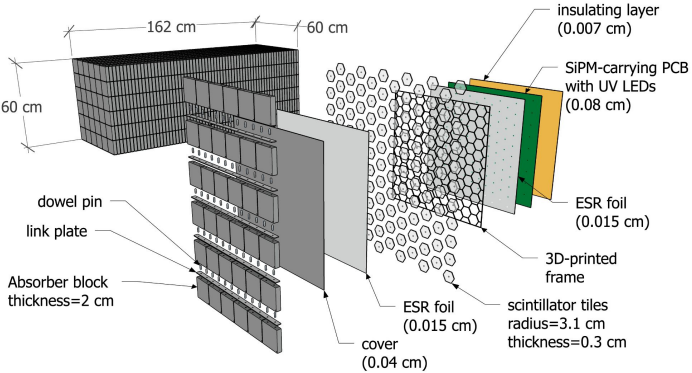


Construction of an SiPM-on-tile ZDC prototype

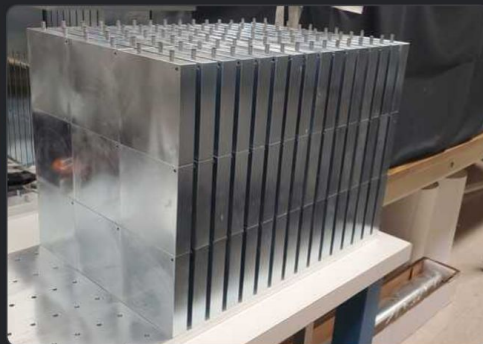
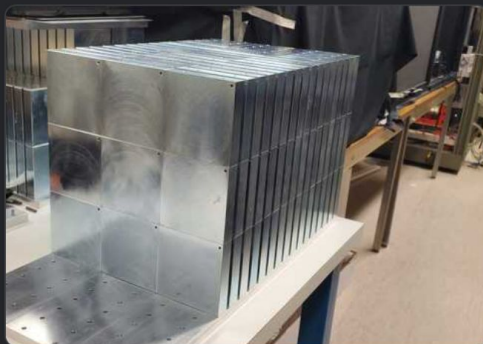
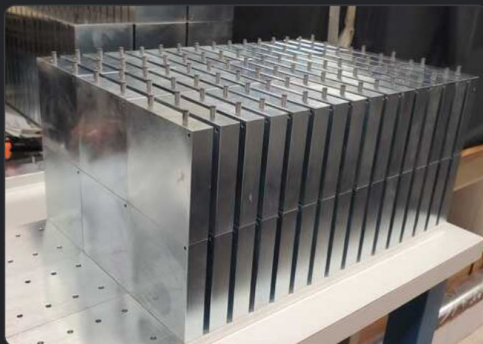
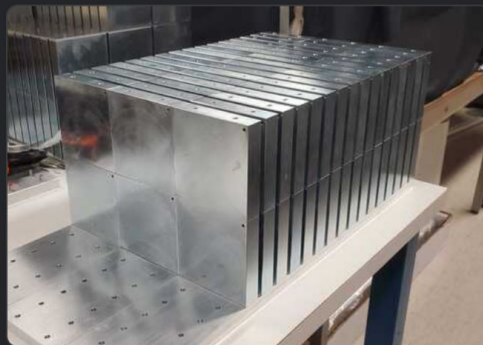
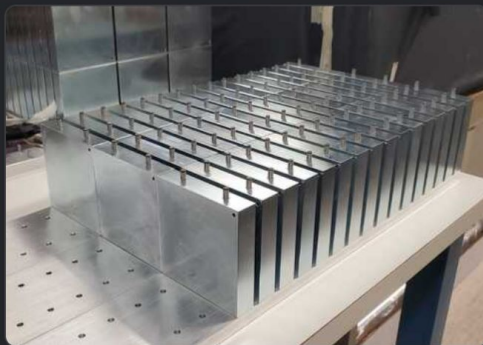
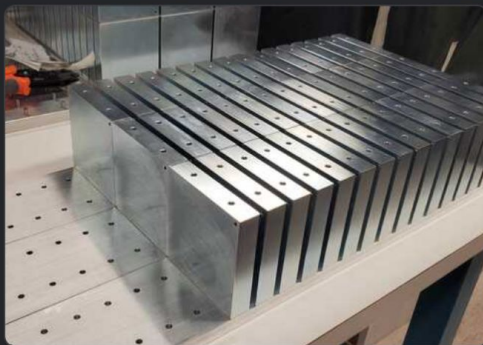
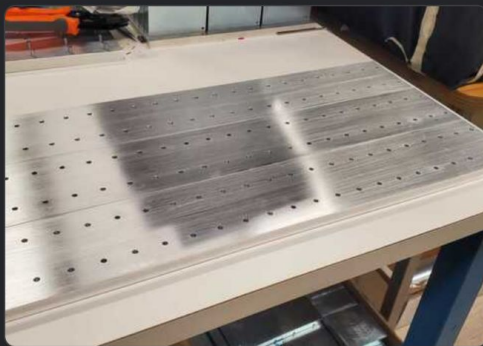
Sebouh Paul
UC Riverside
7/27/2024



Prototype construction

- 30x30 cm² (1/4 transverse area of full detector)
- 15 layers (full detector uses 60)
- Constructed similar to the full detector
- Staggered square cell pattern

