

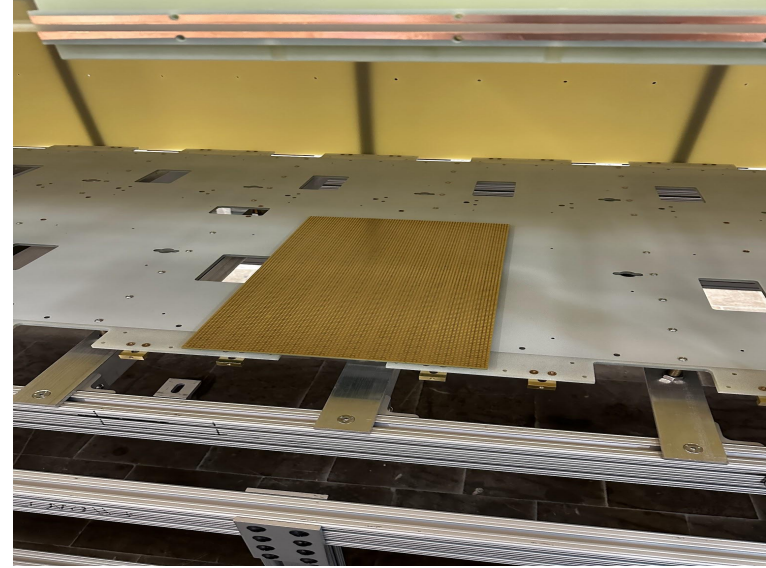
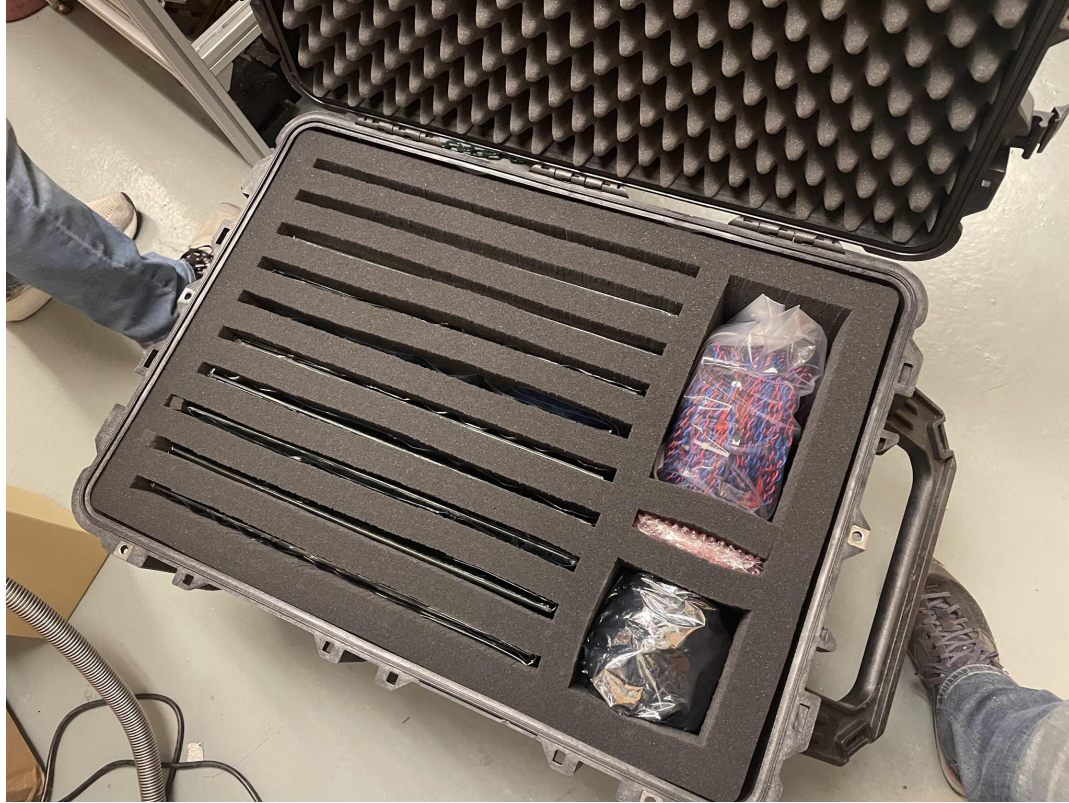
A close-up photograph of a person's hand wearing a white nitrile glove, resting on a metallic surface. The background is a blurred industrial or laboratory setting with yellowish walls and metal structures.

FSD Assembly Update

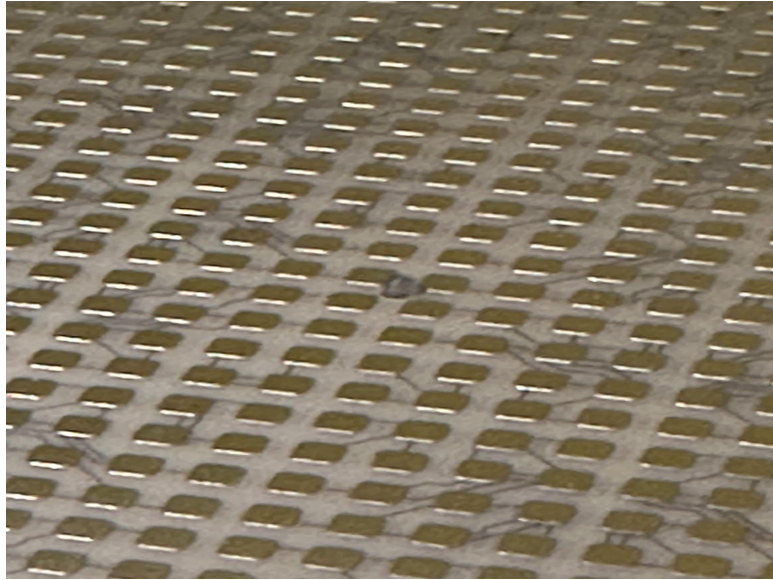
Andrew Lambert on behalf of FSD Assembly Team

