T1064 at FTBF
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Goals: develop hadron/electron identification in pixelized Pb-Scintillating-fiber calorimeter (SpaCal) and determine energy resolution for electrons

Why FTBF? electrons,muons,pions,protons for 1<|R|<30 GV

Excellent people, mechanical aids, beam characterizing detectors

Need improved network, detector integration, user manual

Operation at FTBF

The staging area allows relatively simple setup of the apparatus prior to beamtime. It is best to arrive at least 1 week prior to the allotted time to gain familiarity with weekly schedules and allow ample time for safety reviews and last minute fixes.

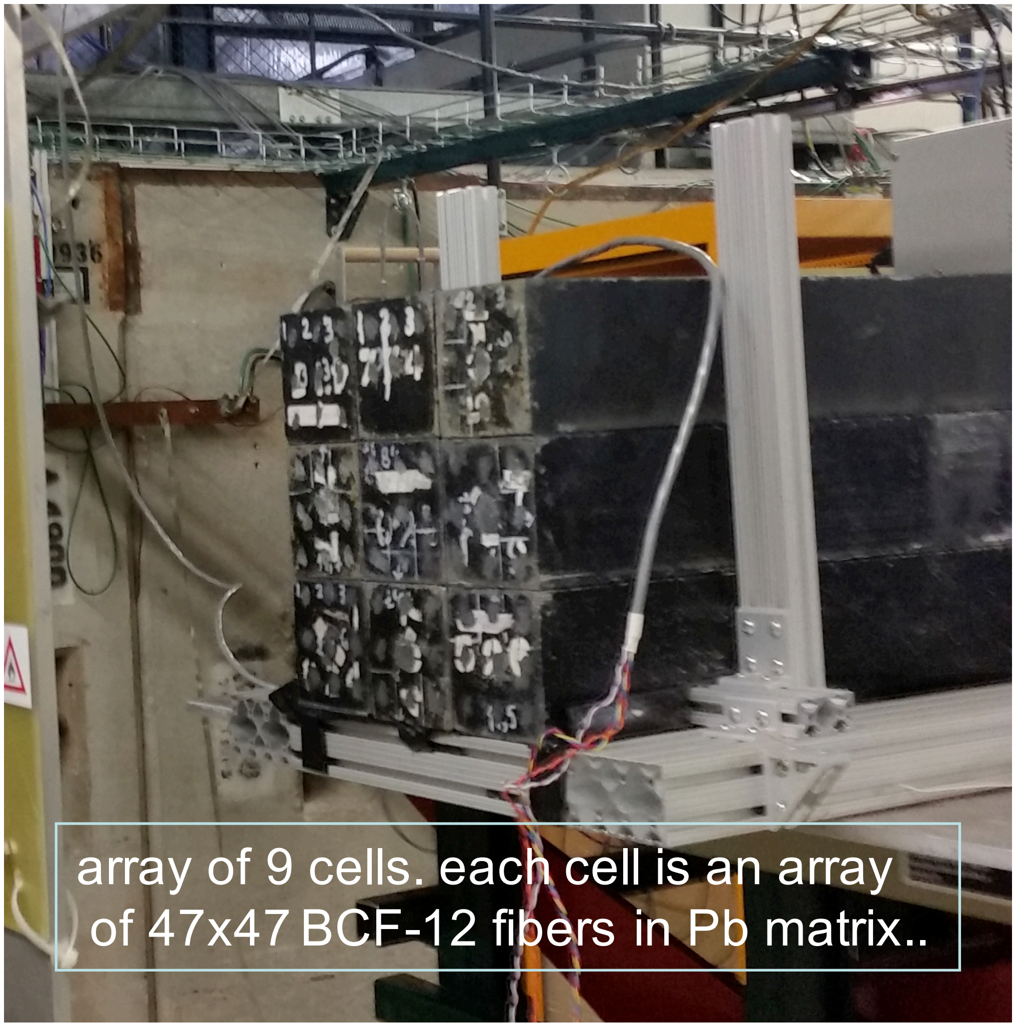
Installation in the cave is simplified by the excellent staff and mechanical devices available (crane, tables, lasers, patch panels)

