IB MEETING 24 MAY 2021

Or Hen, Tanja Horn, John Lajoie

Credit to the entire ECCE Team, EIC Project, and all collaborators

ECCE Highlights – last few months

Much activity – moving at a rapid pace to meet the global timeframe

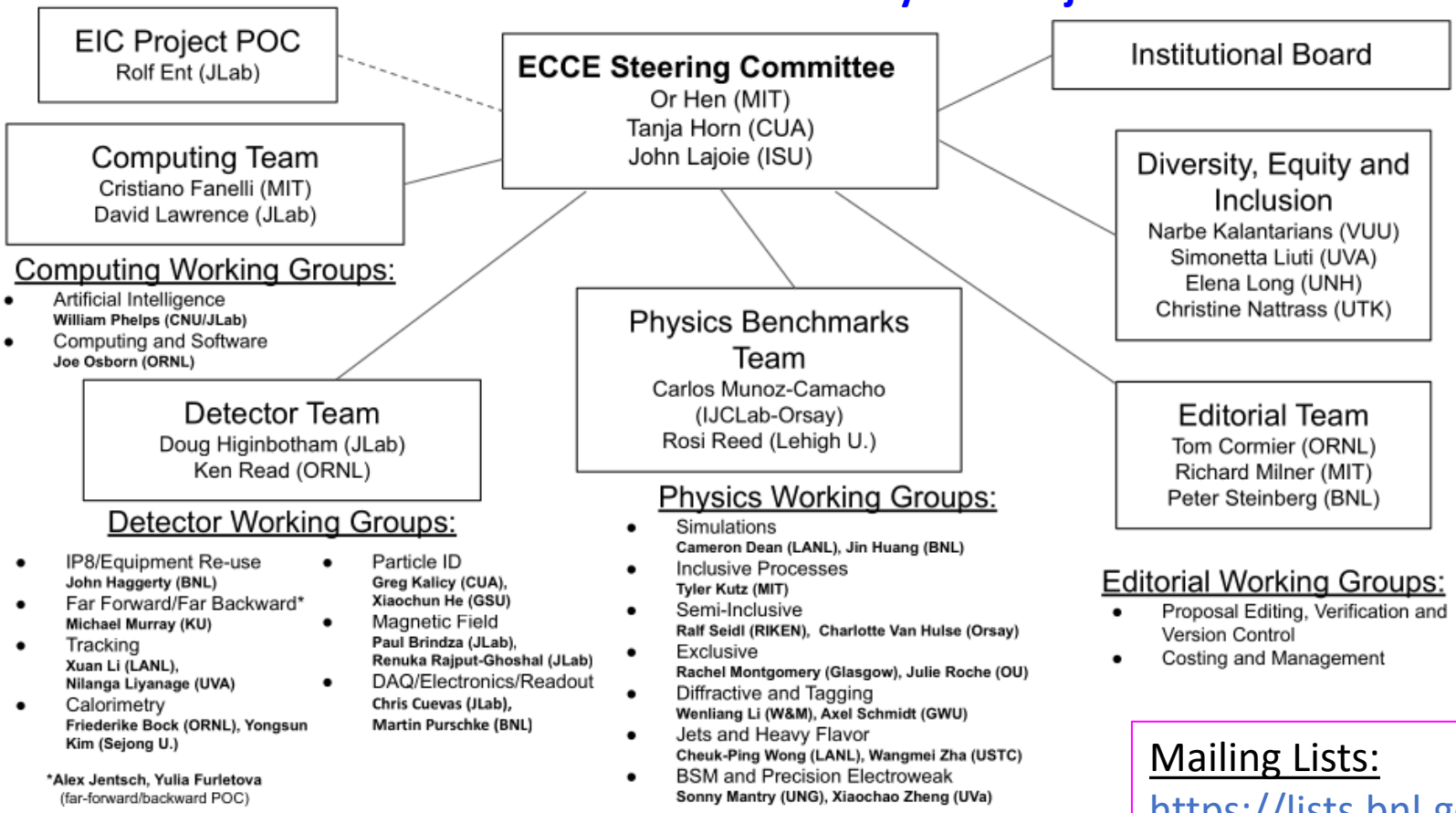
- ✓ 26 February: first IB meeting
- ✓ 5 March: IB approves the Consortium Structure
- March 2021
  - ✓ Team Conveners were selected
  - ✓ Additional institutions joined the effort – now at 76 institutions
  - ✓ Team Conveners added WG co-conveners
  - ✓ Mailing lists were set up
  - ✓ Indico pages were set up
- ✓ 2 April: 1st Simulations Workshop was held
- ✓ 9 April: Start of PWG/DWG meetings and simulation efforts
- April 1st - ~May 20th: Start up activities
  - ✓ Finish implementing initial ECCE setup in Fun4All.
  - ✓ Identify technology alternatives to study with Fun4All.
  - ✓ Identify key physics processes to address physics of NAS/YR
  - ✓ Collected required event generators
  - ✓ Wiki was setup to collect information

