

YR writing

YR-SIDIS working group

9/26/2020

Status

- Main chapters and sections haven been established. PWG contributions:
 - Chapter 7: Physics studies
 - Chapter 8: Detector requirements based on Physics studies
- 8.2 SIDIS requirements will be written by us (around 15 pages)
- 7.x.x are organized by topics, usually containing contributions from several working groups, each section (ie 7.1, etc) to have about 15-20 pages

7.1 Global Properties and Parton Structure of Hadrons

- **7.1.1 Unpolarized parton structure of the proton and neutron (Renee Fatemi, Nobuo Sato, Barak Schmookler, Ernst Sichtermann)**
 - [Sea quark PDFs via SIDIS measurements](#) (Charlotte van Hulse)
 - Impact of EIC on DIS observables σ_{red} , $F_{2,3,L}$
 - Impact of EIC on collinear PDFs
- **7.1.2 Spin structure of the proton and neutron (Renee Fatemi, Brian Page, Frank Petriello, Nobuo Sato, Ralf Seidl, Ernst Sichtermann, Daria Sokhan)**
 - [Sea quark Helicities via SIDIS](#) (Ignacio Borsa, Ralf Seidl)
 - Jet production in polarized DIS at NLO and NNLO (JHQ-WG)
 - Dijet A_{LL} feasibility studies (JHQ-WG)
 - Photon polarized PDFs (JHQ-WG)
 - Helicity dependence in charm production (JHQ-WG)
 - Impact on polarized strange using PVDIS(hadron)
 - Impact of A_{LL} to g_1
 - Impact on small x evolution
 - Interpretation of g_1
- **7.1.3 Parton structure of mesons (Wim Cosyn)**
- **7.1.4 Origin of the mass of the nucleon and mesons (Barbara Pasquini)**
- **7.1.5 Multi-parton correlations (Anselm Vossen)**
 - [Twist-3 PDF measurements](#) (Anselm Vossen)
- **7.1.6 Inclusive diffraction and rapidity gap physics (Anna Stasto)**
- **7.1.7 Global event shapes and the strong coupling constant (Leticia Mendez)**

7.2 Multi-Dimensional Imaging of Nucleons, Nuclei and Mesons

- **7.2.1 Nucleon and meson form factors (Douglas Higinbotham)**
 - Nucleon Form Factors (with Barak Schmookler, Andrew Puckett)
 - Meson Form Factors (with Meson Group, Tanja Horn et al.)
- **7.2.2 Imaging of quarks and gluons in position space (Salvatore Fazio, Barbara Pasquini, Daria Sokhan)**
- **7.2.3 Imaging of quarks and gluons in momentum space (Ralf Seidl, Alexey Vladimirov, Anselm Vossen, Bowen Xiao)**
 - [Unpolarized TMDs and TMD evolution](#) (Alexey Vladimirov, Bowen Xiao, Ralf Seidl)
 - [Quark Sivers and Collins measurements](#) (Alexey Vladimirov, Ralf Seidl)
 - [Chiral-odd distribution functions via di-hadron measurements](#) (Anselm Vossen, Chris Dilks)
 - [Gluon Sivers measurements via di-jet/hadron measurements](#) (Bowen, Liang)
 - [\(TMDs in nuclei? - perhaps in 7.2.5 Anselm \)](#)
 - Jet-based TMD measurements: electron-jet Sivers, hadron-in-jet Collins, and more (Miguel Arratia, Felix Ringer)
 - TEEC (transverse energy energy correlations) (H. Li et al)
 - Dihadrons (X. Wang among others)
- **7.2.4 Wigner functions (Salvatore Fazio, Barbara Pasquini)**
- **7.2.5 Light (polarized) nuclei (Wim Cosyn, Raphaël Dupré, Or Hen, Douglas Higinbotham) (some of following material may go to 7.3.8)**

7.3 The Nucleus: A Laboratory for QCD

- **7.3.1 High parton densities and saturation (Tuomas Lappi, Bowen Xiao)**
 - Introduction to gluon saturation
 - Inclusive cross sections at small x (inclusive cross section dipole picture, BK evolution, shadowing)
 - [low- \$x\$ gluon access via di-jets/di-hadrons/photon-jet correlations](#) (Bowen Xiao, Liang)
 - photon+ dijets in the CGC – (R. Venugopalan et al)

