Incremental Preliminary Design and Safety Review of the ePIC Hadron and Forward Electromagnetic Calorimetry

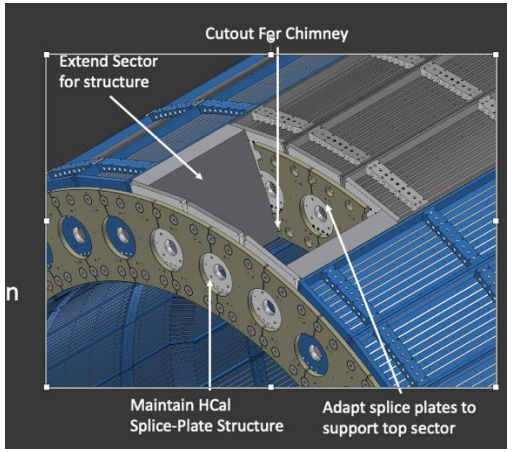
October 30th & 31st, 2025

The review covered the **design and performance** of these detectors with respect to the physics program and **requirements**, ranging from **construction and integration** to **operating conditions and background radiation**. This is an assessment of the readiness of these detector systems in particular towards the upcoming project reviews for **CD-2 (baseline)** for which the design maturity is expected to be 60% or higher.

- Are the technical performance requirements appropriately defined and complete for this stage of the project?
- Is the design of the various detector systems advanced enough and appropriately documented for this stage of the project? Are the current detector plans likely to achieve the performance requirements for the lifetime of the EIC physics program?
- Are the assumptions for construction and fabrication of the various detector components sound and are assembly plans reasonable and consistent with the overall detector schedule?
- Have ES&H and quality assurance considerations been adequately incorporated into the plans at the present stage?
- Have recommendations from previous reviews been adequately addressed? There were none.

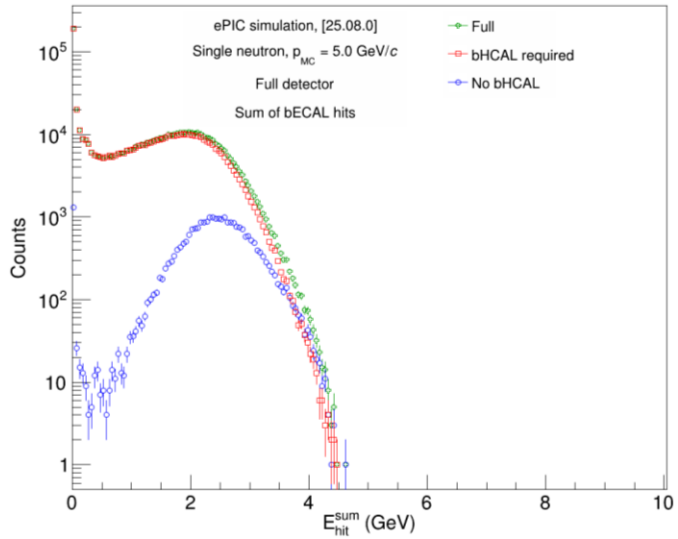
❑ Design and Integration

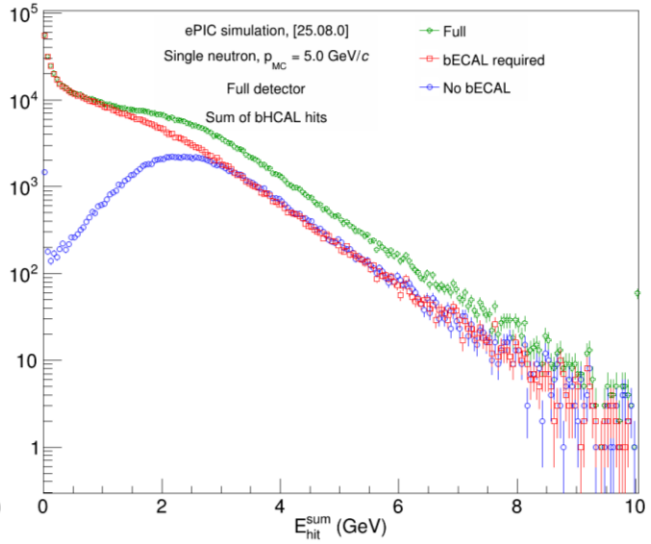
- Pre-existing (sPHENIX OHCal) except for 3 steel sectors need to be modified to accommodate magnet supply chimney



❑ Technical performance

- Complex energy deposition system ➔ requires detailed and comprehensive study
- Motivation for individual tile read-out is muon identification ➔ Needs careful studies to demonstrate

