
# Module Testing at Fermilab

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# Working Groups

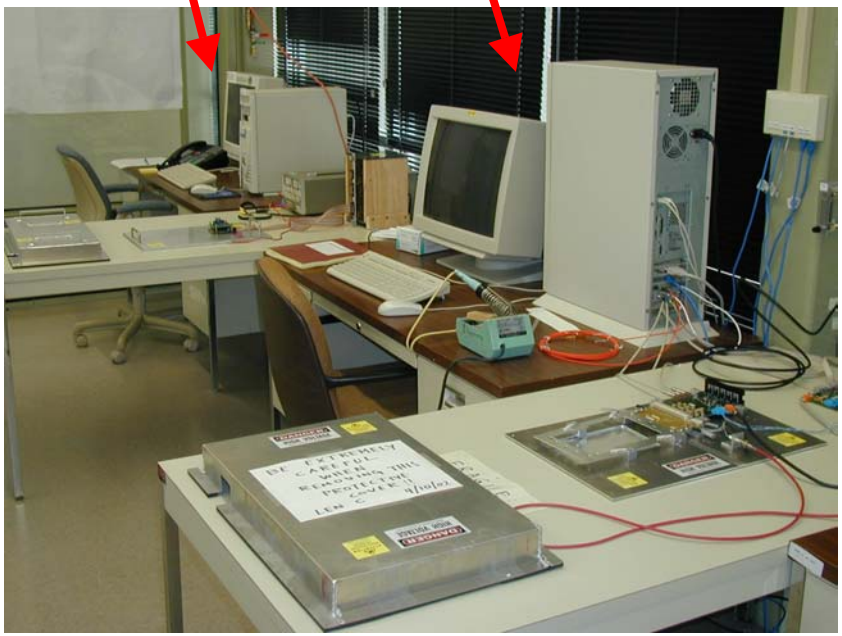
- Gantry and Wire Bonding
  - Bill Kahl – Kansas State University
  - Lenny Spiegel – Fermilab
- Module Testing
  - Elizaveta Chabalina – University of Illinois at Chicago
  - Len Christofek – University of Kansas
  - Slawomir Tkaczyk - Fermilab

# Appreciation

- We would like to express our appreciation to two groups whose assistance was invaluable in helping us get the test stands in working order.
  - Aachen
    - Markus Axer
    - Torsten Franke
    - Michael Poettgens
  - Lyon
    - Laurent Mirabito
    - Patrice Siegrist

# Module Testing Facility

ARCS and DAQ test stands in Sidet at Fermilab



We will have 7 ARCS and 4 DAQ test stands in the room with space allocated for rod burn-in.