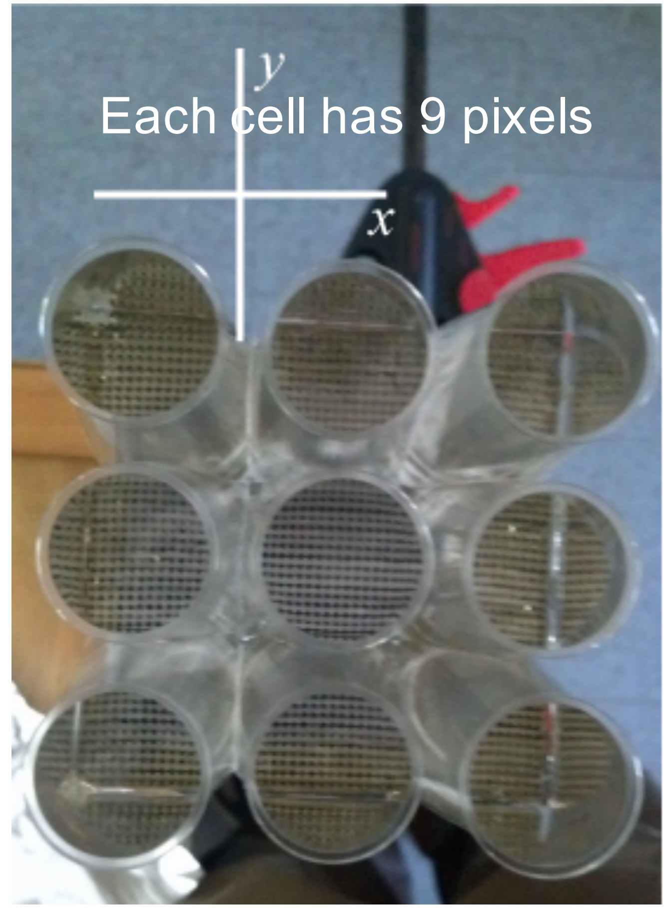
Overall coordination of hardware and activities is excellent.

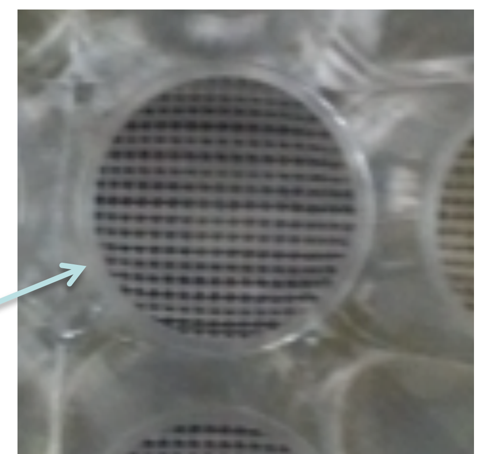
We had some computer network issues, but our stand-alone data acquisition worked fine.

Our detector – a pixelized SpaCal

3x3 stack of pixelized (10 cm)^2 x 117 cm spaghetti calorimeter cells [81 total pixels]





