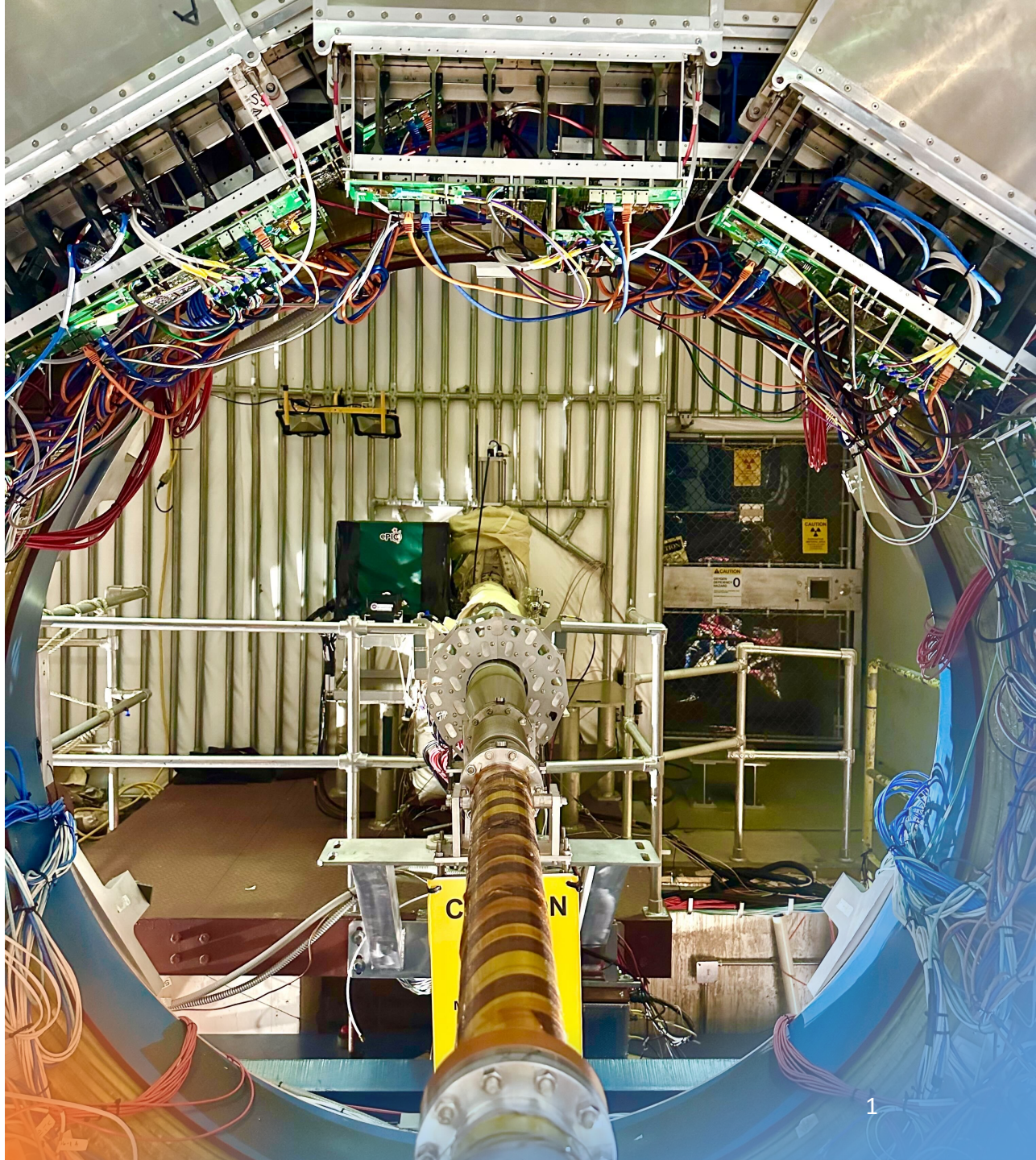
Calorimeter Insert Prototype Test at RHIC

