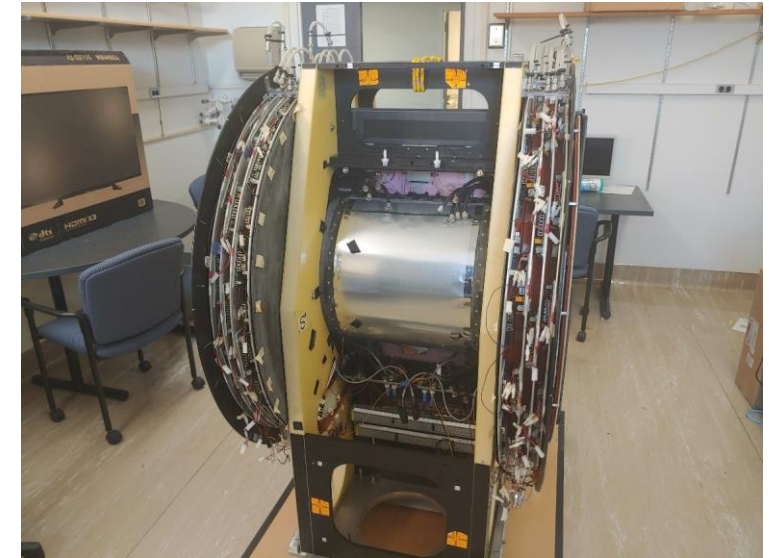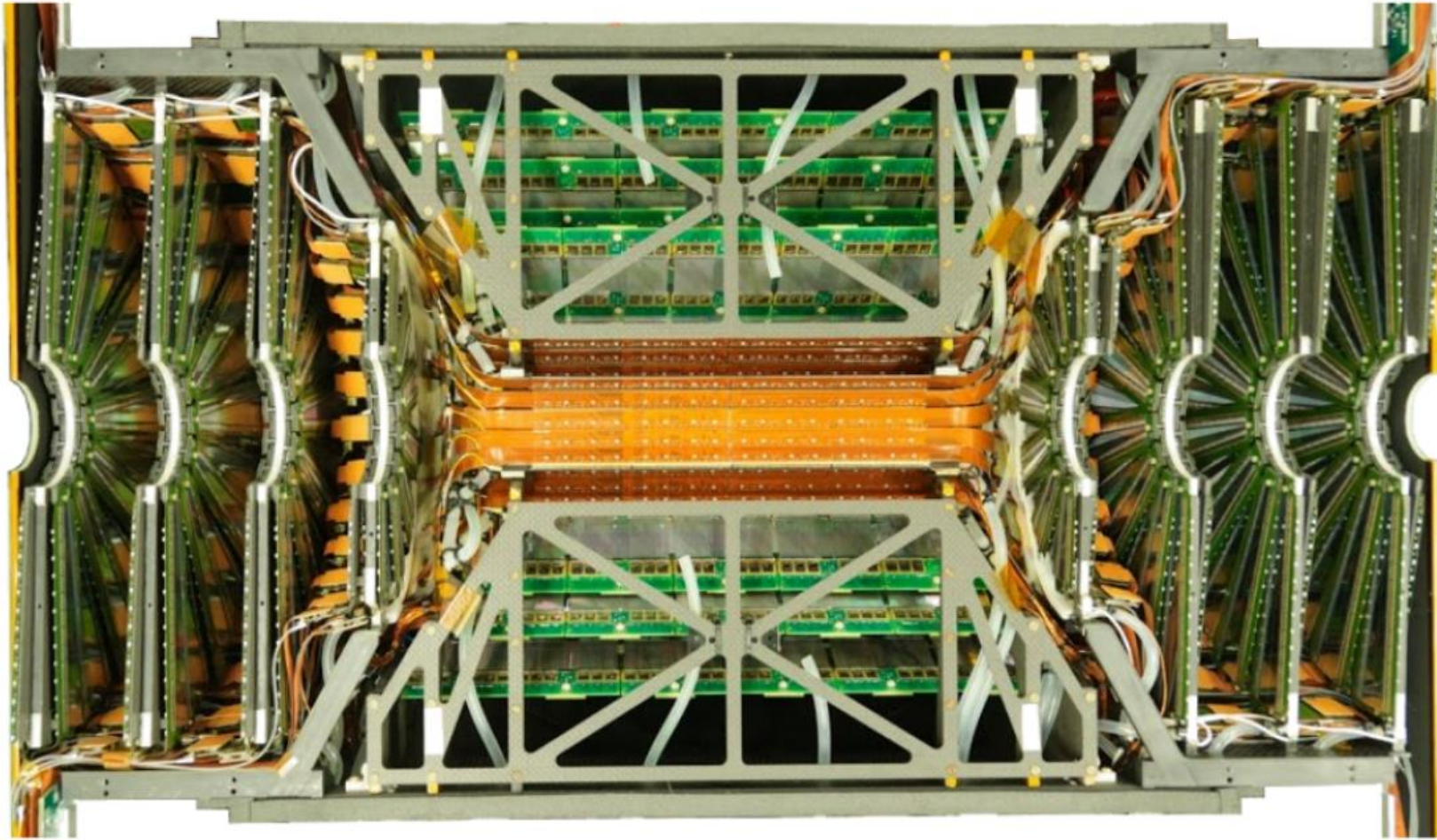# PHENIX FVTX