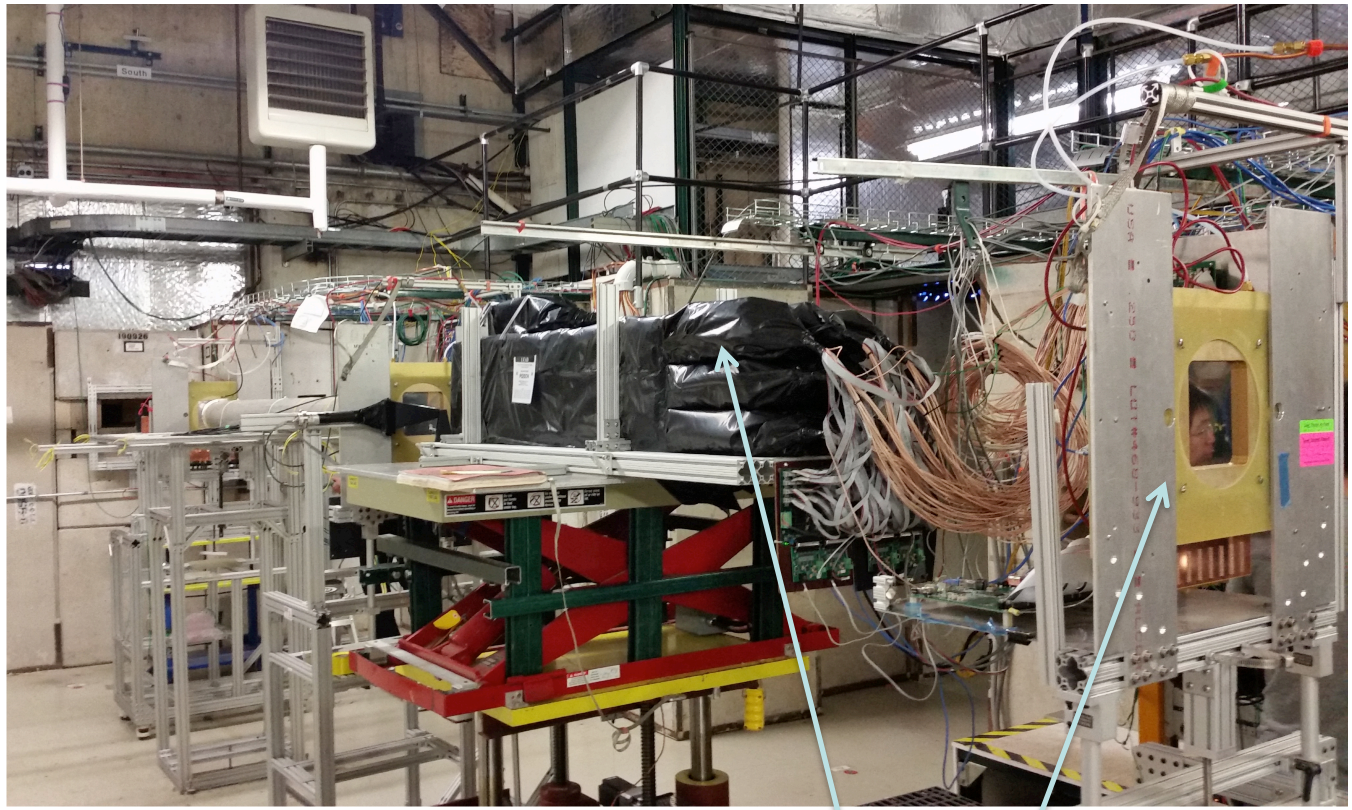


view through 1 pixel light guide to fibers embedded in Pb

Staging

Thanks to JJ (Eugene Schmidt), Todd Nebel, Geoff Savage, and Bill Frank

The laser alignment tool was very slick



remotely positionable table
vertical and horizontal motion

Our 9 cell SpaCal on table
note FTBF MWPCs in front of and behind our detector

Overhead crane to position instrument on table – thanks to Todd Nebel

Data acquisition

Our daq was based on the trigger electronics used at the STAR experiment at RHIC. It is a clocked system designed to operate at ~10MHz.

The accelerator is also clocked, operating at 53 MHz. Sten Hansen at FNAL provided us a scale down unit so that we could synch our daq to the beam. He designed and modified an existing unit in 1 day and it worked flawlessly.

The test beam gets particles for 4 sec every minute. We arranged to synch with the test beam spill after the fact using time stamps, but we could have added this synch in real time.

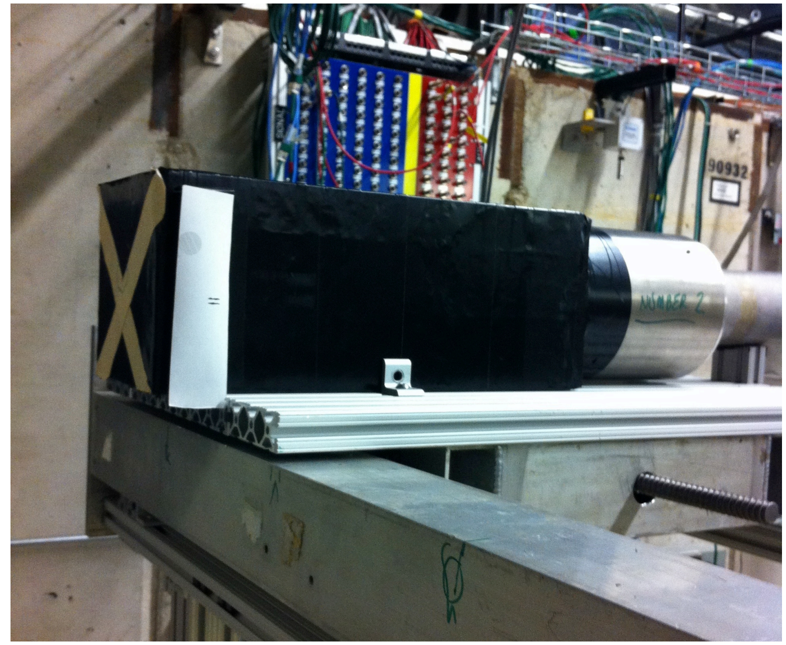
The MWC signals are available after the fact as well, thanks to Ewa Skup, and again we could have arranged to time stamp her data stream with our triggers to facilitate event matching offline.