ECCE Consortium

1. AANL/Armenia
2. AUGIE
3. BGU/Israel
4. BNL
5. Brunel University/UK
6. CCNU/China
7. Charles U./Prague
8. CIAE/China
9. CNU
10. Columbia
11. CUA
12. Czech. Tech. Univ./CZ
13. Duquesne U.
14. Duke
15. FIU
16. Georgia State
17. Glasgow/Scotland
18. GSI/Germany
19. GWU
20. Hampton
21. HUJI/Israel
22. IJCLab-Orsay/France
23. IMP/China
24. Iowa State
25. IPAS/Taiwan
26. JLab
27. Kyungpook Natl. U./K.
28. LANL
29. LBNL/Berkeley
30. Lehigh University
31. LLNL
32. Morehead State
33. MIT
34. MSU
35. NCKU/Taiwan
36. NCU/Taiwan
37. NMSU
38. NRNU MEPhI/Russia
39. NTHU/Taiwan
40. NTU/Taiwan
41. ODU
42. Ohio U
43. ORNL
44. PNNL
45. Pusan Natl. Univ./Kor.
46. Rice
47. RIKEN/Japan
48. Rutgers
49. Saha/India
50. SBU
51. SCNU/China
52. Sejong U./Korea
53. TAU/Israel
54. Tsinghua U./China
55. Tsukuba U./Japan
56. CU Boulder
57. UConn
58. UH
59. UIUC
60. UKY
61. U. Ljubljana/Slovenia
62. UNH
63. USTC/China
64. UT Austin
65. UTK
66. UTSM/Chile
67. UVA
68. Vanderbilt
69. Virginia Tech
70. Virginia Union
71. Wayne State
72. WI/Israel
73. WM
74. Yonsei Univ./Korea
75. York/UK
76. Zagreb U./Croatia

ECCE Consortium Structure

Tyler Kutz joined as Inclusive WG convener



Website:
https://www.ecce-eic.org/
Indico:
https://indico.bnl.gov/category/339/
Wiki:
https://wiki.bnl.gov/eicug/index.php/ECCE

Mailing Lists:
https://lists.bnl.gov
- ecce-eic-public-l
- ecce-eic-ib-l
- ecce-eic-dei-l
- ecce-eic-det-l
- ecce-eic-phys-l
- ecce-eic-prop-l

Global strategy for the DWGs and CWG/AI

1. **Introduce the ECCE General Detector Concept**
   - Central barrel, backward endcap, forward endcap, far forward region and far backward region

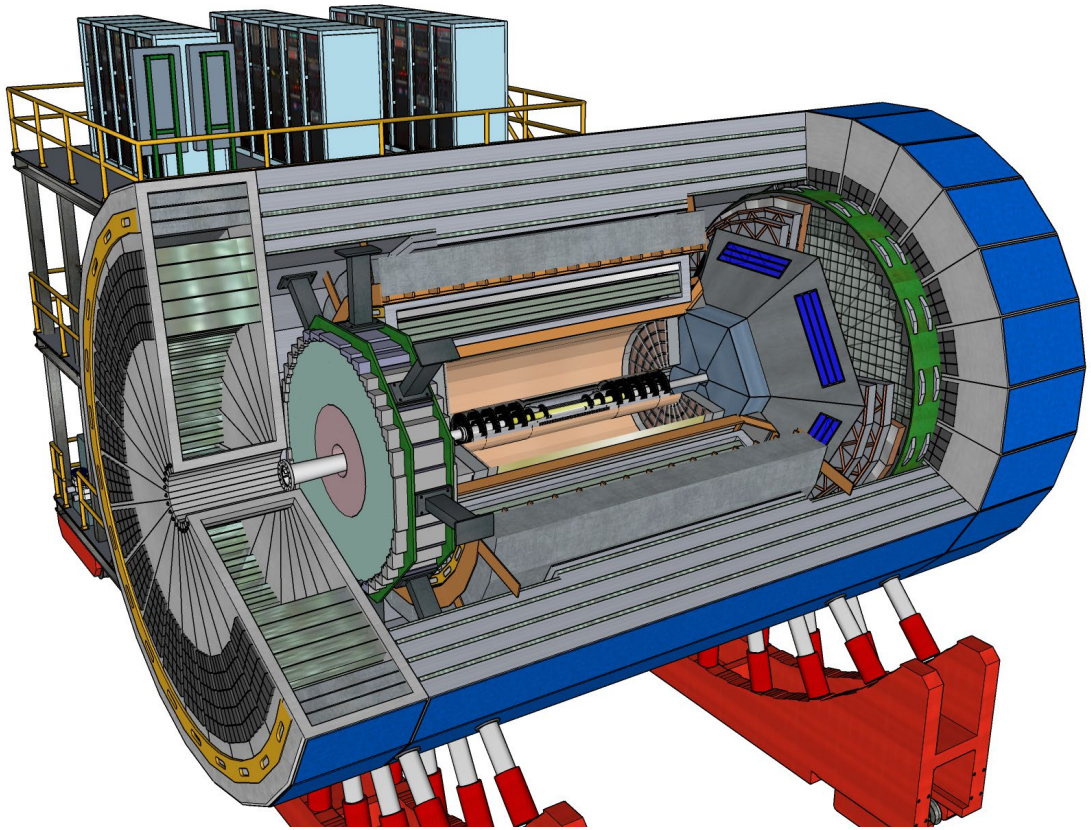
2. **Identify spectrum of technologies for each subsystem**
   - Starting point: Yellow Report

3. **Optimize technology choices together with physics performance**
   - Formulate a dynamic timeline for decision making for the global simulation
   - Start with the design of the inner layers, e.g., fix tracking and PID and then work outwards (radially and in polar angle), e.g., for PID it is important to have knowledge of the magnetic field and the tracking resolution and also minimizing material

