IB Meeting

Monday, April 26 2021

Meeting Agenda

- ECCE Status: Member institutions and convener assignments.
- Follow-up on previous IB meeting:
  - ECCE Advantages
  - Decision making process
  - DEI and code of conduct
- General updates:
  - Communication with project and EICUG
  - IP8 optics

ECCE Consortium: Feb. 26

1. AANL*
2. AUGIE
3. BGU*
4. BNL
5. Charles U*
6. Columbia
7. CUA
8. FIU
9. Georgia State
10. Glasgow*
11. GWU
12. IJCLab-Orsay*
13. Iowa State
14. IPAS*
15. JLab
16. LANL
17. Lehigh University
18. LLNL
19. MIT
20. NCKU*
21. NCU*
22. NRNU MEPhI*
23. NTHU*
24. NTU*
25. ODU
26. Ohio U
27. ORNL
28. PNNL
29. Rice
30. Rutgers
31. Saha*
32. SBU
33. TAU
34. CU Boulder
35. UConn
36. UIUC
37. UKY
38. UNH
39. UTSM*
40. UVA
41. Vanderbilt
42. Virginia Tech
43. Virginia Union
44. Wayne State
45. Weizmann*
46. Zagreb University*

*Non-US institutions (33%)

ECCE Consortium: April 26

Up by 40%!

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11. Duke
12. FIU
13. Georgia State
14. Glasgow*
15. GSI*
16. GWU
17. HUJI*
18. IJCLab-Orsay*
19. IMP*
20. Iowa State
21. IPAS*
22. JLab
23. LANL
24. LBNL/Berkeley
25. Lehigh University
26. LLNL
27. Morehead State
28. MIT
29. MSU
30. NCKU*
31. NCU*
32. NMSU
33. NRNU MEPhI*
34. NTHU*
35. NTU*
36. ODU
37. Ohio U
38. ORNL
39. PNNL
40. Rice
41. RIKEN*
42. Rutgers
43. Saha*
44. SBU
45. SCNU*
46. TAU*
47. Tsukuba U.*
48. CU Boulder
49. UConn
50. UH
51. UIUC
52. UKY
53. UNH
54. USTC*
55. UTK
56. UTSM*
57. UVA
58. Vanderbilt
59. Virginia Tech
60. Virginia Union
61. Wayne State
62. WI*
63. York*
64. Zagreb U.*

*Non-US institutions (40%)

ECCE Consortium: April 26

EIC Project POC
Rolf Ent (JLab)

ECCE Steering Committee
Or Hen (MIT)
Tanja Horn (CUA)
John Lajoie (ISU)

Institutional Board

Computing Team
Cristiano Fanelli (MIT)
TBA

Diversity, Equity and Inclusion
Narbe Kalantarians (VUU)
Simonetta Liuti (UVA)
Elena Long (UNH)
Christine Nattrass (UTK)

Computing Working Groups:

- Artificial Intelligence
- Computing and Software
  Joe Osborn (ORNL)

Detector Team
Doug Higinbotham (JLab)
Ken Read (ORNL)

Physics Benchmarks Team
Carlos Camacho (IJCLab-Orsay)
Rosi Reed (Lehigh U.)

Editorial Team
Tom Cormier (ORNL)
Richard Milner (MIT)
Peter Steinberg (BNL)

Detector Working Groups:

- IP8/Equipment Re-use
  John Haggerty (BNL)
- Far Forward/Far Backward*
  Michael Murray (KU)
- Tracking
  Xuan Li (LANL)
- Calorimetry
  Friederike Bock (ORNL), Yongsun Kim (Sejong U.)
- Particle ID
  Greg Kalicy (CUA)
- Magnetic Field
  Paul Brindza (JLab)
- DAQ/Electronics/Readout
  Chris Cuevas (JLab)

***Alex Jentsch, Yulia Furletova**
(far-forward/backward POC)

Physics Working Groups:

- Simulations
  Cameron Dean (LANL), Jin Huang (BNL)
- Inclusive Processes
- Semi-Inclusive
  Ralf Seidl (RIKEN), Charlotte Van Hulse (Orsay)
- Exclusive
  Rachel Montgomery (Glasgow), Julie Roche (OU)
- Diffractive and Tagging
  Wenliang Li (W&M), Axel Schmidt (GWU)
- Jets and Heavy Flavor
  Cheuk-Ping Wong (LANL)
- BSM and Precision Electroweak
  Sonny Mantry (UNG), Xiaochao Zheng (UVa)

Editorial Working Groups:

- Proposal Editing, Verification and Version Control
- Costing and Management

ECCE Consortium: April 26

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From Previous IB Meeting

W.A. Zajc to Everyone 10:56 AM

I too have to leave this very interesting discussion. It's pretty clear the people very much want to understand both the strategy (What strengths make ECCE the "obvious" choice?) and the process (precisely who will make decisions?)