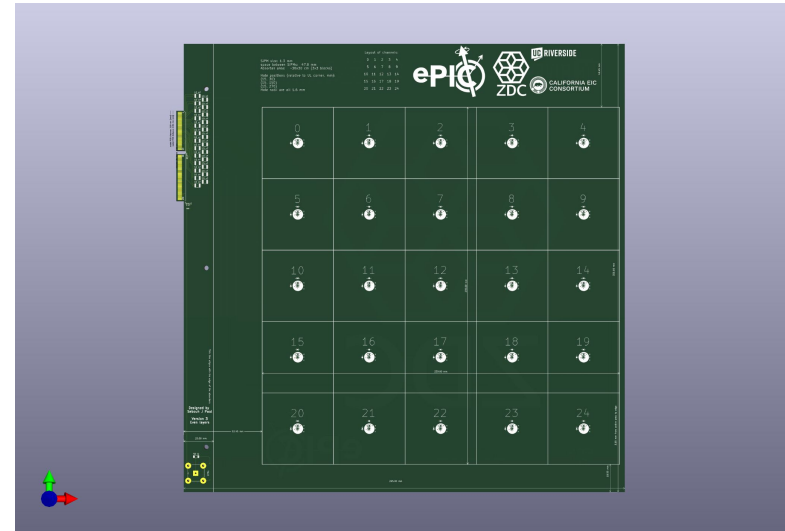
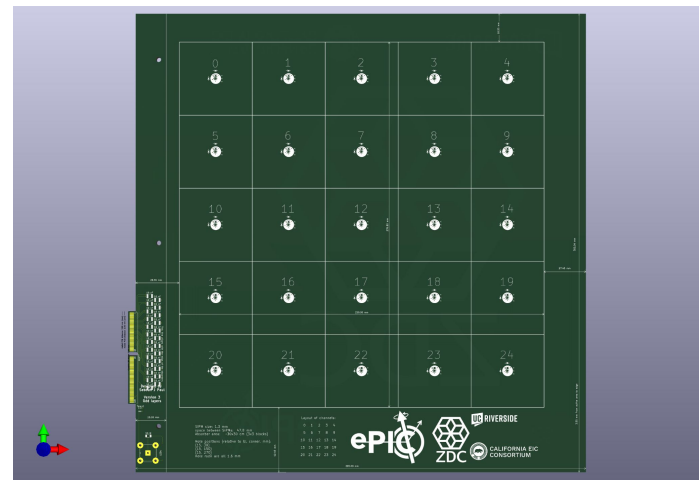
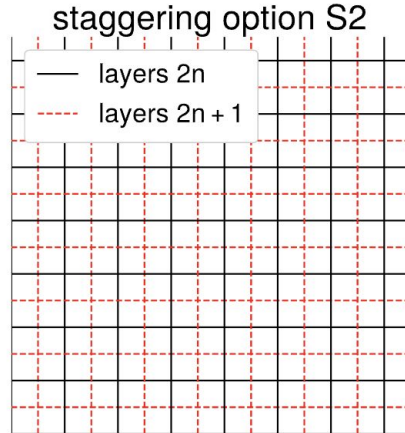
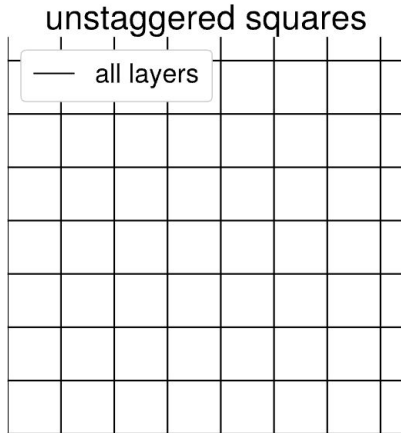




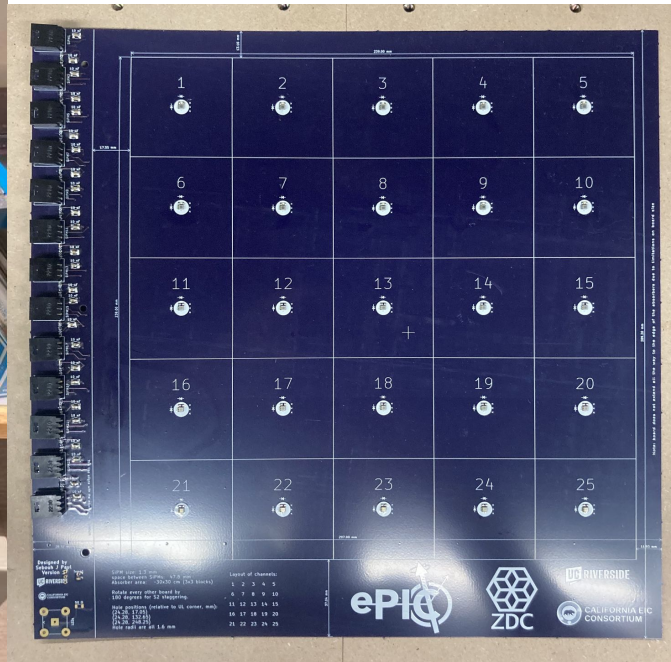
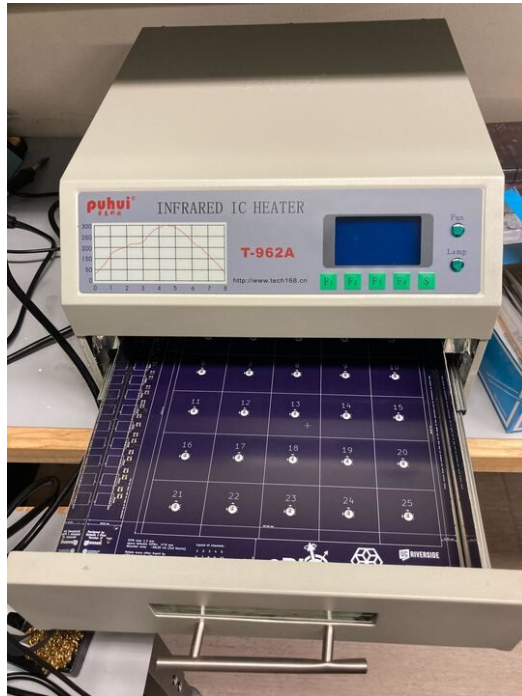
SiPM PCB: staggered design