4. **Upgrade path items**
   - For example, hadron endcap high-resolution HCAL insert

ECCE General Detector Concept

The ECCE detector concept is undergoing rapid development



ECCE ELECTRON ENDCAP STRAWMAN

Tracking: MAPS, Micro Pattern Gaseous Detectors (MPGD)
Electron Detection: PWO&SciGlass or PWO only
- Inner part: PWO crystals (reuse some)
- Outer part (if needed): 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 \w reduced thickness (lower energies)

ECCE CENTRAL BARREL STRAWMAN

Tracking: Silicon barrel tracker (optional Si/GEM hybrid)
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**

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

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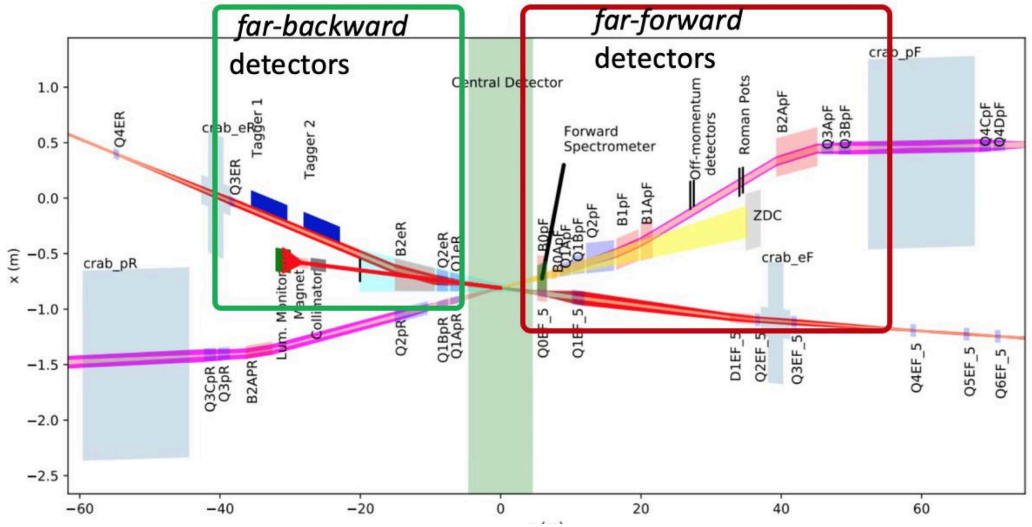

Detector Technologies (from YR)

FAR BACKWARD DETECTORS

- low-Q2 tagger
- Lumi-detector

Lepton polarimetry
hadron polarimetry

FAR FORWARD DETECTORS

- ZDC – **Si/W & PWO (SciGlass)**
- Roman Pots – **Silicon sensors, AC-LGADs**
- Off-momentum det. – **Silicon sensors**
- B0-trackers – **MAPS & timing layers**

Lepton polarimetry
hadron polarimetry

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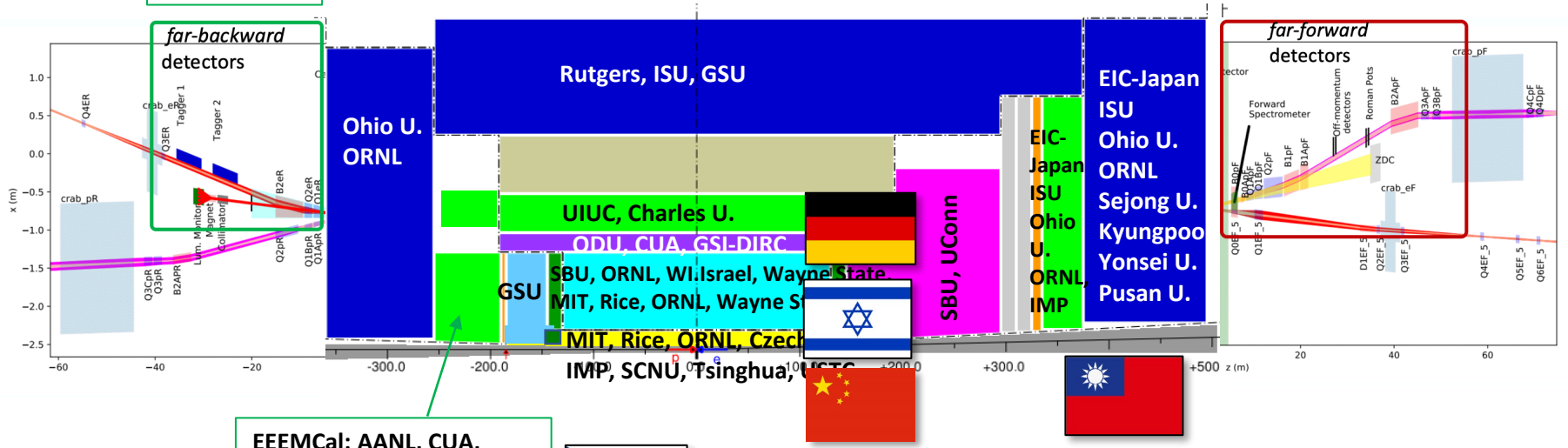
ECCE Consortium and Technology Interest



