Electron-Muon Ranger (EMR)

First Tests at RAL

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Installation in MICE Hall
Preliminary Results
Plans

Mechanics
Electronics
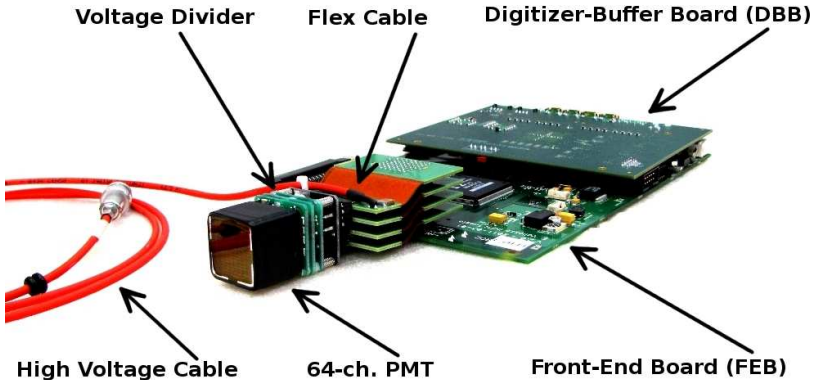Current Configuration

EMR Box and Cabling

- EMR box with 3 X-Y modules (6 planes) was installed in the MICE hall on June 16th
- EMR lower frame was fitted inside KL frame
- the center of the detector was found to be 10 cm higher than beam axis
- most of the cables are temporary, used only for tests
- inner cabling will be fully re-done once all the boards are installed

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Current Configuration

DAQ PCs and EMR Rack

- EMR rack is located next to the detector
  - composition is very different from final
- two PCs are installed next to the rack and used for testing
  - for cosmics test
  - for buffer board debugging
  - can not be combined
- another PC (in MICE Control Room) is used for final DAQ in DATE

Installation in MICE Hall
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Current Configuration

Front-End Board and Buffer Board

- FEB and DBB were connected together for the first time
- both work correctly, digital signal is buffered by DBB

Current Configuration

- 4 planes are equipped with FEB+DBB (236 channels)
- 6 planes are equipped with single-anode PMTs (6 channels)
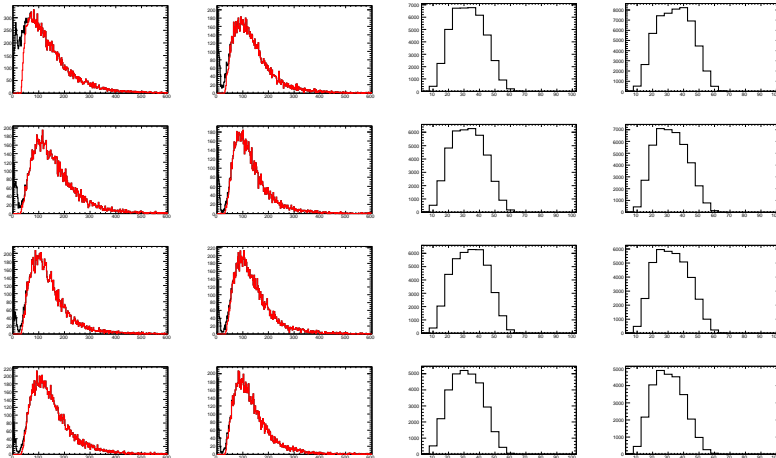- two separate systems work in parallel:

Cosmic Test System

- first and last planes used for cosmic trigger
- FEB configuration (MAROC configuration: masks, thresholds etc.)
- FEB analog and digital readout after every trigger
- not implemented in DATE

Beam Test System

- trigger and spill signals are taken from MICE DAQ
- DBB digital readout after every spill
- implemented in DATE

