



Testbeam and Test Stand Needs

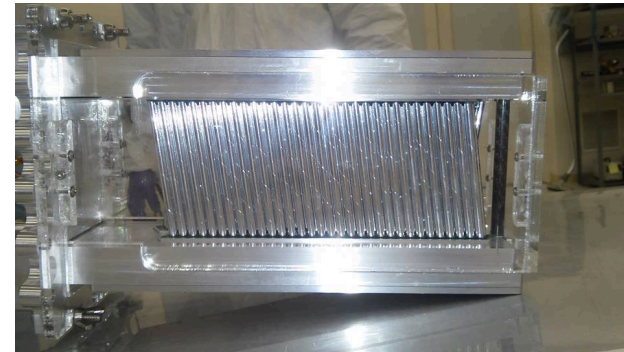
Mandy Rominsky

Trigger and DAQ Satellite Mtg at CPAD 2017

11 October 2017

Overview

- Test Beams and Test Stands are critical components in detector development
 - Testing of detector components
 - Testing of integration between subsystems
 - Exercise analysis and monitoring software
- Interested Parties
 - Users: People who come to test beams and test stands with detectors
 - Beam operators: People who deliver beam to users
 - Facilitators: Sometimes the same as the beam operators, but overall in charge of meeting users needs and being a liason between beam operators and users



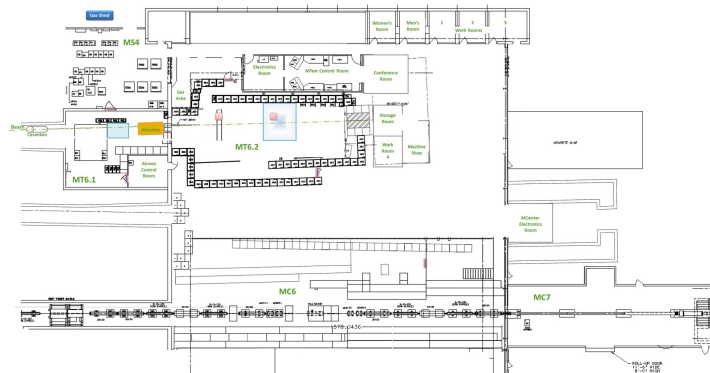
Test Beams

- Fermilab Test Beam Facility (FTBF)
- SLAC Test Beams
- CERN Test Beams



Fermilab Test Beam Facility

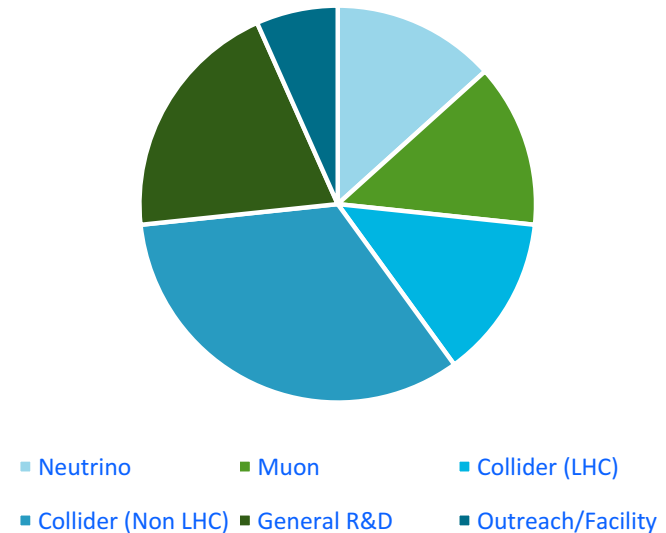
- Two Beamlines available
 - Short term or long term users
 - Beamline instruments include scintillation paddles, MWPC, silicon telescope
- No single DAQ system
 - Telescope read out using CAPTAN
 - MWPC uses a python script (or MIDAS)
 - Cherenkov detectors use ACNET (Accelerator DAQ system)
 - Developing a facility DAQ (See Ryan's talk later today)