Sean Preins

University of California, Riverside

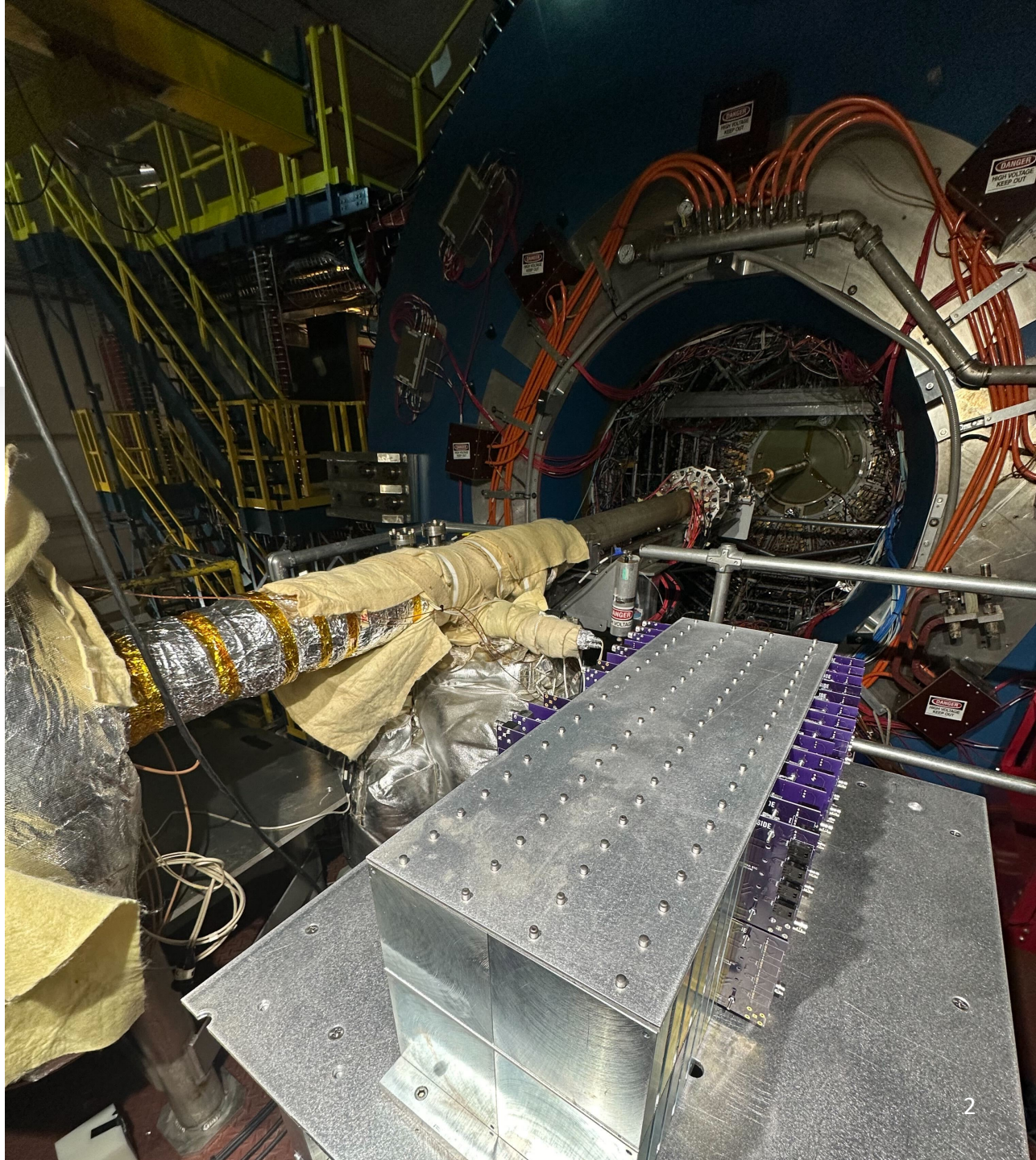
California EIC Consortium Collaboration Meeting 2024

3/1/24



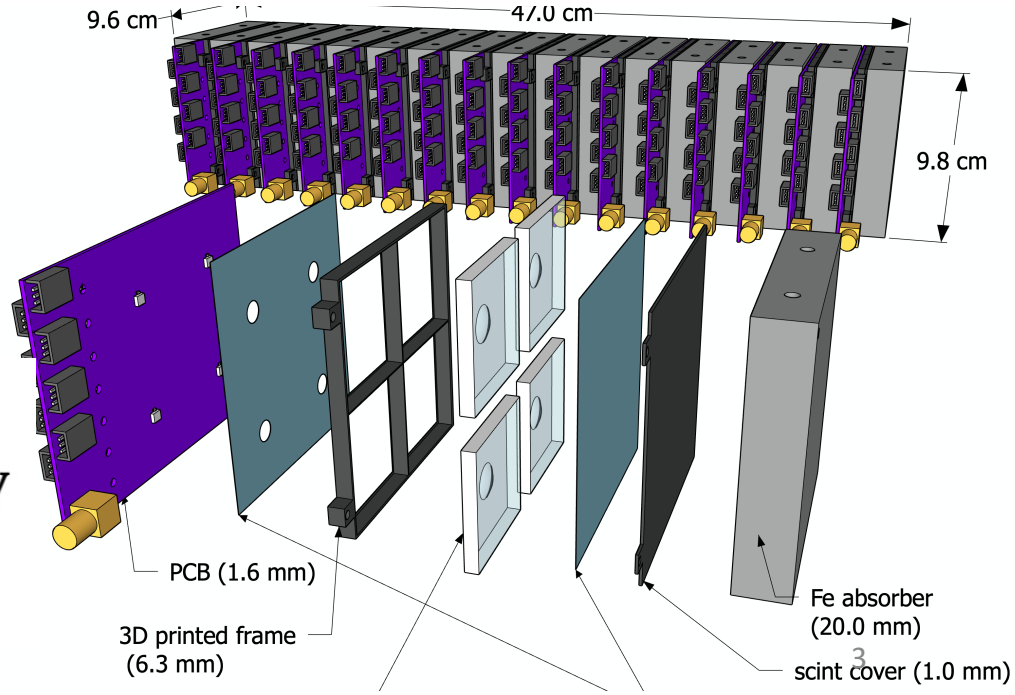
Overview

- Gen I Prototype at JLab
- Gen II Prototype for STAR
- Benchtop cosmic tests
- Initial installation at STAR
- Future upgrade plans



Gen I Prototype

- Gen I Prototype was tested at Jefferson Lab Hall D pair spectrometer in January 2023
- Consisted of 40 channels, 10 layers of iron absorbers / SiPM-on-tile boards
- Published paper in Instruments



