

# Cold Electronics Testing

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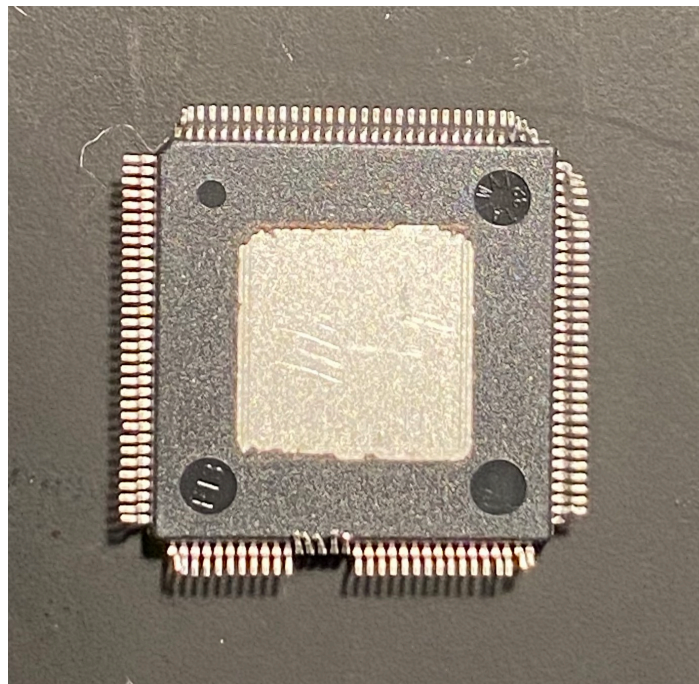
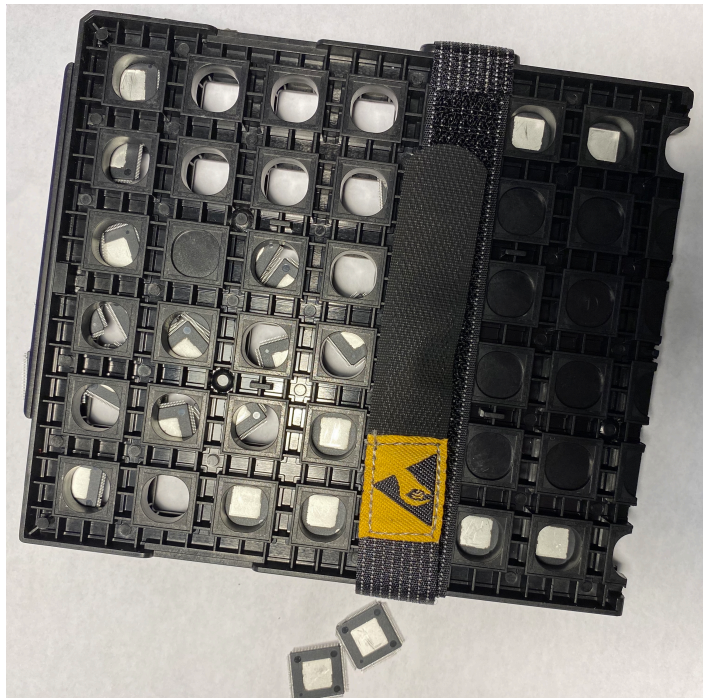
- APA7 analysis status (briefly)
- Need for a knowledge base for everything we have learned and will learn
- New CE testing software design sketch

# APA7: unfinished business

- Most comprehensive study so far done by David Adams
- Noone has taken over the study since
- We have tools to ntuplize the data for you, provide temperature readouts
- Need a group of people to reproduce David Adams' findings, run tests on pulsar data, be ready to compare these to COLDADC1 tests

# Testing COLDADC1: Good news + Very Bad news

- Bad ENOBs were due to voltage settings being too low
- performance restored with higher voltages
- Bad news: 23 / 42 chips got pins severely damaged



- We need a central knowledge base for a lot of information

# For faculty who are running a lab

- Cryo training for every person working in lab
- Protective gear
- Safety / protocols required by institutions
- Safe packaging of devices that are being shipped
- Mail / FedEx
  - Physics depts are usually **receivers**, not **providers** of materials
  - Dealing with computing restrictions
  - Need common knowledge base for PI's
- Use recommended equipment (specific PS, WF, cryostat, etc)
- This all needs to go into the knowledge base Wiki [computing recommended]
- E-learning training “courses” for PI, lab people?

