Welcome to the FermiLab Main Control Room

What is the MCR

- Central control point of the Accelerator Complex
- All accelerators are monitored and controlled from the MCR
- Controls access to the accelerator enclosures
- There are other remote accelerator control consoles on site but none are routinely manned around the clock

Who is in the MCR

- Manned around the clock, 7 days a week, 365 days a year by a crew of ~5 operators and under supervision of a Crew Chief
- Multi-year training program for the operators
- Also used by scientists, engineers, technicians, and anyone else that needs to interact with the accelerators

Why a Control System aka Acclerator Controls NETwork aka ACNET

- Setting and Reading of Devices
- Logging of Devices
- Alarming of Devices
- Feedback Loops
- Finite state machines
- Sequencing of instructions

Control Console

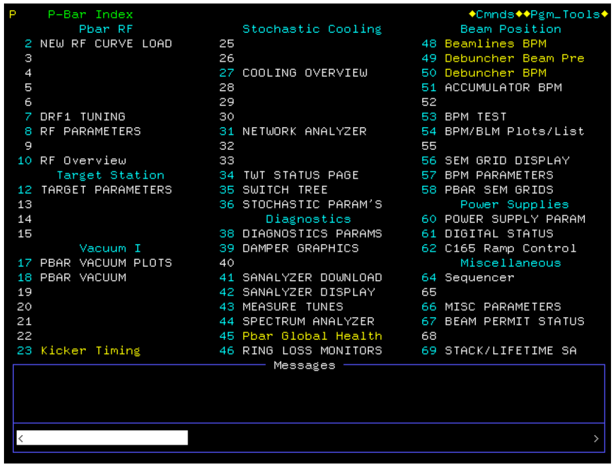
- The console is where you interact with the various devices that make up the accelerator
- Located in MCR, other locations on site, or even offsite
- Can be read-only, or provide various different classes for allowing settings

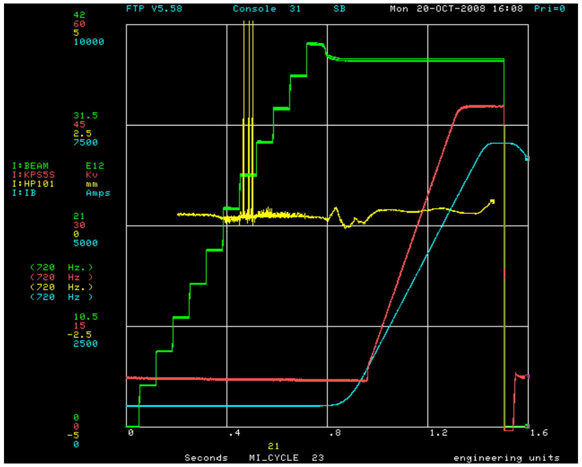
What is a Console

- Multiply Displays
- Keyboard and mouse to interact with the computer
- Trackball and Knob
- Beam switch box
- May be other equipment unique to each location