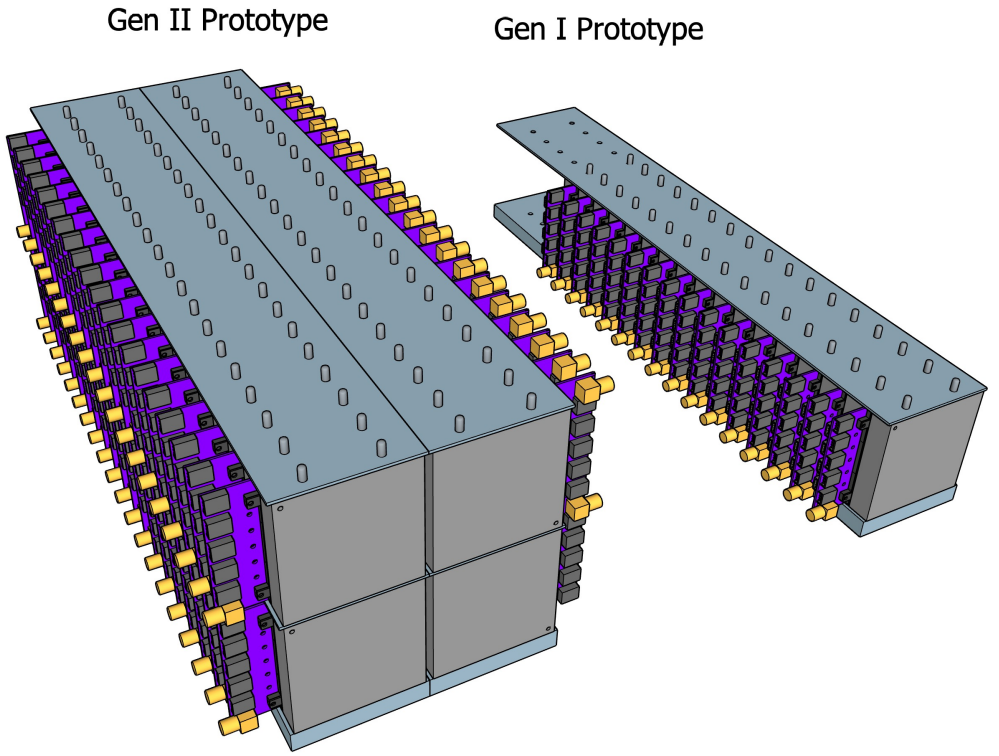
Article

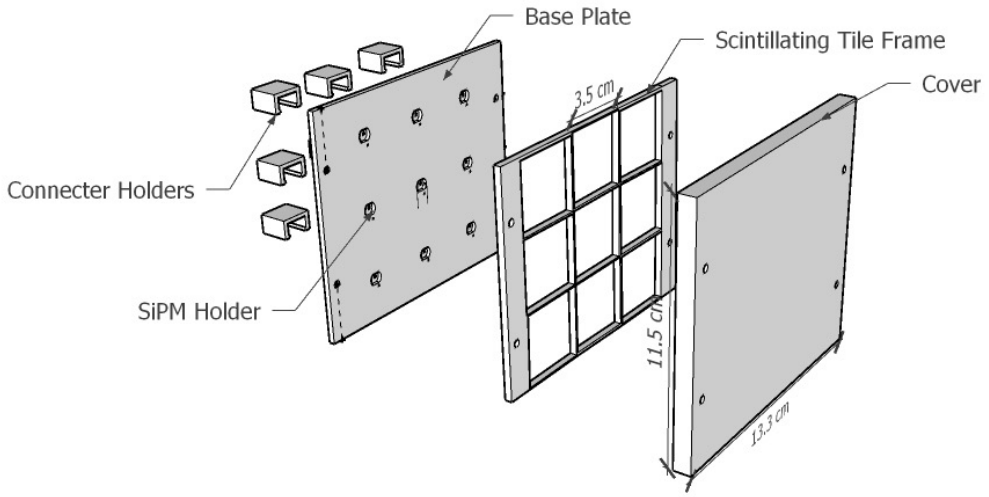
Beam Test of the First Prototype of SiPM-on-Tile Calorimeter Insert for the EIC Using 4 GeV Positrons at Jefferson Laboratory

Miguel Arratia [1,2,*], Bruce Bagby[1], Peter Carney[1], Jiajun Huang[1], Ryan Milton[1], Sebouh J. Paul[1], Sean Preins[1], Miguel Rodriguez[1] and Weibin Zhang[1]

Gen II Prototype

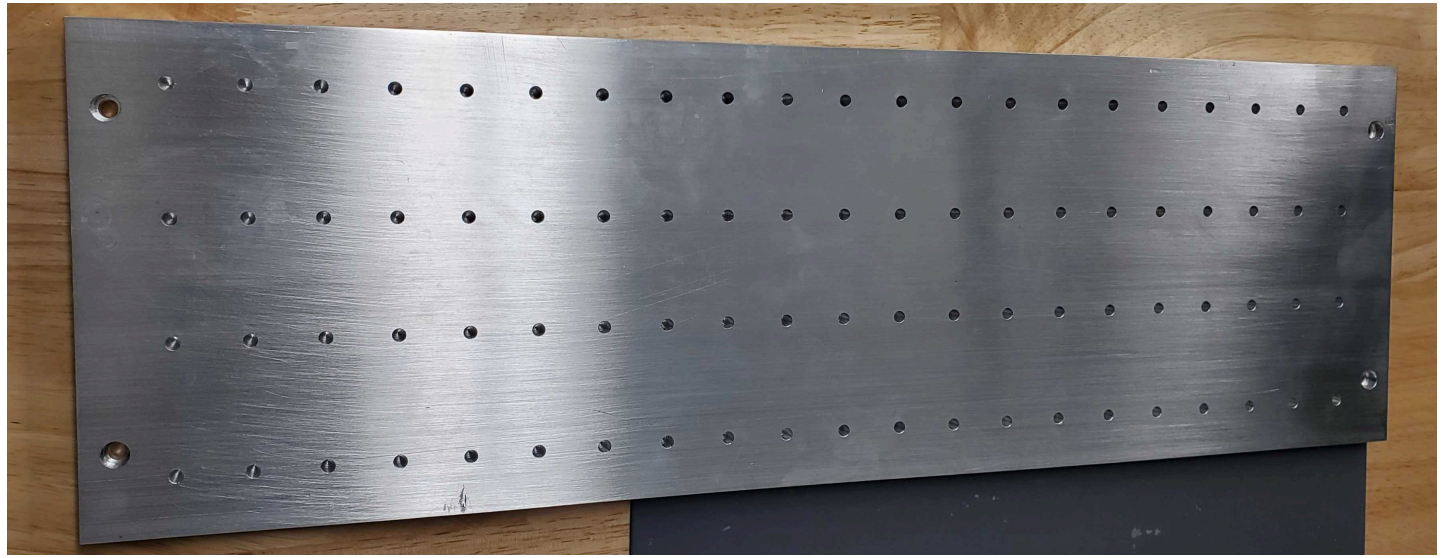
- Gen II prototype consists of ~300 channels, 20 iron layers
- 4x the cross-sectional area of Gen I prototype
- Has three hodoscope layers in front, and external trigger tiles
- Installed in the east side of STAR at RHIC, within $3.2 < \eta < 4.0$ range to emulate CALI conditions in ePIC