detector for AMBER
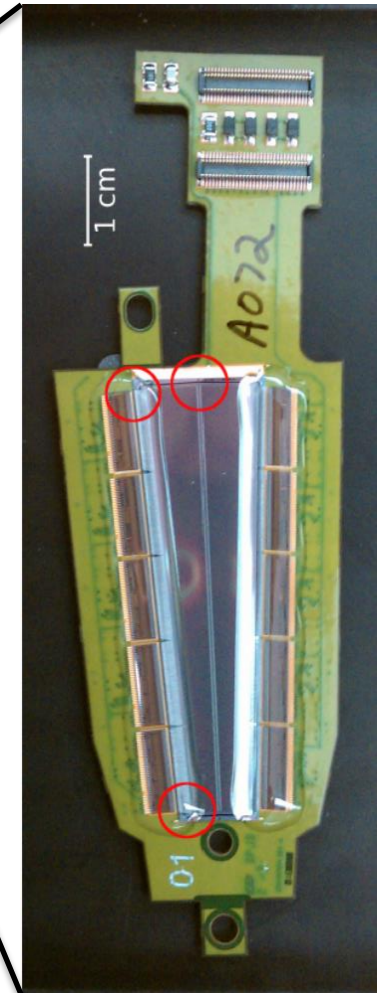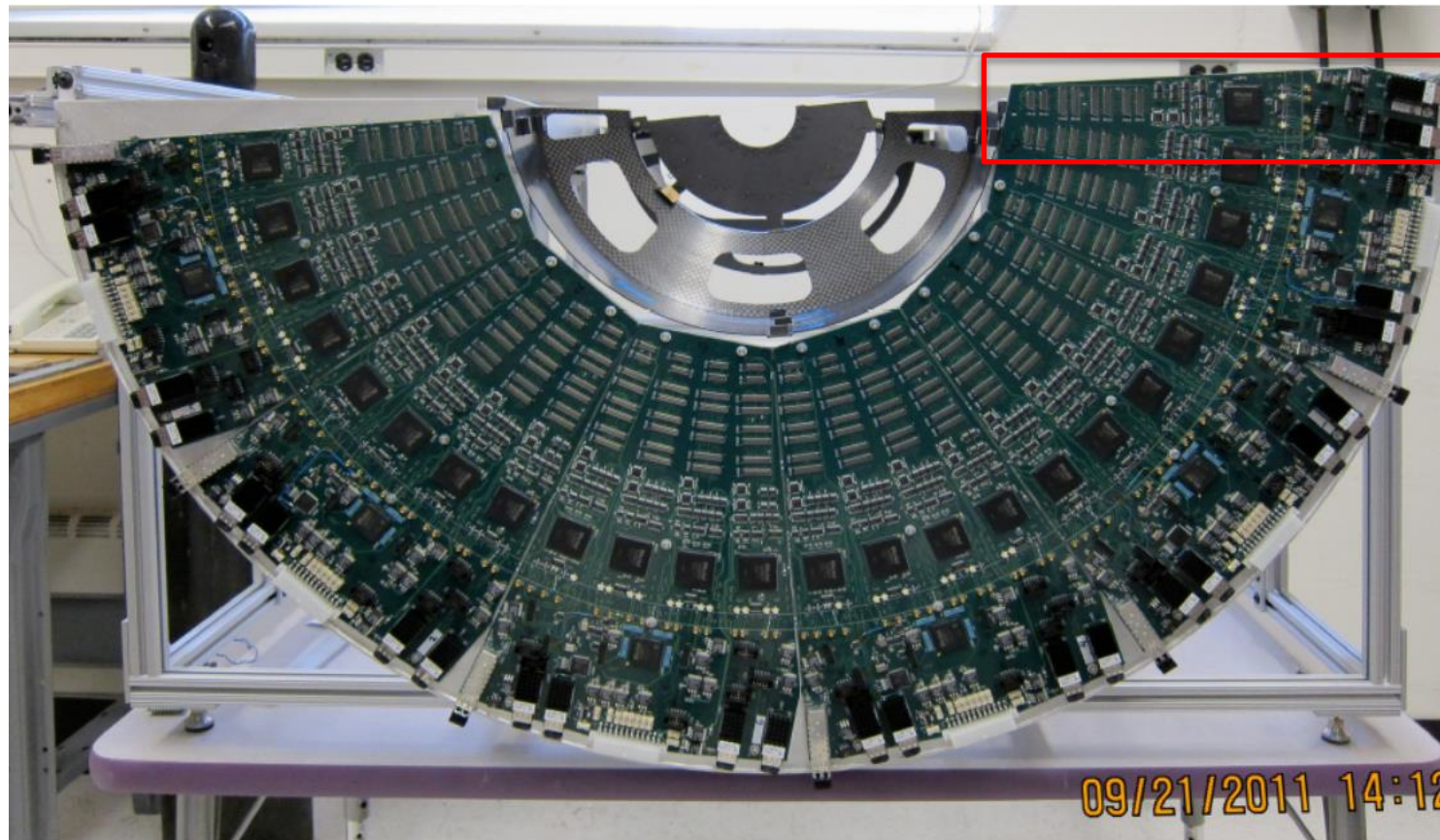