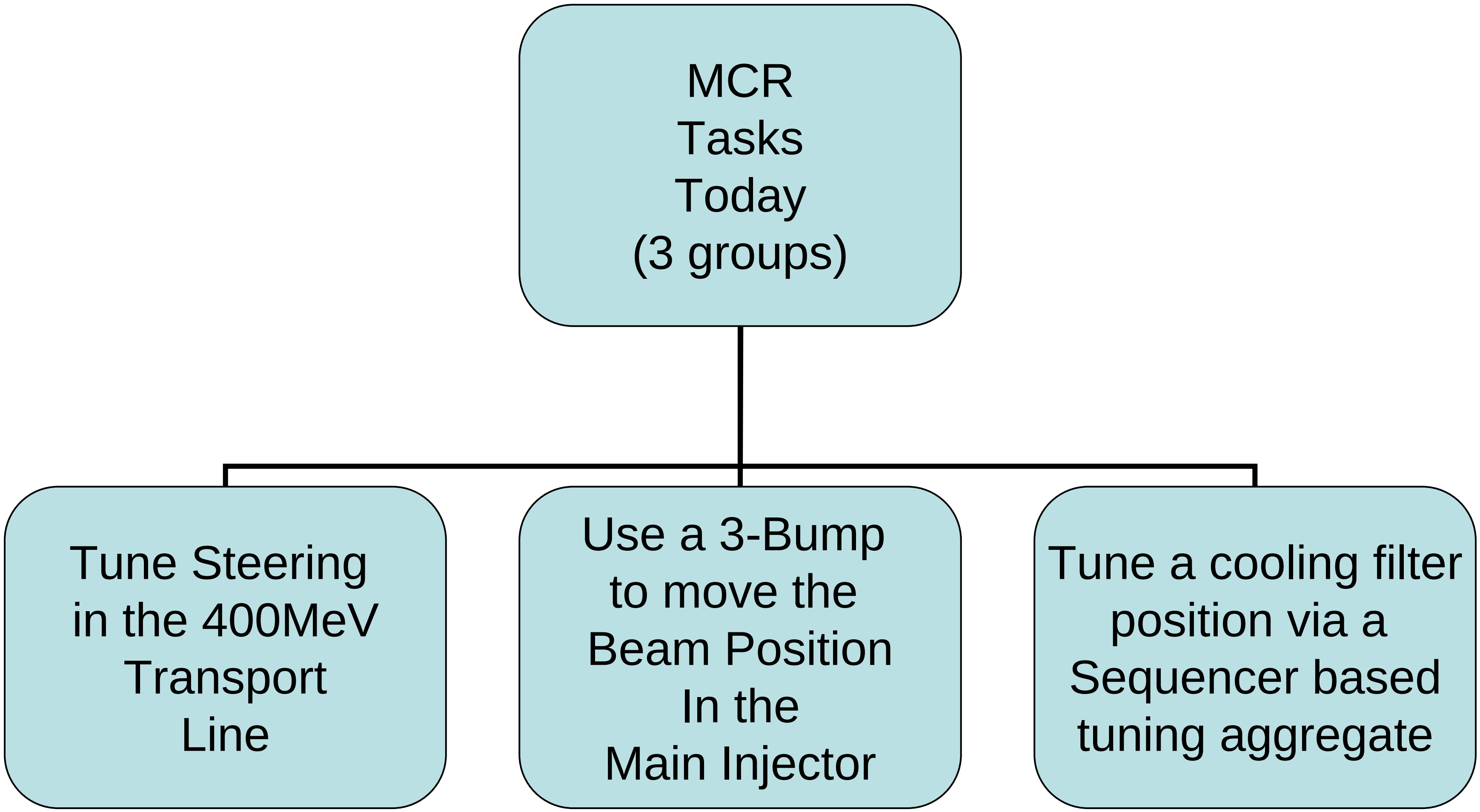
Interacting with the Console

- Index page is used to start various different programs, or a single program configured many different ways
- Various display and plotting packages to show what is happening with the complex