2 ARCS delivered

2 DAQ delivered

# ARC and DAQ Test Stands

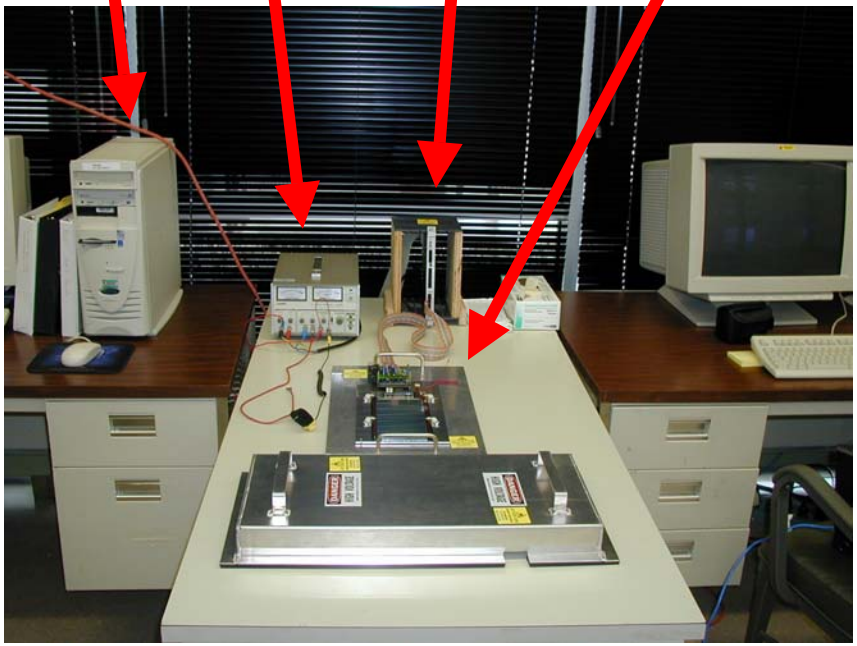
## ARC Test Stand

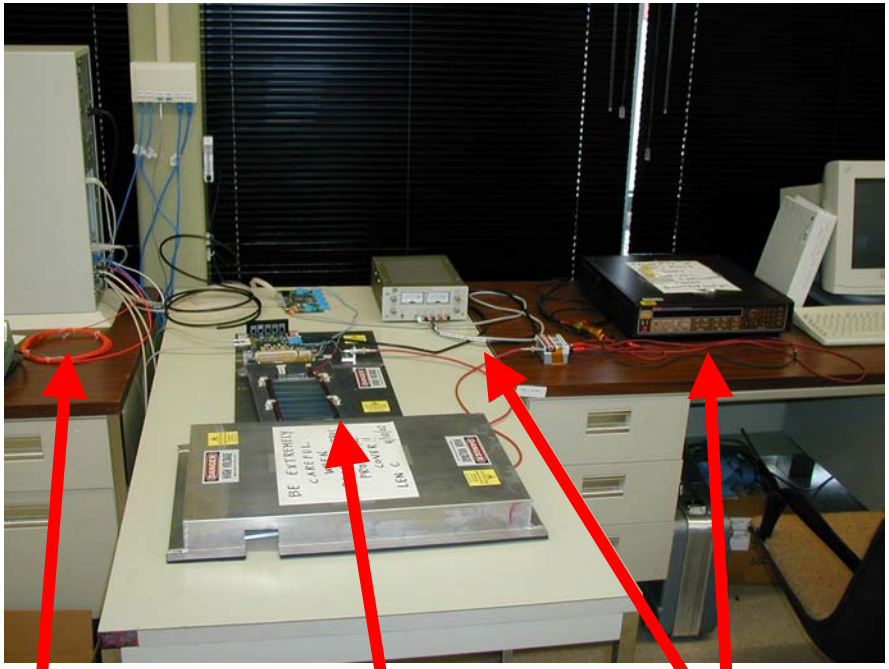
Computer and Memory Expander

