

Summary of the workshop on:

Next-generation GPD studies with exclusive meson production at EIC

Salvatore Fazio (BNL)

also on behalf of:

Marie Boer (Temple), Lech Szymanowski (NCNR), Christian Weiss (JLAB)

Topical Workshop, CFNS, Stony Brook U., 4-6 June 2018

35 participants, 3 days of presentations and discussions

INDICO page: <https://indico.bnl.gov/event/4346/>

Objective: Assess potential of hard exclusive meson production and related processes for GPD studies and plan EIC simulations

- **Concepts and interpretation:** Quark/gluon imaging, energy-momentum tensor
- **Reaction theory:** QCD factorization, finite-size effects
- **Experimental results:** HERA, JLab 6 & 12 GeV, COMPASS; LHC UPC pA, future RHIC UPC plans
- **EIC machine and detector requirements**
- **Simulation tools:** Physics models, PARTONS framework, detector models



Context

- **GPDs: key concept in nucleon structure in QCD**

- Spatial distribution of quarks/gluons
- Angular momentum, energy-momentum tensor

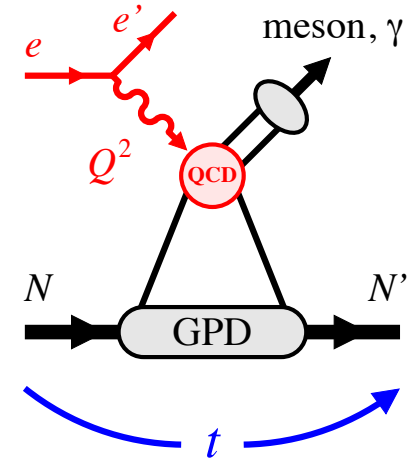
- **GPDs measured in hard exclusive processes**

- $e + N \rightarrow e' + \gamma + N$ (Deeply-virtual Compton scattering)
- $e + N \rightarrow e' + M + N$ (Exclusive meson electroproduction)
- $\gamma + N \rightarrow Q \bar{Q} + N$ (Heavy quarkonium photo/electroproduction)
- $\gamma + N \rightarrow l^+ l^- + N$ (Dilepton production)

- **Current EIC impact studies are based on DVCS only**

- **Advantages of multiple channels**

- Test universality, process-independence of GPDs
- **Separate structures:** Gluons \leftrightarrow sea quarks \leftrightarrow valence quarks, spin/flavor components
- Nuclear imaging (modification of GPDs in p+A collisions)



Processes

- **Light pseudoscalar electroproduction π^0, η, π^+, K^+**
Physics: Helicity-flip/transversity GPDs
Experiments: JLab 6/12 GeV, COMPASS [*new!*]
EIC: Feasibility should be explored – rates, L/T, detection
- **Heavy quarkonium photo/electroproduction $J/\psi, Y, \psi' \dots$**
Physics: Clean probe of gluon GPD
Experiments: High- W HERA, UPCs at LHC [*new!*], near-threshold JLab12
EIC: Essential tool for gluon imaging
Theory needs: NLO corrections, large- x (γ), relation between approaches
Detection: Muon detection?
- **Light vector electroproduction $\phi, \omega, \rho^0, \rho^+, K^*$**
Physics: Gluon \leftrightarrow sea quarks, flavor separation
Experiments: HERA, COMPASS, HERMES, JLab12
EIC: Measurements feasible, physics impact should be explored
Theory needs: Finite-size effects, T response, large- x
- **Dilepton photoproduction $e^+ e^-$**
Physics: Closely related to DVCS, access to $\text{Re}(\text{Amp})$
Experiments: JLab6/12, UPCs at RHIC
EIC: Likely feasible, impact should be explored
Detector: Forward electron tagger for photoproduction, muon detection?

Outcomes of the Workshop

- **QCD factorization with finite-size effects provides realistic description of exclusive meson production**

Use in GPD & imaging studies

Need theoretical work: NLO corrections,
relation between approaches

- **UPCs at LHC extend energy frontier in heavy quarkonium production**

LHCb, ALICE results for $\gamma + p \rightarrow J/\psi + p$ (up to $W \sim 1.5$ TeV)

Consistent with HERA data; no indications of nonlinear effects

- **Meson production could become essential tool for GPD studies at EIC**

Dedicated community, great interest

- **Next-level impact studies need GPD-based physics models**

Aim for GPD extraction with uncertainties

- **Making new tools available - E.g. PARTONS project (H. Moutarde et al.) may play important role in integrating GPD efforts at JLab12 and EIC**



Follow-up Workshop: Warsaw (Poland), January 22-25 2018

Prospects for extraction of GPDs from global fits of current and future data

22-25 January 2019

Heavy Ion Laboratory (Cyklotron)

Europe/Warsaw timezone

Overview

[Timetable](#)

[Registration](#)

[Participant List](#)

[Venue](#)

[Accommodation](#)

The meeting will bring together experimental and theoretical researchers for informal presentations and in-depth discussions. A particular goal will be to enable future collaborative work on process simulations and physics impact studies. The topics of the workshop include among the others:

- experiences in the phenomenology of DVCS/DVMP,
- perspectives of the multichannel analysis,
- the LO and NLO fitting challenges,
- discussion of the fitting approaches/strategies,

and of course of everything that you think is crucial to make the sound predictions/extractions/fits.

Contact

✉ jakub.wagner@ncbj.gov.pl

✉ [Pawel.sznajder@ncbj.gov...](mailto:Pawel.sznajder@ncbj.gov.pl)

✉ Herve.Moutarde@cea.fr

✉ sfazio@bnl.gov



Starts 22 Jan 2019, 09:00

Ends 25 Jan 2019, 17:00

Europe/Warsaw



Heavy Ion Laboratory (Cyklotron)

Ludwika Pasteura 5A, 02-093 Warszawa