

## E-835 SHIFT CREW GUIDE ON HOW TO MONITOR THE COLLECTION OF ACCELERATOR PARAMETERS

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Some of the data collected by the accelerator network (ACNET) is a vital part of the E-835 data acquisition (DAQ). It is important that the E-835 shift takers understand how to monitor this data on-line, in order for them to complement, with the experimentalist's viewpoint, the tasks of the beam manipulators. This will help achieve a successful and oops-free data taking.

**ACNET data** The readings of the beam-position monitors (BPMs) provide information on the length of the antiprotons' closed orbit; a spectrum analyzer (SA) located at AP-10 measures the frequency profile of the beam as detected by the longitudinal Schottky pickup. Combining this information with periodic measurements of the Accumulator lattice, it is possible to deduce the energy distribution of the beam.

Other ACNET parameters are also recorded: deceleration ramp index, beam current, transverse emittances, cooling status, target- and vacuum-related quantities, standard time. The complete list can be found in Table 1.

The application program called P77 gathers all this data and sends it to the E-835 DAQ approximately every 2 minutes. P77 also makes a preliminary calculation of the beam energy, using the lattice functions as input parameters.

**Checking if P77 is running** During E-835 data-taking, **it is of great importance to make sure that P77 is running!** Currently, P77 is run either by the P-Bar crew at AP-10 (x4370) or by the operators in the Main Control Room (MCR, x3721). Even if they started it after a deceleration, it

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<sup>1</sup>Please contact me by phone (x6123) or by e-mail (stancari@fnal.gov) for any questions or comments about this document. This guide is available on the web at <<http://www-e835.fnal.gov/stancari/e835/>>.

ACNET Device	Description
(the following are read by P77 from the Accelerator Network)	
X:POFTT	deceleration ramp index
A:IBEAM	beam current
A:IBPSI	bend-bus current
A:BFIELD	bend field
A:RLFS0	RF frequency
A:R3HLFB	RF voltage
A:EMITH	horizontal emittance (@ 79 MHz)
A:EMITV	vertical emittance (@ 79 MHz)
A:EMT5H	horizontal emittance (@ 500 MHz)
A:EMT5V	vertical emittance (@ 500 MHz)
A:CMTW01	mom. cooling power
A:CMTW02	mom. cooling power
A:CMPA01	mom. cooling attenuator
A:CMTM01	mom. cooling delay
A:MARAYU	mom. cooling pickup tank position
E:GJPSP	gas-jet pressure set point
E:GJPRB	gas-jet pressure read back
E:GJTSP	gas-jet temperature set point
E:GJTRB	gas-jet temperature read back
E:GJDENS	gas-jet density
A:IG400	ion gauge
A:IG500D	ion gauge
A:CC500D	cold cathode
G:TODSEC	seconds from 1 Jan 1970
(the following are calculated by P77)	
A:PBEAM	beam momentum in the lab
A:EBEAM	beam energy in the lab
A:ECM	CM energy
A:DELBPM	averaged BPM difference between current and reference orbit
A:SIGMAP	momentum spread in the lab

Table 1: ACNET data sent by P77 to the E-835 DAQ (individual BPM readings and SA measurements not included). An error status shows up in the P77 data display (Figure 1) as a value of -666 for the device in error.

might get stuck. One way to verify that it is alive is to check the E-835 scalers window (it usually runs in the Counting Room on the X-terminal to the right of fn835y and it is green): it should show the parameters A:IBEAM and A:PBEAM and the time when they were last updated; **make sure the display is not more than 5 minutes old!**

**Fast Time Plots** Another way of checking ACNET parameters is by making a Fast Time Plot (FTP). Besides telling you whether P77 is alive or not, an FTP will help you monitor the beam energy and momentum spread, as well as displaying any ACNET parameters as a function of time or of another ACNET parameter, as long as you know their names. **It is strongly recommended that the E-835 shift crew keep an eye on the beam energy and momentum spread as a function of time during data taking!** FTPs run on accelerator consoles; there is one in the AP-50 Counting Room on the table on your right as you enter the room. Here is how to start a Fast Time Plot:

