

Fermilab Test Beam Manual for ATLAS Pixels

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1 Overview

This document is intended to familiarize users at the Fermilab Test Beam Facility about the rules and procedures for a safe and successful run. The experiment leader or their deputy should go through this document with each person when they arrive at the test beam area. The following are the guiding principles of the test beam:

- Saddle your own horse
- Don't do stupid things
- S%!t happens

—Moritz, remembering old cowboy quote

Experiment Leader

The Experiment Leader is the one responsible for the safe and smooth operation of the test beam. They will be the point of contact for communications with the Fermilab Test Beam Facility (FTBF) Coordinator, Mandy Rominsky. The Experiment Leader is responsible to see to all the paperwork is in place before the test beam, confirm all participants are trained and aware of the information described in this document, and that they understand their role and responsibilities while at the FTBF. For any urgent issues that arise, the Experiment Leader should always be contacted and kept apprised of situations. If the Experiment Leader is not 'on call', then a deputy must be named to assume the responsibilities.

TEST BEAM SPRING 2017:

FTBF Coordinator: Mandy Rominsky, +1 630-840-8599, rominsky@fnal.gov

FTBF Coordinator Deputy: JJ Schmidt, jj@fnal.gov

Experiment Leader: Jessica Metcalfe, +1 541-968-5358, jessica.metcalfe@gmail.com

Experiment Leader Deputy (March 25 - March 31): Larry Nodulman, ljn@anl.gov

Technical Scope of Work

A Technical Scope of Work (TSW) needs to be submitted for the test beam period by the person responsible for the experiment. This document outlines the purpose, needs, and hazards of the experiment. All users should become familiar with this document before starting the test beam. You can find the current TSW here:

<https://fermipoint.fnal.gov/service/tsworc/Lists/tsworc/DispForm.aspx?ID=930>

Fermilab Test Beam Facility (FTBF)

The FTBF area we use is called MTest. It encompasses the entire building. The test beam areas are subdivided into sections for isolated Controlled Access area. Please familiarize yourself with the rules of the FTBF area. They can be found here (also part of your training):

<http://www-esh.fnal.gov/pls/default/itp.its?id=34363V>

Top Reminders

- Inform the Experiment Leader of any major changes in equipment prior to powering on/energizing
- Always keep your Control Access key with you at all times
- At least one person must always be in the Control Room while the test beam is on—if you are last to leave, check that it is off

2 Before Arriving

Training

All users are required to register as a Fermilab User and take all required training. Here are the instructions to register:

1. Please start the registration at this page:
<http://ftbf.fnal.gov/obtain-id/>
2. To start the registration process select 'request Fermilab Computing Priveledges'. This will get you registered and allow you to take online training.
3. For the 'Affiliation', select Test Beam (near the end). For 'Affiliated Institution', this should be your home institution.
4. The Fermilab Contact Name is
Mandy Rominsky
630-840-8599
rominsky@fnal.gov
5. Institution Point of Contact is your home institution.

When you arrive, you will be able to get an id badge if you've completed the general online trainings. It usually takes about 30 minutes (take picture and then wait 30 minutes). Once you are added to the TSW experiment additional training courses will be required. Please complete ALL courses indicated.

Controlled Access Training

To enter the test beam area while the system is interlocked you will need to have Controlled Access training and Practical Rad Worker training (among others). The practical course is done in-person in a classroom setting. You can register for the class directly from your training profile. ALL the courses in your profile need to be 'Complete' before you start work at the test beam. The only exception is that you may come work in the Control Room without the Practical Rad Worker (classroom) training, but you will NOT be able to make a Control Access. Once you have completed all the training you will be eligible to receive a dosimeter. In order to make a controlled access at the FTBF, you will also need Controlled Access Leadership training. This is done at FTBF by JJ Schmidt and does not need to be scheduled in advance.

Dosimeter

Once you have completed all the training you will be eligible to receive a dosimeter. The dosimeter must be worn at all times during a controlled access. It is recommended to wear all the time you are at the FTBF. Dosimeters should generally not be taken outside the FTBF to avoid any spurious doses. There is a board across from the restroom outside the control room where you can leave your dosimeter—please put your name on it with tape. After completion of the test beam period you must return your dosimeter. You will receive a weekly email to update your dosimeter reading. If you are ONLY using it for the FTBF, then you can ignore this email.

Equipment Preparation

A schematic of all the equipment that will be installed in the test beam is needed before the electrical safety inspection. The schematic should include all connections, types of cables, expected currents and voltages, compliance settings, and fuses.

DUT Preparation

It is always advisable to test your devices under test (DUT's) as much as possible before arriving at the test beam.