ND-LAr Consortium Bi-Weekly Meeting

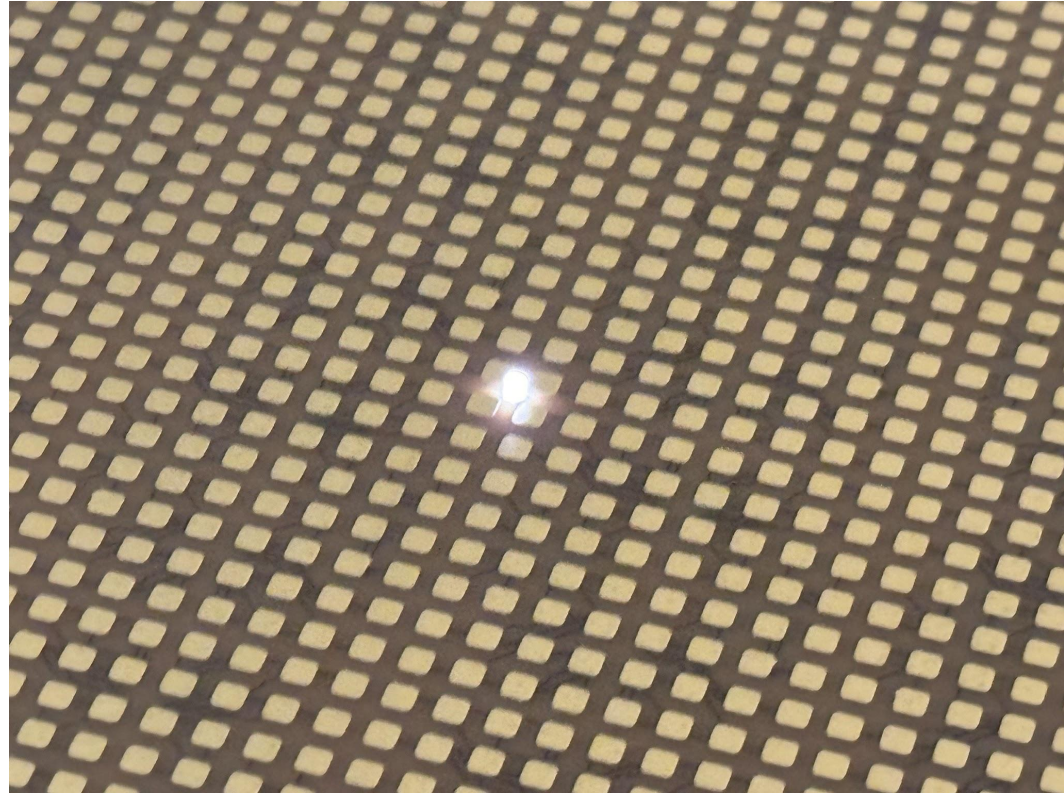
September 26th, 2024

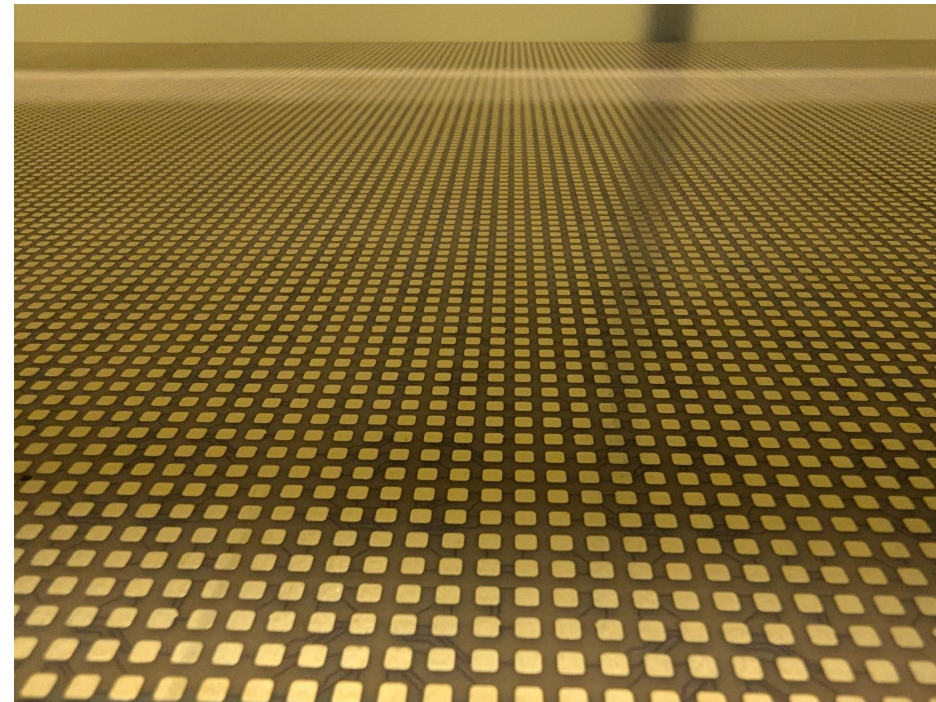


- First batch of 10 charge tiles with cables and pacman board arrived
- Test fit of first tile on the anode panel

