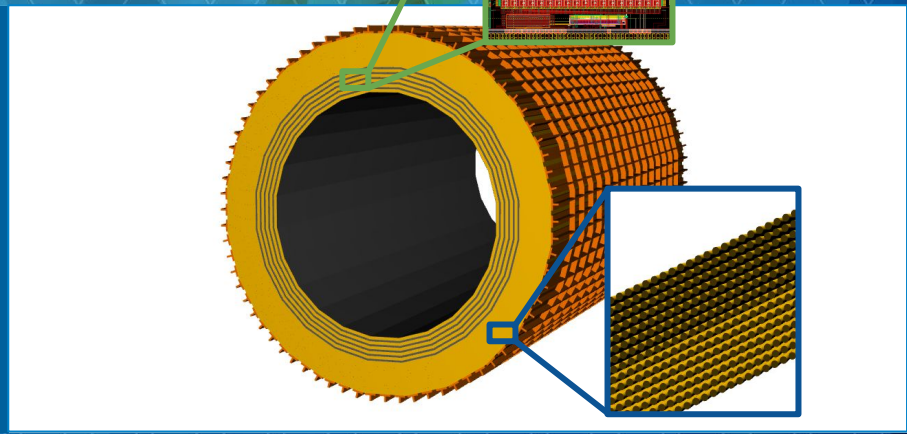
BIC Meeting,
Dec 12, 2023

Barrel Imaging Calorimeter
Updates



Maria Żurek
PHY, Argonne National Laboratory

ePIC General Meeting

Friday 1 Dec 2023, 09:30 → 11:00 America/Chicago

https://indico.bnl.gov/event/21119/

Description **Connection Information:** https://iastate.zoom.us/j/5671810336?pwd=Q1pwM2Q5NFk0T2xqMlJiWDcwcXlOdz09

Recording: https://youtu.be/Tv6mDDdI8kE

09:30 → 10:40 **General Status and Updates**

Conveners: John Lajoie (Oak Ridge National Laboratory), Silvia Dalla Torre (INFN, Trieste)

09:30 **ePIC Collaboration News** 20m

Speakers: John Lajoie (Oak Ridge National Laboratory), Silvia Dalla Torre (INFN, Trieste)

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09:50 **Collaboration Council News** 15m

Speakers: Bernd Surrow (Temple University), Ernst Sichtermann (Lawrence Berkeley National Laboratory)

20231201 - ePIC CC...

10:05 **Review of CD-3A Comments and Recommendations** 20m

Speakers: John Lajoie (Iowa State University), Silvia Dalla Torre (INFN, Trieste)

Review of CD-3A Co...

10:25 **Discussion** 10m

Speakers: John Lajoie (Iowa State University), Silvia Dalla Torre (INFN, Trieste)

TIC meetings, NEWS

An update to the structure suggested by a deeper analysis of the ePIC collaboration

Technical Coordinator Office (TC-office)

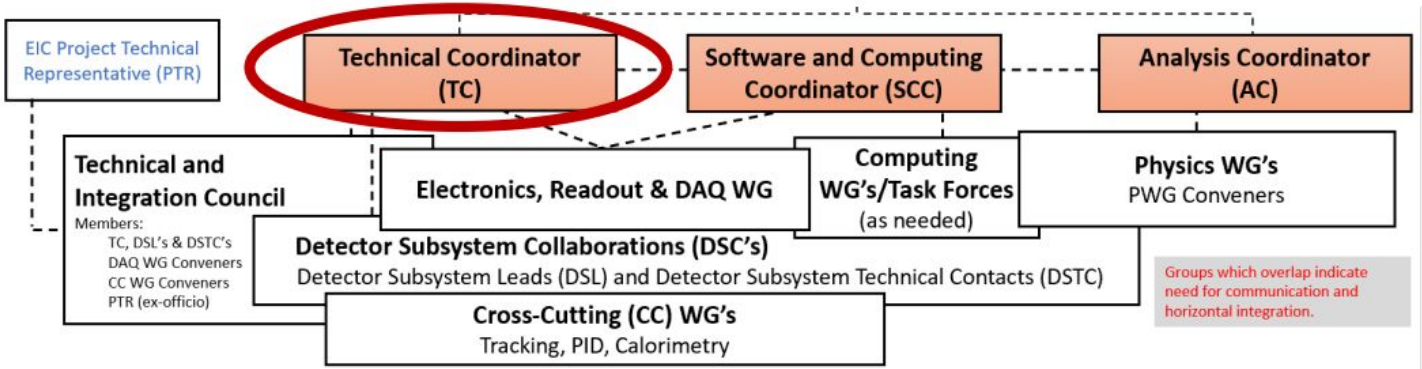
Silvia Dalla Torre
Acting as TC

TC-office members

Prakhar Garg
(Yale)

Oskar Hartbrich
(ORNL)

Matt Posik
(Temple)



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ePIC engagement in TDR

What follows is an **initial information** about a process that is being designed.