Two versions, shifted diagonally by half a cell, alternating layer by layer

Purpose: to improve the position resolution of the detector

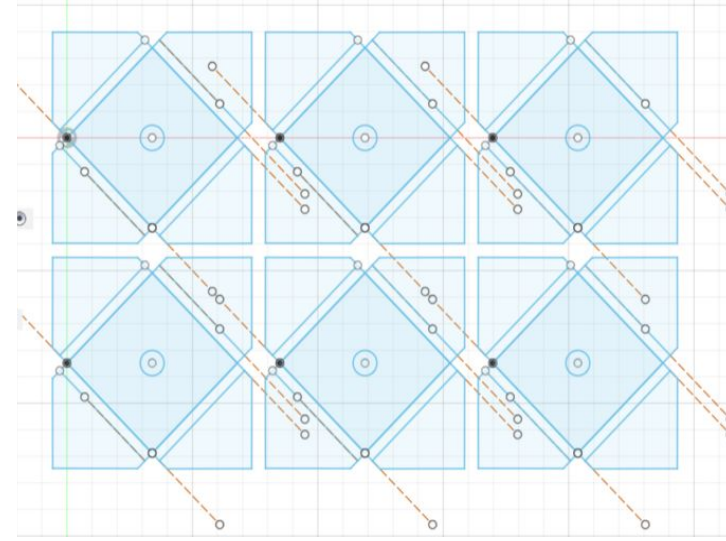
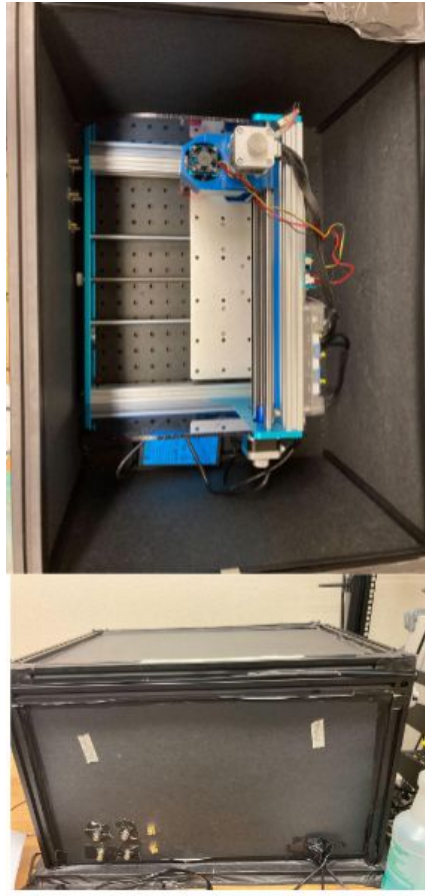
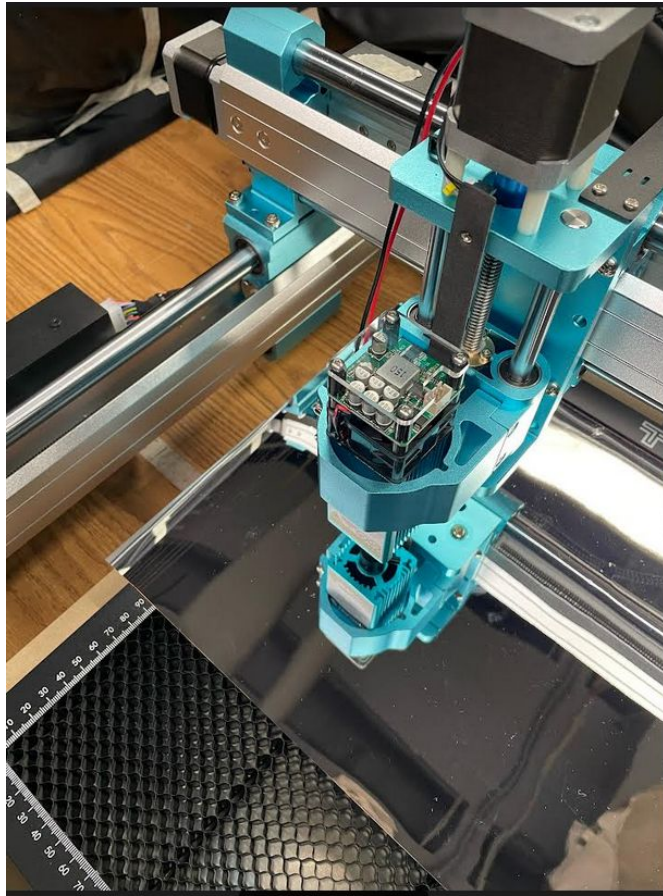


Use stencils when applying soldering paste, then PCB is placed in oven before placing SiPMs and other components

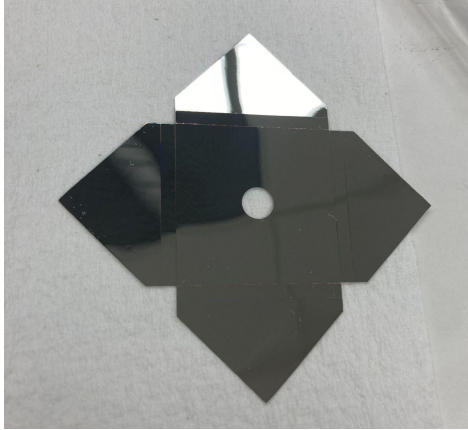


Setup for cutting and creasing reflective foil

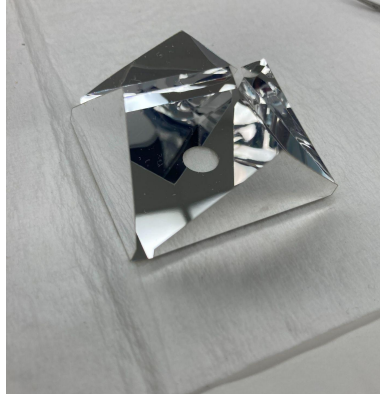
Laser component attached to CNC Machine, and placed in a dark box for safety.