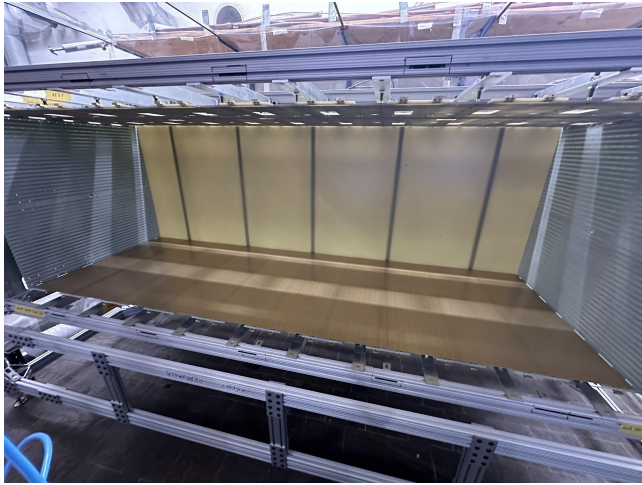


Test of LED hole for light readout calibration

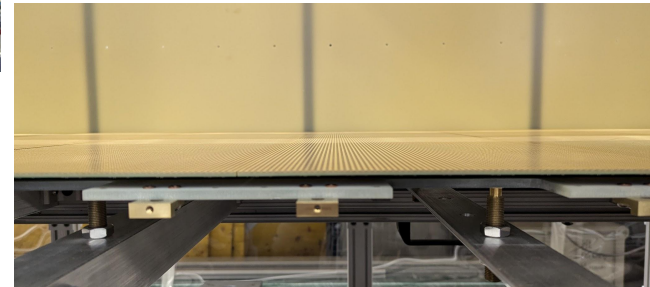
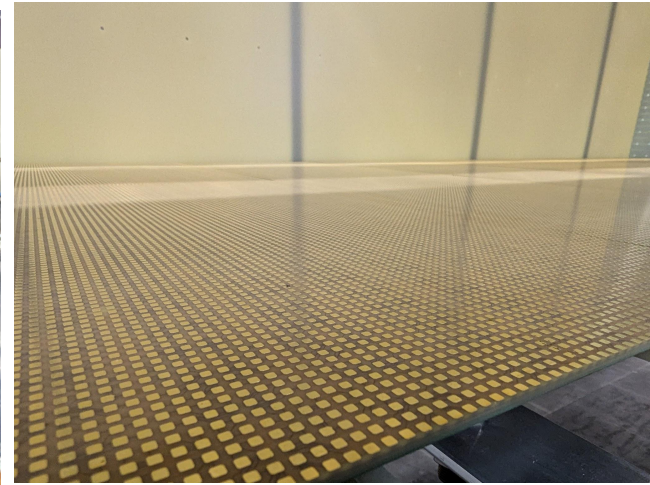
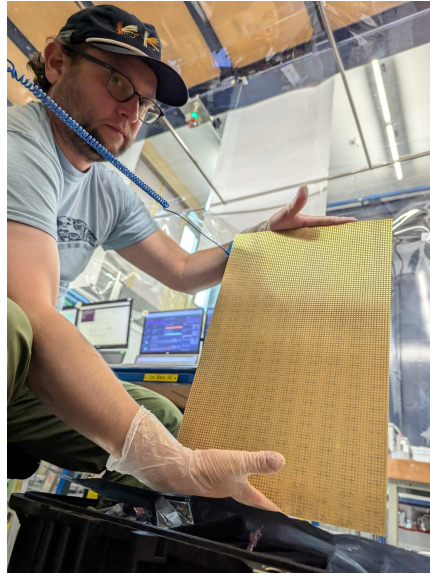


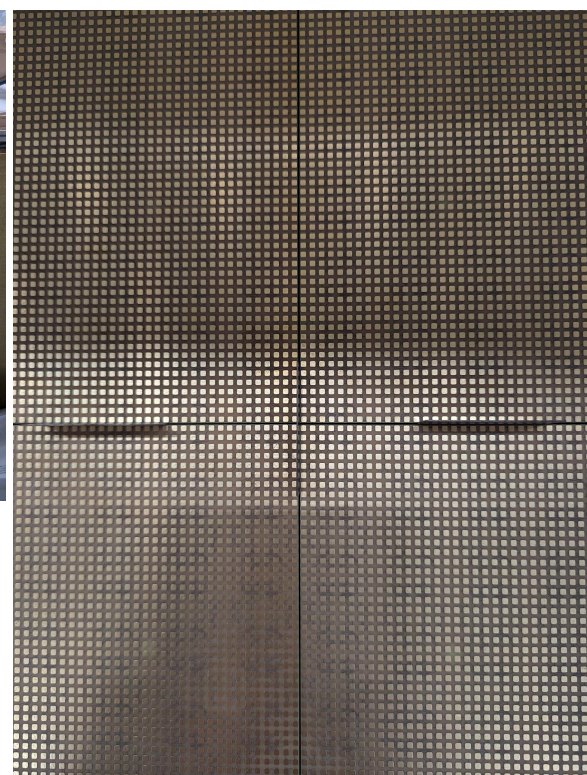
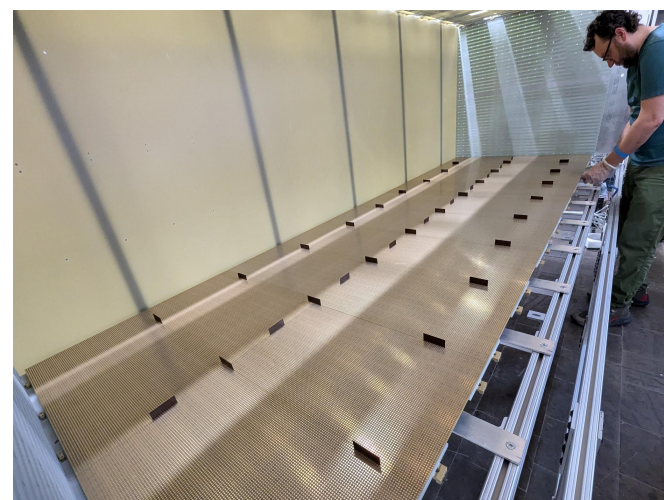


- Started installation of first anode
 - 10 tiles installed in a single column -> 10,240 channels per tile