1. On the upper part of the console keyboard, press the blue button that says 'Utilities'; the Utilities TV window will pop up.
2. Interrupt on 'FTP' between the two yellow diamonds; an FTP box will be displayed.
3. Interrupt on 'Restore' between the two yellow diamonds; from the menu, choose 'P-bar'. You will be given a list of plots already set up; choose number 1, which should be called 'E-835 Beam Parameters'. It is a plot of center-of-momentum (CM) energy (A:ECM), momentum spread (A:SIGMAP) and difference between RF frequency (A:RLLFS0) and average beam revolution frequency (A:CENFRQ).
4. Check the limits of the plot. A reasonable range for TIME is from 0 to 1200 s; A:SIGMAP is usually between 0 and 2 MeV/c; the frequency difference should go from -1 to 1 Hz. As regards A:ECM, put the energy requested by E-835  $\pm 0.2$  MeV.
5. Choose the window to which you want to send the plot. You have three choices: GxSA, GxSB or GxSC. Choose one that is not being used by interrupting on the red diamond in the upper left corner of the FTP box. **If, by mistake, you interrupt on the letters SA (or SB or SC) instead, you will restore the last FTP that was plotted in that window; in this case, you will probably have to restart from point 3.**

6. Start the plot by interrupting on any of the variables or their limits.

The CM energy, the momentum spread and the average beam revolution frequency are calculated by P77, so their value should change approximately every 2 minutes. If they do not change at all, it means that P77 is not running properly; you should contact whoever is running it and suggest that they stop P85 (the E-835 Babysitter), restart P77 and then restart P85.

The **CM energy** should stay constant to within  $\pm 50$  keV during data-taking. Depending upon the charmonium state under study, if A:ECM exceeds those limits you might consider contacting the beam manipulators or starting a new run. Keep also in mind that a drift of  $-150$  keV is normal in the half hour after the jet target is turned on.

The **momentum spread** should be between 0.6 and 1.6 MeV/c, depending upon the beam intensity (large stacks are allowed a larger momentum spread to avoid instabilities); recall that in the region of interest of E-835 the momentum spread  $\Delta p$  in the lab is roughly 4 times as large as the corresponding spread in CM energy:  $\Delta E_{CM} \simeq \Delta p/4$ .

The **RF frequency** A:RLLFS0 should be within  $\pm 0.5$  Hz of the average revolution frequency A:CENFRQ for the BPMs to pick up the position of the center of the beam distribution. If the two frequencies are sensibly different, it means that P85 (the E-835 Babysitter) is not doing its job. Again, contact whoever is running P85, either at AP-10 or in the MCR.

**Printing console windows** To print out a Fast Time Plot, or anything else on the console screen, follow these steps:

1. On the upper part of the console keyboard, press the blue button that says 'Utilities'; the Utilities TV window will pop up.
2. Interrupt on 'COPIES' in the upper right corner.
3. Choose which window to print out by interrupting between the angle brackets next to 'Copy from'.
4. Select the AP-50 printer by making sure that the angle brackets next to 'To' show 'BLK/WHT PRTR'; also, in the bottom box, interrupt next to 'Queue' and select 'AP50\_HP4SI'.
5. Send the window image to the printer by interrupting on '>>Copy<<'.