Kun Liu
Los Alamos National Laboratory
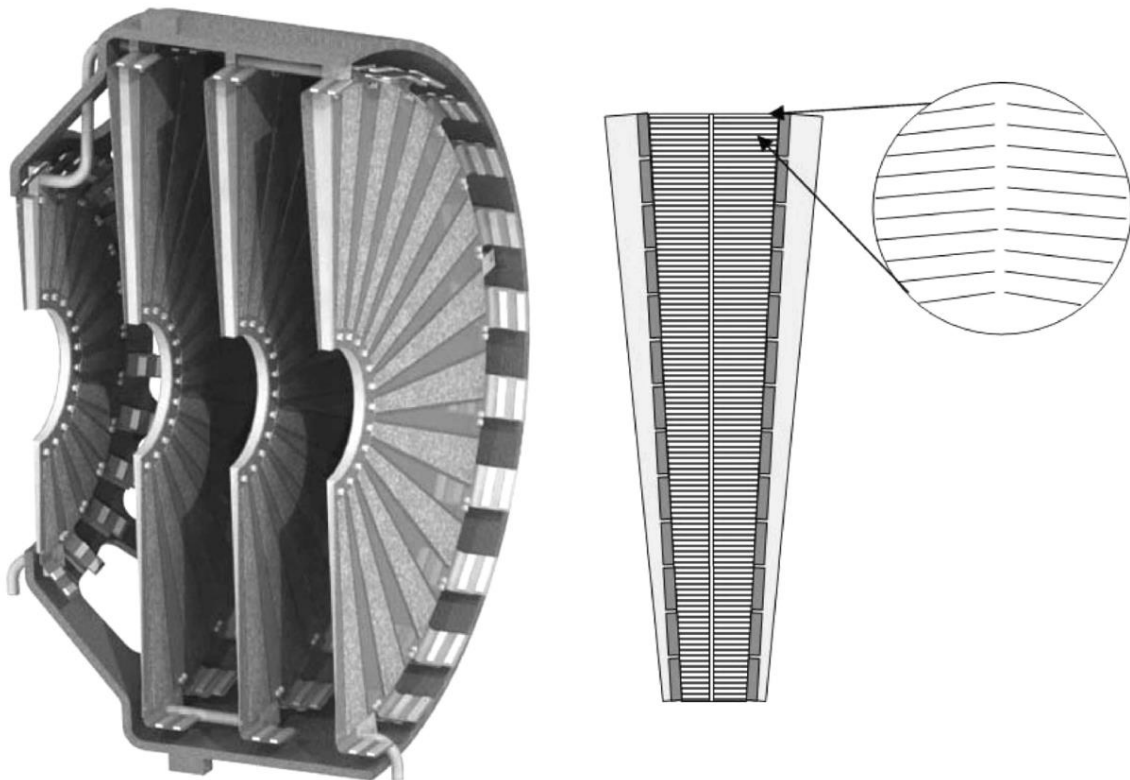April 19, 2022