Laser cut sides with etched folds.



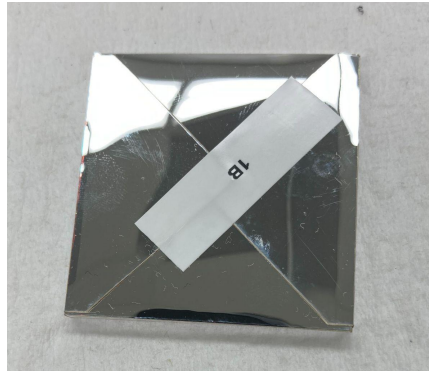
Folds are made.



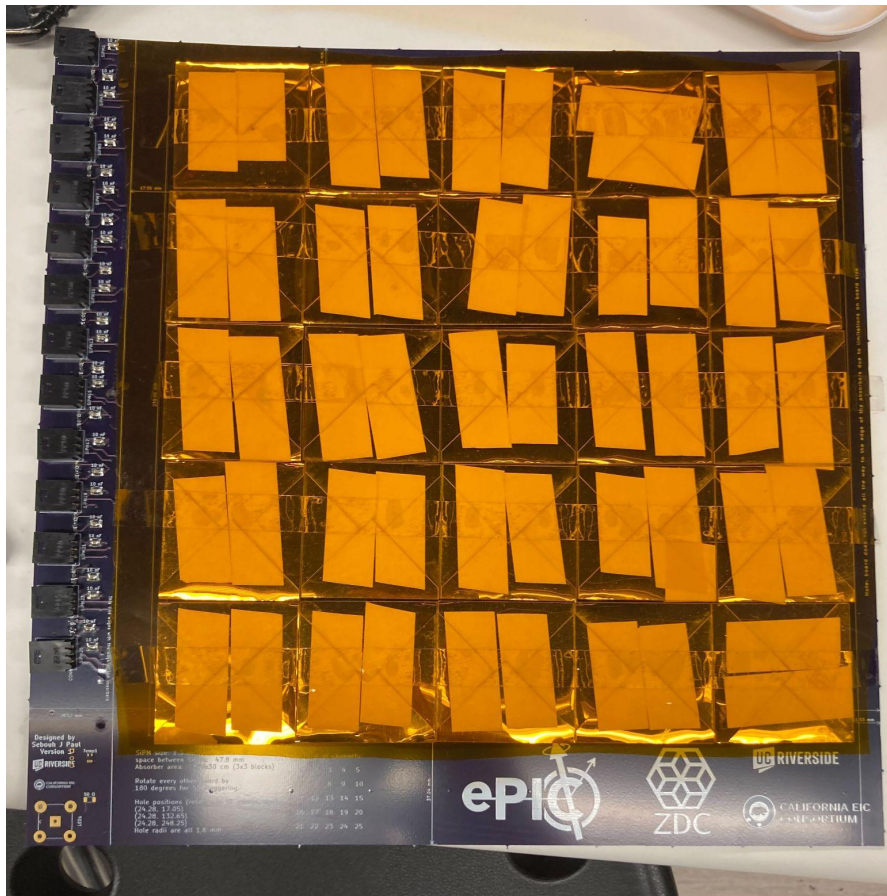
Scintillator is placed



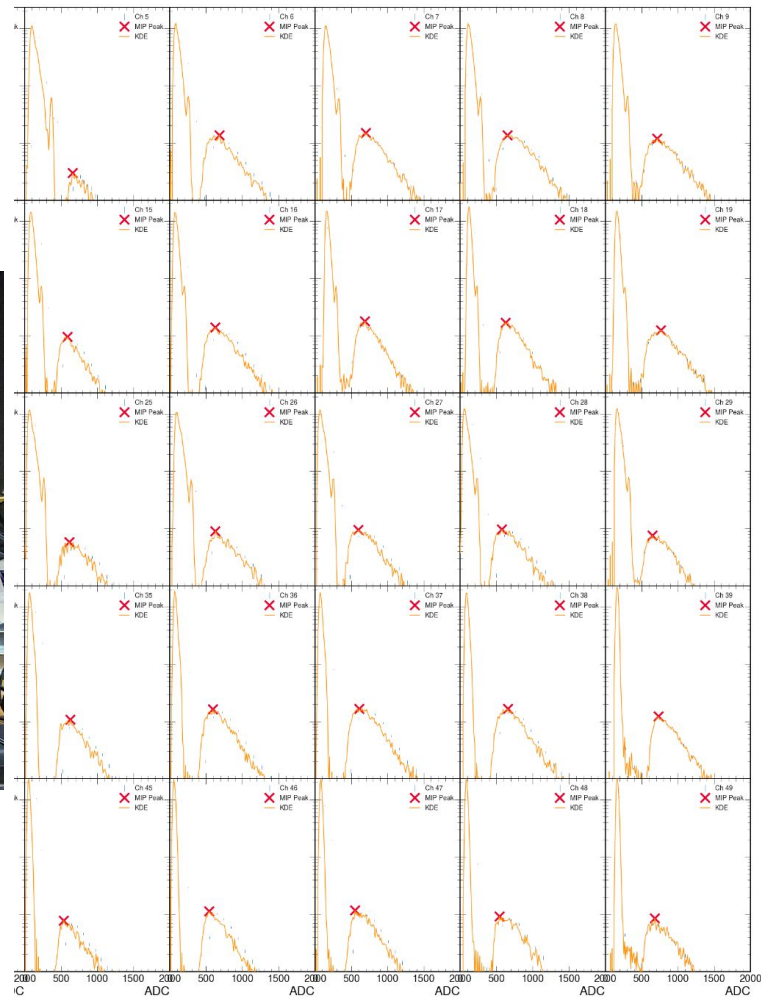
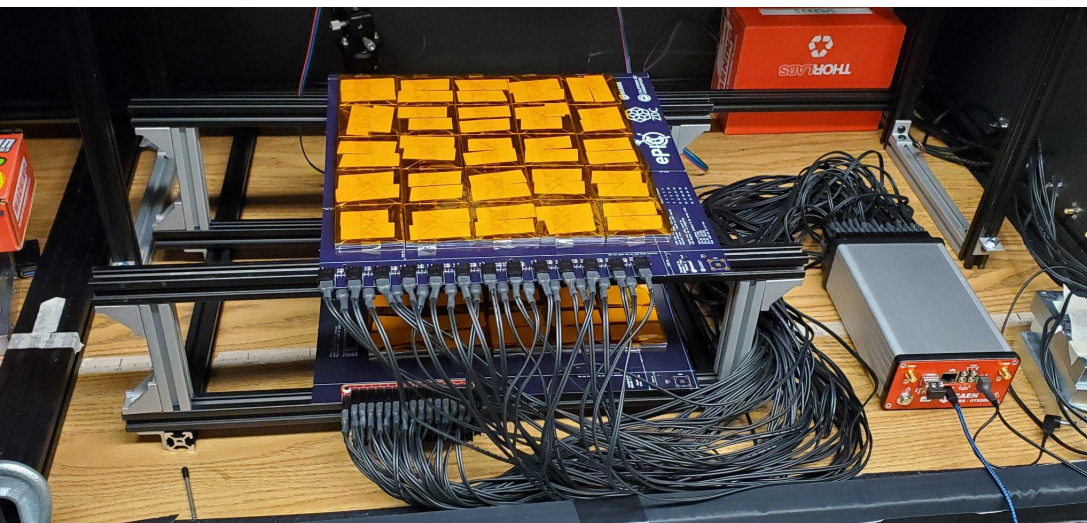
Scintillator is wrapped and taped over.