What are we doing today



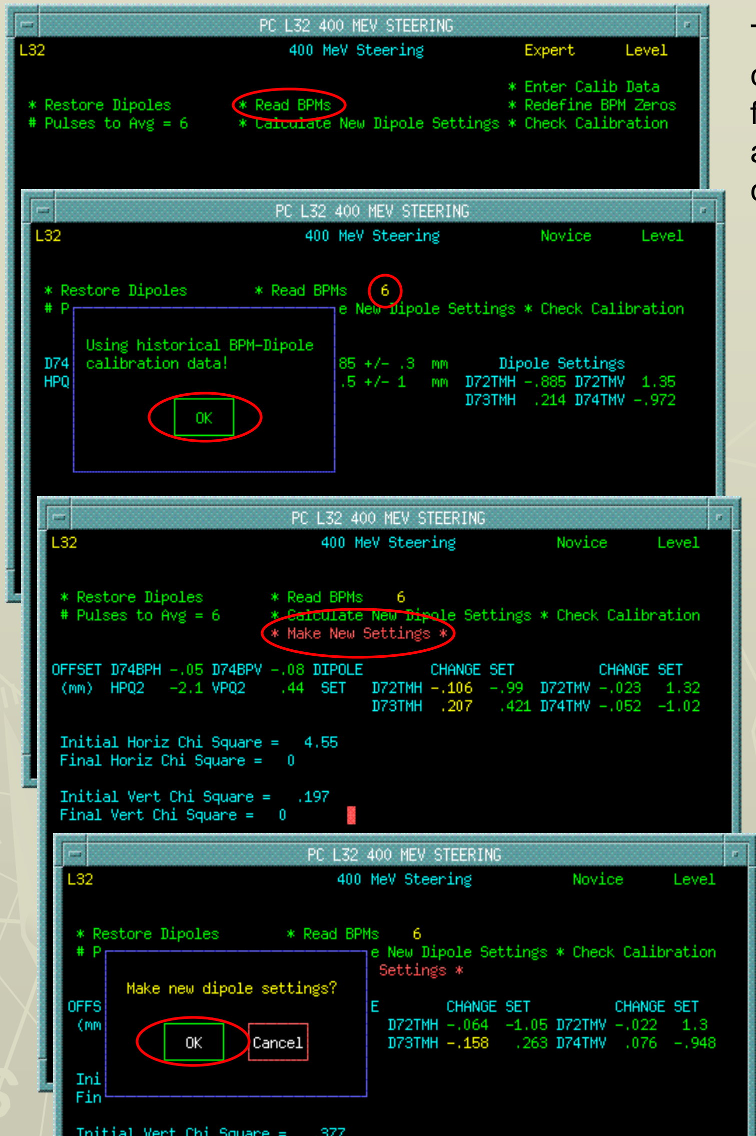
Time for our MCR Tasks

Break in to three groups
Each group will be assigned
a position in the MCR
and given directions for
their task

Linac Steering

Directing beam from Linac to Booster

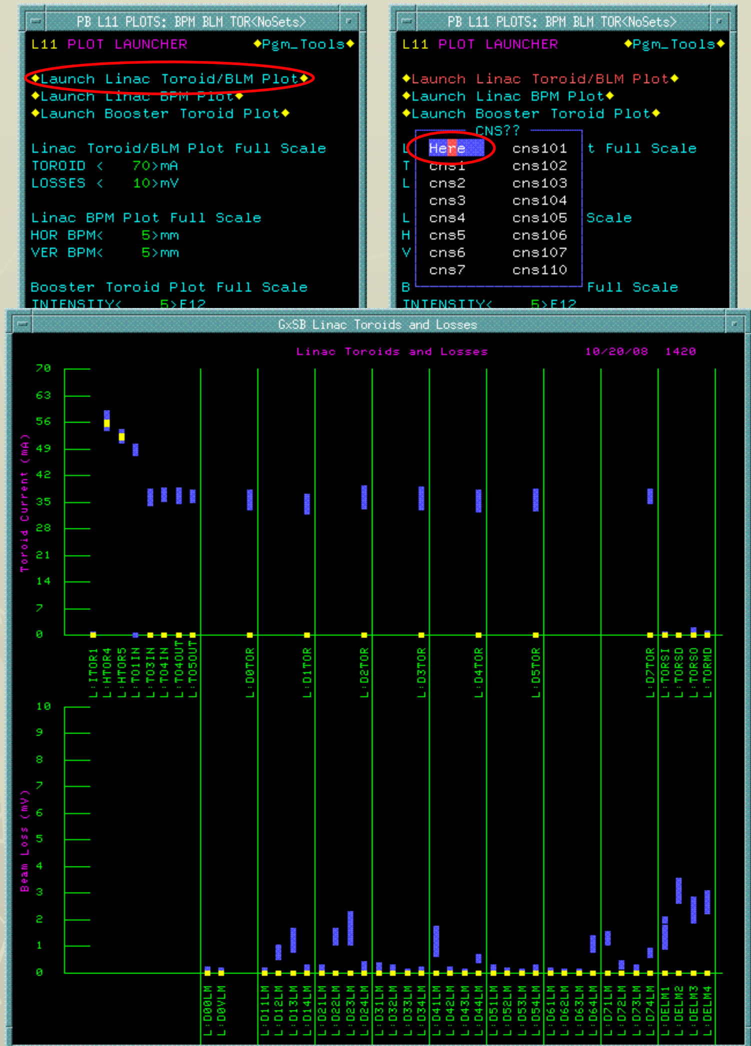
Linac 400 MeV Steering Program



The purpose of the 400MeV steering program is to use four dipole corrector trims at the end of Linac to put the beam in "nominal" positions for it's trip through the 400MeV line to the Booster accelerator. The algorithm samples BPM data in the downstream end of the Linac and calculates the horizontal and vertical corrections for the trim magnets.

- Using L32
- Interrupt on **Read BPMs**
- Turn on Studies pulses using the BSSB switch.
  - Wait for 6 pulses.
- Interrupt: **Calculate New Dipole Settings**
  - and take the "OK"
- L32 calculates trim changes vertically and horizontally
  - Interrupt: **Make New Settings** and interrupt "OK" to implement the new changes

