

HYCAL STATUS

PRAD COLLABORATION MEETING



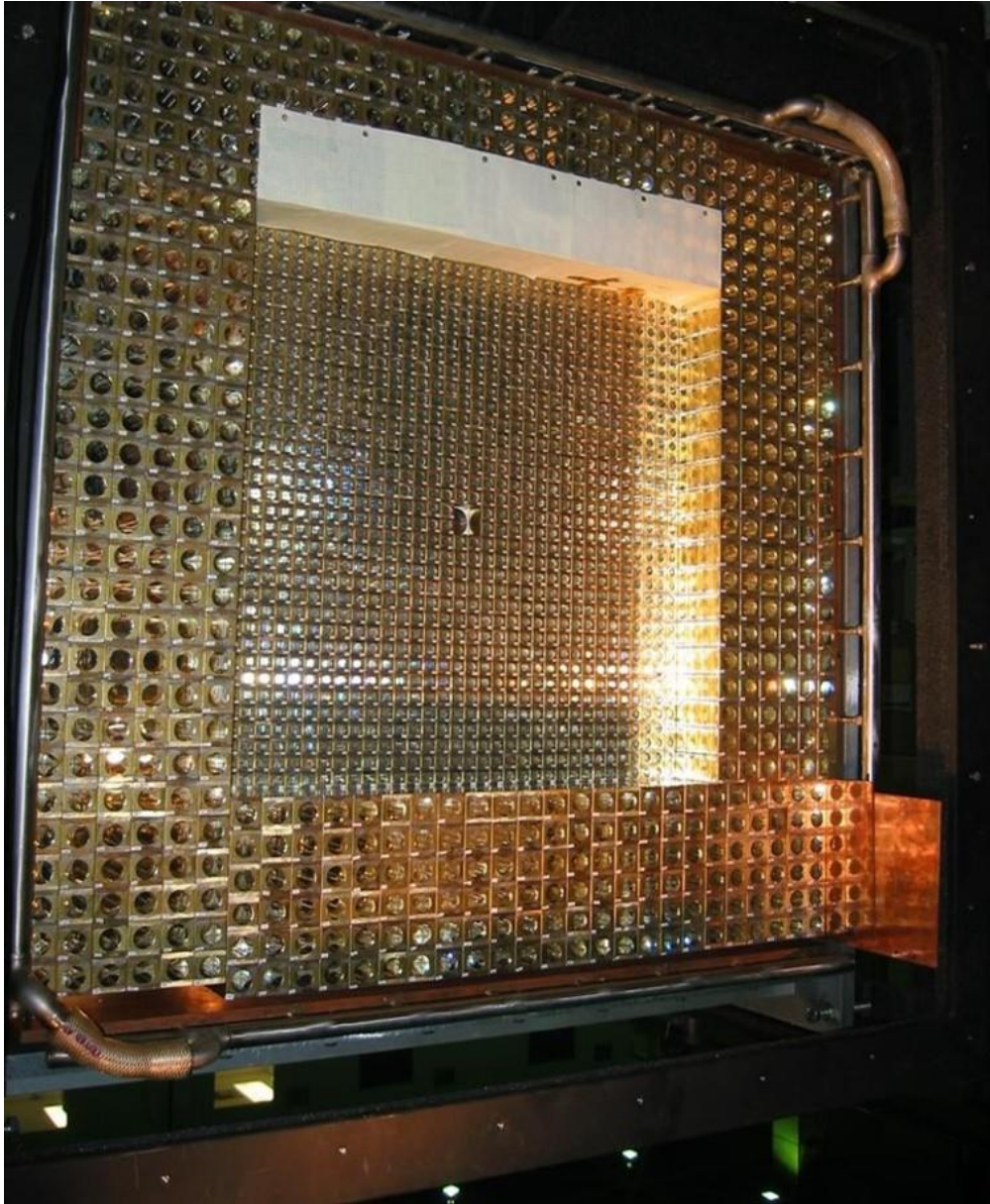
MISSISSIPPI STATE UNIVERSITY™
DEPARTMENT OF PHYSICS
AND ASTRONOMY