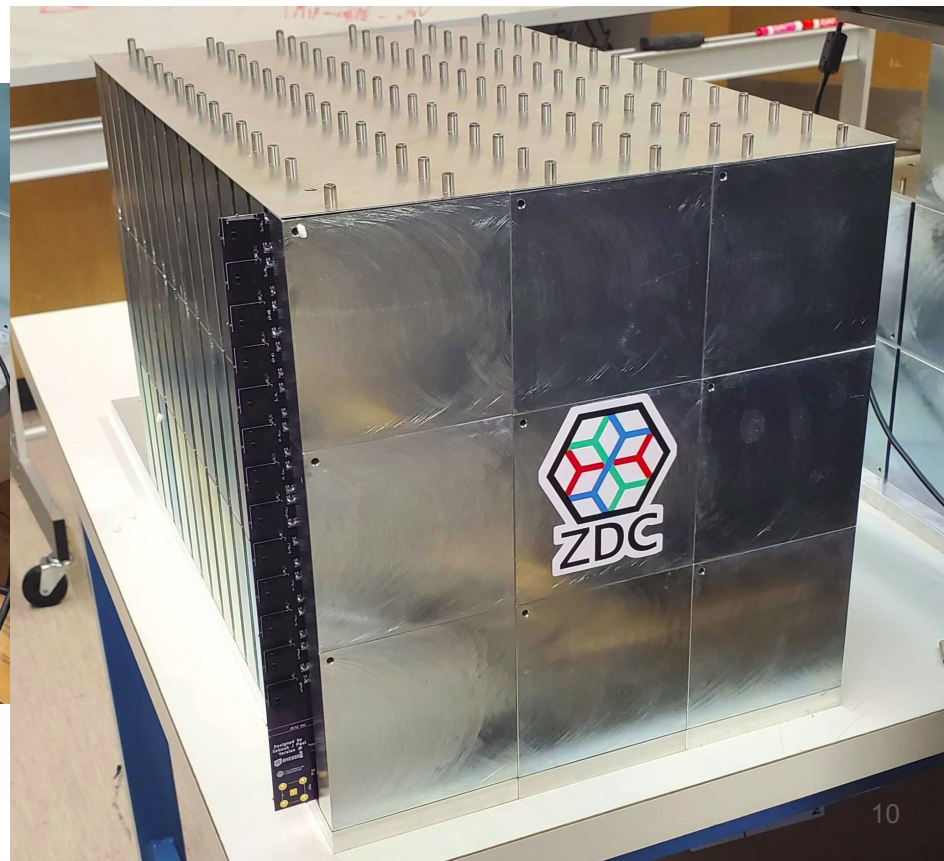
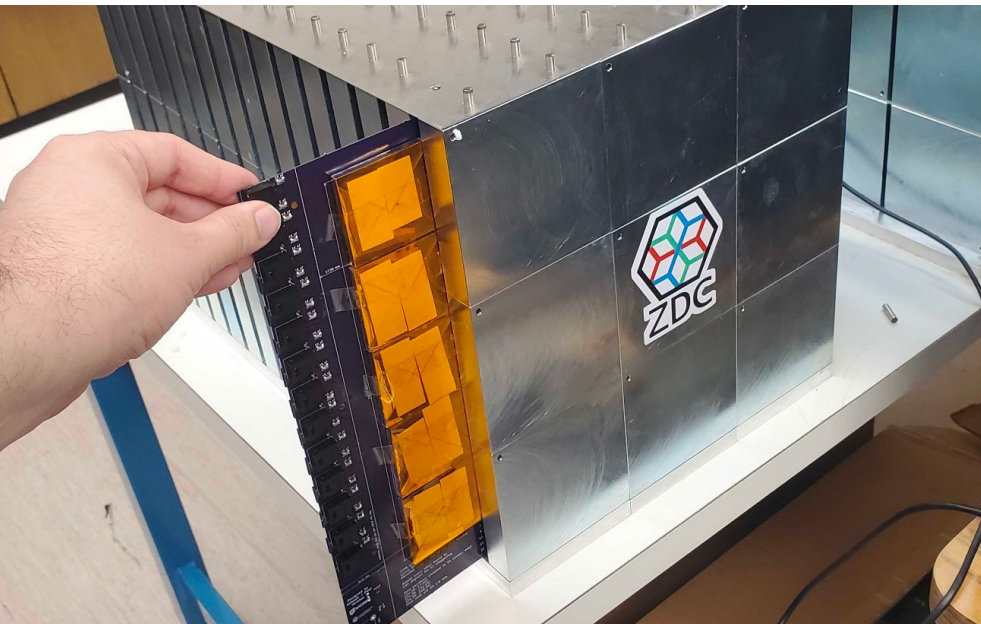
Cover with polyamide film on top and bottom for protection