The table position is also readout every second, and the data files for a run are available offline thanks to Ray Safarik.

Thanks to Steve Chappa for providing a safety-approved power supply that allowed us to use and monitor our Cockroft-Walton PMT bases

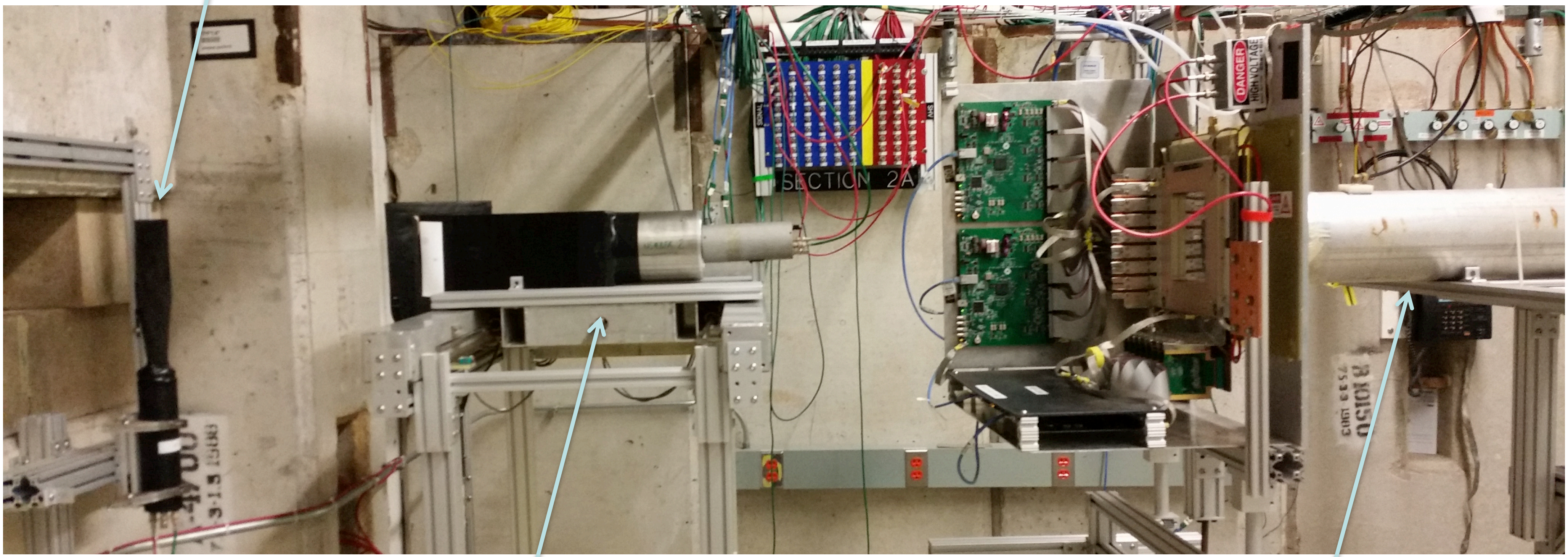
FTBF PbGl

Thanks to Erik Ramberg, who originally developed this beamline, and told us about the PbGl