Set-up Procedure

The equipment in the test beam area needs to be set up without turning any equipment on. The equipment will be subject to safety inspection according to the hazards identified in the TSW. This will almost always include an electrical inspection. The Experiment Leader will coordinate with the FTBF Coordinator to arrange a time for the inspection. If the equipment in the set-up is modified outside the approved inspection, then the Experiment Leader and FTBF Coordinator need to be informed before any equipment is energized. *Likewise, any set-up involving gas, pressure chambers, extreme temperatures, potential oxygen deficiency, flammable materials, radioactive materials, toxic materials, high voltages, exposed electrically energized contacts, or anything else that could be a potential hazard to the safety of the people, equipment, or facility should be included in the TSW and undergo a safety inspection before it can be used.*

3 Safety Guidelines

The most important aspect of the safety guidelines is to think through your actions before you start, be aware of your situation, apply common sense, and ask the test beam coordinator if in doubt of any situation. Remember, EVERYONE has the right to tell others to 'Stop Work' if they see a potentially dangerous situation. You are required to stop what you are doing and step back if someone gives you a Stop Work order.

Controlled Access During a controlled access, you must always have your Control Access key with you at ALL times. This means from the moment it leaves the key tree box to the moment it is returned to the box. Please don't give your key to someone to return for you, or leave laying around the control room if you retain your key after completing a controlled access. But don't leave it in your pocket and fly away with it! All keys must always be returned before anyone can start beam again. Two people must always be in the CA area at any time and should remain in visual contact. If 3 people go in, you can NOT leave 1 person behind in the Control Access area. There must always be one key in the keytree box in case emergency personnel need to enter.

Controlled access procedures:

- Designate a Control Access Leader (CAL)
- Fill out the CA form with ID's and key numbers
- CAL call the main control room (MCR) x3721
- request CA in MT6 Section 2 (on key box)
- give key number then ID number to MCR
- distribute keys
- CAL checks everyone has a key before entering
- one person turns key in CA panel for 'green light' and declares loudly and clearly
- another person unlocks the CA door and turns their key in the CA panel on the other side and declares 'green light'
- everyone enters the CA area
- the CA door is closed and locked
- the same procedure is followed for exiting
- when finished with CA the CAL calls the MCR and returns the keys to the key tree
- a siren will go off once the keys are returned in the unfortunate event that someone was left behind, they know to drop the interlocks

The interlocks will drop if you open the CA door with your key if the 'green light' on the CA panel is not on. If you do not follow the CA procedures, the interlocks will drop. You should not drop the interlocks unless it is an emergency. If you want open access procedures, you need to request it from the MCR.

Open access procedure:

- call MCR and request open access
- they will open the key box
- take a key, unlock the CA door, and return the key to the box and close the key box
- all keys should remain in the key box during open access
- to go back into CA (to request beam), request a 'search and secure' from the MCR
- MCR will send a team to close the area, it usually takes 20-30 minutes
- Please only request open access sparingly—if you enter several times a day, it should be done using controlled access

Equipment Safety

All equipment set-ups should be communicated to the Experiment Leader before the system is energized (powering on, creating a pressure vessel, running gas, etc.) and confirmed to be within the TSW. The Experiment Leader will judge if the set-up requires additional safety inspection.

Equipment should always be used for its intended use. Commercial units must meet specific safety standards. If operated outside the intended use, then it becomes custom equipment. Any modifications will ALWAYS require inspection.

Exposed high voltage is a common concern in test beam set-ups. Due precaution is required in using exposed high voltages. This usually entails a current compliance or interlock system, which de-energizes the system if the current increases above the compliance threshold. All such systems will need to be inspected by the electrical safety team.

When connecting or disconnecting equipment or samples, any equipment should be powered down or de-energized before plugging/unplugging or making any other type of connection. If you think the equipment is already off, please confirm for yourself. You are responsible for your own safety and actions. If you are not familiar with the equipment set-up to know what is being powered, you should find someone who is before touching the set-up. *Everyone is personally responsible to know and understand the equipment they are working with.*

The telescope is on a motorized table. This table only moves very slowly, but can still present a pinch hazard, or can damage equipment if there is not enough slack in the cables for movement. There is an emergency table stop button on the wall by the table. Keep loose clothing, fingers, hair, etc. away from the mechanisms while the table is in motion to avoid a pinch hazard.

A panel on the wall allows you to turn on lasers used to align equipment with the beam. Don't look directly into the laser light source.

Please label equipment as much as possible. You are less likely to make mistakes with an organized system. Safety labels such as High Voltage will be required to pass safety inspection.

Please keep the area in the test beam tidy. Keep cables and such bundled and use strain relief. Keep loose cables off the floor when possible to avoid trip hazards.

Check any ladder before use to make sure it is in good working order. Make sure the feet of the ladder are on stable ground. Always keep three points of contact for stability.

Please have a plan of action before entering the test beam area under a Controlled Access. Identify responsibilities of who is doing what.

Please stay aware of your surroundings and think through your actions before you start.