Glasgow U., ODU

BGU/Israel, MIT, ORNL, UIUC, IJCLab-Orsay, EIC-Japan, TAU/Israel, UVA, GWU, MIT-BATES, HUIJ/Israel

EEEMCal: AANL, CUA, Charles U., FIU, IJCLab, MIT, Lehigh U., UKY, JMU

Polarized Beam and polarimetry: MIT, UNH, SBU

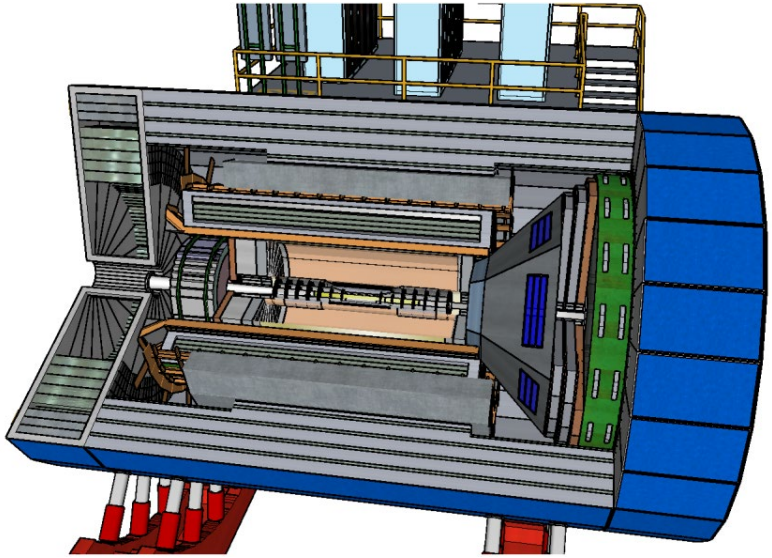
Electronics: Columbia, ORNL

DAQ/Trigger: ISU, CU Boulder, OU, ORNL, SBU, UConn, LLNL

Artificial Intelligence: MIT, CNU, Brunel U.

Major items for the ECCE Detector Concept

- **Optimization EEEMCal and DIRC**
  - DIRC prism on electron side has advantages for EMCal, DIRC and dRICH
- **Barrel detector configuration**
  - Global optimization to address physics requirement on both e/π and π/K/p; Tracking: best use of space for all Si option
- **Hadron endcap HCAL**
  - Alternative for improved resolution

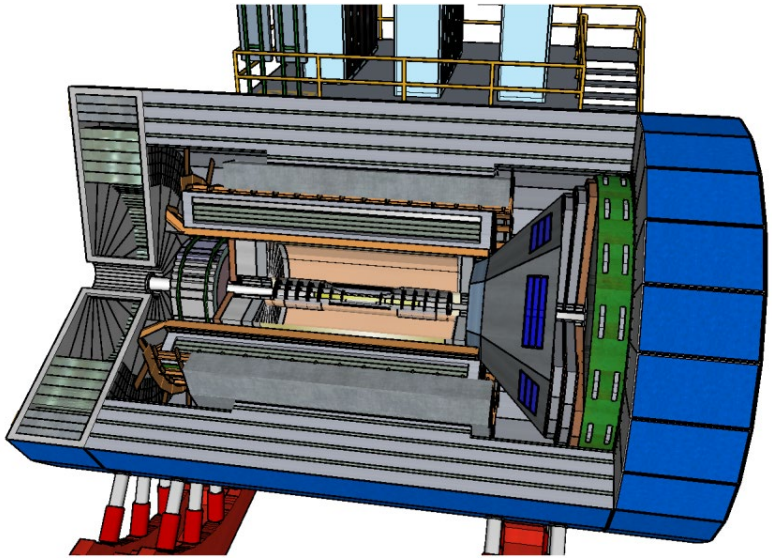


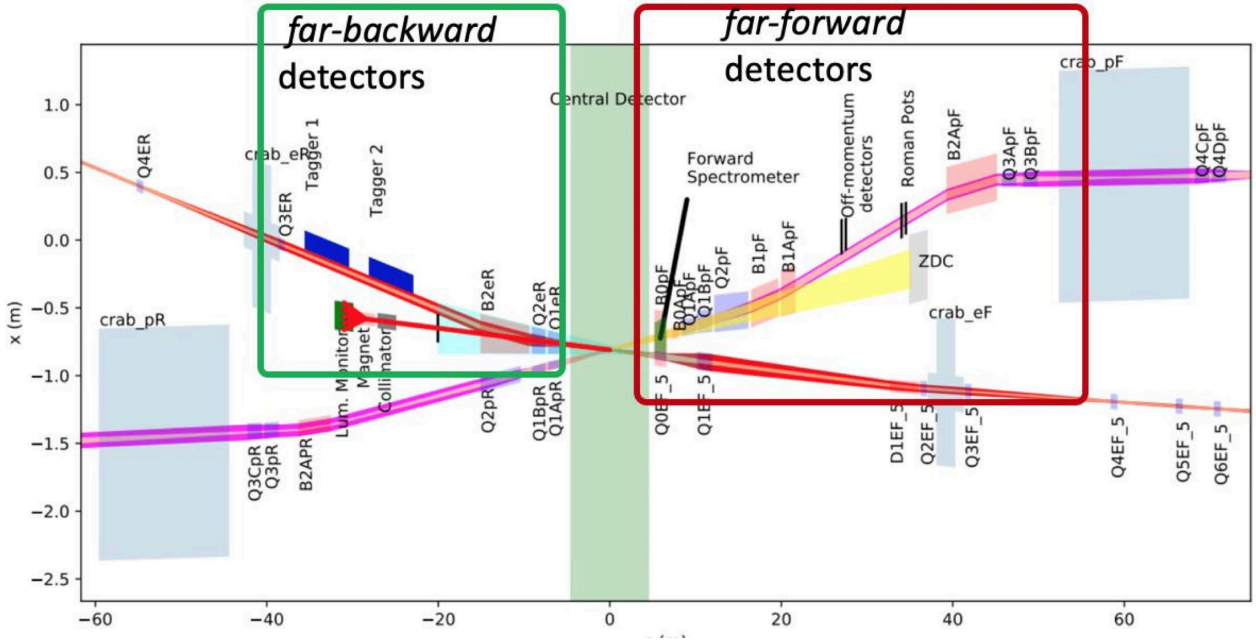
Potential barrel option that may fulfil requirements and has some flexibility

