# Tevatron BPM Measurements Taken on Saturday, January 10, 2004

Measurements were taken to obtain data on BPM pick-up directionality as a function of beam position. The beam condition at the time was a proton-only, twelve-bunch (12x0) store, Store #3141. Beam intensity was about 2.8E12 total in the 12 bunches.

The study was done between 16:20 and 17:15 hrs. During that time there were 21 conditions of interest as the beam was bumped at A14 and A15. The VA14 bump utilized vertical correctors at A12, A14, and A16; the HA15 bump utilized horizontal correctors at A13, A15, A17. Thus the vertical bump spanned the horizontal pickup location and vice versa.

Three data acquisition set-ups were active. Signals from the four ports of the horizontal A15 BPM were split and connected to the "damper board" setup and to a Tektronix scope. Signals from the four ports of the vertical A14 BPM were connected to the Recycler Echotek set-up.

Signal paths were as follows:

VA14 proton signals – cable from pickup into 6dB pad into 53MHz bandpass filter into EchoTek input

VA14 pbar signals – cable from pickup into 3dB pad into 53MHz bandpass filter into EchoTek input

HA15 proton signals – cable from pickup into 10dB pad into MCL BLP-70 lowpass filter into 6dB pad into MCL ZFSC 2-2 splitter, one output directly into Tektronix scope (50 ohm input impedance), second output into 3dB pad into damper board input

HA15 pbar signals – cable from pickup into 6dB pad into MCL BLP-70 lowpass filter into MCL ZFSC 2-2 splitter, one output directly into Tektronix scope (50 ohm input impedance), second output directly into damper board input

Data from the damper board system was recorded and time-stamped on the local PC and data from the scope was manually saved on the scope's internal hard disk. The damper board and scope will both yield complex data. There should be four scope files (one for each of four traces) for each of the 21 conditions. The scope was set up to sample at 250MHz and there should be 4 million samples per trace.

Data from the Recycler EchoTek was recorded on the ACNET data logger. Data logger channel names are not obvious, since they were created for other purposes; the correlation is T:VPIA14 recorded the proton "A" signal, T:VAIA14 recorded the proton "B" signal, T:VPIA18 recorded the pbar "A" signal, and T:HPIA19 recorded the pbar "B" signal. Unfortunately, I discovered after taking the measurements that only 3 of the 4 signals were actually recorded due to an error in logger setup; the pbar "A" signal was lost. This data is magnitude information only; complex data is not available.

The table below identifies the conditions of interest, the approximate time (by my wristwatch) at which the bumps were adjusted to the corresponding setting, and the name of t the oscilloscope data file corresponding to that bump setting.

Note that the scope file names include "scope time" at which the file save was initiated. Note that scope clock time must have been a fraction of a minute faster than