Radioactive Samples

*need to add this section**

currently there are none yet to deal with

4 Running Beam

At least one person must be in the Control Room the entire time beam is being delivered to MTest.

Request Beam

To request beam, contact the Main Control Room (MCR) x3721. Tell them you would like beam on, the type of particle, energy of particle, and number of particles. For example, 120 GeV protons with 100,000 protons/spill.

You can also request that they change the shape of the beam, i.e. make the beam spot larger/smaller, or move to the left/right.

When you are done taking data for the night, or anticipate a long access period, call the MCR tell them you want to turn the beam off and tell them your plans for leaving. This will help them plan their schedule better.

Monitoring Beam

Two monitors near the ceiling show the status of the beam current running. If they are delivering beam to the test beam area (MTest), you will see the number of particles on the screen. If the beam goes down or there is maintenance happening, a notification will be on the monitor. In addition, there is another monitor that displays the type of particle, energy, counts at several scintillators in the test beam area, and a countdown to the next spill. There is also live video feed of the test beam area on display in the Control Room.

Beam Structure

One spill is delivered every minute to MTest. The spill lasts for 4.2 seconds and delivers the number of particles requested (or close).

5 Communication and Planning

The Experiment Leader is responsible for communicating all procedures, safety information, and run plan to all participants. The test beam is often a fast-paced experiment especially in the initial debugging phase. It is important that everyone understands what everyone else is doing. The Experiment Leader should be kept informed of all activities at all times. To aid in the communication several logs and twiki pages catalogue the different happenings at the test beam.

Argonne twiki:

https://atlaswww.hep.anl.gov/asc/wikidoc/doku.php?id=itk:testbeam_febmi2017

Argonne log:

https://docs.google.com/document/d/1OBGsV37LnOo-apKRDv1zEWljP_SbH9TpoThvLJ0NDyk/edit#

Geneva twiki:

https://twiki.cern.ch/twiki/bin/view/GeneveAtlas/TB2017_Fermilab

Geneva chat room:

<https://mattermost.web.cern.ch/atlas-ams-cmos/channels/fermilab-2017>

On these pages you can find all the shift schedules, logs, instructions, and summaries.

Run Plan

An overview of the current run plan for the HVCMOS sensors can be found here:

https://docs.google.com/spreadsheets/d/1Uv5hGlnCU5rnV7FzXFXE400cko_fOGiu8kYgUpBxdu8/edit#gid=876192247

It details the order of sample testing and plans for irradiations.

The testing plan for the RTI modules can be found here:

https://docs.google.com/spreadsheets/d/1Uv5hGlnCU5rnV7FzXFXE400cko_fOGiu8kYgUpBxdu8/edit#gid=876192247

The status of the test beam can also be found at the top of the Argonne twiki. This tells if we are operating beam, debugging, shut down for maintenance, etc.

Shifter Instructions

While on shift, you can assist in taking data. A quick start guide on how to run the DAQ and take data can be found here:

<https://docs.google.com/document/d/1c0UE1NvmkBhJ4uaZUzRNWKqHAOI5j43DbJwnIyXC7yM/edit>

Sometimes this is rather boring—this is great! It means we are taking data smoothly. While in the Control Room (or back at home), you can analyze data from the test beam. Information on how to access and analyze data can be found on the twiki pages.

One person will also be identified as the 'On-Call' expert. The person and their number will be identified on the white board by the control DAQ computer in the Control Room. This person will assist if there are any issues with equipment or data taking.

If at any time you are unsure of what you are doing or what to test, contact the Experiment Leader (or Deputy) or On-Call expert.

Shift Hand-off

While in smooth data taking mode, a new shifter can check the Geneva and Argonne logs for the status of which HVCMOS sample to run. Likewise, you can check the Argonne log for the hand-off instructions relating to the RTI modules. Most of the time, there will be large amounts of overlap with shifters. During this time, all people present will review the planned schedule for the day and put this in the Geneva and Argonne log files. One can also check the 'To Do' section on the Geneva twiki.

If you are on the morning shift, assuming the night shifter leaves before 8 am, the night shifter and morning shifter should make contact via mattermost chat room, skype, phone, etc. to discuss the plan for the hand-off. The night shifter should leave final instructions in a previously designated place, i.e. the shift log. All shifters are required to stick to the agreed upon plan.

A daily meeting will be held with the Experiment Leader or Deputy. This will be at a time designated by the Experiment Leader and may change based on the current activities. The default time is 10 am.

A weekly meeting will be held at the test beam on Monday at 10 am to discuss activities from the previous week, review known disruptions in beam time, and plan/review the activities for the week.

For more detailed meetings on results, there is a Geneva HVCMOS weekly meeting on Tuesdays at 7 am CDT and an Argonne Pixels weekly meeting on Wednesdays at 2:30 pm CDT.