SRDAPV

Power Supply

Front End Adaptor and Hybrid/Module





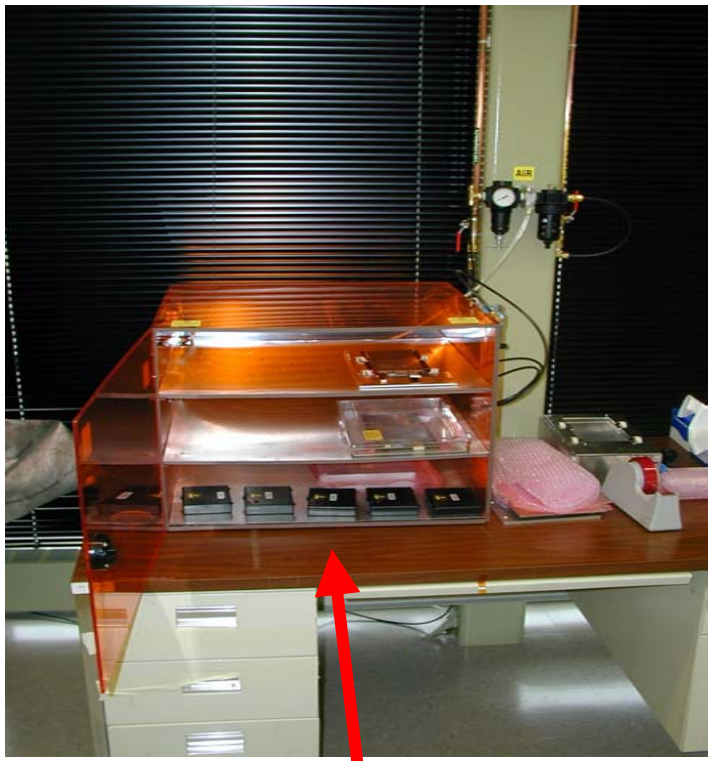
FEC, FED, TSC and Fiber Optic Cable

CCU, UTRI and Module Carrier

LV and HV Power Supplies

