

ePIC Barrel ECal Meeting - 06/12-16/23

Prototype and Beam Test Plans

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SciFi/Pb calorimetry - R&D

SciFi/Pb tested extensively in for energies $E_\gamma < 2.5 \text{ GeV}$

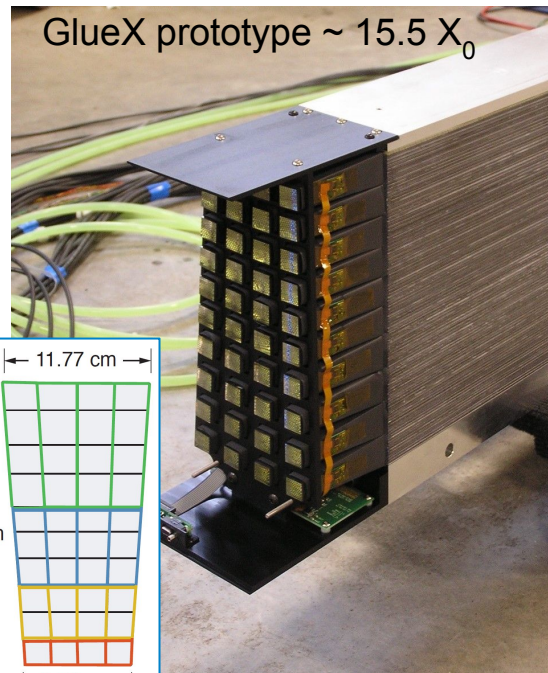
- At EIC energies up to $\sim 10 \text{ GeV}$ for photons and $\sim 50 \text{ GeV}$ for electrons
- **Higher-energy data** important to constrain the constant term of energy resolution

R&D goals with GlueX prototype

- Obtain **responses to electromagnetic and hadronic showers** to benchmark simulations and provide input to realistic **waveform analysis**
- This will be further used to optimize the detector design

Beam tests plans

- **Hall D, electrons** (energies up to $\sim 6.2 \text{ GeV}$), FY23
- Following tests in **FNAL with pion/electron** beams for hadronic response



- 60-cm long prototype
- 40 light guides on either side
- 40 SiPMs per side

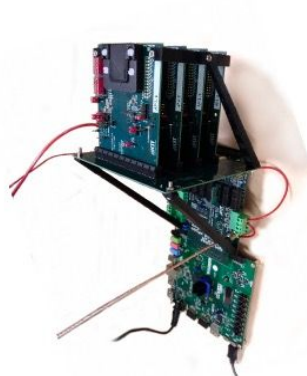
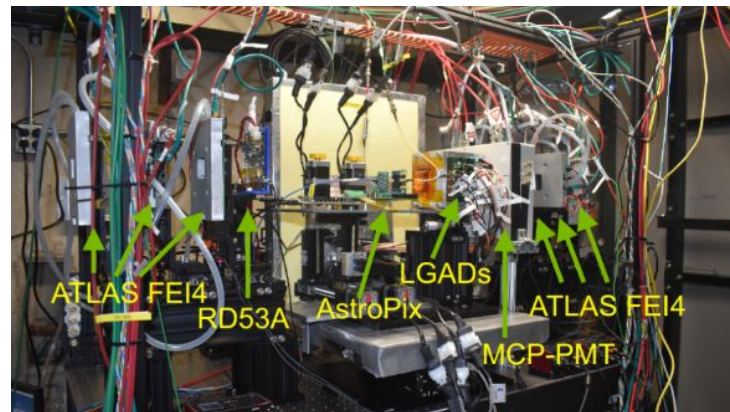
Imaging layers - R&D

R&D program towards prototyping the generic imaging calorimetry for EIC in FY23

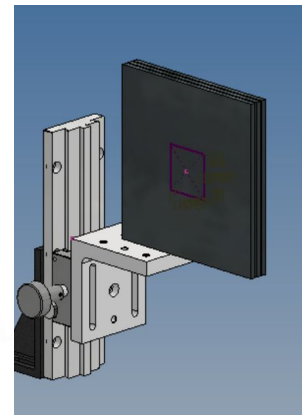
- Tests of **AstroPix v2/v3a sensor** in the EM calorimetry environment
 - **Multilayer chip tests** in FNAL with protons, pions and electrons, tests with tungsten radiator, readout aspects (ANL LDRD grant)
 - Beam tests in February and May 2023
 - **Irradiation test** in the FNAL ITA Facility (ANL LDRD grant)