The initiative started from the SP-office
Initial feedback from

- CC management
- ePIC Coordinators
- EB

collected and integrated.

PM promptly informed and positive reaction expressed.

NEXT STEP: discuss with the **whole Collaboration** at the ePIC Collaboration meeting in January, where there will be a dedicated plenary session.

TODAY COMMUNICATION: to make the whole Collaboration aware and let you the time to think about and contribute with your feedback at ePIC Collaboration meeting.

Technical Design Report (TDR) – Detector, the needs

From the Project Management talk, ePIC Meeting, Warsaw, July 2023

Chapter 2: Physics Goals and Requirements *(should be short, < 50 pages)*

- 2.1 EIC Context and History (like CDR 2.2 or YR section 1)
- 2.2 The Science Goals of the EIC and the Machine Parameters (like CDR 2.3)
- 2.3 The EIC Science (follow YR structure)
- 2.4 Scientific Requirements

Chapter 3: Interaction Region 6 Overview (Elke/Rolf contributing)

Chapter 8: Experimental Systems *(can be long such that we can use as standalone detector TDR)*

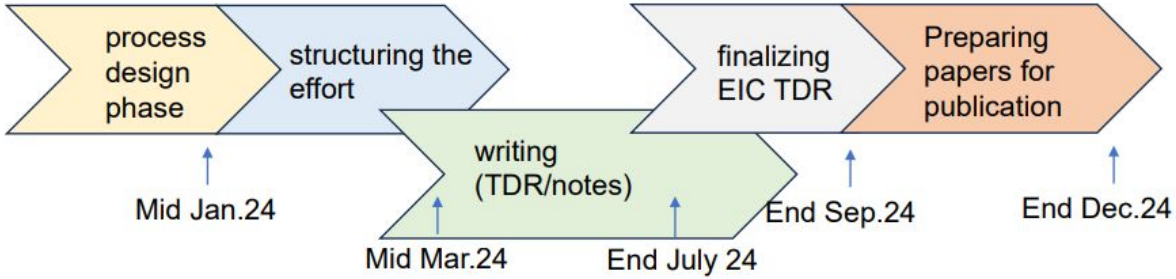
- 8.1 Experimental Equipment Requirements Summary (like CDR 8.2)
- 8.2 General Detector Considerations and Operations Challenges (YR 10, CDR 8.3)
- 8.3 EIC Detector
- 8.4 Detector R&D Summary
- 8.5 Detector Integration
- 8.6 Detector Commissioning and Pre-Operations

Chapter 11: Commissioning (Elke/Rolf contributing)

Appendix-B: Integration of a Second Experiment (mainly emphasizing feasibility, luminosity sharing, polarization with two experiments, and first-order checks of magnets/acceptance)

TDR – the ePIC goals and timelines

- The ePIC contributions to the EIC TDR (Chapters 2,8)
  - The EIC TDR is the top priority
  - Precise timescale driven by EIC project requirements
- Scientific production/dissemination
  - An extended version of the ePIC detector section from the EIC TDR with appropriate front matter, published in a scientific journal (such as NIMA, JINST, PRC, …)
    - *Derived from TDR Chapter 8*
  - An ePIC Physics Performance long paper published in a scientific journal (such as NIMA, JINST, PRC, …)
    - *Derived and expanded from TDR Chapter 2 (Section 2.3)*



