

## Intro to the session on Early Science





Rosi Reed (Lehigh) - Salvatore Fazio (U. Calabria & INFN CS) ePIC Collaboration Meeting – January 2025

#### From Elke's talk @ Strategy Workshop

#### Proposal for EIC Science Program in the First Years

Year - 1	Year - 2	Year - 3	Year - 4	Year - 5
Start with Phase 1 EIC lew Capability: Commission electron iolarization in parallel Run: 0 GeV electrons on 115 GeV/u eavy ion beams (Ru or Cu) > Physics: ives world-wide new data on IPDFs and a first look on aturation	Start with Phase 1 EIC Commission electron polarization in parallel New Capability: Commission hadron polarization in parallel Run: 10 GeV electrons on 130 GeV/u Deuterium Physics: • gives world-wide new data -> critical baseline for nPDFs and saturation • free vs. bound proton structure Run: Last weeks 10 GeV electrons and 100 GeV polarized protons Physics: first look to 3d imaging of the proton	Start with Phase 1 EIC Commission electron polarization in parallel Commission hadron polarization in parallel New Capability: Commission running with hadron spin rotators Run: 10 GeV electrons on 130 GeV transverse polarized protons Physics: 3d imaging of the proton / mass of the nucleon Run: Last weeks switch to longitudinal proton polarization Physics: first look helicity structure of the proton – unravel quark, gluon and orbital angular contributions	Start with Phase 1 EIC Commission electron polarization in parallel Commission hadron polarization in parallel Commission running with hadron spin rotators New Capability: Commission hadron accelerator to operate with not centered orbits Run: 10 GeV electrons on 250 GeV transverse and longitudinal polarized protons Physics: • 3d imaging of the proton at low x • helicity structure of the proton – unravel quark, gluon and orbital angular contributions	Start with Phase 1 EIC Commission electron polarization in parallel Commission hadron polarization in parallel Commission running with hadron spin rotators Commission hadron accelerator to operate with not centered orbits <b>Run:</b> 10 GeV electrons on 166 GeV transverse and longitudinal polarized He-3 <b>Physics:</b> • 3d imaging of the nucleons → flavor separation • helicity structure of the nucleon– unravel helicities for different quark flavors • first look to nuclear binding

Time to install additional ESR RF and HSR PS to reach design Current and max. Energies

- It's beneficial that we demonstrate to DOE that ePIC/EIC will achieve a meaningful and impactful science program within the first 5 years
- At the summer EICUG/ePIC meeting, Elke kicked off the discussion on what phasing the EIC might mean to an early science program
- This starting point has generated a growing discussion within the collaboration

This has led to a first ePIC Early Science Workshop in September 2024.

https://indico.bnl.gov/event/24432/

### **Expected** luminosities

- Each year: 1/2 year operation with 80% uptime
- eA luminosity is per nucleon
- ep luminosity range for low high divergence
- For years with two species, division is just a guess

	Species	Energy	Luminosity (fb <sup>-1</sup> )	e polarization	p/A polarization
Year 1	e+Ru or e+Cu	10 x 115	0.9	N/A	N/A
Veer 2	e+d (21 weeks)	10 x 130	9.2	N/A	N/A
Year 2	e+p (5 weeks)	10 x 130	0.95 - 1.03	N/A	trans?
Year 3	e+p	10 x 130	4.95 - 5.33	N/A	trans & long
No on A	e+Au (13 weeks)	10 x 100	0.42	N/A	N/A
Year 4	e+p (13 weeks)	10 x 250	3.09 - 4.59	N/A	trans & long
Year 5	e+Au (13 weeks)	10 x 100	0.42	N/A	N/A
	e+ <sup>3</sup> He (13 weeks)	10 x 166	4.33	N/A	trans & long

## Goals

- $\circ$  Hard constraints by the phasing of the machine and detector
- Within those constraints:
  - Compelling science deliverables?
  - Priorities for the E.S. case: which process we should focus on?
  - Final deliverable?
    - a paper on the E.S.?
    - a chapter in the larger ePIC science paper?

• We plan to hold **E.S. workshops at regular intervals** to follow up on progress and suggestions

 A follow-up workshop in ~March will have fits projections by all PWGs according to the priority list we establish today

# Agenda

9:00	Introduction and Setting the Stage	Salvatore Fazio		
	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	09:00 - 09:10		
	Configuration and Capabilities for the Phase-1 EIC	Elke-Caroline Aschenauer		
	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	09:10 - 09:40		Update from the proje
	Theory: TMDs and GPDs with early data	Alessandro Bacchetta		
:00	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	09:40 - 10:10		
	Theory: Opportunities for first EIC physics	Dr Maria Zurita	$\rightarrow$	Guidance from theory
	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	10:10 - 10:40		
	Coffee Break			
00	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	10:40 - 11:10		
	SIDIS Early Science Plans	Ralf Seidl et al.		
	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	11:10 - 11:30		
	Jets/HF Early Science Plans	Rongrong Ma		Plans and projections
	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	11:30 - 11:50	$\rightarrow$	by some PWGs
	Plans with exclusive and diffractive probes	Raphael Dupre et al.		by some P was
00	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	11:50 - 12:10		
	Open Mic (5' Flash Talks)	Salvatore Fazio		
	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	<u>12:10 - 12:40</u>	•	Open mic and
	Discussion of Future Early Science Deliverables	Salvatore Fazio	$\rightarrow$	priority discussion
00	Sala degli Svizzeri, Villa Mondragone, Monte Porzio Catone (RM), Italy	12:40 - 13:10		4
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