Rosi Reed to Everyone 10:53 AM

I will have to leave - but I do think a lightweight bylaws could be useful - hard to have a code-of-conduct without some "rules" but I don't think a 10 page document such as other experiments have is necessary at this point.

ECCE 101

- ECCE consortium comprises 64 institutions assembled around the idea of developing an EIC detector envisioned to offer full energy coverage and an optimized far forward detection region.
- ECCE is investigating a detector based on an existing 1.5T solenoid in both EIC interaction regions, ready for the beginning of EIC accelerator operation.
- ECCE consortium will respond to the EIC call for detector proposals with a plan to address the full range of EIC physics outlined in the NAS study and the Yellow Report, as the EIC project detector (“Detector 1”).
- ECCE shares the vision of the Nuclear Physics community that the EIC science mission is best served by two detectors.
- ECCE is open to all to participate - freedom of choice to also work on other proposals

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- **Low risk** due to re-use of existing magnet and various detectors.
- **Inexpensive** due to magnet and detector reuse (we hope)
- **Flexible and optimized** by studying both IRs
- **Most realistic detector to be ready by CD4a.**

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Decision Makin Process

Three key decision-making points:

- What technologies do we wish to simulate
- Which physics channels do we wish to study
- What technologies go into the proposal (based on simulations results)

*DWG & PWG will address this in more detail

Detector Tech Decision Makin Process

Detectors: based on a matrix of:

- IB interests,
- Cost,
- Risk,
- Performance.

Main discussions will take place in DWG meetings – **join to impact**!

We think most major decisions will arrive at consensus based on DWG/PWG studies. If there is a case that doesn't, and the decision is fundamental to the direction ECCE takes, the Steering Committee will put the question to the IB for a binding vote.

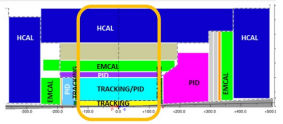
But… Not starting from scratch

Using lots of knowledge accumulated during the YR process

Have some sense of IB preferences from EOI process and discussions with groups when joining ECCE

See current thinking in previous IB meeting opening talk: (https://indico.bnl.gov/event/11120/)

ECCE Detector – central barrel



FOR CENTRAL BARREL NEED:
- **Tracking** resolution pT
- **Tracking** resolution vertex
- **Electron PID** (e/h separation)
- **Hadron PID**
- Solenoid (**reuse**) **bore diameter fixed**: 2.8 m – constraint for detector technology selection

ECCE CENTRAL BARREL STRAWMAN

Tracking: Silicon barrel tracker
- Compact
- Allows to focus on projectivity – no impact of nonuniformity of magnetic field in central region

Electron PID: SciGlass (backup: W/Sc (Pb/Sc) shashlik)
- SciGlass remains to be demonstrated
- Several backup options – lower resolution though

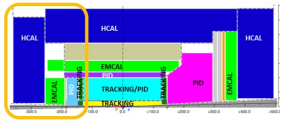
h-PID: hpDIRC & AC-LGAD
- Compact
- AC-LGAD never been shown for barrel configuration
- AC-LGAD backup: dE/dx (needs more space)

HCAL: magnet steel (**reuse**) - **Fe/Sc**

Space budget:

Function	Maximum [cm]
Tracking (incl. 5 cm support)	50
Hadron particle identification	10
Low energy particle identification	15
EM Calorimetry	50
PID & EMCal support structure	15
Total	**140**

ECCE Detector – electron endcap



FOR ELECTRON ENDCAP NEED:
- **Tracking** resolution
- **Electron Detection with high precision**
- **Hadron PID**