Monitoring Linac

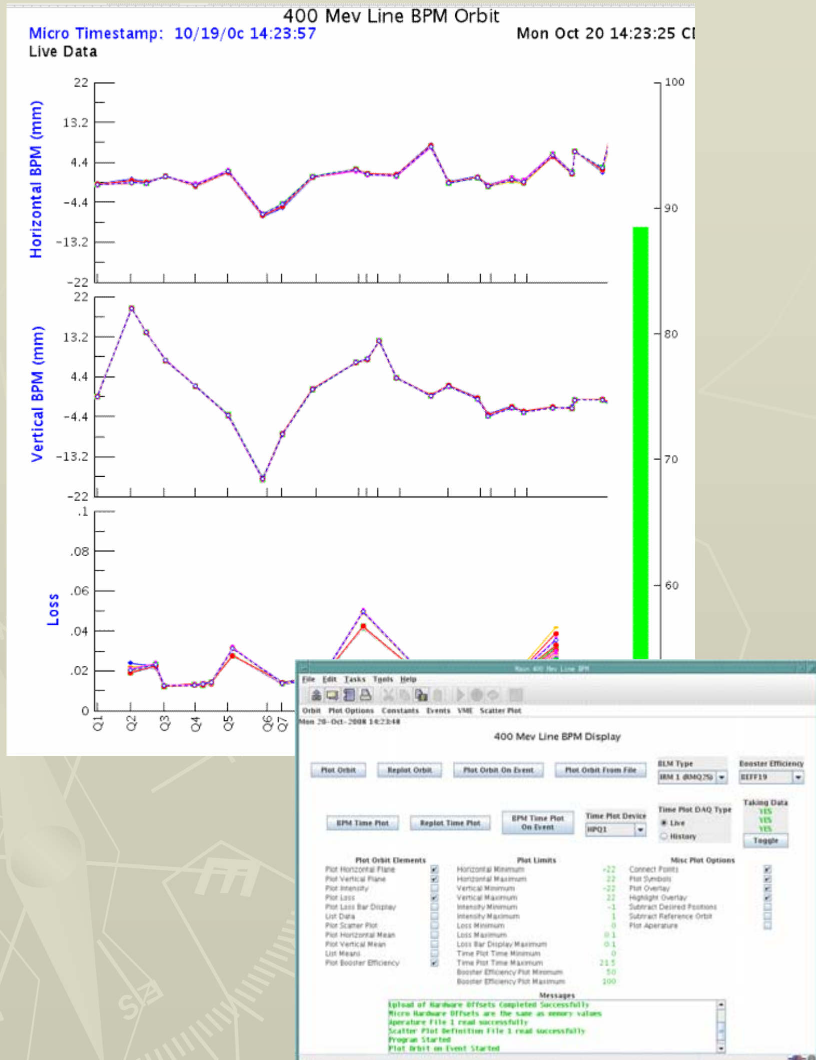


L11 program is used to monitor beam intensities and losses as beam is transmitted through Linac

- From L11 paramenter page
  - Verify Torroid scale = 70MA
  - Verify Losses scale = 10 mA
- Interrupt: Launch Linac Toroid/BLM plot
  - Interrupt: **HERE** to start plot
- Beam intensities are on the upper graph
- Beam Losses are on the lower graph