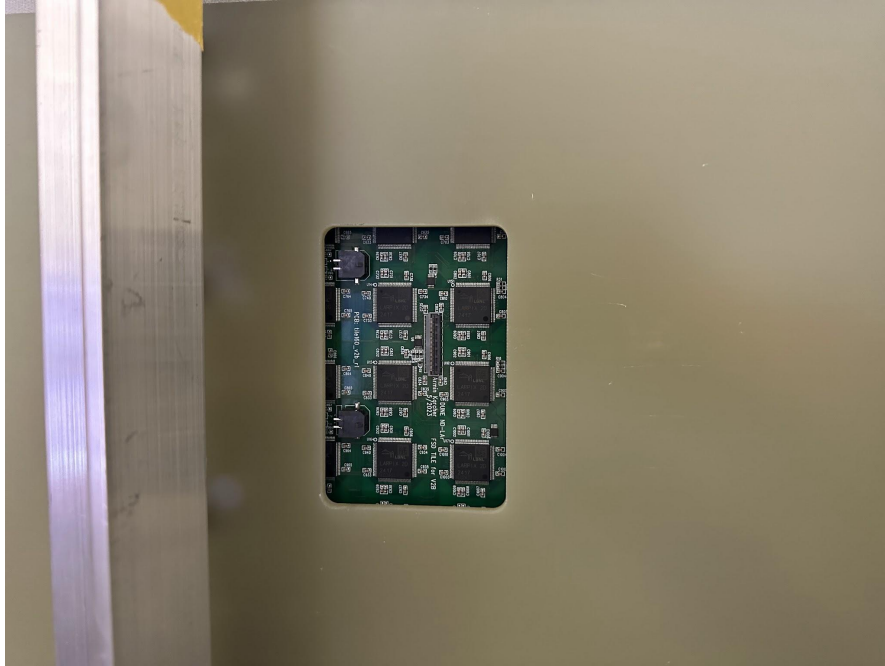
- Completed installation of first anode!
- All tiles visually inspected prior to installation (cold tested at LBNL prior to shipment)
- All bolts torqued to 1.0 N-m
- Expecting a full anode can be installed, aligned and torqued in 1 day





- 0.5 mm thick shims used to control tile spacing and perform alignment
- Anode covered with ESD film for protection (both dust and electrostatic)

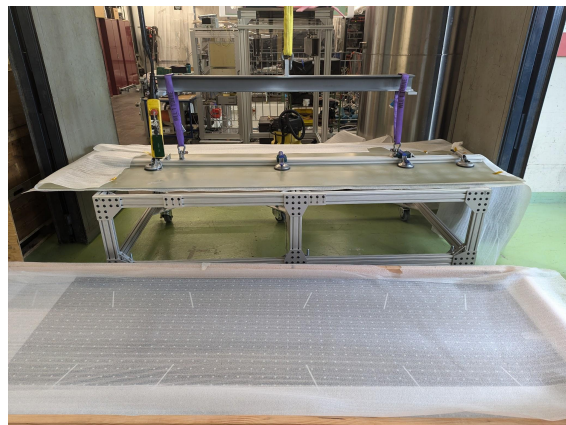
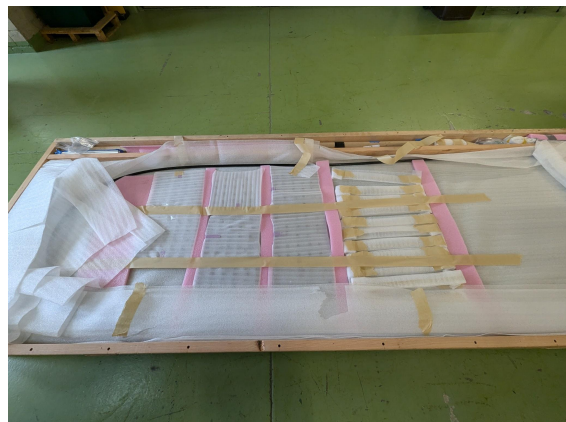




- Anode cutouts for tile cables - power and data cables routed on backside of the anode panel
- Also LRO, temp sensor, and calibration cables/fibers are routed on the backside -> will get busy!



- Tested field cage handling on dummy module with suction cups connected to crane
 - Keep field shell very flat during lifting operations
 - Makes handling much easier and reduces risk



- Remaining charge tiles, cables, pacman and power supplies arrived from LBNL
- Cathode, HV FT parts arrived from SLAC
- Targets for charge calibration arrived from U Hawaii

Week September 16th-20th

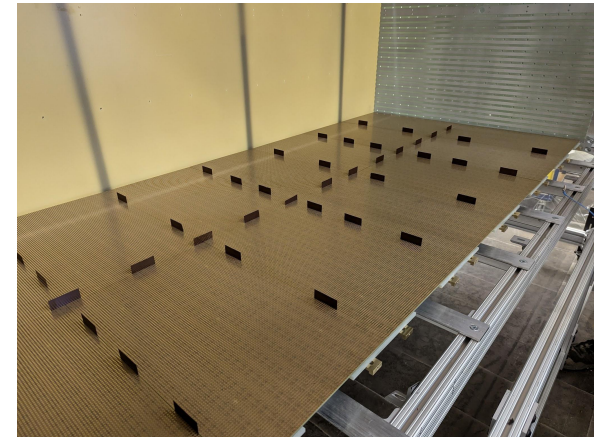
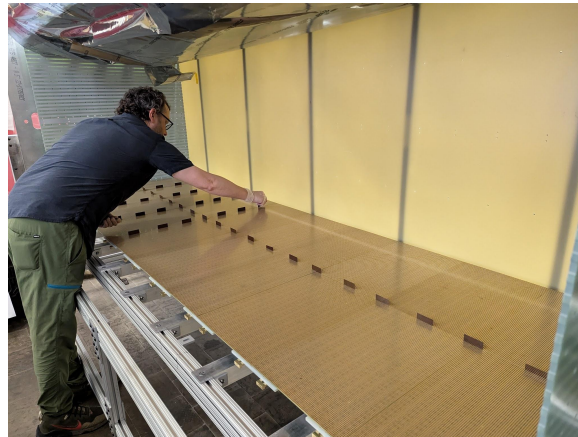