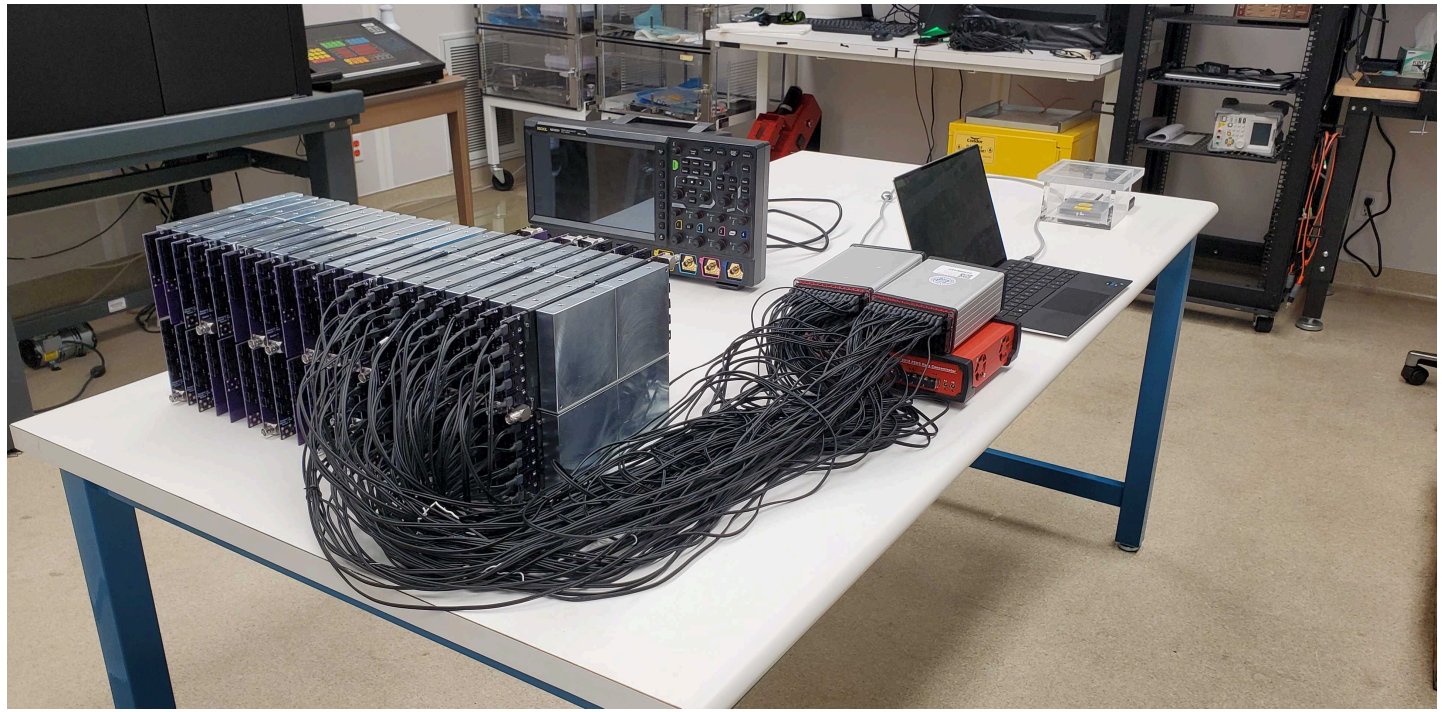




Gen II Prototype

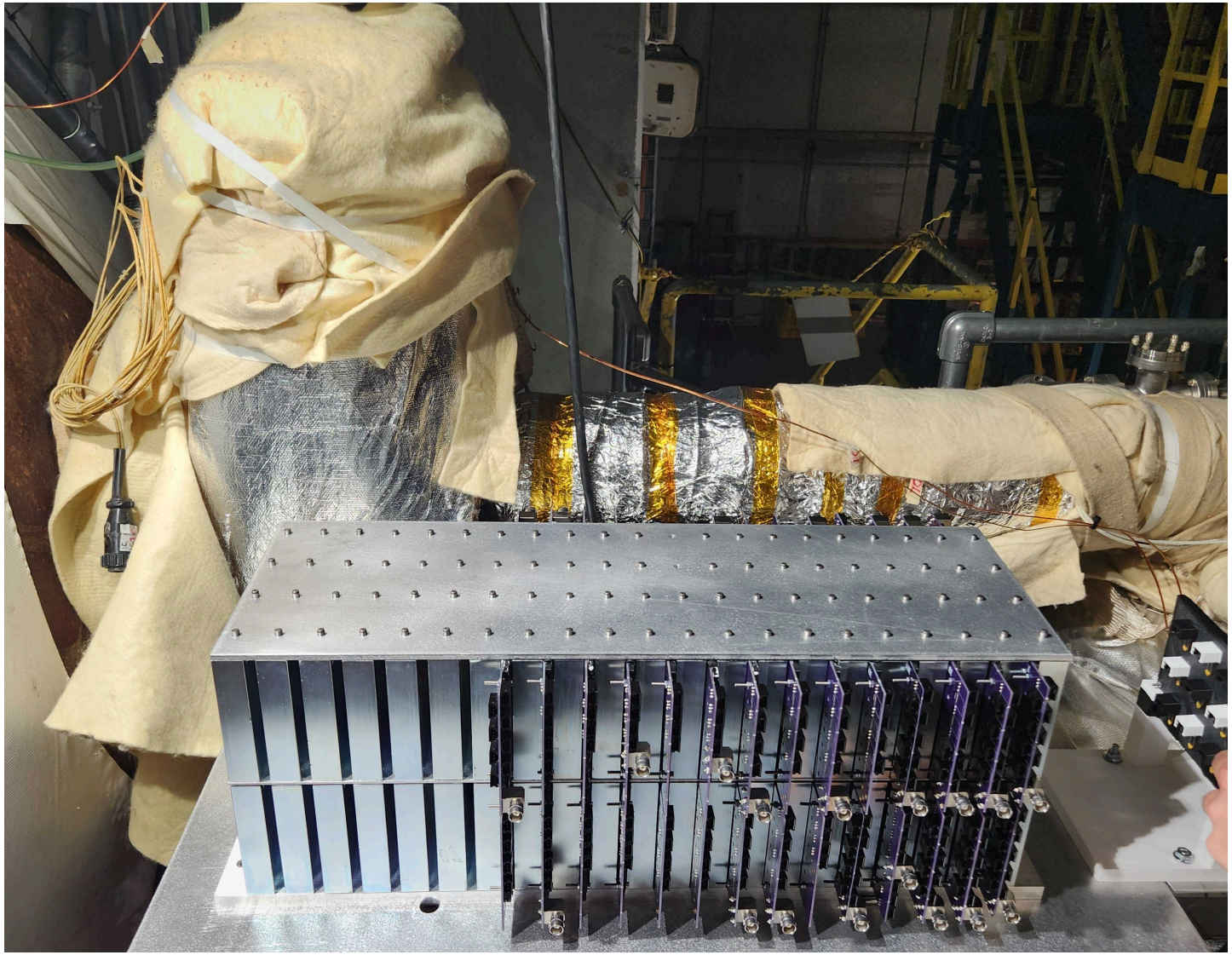
- Base plate, dividing plates, and scintillating tiles are machined in-house
- Consists of high granularity hexagonal tiles in front, larger granularity square tiles in rear
- Dark box consists of an 8020 frame, covered in black-out canvas