available to measure electron energy

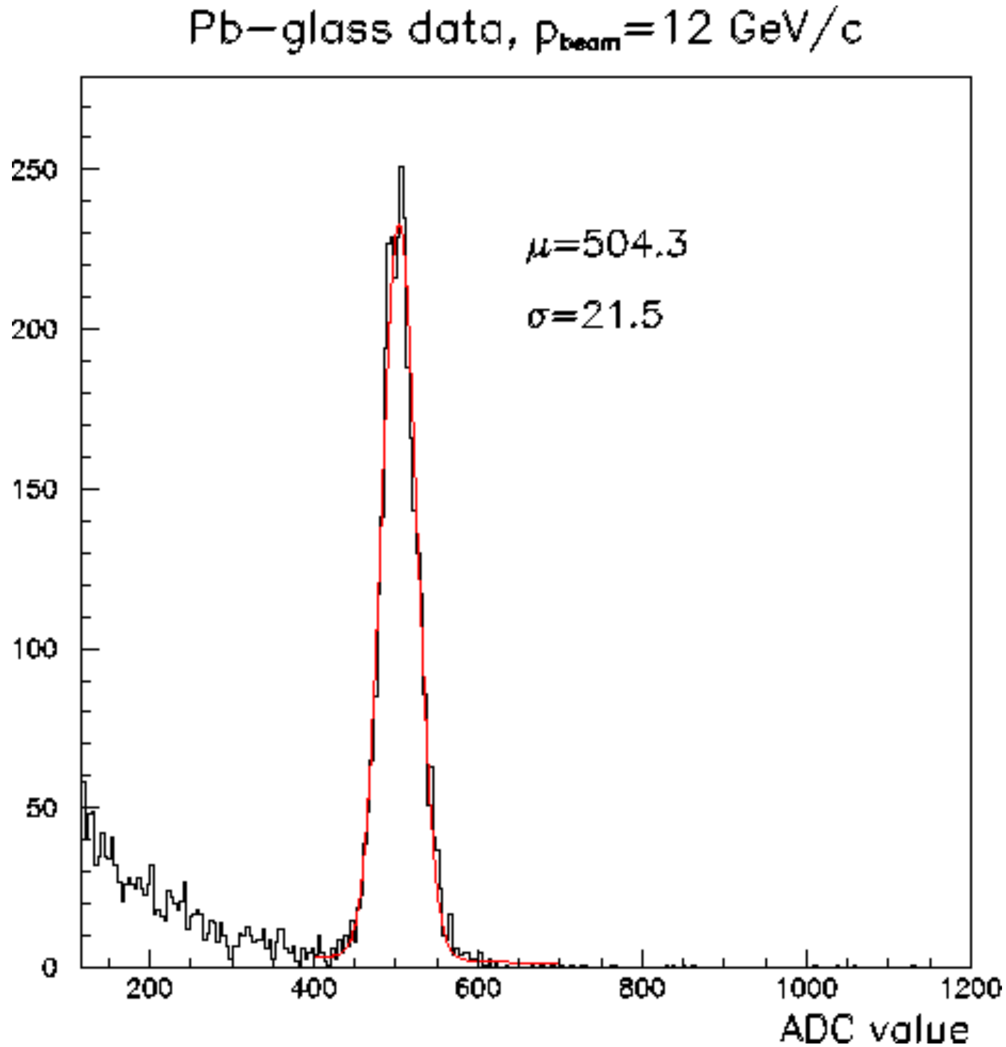
beam scintillator



sliding table in/out of beam

evacuated pipe to minimize mult scat

Pb-glass Response



- Uses CAMAC readout of Pb-glass courtesy of Ewa Skup, et al.
- Used to check tertiary electron beam energy resolution
- For T1064 calorimeter test, Pb-glass translated out of beam, using translation table courtesy of Todd Nebel
- Data acquired for p_{beam}=8, 12, 16, and 24 GeV/c negative ions.

