YR Physics Working Group meeting

April 15, 2020

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Agenda

- Review of the YR timeline

- Discussion on the charge for the Pavia meeting

- Input from subgroups on:
  - Pavia meeting agenda
  - Software and computing needs
  - Preferences on writing tools (eg. Word vs Latex, etc)

- Questions, comments from subgroups

YR Timeline (I)

SC (Rolf's) slides at Temple

January 2020	Software tutorials are given, all activities are underway
March 19-21	First workshop at Temple University – Philadelphia *Goal: present progress for various groups and sub-groups, with much discussion and work time, initiate detector complementarity study based on detector technologies*
May 22-24	Second workshop at U of Pavia – Pavia, Italy *Goal: present initial physics measurements and detector requirements following five chosen processes/tools (inclusive measurements, semi-inclusive measurements, jets and heavy quarks, exclusive measurements, diffractive measurements & tagging), present detector concepts and implications for physics measurements. Complete detector requirements table including segmentation needs.*
August 3-7	Status reports at EICUGM @ FIU – Miami, FL *Goal: Conveners/sub-conveners inform community about status and progress. Conveners identify possible issues (if any) in meeting with EICUG Steering Committee.*
September 17-19	Third workshop at CUA – Washington, DC *Goal: present mature studies of detector requirements from physics processes, balance detector concepts versus impact on physics measurements. Discuss possible systematics reduction among complementary detector choices. Complete final "to-do" list for YR(s).*
November 19-21	Fourth workshop at UCB/LBL – Berkeley, CA or Final Meeting (assembly of Yellow Report(s)) *Goal: distribute draft YR sections before meeting*
January 2021	(optional) Final Meeting **Completion of Yellow Report**

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YR Timeline (II)

SC (Rolf's) slides at Temple

2021 January

- After assembly of Yellow Report(s), in parallel:
  ▸ Period of web-based EICUG community input.
  ▸ Independent review team reads and comments.
- Final Yellow Report(s) to be released after folding in input. Goal is ~~April 2021 (or, expedited~~ January 2021).
- E.g., if fourth workshop at UCB/LBL is final meeting, a possible timeline could be:
  ▸ November 22 – November 29
    ◉ Editing by Conveners and Steering Committee.
  ▸ November 29 – December 20
    ◉ In parallel, period of web-based EICUG community input and independent review team reads and comments.
  ▸ December 21 – January 11
    ◉ Final editing of Yellow Report(s)

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Charge for Pavia

Straw-man plan of attack:

a.- Review previous existing work related to your subgroup.

b.- Converge on a set of important and representative measurements for your subgroup.

Presented at the Temple meeting

c.- Break-down physics deliverables into "physics objects" (PO) [electron, hadron (ID/noID), muon, jet]; map out kinematics for each PO.

Main goal for Pavia

d.- Cross-check PO maps across physics subgroups to determine the most challenging constraints in terms of detector design; resolve overlaps [decide who runs what].

e.- Focus on fast simulations for the most demanding measurements first; determine the optimal/acceptable detector performance; confirm/check resulting impact on the rest of the measurements

Simulation baseline parameters

Based on the current BNL design, we suggest, as a starting point for our physics simulations, to study one or several of the following beam energy combinations:

p-e	275 on 18 GeV	100 on 10 GeV	100 on 5 GeV	41 on 5 GeV
d/^{3}He/^{4}He-e	110 on 18 GeV	110 on 10 GeV		41 on 5 GeV
C/^{40}Ca/Cu-e	110 on 18 GeV	110 on 10 GeV		41 on 5 GeV
Au-e	110 on 18 GeV	110 on 10 GeV		41 on 5 GeV

(For nuclei the energy refers to the energy per nucleon)

Please assume integrated luminosities of 10 fb^{-1} and 100 fb^{-1}

A polarization of 70% may be assumed for electrons and light ions

Exchanges with DWG

- ✓ Document studies/results in the wiki: https://wiki.bnl.gov/eicug/index.php
- ✓ Send information to the detector group in order to update the interactive detector matrix

η	Nomenclature			Tracking			Electrons		π/K/p		HCAL	Muons
				Resolution	Allowed X/X₀	Si-Vertex	Resolution σ_E/E	PID	p-Range (GeV/c)	Separation	Resolution σ_E/E	
-6.9 to -5.8	↓ p/A	Auxiliary Detectors	low-Q2 tagger	$\sigma\theta/\theta < 1.5\%$; $10\text{-}6 < Q2 < 10\text{-}2$ GeV2								
...												
-4.5 to -4.0			Instrumentation to separate charged particles from photons									
-4.0 to -3.5							$2\%/\sqrt{E}$					
-3.5 to -3.0		Central Detector	Backward Detector	$\sigma_p/p \sim 0.1\% \oplus 0.5\%$		TBD			≤ 7 GeV/c		~50%/√E	
-3.0 to -2.5												
-2.5 to -2.0				$\sigma_p/p\ 0.1\% \oplus 0.5\%$			$2\%/\sqrt{E}$					
-2.0 to -1.5							$7\%/\sqrt{E}$	π suppression up to 1:10⁴				
-1.5 to -1.0				$\sigma_p/p\ 0.05\% \oplus 0.5\%$			$7\%/\sqrt{E}$					
-1.0 to -0.5			Barrel	σ_p/p $\sim 0.05\% \times p + 0.5\%$	~5% or less X	$\sigma_{xyz} \sim 20\ \mu m, d_0(z)$ $\sim d_0(r\Phi) \sim 20/p_T$ GeV $\mu m + 5\ \mu m$	(10-12)%/√E		≤ 5 GeV/c	≥ 3 σ		TBD
-0.5 to 0.0												
0.0 to 0.5												
0.5 to 1.0												
1.0 to 1.5			Forward Detectors	σ_p/p $\sim 0.05\% \times p + 1.0\%$		TBD			≤ 8 GeV/c		~50%/√E	
1.5 to 2.0												
2.0 to 2.5									≤ 20 GeV/c			
2.5 to 3.0				$\sigma_p/p \sim 0.1\% \times p + 2.0\%$								
3.0 to 3.5									≤ 45 GeV/c			
3.5 to 4.0	↑ e	Auxiliary Detectors	Instrumentation to separate charged particles from photons									
4.0 to 4.5												
...			Neutron Detection									
> 6.2			Proton Spectrometer	$\sigma_{intrinsic}(\|t\|)/\|t\| < 1\%$; Acceptance: $0.2 < p_t$ < 1.2 GeV/c								

https://physdiv.jlab.org/DetectorMatrix/

YR Wikipages

Pavia agenda

Current (and very preliminary) plan:

- Day 1 – Plenary
    - ➢ Project, accelerator design reports
    - ➢ Physics and detector WG overviews
    - ➢ Complementarity/EoI discussion
    - ➢ Possibly software Q&A

- Day 2 – Parallel/Semi-parallel
    - ➢ WG parallel sessions
    - ➢ PWG & DWG joint sessions

- Day 3 - Plenary
    - ➢ WG summaries
    - ➢ Discussion on next steps

Input from subgroups

➤ Software needs

      - tools: event generators, simulation software

      - computing resources: storage, cpu…

➤ YR writing tools (Latex vs Word)

➤ Other general input/questions

Next meeting: May 6 at 11AM EST