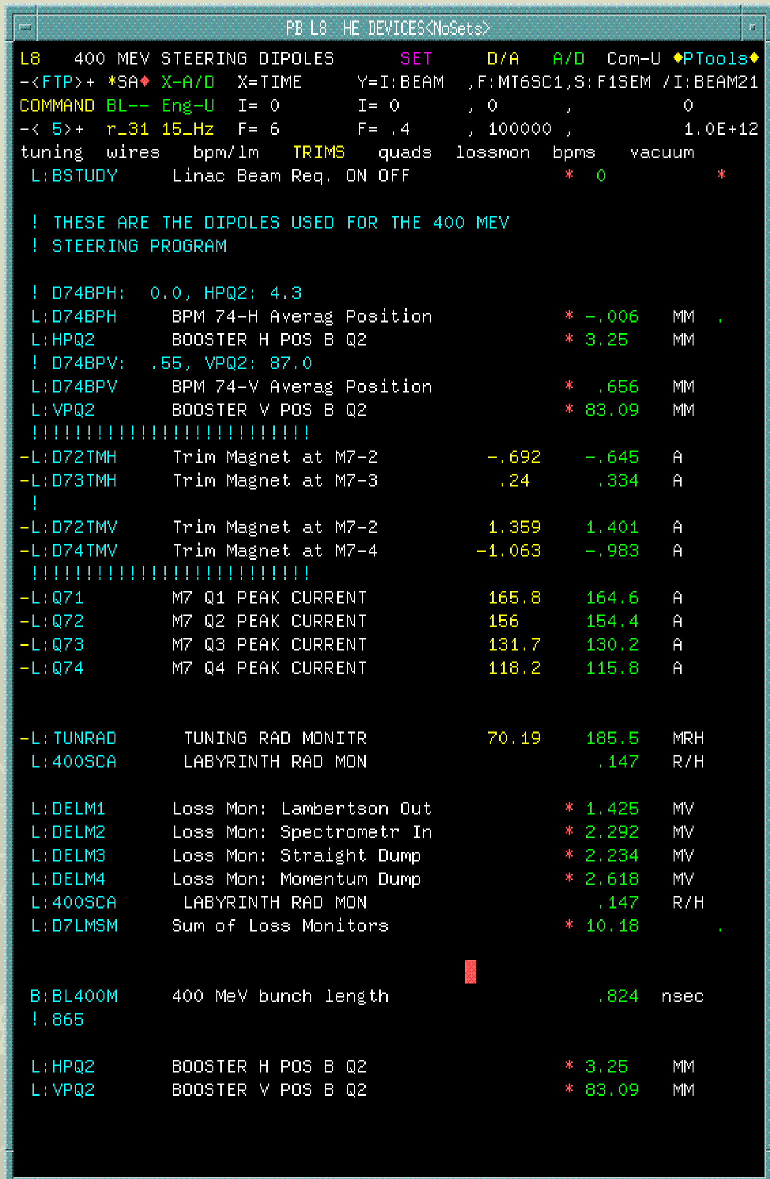
Monitoring 400MeV Line

We use a Java Program to monitor beam transmission in the 400 MeV line from Linac to Booster



- ► Using a Java application to monitor beam position and losses in the 400MeV line.
  - Refresh the plot by interrupting on **Replot Orbit**

Monitoring 400MeV Line



We use parameter pages to keep track of changes and enable us to return to initial condition.

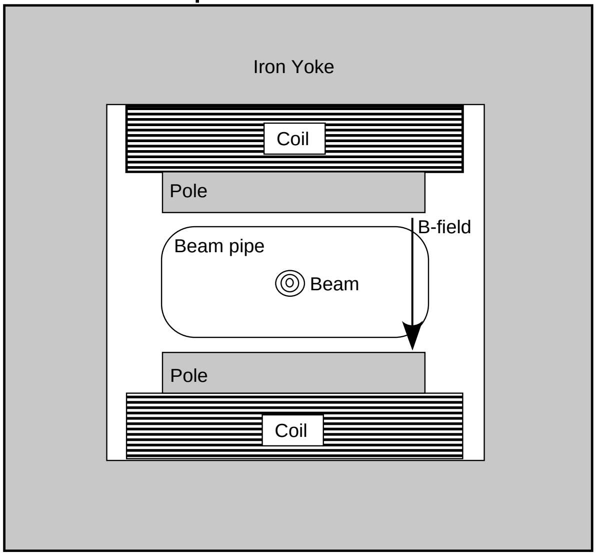
- **L8 400 MeV Steering Dipoles**
  - **Subpage <5> Trims**
  - **Horizontal changes are made to :**
    - **D72TMH**
    - **D73TMH**
  - **Vertical changes are made to :**
    - **D72TMV**
    - **D74TMV**

Beam steering in circular machines

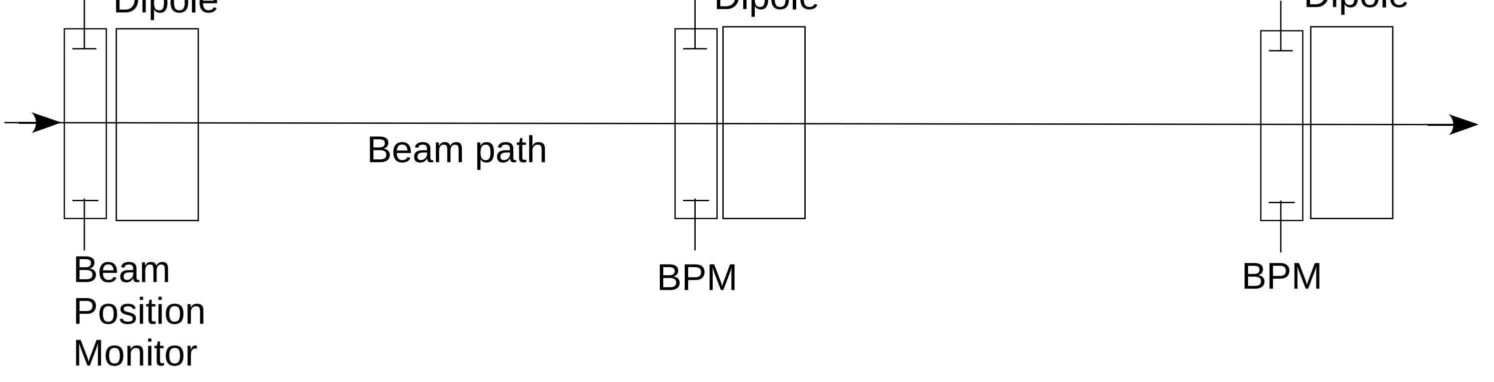
When it is desired to move the beam path (or orbit) at one location in the accelerator, Dipole Correctors are used. These are small electromagnets that are controlled individually, each producing an angular change in the beam path. The dipoles must be used in organized groups to create a local displacement. The most basic of these is called a Three-Bump.