System	Function	Thickness	Inner Radius	Outer Radius
All Silicon	Vertex/Tracking	47		51
AC-LGAD	Tracking/timing	8	51	59
Inner support for DIRC, EEEMCal		10	59	69
DIRC	PID	3.5	69	72.7
Outer support DIRC, EEEMCal		3.5	72.5	76
TOF/AC-LGAD	Timing/tracking	8	76	84
Barrel EMCal	EMCal, e/π separation	50	84	134
Support for barrel EMCal		6	134	140

Major items for the ECCE Detector Concept

- **Far Forward Region**
  - IP6: ready for detailed studies
  - IP8: anticipate studies to start in June
    - Likely up to 35 mr crossing angle and secondary focus.
- **Far Backward Region**
  - ready for detailed studies



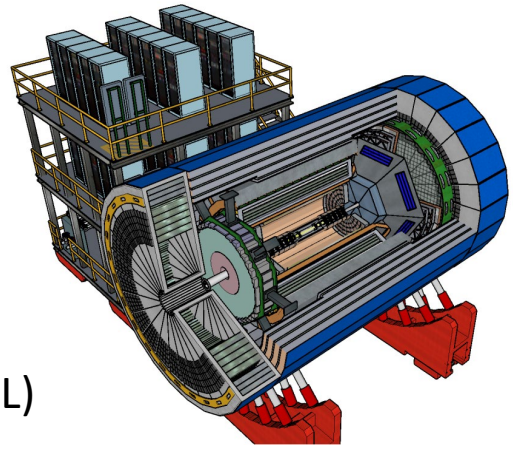


ECCE Detector Team – Detailed studies ongoing

Team Leaders: Ken Read and Doug Higinbotham

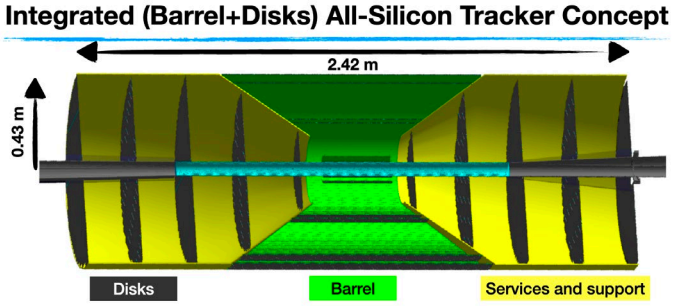
Topic and Conveners

Magnetic Field: Paul Brindza (JLab) & Renuka Rajput-Ghoshal (JLab)
Tracking: Xuan Li (LANL) & Nilanga Liyanage (UVA)
Particle ID: Greg Kalicy (CUA) & Xiaochun He (GSU)
Calorimetry: Friederike Bock (ORNL) & Yongsun Kim (Sejong U.)
DAQ/Electronics/Readout: Chris Cuevas (JLab) & Martin Purschke (BNL)
Far Forward/Far Backward: Michael Murray (KU)
IP8/Equipment Re-use: John Haggerty (BNL)



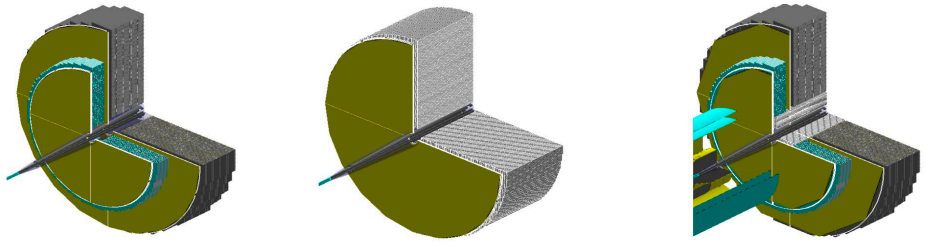
Sketchup of ECCE

Calendar of meetings can be found at: https://indico.bnl.gov/category/345/



Presented at May 11th ECCE Tracking Meeting

Detailed review of Calorimetry options (far forward shown)



Presented at May 4th Calorimetry meeting

Please get involved by joining the mailing list: ecce-eic-det-l (and other ecce lists) by going to: https://lists.bnl.gov/mailman/listinfo and subscribing.

