'EIC Yellow Report' kick-off meeting
Physics/detector working group

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Introduction

- The EIC covers a wide range of physics topics !

  As described in EIC White Paper and NAS report, plus additions
- The goal is to provide input for detector design
- Physics topics → processes → detector requirements

- These slides are intended to start the discussion
- We anticipate further input from the SC, conveners of detector/physics WG, sub-conveners, this meeting, and the community

Physics/detector WG – parallel session

Thu 2:00pm — 3:45pm: gathering input from participants !

physics topics, processes / measurements,

detector requirements,

sub-conveners

3:45pm — 4:45pm: session for Physics-WG conveners

summarize input/discussion to present it at the plenary session

Physics/detector WG – organization

- Composed of multiple sub-groups led by sub-conveners (experts)
- Organized by physics topics or processes

  as mentioned in EIC White Paper and NAS report + additions
- We assume several sub-conveners per group

Physics topics

White Paper & NAS measurements

1. Global properties and parton structure of hadrons
   a. Spin structure of proton & neutron (spin sum rule, helicity distributions, transversity)
   b. Mass of the nucleon and mesons
   c. Multi-parton correlations (structure function g_2)
   d. (Inclusive) diffraction

2. Multi-dimensional imaging of hadrons
   a. GPDs and 3D-imaging (includes also Ji's sum rule, pressure and shear distributions)
   b. TMDs and 3D-imaging
   c. Wigner functions (includes, in particular, orbital angular momentum)
   d. Form factors and 2D-imaging in position space

White Paper & NAS measurements

3. The Nucleus: A Laboratory for QCD
    a. High parton densities and Saturation
    b. Diffraction
    c. Particle propagation through matter, energy loss
    d. Collective effects (shadowing, anti-shadowing, ridge effect, other emergent phenomena)
    e. Special opportunities with jets and heavy quarks
    f. Short-range correlations, origin of nuclear force
    g. Structure of light (polarized) nuclei

4. Understanding hadronization
    a. Hadronization in the nuclear environment
    b. Hadronization in the vacuum
    c. Particle production for identified hadron species
    d. Production mechanism for quarkonia and exotic states
    e. Spectroscopy

5. Connections with other fields
   a. Electro-weak physics (e.g. scale dependence of Weinberg angle)
   b. Neutrino physics
   c. Cosmic-ray / astroparticle physics
   d. BSM physics (e.g. lepton flavor violation)
   e. Other connections to pp/pA/AA
   f. Lattice QCD

Physics topics linked to processes & measurements

White Paper & NAS measurements

Processes↦ / ↧ Topics	Inclusive	Semi-Inclusive	Jets, Heavy Flavor	Exclusive, Diffractive, Forward Tagging
Global properties and parton structure	Incl. SF	h, hh	j, Q	Incl. diffr., excl. J/Ψ, Υ, tagged DIS on pol. D/He
Imaging		h	j, jj, j+h, Q+Qbar, [QQbar]	Excl-DIS: DVCS, DVMP (J/Ψ, Υ, ρ^0, ϕ, π+, K, ρ+, K*…), Elastic scattering
Nucleus	Incl. SF	h, hh	j, jj, Q, [QQbar]	Diffr. SF, coh. & incoh. VM, jj, h, hh D/He FF, nucl. fragments
Hadronization		h, hh, j+h	j, Q	
Other fields		CC DIS, γ-A total X-sec		γ-A diffr. X-sec γ-A elast. X-sec

Processes & detector requirements

Different science sub-groups may have similar detector requirements, e.g.

- (Semi-) Inclusive DIS:

PID up to high p_T, tracking, wide rapidity coverage (dihadron and dijet)
(x,Q2,y) determination and resolutions, e-calorimetry (forward-e, barrel & forward-h) and h-calorimetry (barrel & forward-h)

- Jets and Heavy Flavors:

Vertex requirements & resolutions, barrel calorimetry, h-calorimetry, tracking to low p_T, PID

- Forward Tagging (deep exclusive, diffractive, tagging):

Centrality resolution, ZDC, roman pots, other forward detectors and forward-hadron tracking requirements, forward-hadron and barrel calorimetry segmentation

Goals during this meeting

- Discuss and setup the working group structure (by physics topics, by processes)
- Discuss the charge of the different working groups
- Gather input on people interested to join the different working groups
- Discuss a work plan:
  - Regular independent WG meetings, common meetings, etc
  - Milestones, (realistic) deliverables and timeline

Proposed physics WG organization:

Subgroups:

- Inclusive DIS
- h SIDIS
- Jets, heavy quarks
- Deep exclusive
- Diffractive & Tagging

15-20 subgroup conveners
Aimed at covering all relevant physics topics

Physics topics linked to processes & measurements

White Paper & NAS measurements

Processes ↦ / ↧ Topics	Inclusive	Semi-Inclusive	Jets, Heavy Flavor	Exclusive	Diffractive, Forward Tagging
Global properties and parton structure	Incl. SF	h, hh	j, Q	excl. J/Ψ, Υ	Incl. diffr., tagged DIS on pol. D/He
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Hadronization		h, hh, j+h	j, Q		
Other fields		CC DIS, γ-A total X-sec		γ-A elast. X-sec	γ-A diffr. X-sec

Proposed physics WG organization:

Subgroups:	Conveners:
• Inclusive	2-3
• h SIDIS	3-4
• Jets, heavy quarks	3-4
• Exclusive	2-4
• Diffractive & Tagging	3-4

13-19 subgroup conveners
Aimed at covering all relevant physics topics

Suggestions for motivated people willing to commit
a **significant** effort over 1-year are welcome

Next steps:

- Solicit input from the community on physics and subgroups conveners (~1 week)
- Finalize subgroups/conveners (end of Dec)
- Survey existing work within subgroups; prepare outline of subgroup contributions for YR (end Jan)
- Temple meeting: each subgroup reports on their progress