FY24 Plan

- Response to electromagnetic/hadronic shower with multilayer AstroPix v3 prototype



v2 multilayer
chip boards

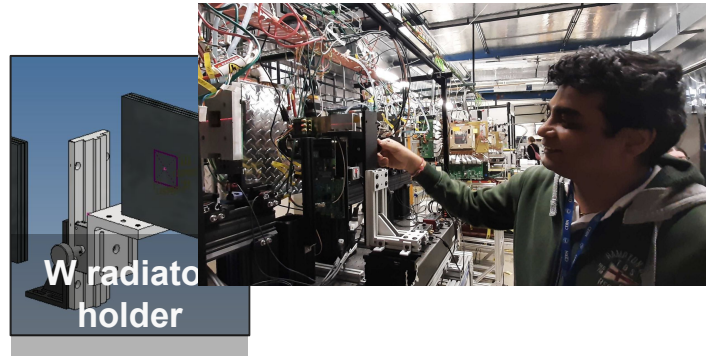
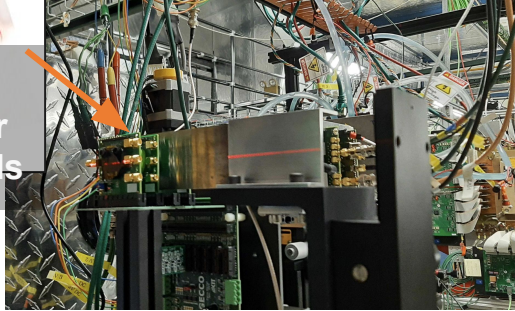
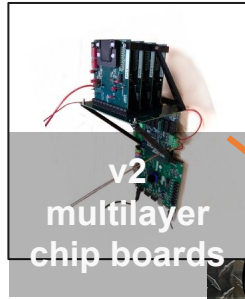


W radiator holder

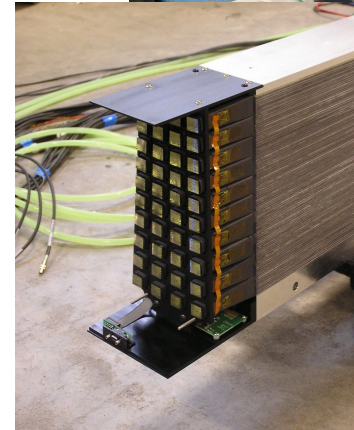
Prototyping Strategy for the Barrel ECal

1. **Small-scale prototype** with baby ECal and SciFi/Pb layers and AstroPix chips/layers (R&D)
 - a. FY24/FY25 (Fermilab MTest goes into shutdown in FY26)
2. Large scale prototyping (engineering test articles):
 - a. Full AstroPix tracker stave
 - b. Full length prototype for SciFi/Pb (not full depth sector, to test mechanical stresses, integration with tracker staves, etc.)
3. First article sector in pre-production phase
 - a. Integrated full size ScFi/Pb sector with AstroPix layer(s)