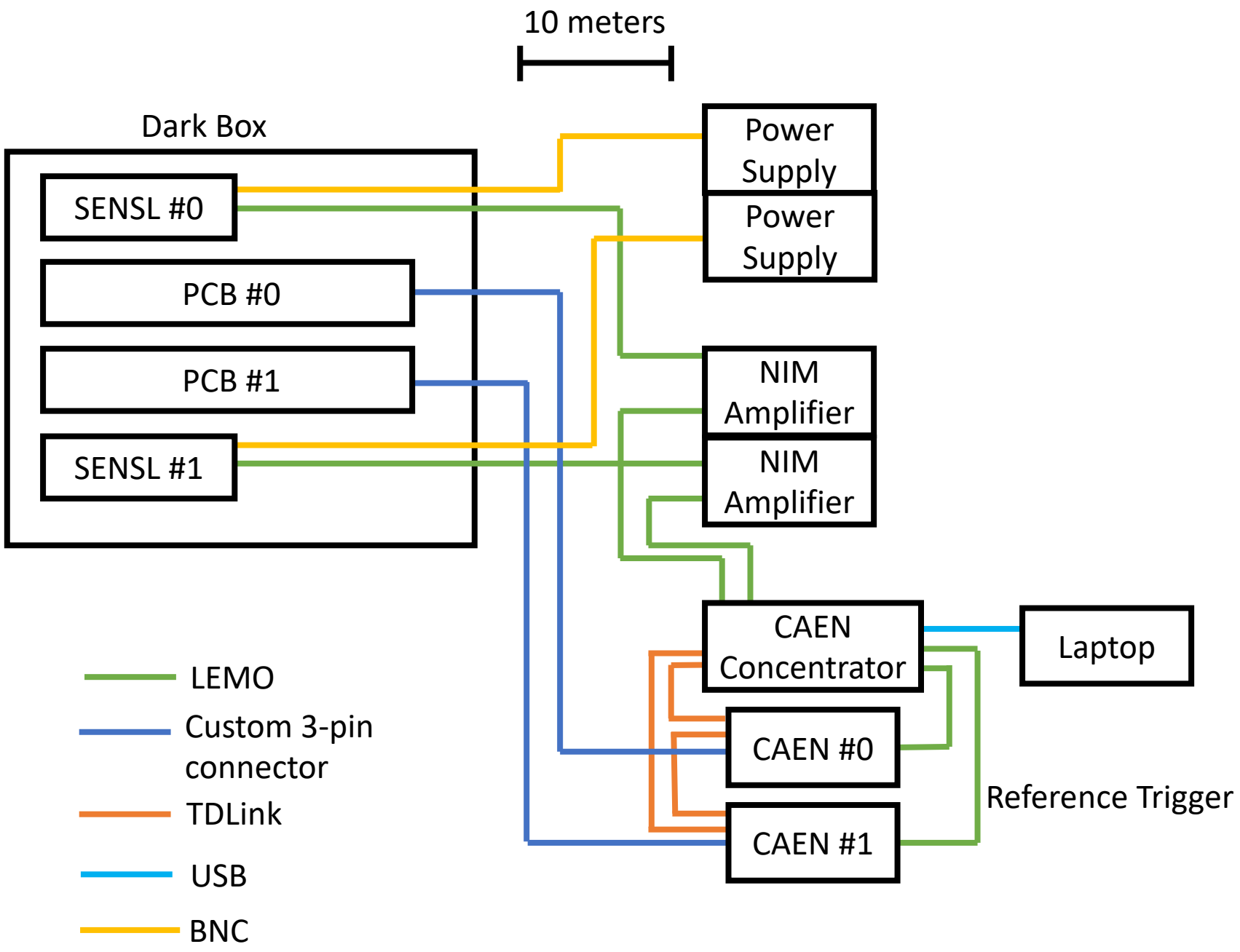


Gen II Prototype

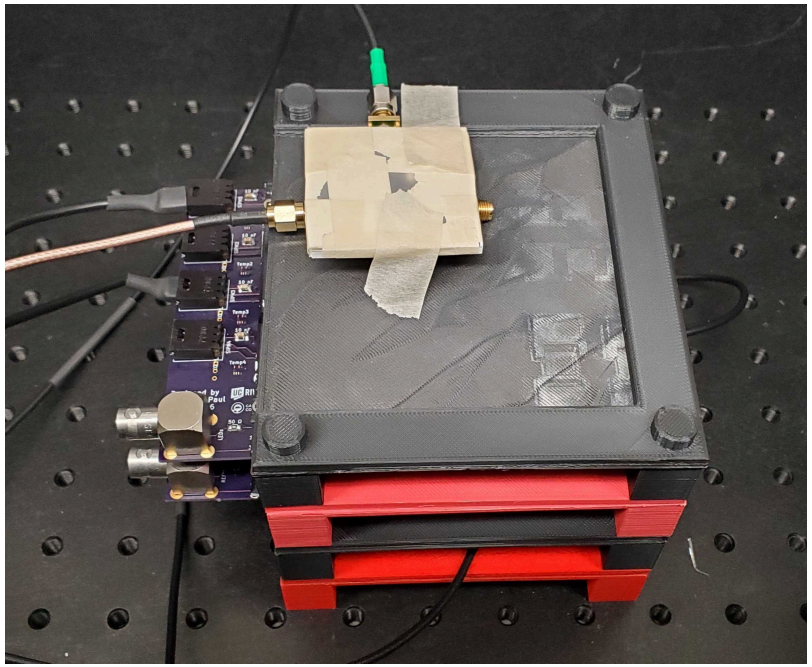
- All 302 channels have been tested with cosmics at UCR in benchtop tests
- Installed in STAR on Feb 23-28
- Goals:
  - MIP calibration
  - π^0 analysis