FTBF Users

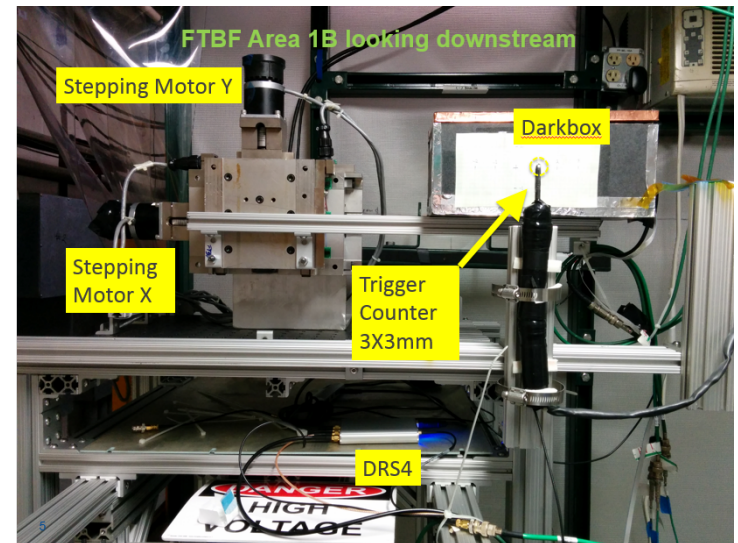
- A wide variety of groups
 - Neutrino, Muon groups
 - Collider groups (RHIC, LHC)
 - General R&D
 - Education and training
- These groups all have different needs
 - Some need almost no DAQ system
 - Some need full DAQ systems
 - Most appreciate environmental information

FY16 Experiments by Research Focus



FTBF Users: T1041 (CMS)

- Simple set up to test components for a calorimeter upgrade at CMS
- No “official” DAQ
- Needed:
 - Our CMS Telescope
 - Motion table information
 - Simple, remote readout for their detector: used facility DRS4



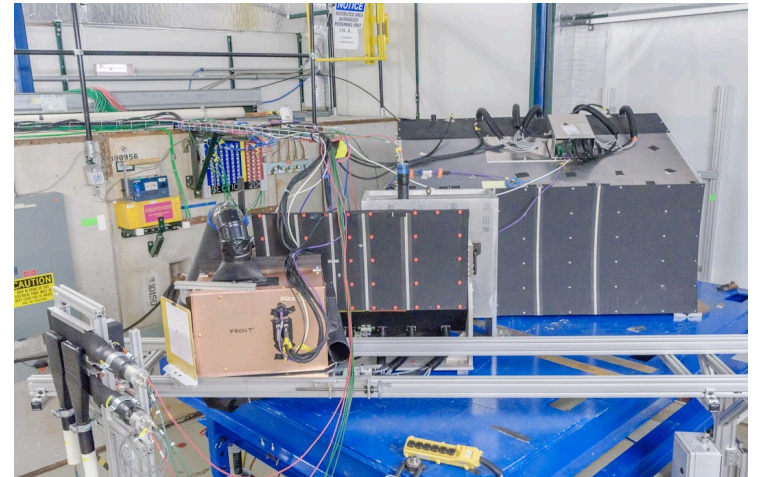
FTBF Users: Mu2e Cosmic Ray Veto test

- Testing configuration of counters
 - Important to use a moveable stage to test full detector
- Their needs:
 - Facility MWPCs for tracking
 - Motion table
- Their DAQ
 - Used their own system, including our MWPCs, brought their own controller for them.



FTBF Users – sPHENIX

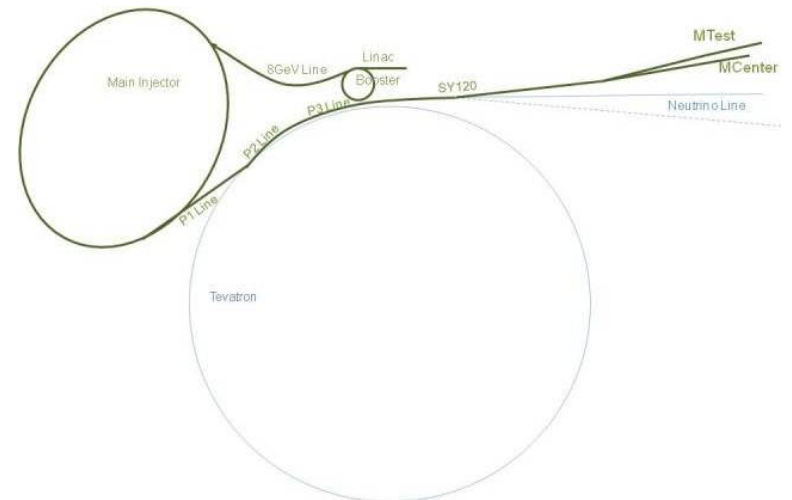
- Testing the high rapidity sections of their calorimeters and test new FE boards
 - Good example of integration
- Their needs
 - Environmental needs
 - Camera, motion table data
 - Information from facility detectors
- They used their own RCDaq
 - Flexible, script based DAQ
 - The expert is here! Talk with him about features
 - Able to readout our motion tables and other detectors



