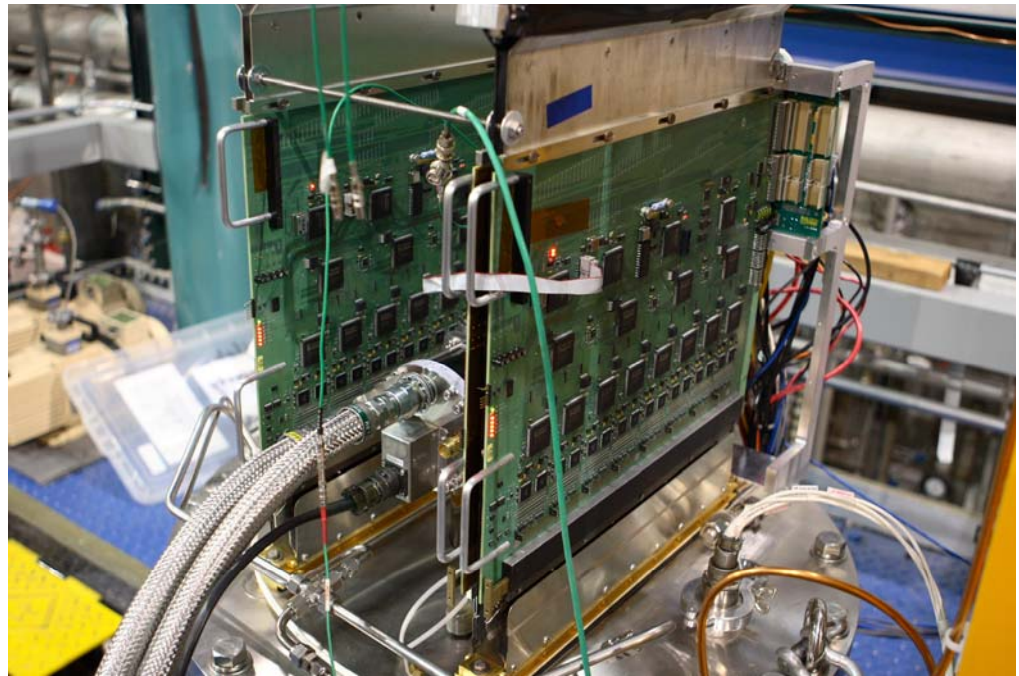
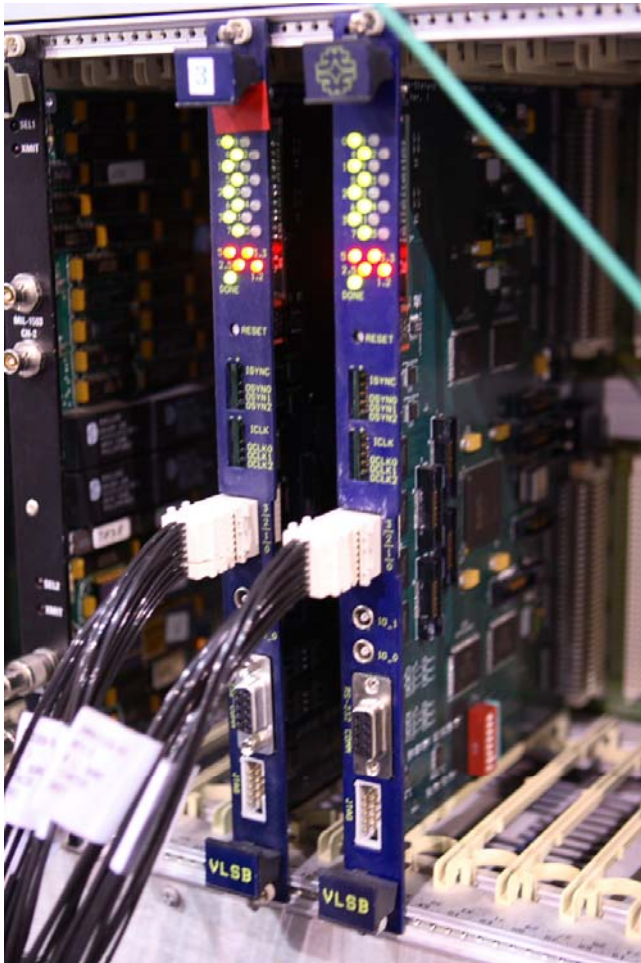


MICE Tracker Readout Update, Preparation for Cosmic Ray Tests



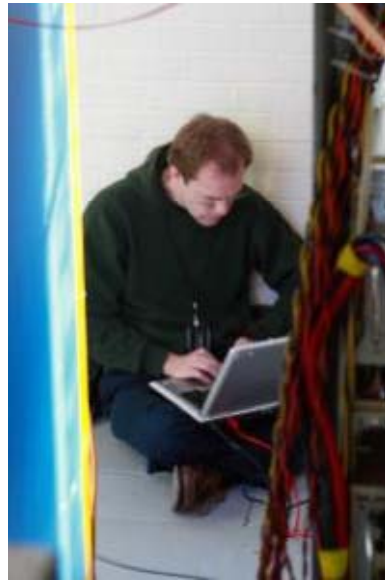
- Cosmic Ray Tests at RAL
- AFE-III Firmware Development
- VLSB Firmware Development
- Summary and Plans