We will be making a three bump in the Main Injector and observing the effect on the beam position.

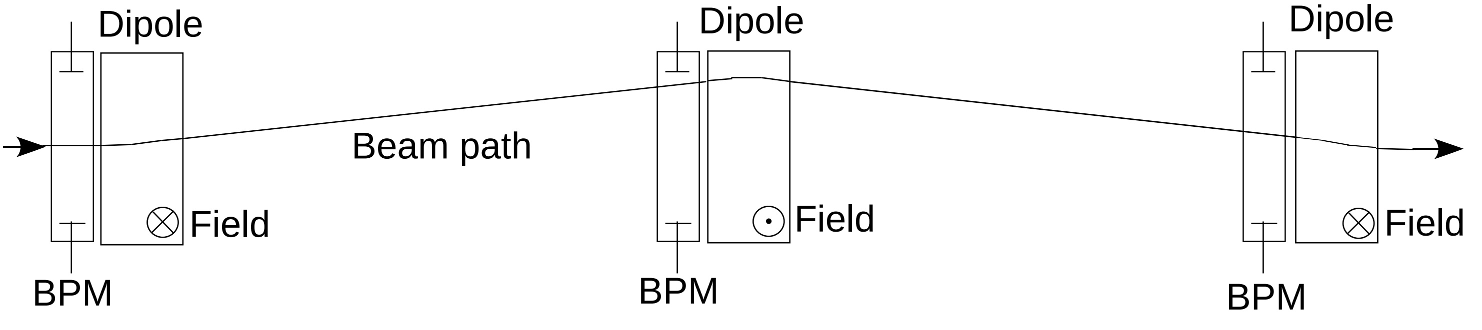
Dipole Corrector



Corrector currents at zero



A "Three-bump" produces a local beam displacement



Making and measuring corrections to the beam orbit in the Fermilab Main Injector

We will be performing a local orbit bump of the proton beam in the Main Injector, using the principles outlined on the previous page. The procedure will be outlined in general terms here:

First we will launch the beam position measuring application known as Page I39. The instructor will explain how to launch application pages.

Next we will launch a second application called a “parameter page” which allows the reading and setting of any of the accelerator devices. The parameter page we are using will contain pre-defined “three bumps” which will allow us to create orbit displacements at chosen location in the Main Injector.

We will then examine a saved orbit measurement and verify that the current beam orbit matches this file, which we will be using as a reference.

The instructor will then suggest reasonable values the guests may enter for the three bump and allow them to “knob” the corrector currents accordingly and observe that the three magnet settings are ganged together to a specific ratio to produce a local displacement.

The instructor will then describe how to measure the new orbit, allowing the guests to perform this measurement. The measured orbit positions will then be subtracted from the reference file, allowing the recent changes to be clearly observed.

If time allows, we may perform this operaation in both horizonatal and vertical planes.