Small Scale Prototype

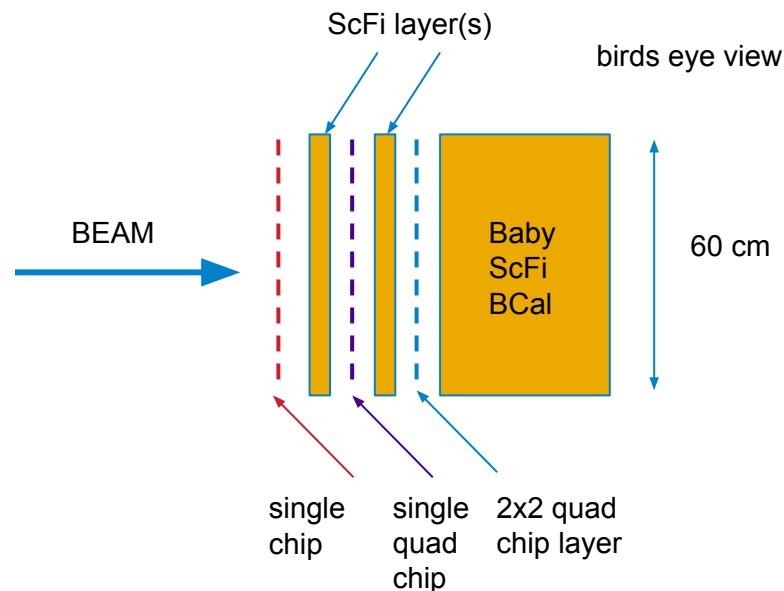


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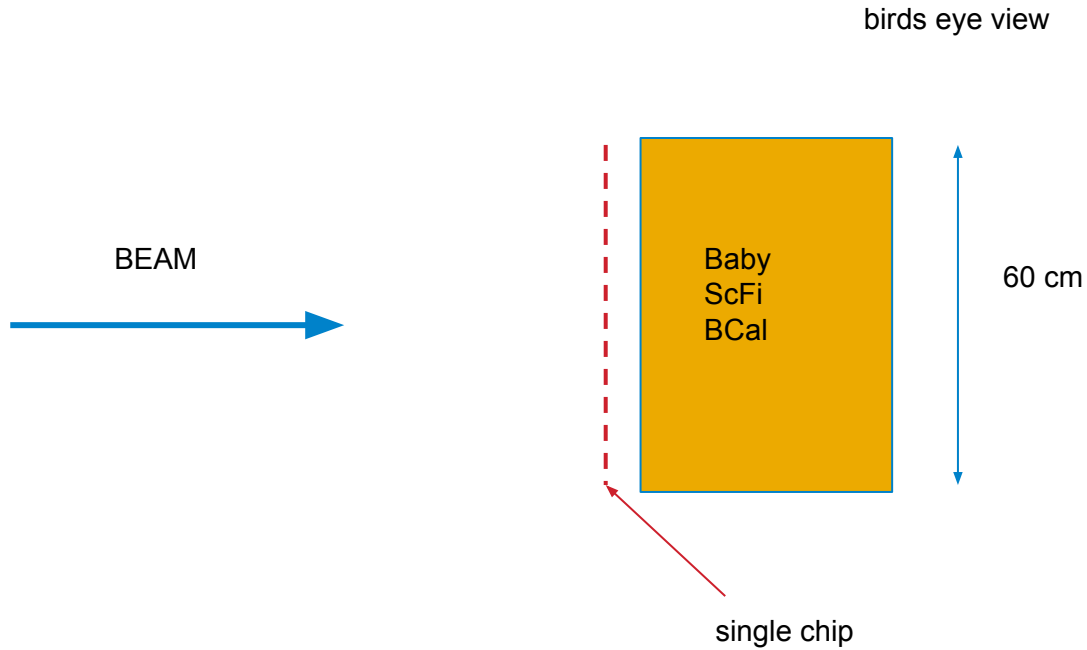