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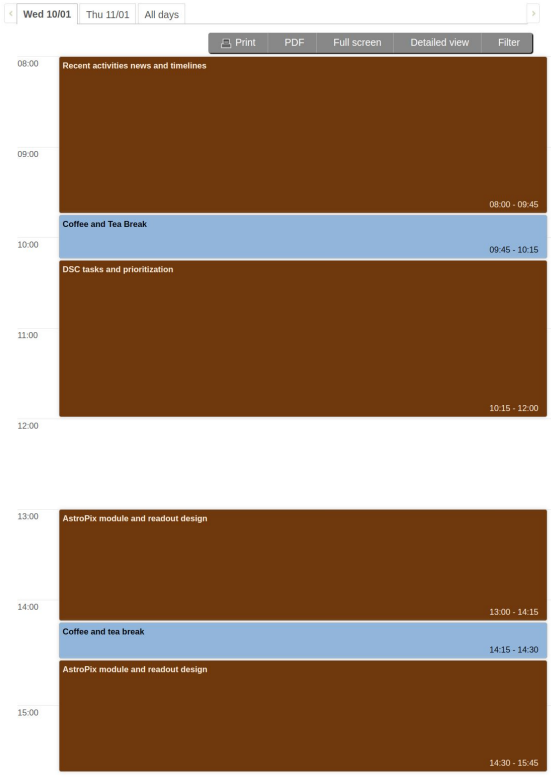
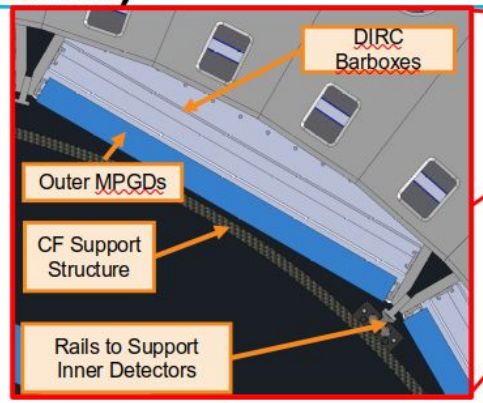
ePIC COllaboration Meeting: https://indico.bnl.gov/event/20473/

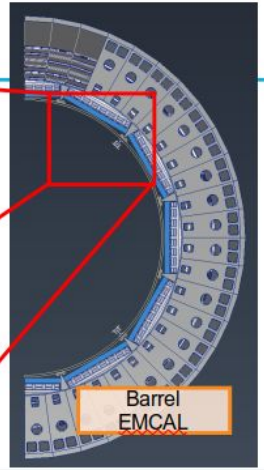


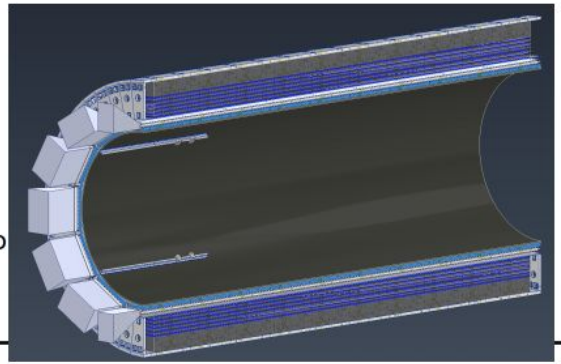
TIC Meeting - 12/11/23
https://indico.bnl.gov/event/21106/

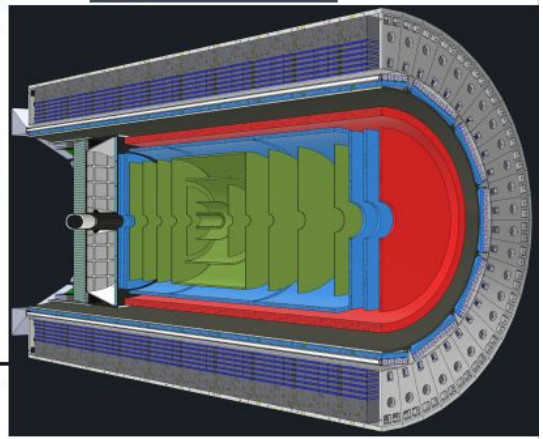
DIRC Support (D.Cacace)

- Current plan is to use barrel EMCAL for support of Inner Detectors/Waiting for Barrel EMCAL group to confirm the design of Barrel EMCAL.
- Outer MPGDs and DIRC barboxes will be nested in the area between rails.
- A carbon fiber Support Structure supported using Barrel EMCAL will support all the inner detectors
- Separate Rails will be used for EEEMCAL and pfRICH Installation
- Gaps between the EEEMCAL and the carbon fiber cylinder will allow fo inner services to be brought out