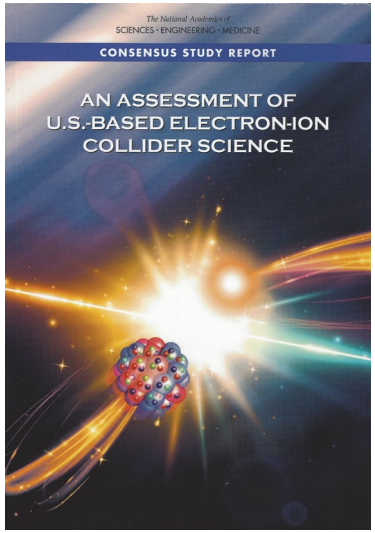
ECCE Computing Highlights

C. Fanelli, D. Lawrence

- The ECCE computing team (conveners: C. Fanelli, D. Lawrence) is structured in two working groups:
  - **Computing and Simulations WG** (***convener: J. Osborn***) contributes to identify, estimate and manage computing resources as well as developing tools for simulations
  - **Artificial Intelligence WG** (***convener W. Phelps***) integrates new cutting-edge algorithms that contribute to the optimal design of ECCE sub-detectors system

- Discussion / activities underway:
  - ECCE computing usage request (BNL/JLab)
  - System for job submission, OSG + S3 storage, Data cataloging, communication channels
  - Identification/allocation of compute resources
  - Strategy for AI optimization of (sub-)detectors
- Document present and future computing needs in the proposal
  - Simulations and AI, Data acquisition, Monitoring, Reconstruction, Processing
  - Work with DAQ WG (see, e.g., Streaming Readout) and detector WGs for data rates
- Biweekly SDCC ECCE meetings, https://indico.bnl.gov/category/339/calendar

ECCE Physics



- **NAS:** An EIC can uniquely address three profound questions about nucleons — neutrons and protons — and how they are assembled to form the nuclei of atoms:
  - How does the **mass** of the nucleon arise?
  - How does the **spin** of the nucleon arise?
  - What are the **emergent properties** of dense systems of gluons?

Detector 1 Collaboration Proposals: Experiments must address the EIC White Paper and NAS Report science case. The collaboration should propose a system that meets the performance requirements described in the EIC CDR and EICUG YR. The design should be compatible with that of the accelerator and interaction region layout of the CDR. Completion of detector construction must be achieved by Critical Decision (CD)-4A, the start of EIC accelerator operations.

The Proposals should include two parts:

1. A description of the science addressed and performance estimated through simulation including, but not limited to, e/γ, jets, π/K/p separation, vertex, and tracking, and how the simulated performance compares to the requirements detailed in the YR. The realization of the conceptual detector design given the technology choices, the R&D needs, risks, and, if applicable, adoption of emerging new technologies.
2. A collaboration roster and structure, timescale and cost (including potential sources of funding sources and assumptions), and potential upgrade paths.

Global strategy for PWGs

- **Need to include ~10 key physics performance plots that illustrate the strengths of ECCE** (a few may be double panels)
- **Mandatory for detector 1: The proposal will illustrate ECCE ability to address the EIC physics as shown in the NAS/WP**
  - Some of the key performance plots must reflect "known" NAS/WP figures that should be adapted to ECCE specifics
- **The proposal will also illustrate physics performance that illustrate the strengths of ECCE**
  - Some of the key performance plots from YR should add to the NAS/WP.
  - A description of the science addressed, and performance estimated through simulations including, but not limited to: e/gamma, jets, pi/K/p separation, vertex and tracking, etc., and how the performance compares to the YR.
  - Some of the key performance plots should illustrate IR-6 vs. IR-8 performance.
- **The proposal will illustrate what Early Science can be done**
  - Ensure (some of the) key performance plots selected to show NAS/WP science performance also demonstrate early science.
  - Assume for first year beyond CD-4 energies of E_p=~250 GeV, E_e=~10 GeV, and ~5 fb^{-1} polarized e-p (g1 at low-x) and ~2.5 fb^{-1} e-(heavy)A (% diffraction)
  - General starting point for ions to be studied: d/^{3}He/^{4}He-e, C/^{40}Ca/Cu/Au-e

Physics Studies

- The proposal will present studies based on physics topics
  - Origin of Hadron Mass
  - Spin: Spin&Flavor, Imaging
  - Nuclei: emergent properties, saturation, hadronization

- Balance of ~10 Key Performance Plots very important as must illustrate ECCE can do the NAS/WP Science, has promise to do more YR science, can deliver early science, and balance performance at IR-6 vs IR-8.