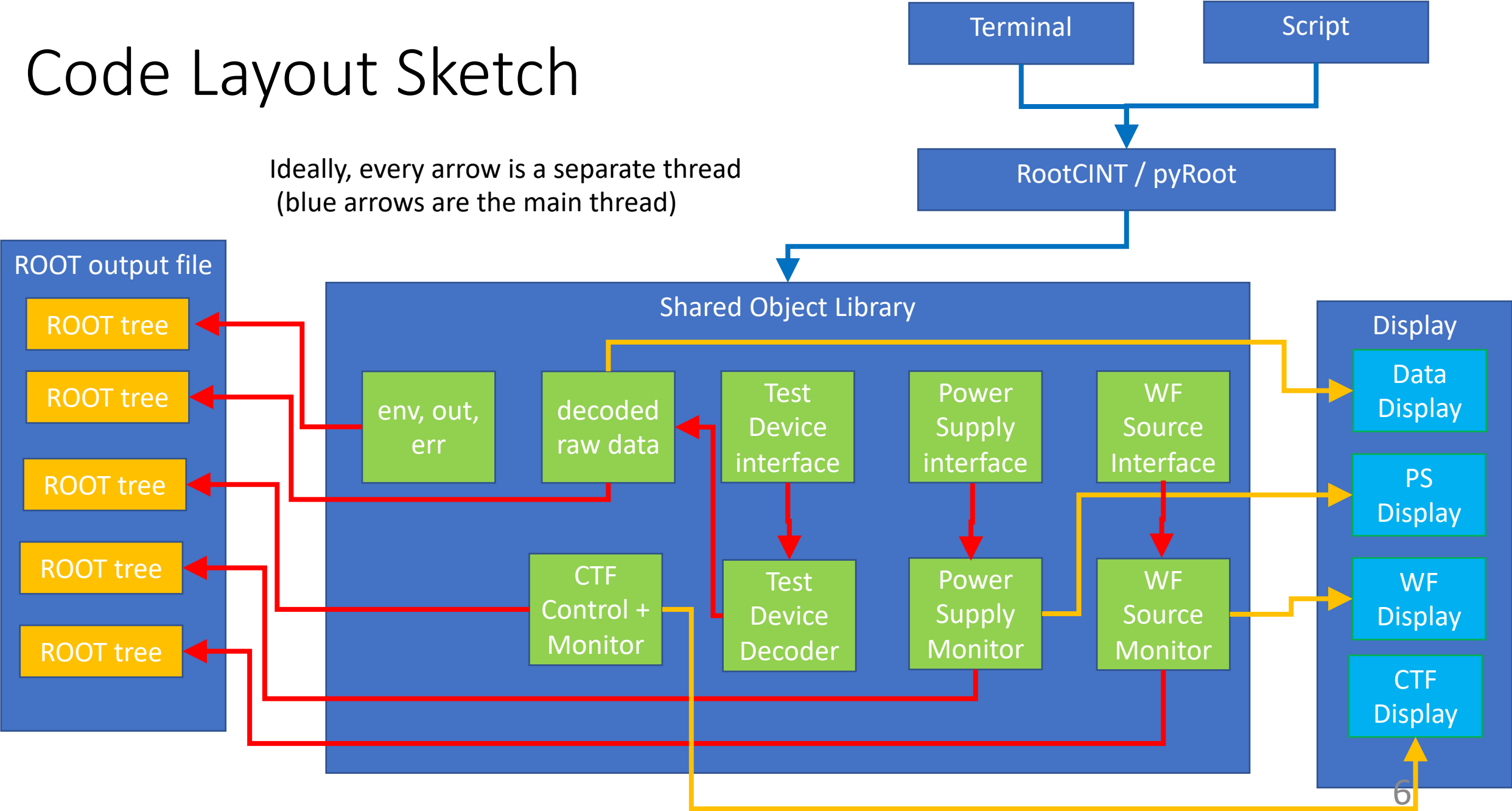


# Boundary conditions for CE testing Software

- Needs to be written by multiple institutions to ensure shared expertise
- Sometimes conflicting:
  - engineers prefer Windows -> python + pickle
  - Physicists use ROOT -> not directly available for Windows 10
- Code manager should understand what is going on (me => c++, ROOT)
- Implement as many useful aspects of ProtoDUNE and ColdDATA tests, without the overhead of additional frameworks
- “Should be lightweight”

# Code Layout Sketch

Ideally, every arrow is a separate thread  
(blue arrows are the main thread)



# Other Requirements / Features

- Generating specific-yet-random default file name
- Locking the resources to one process  
(i.e. one session running these tools should lock out others)
- Locking resources when multiple threads are designed to access same resource
- Check correct firmware is loaded for the test
- Visual identity – ROOT's default GUI is pretty bad
- Automatic check for newer versions @ GitHub
- Actual tests – copy and reproduce the current set of tests done for ColdADC1
- Separate task: study what we really learn from the ColdADC1 noise + DNL + ENOB tests, are these values which improve or hurt performance?
- PDF “final final report” – via LaTeX
- This is not a complete list

# Should be lightweight

- I'm translating this to "Should **feel** lightweight"
  - Currently using single process, single thread to do everything
  - Test stand DAQ machines are spec'ed to be multi-core servers, but we're not using the other cores / threads
  - Server class machine gets single thread bogged down to processing 2Mx16 channels for several minutes
  - By deploying **multiple threads**, we will make the process faster, more "lightweight"-feeling
  - Multithreading only when and where needed to keep the main thread from getting bogged down or interrupted



# Test Interface Device – What will the PC talk to?

- Different approaches to communicating to the devices have been used at different testing sites
  - Single ASIC directly bonded onto a test board
  - Raspberry Pi communicates to test board, does DAQ
  - FPGA mezzanine card communicates to multiple test boards
- Most mass-production tests have been using the BNL FPGA Mezzanine card
- Well understood, stable interface, with existing code and support from BNL experts
- Use this card as the testing interface until new WIB is fully commissioned and understood

# The **real** goal is building a community

- The end goal isn't so much a working piece of code, it is dissemination of knowledge + experience to institutions interested in CE testing
- Perpetual Zoom Meeting: <https://ufl.zoom.us/j/99031531865>
- Slack Channel, GitHub repository TBA soon
- Request Wiki page within the dune wiki system for knowledge base
- Will ask conveners to announce final coordinates for Zoom, Slack, and Wiki when everything converges
- Over the course of this week, I will do my best to be available in the Zoom meeting

# Summary

- There are plenty tasks for groups to get involved in testing:
  - Building the CE testing framework (lots of pieces)
  - Analysis of APA7 data
- Intent: get a summer student, pick a task and deliver
- Deliberately not writing system-level tools myself, others can write those while sheltered in place or away from lab
- As people sign up for tasks, relevant HW will be provided (?)