Cosmic Ray Tests

- From Nov. 12 – 19, a cosmic ray test stand was set up at RAL including the following systems
 - Scintillating Fiber Tracker
 - Cherenkov Detector
 - Data Acquisition
 - *Time of Flight counters not ready for tests*
- Ultimately, problems with the two VLPC cryostats for the trackers prevented data taking
 - One didn't cool down all the way to necessary operating temperature.
 - The other developed leaks, possibly during overseas transit.
- Both cryostats shipped to FNAL for inspection and repair.





Malcolm Ellis not pictured because he was the photographer.

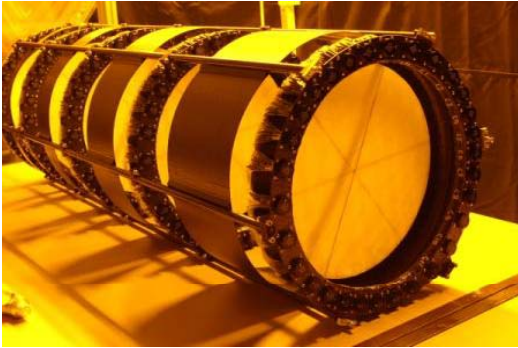


Cosmic Ray Tests, Tracker

- The first tracker has been assembled.
- The fiber-waveguide connections have been tested showing only one dead channel.
- The tracker firmware has been exercised with self-injection data.
 - Data to VLSB boards looked fine.
 - Strange values written to control registers suggested problems with data taking with multiple boards.



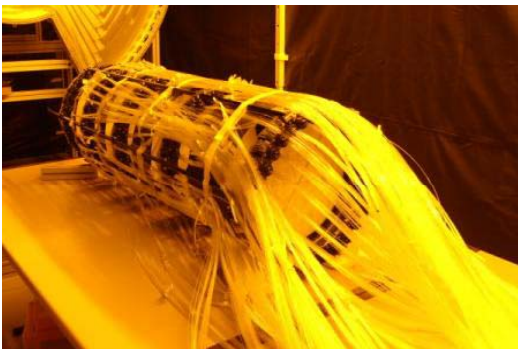
Tracker Photographs



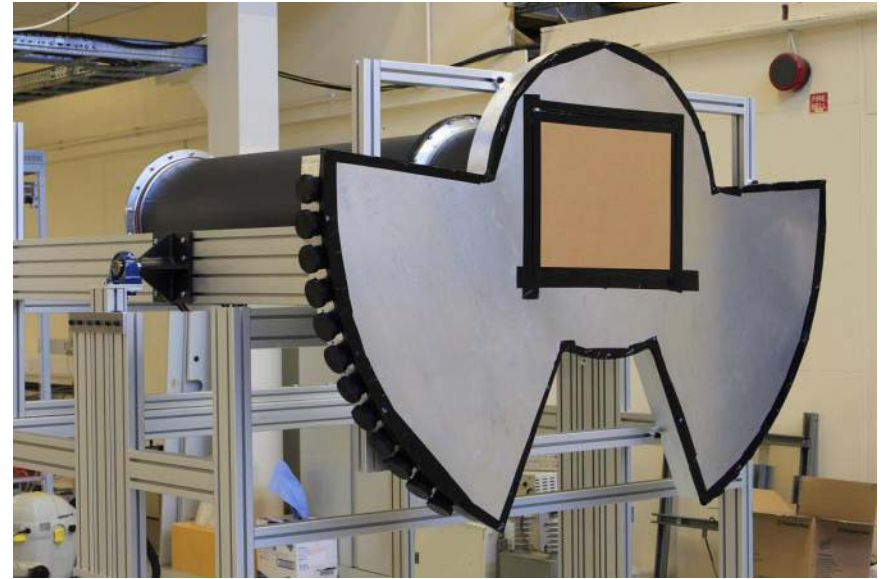
5 tracker stations



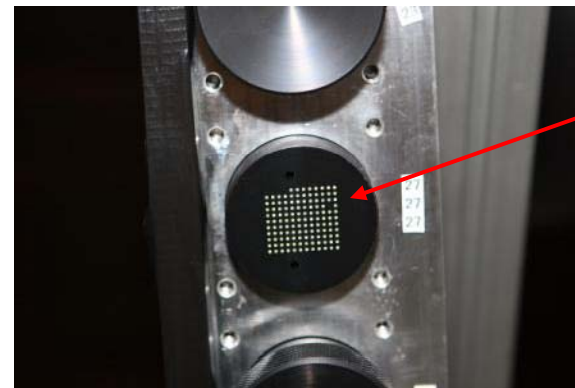
Connecting waveguide fibers



All waveguide fibers organized and bundled



Tracker, waveguide fibers, and patch panel all assembled



Only one dead channel



Work at Fermilab (FNAL)

- Cryostats shipped back to FNAL.
 - First cryostat compressor jumpers weren't set properly (cryostat was o.k.)
 - Second cryostat had a leak in one cassette (other cassette now has leak!).
 - Power supplies had oscillating voltages.
 - Problem traced to faulty ground
 - Another power supply will be needed (one per cryostat)
- Possible problems with 10 meter long LVDS cables for VLSBs; current work using 3 meter long cables.
- Tracker firmware being tested at FNAL. (more later)
- Try for cosmic ray tests at RAL in March.