## DAQ Test Bench

# Hybrid/Module Handling and Storage



**Latex Gloves**

**Surgical Mask**

**Dry Box**

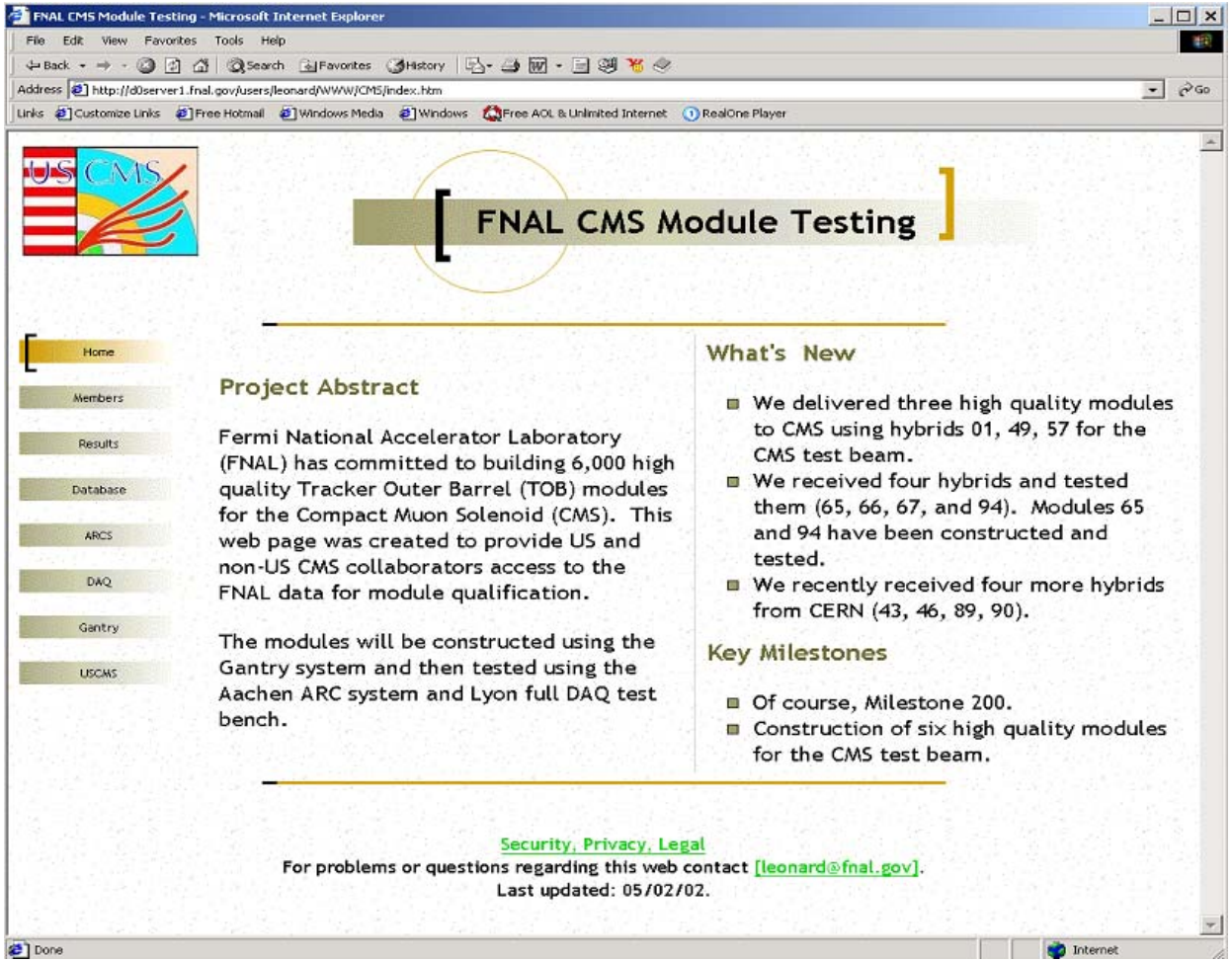
**Always practice good handling habits !**