PR^oton
Radius



OUTLINE

- Overview
- Crystal Section Status
- Temperature Monitoring System
- Moisture Interlock and Leak Repairs
- Chiller Test Status
- Multi-channel Testing
- Future Work



HYBRID CALORIMETER (HYCAL)

- 1152 PbWO_4 $2.05 \times 2.05 \text{ cm}^2$ by 18 cm long crystals
 - Collect energy deposition via scintillation.
- 576 PbO -doped $3.85 \times 3.85 \text{ cm}^2$ by 45 cm long glass modules
 - Collect energy deposition via Cherenkov radiation.
- Only the central crystal section is planned to be used for the upcoming experiments.
- Has a Light Monitoring System used for calibration that puts an LED signal out to every module along with having reference detectors.
- Radiative cooling from chilled copper plates and fan system.

HyCal Layout (Module ID Notation) [Front View - PbWO4 ONLY] LMS																																		
1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	
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Legend	
	Bad
	Issue
	Good

For Reference W1 = 1001 so W# = 1000+#

CRYSTAL STATUS REMINDER

- All but 1 crystal module are in proper working order after repairs were completed.
- Trying to remove the PMT from this crystal may be too risky due to the crowding and potential to damage other modules.

TEMPERATURE MONITORING SENSORS

- 34 Temperature Sensors Dispersed across HyCal
 - 12 are across the detector face
 - 8 are on the cooling plates
 - The rest are on various cooling lines and electronics/PMTs in the back of HyCal
- Sensors are calibrated to a $10\text{mV}/^{\circ}\text{C}$ linear relationship
- Well suited for a $-40^{\circ}\text{C} - 110^{\circ}\text{C}$ range and we are aiming to steadily maintain 17°C
- They require a voltage supply between 4 – 30V. Testing was done with a 5V supply.
- Will cover observed performance later.



TEMPERATURE READOUT



9/12/2025

- We have a NI-cRIO system with NI-9205 and NI-9201 for the readout system.
- Programmed in LabView with the help of Nathan and can now read all channels out to EPICs.
- Samples each sensor at a rate of 1 Hz
- Potentially mount below HyCal in the former Dynode Summation Rack.