FVTX detector

- Silicon-strip vertex tracker designed and built by LANL for PHENIX
- Sensors, front-end ASICs, mechanical/cooling structure, PS available to take (for free)
- Detector was very lightly used

Silicon-strip sensors

Sensor specs

Silicon sensor thickness (μm)	320
Strip pitch (μm)	75
Number of strips per column	1664
Inner radius of silicon (mm)	44
Outer radius of silicon (mm)	168.8
Strip length at inner radius (mm)	3.4
Strip length at outer radius (mm)	11.5
Pulse timing (ns)	30
Number of wedges per disk	48

Readout chain

Front-end ASIC (FPHX)

Wire bonds to HDI for chip I/O, power, and ground

2.7 mm

Bond pads to strips
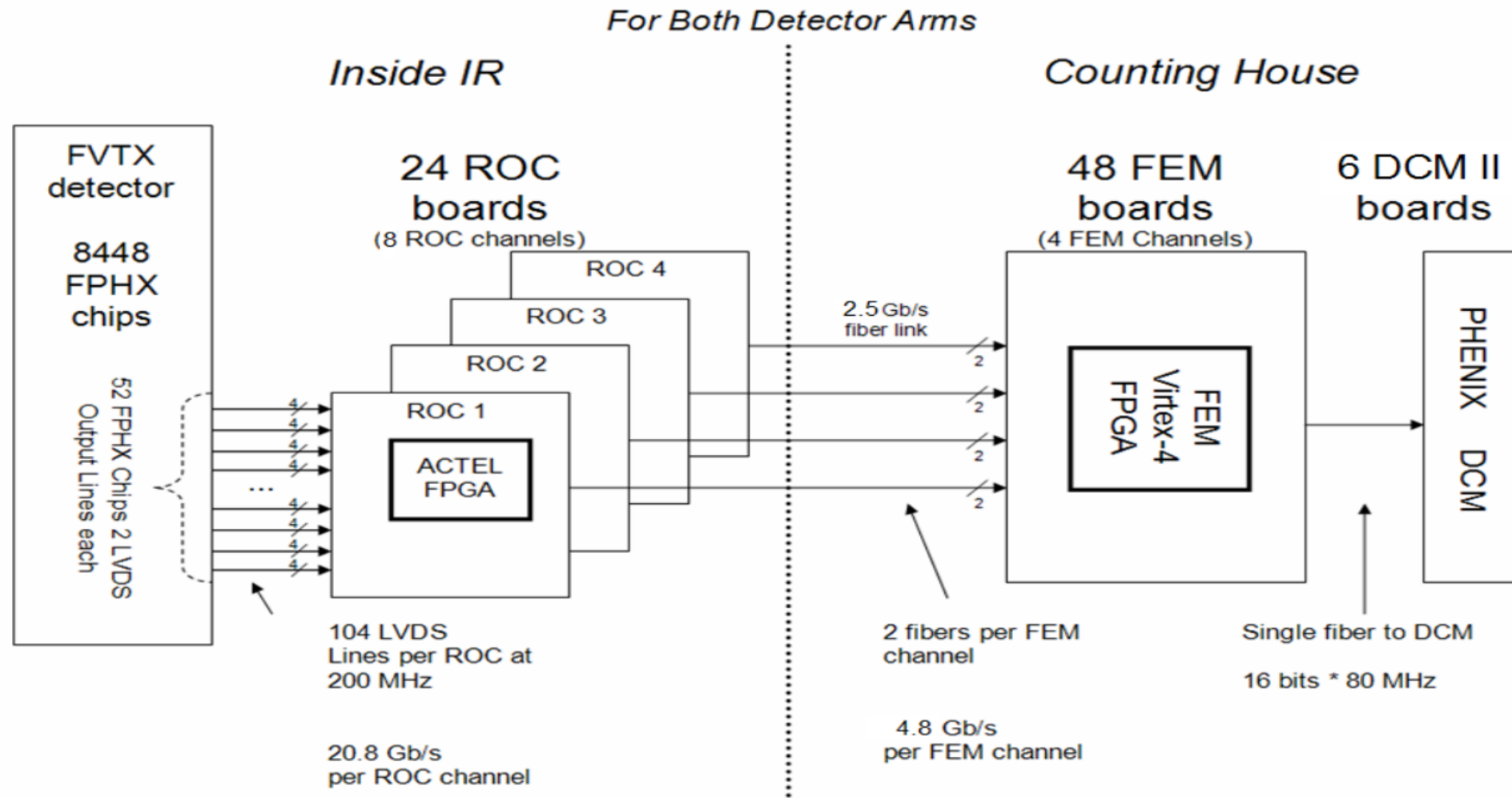
- Directly bonded to the detector

- Programmable bias, threshold, rising/fall time, etc.

- Trigger-less data push structure, continuous 20-bit (7-bit address, 7-bit time stamp, 3-bit ADC) data stream via LVDS output

- Process up to 4 hits within 4 clocks
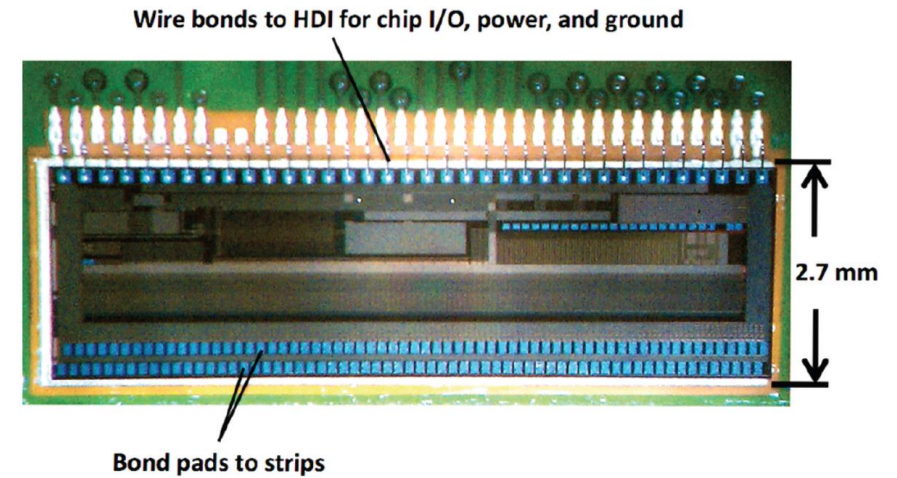
Readout Card (ROC)