FTBF Issues and Needs

- Observations

- Last year, we had three different groups (2 ATLAS and 1 CMS) that were all testing radiation hardness of various sensors using telescopes. Maybe should combine efforts?
- Many groups will share info with each other. Really wonderful to see the cooperation!
- Beam operators would like to read out our instruments
- We'd like to read out theirs too!
- Lacking slow control information



SLAC

- Several beamlines can be used for test beam
 - ESTB is most traditional beamline
- Uses only electrons, so no need for particle ID
- Well defined beam with good resolution
- Not always easy to get feedback to operators about beam quality
 - Generally good so not a huge problem.



SLAC Users

- Broad range of users from a multitude of experiments
- From Carsten Hast (BTTB 5):

- FY 2013
 - T-505: Tests of 3D silicon pixel sensors for ATLAS, P. Grenier, SLAC
 - T-506: EM Shower Damage to Si Diode Sensors, Bruce Schumm, UCSC
 - T-507: Test of a RICH-Prototype Based on CsI-GEMs for an Electron-Ion Collider, T. Hemmick, Stony Brook University
 - T-508: HERA-B ECal modules beam test for $G_{\text{EP}}(5)$ at Jefferson Lab, E. J. Brash, Christopher Newport University
 - T-511: Test of a Silicon-Tungsten Electromagnetic Calorimeter for the ILC SiD, R. Fry, Univ. of Oregon
- FY 2014
 - T-505: Tests of 3D silicon pixel sensors for ATLAS, P. Grenier, SLAC
 - T-512: Calibration of the g-2 calorimeter, D. Hertzog, Univ. of Washington
 - T-513: Channeling and Volume-Reflection Studies of High-Energy Electrons in Crystals, U. Wienands, SLAC
 - T-510: Geosynchrotron radio emission from extensive air showers to detect ultra-high energetic neutrinos at Antarctica, K. Belov, UCLA
 - **T-513: Channeling and Volume-Reflection Studies of High-Energy Electrons in Crystals, U. Wienands, SLAC**
 - T-509: Develop a Neutron Beam Line for Calibration of Dark Matter Detectors, J. Va'Vra, SLAC
 - T-506: EM Shower Damage to Si Diode Sensors, Bruce Schumm, UCSC
 - **T-516: ATLAS Inner Tracker (ITK) Upgrade, Test of several pixel sensor technologies, M. Bomben (Paris), P. Grenier (SLAC), S. Grinstein (Barcelona), D. Muenstermann (Geneva) and J. Weingarten (Göttingen), on behalf of the ATLAS-ITK Pixel Group**
 - T-520: Radiation Test of Epoxy for LCLS Delta Magnet, C. Field, SLAC
 - **T-517: PHENIX MPX-EX Calorimeter, T. Hemmick, Stony Brook University**
 - **T-516: ATLAS Inner Tracker (ITK) Upgrade, Test of several pixel sensor technologies, ATLAS-ITK Pixel Group**
 - T-519: Calibration of the g-2 calorimeter, D. Hertzog, Univ. of Washington
- FY2015
 - T-506: EM Shower Damage to Si Diode Sensors, Bruce Schumm, UCSC
 - T-523: Channeling of Electrons in Crystals, U. Wienand, SLAC
 - T-525: Atlas IBL Pixel, A. Pranko, LBNL
 - T-529: Radiation Testing of LCLS-II Kicker Electronics, T. Beukers, SLAC
 - T-530: Microwave Cherenkov Calorimeters for Ultra-high Intensity Beams, P. Gorham, U. Hawaii
 - E-222: Development of Electron Radiography for Material Science. F. Merrill, LANL
- FY2016
 - T-506: EM Shower Damage to Si Diode Sensors, Bruce Schumm, UCSC
 - T-534: Commissioning, characterization and improvement of the Carleton University Silicon Telescope, C Hast, SLAC
 - T-537: Radiation testing of pyroelectric detector with preamp for LCLS-II BLEN system, L. Sapozhnikov, SLAC
 - T-539: SLAC Atlas Silicon Pixel Tests and various follow on experiments Su Dong, SLAC, et al.
 - T-540: 3D Position Reconstruction via Depth-Dependent Diffusion (ePix), C. Kenney, SLAC
 - T-541: Testing Beam-Loss Detectors for LCLS-2, A. Fisher, SLAC
 - T-536: Test of the Final PbF2 Calorimeter Systems for the Muon g-2 Experiment, D. Hertzog, Univ. of Washington
 - T-530: Microwave Cherenkov Calorimeters for Ultra-high Intensity Beams, P. Gorham, U. Hawaii
 - E-222: Development of Electron Radiography for Material Science, F. Merrill, LANL
 - T-542: sFlash (Fluorescence and phosphorescence from alumina air showers), P. Sokolsky, Univ. Utah
 - T-539: SLAC Atlas Silicon Pixel Tests, Su Dong, SLAC
 - T-545: LBNL Pixel Devices, Maurice Garcia-Sciveres, LBNL
 - T-523: Undulator Radiation from Channeling of Electrons in Crystals, U. Uggerhoj, DPAAU
 - T-546: Characterization of dump generated neutron background, D. Snowden-Ifft, Occidental College