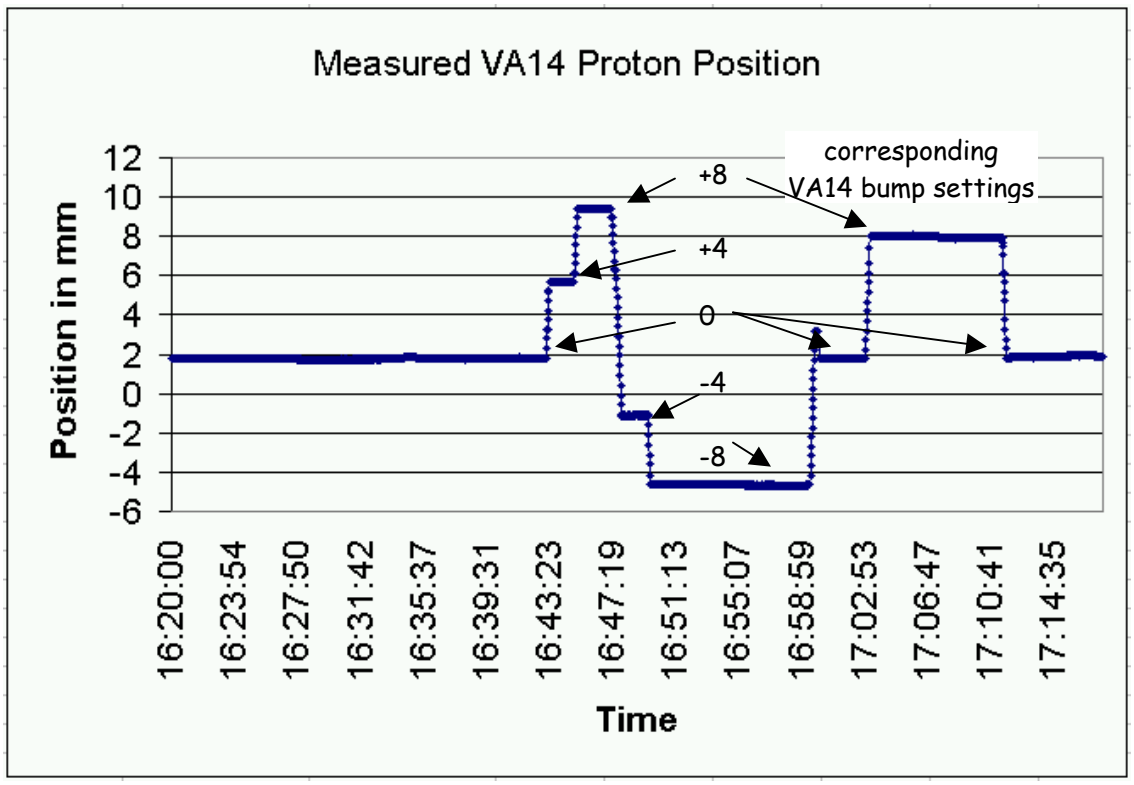
wristwatch time, since, e.g. 9th condition, there are some instances where scope file name for previous condition is later that time indicated for change to new condition. Where such confusion might appear, the re-registration of the files, times, and conditions should be obvious from the sequence of bump conditions and the data saved. Damper board files will be identified only with the PC clock file creation timestamp.

The plot below shows the VA14 position as determined from the data-logged Recycler system data during the period of interest. Note that there appears to be hysteresis in the bump settings as the two VA14 settings of +8 at two different times resulted in significantly different measured positions; more than could be explained by different horizontal positions in that pickup (because at the second +8 setting, the horizontal bump was scanned from _8 to –8 !)

Table 1.

| Begin Change to Setting (wristwatch time) | HA15 Bump Setting (mm) | VA14 Bump Setting (mm) | Scope File Name for this Setting |
|---|---|---|---|
| before 16:27 hrs | 0 | 0 | - 162722 |
| before 16:27 hrs | 0 | 0 | - 163037 |
| not recorded | +4 | 0 | - 163217 |
| ~16:33 | +8 | 0 | - 163505 |
| ~16:35:10 | -4 | 0 | - 163645 |
| ~16:37:05 | -8 | 0 | - 163901 |
| ~16:41 | 0 | 0 | - 164330 |
| ~16:43:16 | 0 | +4 | - 164528 |
| ~16:45:00 | 0 | +8 | - 164702 |
| ~16:47:18 | 0 | -4 | - 164848 |
| ~16:49:30 | 0 | -8 | - 165041 |
| ~16:51:25 | +4 | -8 | - 165234 |
| ~16:53:12 | +8 | -8 | - 165427 |
| ~16:55:00 | -4 | -8 | - 165635 |
| ~16:57:18 | -8 | -8 | - 165853 |
| ~16:59:33 | 0 | 0 | - 170139 |
| ~17:03:00 | +4 | +8 | - 170428 |
| ~17:05:25 | +8 | +8 | - 170632 |
| ~17:07:15 | -4 | +8 | - 170852 |
| ~17:09:25 | -8 | +8 | - 171047 |
| ~17:11:25 | 0 | 0 | - 171325 |

Plot 1.


Measured VA14 Proton Position
corresponding
VA14 bump settings
+8
+4
0
-4
-8
Position in mm
12
10
8
6
4
2
0
-2
-4
-6
16:20:00
16:23:54
16:27:50
16:31:42
16:35:37
16:39:31
16:43:23
16:47:19
16:51:13
16:55:07
16:58:59
17:02:53
17:06:47
17:10:41
17:14:35
Time