Comments on the first draft of the ePIC Early Science Report:
3/11/2026

Thomas Ullrich

General:
Overall a bit disappointed. Not sure at the end what one learns and much I think is missing. Needs certainly work.

What I thought the report will do is at least provide a table/matrix listing all measurements (golden/silver/bronze) listed in the WP and YR like:

Measurement	Ranking	Year 1 Impact	Year 2 Impact	Year 3 Impact	Year 4 impact
DVCS (ep)	golden	none	low	low	moderate
…					

This could be a long list but so what. This for me would key. It lets you optimize any early science but it is also honest in that it shows what cannot be done. This would be something one would like to see potentially in the Conclusions.

There are parts (abstract) where we are overselling things a bit which is very dangerous in the current situation.

For every topic some measurements are picked 0 not alkways the most compelling ones in my view. Looks a bit like random. A bit an overview of the many measurements and a grading (table above) would be good. May be have a table I mention above split into parts for each process/section (incl., SIDIS, excl)

Detail: headings are sometimes capitalized sometimes not

Specifics:

Abstract: careful with the compelling and high-impact - may be moderate a bit. There should be also a sentence at the end that ultimately the full EIC is needed to explore the full breath as outlined in etc etc etc

Style: Based on “realistic”, sounds odd as if we released unrealistic things before - may be expected

Page 1:

- “main ePIC detector” - means what?

- Bean -> beam
- No need to put roman pots in quotations

Page 2:
- elswehere -> elsewhere
- Transition from first paraph to block describing the physics is a bit harsh - needs some transition
- Line 64-91 may be use bullets
- Diffarctive processes are quadratically dependent - careful here not all, some are some are not
- 3rd paragraph - easy on the ‘important’ repeatedly

Page 3
- In table I would not use and/or just ‘or’
- It’s detector -> its detector

Page 4
- These SFs serve as vital inputs for parton distributions to fits to the data. **No they don’t**. PDF fitter use the reduced cross-section in all cases (to my knowledge). They deal with the F2/FL parts.

Page 5
- The FL points are **not** impressive at all. We might better leave them out - or say that FL needs many more energies and an excellent overall normalization that will take some time to achieve.
- Style: line 172-173 - question is not really a topic

Page 7
- Sync figure 5 with eq in line 196 (indicate P_in)
- I find nPDF terribly uncompelling. We can do it and should do it but it’s really not a highlight. It’s an improvement of some parametrizations used by heavy-ion modellers and the audience is a handful of people. We really do not learn anything. It’s bread and butter that doesn’t push our knowledge of QCD.

Page 8
- theGeneric -> the generic

Page 9
- 254: si -> see

Page 11
- Fig 9 left - last point is corrected by 3 orders of magnitude. This might raise some eyebrows, especially since the point before has none and huge errors.
- 289: transverse spatial distribution **and their fluctuations**

- I am very nervous about rapidity gaps and backgrounds. Some words might be in place here.

Page 12

- We have many suggested measurements on saturation. Fig 10 shows the most challenging and complex one with which we were and are struggling. There are simple high-impact measurements like the ratio of diffractive over total cross-sections and many others. Also no reference to Marcia's paper that produced the idea that makes Fig 4 left work.
- Fig 4: is a year 4 measurement (may be)

Page 13

- Figure 11: again year4 only

Page 14

- Figure 12: again year4 only
- If there are no studies with the lighter ions we will run (say Cu), jets and HF in eAu or ePb is not really early science.

Conclusion: is sort of OK I think, the last paragraph is overselling it a bit.

Taku Gunji

General:

（1）From the perspective of what can realistically be measured in the early stage, it is very useful that the report evaluates observables such as proton and neutron structure functions, nuclear modification factors, and diffractive processes. This helps clarify the concrete experimental reach of the program.

However, since the EIC science case is built around the pillars of **mass, spin, and gluon saturation**, it would be important to also include discussions that more directly address the **discovery or impact potential** in these areas. For example:

- What is the **discovery potential for gluon saturation** in the early program (e.g., at what significance level could it be established)?