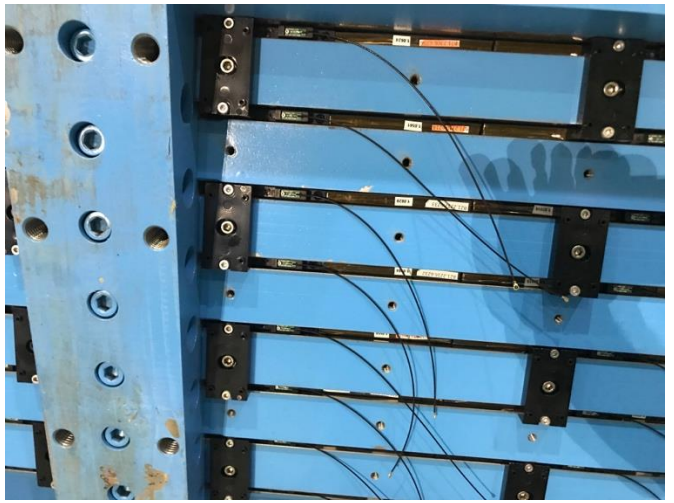




❑ Construction and assembly

Assembly steps

- Remove covers
- Leave tiles installed (except for 3 chimney sectors, see above)
  ➔ Time saving compared to sPHENIX
- Replace SiPM boards
- Install read-out electronics and LED driver boards in electronics boxes in center of detector
- Install coax cables from SiPMs to read-out electronics

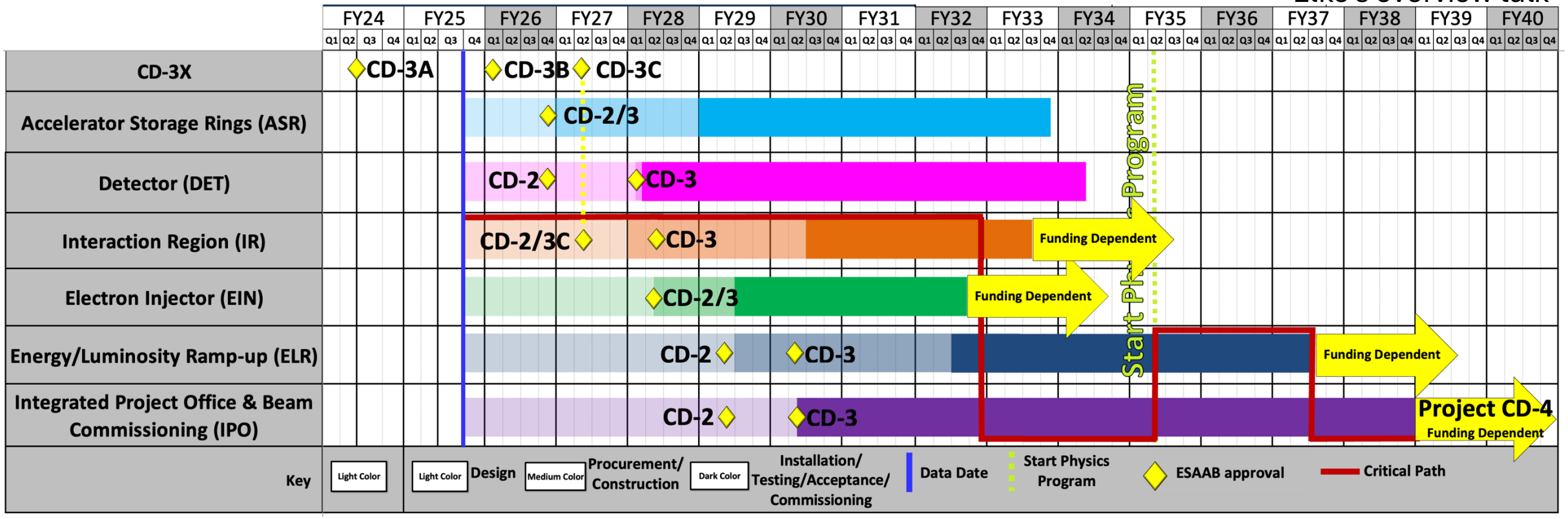


❑ Schedule

- BHCal fully removed from sPHENIX by January 2029 (BHCal installed by April 2031?)
- Then have 1.5 years for refurbishment
- Assuming 4-person-years for the refurbishment (sPHENIX experience) ➔ we need 8 people working in the factory at any given day
- Plan to accomplished this with contributed student and postdoc labor + technician support

Outlook to CD-2 (Performance Baseline)

Elke's overview talk



- Complete energy calibration & simulations to evaluate the potential of single-tile readout for improving muon identification.
- Chimney modifications
- Estimate extra tiles & identify vendor base

Review Committee – Closeout

Connor Miraval (BNL), Stefano Miscetti (LNF), Roman Poeschl (IJCLab), and Felix Sefkow (DESY)

Charge Question #1

Are the technical performance requirements appropriately defined and complete for this stage of the project?

Response:

Yes for Femcal and BHCAL, Conditional YES for LFHCAL and nHCAL, Yes for Integration

Charge Question #2

Is the design of the various detector systems advanced enough and appropriately documented for this stage of the project? Are the current detector plans likely to achieve the performance requirements for the lifetime of the EIC physics program?

Response:

Yes For Femcal, BhCAL. Conditionally for FHCAL and nHCAL. Yes for Integration

Charge Question #3

Are the assumptions for construction and fabrication of the various detector components sound and are assembly plans reasonable and consistent with the overall detector schedule?

Response:

Yes for FEMCAL and BHCAL. Conditional yes for LFHCAL and nHCAL. Yes for Integration.