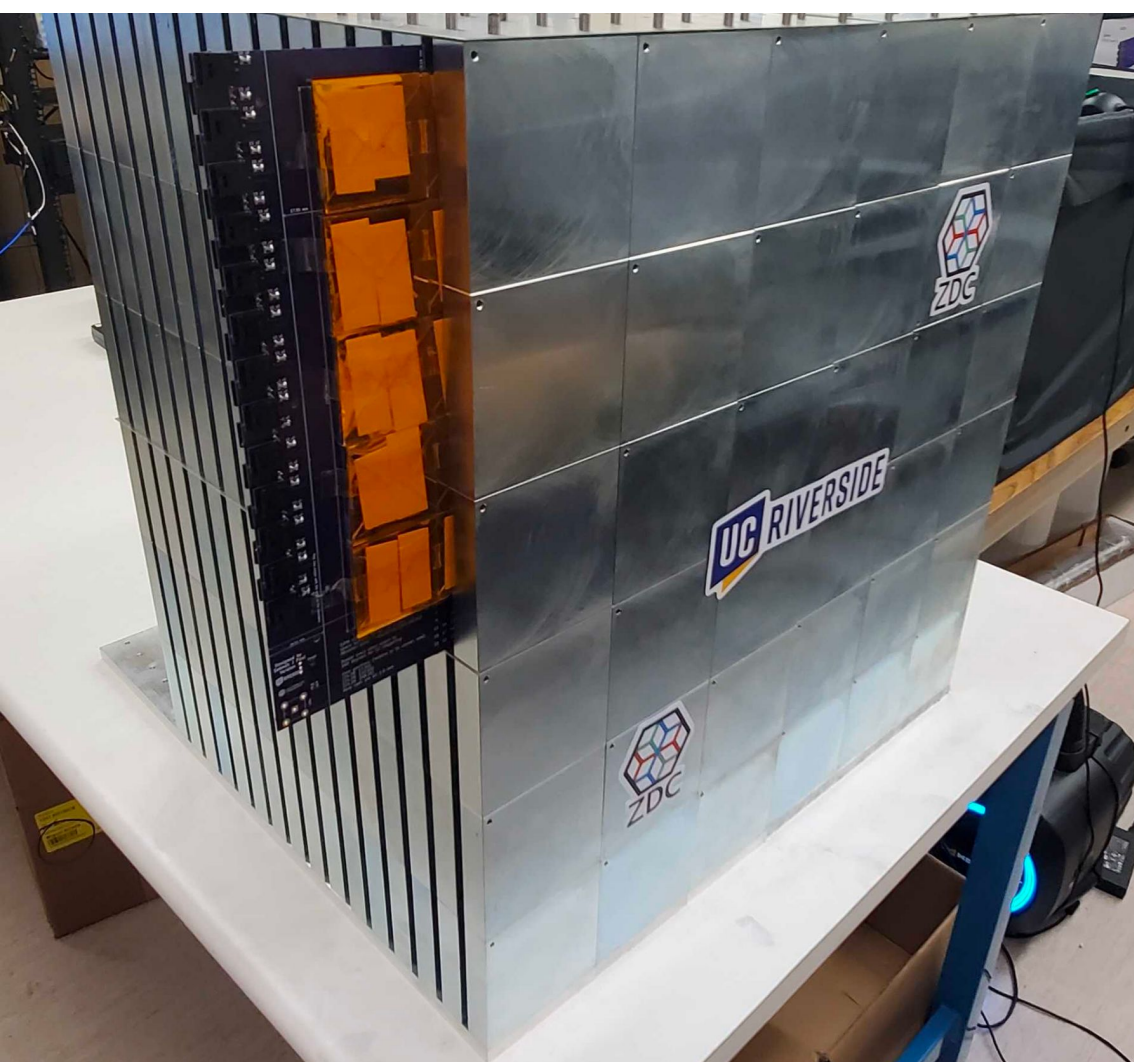


QA with SiPM IV and cosmic rays



PCB slides into place between absorbers





Preview of full-size ZDC

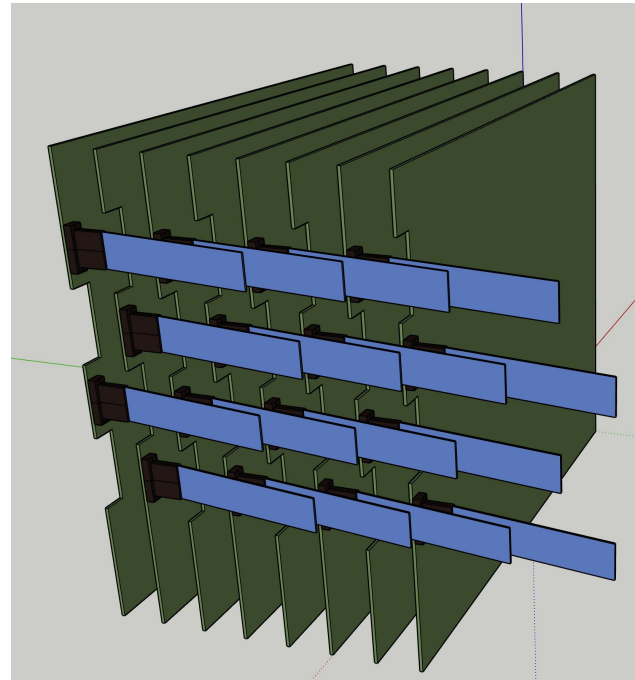
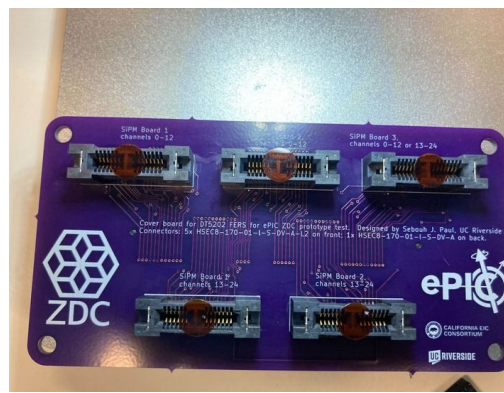


Transfer board