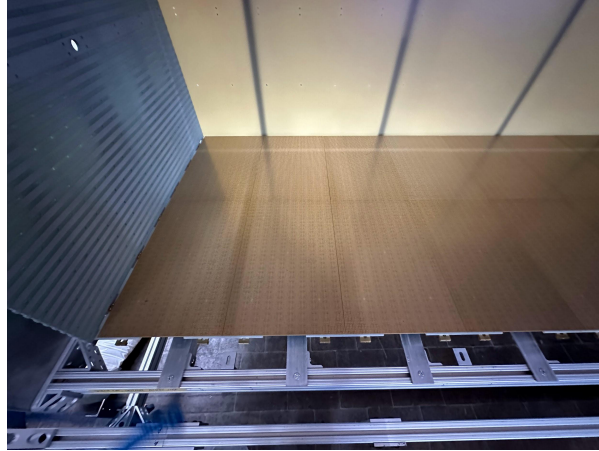
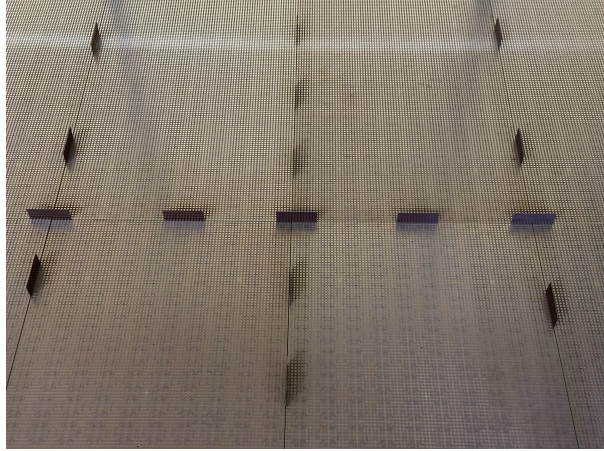
- Cathode unpacked and transferred to foam padded carts in Grosslabor
- Cathode brackets and HV socket installed
- Targets gluing and cathode installation to take place the following week



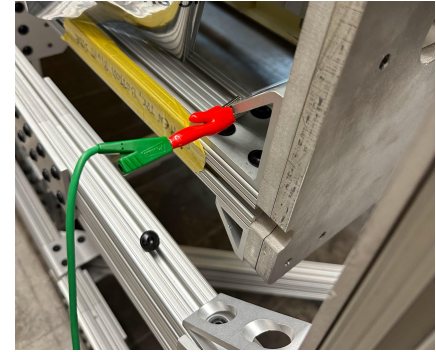


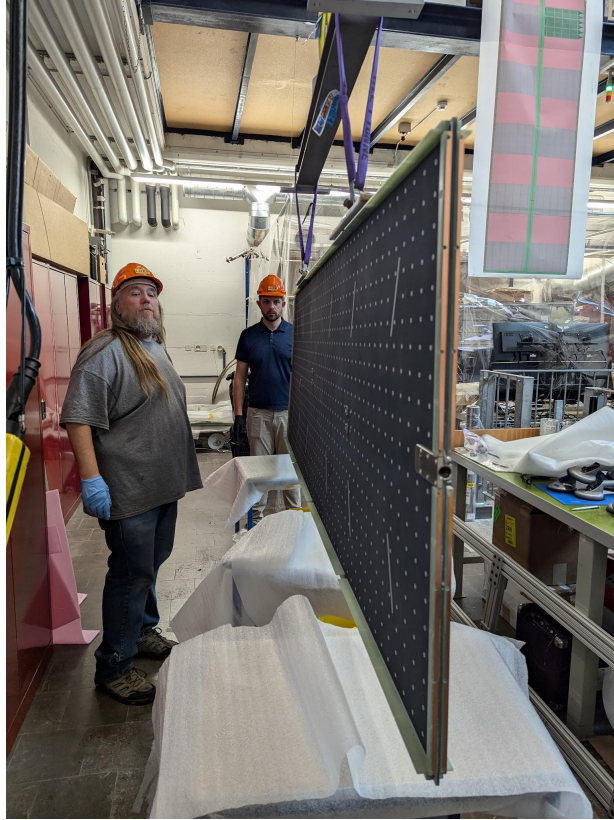
- Frame rotated and 2nd anode plane tiles installed today
- ESD shield installed also on the back of anode plane
- Shims between tiles placed in preparation for final alignment and bolt torquing next week



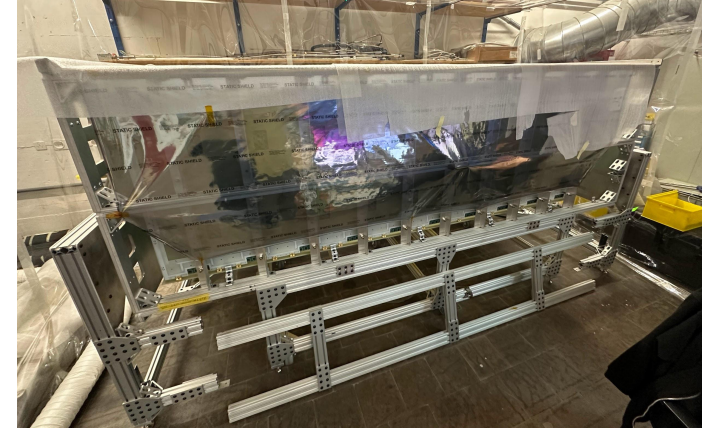


- Completed final alignment of pixel tiles on 2nd anode panel
- Covered completed anode and pixel tile assembly with ESD protective film
 - Both anode assemblies are covered with ESD protective film and the assembly frame is grounded to the building
- Installed 409,600 CRO channels... entire 2x2 has 337,600 CRO channels

