MICE Tracker Test at Fermilab Status Report

Amit Klier

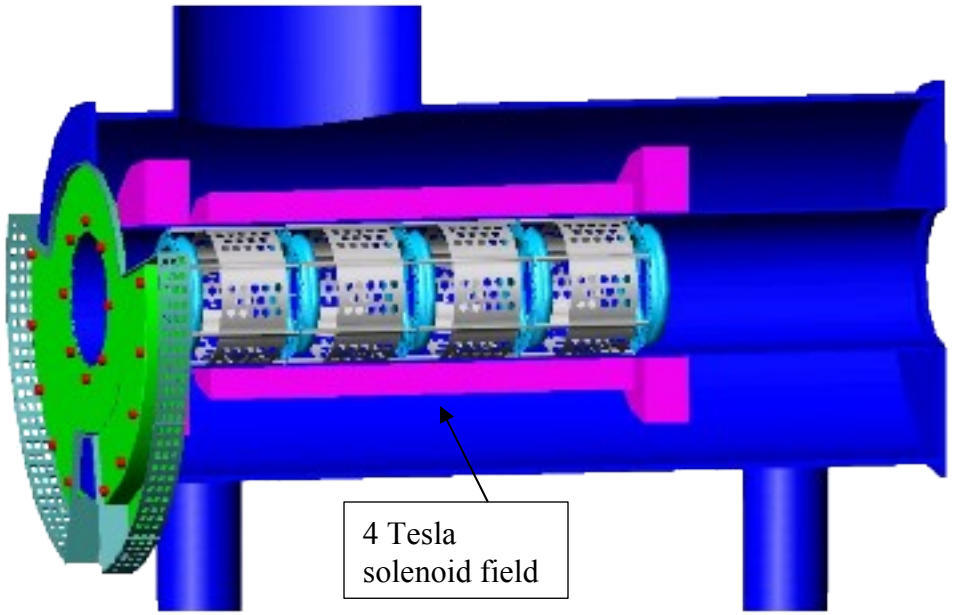
University of California Riverside

Alan Bross, Paul Rubinov (FNAL), Malcolm Ellis (Imperial), Makoto Yoshida, Hideyuki Sakamoto (Osaka), Amit Klier (UCR), Jean-Sebastian Graulich (Geneva)

Outline

- Introduction
  - MICE Fiber Tracker
  - The Prototype
  - Test Beam at KEK
- Preparations for KEK Test
  - Cosmic Test at Fermilab
  - More to do