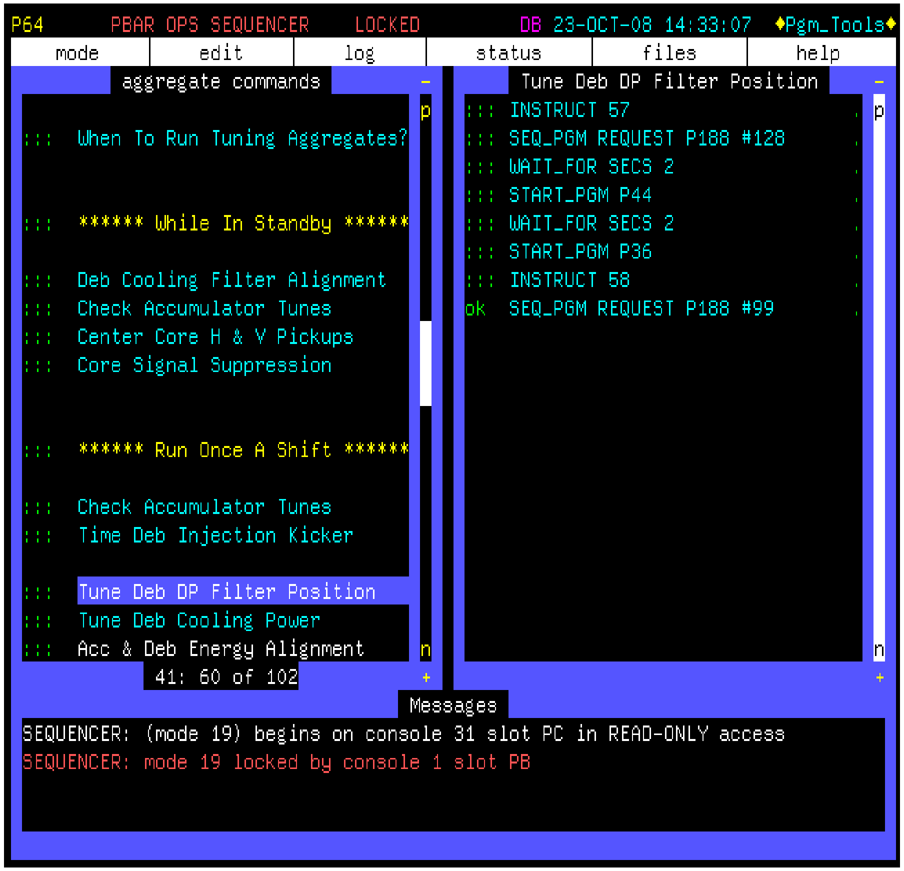
Questions about this procedure will be welcomed at any point, and we expect this to be a very interactive and informal session.

Tune the Debuncher Momentum Filter

The Antiproton Source Debuncher has a Momentum Stochastic Cooling system. There is a notch filter to insure we only amplify the proper signal. It is check once a shift for proper alignment.

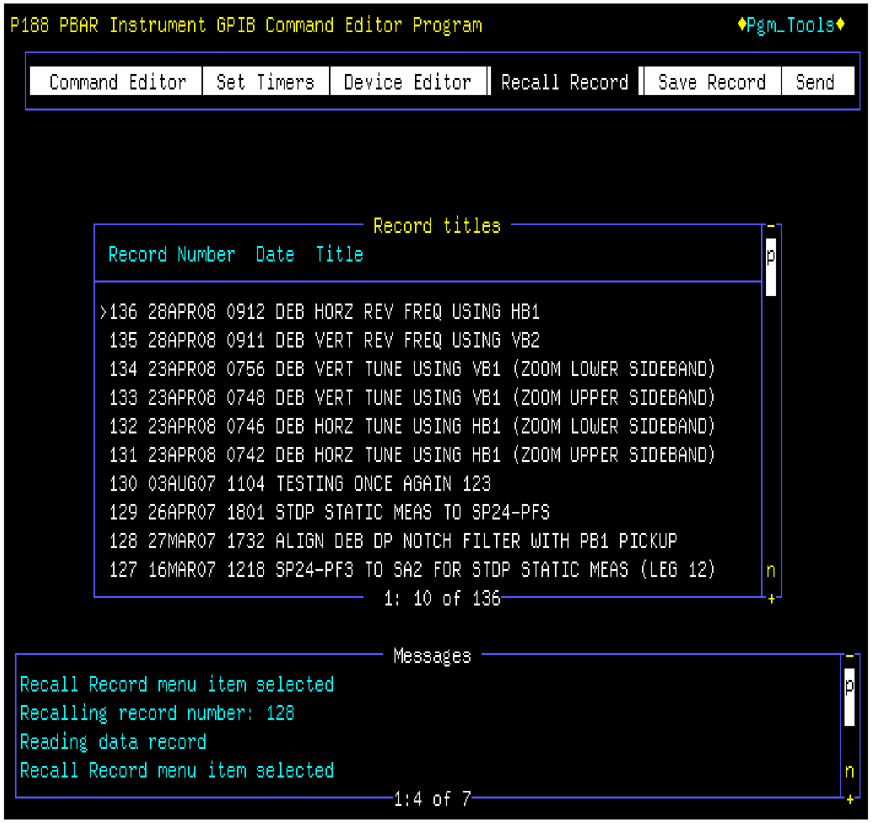
Start the Sequencer Program

- The sequencer program allows for group of commands to be executed along with providing instruction for the task