Connects FERS unit to ribbon cables going to SiPM boards:

1 CAEN FERS services 2.5 SiPM boards.

Compatible with HGROC boards

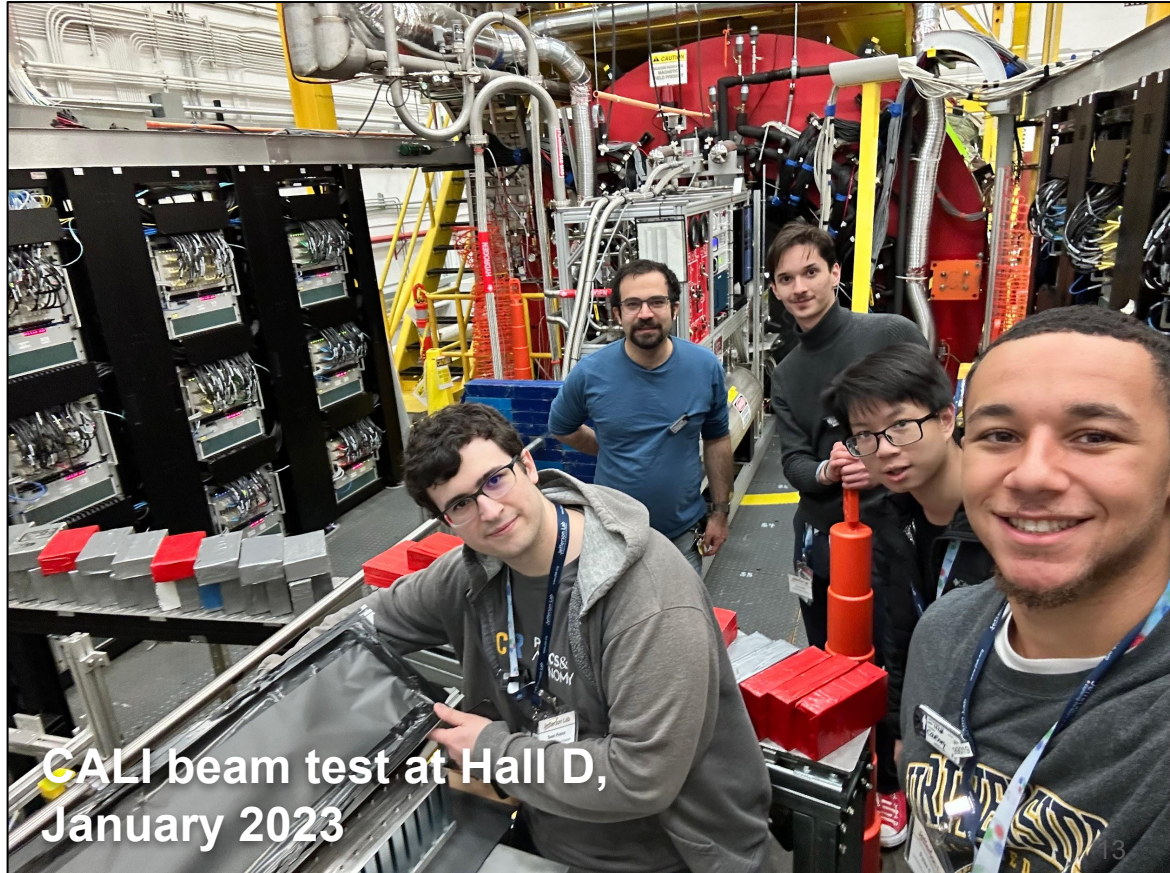


Conclusions/Summary

A ZDC prototype is being constructed at UCR, to be used in an e^+ beam test, Fall 2024 at JLab's Hall D.