  - SiPM radiation hardness test



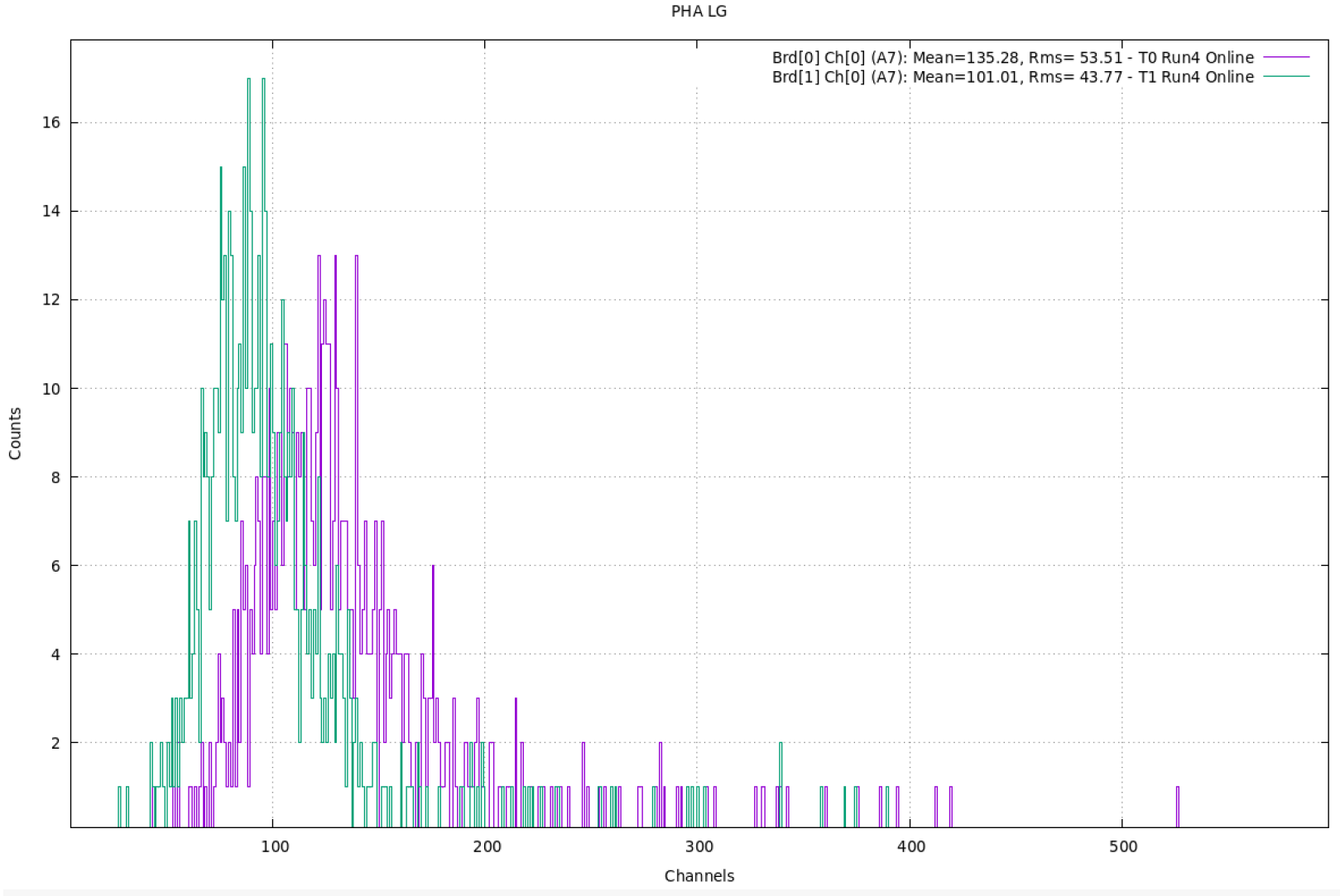
Cosmic Test Setup



- Reading multiple CAEN units requires an external trigger system
- Coincidence test with two external trigger tiles, recording across two CAEN units