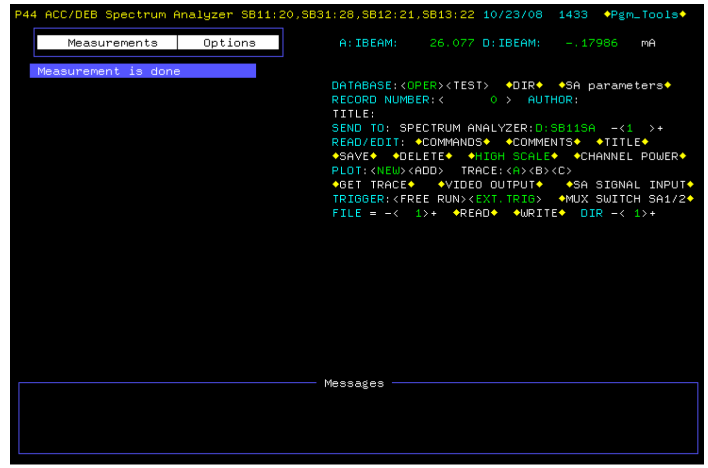
Load the Analyzer

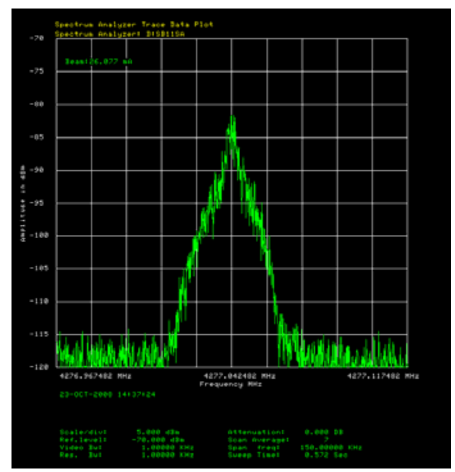
- Load a spectrum analyzer with the correct setup to look at the filter.
- This includes switching the proper signal into the instrument.



Look at the Data

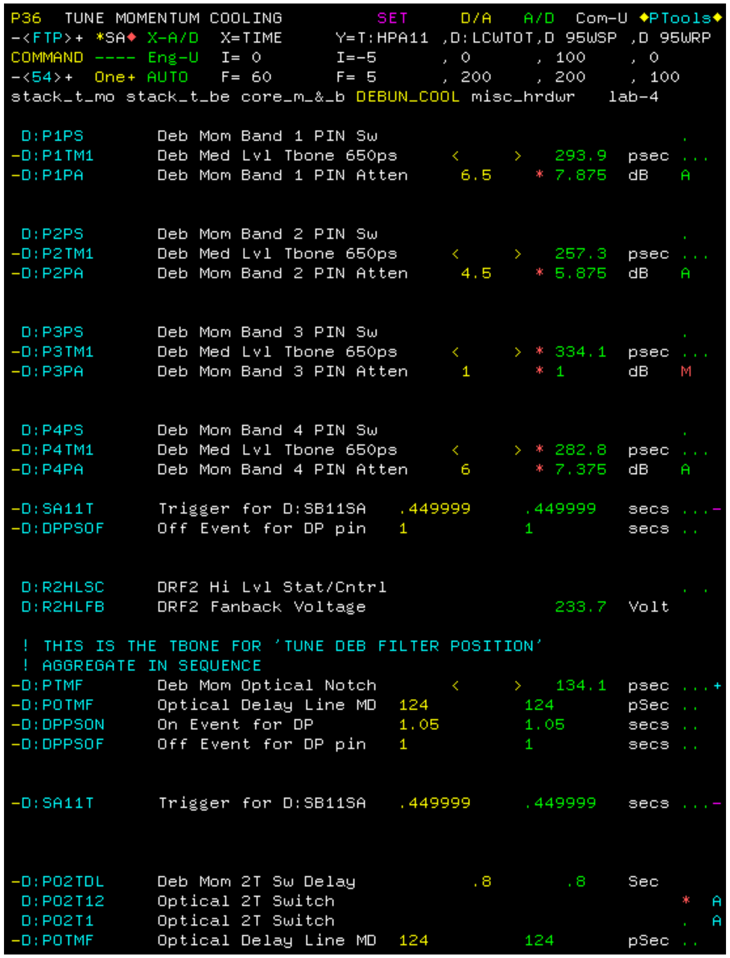
- Look at the data and save the starting position.
- This can also be looked at on the cable TV system.





Change the filter position

- Using the parameter page called up by the sequencer, we will correct the filter position and then copy the new position.



Put the analyzer back

- Restore the spectrum analyzer back to its default configuration
- If this was being done for operations, we would also document the change in a log book.