CERN Test Beams

- ****Most information on their website:**
 - <http://sba.web.cern.ch/sba/>
- **Many different test beam options**
 - Very large and versatile program.
 - Supplies high energy hadron beams and possibly Ion beams
- **CERN Test Beam users**
 - LHC based (CMS, ATLAS, LHCb, ALICE)
 - Accelerator upgrades
 - Industrial uses



CERN Test Beams – Telescopes

- Large groups from LHC want to test radiation sensitivity for new sensors for HL LHC upgrade
- Large concentrated effort to build common tools: DAQ and telescopes
- Workshop dedicated to this: <https://indico.desy.de/event/bttb6>
 - Last year:
<https://indico.desy.de/conferenceDisplay.py?ovw=True&confId=16161>

5th Beam Telescopes & Test Beams Workshop

24th - 27th January 2017, Barcelona
<https://indico.desy.de/event/bttb5>

Topics:
Beam lines & infrastructures
Beam telescopes & device integration
Data analysis, tracking, alignment
Simulations & software packages

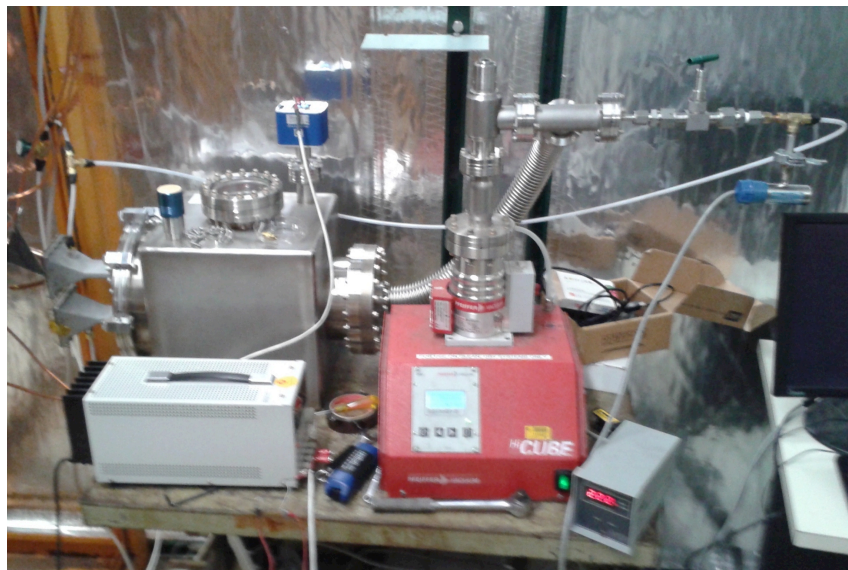
Abstract submission deadline: 23-12-2016
Registration deadline: 23-12-2016

Organising Committee:
Jan Dreyling-Eschweiler (DESY)
Hendrik Jansen (DESY)
Joern Lange (IFAE)
Iván López (IFAE)
Simon Spannagel (CERN)
Stefano Terzo (IFAE)

IFAE
DESY

Test Stands

- Extremely broad range of capabilities
- Does DAQ need to go from test stand to test beam to full experiment?
- Test stands might be at labs or might be at home institutions
- Will discuss the NOvA test stand, PAB, cosmic ray telescope at FNAL.