Cosmic Run
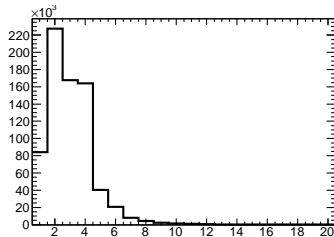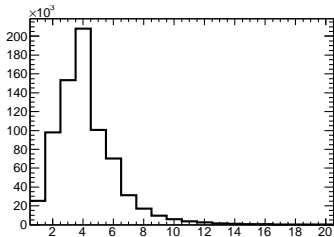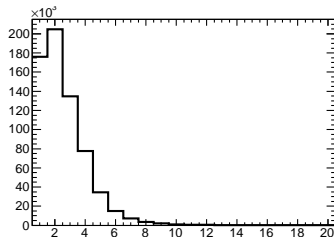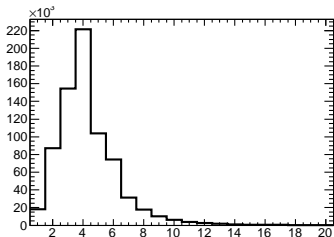## Example of Analog (left) and Digital (right) Signals of 8 Bars

Cosmic Run
Analog VS Digital Signal in All Bars. 1 Plane.

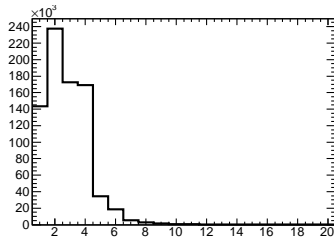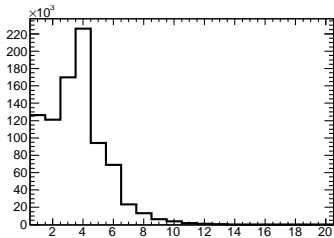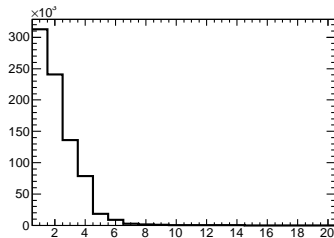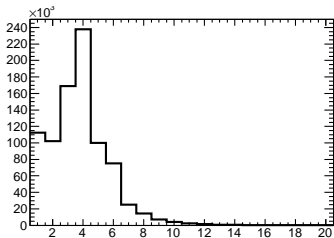Installation in MICE Hall
Preliminary Results
Plans

Cosmic Test System
Beam Test System
Problems
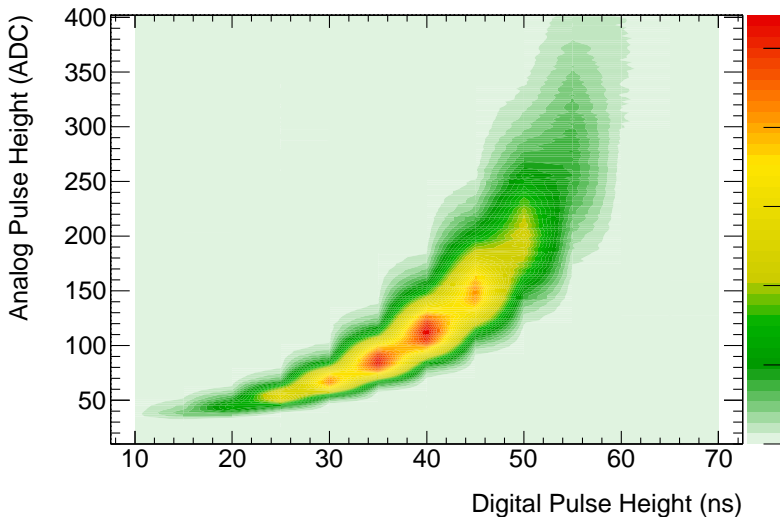
Cosmic Run
Total Number of Hit Bars per Plane. 4 Planes.

