Minutes, 1/08/04 Tevatron BPM Upgrade Meeting
Stephen Wolbers

This set of minutes, and all future minutes, are or will be deposited in the Beams Document Database as document number 792.

The agenda as announced consisted of:

1. Bob Webber -- Mathcad demo.
2. Measurement status.
3. Mark Fischler -- Resolution

1. Bob Webber -- Mathcad demonstration

- Bob has developed a program (in Mathcad) to visualize the bunch locations and crossings in the Tevatron. It has been deposited in the Beams Doc DB #959.

- Bob gave a nice demo of the program during the meeting. First, he included the Tev BPM positions, found in a file he got from Mike Martens. He places 36 p and 36 anti-p bunches in the machine, separated by 396 ns, and cogged in various ways (injection, collision, whatever). Then he can look at the position of all the bunches as a function of time or look at a fixed position and watch the bunches pass by. This looks like a very nice program.

2. Measurement status.

- Bob showed some of the recent measurements from the RR Echotek (in Tev BPM mode) connected to A14. Looking at the proton position Bob estimates a resolution of 10-20 microns. This is not as good as Warren Schappert saw earlier so there are some improvements being investigated, inlcuding: raising the gain early in the digital processing, using better analog filters, etc. We discussed how we could get the data and do a fit to it. It does look possible. Bob estimates that the turn-by-turn resolution is about 100 microns.

3. Mark Fischler -- Resolution.

- Mark talked about how one can define and then using that definition measure the resolution of the BPM system. This work is written up in Doc 960. The talk itself will also be found in Doc 960.

- The measurement technique involves moving the beam by a small amount, making a measurement, moving it again by a small amount, making a measurement, etc. One can use the results to measure the absolute resolution of the device (with some error). There was some discussion about our ability to make these small motions in the Tevatron. An email from Mike Martens was sent later and I reference it here:

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Subject:
DFG resolution and minimum beam movement
From:
martens <martens@fnal.gov>
Date:
Thu, 08 Jan 2004 15:14:09 -0600
To:
Stephen Wolbers <wolbers@fnal.gov>, Mark Fischler <mf@fnal.gov>, Jim Steimel <steimel@fnal.gov>, Bob Webber <webber@fnal.gov>

At 150 Gev the Tevatron dipole correctors give a kick to the beam of 0.8433 mrad at full scale of 50 Amps.
This corresponds to 32768 (or 215). Thus one LSB of change in the dipole correctors gives a kick of 2.57e-8 radians.

The amount of beam motion this gives is about 1.3 um for most of the Tevatron (with the exact number depending on the beta function at the particular location.) If we choose the location of the dipole corrector (at a lower beta value) and

the location of the BPM (at a lower beta value) appropiately, then the motion is reduced by a factor of about 3, to about 0.4 um.

However, even though the controller has a 16 bit ADC, the power supply regulator may not have the same precision. If for instance, the dipole corrector has only 12 bit resolution, then the minimum move we could make would be about 5 um. (I am trying to find a power supply expert who can answer this question for me.)

Mike