- Cosmic ray landaus measured, triggered on external tiles, with 10-meter-long cables



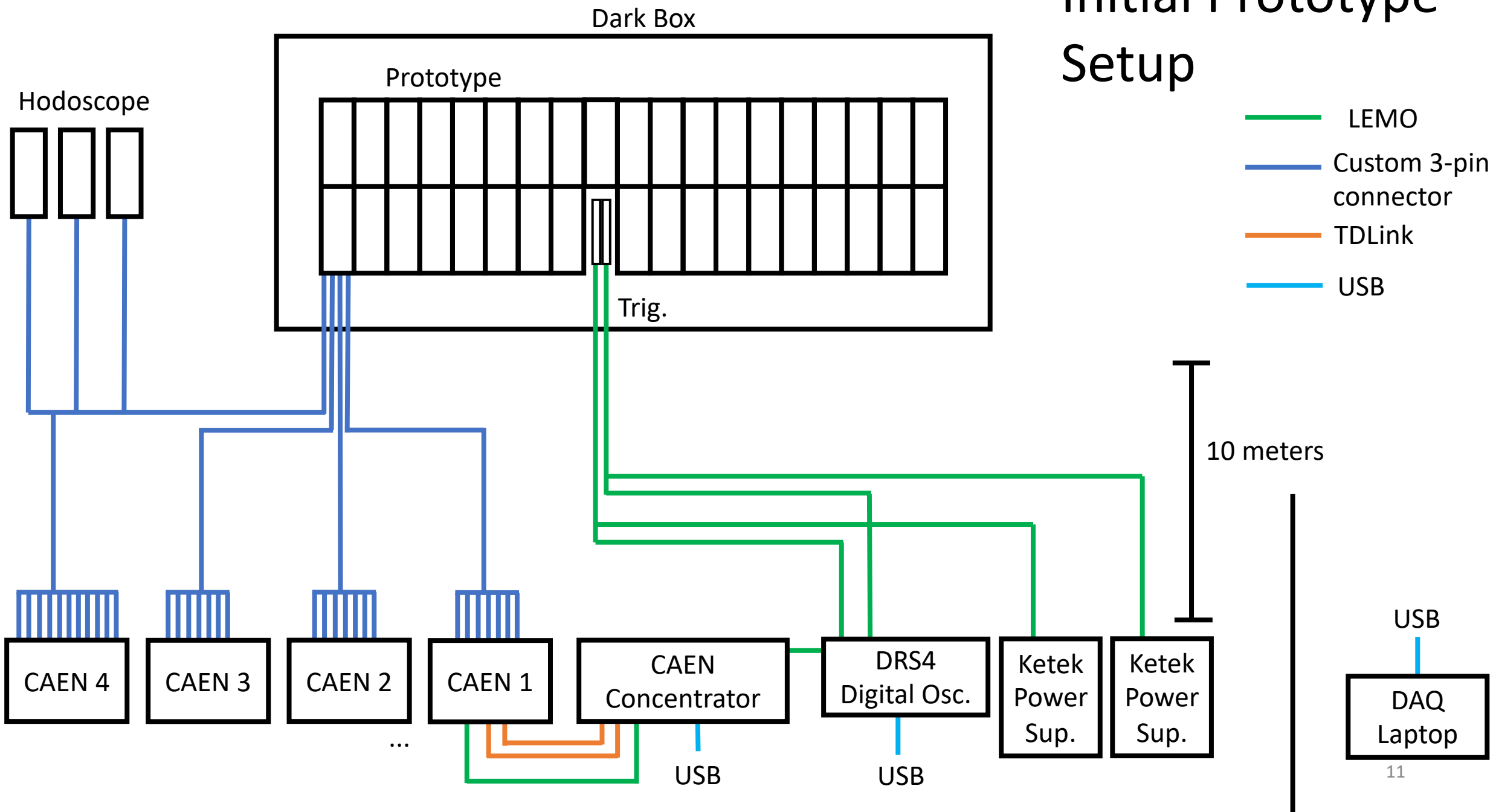
Initial Installation at STAR

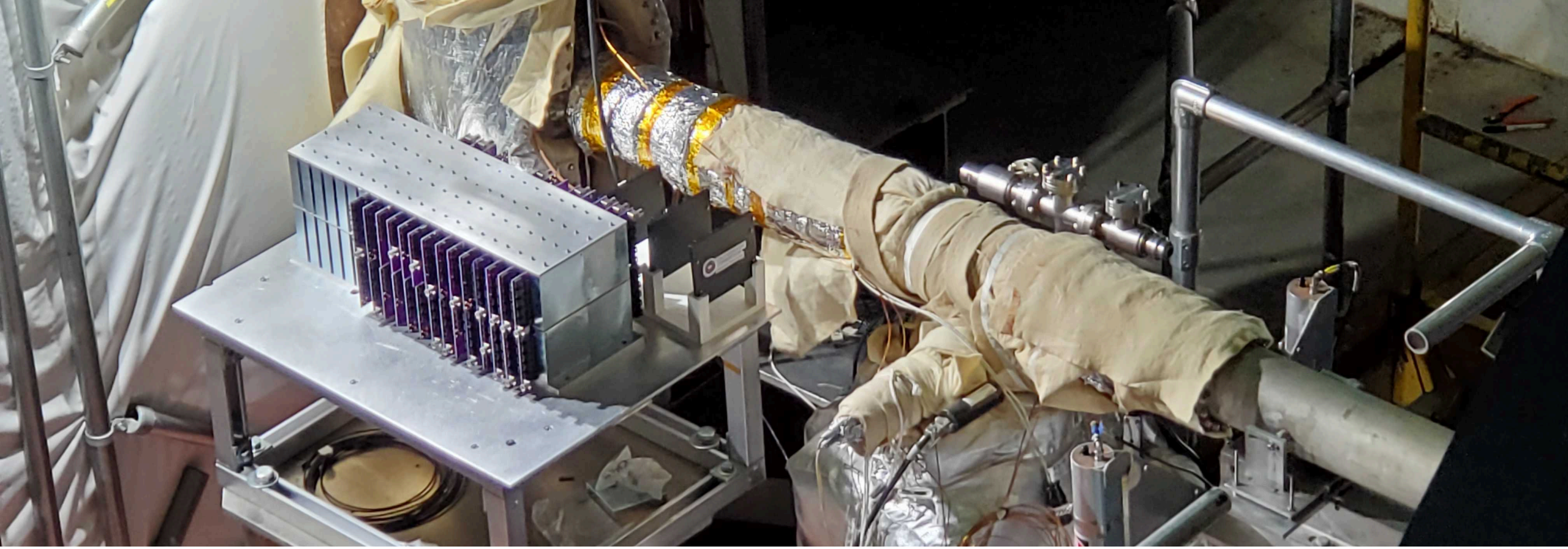
- Majority of the Gen II prototype equipment was installed in the east platform of STAR on Feb 23 – 28
- DAQ systems were placed 10 meters away from the prototype, below the platform
- Trigger system was simplified to use a DRS4 digital oscilloscope for discrimination and logic

