



Beam Instrumentation Department

MI DCCT Computations

A brief look at the MIBEAM front-end operation
and calculations for the DCCT

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MIBEAM front-end Hardware

MIBEAM front-end is a VME MOOC based front-end located at MI-30. It consists of the following hardware:

- MVME-2401 CPU card
- ICS110BL digitizer board
- PMC-UCD clock decoder
- SBS IP carrier board with an IP MDAT transmitter
- MDAT Fanout board.



ICS110BL digitizer board

- 24 bit Sigma-Delta A/D converter (18 actual bits measured).
- 6.4 MHz sample rate.
- 50 kHz update rate with 128 sample averaging or 100 kHz update at 64 sample averaging.



Front-end timing and calculations

- Data is collected from the ADC by a task running at 2880 Hz.
- Data is averaged over 4 samples at 720 Hz, this data is stored in a buffer.
- All ACNET request are filled by returning the data stored in the buffer asynchronously with data collection.
- Scaling is done with the simple equation $y = ax + b$, where y is the ACNET readback, x the input from the ADC, a the scale factor and b the offset (both readable and lumberjack via ACNET).
- A running average (X:RABEAM) is calculated with the equation:
$$y_{ave} = (y_{old} * weight) + (y_{current} * (1 - weight))$$
 where the weight is between 1 and 0. Zero gives no averaging and 1 gives no update.
- Main devices are X:BEAM and X:BEAMS.



Calibration

- Calibration of the front-end is done via telnet to the front-end. This is done by either the engineer or programmer.

```
1 - Outland (outland.fnal.gov)
File Edit Transfer Fonts Options Tools View Window Help
[Icons] F1 F2 F3 F4 [Icons]
//MI DCCT Front-End
// software by Tom Meyer
// Compiled: Apr 8 2004 15:38:49
// Time Since Boot: 75 Days and 1325 Mins
Channel 0          Channel 1          Time of Collection
1.6306819Volts    0.602612 Volts          26114 Time Stamp    4 Samples
+5-----+
0 0 0 0 0
0X1XX1XX1XX1XX1 - - - - -
-5-----+
A)Chan0 Scale Factor 3.511500          B)Chan1 Scale Factor 80.329399
C)Chan0 Offset      0.005000          D)Chan1 Offset      0.171500
M)Mdat Delay 230          X)Exit  !/1)Diagnostics  @)AcnetVerbose
Enter Choice:
```



Miscellaneous

- Tevatron DCCT front-end (TBEAM) is identical in hardware and software.
- Scale Factors and Offsets have the ACNET names X:BEAMSF and X:BEAMOF where X is the machine initial, I, R or T.