Center for Frontiers in Nuclear Science

Stony Brook University

# PIONEER Tracker

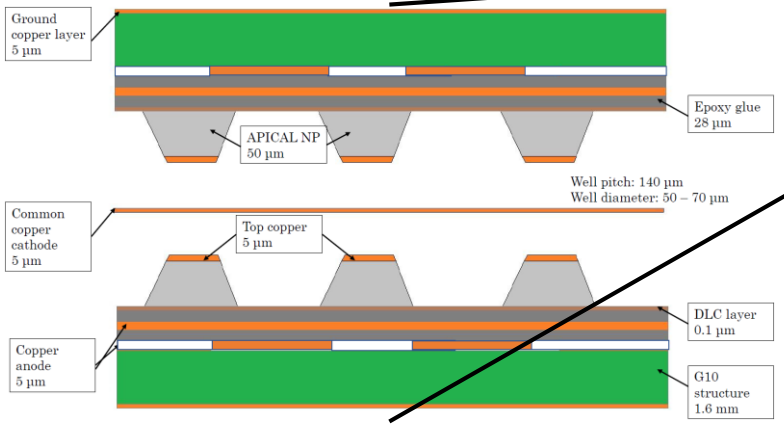
JAYDEEP DATTA[1], ABHAY DESHPANDE[1], JOSH LABOUNTY[2]

1. CFNS, STONY BROOK UNIVERSITY

2. UNIVERSITY OF WASHINGTON

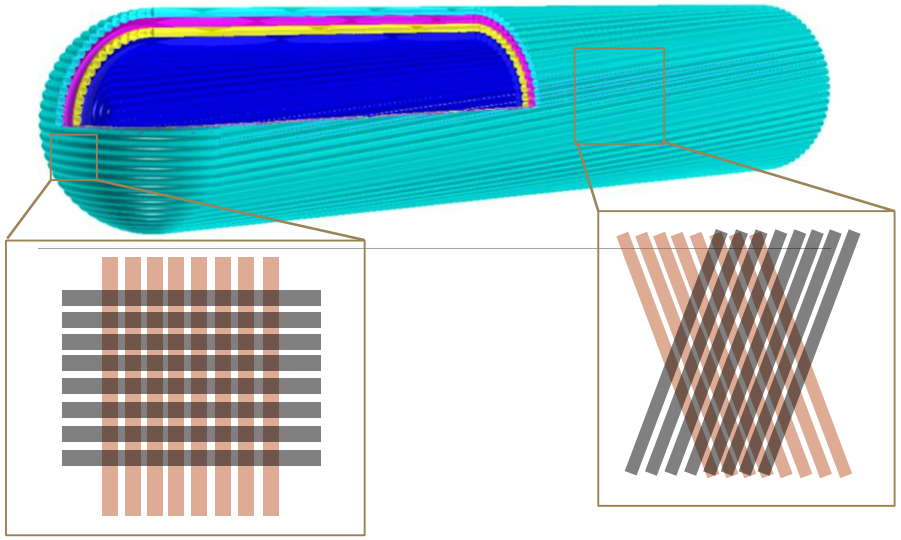
# Motivation and Technology

- The tracker hits will help to correlate the hits in ATAR with the Calorimeter
- For this good spatial and time resolution required
- Scintillation fiber and µRWELL are two possible choices




