

BLM Dose Accumulations

Scope of data maintained

Fri, Jun 16, 2000

From approximately 70 Booster beam loss monitors, accumulations of beam loss will have to be maintained. This note explores the details of how this works.

Sums or Averages?

A running average can be computed that weights recent data more heavily. For example, to compute a running average over one-minute intervals, one can use

$$a_i = ((N-1) * a_{i-1} + d_i) / N,$$

where $N = 900$ cycles @ 15 Hz, a_i = an updated average, a_{i-1} = the previous average, and d_i = the new cycle data value.

This average can provide a useful reflection of the current rate of beam loss, but it does not easily translate into a long term beam loss total. It does have the advantage that its range is fairly bounded, unlike a total summation of beam loss, whose range depends upon the number of cycles over which the summation is calculated.

Computing a sum of total beam loss is trivial, although one must insure that enough significance is maintained for the time over which the sum covers.

Conversion to rads/sec

The raw output from the beam loss monitors is from a log amplifier. The conversion to radiation units in rads/second is via the following formula:

$$R = 10^{(2.5 * V - 3.343)}, \text{ where } V = \text{volts and } R = \text{radiation.}$$

The A/D used in the Swift digitizers is a signed 12-bit value with a range of +/-10 volts. For positive voltages, then, we have 2048 possible readings, so a table of converted readings turns the job of conversion into a simple table lookup. These results are floating point values. The table can be built when the local application is initialized. To forestall its taking up too much time, it can schedule this activity for a few milliseconds each 15 Hz cycle.