Jefferson Lab
Thomas Jefferson National Accelerator Facility

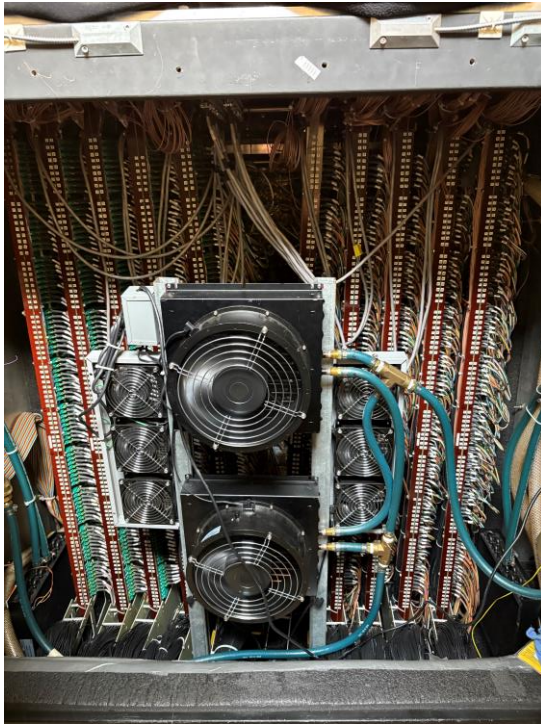


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CHILLERS

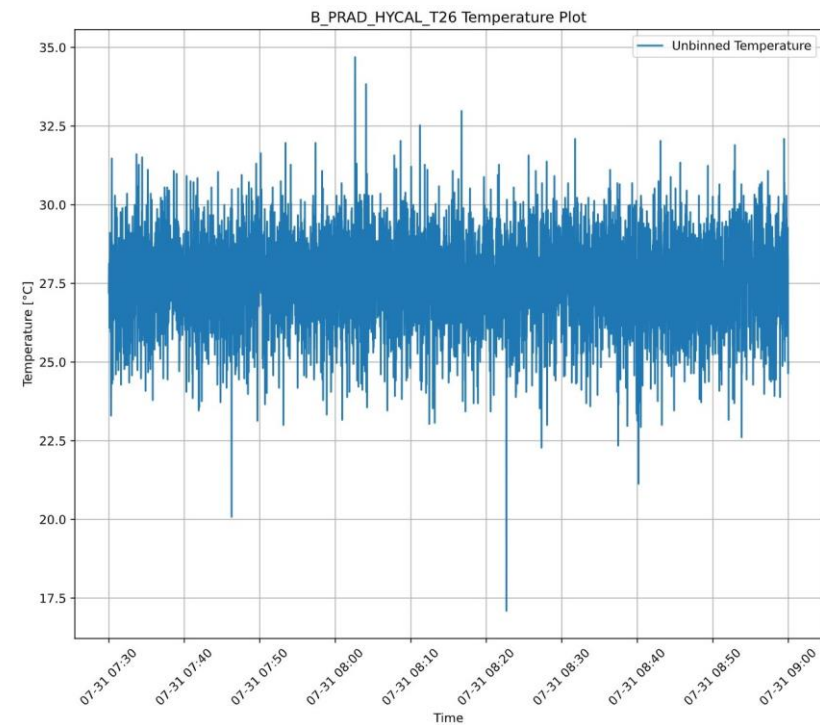
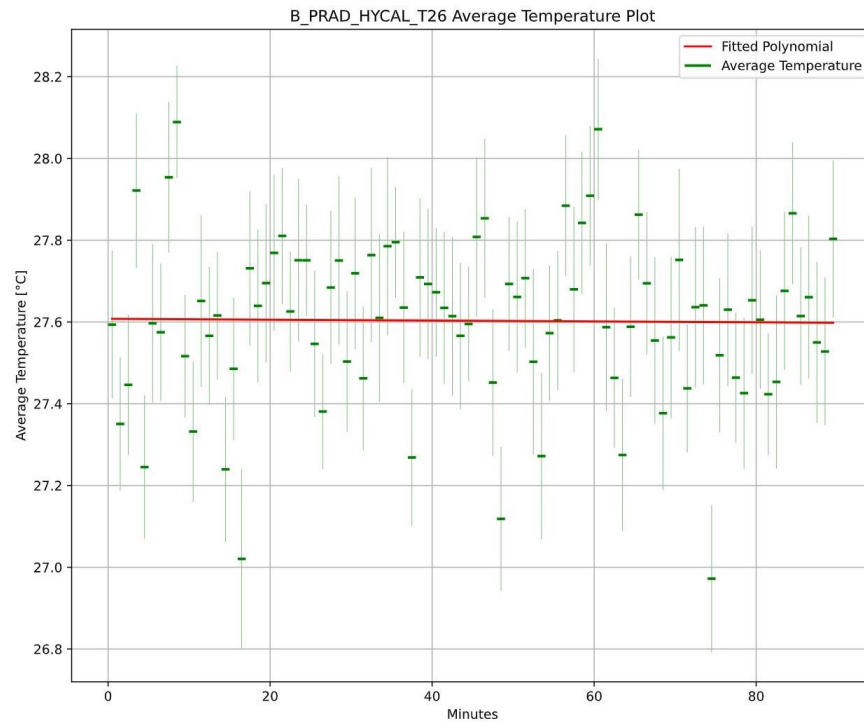
- New Delta T Systems Model VSPA-002 as the primary HyCal Chiller.
- Original Affinity Model FAA-015D-DD01CA as backup.
- Krister recommissioned the leak interlock system that consists of a wicking cable throughout HyCal, and it works very well.





