

Fermilab

Proton Source Department/Beams Division

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Characterizing the Length of Tevatron Down Time

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The downtime logged by the Operations Department for the Tevatron has been collected for the period Jan 1, 2003 through September 5, 2003. These data are available through the URL <http://www-bd.fnal.gov/cgi-mcr/dt.pl>. The following "System" categories have been selected:

- TWATR
- TVAC
- TRF
- TQUEN
- TPS
- TMISC
- TMAG
- TCRYO
- SAFETY*
- POWER*
- CTIME*
- CR&LK*
- CMISC*

Where * indicates that some items unrelated to the Tevatron have been removed.

The spreadsheet that contains all these items is available at the URL <http://bdps06.fnal.gov/TevDownTime.xls> (this URL is not available offsite).

A frequency distribution of the downtime duration from this spreadsheet is shown in Figure 1. The calculated mean of this distribution is 2.2 hours. The calculated standard deviation is 2.4 hours. Therefore, this distribution is characterized by the exponential distribution,

$$f(t) = Ie^{-It}$$

with $I = 1/2.2$ hours. This corresponds to a probability of remaining in a downtime of 36.5% per hour.

The Monte Carlo model of the Fermilab Collider complex (see a talk on this topic at <http://beamdocs.fnal.gov/cgi-bin/DocDB/ShowDocument?docid=829>) is based on the accurate use of random numbers. In order to reproduce accurately this distribution, a C++ class has been constructed, called RandomExp, that implements this distribution, with a slight twist. Note in the distribution that the first bin, corresponding to down time

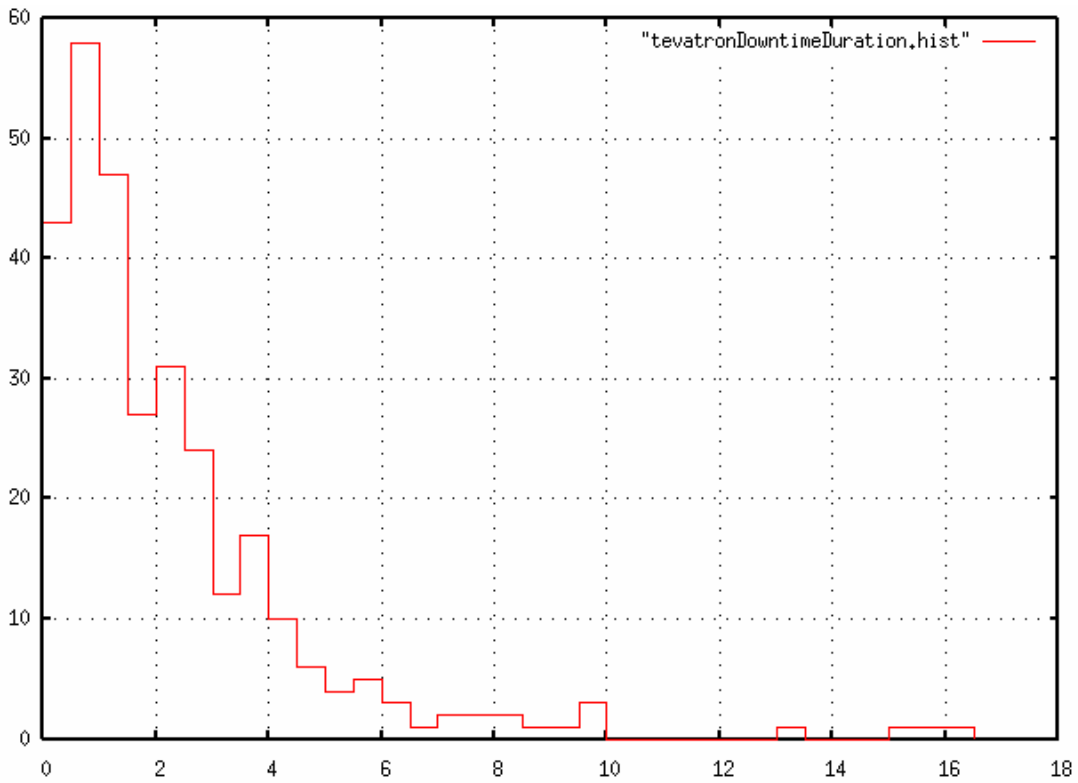


Figure 1, Duration of Tevatron downtime, a frequency distribution

less than one-half hour, is under populated. This is modeled in RandomExp with a constant offset for the random number, in this case, 0.2 hours. This deficit is easily understood as the minimum time that a recorded Tevatron downtime can last.

Figure 2 shows the Tevatron down time and the RandomExp model representation of it.

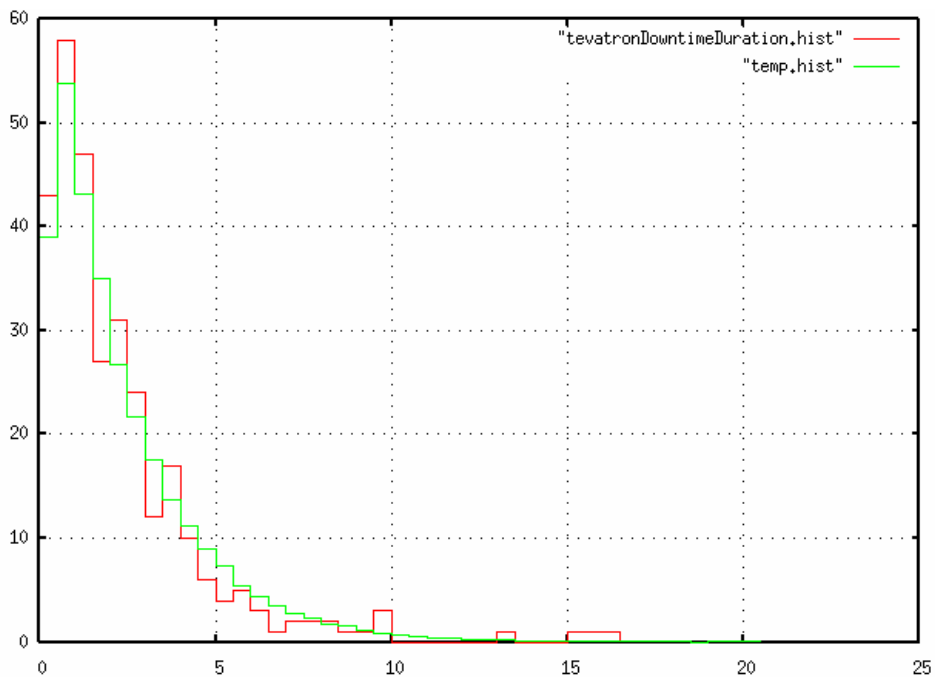


Figure 2, The representation of Tevatron down time in the Tevatron Monte Carlo model.