7.4 Understanding Hadronization

- **7.4.1 Hadronization in the vacuum (Brian Page, Ralf Seidl, Anselm Vossen)**
 - [Lambda fragmentation](#) (Anselm Vossen, Jinlong)
 - [Light meson fragmentation functions and flavor sensitivity](#) (Charlotte van Hulse, Ralf Seidl)
 - [Di-hadron FFs](#) (Anselm Vossen, Chris Dilks)
 - Jet angularities (JHQ-WG)
 - Jet fragmentation functions and groomed light and charmed jet substructure (JHQ-WG)
- **7.4.2 Hadronization in the nuclear environment (Brian Page, Ralf Seidl, Ivan Vitev)**
 - [Nuclear FFs for light hadrons](#) (Ralf Seidl, Pia Zurita, Charlotte van Hulse)
 - Jet angularities (JHQ-WG)
 - Jet fragmentation functions and groomed light and charmed jet substructure (JHQ-WG)
 - Hadronization in heavy flavor (I. Vitev)
 - In-medium evolution of fragmentation functions. Light and heavy flavor production (Z.Liu et al)
 - Simulations of in-medium modification ratios (X. Li et al)
- **7.4.3 Particle production for identified hadron species (Leticia Mendez)**
- **7.4.4 Production mechanism for quarkonia and exotic states (Spencer Klein, Justin Stevens, Ivan Vitev)**
 - [Photoproduction mechanisms for X,Y,Z states in ep](#) (Justin Stevens)
 - [X,Y,Z states in eA collisions](#) (Justin Stevens, Spencer Klein, Ivan Vitev, M. Durham et al)
- **7.4.5 New particle production mechanisms (Spencer Klein)**
- **7.4.6 Spectroscopy (Justin Stevens)**
 - [X,Y,Z state spectroscopy](#) (Justin Stevens)

7.5 Connections with Other Fields

- **7.5.1 Electro-weak and BSM physics (Ciprian Gal, Krishna Kumar, Sonny Mantry, Nobuo Sato)**
- **7.5.2 Neutrino physics (Shunzo Kumano, Roberto Petti)**
- **7.5.3 Cosmic ray/astro-particle physics (Spencer Klein)**
- **7.5.4 Other connections to pp, pA, AA (Tuomas Lappi, Thomas Ullrich, Bowen Xiao)**
 - [Low-x gluons and factorization in ep vs pA and AA](#) (Bowen Xiao)
 - Implications of PDF determinations for pp, pA physics
 - Initial conditions for hydrodynamics in AA collisions
 - [Lambda polarization from eA to AA](#) (Anselm Vossen)
 - Parton interactions in matter (I. Vitev, X. Wang etc)
- **7.5.5 Lattice QCD (Martha Constantinou, William Detmold, Sergey Syritsyn)**
- **7.5.6 Snowmass Process (Abhay Deshpande, Pavel Nadolsky)**
- **7.5.7 Radiative corrections at the EIC (Jan Bernauer)**

Status

- We have started writing parts that are already doable (esp 8.2 or where recent impact studies exist already in publications)
- Still need to get impact studies for several sections
- Tight timeline:

Implications for Timeline between now and Berkeley Meeting

The EIC Measurements and Studies

Global Properties and Parton Structure of Hadrons

- 1.1 Unpolarized parton structure of the proton and neutron (Renee Fatemi, Nobuo Sato, Barak Schmookler, Ernst Sichtermann)
- 1.2 Spin structure of the proton and neutron (Renee Fatemi, Brian Page, Frank Petriello, Nobuo Sato, Ralf Seidl, Ernst Sichtermann, Daria Sokhan)
- 1.3 Parton structure of mesons (Wim Cosyn)
- 1.4 Origin of the mass of the nucleon and mesons (Barbara Pasquini)
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- 1.7 Global event shapes and the strong coupling constant (Leticia Mendez)

→ First draft of sections 7.X and 8.X by October 15

→ Remaining ~ 4 weeks for

- (1) coordinating edits within the physics volume, and between physics and detector volumes
- (2) (some) updates of results

From Andreas Metz@CUA meeting

8. Detector Requirements

- 8.1 Inclusive measurements
- 8.2 Semi-inclusive measurements
- 8.3 Jets and Heavy Quarks
- 8.4 Exclusive measurements
- 8.5 Inclusive diffractive measurements & Taggi
- 8.6 Summary of requirements

Timeline - Option A

If 4th workshop at UCB/LBL is final meeting, the timeline is:

- November 1 - November 18
 - ▶ SC assembles independent review team (readers) with input from conveners
- November 22 – November 29
 - ▶ Editing by Conveners and Steering Committee
- November 29 – December 20
 - ▶ Period of web-based EICUG community input and independent review team reads and comments
- December 21 – January 11
 - ▶ Final editing of Yellow Report(s)
- January 15
 - ▶ Release Yellow Report(s)

From Rolf/Thomas@CUA meeting