- Receive data via LVDS from multiple FPHX
- Core function implemented on Radiation-hard FPGAs
- Combine and sync the data streams
- Send data to FEM in the counting house via optical fibers
- Handle slow control and calibration

Front End Module (FEM)

- Receive data from ROCs over optical fiber
- Associate incoming data with beam clock counter and buffer the last 64 beam clocks
- Receive L1 trigger and send the data-of-interest to DAQ
- Distribute and receive slow control data

Adapting FVTX for AMBER's 2025 DY run

- Use 4 large disks and place them immediately after the last target

- Reuse the sensors, disk structure, cooling system, PS from FVTX

- Fabricate new ROCs based on the same board design, but change the FPGA firmware to directly interface with AMBER's DAQ data collector

2024 Drell-Yan setup
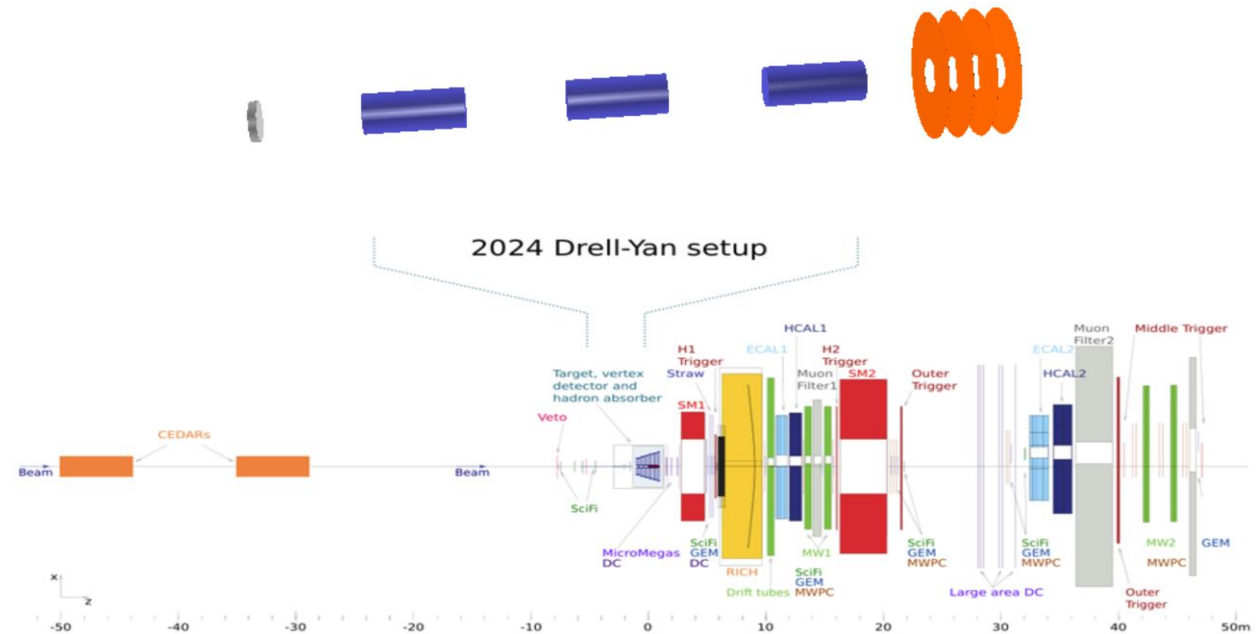
Funding

- DOE early career
  - ❑ $2.5M ($0.5M/year for 5 years)
  - ❑ Cover the full detector
- LANL LDRD
  - ❑ $1M ($0.33M/year for 3 years)
  - ❑ Cover ¼ of the detector – a prototype
  - ❑ Will seek future funding to instrument the remaining detector

Expect the announcement in late June or early July

Tentative schedule