- Introduce the concept of “godparent” – people who check that there is good overall representation of physics plots and nothing is missing

ECCE Physics Benchmark Team - Highlights

C. Munoz-Camacho, R. Reed

Working Groups:

Inclusive Reactions
Electroweak and BSM
Semi-inclusive Reactions
Jets and Heavy Flavor
Exclusive Reactions
Diffractive & Tagging
Simulations

Full detector simulations ongoing already:

- 1st/2nd test productions completed !
  - ✓ 3 sets of 1,000,000 events for testing purposes:
- 1st Simulation Workshop: April 2
- 2nd Simulation Workshop: May 21
- **June 15:** 1st large simulation production (with few selected detector configurations)

Open Tasks

Contents [hide]

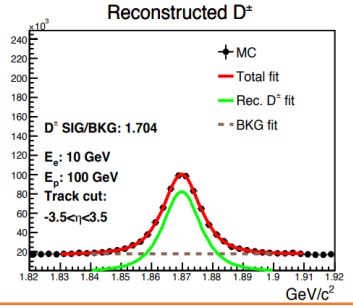
BSM and Precision Electroweak

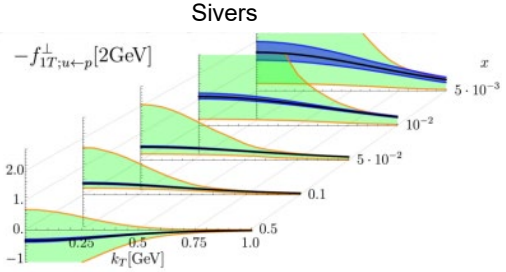
Conveners: Sonny Mantry (UNG), Xiaochao Zheng (UVa, xiaochao@jlab.org)

- Task 1: Parity-violation physics (*ongoing*)
  - Apv(e) and extraction of weak mixing angle and F_1,3^gZ
  - Apv(p) and extraction of structure functions g_1,5^gZ
  - (open): simulation for pion background
- Task 2: Charged lepton flavor violation (*ongoing*); Ref: Yellow Report v1.1 page 219-220;
- Task 3 (open): Sensitivity study of Ae+e- and possible extraction of AA coupling and F_3^gZ;

More at:
https://wiki.bnl.gov/eicug/index.php/Open_Tasks

- Weekly meetings ongoing in all working groups: (indico calendar)
- Identified key processes to address physics of the WP and NAS report
- Sample plots for proposal under discussion





Lots of exciting opportunities for new collaborators!

ECCE DEI Overview

N. Kalantarians, S. Liuti,
E. Long, C. Nattrass

- Taking DE&I seriously – build it in from the beginning
- Struggling a bit with the “proto” part of “proto-collaboration”
  - Issues integrating DE&I into convenor appointments
  - Hard to make some types of rules
- DE&I Team working on code of conduct
  - Using examples of best practices from other experiments, fields
  - Will be presented to IB for discussion, approval
- Based on conduct we plan on developing guidelines for ECCE meetings
  - Try to head off problems before they occur

ECCE Editorial Team Overview

T. Cormier, R. Milner,
P. Steinberg

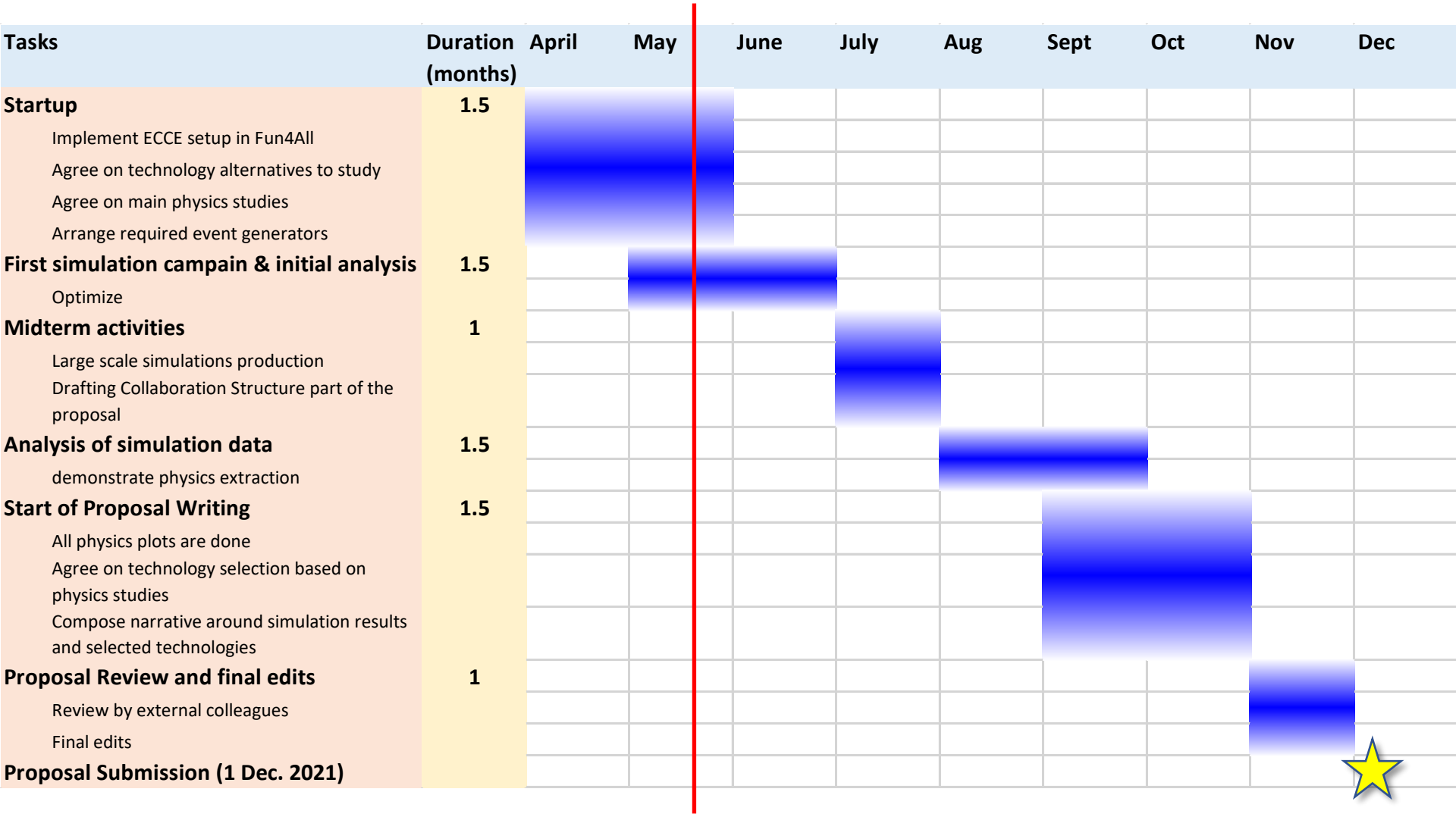
- ECCE is working together to produce a proposal that will succinctly identify the distinct strengths of the ECCE detector and how those will address the compelling science goals of the EIC.
- ECCE expects to produce a substantial amount of supplementary material that will be published in addition to 60 page proposal
- ECCE has an experienced project team from ORNL working on cost, schedule and risk (CSR) issues