Charge Question #4

Have ES&H and quality assurance considerations been adequately incorporated into the plans at the present stage?

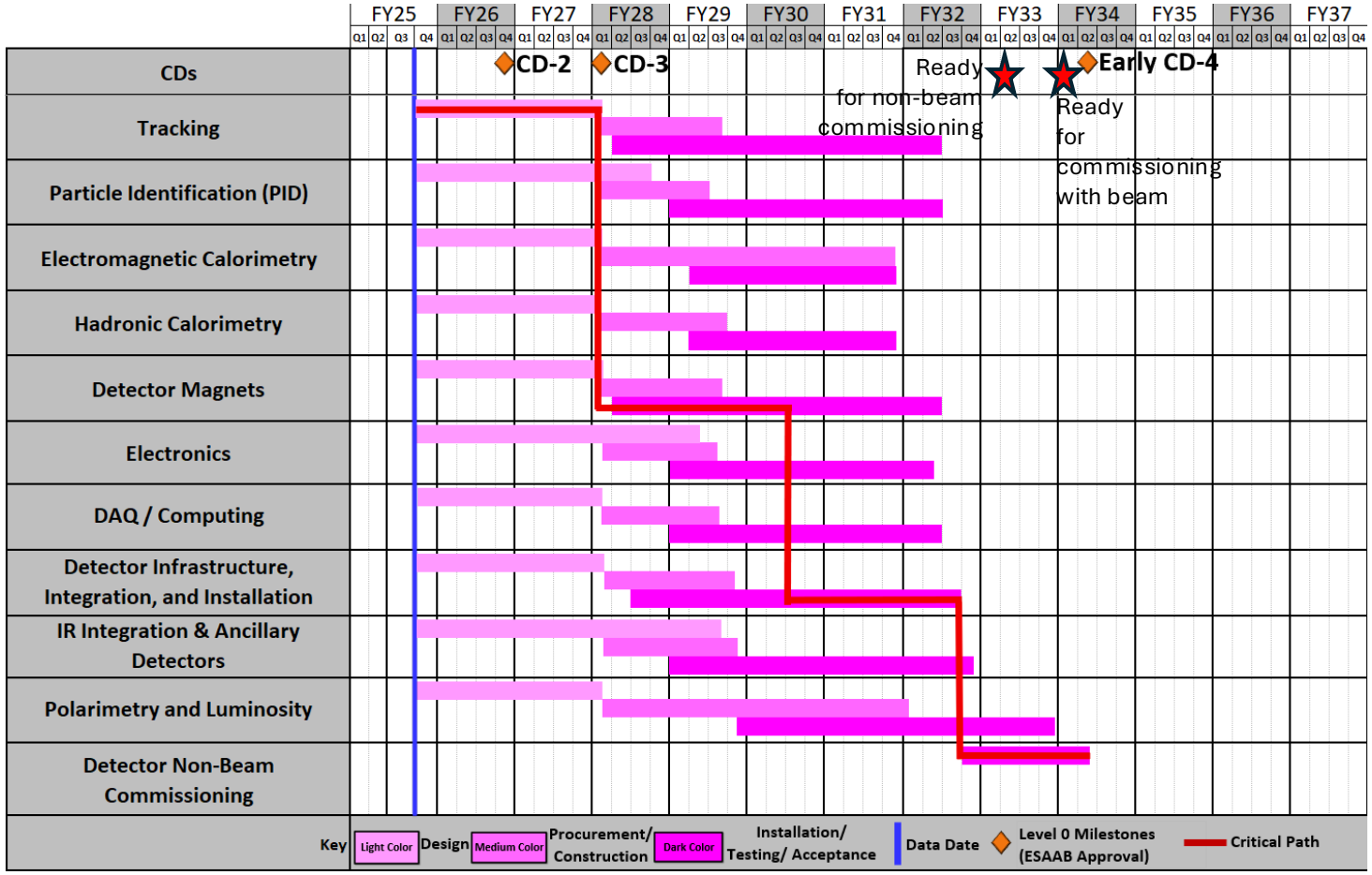
Response:

YES

Backup

DET Schedule

Elke's overview talk



Schedule Drivers:

- **To hold the date for a CD-2 Independent Project Review (IPR) expected not before June 2026**
- To keep the (inter)national user community engaged and limit the danger to lose groups
- all subdetectors need to be more or less ready at the same time to be assembled to ePIC
- Superconducting Solenoid → CD-3A item
- Silicon Sensors (MAPS, AC-LGAD & ASTROPIX)
- ASIC long time frames only one ASIC designed from scratch all others are modifications to existing ASICS
- Items with long production times, single vendor and complex assembly → CD-3A & CD-3B
- International agreements driving in-kind and MAPS design (agreement with CERN)

Planning Dates 2025 - 2026	
June 2025	Technical Design Review conducted by DAC
Nov 2025	Nov. 12-14: Baseline Readiness Assessment review scheduled
March 10th – 12th 2026	DOE Status Review
Q3 FY26	June 2026 CD-2 IPR

High Level Installation Schedule

Elke's overview talk