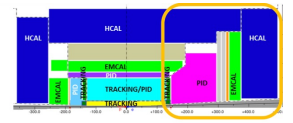
ECCE ELECTRON ENDCAP STRAWMAN

Tracking: MAPS, Micro Pattern Gaseous Detectors (MPGD)
Electron Detection: PWO&SciGlass
- Inner part: PWO crystals (reuse some)
- Outer part: SciGlass (backup PbGl)

h-PID: mRICH
- From yellow report

HCAL: Steel from magnet or Pb/Sc or Fe/Sc
- Not instrumented and only serve as flux return?
- Instrumented with reduced thickness – lower particle energies

ECCE Detector – hadron endcap



FOR HADRON ENDCAP NEED:
- **Tracking forward resolution**
- **h-PID**
- **Reasonable electron PID**
- **Good hadron calorimetry and desire for high resolution calorimetry**

ECCE HADRON ENDCAP STRAWMAN

Tracking: MAPS, Micro Pattern Gaseous Detectors (MPGD)
h-PID: dRICH&TOF
e/h separation: TOF & aerogel
- TRD to separate electrons from high momentum hadrons?

Electron PID: W/ScFi, Pb/Sc or W/Sc shashlik
HCAL: Pb/Sc or Fe/Sc
- Alternative for improved resolution: dual readout, high-granularity

Physics Decision Makin Process

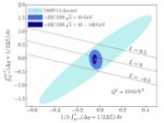
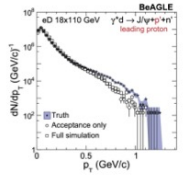
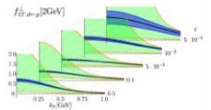
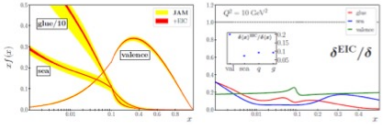
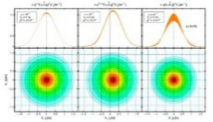
A lot is already decided for us by the need to demonstrate EIC NAS Study and EIC white Paper

Still can choose between several observables.

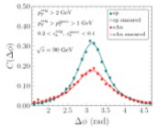
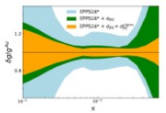
+ we want to do several ‘ECCE Strength’ studies.

→ Join PWG meetings and workshop!

Physics Studies Focus: a first look

Plots to demonstrate EIC NAS Study, White Paper	Plots to show unique ECCE strengths
• Origin of Nucleon Spin 	• Light-ion tagging 
• Confined motion of partons 	• Pion/Kaon structure 
• 3D imaging quarks and gluons 	• Diffractive jets?

• Nucleon mass	• nuclear modifications and in-medium evolution
	  • D/D* reconstruction and heavy-flavor in jets.
	  • showcasing ECCE lower pT-cutoff due to the 1.5T field

• High gluon densities in nuclei 	
• Quarks and gluons in the nucleus 	

Bylaws and code of conduct

- DEI committee working hard on our code of conduct.
- Taking examples from existing consortia
- Code of conduct will be discussed with the IB which will also ecide on the need for bylaws.
- Takes time to do this right.

Communication with Project and EICUG

- We, like others, are disappointed that EIC@IP6 added an exclusivity claw to their convener invitations, preventing them from collaborating with other efforts. We think its counter productive to our goals as a community and expressed this view to the project, EIC@IP6, and EICUG steering committee leadership.

- A meeting will be held on May 6 in which the project, EICUG steering committee leadership and ECCE, CORE and EIC@IP6 leaderships will discuss costing templates and proposals review process. We will update the IB with what we learn.

IP8 status

2nd IR - FAQ

4) **Will there be any support from the Project to optimize the interaction region design?** The design for Detector 1 should be compatible with that of the accelerator and interaction region layout of the CDR. Some interaction region optimization may be implemented during the year and, if approved, will be passed on to the EICUG. The design for Detector 2 should be based on the interaction region conceptual layout shown at https://indico.bnl.gov/event/10677/timetable/#9-ir2-development-status, with perhaps some interaction region optimization. Support for the latter should be requested through the Project Executive Management Team.