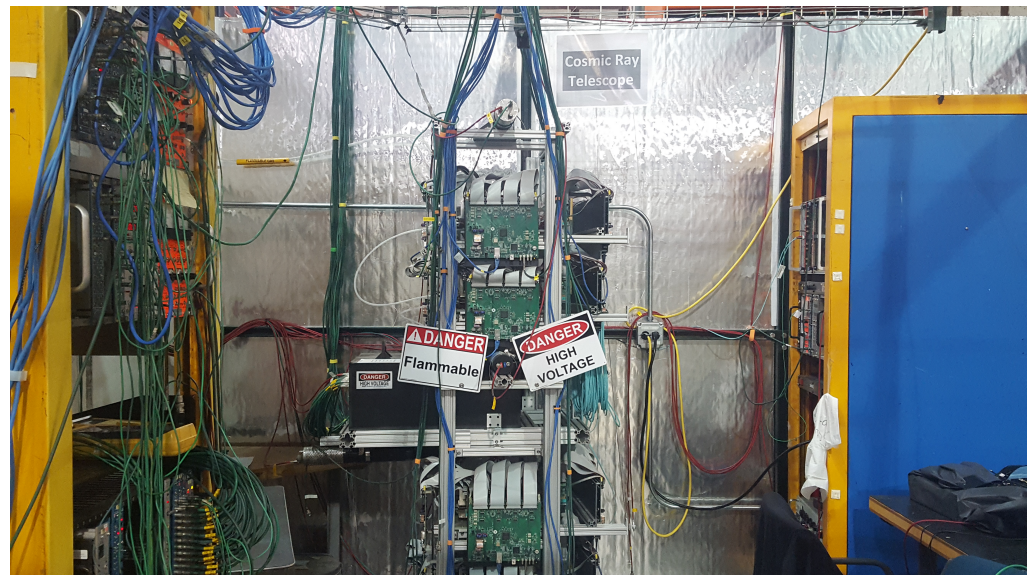
PAB Liquid Argon Test Stand

- Facility available to users for detector testing in liquid Argon. (<http://neutrino.physics.fnal.gov/facilities/>)
- Linux and Windows machines for DAQ
 - Basic electronics crate available (NIM, CAMAC) from PREP
 - HV available
 - Cryogenic/vacuum/gas analyzers/purity monitors in iFIX



Cosmic Ray Test Stand at FTBF

- Uses the same MWPCs as the main facility
 - Slightly modified readout
 - No environmental information
- So far, only 2 users
 - Both have to integrate their detectors with MWPCs



NOvA Test beam

- DAQ Test stand currently being built
- NOvA test beam being constructed
- Will need to trigger system, slow controls
 - Working with Computing at Fermilab



Peripherals

- A common problem that comes up is computing permissions
 - People will develop a DAQ on a computer to bring to a lab
 - Have problems getting network access
- Slow controls
 - At Fermilab, we have a controls group. They can develop tools, but users don't have much say in what is used
 - Controls group also installs things like cryogenics control and other environmental controls.

Test Beam Needs

- Facility instruments integrated with users' DAQ
- Facility info with beamline experts (maybe only a FNAL problem?)
- Beam vs non beam users
- Support of whatever product there is
- Training experts
- documentation

Test Stand needs

- Slow control, environmental needs
- Portability
- Flexibility
- Experimenter controlled vs facility offering

Concluding thoughts

- Test beams and test stands are a complicated dance between users and facilitators
 - How to make a system that is flexible and useful for a broad range of groups?
- Knowing the environment for tests is really important
 - Maybe not all the time, but will certainly help make sense of what's going on in funny data
- There should be support at test beams to help with DAQ issues.
- Looking forward to lots of discussion today!