



Tracker Cosmic Ray Test 2011

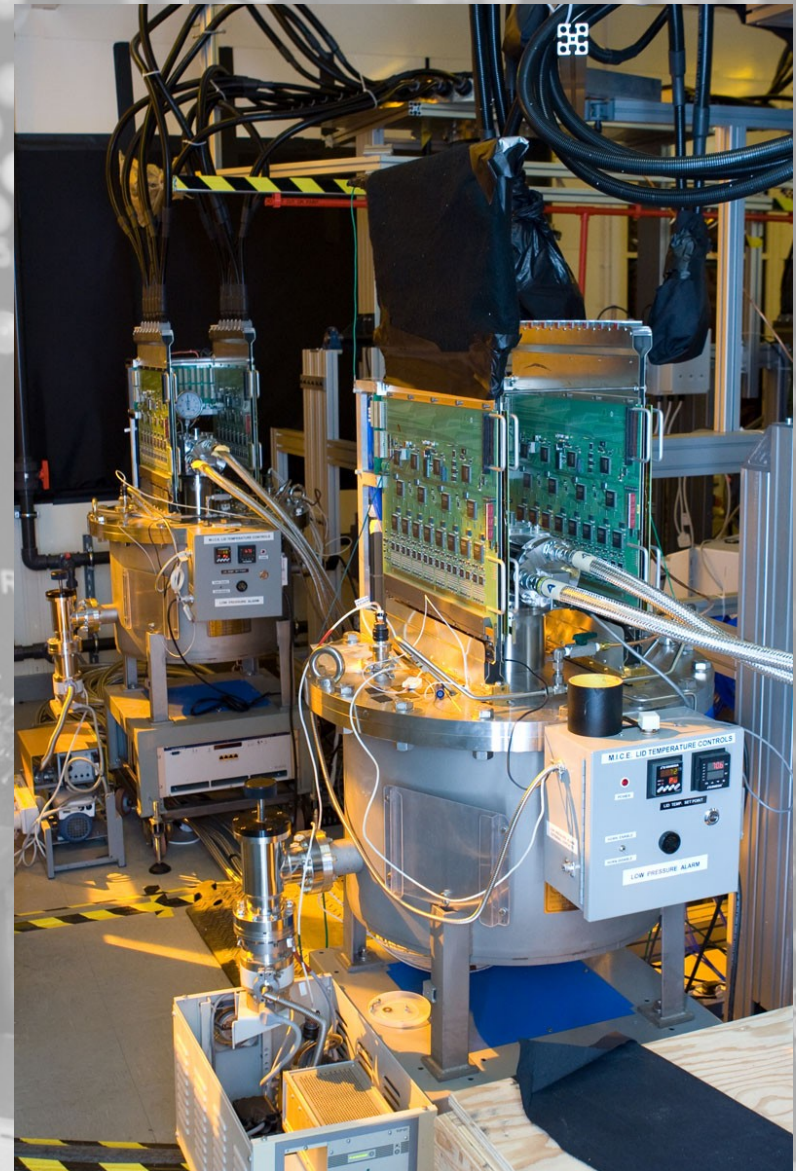
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UC Riverside
CM 29 - February 16, 2011**

2011 Cosmic Ray Test Plan

- **What do we want to do?**
 - Take more cosmic ray data with both trackers simultaneously
- **Why?**
 - Last time took data – 2009
 - Never satisfactorily set up and timed in trigger
 - Never before run both trackers at the same time
 - Tracker expertise leaving
 - Do this test → make detectors secure until installation in Hall
- **How long?**
 - Until we: enable two-tracker readout, verify tracker quality, MLCR readout?