MICE Fiber Tracker

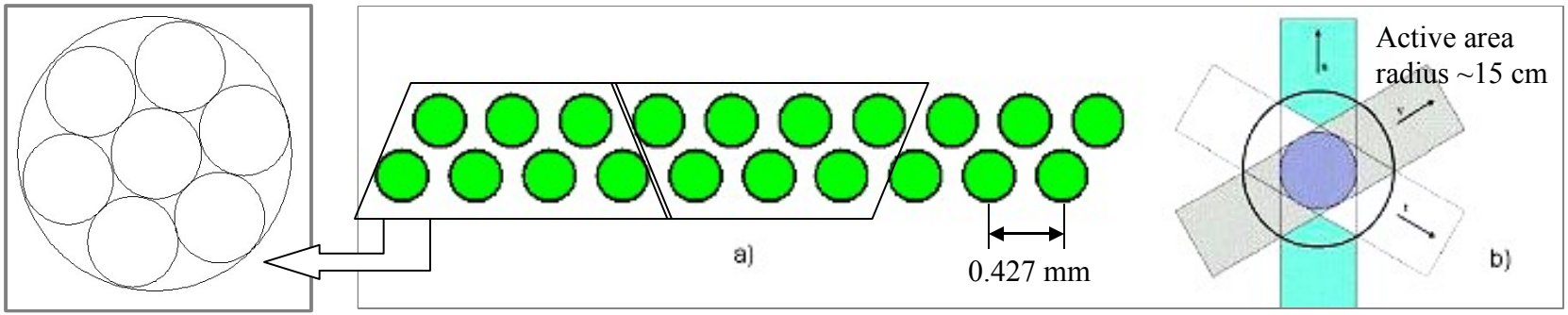


5 “stations” (not equally spaced) at each end of the MICE cooling channel

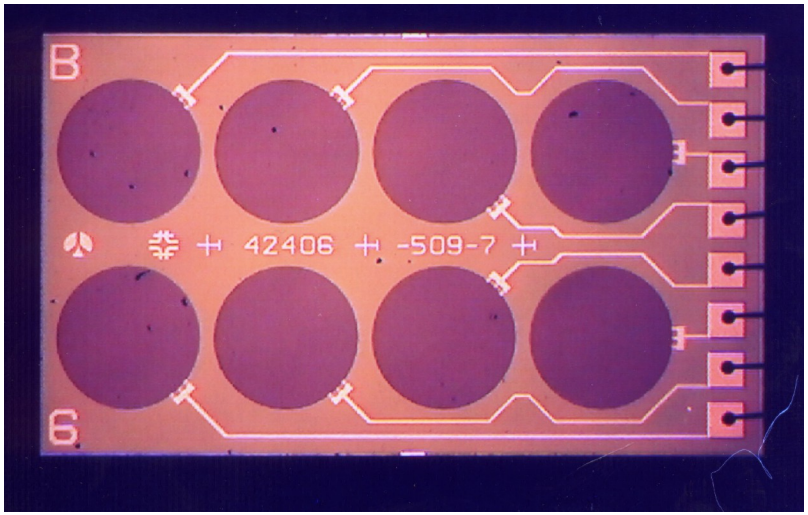
Each station has 3 planes

Each plane has two layers of 0.35-mm scintillating fibers

7 fibers are bundled into 1.05-mm clear fibers for readout



SciFi Readout

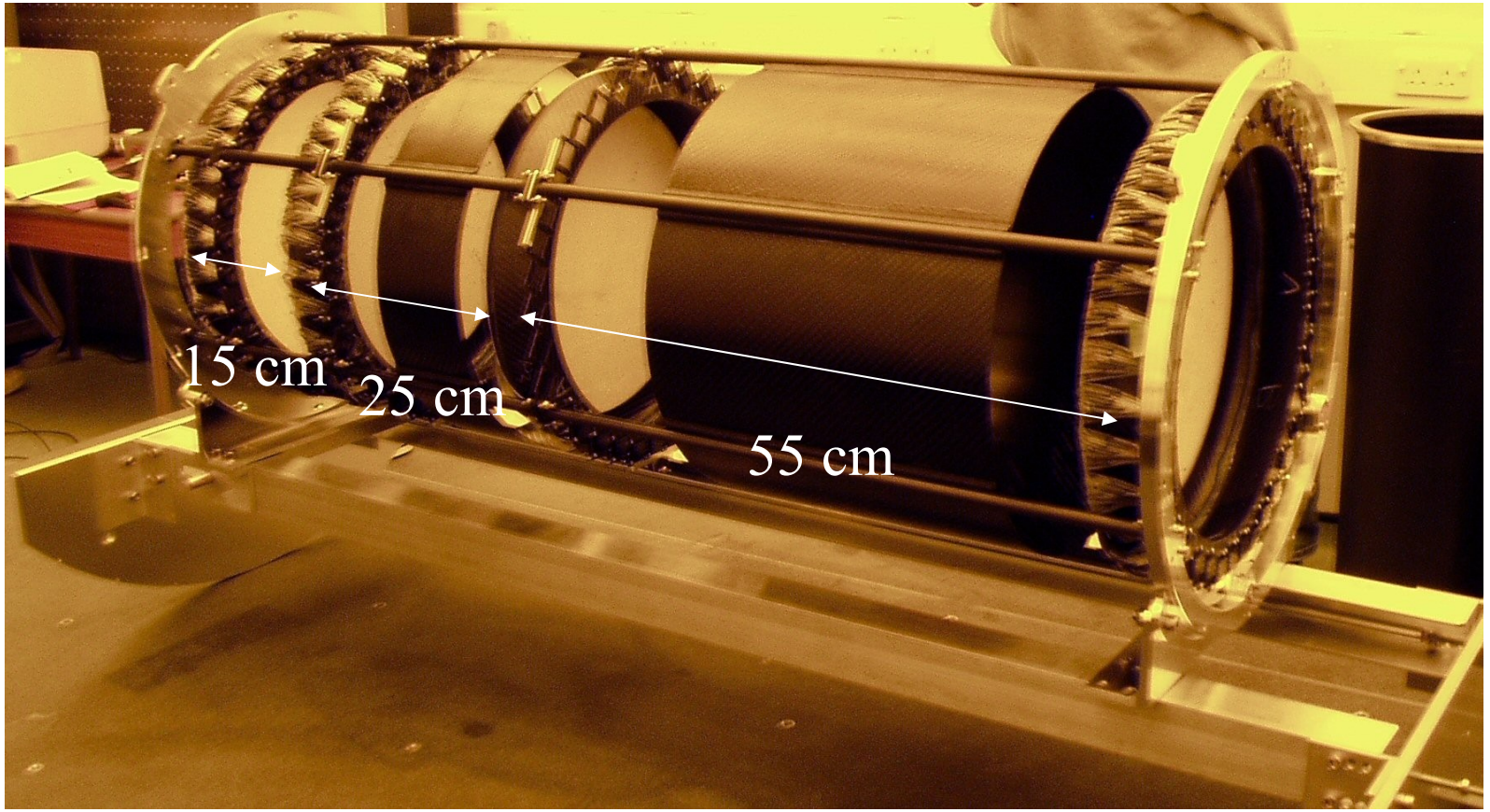


- Similar to D0
- Light from fibers is read with VLPCs
  - Operate at 9 K, achieved using cryocoolers
- Signal converted to digital using AFE-II (Analog Front End) boards
  - Improved version of AFE board, for D0 upgrade
  - First time used here