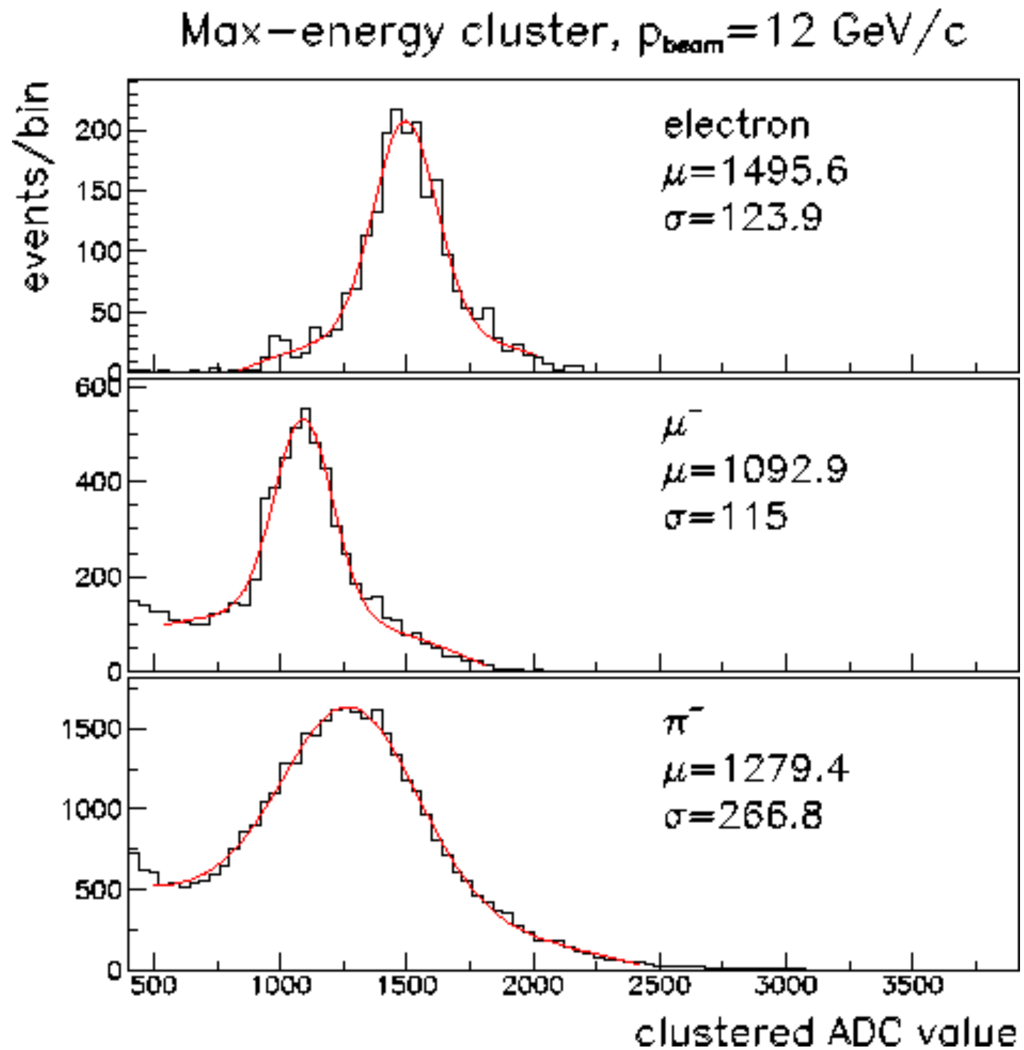
Other FTBF instrumentation

scintillators in beamline used by MCR for tuning and rate monitors

Gas Cherenkov detectors used to select particle species in secondary and tertiary beam.
The line is tuned to specific rigidity and delivers mixture of muons, electrons, pions, and protons which can be identified by their Ck signals. Thanks again to Sten Hansen for providing non-inverting isolation circuits on short notice so we could add these signals to our data stream.

The gas pressure in each Ck detector is remotely settable. Again, the pressure readings are recorded every few seconds and available in offline files thanks to Doug Jensen. There are two PMTs that view the gas Ck providing an inner and outer ring measurement for velocity selection.

T1064 Calorimeter Response



- Just a small sample of T1064 calorimeter response, with present knowledge of pixel gains and cluster-finding parameters
- Uses downstream Cerenkov (inner and outer) signals for particle identification, readout through T1064 electronics
- Final result for resolution will depend on final gain matching of pixels. The analysis is underway…

Conclusions

Special thanks to JJ (Eugene Schmidt) for setting the atmosphere and providing a very positive overall experience here.

The FTBF is very well run by Mandy Rominsky

There are excellent resources at FNAL to provide help with setup and running, providing specialized electronics as needed.

Mike Backfish and the MCR guys were very helpful and responsive as we tuned beam rigidities from 1 GV to 30 GV

We would have benefitted had I (Hank) been more familiar with the possibilities for incorporating FNAL detectors into our data streams.

Other users would benefit from having a User's manual that describes some of the detectors and their connections in detail, as well as having clear isolated connectivity to them.