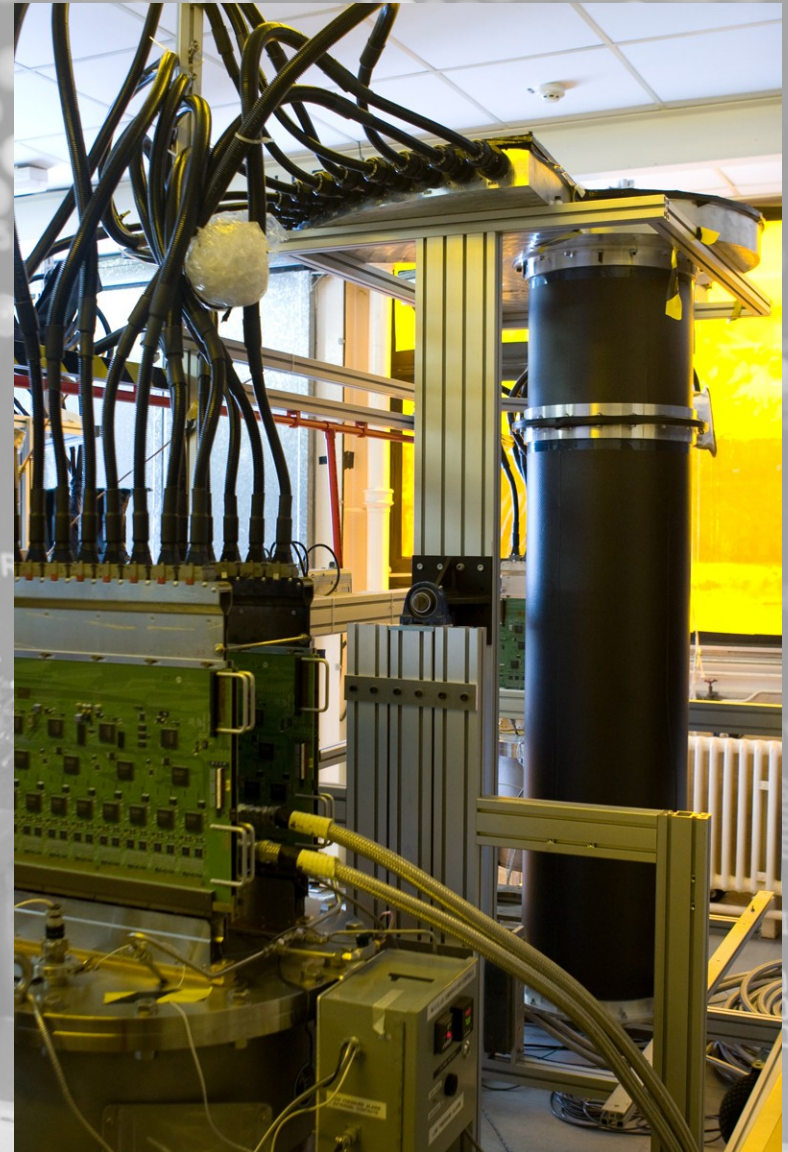
Tracker Hardware

- 2 trackers
- 4 cryostats
- 16 AFE-Ilt boards
- Readout electronics
- Readout code
- Trigger
- Fake ISIS RF signal



Tracker Hardware Status

- **Minimized He background in Lab7**
 - Vent pumps outside
 - New He tank and regulator
- **Vacuum pumps good**
- **New hoses on Cryo 2 & 4 to stop leaks**
- **All AFE boards cabled to VLSBs**
- **New trigger panels in Lab7**
 - Need to mount
- **All readout electronics modules in hand**



Cryostats Near Ready

- **Cryostat 1**

- Vacuum
- Cold cathode gauge
- Trigger Cabling
- Cooldown

- **Cryostat 2**

- Vacuum
- Cold cathode gauge
- Trigger Cabling
- Cooldown

- **Cryostat 3**

- Vacuum
- Cold cathode gauge
- Trigger Cabling
- Cooldown

- **Cryostat 4**

- Vacuum
- Cold cathode gauge
- Trigger Cabling
- Cooldown

MICE AFE-It Status

Feb 7 2011

Paul Rubinov – FNAL

Tom Fitzpatrick - FNAL

AFE in MICE

- **The key problem for AFE in MICE is the ISIS RF**
 - More precisely: the key problem is knowing when muons are crossing the tracker
- **AFE was never designed for a changing frequency**
 - ISIS increases frequency as the bunches are accelerated (~3.0 to 3.1 MHz during time we dip the MICE target)
- **It's difficult to make it work at any fixed frequency more than about 25 ppm away from 53.104MHz (would need hardware mods)**
- **Another way to state the problem:**
 - We need to open the integration gate before the first muon gets there