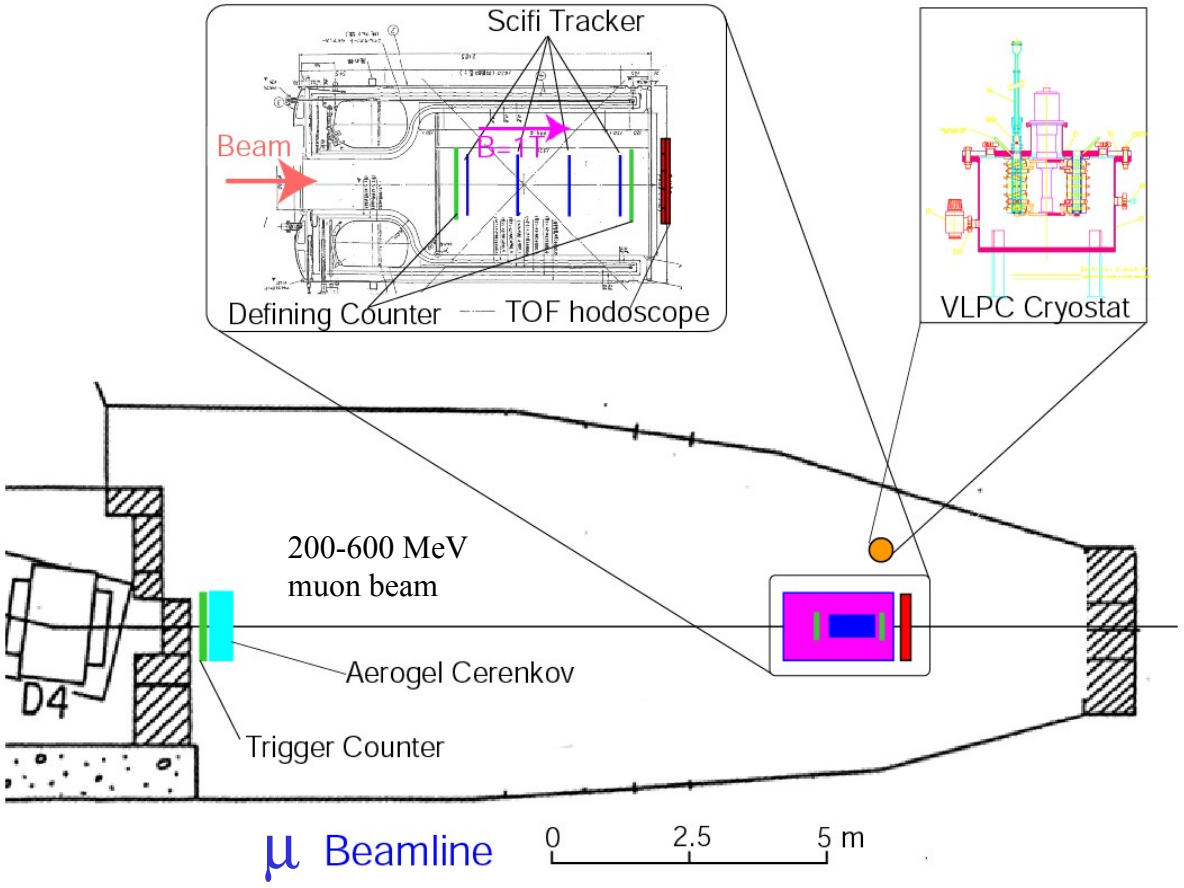
Fiber Tracker Prototype

- Prototype #1
  - 3 stations (one full, two with a missing plane)
  - Varying 3HF concentration
  - Built in 2003, cosmic tested at the D0 test stand at Fermilab (using D0 readout electronics)
- Prototype #2
  - A 4^{th} station (full) added
  - To be tested at KEK with a muon beam
  - Currently at Fermilab (new electronics tested and cosmic run)

Prototype #2 Assembled at IC