- To what extent can the different contributions to the **proton mass decomposition** (quark energy, gluon energy, trace anomaly, etc.) be constrained?

- How far can the **quark and gluon spin contributions** be determined, and how does this compare with what has already been achieved at **RHIC**?

Including figures or projections that explicitly address these questions would strengthen the report, particularly in communicating the broader scientific impact of the early EIC program to researchers outside the immediate field.

（2）The connection between **Chapter 2 and Chapter 3** is not entirely clear.

Chapter 2 presents the **EIC science goals together with the key observables** needed to address them. In contrast, Chapter 3 describes the **early science program**, but the relationship between the two chapters is not sufficiently explicit.

It would be helpful to clearly connect the early science program to the science drivers introduced in Chapter 2. In particular, for each major science topic outlined there, the report should specify **what concrete objectives are expected to be achieved during the early science phase**.

At present, the **milestones or target sensitivities for the early phase are not clearly defined**, making it difficult to understand how the early program advances the core science goals of the EIC. Establishing a clearer mapping between the science goals (Chapter 2) and the early measurement goals (should be outlined in Chapter 3) would significantly strengthen the report. If those measurement goals are defined quantitatively, having figures or projections for mass and spin decomposition (comment (1)) may not be mandatory.

J. Lajoie

I am not going to try to correct all the editorial, language and spelling issues - just put the damn thing through ChatGPT or something - it would be kind to the referees to have done this ahead of time.

General structure -

The PACs were given the guidance to select a subset of measurements where they could show an impact. In general they have tried to follow that but the presentation is not consistent between the different sections.

There is almost no acknowledgement of prior work at RHIC, JLab, HERA or LHC and no references! As the audience for this work is primarily the NP community this will come across as arrogant and alienation - we cannot do this! Each section should have at least a heavily referenced paragraph in the introduction that explains (a) why this is important and (b) what the prior art is.

References are general missing throughout - every assertion should be referenced.

Projections of the reduction in uncertainty on extracted physics quantities are the most powerful way to show the effect of EIC Early Science! Try to do this consistently throughout the document. The argument is that EIC early science will teach us something - show this!

Needs a stronger editorial hand - Sections 1/2/3 are fairly well written overall, but the latter sections show a varying quality of writing. Have a few people edit the document so that it some through in a clear, single voice through all sections.

Many of the figures show two different things in the LHS/RHS - avoid this! A given figures should all address the same physics or it will generate confusion among the reader.

Finally - do we need the appendices? I think the document would be more effective if it was just the main document and did not include the appendices but instead deferred them to the NIM special issue.

Inclusive Measurements:

Line 158 - this is 5x130, not 5x30, correct?

Figure 2 - complicated figure but does show the complementarity between ZEUS, H1 and EIC

Figure 4 - instead can you show a projection of how this would reduce the error on the polarized structure function? This would be much more powerful.

SIDIS:

Figure 6 - like this very much

Transition to gluon saturation - What will the impact study show? If it's not compelling, eliminate it.

Is it possible to get a projection of impact of A_UT on Sivers and Collins? This would be more compelling.

Exclusive and Diffractive Measurements:

DVCS - just begs for a discussion of prior measurements (and their limitations) at JLab

Figure 9 - must be replaced by an impact study, this is not really compelling

Diffractive DIS - avoid jargon like "Method L", - the extraction is good, is there a theoretical comparison for Figure 10 LHS?

Jets and HF:

Figure 11 LHS - can this be compared to what would be expected from EPPS21, for example? Or NNPDF?

Figure 11 RHS - Are there any theoretical predictions that can be put on this plot? By itself it is unconvincing.

Figure 12 - any theory or nPDF curves that can be put on this plot?

Spin Sensitivity - can we redo some of the impact contours from the yellow report?

Summary:

I like the approach here - head-on and directly address what Early EIC Science will address about the NIM Science Pillars

Wim Cosyn

Notes taken during read through

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general
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Overall structure is too much "thrown together". Needs stronger editorial hand I think. In main text main points/messaging/structure needs to be more clear/supported without resorting to buzzwords ("extraordinary discovery potential" etc.). Appendices read better (?).