MICE Tracker Acronyms

- AFE-II – Analog Front End, Version II, with time
- VLSB – VME LVDS Serdes Buffer
 - Versa Module Eurocard
 - Low Voltage Differential Signalling
 - Serializing/Deserializing
- FPGA – Field Programmable Gate Array
 - AFPGA controls analog data
 - DFPGA controls digital bitmap of which channels are on.



Future Tasks for AFE-It Firmware

- Integrating Senerath's DFPGA code
 - Senerath has released his (possibly) last version
 - When tracker readout system is tested and working, we will determine what roles the current and Senerath's DFPGA codes will have.
- Implementing and debugging AFPGA 4-level buffer
 - Bulk of code in place
 - Need to work out potential timing conflict between incoming triggers and data transfers between AFPGA/DFPGA
- Testing that PLL locks on to variable ISIS signal
 - Hardware and firmware all set
 - Need to put everything together to test and work out kinks

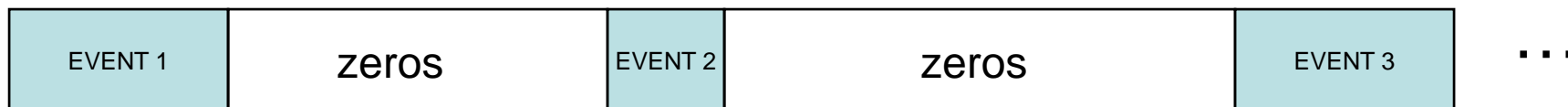
Goal: Finish these in a couple months.



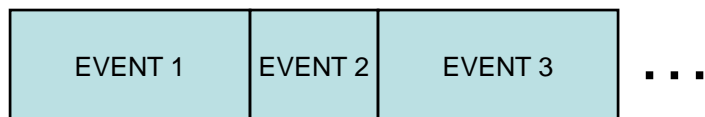
VLSB Firmware Modifications

- Data storage in memory banks

- Before modifications



- After modifications



- Newly utilized registers: used by MICE DAQ

- Registers 0 – 3: Memory bank addresses of last data word
 - Register 15: Number of events in spill



VLSB Firmware Modifications

- Enable trigger word operation for all four memory banks, not just first bank.
- Fast clear of memory banks
 - Simulated data written to VLSB
 - When fast clear bit set by MICE DAQ
 - All memory addresses set to zero.
 - Fast clear done bit properly set after last address cleared.



VLSB Testing

- We're using a test stand at FNAL which sends repeating data patterns to the 4 memory banks of VLSB boards.
- A two-board set-up is being used.
 - Preparing each board to receive data takes about a μs per board which is too long.
 - To get this to work, we're sending a data trigger enable signal from a master board to a slave board via a LEMO cable connection. This takes only about 20 ns.
 - For MICE beam, this won't be necessary, but it's useful for self-injected data and cosmic ray data taking modes.
- This has uncovered some code bugs which have been corrected.



VLSB Testing

- What works
 - Suppression of zero words
 - Triggering on control register specified trigger word
 - Data trigger enable signal sent from master board to slave board in about 20 ns.
 - Control registers correctly indicate
 - Final address of memory bank with data
 - Number of events in a spill
- What doesn't work
 - Getting both boards to start recording data at the start of first trigger word.



Preparation for Cosmic Ray Test

- Connect power supply to two cryostats (*done*)
- Cryostat temperature tests (*done*)
- Get new AFE-II and VLSB firmware working together
- Characterize 4 cassettes
- Simulate cosmic ray test with LED



AFE-Itt and VLSB Boards

- 8 boards for 2 cryostats fully tested and characterized.
 - 4 boards assigned to 3rd cryostat, not yet tested and characterized
 - 11 spare boards available, 4 of which will be assigned to 4th cryostat.
-
- 23 AFE-Itt boards available for MICE

 - 19 VLSB boards available for MICE.



Summary

- Preliminary firmware package being set up for data readout tests at FNAL
 - Only one level of 4-level buffer
 - Using modified D0 DFPGA instead of Senerath's DFPGA.
- Aiming for
 - Reshipping tracker readout system to RAL in March
 - Unpacking tracker readout system at RAL in March for cosmic ray tests
- End in sight for full firmware for MICE (~ 600 triggers/ms)