# Web Pages

**We have a web page, so you can see what is going on at Fermilab.**

**All our results can be accessed through this web page.**

**You can reach this page through the link below.**



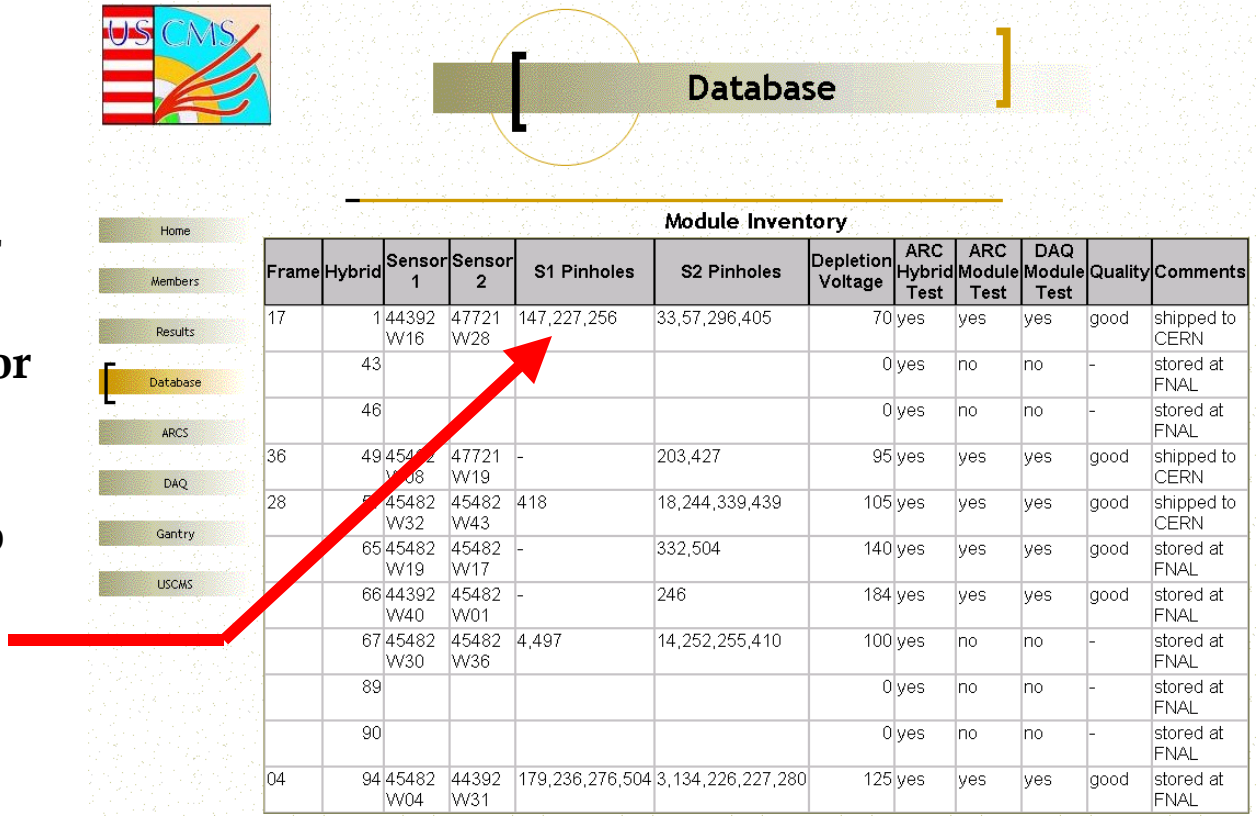

**uscms.fnal.gov/uscms/subsystems/sitracker/sitracker.html**

# Database

**We are learning how to use the CMS database and will be entering our results. Since we are in pre-production, we made a mini-database that we have been using to help us keep track of our test results.**

**Sensor 1 (S1) is the sensor closest to the hybrid and S2 is the second sensor of the module.**

**S1 pinholes correspond to a skipped bond on the hybrid and S2 pinholes correspond to a skipped bond between sensors.**




| Frame | Hybrid | Sensor 1 | Sensor 2 | S1 Pinholes | S2 Pinholes | Depletion Voltage | ARC Hybrid Test | ARC Module Test | DAQ Module Test | Quality | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 1 | 44392 W16 | 47721 W28 | 147,227,256 | 33,57,296,405 | 70 | yes | yes | yes | good | shipped to CERN |
| | 43 | | | | | 0 | yes | no | no | - | stored at FNAL |
| | 46 | | | | | 0 | yes | no | no | - | stored at FNAL |
| 36 | 49 | 454[illegible] | 47721 W19 | - | 203,427 | 95 | yes | yes | yes | good | shipped to CERN |
| 28 | [illegible] | 45482 W32 | 45482 W43 | 418 | 18,244,339,439 | 105 | yes | yes | yes | good | shipped to CERN |
| | 65 | 45482 W19 | 45482 W17 | - | 332,504 | 140 | yes | yes | yes | good | stored at FNAL |
| | 66 | 44392 W40 | 45482 W01 | - | 246 | 184 | yes | yes | yes | good | stored at FNAL |
| | 67 | 45482 W30 | 45482 W36 | 4,497 | 14,252,255,410 | 100 | yes | no | no | - | stored at FNAL |
| | 89 | | | | | 0 | yes | no | no | - | stored at FNAL |
| | 90 | | | | | 0 | yes | no | no | - | stored at FNAL |
| 04 | 94 | 45482 W04 | 44392 W31 | 179,236,276,504 | 3,134,226,227,280 | 125 | yes | yes | yes | good | stored at FNAL |

# Quality Assurance

- All components will be delivered from Europe to Fermilab.
- We will use the official testing procedures to test the hybrids and modules.
- Fermilab and UCSB are production sites and we will both use the CMS database to track components.