Section 2 (p1-2) whole section can be structured much better, all seems a bit randomly organized
e.g., why start with treshol prod of quarkonia? (I guess mass etc., but do you really want to start like that?)

make figure style a bit more uniform?
e.g. section 4/5 DIS/SIDIS (labeling of 4 momenta)
then A.2 uses e,e' as electron 4momenta

why isn't eA inclusive data (Ru,Au,d,He) more stressed in sec. 4?
paragraph on p5 reads very vague..

p13 conclusion 3 pillars: 3rd pillar gluon saturation can be more highlighted in the text before (e.g. diffractive VM prod)
also what about inclusive diffraction in eA?? No real studies included?? thought this was a promising channel for sat and there will be plenty of data (with RP)?

p44 C3 too much repetition from main text or not? approach of diffractive appendix is in general way more elaborate than other appendices

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specific
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p4 l144 why write xF_3? [ok, clear for more detailed formula in appendix, but can we just write F_3 here or not?]

p5 l168 nuclear effects: a bit vague?

p7 l198 "This
variable typically ranges between 10−1 and 1."

what is meant with typically?? phys limits 0<z<1...
and then...?

p7 l200 "not so relevant for the SIDIS measurements"
OK, but target fragmentation contains a lot of interesting physics...

p7 l211 "in such cases the observables simultaneously depend on
nuclear PDFs and on the FFs in the medium"
I don't get the distinction between pA,AA / eA here? Both will have pdfs and ffs entering?

p13 l351 fragmentation vs recombination (explain?)

p25 l629 e+Au -> eA (since there will be several A)
p29 Fig A.11 why Q^2 values so close together?? Wide range will be possible...(I guess because Sat models?)
Refs for models?

p41 l871 not ion rest frame but 2N rest frame

p43/44 DVMP/DEMP difference? confusing.

p46 what is meant with physics variables here?

p51 are equation details needed here? (refer to papers)

p56 (23) -> are those 4 possible estimates for t? notation is confusing

p57 l1262 do configs not available in early running need to be included?

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typos, weird phrasings
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p2 l65 to access to gluon distributions
p2 l78 quark and gluons
p3 129 it's
p4 l138 Fig. 1)
p4 l152 demonstrateS
p5 l186 with thanks to
p7 fig5 caption at least ONE hadron
p7 l216 roughly averaged out??? what is meant by this
p8 l238 performent
p8 l241 whithing, reduce
p8 l244 theGeneric

p9 l254 si, whithing
p13 fig11 simulation campaign (left) simu campaign (right)
p18 l487 with at lower y
p28 l690 Table. 1 // will be ran
p34 l764 based [15]
p35 l779 reduce
p39 l817 18x
p41 l856 C.6 not mentioned (integrate in C.5?)
p42 l911 Eq. 1 nowhere to be seen? (at least not hyperlinked)
p45 l998 x \times
p45 l1009 OAM lowercase
p45 fig C1 green/black too hard to distinguish?
p47 table C.2 fix layout + I don't understand the columns (with caption)
p50 l1115 t_BABE?
p51 l1131 \text{spectator} in the math
p53 Fig C.7 labels too tiny
p56 l1217 Eqn. 22
p58 caption C.11 5x41 \times
p60 l1328 10x100
p67 Ref [95] last name missing?

Meeting Notes - 3/11/2026

Thomas - left with the feeling that if someone else were given the task they would do it differently. What to choose?

Build this off the Yellow Report and use the matrix to determine where the high impact measurements are, the prioritize these measurements

Taku - needs to look in detail, but from the perspective of what can be measured this report is useful. However, agrees that it would be important to discuss the impact potential. - Impact plots! Should focus impact plots on the NAS science pillars, or at least make a connection to them.

How we can connect to and improve our understanding is still missing!

Thomas - don’t have to make a science case, from all the science we can do what can we do in the first year!

Wim - Way too much thrown together. The discussion of the three pillars doesn’t match to the physics that can be done in the first few years.