µRWELL technology

Preliminary idea two layers of µRWELL PCB with common cathode

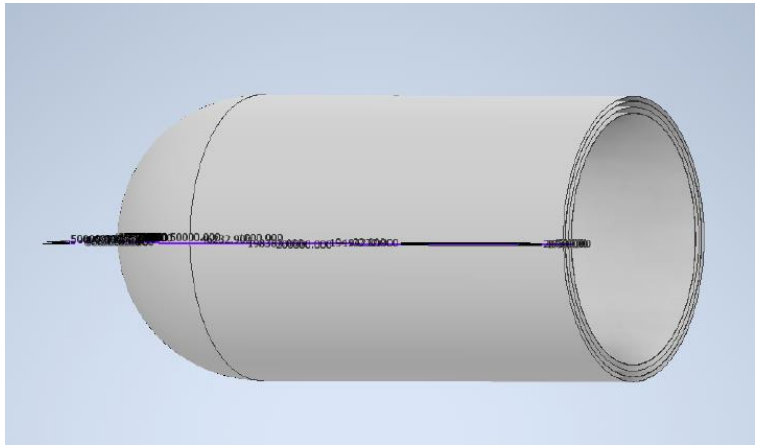


SciFi pictures from Josh's slides

# μRWELL Technology

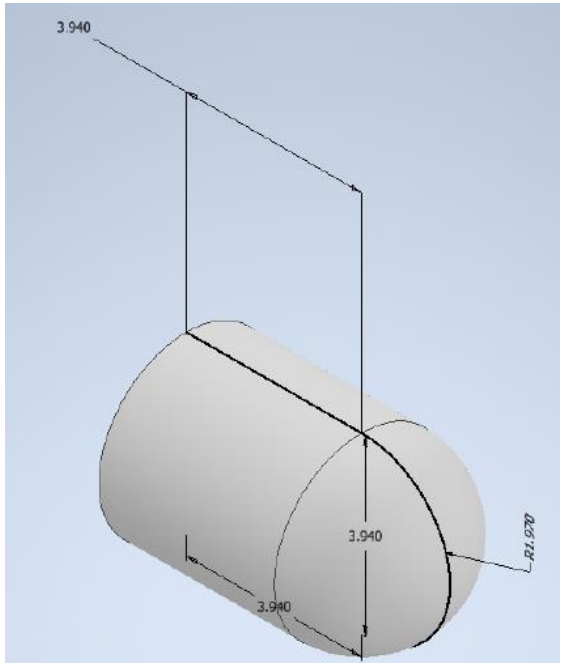
Pros

- Gas detector technology
- Small amount of material
- Spatial resolution ~ 50 μm
- Time resolution ~ 5.7 ns

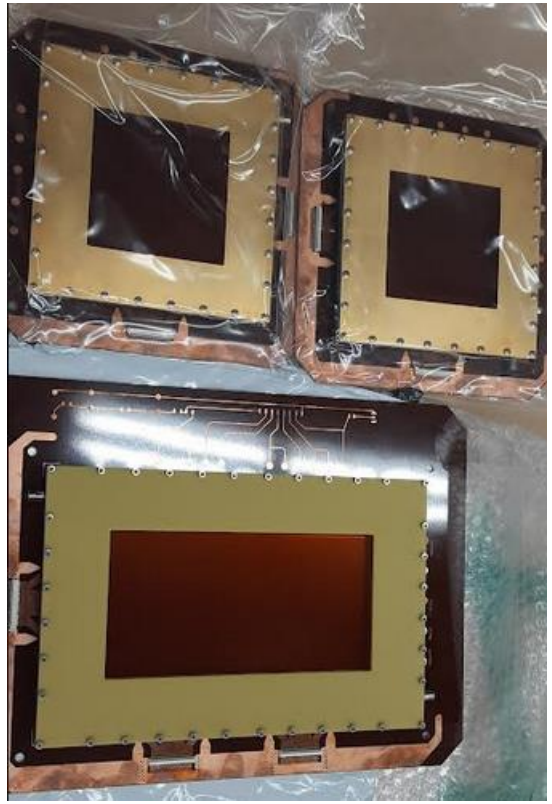


Cons

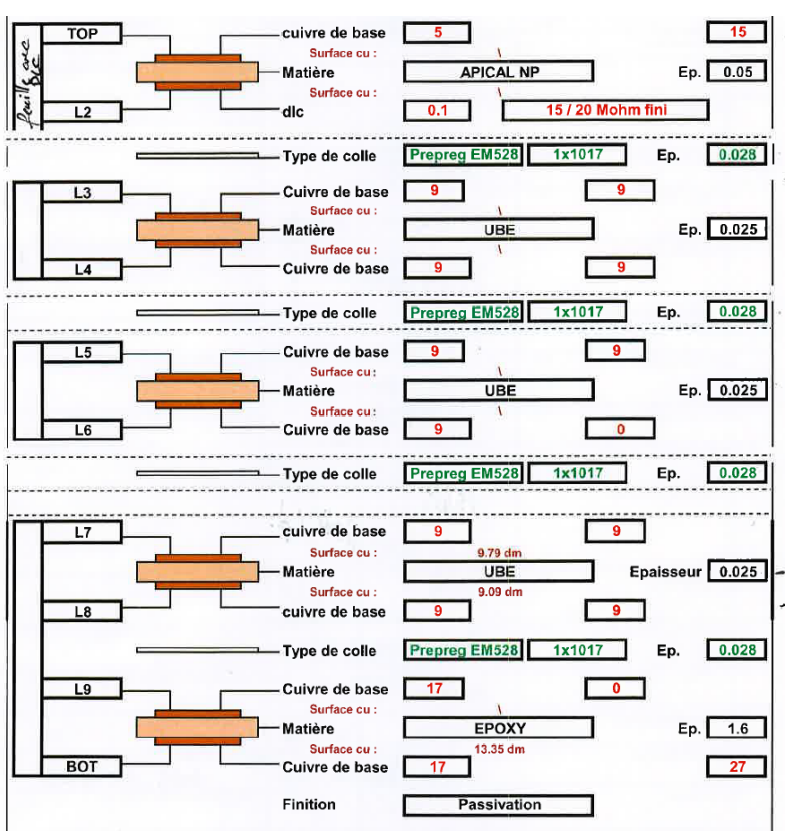
- Need a single volume detector to reduce dead materials, making construction complicated
- Readout scheme needs to be tested