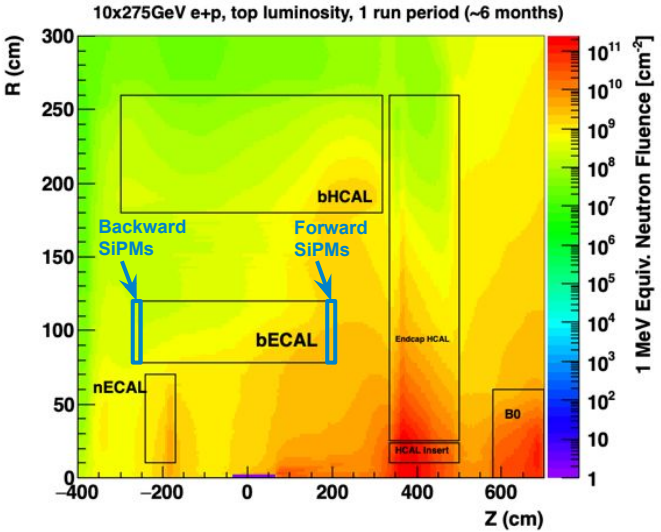


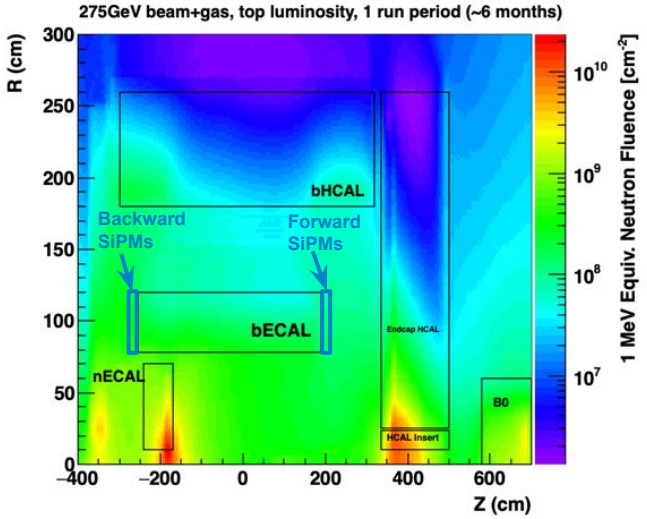


BIC now: r = 81.5 cm, length = 440 cm

Radiation dose at the Barrel ECal SiPMs

https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses



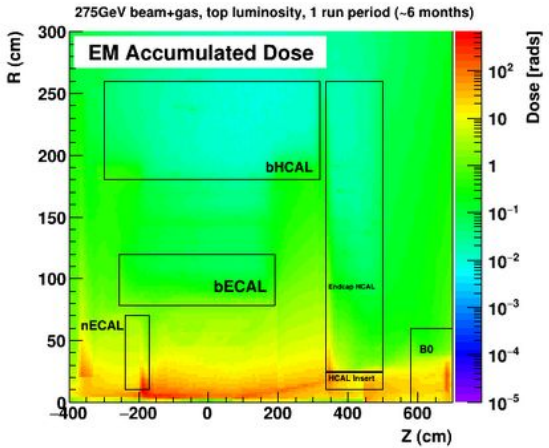


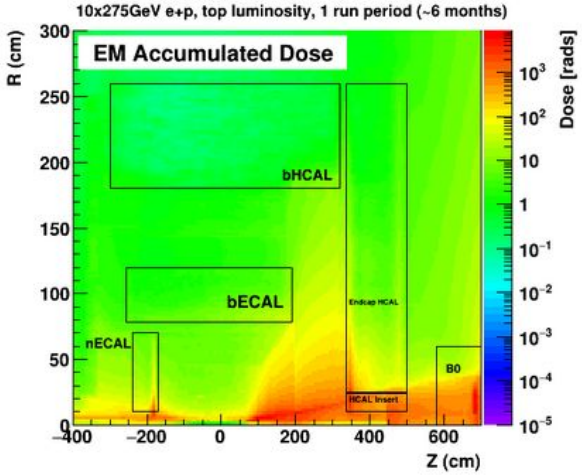
	Forward SiPMs (+z)	Backward SiPMs (-z)
Dose from physics*	~ 3 x 10^{10} / cm^2	~ 6 x 10^9 / cm^2
Dose from beam + gas*	~ 9 x 10^9 / cm^2	~ 5 x 10^9 / cm^2

*In 1 MeV neutron equivalent fluence for 10 year of running

Radiation dose at the Barrel ECal SiPMs

https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses





	Max dose
Dose from physics*	30 rads
Dose from beam + gas*	400 rads

Hadronic radiation doses give overall factor of 2 to the numbers in the table

* per 10 running periods

Barrel Ecal: needs for radiation hardness studies

1. **Need to study radiation hardness of:** SiPMs, front-end electronics, AstroPix chips

2. **Doses based on** https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses:
   1 MeV neutron equivalent neutron flux for 10 year of running: max ~ 4 x 10^{10} / cm^2
   EM Accumulated dose: ~ 1 kRad

3. **Timeline:**
   a. AstroPix (v3, v2) sensors tested in FNAL MTA Facility in FY23 (passive, FY24 active irradiations planned)
   b. SiPMs (S14161-6050-04, S14161-6050, S13360-6050) in FY24 at FNAL (some tests done for Insert in LBNL, FY23, from what we understand)
   c. Front-end electronics for SciFi - FY24/25 (Coordinated test for HGCROC?)
   d. End-of-stave card for AstroPix - FY24/25

4. **Facilities:** FNAL ITA (low-energy proton, FY23/24), EM irradiation: JLab, LEAF at ANL, …