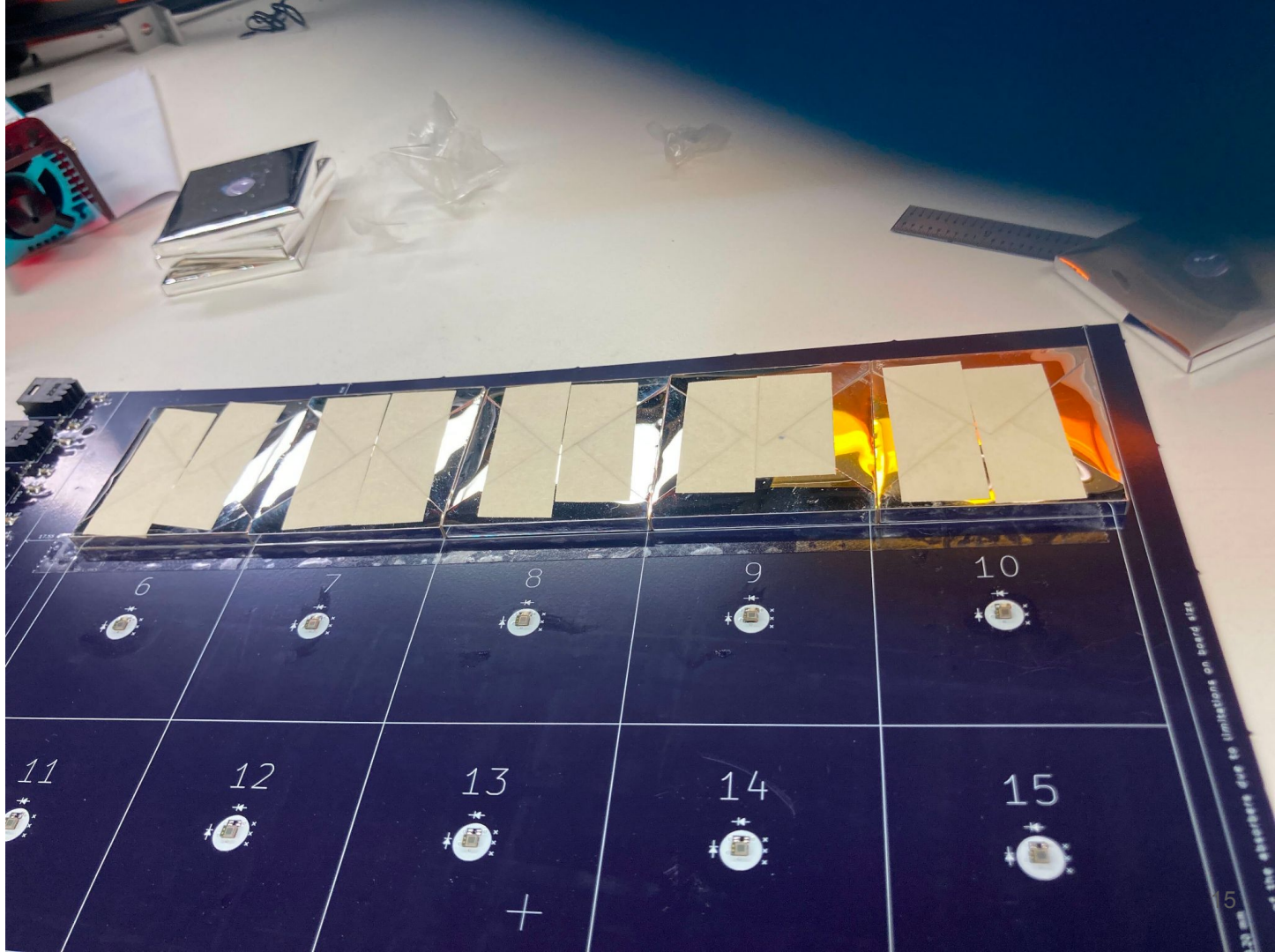
Goals:

- EM scale and resolution
- Position resolution with staggered design
- Uniformity
- 3D shower shapes



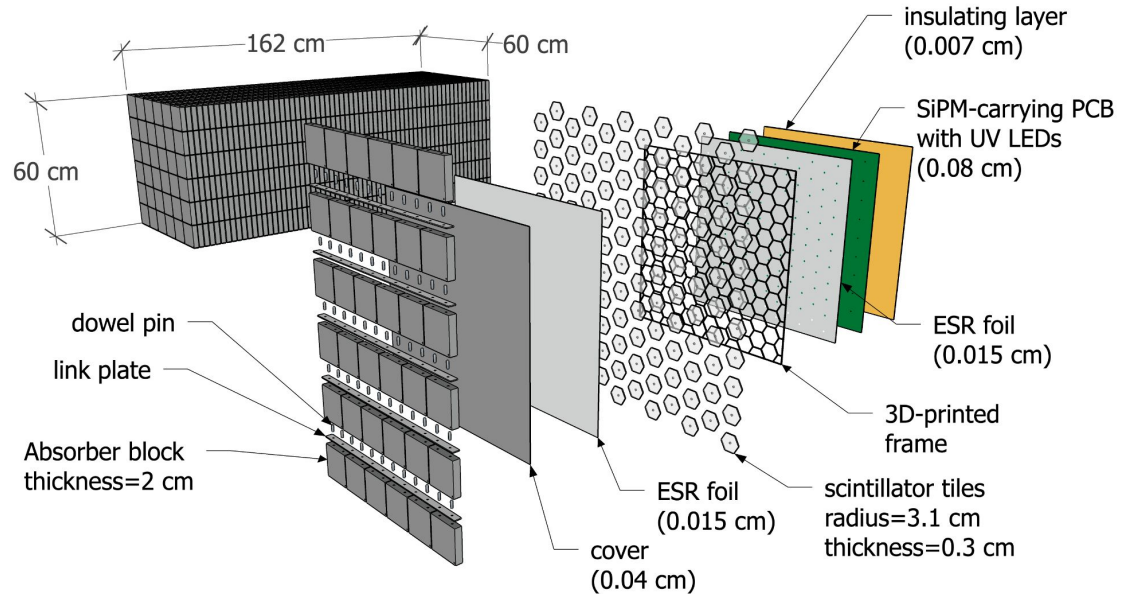
Backup slides

ESR-foil covered tiles are taped to the PCB board



Zero-degree calorimeter

- Located ~35 m downstream of target along proton-beam direction
- Detects neutral particles
- Uses SiPM-on-tile technology similar to forward Hcal insert
- Self-supporting structure with stainless steel absorbers, repurposed from STAR experiment



Staggered design

- Cycles through four layouts of hexagonal tessellations
- Improves position resolution of detector through higher effective granularity