Installation in MICE Hall
Preliminary Results
Plans

Cosmic Test System
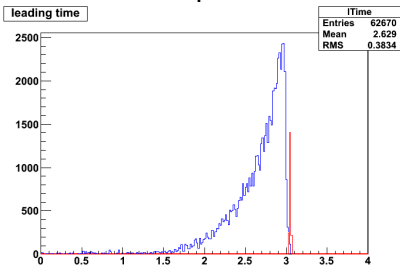Beam Test System
Problems

Cosmic Run
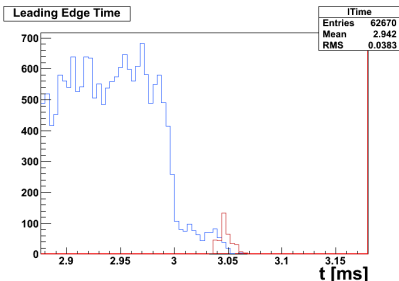## Number of Bars per Cluster (Group of Bars). 4 Planes.

Beam Run: June 30 - July 2
Leading Edge Time of EMR hits (blue) and Spill Width (read)

Time distribution of the EMR hits inside the spill window
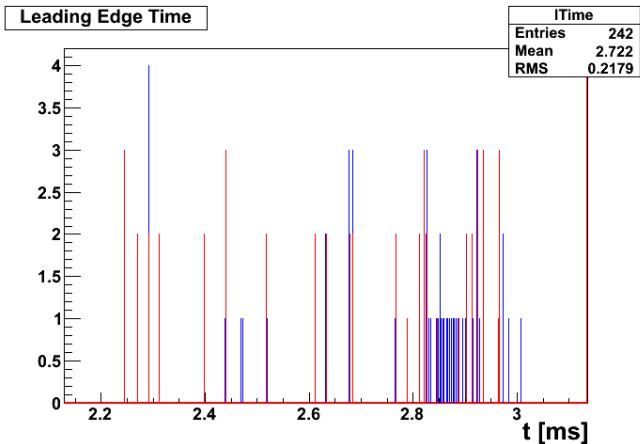
Zoom over the end of spill

- the spill width is measured by DBB boards
- all hits within spill gate are recorded together with particle trigger signals

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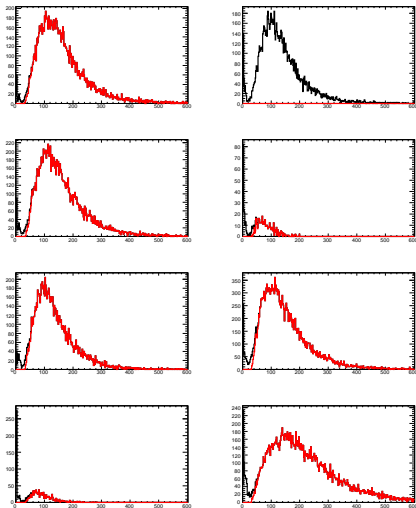Cosmic Test System
Beam Test System
Problems

Example of one Spill
Particle Triggers (red) and EMR Hits (blue)

- particle triggers should be associated to EMR hits

Problems

- a few dead digital channels, probably due to cables or VME board
- broken fibers (known problem)
- communication between DBB and VRB is lost over long cable (15m), probably due to a broken transmission cable

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Preliminary Results
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Short Term
Long Term
Conclusions

Short Term Plans

Hardware

- integrate fADC readout of single-anode PMTs in DATE and in the on-line monitoring
- integrate FEB configuration VME board in DATE
- integrate 32-bit DBB read-out VME board in DATE

Software

- extract from data all the relevant info for the on-line monitoring and possibly event display
- use simple software for tests and debugging
- develop EMR analysis code in MAUS framework

Yordan and myself are people in charge of these tasks

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Long Term Plans

Electronics

- upgrade to 6 FEBs and 6 DBBs. This requires new FEB configuration VME board since the current board can can only work with 4 FEBs
- update DBB readout board and its firmware
- upgrade DBB: add two additional signals - particle trigger request and clock, use ECL or LVDS for additional signals
- start full production of FEBs and DBBs

Mechanics

- make final decision about production procedure of EMR planes (to reduce possibility to break fibers)

Conclusions

- EMR installed in MICE hall
- all available electronics were installed and tested
- cosmic tests showed that all equipment works correctly
- DBB and readout board implemented in DATE
- beam data recorded and will be analyzed soon
- the system is far from final
- many modifications are foreseen