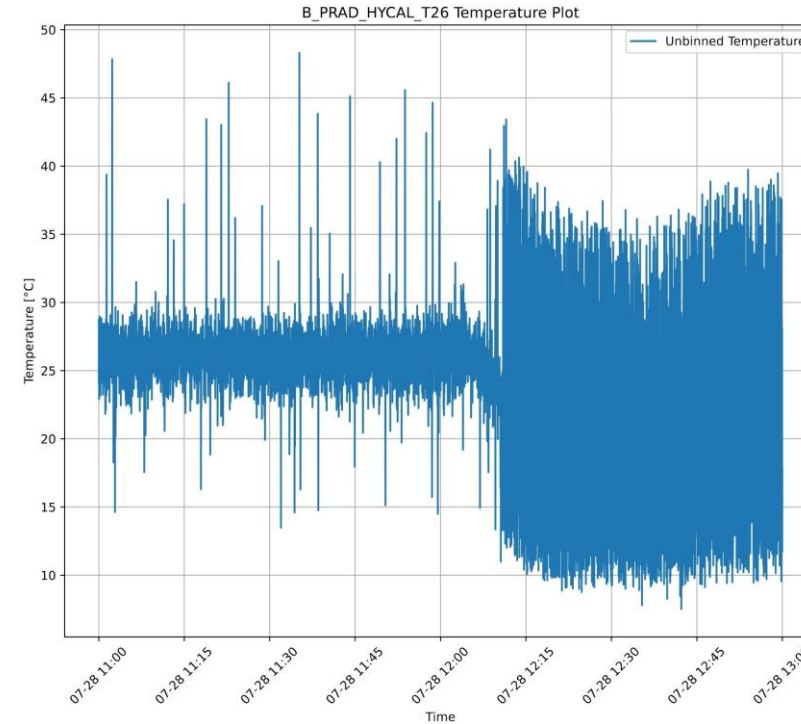
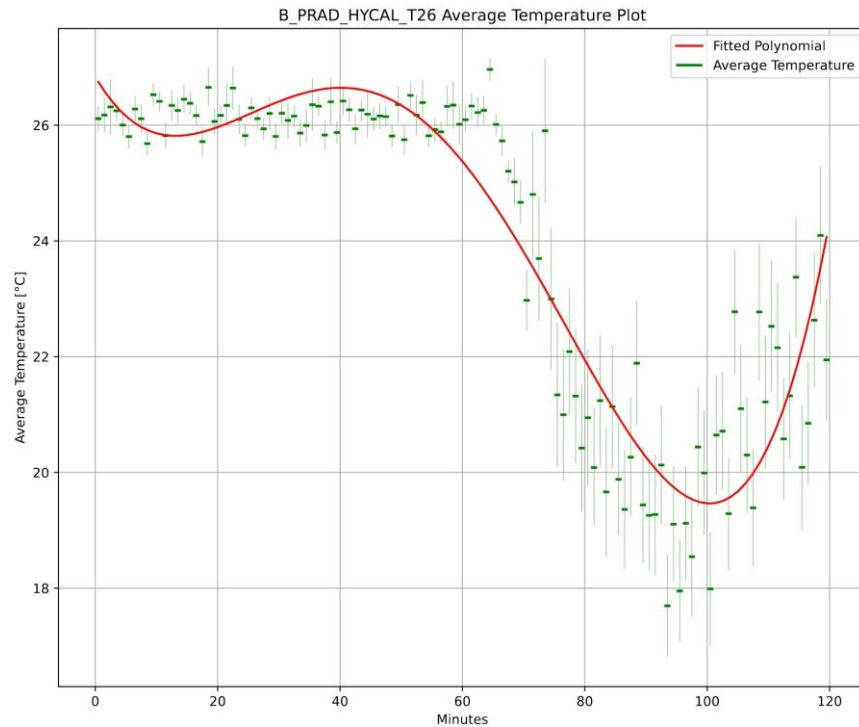
CHILLER TEST

- Initially multiple leaks were found at the various braze joints.
- These were sealed by Steve and Dontre.
- Now we are prepping a test under Nitrogen purge.
- The fan system works well.