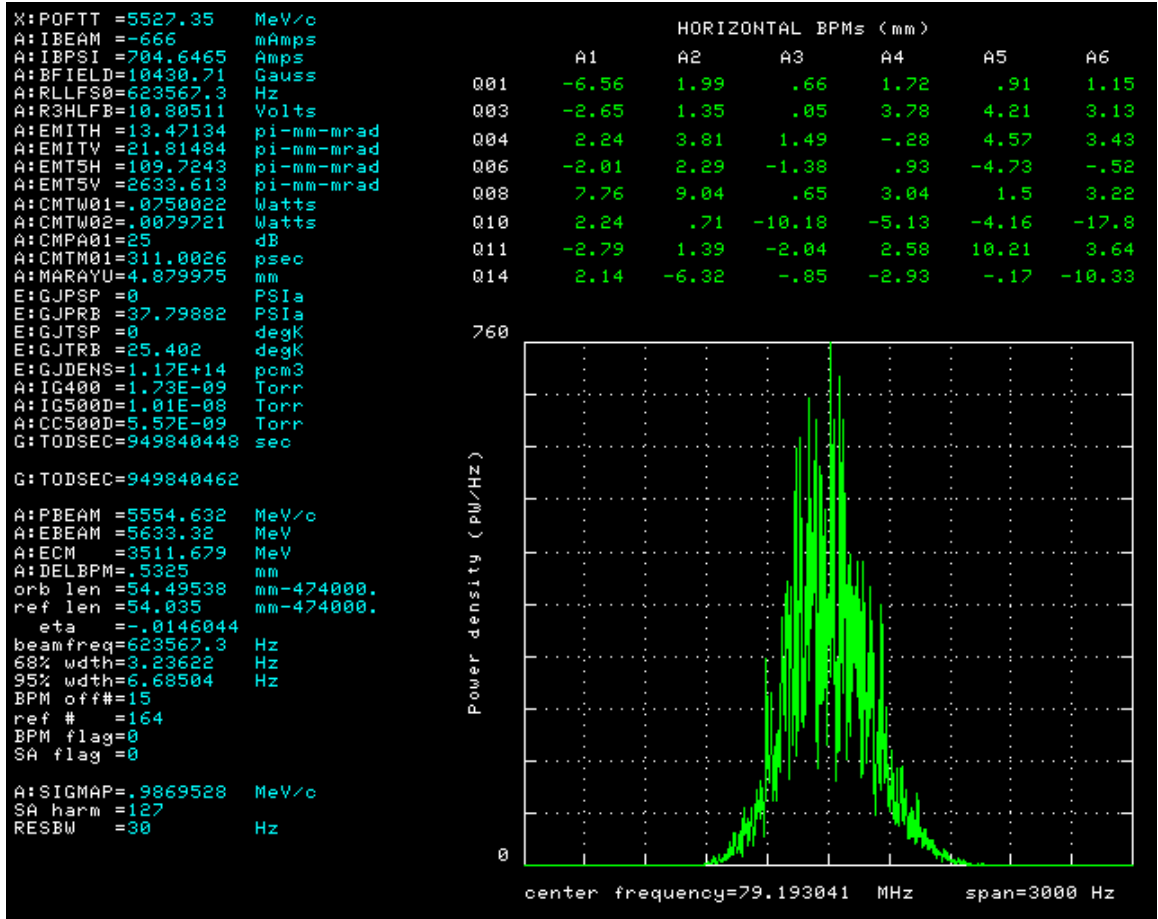


Figure 1: Example of P77 data display.

Name	Pager	Lab phone	Home phone
Dave McGinnis	314-0998	x2789	293-0997
Giulio Stancari	–	x6123	x4855
Steve Werkema	722-4359	x2232	260-1536

Table 2: Contact people.

**The P77 data display** A check of the integrity of the ACNET data is the P77 data display (Figure 1). On the left side it has a list of devices, whose meaning is explained in Table 1 (devices in error are shown with a value of –666). A list of quantities calculated by P77 itself is also shown in the left column. On the right side, the horizontal BPM readings are listed, below which the latest SA profile is plotted. This data display can be dumped to screen from the console running P77 (usually at AP-10 or in the MCR) and sent to the AP-50 printer upon request. This is normally done at least once after each deceleration.

**Summary** These are some of the tasks that the E-835 shift crew should undertake:

- Find out who the current beam manipulators are (AP-10 types or MCR operators), so that you know who to contact in case of problems.
- Make sure that the E-835 DAQ is continuously receiving data from P77.
- Keep an eye on beam energy, momentum spread and difference between RF frequency and average beam revolution frequency.
- Periodically (every 2 hours?) ask the operators for a printout of the P77 data display and make sure all devices are read out correctly.
- If in trouble with accelerator-related issues, contact the AP-10 crew, the MCR operators or one of the P-Bar deceleration ‘experts’ listed in Table 2.