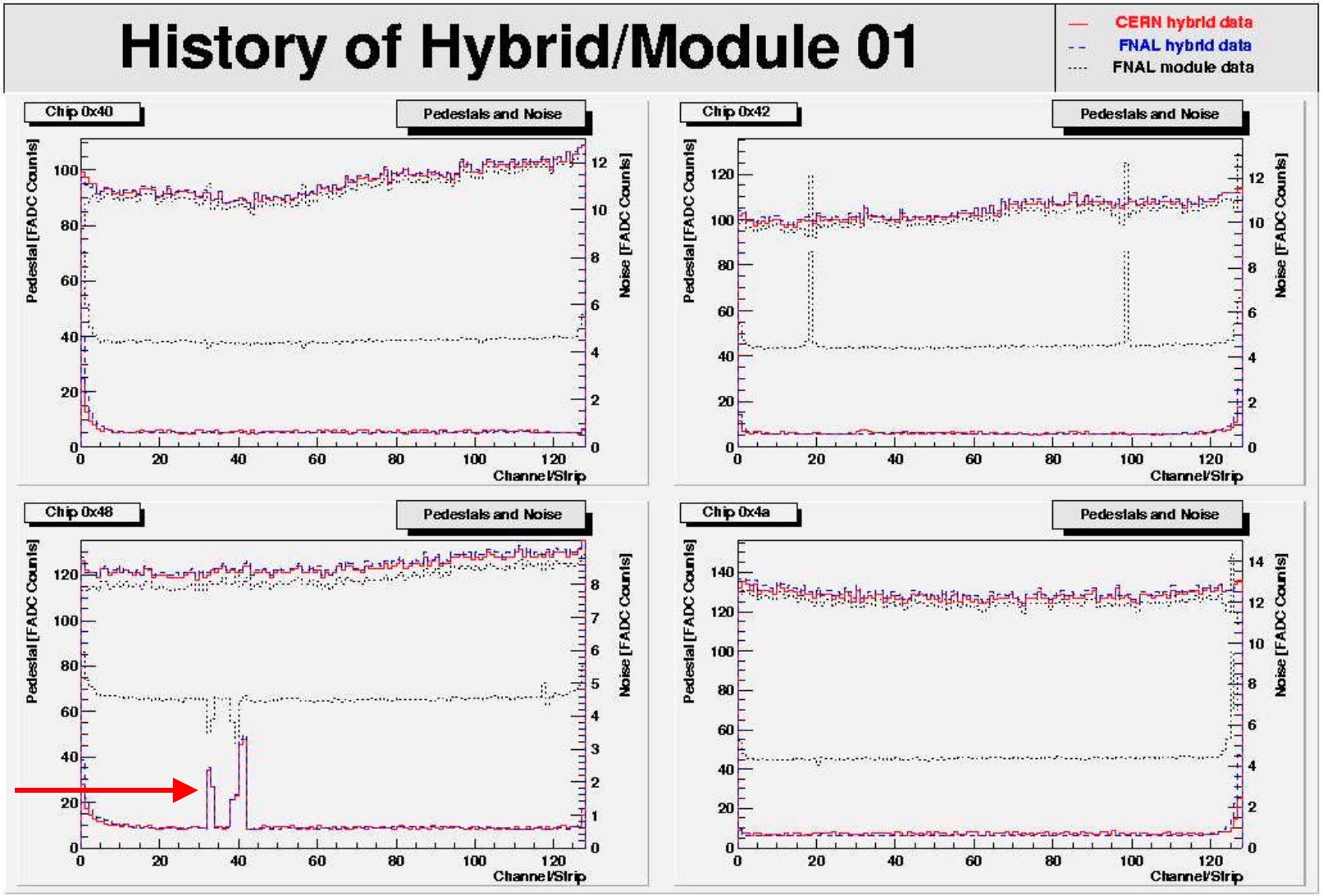
# Production Testing Procedure

1. Test hybrid on ARC test stand.
2. Create a module using the hybrid and then test the module on the ARC test stand (make possible repairs, if necessary).
3. Turn modules into rods and burn them in.
4. Test rod with CMS DAQ test bench.

# Our Experience with the ARC Test Stand

- In order to commission our ARC test stand, all seven milestone hybrids were tested at CERN with their ARC test stand.
- After the hybrids were shipped to Fermilab, we tested the same hybrids to confirm our ARC test stand was working properly.
- Modules were then constructed using these hybrids and we tested them again using the ARC test stand.
- We found excellent agreement between all tests.

