon TMD studies

Plans from last
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- Analysis of single and double spin asymmetries for C-even quarkonium production
- Calculation of matching coefficients of gluon TMDs
- Model calculation of T-odd gluon TMDs
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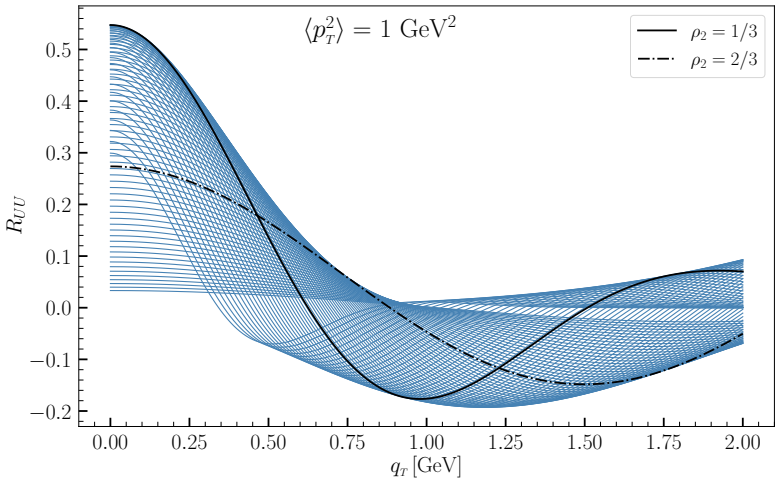
https://arxiv.org/abs/2403.20017



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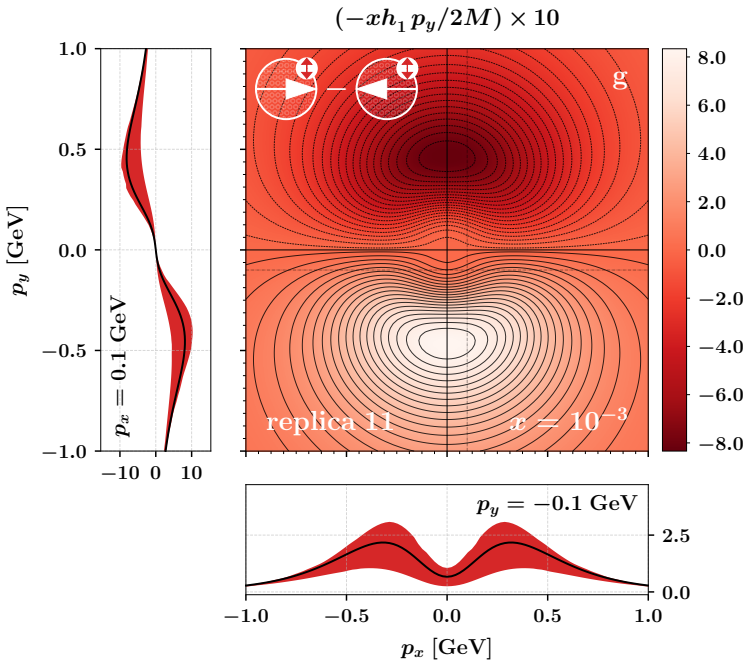
https://arxiv.org/abs/2402.17556



Extra results

https://arxiv.org/abs/2402.01836: transverse momentum moments

https://arxiv.org/abs/2402.01612: Transverse Λ polarization

https://arxiv.org/abs/2401.14266: alternative approach to TMD parametrization (HSO)

https://arxiv.org/abs/2312.08655, https://arxiv.org/abs/2404.04088 study of transverse momentum with parton branching approach

Workshops

SCET 2024
https://indico.fis.ucm.es/event/20/
Salamanca, 15-18 April 2024

QCD Evolution 2024
https://agenda.infn.it/event/38747/
Pavia, 27-31 May 2024

Transversity 2024
https://agenda.infn.it/event/38132/
Trieste, 3-7 June 2024

Conclusions 1/2

- It was an honor for me to coordinate the full chain of TMD studies (data taking, global analyses, formal developments)
- The WP was complex to manage since it contained both experimental and theoretical work
- The WP provided many results from both the experimental and theoretical side. All deliverables achieved. Some problems with e^+e^- data analysis.
- TMD studies have a bright future ahead

Conclusions 2/2

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- From the perspective of infrastructure access, we used CERN access for experimental work and meetings and ECT* access for meetings
- From the perspective of VA, we had an intense collaboration with 3DPartons, which we hope can continue in a future program