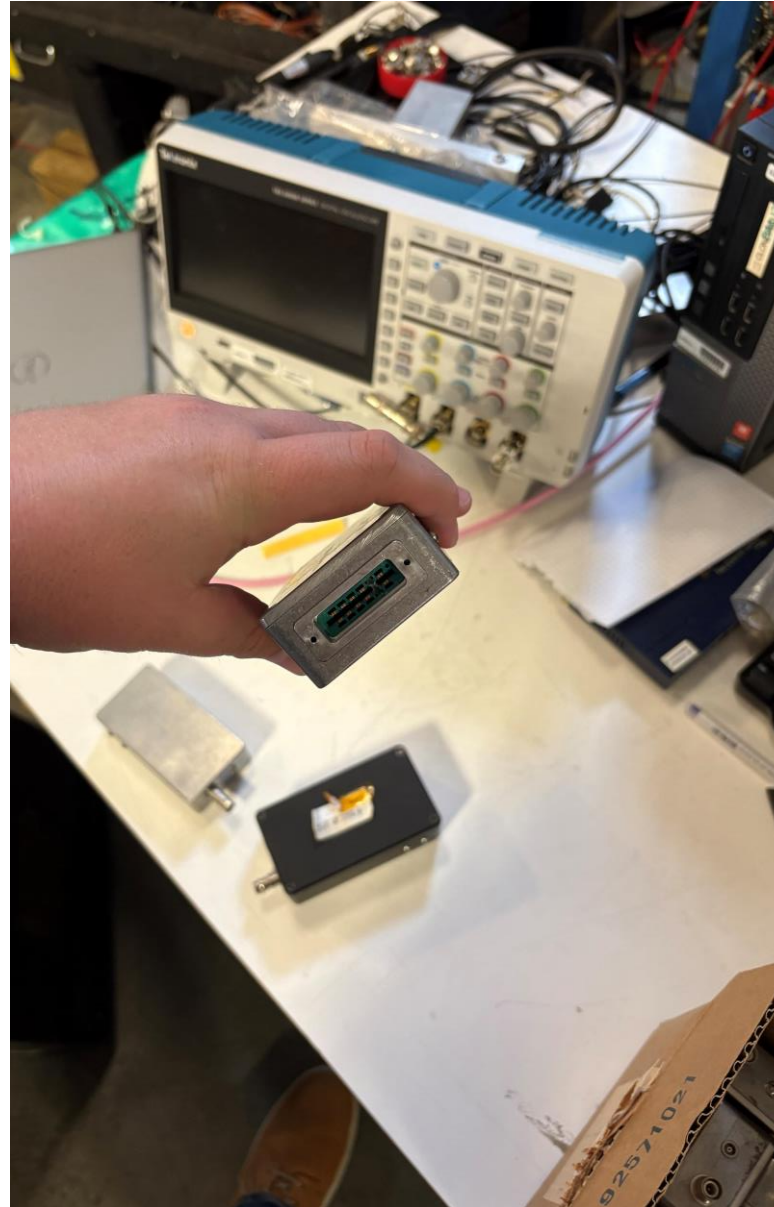
SENSOR BEHAVIOR

- The right plot shows the raw data from one of the sensors on a copper plate while the system was at the ambient temperature in the ESB over 1.5 hours.
- The left plot shows the same data binned by the minute with the statistical error.



MONITORING DURING COOLING

- There was a ~40-minute period where the chiller worked prior to tripping.
- Here we can see the same sensor being sensitive to the temperature change.



9/12/2025

MULTICHANNEL TESTING

- All manufacturing of the 15 (+ the 1 existing) pass through modules has been completed.
- There are 2 HV boards in the ESB ready for our use.
- We have 3 fADC Boards out at the ESB.
- Upon the conclusion of the Chiller Test, we are prepared to move forward with testing of 4x4 blocks of crystals to ensure the multichannel firing capabilities of the DAQ.



FUTURE HYCAL WORK

- As fADCs are installed in Hall B, we need to cable them according to the new mapping.
- We will also need cable supports and management trays to not have them damaged from the weight.
- HyCal needs to be moved to the hall and cabled in place.
- Preparations need to be made on the transporter.
- The power needs to be restored to outlets aboard HyCal for the fans, and temperature monitoring.

ACKNOWLEDGEMENTS



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ENERGY

Office of Science

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- Dr. Aruni Naadesani, Mississippi State
- Buddhiman Tamang, Mississippi State
- Hall B Staff/Technicians
- PRad Collaborators

QUESTIONS?