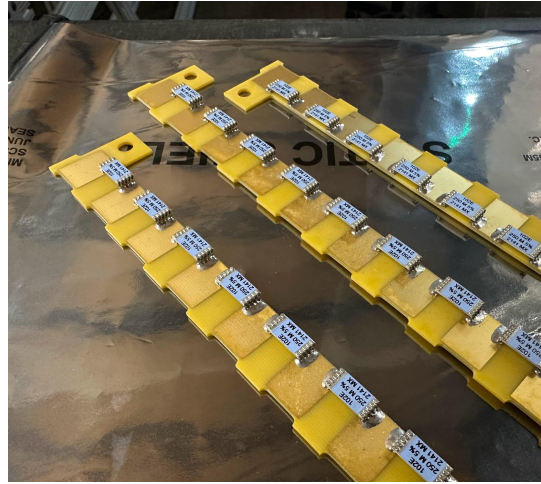
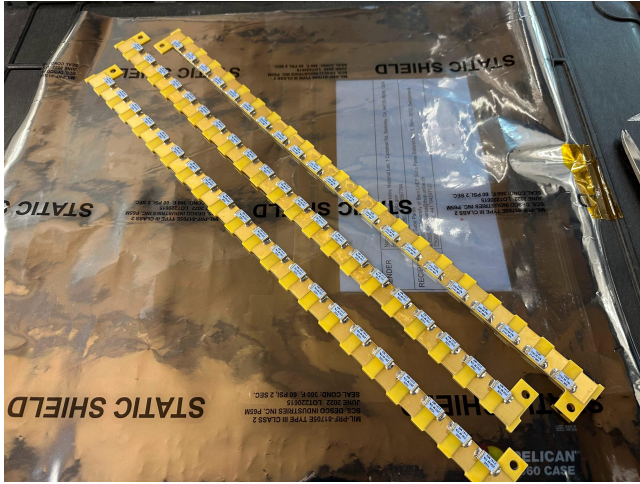




- Applied approved torque to PEEK bolts on cathode
- Rigged cathode for insertion to the TPC using spreader bar and slings
 - Slings are kept vertical (0 deg angle) to not impart an lateral loads to cathode
- HV socket is visible at the top of the cathode
- Copper strips on brackets also visible

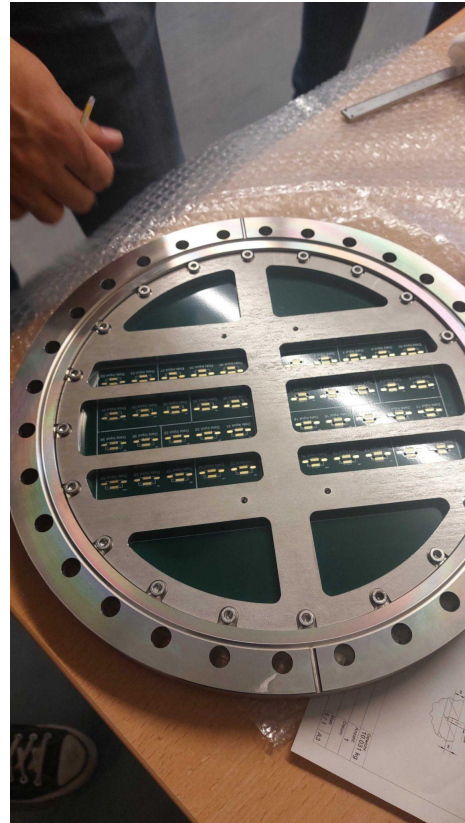
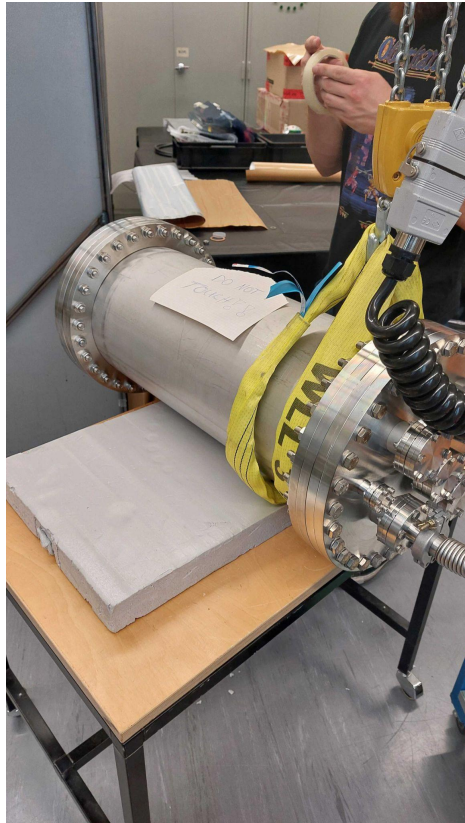


- Cathode is installed to the TPC main body, notice ESD protective film on anodes
- TPC wheeled back into tent and covered with foam wrapping to protect against dust

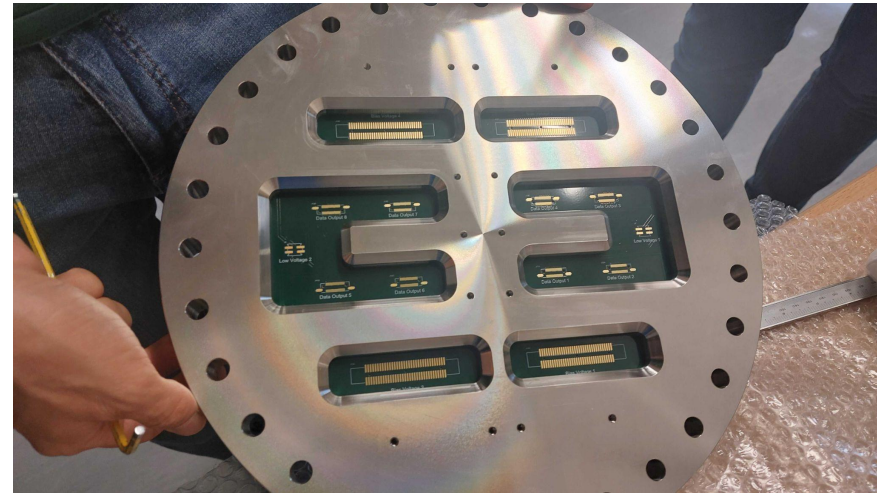


- Visual inspection of resistor boards for Field Shell
 - Also verified functionality
- ADCs and VGAs are in the VME crate
 - VGAs tested and ready
 - ADCs to be tested & software upgraded