ECCE Anticipated Future Highlights

- May 20th - July 1st [~1.5 months]:
  - First simulation campaign with a few detector configurations & initial analysis.
  - Debug the many things that won't go right the first time :)
- July 1st - Aug. 1st [1 month]:
  - Large scale simulations production
  - Drafting 'collaboration structure' part of the proposal by writing team.
- Aug. 1st - Sep. 15th [1.5 months]:
  - Analysis of simulation data to demonstrate physics extraction.
  - Presentation at August 2-6 EIC UG meeting
- Sep. 15th - Nov. 1st [1.5 months]:
  - All physics 'plots' are done.
  - Final evaluation of technology selection based on physics studies results.
  - Compose narrative around simulation results and selected technologies.
- Nov. 1st - Nov. 30th [1 month]:
  - Proposal review by external colleagues.
  - Final edits

ECCE Timeline

Today, 24 May



ECCE IB Meetings Schedule

- Will take every two weeks – the next four meetings are:
  - Monday June 7
  - Monday June 21
  - Monday July 5
  - Monday June 19

- Suggested meeting times – rotating to accommodate time zones

Date	EDT	UK	Europe	Japan
May 24	8am	1pm	2pm	9pm
June 7	4pm	9pm	10pm	5am
June 21	5am	10am	11am	6pm
July 5	8am	1pm	2pm	9pm
July 19	4pm	9pm	10pm	5am
…				

ECCE 24 May Meeting Agenda

- ❑ Updates since last IB meeting
- ❑ The Teams will present their updates
- ❑ Next steps: important discussion about the timeline and open tasks and opportunities

5th ECCE Institutional Board Meeting

Monday 24 May 2021, 08:00 → 13:20 US/Eastern

Description Connection Information:

08:00 → 08:30 **ECCE News and Status**
Speaker: Tanja Horn (Cath)

08:30 → 08:45 **Discussion**

08:45 → 09:15 **Detector Team**

- 08:45 **Detector Team Report**
  Speakers: Douglas Higinbotham (Jefferson Lab) , Kenneth Read (Oak Ridge National Laboratory)
- 08:55 **PID Detector Working Group update**
  Speakers: Grzegorz Kalicy (CUA) , Xiaochun He (Georgia State University)
- 09:00 **Discussion** ¶

09:15 → 09:30 **Editorial Team**

- 09:15 **Editorial Team Report**
  Speakers: Peter Steinberg (BNL) , Richard Milner (MIT) , Tom Cormier (ORNL)

09:30 → 09:45 **Diversity, Equity and Inclusion**

- 09:30 **DE&I Report**
  Speakers: Christine Nattrass (University of Tennessee, Knoxville) , Elena Long (University of New Hampshire) , Marie BOER, simonetta liuti (universoty of virginia)

09:45 → 10:15 **Physics Benchmark Team**

- 09:45 **Physics Benchmark Team Report**
  Speakers: Carlos Munoz Camacho (IJCLab-Orsay (France)) , Rosi Reed (Lehigh University)
- 10:00 **Discussion**

10:15 → 10:30 **Computing Team**

- 10:15 **Computing Team Report**
  Speakers: Cristiano Fanelli (MIT) , David Lawrence (Jefferson Lab)

10:30 → 11:00 **Further Discussion**

You can make ECCE happen!

- ECCE offers a great start to realizing the EIC Science Program.
- Ongoing activities are the first steps in designing ECCE and evaluating its ability to address the EIC science mission
- Nothing is set in stone – your participation defines ECCE
  - We need your input and creativity
  - This is a once in a lifetime opportunity

Enjoy the workshop!

Mailing lists: https://lists.bnl.gov/mailman/listinfo

ecce-eic-public-l : ECCE consortium public announcements
ecce-eic-ib-l : Institutional board announcements
ecce-eic-dei-l : Diversity, Equity and Inclusion Team discussions and announcements
ecce-eic-det-l : Detector Team discussions and announcements
ecce-eic-phys-l : Physics Benchmark Team discussions and announcements
ecce-eic-prop-l : Proposal Team discussions and announcements

https://www.ecce-eic.org/