Small Scale Prototype

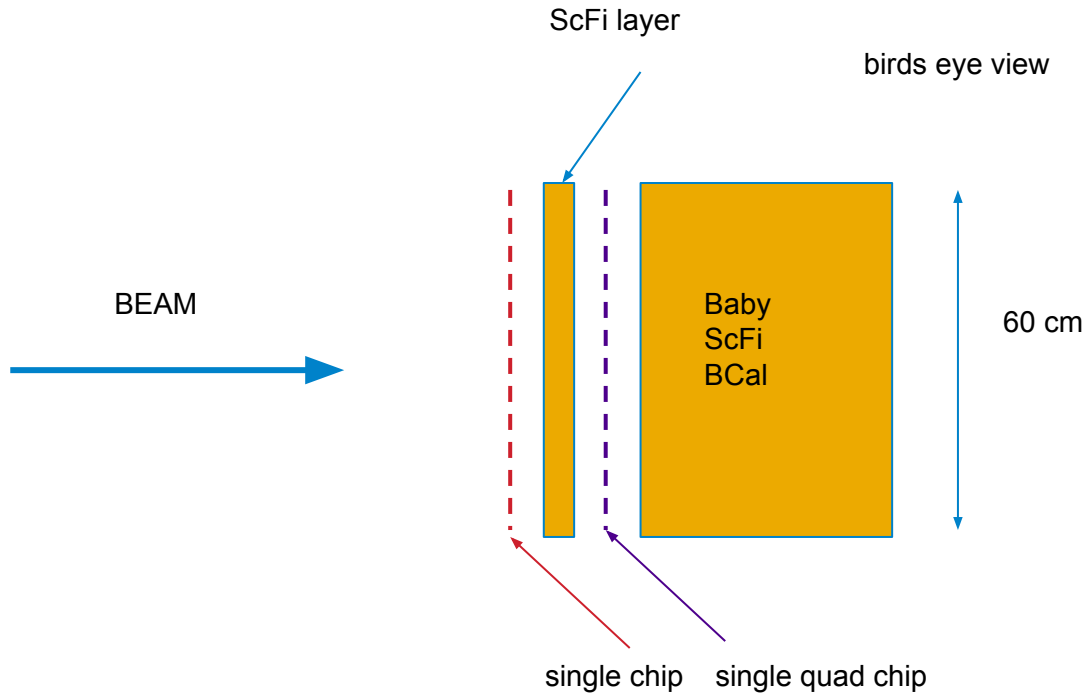
- Baby BCal to be calibrated with cosmics and prepared for shipment from JLab (20 cm thick)
 - Possibility of producing a few extra (2?) ScFi/Pb layers (2 cm thick)
 - Planned to be included in the this year proposal for the T1224
 - Installation summer 2024
 - Exact beamtime plan to be discussed with main goal to integration between AstroPix and ScFi/Pb DAQ
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- So far we work with a single v3 chip
 - Ultimate goal: Multichip layer tested in between ScFi/Pb layers
 - e.g. 1 quad chip in 1st AstroPix layer, 2x2 quad chips in 2nd AstoPix layer