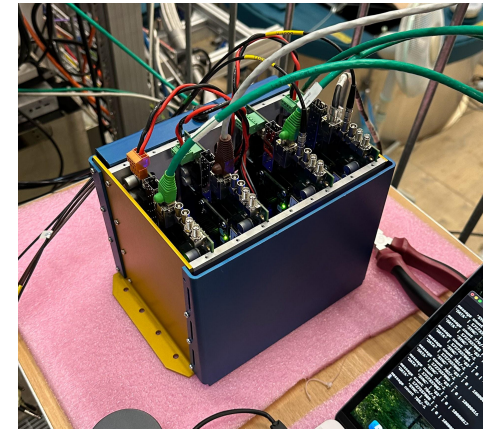


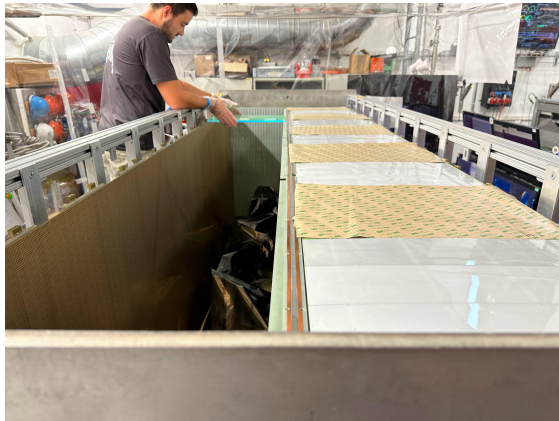
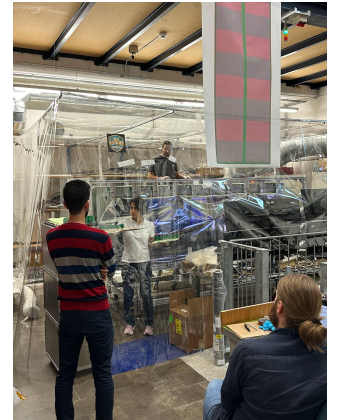
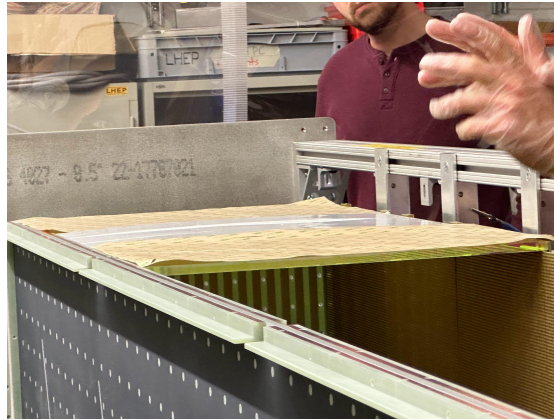
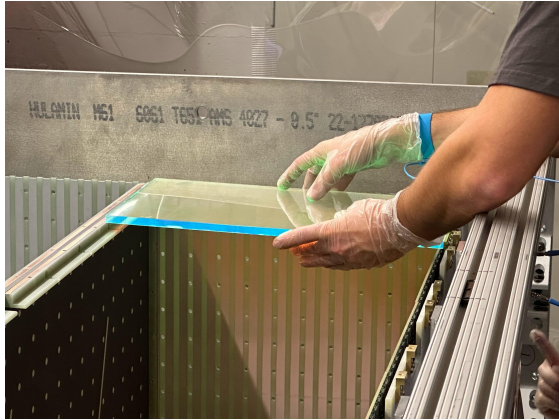
- Light Readout feedthrough both leak and pressure tested
 - Leak tight
 - Pressure tight
- Ready for TPC assembly





- PACMAN electronics enclosure is assembled
 - All 4 PACMAN under test
- All Cold LRO PCBs assembled!





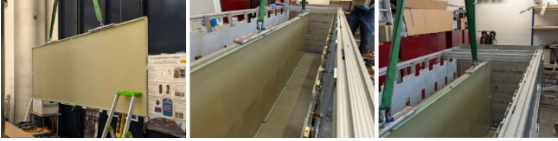
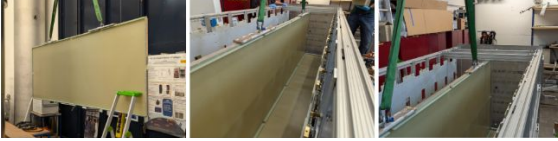


- Installation of 10X ArCLight and 10X LCM completed!
 - Easy installation, all bolts torqued
 - 120 SiPMs installed, next 120 SiPMs installed 9/27
 - 240 total in FSD



- 4X Resistor PCBs installed to Top/Bottom Field Shell Panels
 - Contact clips installed prior to side panel installation (9/27)