KEK Test Beam Layout

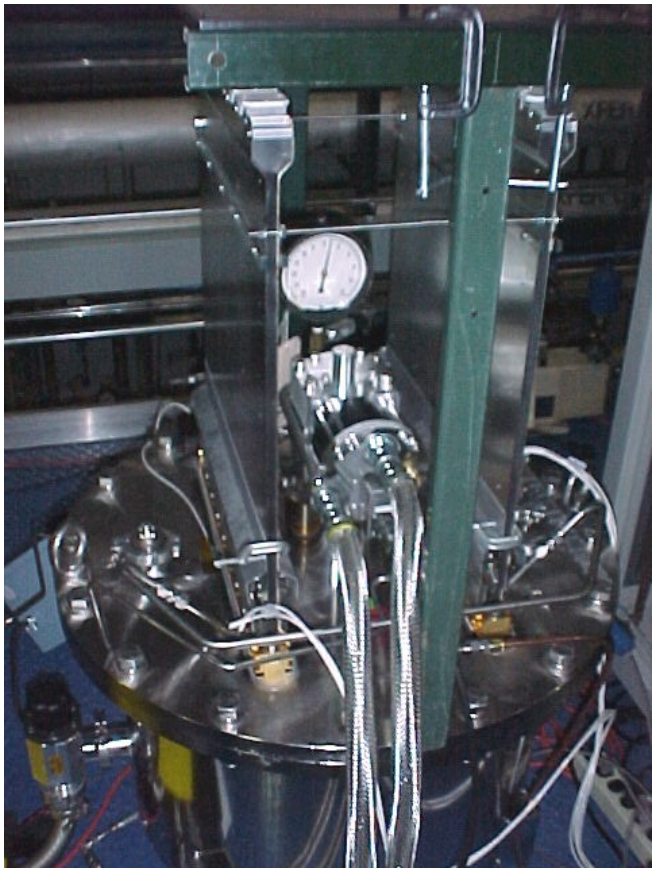


KEK Test Beam Schedule

- May 26th – June 2nd 2005
  - No tracker
  - Performance of other detectors (triggering, defining counters) checked
- September 27th – October 3rd 2005:
  - Phase 0: B=0, high-intensity “cosmic” test
  - Phase 1: Test tracking with magnetic field
  - Phase 2: Use a beam diffuser for a large emittance beam

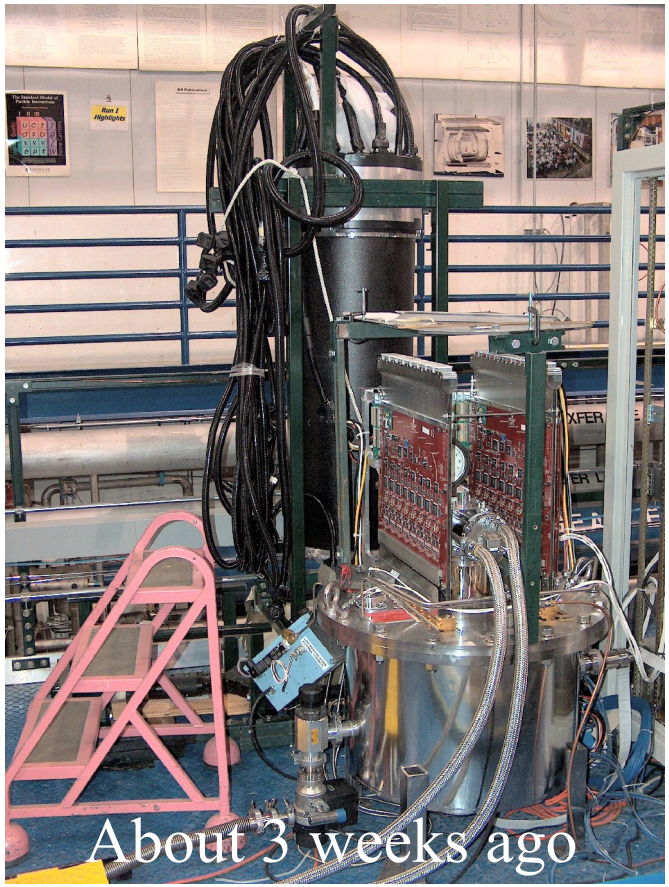
    (possibly in January 2006)