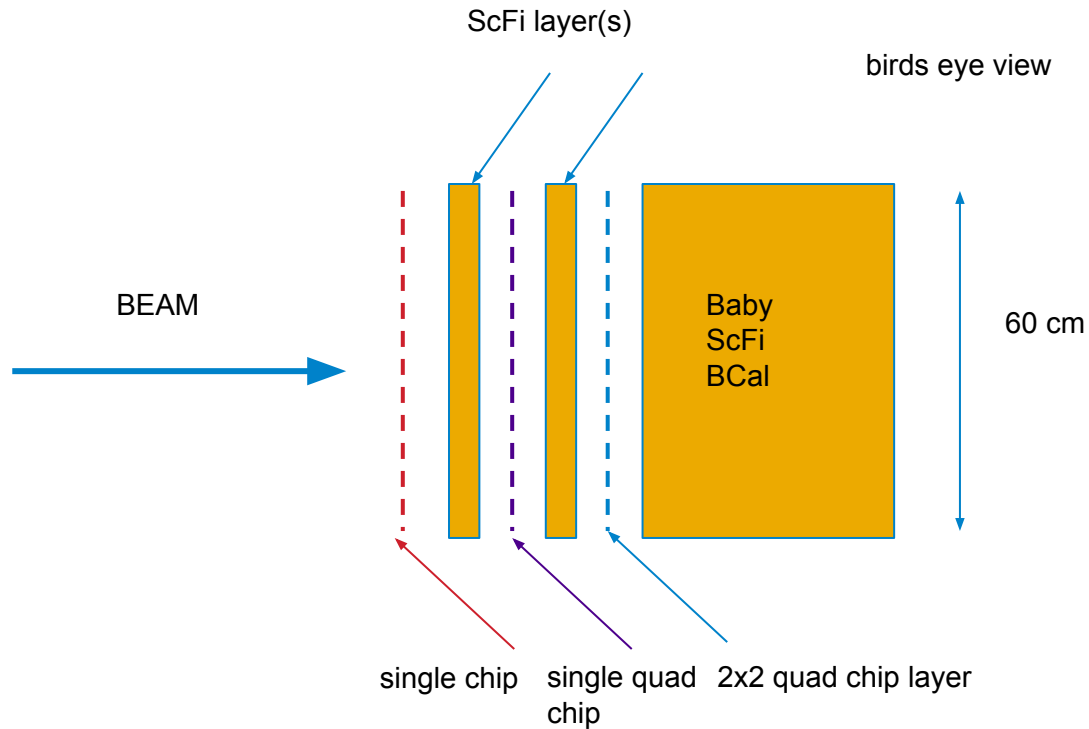
Small Scale Prototype



Small Scale Prototype



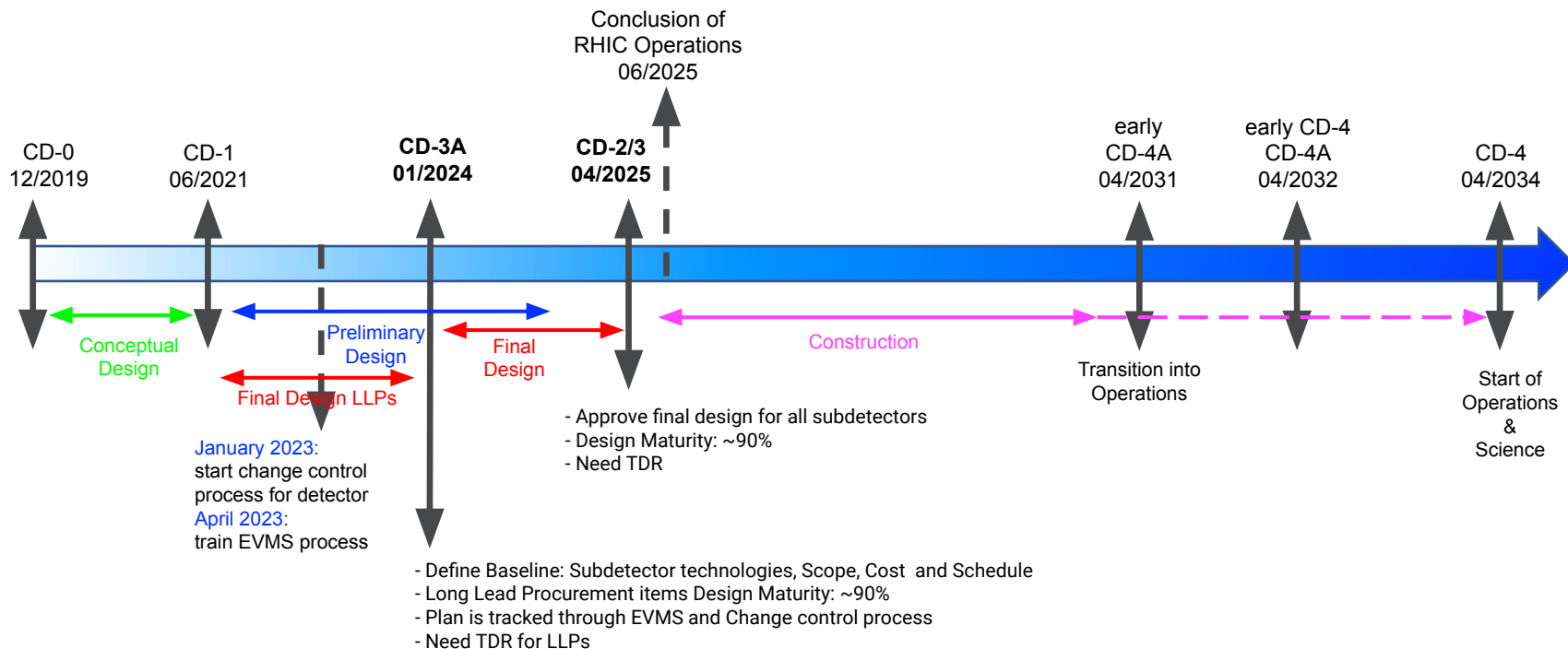
Small Scale Prototype



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EIC Project Schedule



High Level Schedule

Jul 2023 - Oct 2024: Design

Jan 2024 - Oct 2024: Prototyping/First article (*note any beam tests relate to R&D not to EMCal WBS*)

Oct 2024 - Oct 2025: Production development

Feb 2025 - Feb 2026: Procurement process

Feb 2026 - May 2029: Contract Award followed by material delivery

May 2026 - Sep 2029: Production for Pb/SciFi and test & assembly for Si, and ship to BNL

Sep 2029 - Dec 2029: Sector assembly at BNL (light guides, SiPM, etc.)

Dec 2029: Deadline to have all sectors and Si staves ready for integration

Dec 2029 - Feb 2030: Sector assembly in a barrel

Feb 2030 - May 2030: Insert/integrate Si staves

Schedule