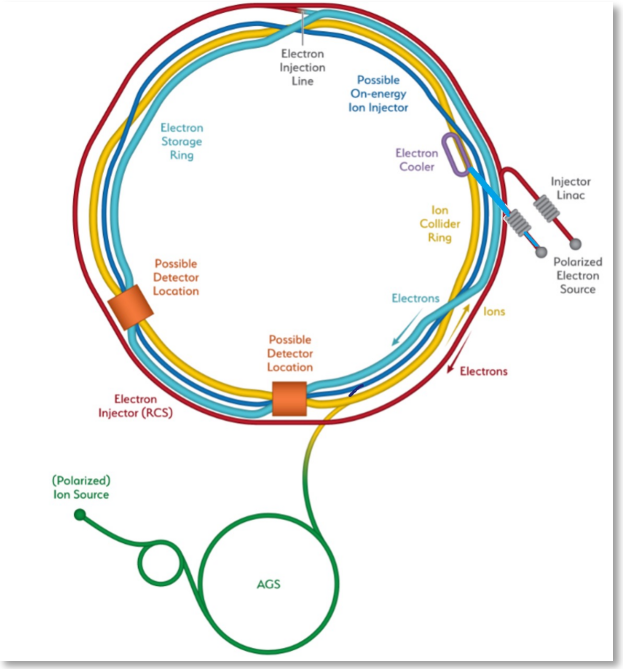
> "Detector 1 … Some interaction region optimization may be implemented during the year and, if approved, will be passed on to the EICUG."

The Project is trying to fold in the option to rewire for lower proton energies the final focus lens into triplet focusing. This is applicable at **both IP6 and IP8** and could increase the luminosity @E_{cm} ~ 40 – 60 GeV by a factor of almost 2 (work in progress!)

> "Detector 2 … with perhaps some interaction region optimization. "

See next slides

2nd IR Position Paper



https://indico.bnl.gov/event/10677/sessions/4108/attachments/33241/53351/IP-for-2ndIR.v3_post.pptx

IP6 - planned EIC project detector location

- hadrons "going from inner to outer arc"

IP8 - viable location for complementary detector/IR

- hadrons "going from outer to inner arc"

→ IR designs NOT interchangeable with each other

→ EIC Project position paper for 2nd IR to define commitment of layout and compatibility verification, and trigger point for further work. Scope agreed upon.

From Position paper: "It is important to realize that the IR designs are not interchangeable with each other, with the hadrons going from inner arc to outer arc in IR6 and in opposite direction in IR8. The physical layout of the IR halls (IR6 and IR8) and adjacent tunnel sections differ significantly such that the IR designs are not interchangeable. Two different dedicated designs are required that can directly lead to complementarity in science reach. **The path length for the hadron and electrons in the IR varies between different IR designs. The overall path length difference in electron and hadron collider rings is a design constraint with little margin for modification once the lattice design, the placement of the hardware components in the tunnel, is frozen. From this it follows that the path length and therefore the conceptual lattice design of the second IR must be part of the integrated EIC design from the beginning. Otherwise, we risk excluding specific designs** required for maximal science reach. Lastly, a 2nd IR will add a second beam collision per turn once operational, and viability of stable beams with a potential 2nd detector and IR deliverable must be ensured."

2nd IR Progress and Status

- Position paper for 2nd IR to define commitment of layout and compatibility verification, and trigger point for further work. Scope agreed upon.
- Basic concept of a 2nd IR option fulfilling many RHIC boundary conditions (crossing angle can not be too large, < 50 mr, and not too small, > 25 mr) was presented by Vasiliy Morozov at 2nd IR meeting.
    - In this lattice more space was required for positioning crab cavities, etc.
- Have now integrated this 2nd IR design into the overall EIC layout, with as goal to minimize need for new RHIC magnets far away from the IP (J. Scott Berg) – this also constrains crab cavities to “existing” locations.
- Laid out two configurations
    - 35 mrad, beam lines converging on forward hadron side
    - 25 mrad, beam lines diverging on forward hadron side (i.e., extra beam kink)
- Ongoing work:
    - Fold in secondary focus – think this is doable within available lattice space.
    - First acceptance tests show a “cut”, and that some optimization of magnets and optics is still required to obtain good acceptance (this has to do with that for IR-8 the Zero-Degree Calorimeter is “on the other side” of the beam).
- **We plan to pass things on to EICUG next month (May) for further discussion and physics simulations - we first need to ensure we have a quasi-stable optics layout and give the right acceptance.**

We’re Making Great Progress!
[tune in to Teams talks for details]