# Material description



Micro-RWELLs



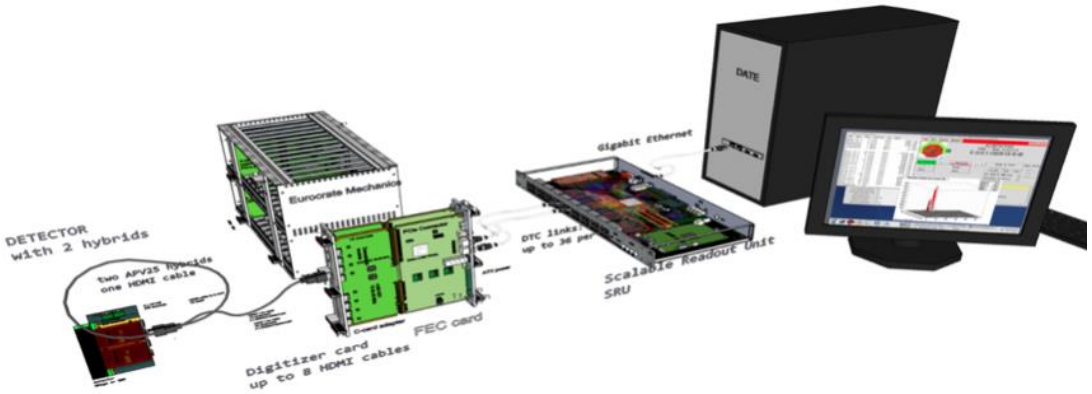

µRWELL stage

Capacitive sharing stage
Mostly copper, Kapton
and insulating material

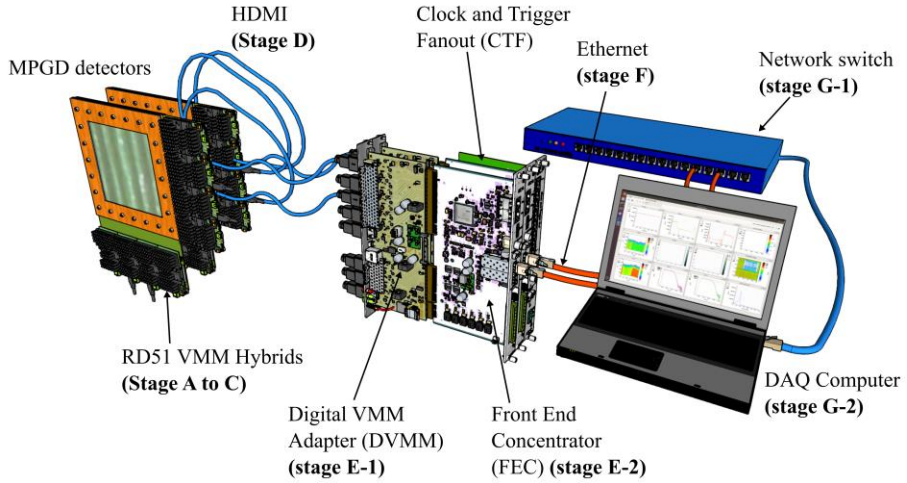
Readout stage

# DAQ system

- APV25 cards, SRS, and RCDAQ as DAQ software
- APV25 is robust but slow, with huge dead time
- New system VMM3A cards
- Continuous data acquisition system
- Needs a separate LV supply to operate and a dedicated cooling system



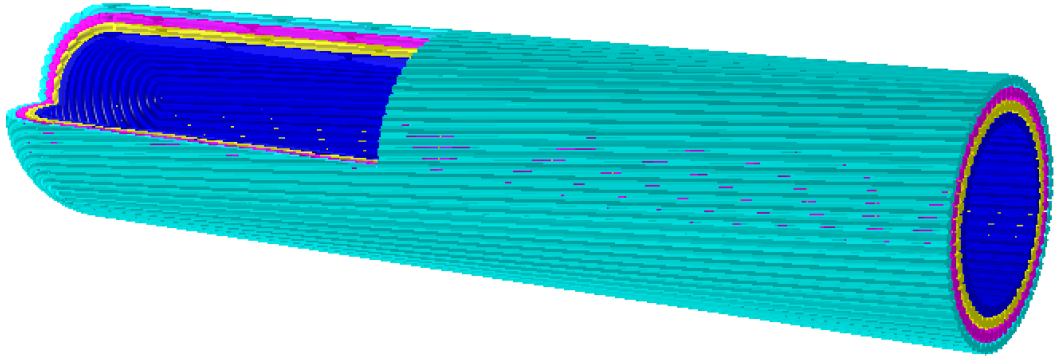

APV25 and SRS system




VMM and SRS system

# Scintillation Fiber

- Established tracking technology
- 4 layers of 500 μm scintillating fibers. Approximately 1000 channels of readout.
- 2 - 3 ns of timing resolution [to be verified with simulation]
- Preliminary studies suggest a theta/phi resolution for particles emerging from ATAR of < 0.2 rad
- Design challenges (fiber bending, etc.)
- Pileup could be challenging to disentangle
- SiPM for detecting photons, needs dedicated cooling



Pictures from Josh’s slides

# Future Plans

- Need to fix the tracker shape and space constraints
- Working on readout scheme for bullet-shaped, μRWELL based tracker
- Figuring out the details to make one such detector
- Planning to use μRWELL detectors as cosmic tracker
- Need to figure out integration to DAQ
- SciFi idea needs to be studied more

# Acknowledgement

Thanks to Josh for the study on SciFi.

Thanks to the PIONEER collaboration

# Thank you