Paul & Tom's solution

- Our solution is one of their favorites: let someone else worry about it
 - We expect to be supplied a signal that indicates when the TriP-t integration window is to be open
 - We distribute this across the board using low skew routing, so all channels are live at the same time
 - Once data is in the pipeline, after trigger, we digitize and readout at 53Mhz as always.
- Required from MICE:
“integrator live” signal and fixed latency trigger

Status

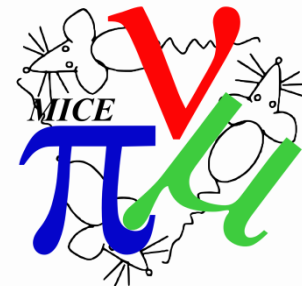
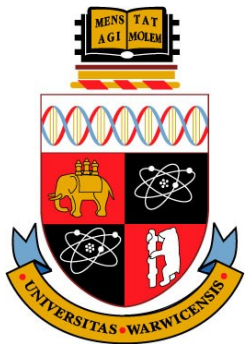
- **We also tried to simplify the data format and the firmware**
- **Current status is: 100% done, but continuing to test for more subtle problems**
- **Caveat: we have one AFE board and one VLSB at Fermilab**
 - Will test thoroughly at RAL next week
- **Using Malcolm's Excel based readout**
- **Capable of ~150 events per ms long spill, but this depends on trigger latency if it is greater than about one half of ISIS RF bucket**

Example Output File: Zero Suppression Off

(with zs on, just take away all lines with hit=0)

*** Parsed Data ***

--- Bank0 ---	len=256	evt	hit=1	ch num	t	amp
0	0x0500191A =>	5	0	0	25	26
1	0x05C046FF =>	5	1	64	70	255
2	0x05201919 =>	5	0	32	25	25
3	0x05601F21 =>	5	0	96	31	33
4	0x0501171A =>	5	0	1	23	26
5	0x05410B19 =>	5	0	65	11	25
6	0x05211719 =>	5	0	33	23	25
7	0x05611E1E =>	5	0	97	30	30
8	0x05021A1B =>	5	0	2	26	27
9	0x05C23BFF =>	5	1	66	59	255
10	0x05221718 =>	5	0	34	23	24
11	0x05621F20 =>	5	0	98	31	32
12	0x0503191B =>	5	0	3	25	27
13	0x05430C18 =>	5	0	67	12	24
14	0x05231718 =>	5	0	35	23	24
15	0x05631F1E =>	5	0	99	31	30
16	0x05041818 =>	5	0	4	24	24



Tracker DAQ

D Adey

CM29

RAL

8/2/11

Readout

Readout functions for VLSBs implemented and integrated with MICE equipment list

Communication with VME/access of registers tested

New AFE and VLSB firmware will require some changes, primarily shift from cosmic to beam data and triggering

Unpacking also depends on new firmware and data format – work underway

Reconstruction

Cosmic ray reconstruction tested and will be used in upcoming test

Helical reconstruction working, but lacks efficiency (will not do 600/s) and has areas for improvement eg. scattering/energy loss in the Kalman noise

Improvements to space point level recon, fast helical fit and improvement of Kalman also in progress

Cosmic Ray Test Plan

- **Hardware ready to go shortly**
- **Tom, Paul arrive Friday/Monday**
- **Upgrade firmware**
- **Test readout with new version of spreadsheet**
- **Test with internal fixed freq trigger, internal variable freq trigger, external mimic of ISIS RF signal (variable freq)**
- **Test readout with modified DATE - David**

Summary

- **Make upgrades to firmware and readout**
 - No running directly from control room
- **Start 2011 cosmic ray data-taking by Feb 25**
 - Assess data monthly (max 3 months)
- **By end of May (latest) make trackers safe and put into storage**