FSD Lessons Learned

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Index	Event Type (Positive or Negative)	Description of the Event	Effects of the Event	Installation Phase	Solution	Photos											
1	Positive	Correct order to put together the module assembly frame	Following the right order makes the frame assembly much easier	Preparations of frames for module assembly	1) Assemble lateral walls 2) Set the front side vertical (can align it vertical) and tie to something so that it stays vertical 3) Attach each lateral side, using cribbing to keep them at the right height 4) Bring back side in place and attach to sides												
2	Positive	Use 8020 bars wrapped in plastic or covered with foam or a low-friction plastic (like Teflon) when inserting anode planes in the assembly frame	Makes anode plane insertion easier and safer for the plane itself, minimizing the chances of plane excessive bending	Module assembly	Install 8020 bars with the long edge vertical and covered in foam, or a low-friction plastic. Bars have to stick out from the frame at least 0.5 or 1 meter. Brass standoffs have to be lowered so that the 8020 bars are higher than them. Anyway the final standoff height has to be higher than the 8020 one, to allow transfer of the plane from bars to standoffs. Anode plane will first be sit on top of the bars outside of the frame, than slide along the bars into the frame.												
3	Positive	Installing brass blocks on anode plane with screw not fully tightened	Makes installation of side, top and bottom field cages much easier	Module assembly	When installing brass blocks on the anode planes, do not tighten the screws completely. Leaving them a bit wiggle will make field cage installation easier. Tighten them after corresponding field cage is in place												
4	Positive	Cathode, top and bottom field cages installation outside of the assembly frame to allow for cathode installation with the crane	Easier, and safer installation of the cathode, minimizing chances of cathode excessive bending	Module assembly	After the first side field cage panel is installed, take frame out of the assembly cradle and back on the handling frame to allow installation of the cathode with the crane from the top. This avoids the need for installing the cathode horizontally, which makes it more challenging not bending it during the installation process												

- Cataloging all Lessons Learned from FSD preparation and assembly process, capturing positive, neutral, and negative issues/event and proposing solutions/mitigations
 - To be presented and discussed post FSD

FSD Live Schedule - Targeting Operations in October

FSD Assembly and Test Schedule			7/22	106	11/5																												
ND-LAr Consortium			Start Date 7/22																														
Prepared by: Andrew Lambert			Display Week 9																														
Task	Progress	Start	Days	End	09/16/2024 09/23/2024 09/30/2024 10/07/2024 10/14/2024 10/21/2024 10/28/2024 11/04/2024 11/11/2024 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W																												
<input type="checkbox"/> FSD TPC Assembly	35%	9/11	30	10/11																													
<input type="checkbox"/> Anode Panel #1 Install	100%	9/11	1	9/11																													
<input type="checkbox"/> Anode Panel #2 Install	100%	9/11	1	9/11																													
<input type="checkbox"/> Install Anode Panel #2 Pixel Tiles	100%	9/17	1	9/17																													
<input type="checkbox"/> Install Anode Panel #1 Pixel Tiles	100%	9/20	1	9/20																													
<input type="checkbox"/> Dummy Field Cage Side Panel Install	100%	9/21	1	9/21																													
<input type="checkbox"/> Cathode Assembly and Installation	100%	9/23	1	9/23																													
<input type="checkbox"/> Top and Bottom Field Cage Install	100%	9/23	1	9/23																													
<input type="checkbox"/> Light Tile Array #1 Install	0%	9/25	2	9/26																													
<input type="checkbox"/> Field Cage Side Panel #1 Install	0%	9/26	1	9/26																													
<input type="checkbox"/> Light Tile Array #2 Install	0%	9/27	1	9/27																													
<input type="checkbox"/> Field Cage Side Panel #2 Install	0%	9/30	1	9/30																													
<input type="checkbox"/> Install Upper Field Structures and Module Structures	0%	10/1	1	10/1																													
<input type="checkbox"/> Cable All Pixel and Light Tiles and Perform Checks	0%	10/2	2	10/3																													
<input type="checkbox"/> Install Calibration Hardware?	0%	10/4	1	10/4																													
<input type="checkbox"/> Rotate FSD TPC	0%	10/7	1	10/7																													
<input type="checkbox"/> Install FSD Cryostat Lid and Transfer to Cryostat	0%	10/7	1	10/7																													
<input type="checkbox"/> MS: FSD Fixture Work Complete, TPC in Cryostat	0%	10/7	0	10/7																													
<input type="checkbox"/> Final Cabling of TPC, Install Feedthroughs	0%	10/8	2	10/9																													
<input type="checkbox"/> Warm Commissioning	0%	10/10	2	10/11																													
<input type="checkbox"/> MS: Warm Comm. Complete, Ready for Cryo Ops	0%	10/11	0	10/11																													
<input type="checkbox"/> FSD TPC Cryogenic Operations		10/12	24	11/5																													
<input type="checkbox"/> Evacuation	0%	10/12	3	10/14																													
<input type="checkbox"/> Cooldown and Fill	0%	10/15	2	10/16																													
<input type="checkbox"/> MS: FSD Run 1 Ready to Begin Operations	0%	10/16	0	10/16																													
<input type="checkbox"/> FSD TPC Operations Run 1	0%	10/17	10	10/26																													
<input type="checkbox"/> Drain and Warmup	0%	10/27	5	10/31																													
<input type="checkbox"/> Extract FSD TPC	0%	11/1	5	11/5																													
<input type="checkbox"/> MS: FSD Run 1 Complete	0%	11/5	0	11/5																													

Summary

- FSD Assembly is underway and going well - many thanks to UniBe LHEP team for preparing the FSD Facility and hosting visitors!
 - Gratitude to all the folks that have traveled here to assist with assembly
 - Thanks as well to those assisting from remote locations by answer questions and shipping spare hardware
 - It has been a huge help to have these contributions!!!
- Collecting Lessons Learned to be incorporated into ND module production
 - Spreadsheet is organized and owned by Roberto Acciarri
- Daily toolbox meeting to plan each day's activities - chaired by Serhan Tufanli, 9AM Bern Time
 - Keep track of who is doing what and where -> personnel and detector safety
 - Zoom link: please email serhan.tufanli@unibe.ch, acciarri@fnal.gov, or arlambert@lbl.gov to request Zoom coordinates/link
- Subscribe to the #fsd-operations Slack channel to follow daily progress:
 - <https://dunescience.slack.com/archives/C07FRD20B4K>
- Overall the progress is holding to schedule and barring future issues we expect to run the FSD this October

Greetings from Bern!!