Initial Installation at STAR

- PCBs require custom 3-pin cables, 25 were completed for the initial installation
- The channels were spread across the four CAEN units to continue testing our DAQ system

Initial Prototype Setup

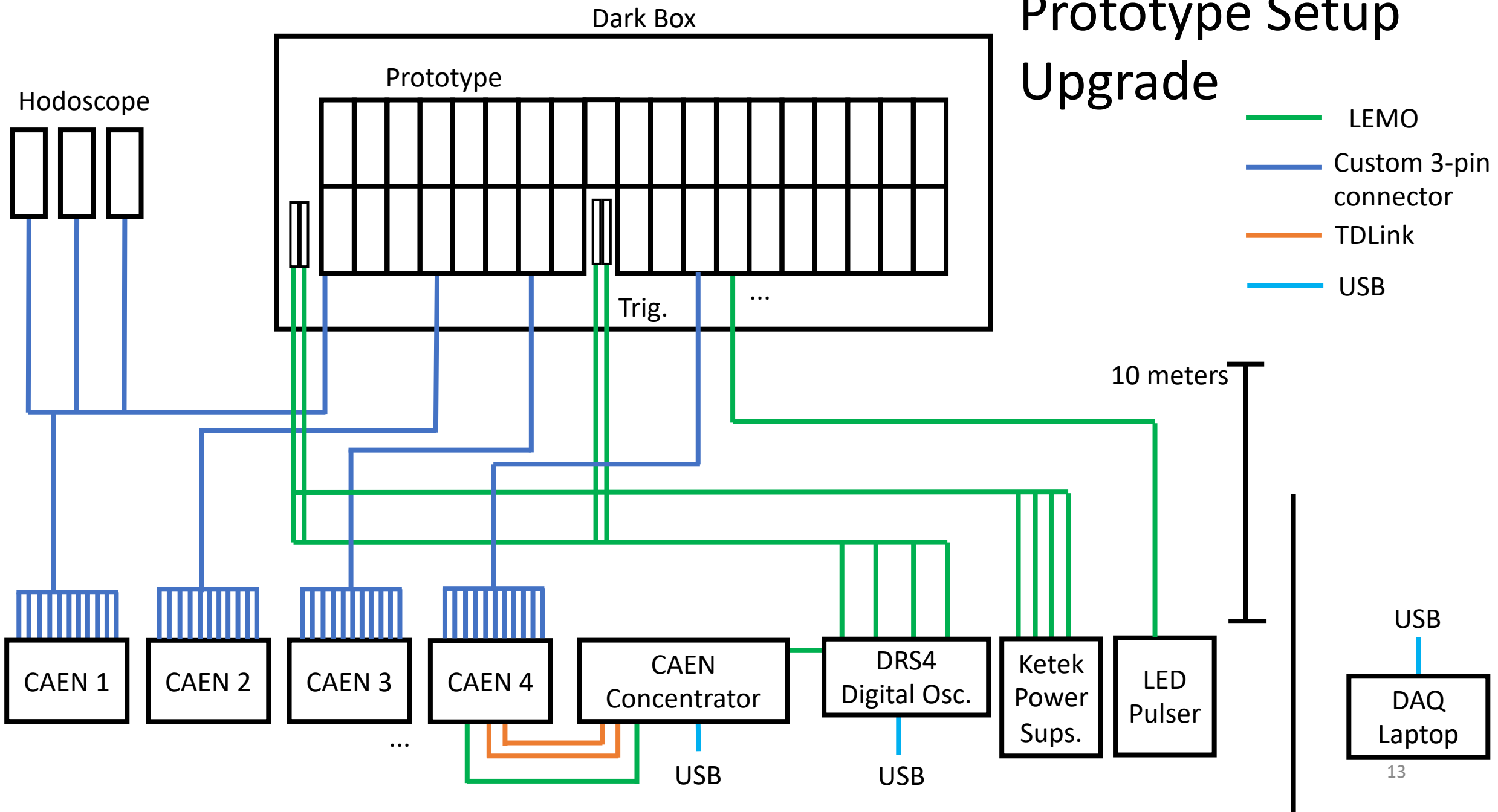




Future Upgrade Plans

- Connect all 302 channels (256 channels available with four CAEN units)
- Add two more trigger tiles in front of prototype to provide a charged particle trigger, and assist with cosmic triggers
- Include remote LED pulser for at least one board
- Plan to upgrade late March

Prototype Setup Upgrade



Thank you!