# Milestone ARC Calibration



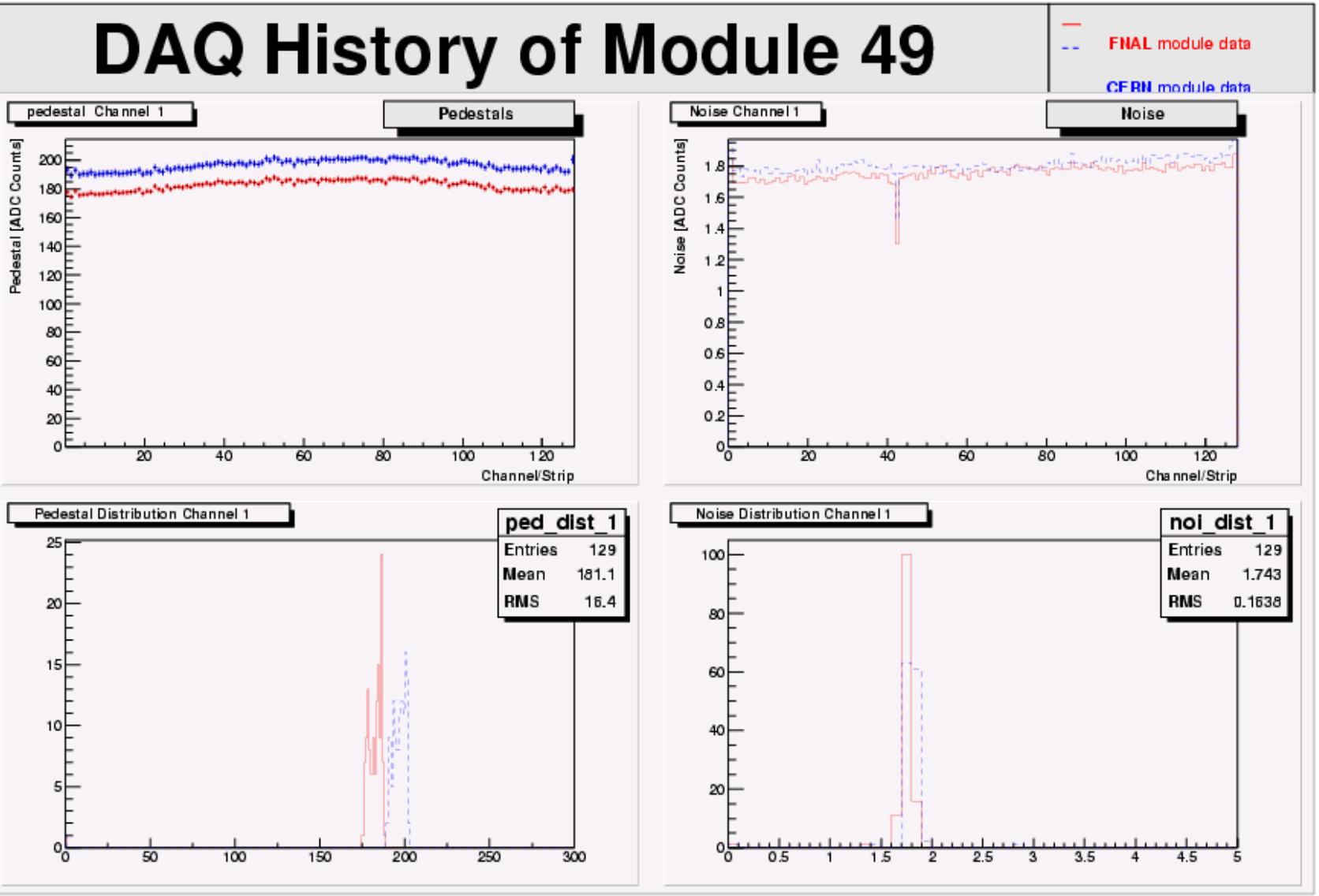

**Defect of pitch adaptor**

# Our Experience with the DAQ Test Stand

- In order to commission our DAQ test stand, all seven milestone modules were tested at FNAL with our DAQ test stand.
- After the modules were shipped to CERN, we tested the same modules to confirm our DAQ test stand was working properly.
- We found excellent agreement between all tests and found an average noise per chip of 2 ADC counts and CMN ~0.5 ADC.

# Milestone DAQ Calibration

## DAQ History of Module 49



# Summary & Conclusions

- We have constructed 7 Milestone 200 TOB modules.
- Six modules were shipped to CERN for test beam studies (all modules survived the journey back to CERN).
- We have all the software for running the test stands and for data analysis. (We ported ARCS to Windows NT).
- We are now preparing our facility for production testing.
- Presently, we have 4 additional hybrids, 22 sensors and 12 frames.