Preparations at Fermilab



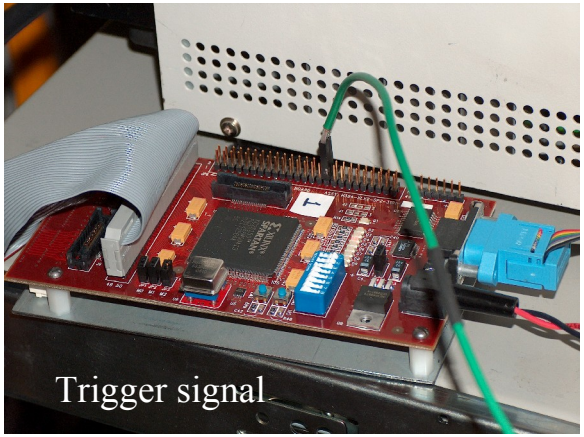
- Cryocooler has been running for over 3 months.
- Cold-end temperature was ~5.31 K until two weeks ago (stable)
- Went down to ~5.27 K after operating temp. control (set to 6.8 K when VLPCs run) still stable

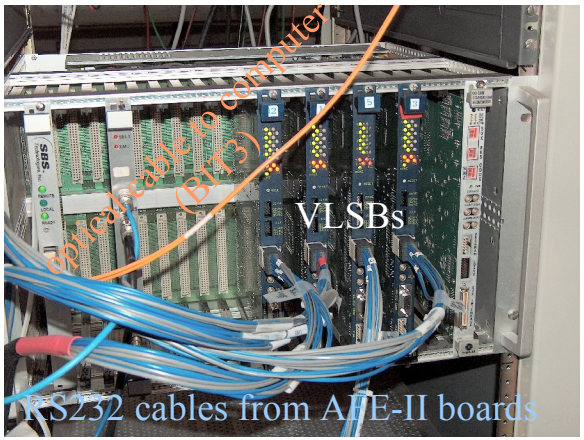
Prototype Hardware



- Tracker prototype has 16 waveguides of 128 clear fibers = 2048 channels
- A cryocooler has 2 cassettes = 4 AFE-II boards (2 RH, 2 LH)
- An AFE-II board has 8 TRIP chips for processing 512 ADC channels. That's 2048 channels in total

More Electronics..



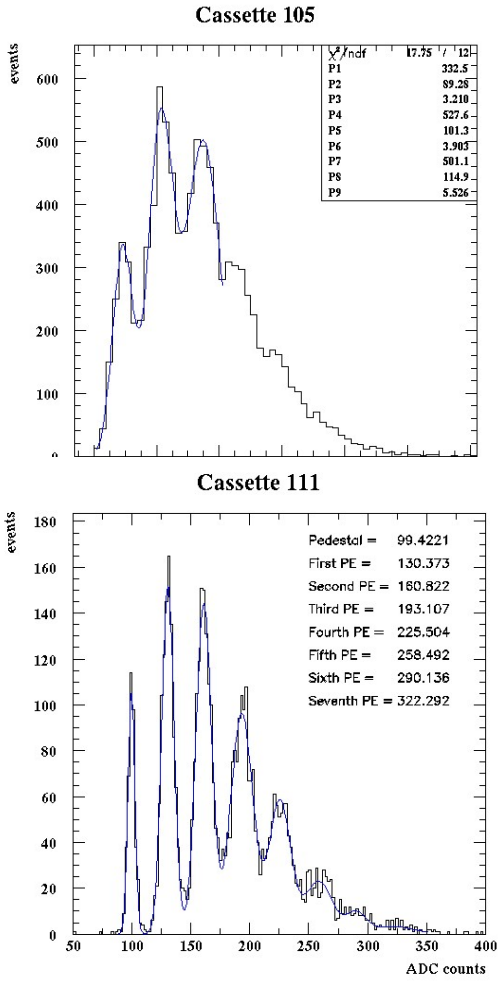


- Avnet board provides clock, trigger to all 4 AFE-II boards (replaces 4 SASEQs)
- Four VLSB boards read ADC signal from AFE-II to VME crate

The Status a Week Ago

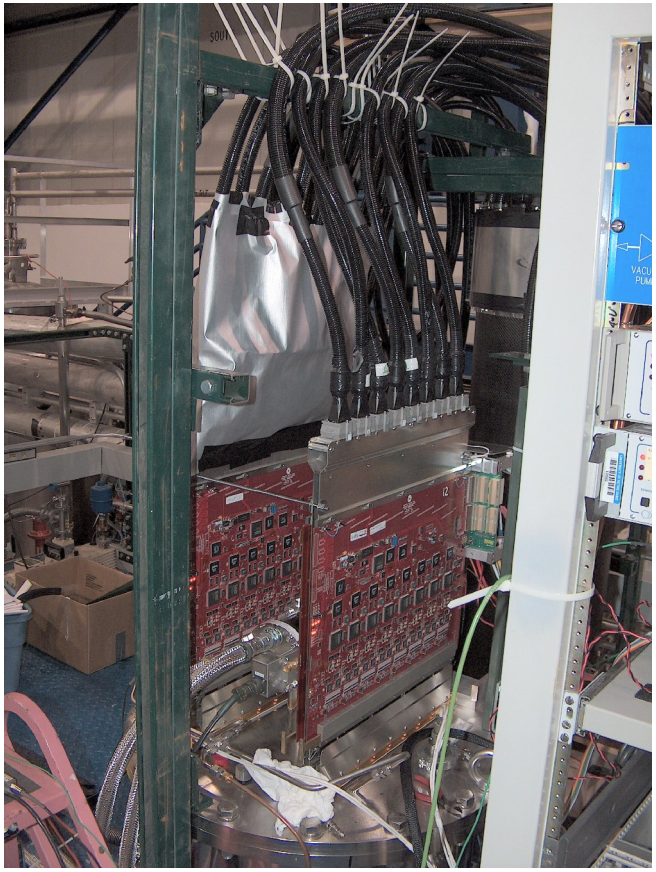
- Linux-based readout code being debugged (M. Ellis)
- Trigger counters operate (M.Yoshida, H.Sakamoto)
  - Event rate ~ 0.5 Hz
- Many hardware pieces were still missing
  - One right-handed AFE-II board was still missing
  - Only one VLSB board (out of 4) operating – could read only one AFE board at a time
- Friday: pulsed LED run was performed (left-hand board on left-hand cassette only)
  - Define trigger time delay
  - Pedestals and few-photon data taken
  - Resolution still not convincing…

This Week's Developments



- Noise from 3.3 V power board reduced by… removing the little board
  - Resolution improves
- Tuesday – last AFE-II board calibrated – all four are finally in place
  - Pulsed LED data taken for all four boards
  - 2 (out of 32) MCM channels seem to be noisy

This Week's Developments (2)



- Wednesday afternoon – waveguides mounted
  - Problem: not all are marked
- Evening – start cosmic data-taking
  - Event rate ~0.04 Hz (trigger efficiency ~8%)
- Thursday morning – power supply trips
  - Approximately 1,200 events were collected
  - No data analysis yet..

Current Status

- As of yesterday morning (following power trip), Avnet board couldn't communicate with AFE-II
- Yesterday afternoon the problem was fixed, and cosmic data-taking resumed around 6 pm
- Data taking ended around 10:45 am today
- In total, 4,328 cosmic triggers and over 25,000 calibration events (pedestals and LED pulser) were collected

Near Future Plans

- Mid-August – pack and ship tracker, cryocooler and electronics hardware to KEK
  - Alan Bross should follow…
- Software:
  - Process cosmic data, calibration, dead chanels
  - Debug/improve data-taking software (Linux)
  - Modify G4MICE to accommodate KEK test beam
- Arrive at KEK towards the last week of Sept.
  - Need time to assemble, test before the run
  - Trying to get two D0 electronics people to KEK