

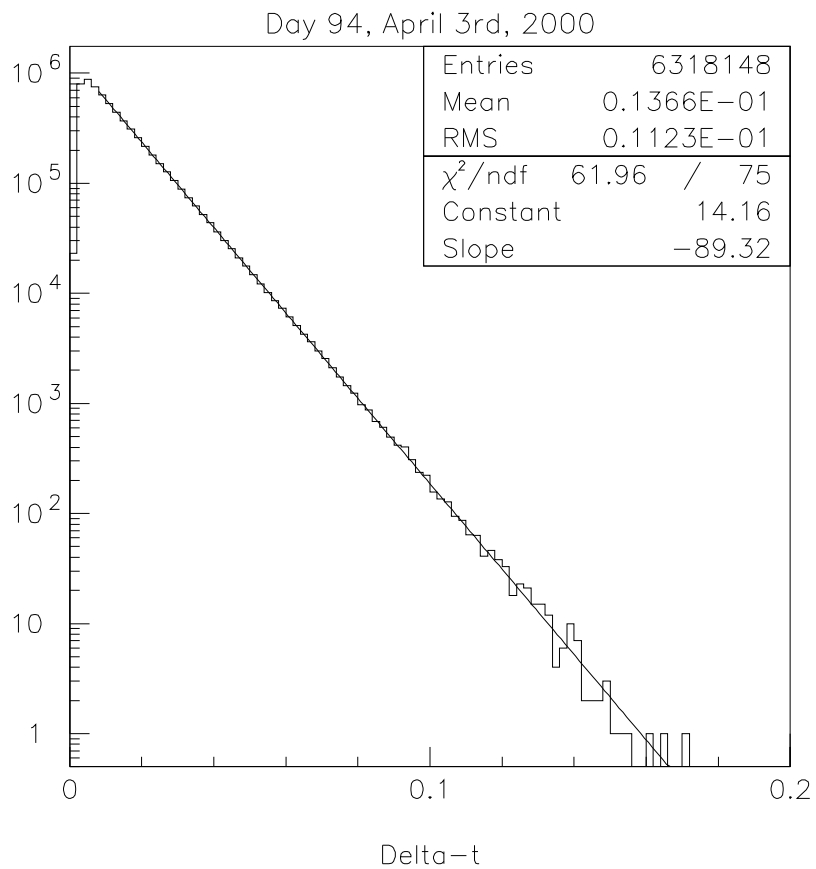
A Study of Life & Death of the AMANDA Detector

..... and some GPS problems

<http://www.physto.se/~walck/amanda/livedead/>

The “GRB day”

It all started with investigating a full day of raw data for GRB studies (day 94).



Method (briefly)

- Live-time

- Sum over all files including 'bias correction'

$$T = \sum_{\text{files}} \frac{n_i}{n_i - 1} (t_i^{\text{last}} - t_i^{\text{first}})$$

where n_i is the number of events in file i .

- Dead-time

- Above a cut-off of $> 10ms$ distribution perfect exponential in the variable $x = \Delta t - t_{\text{cutoff}}$

$$f(x; \tau) = \frac{1}{\tau} e^{-x/\tau}$$

- Use maximum likelihood estimate *i.e.* the average

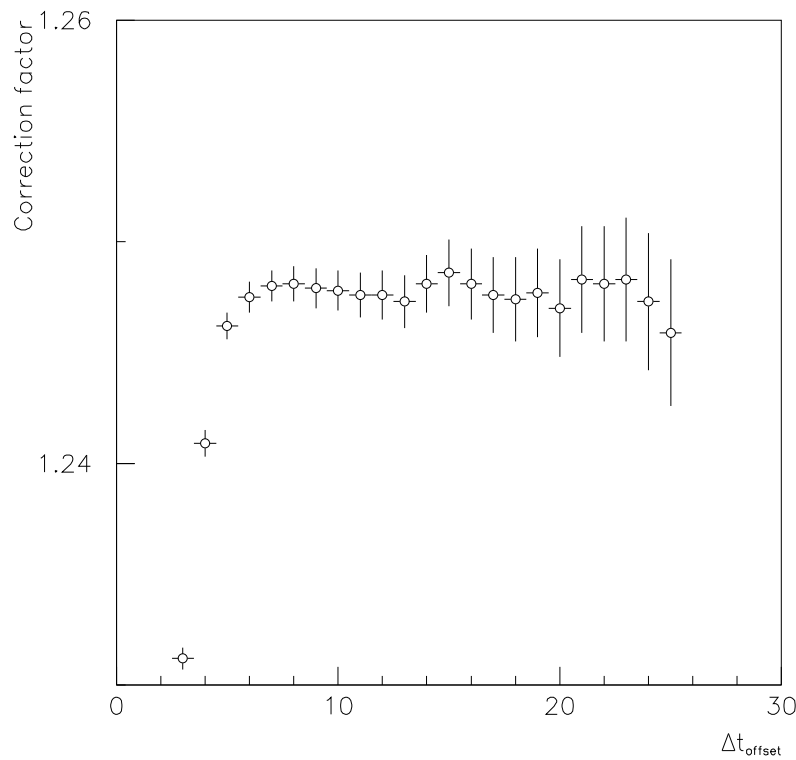
$$\hat{\tau} = \frac{1}{n_{\text{above}}} \sum_{i=1}^{n_{\text{above}}} x_i$$

for the n_{above} events with $\Delta t > t_{\text{cutoff}}$

Robustness in cutoff

The method is very insensitive to the cutoff as long as it is not too low where the distribution has started to drop. Having it too big increases the errors of the estimates. Using 10 ms for the moment.

The dead-time correction factor vs the cutoff chosen for the estimation of the exponential parameter (*i.e.* the mean).

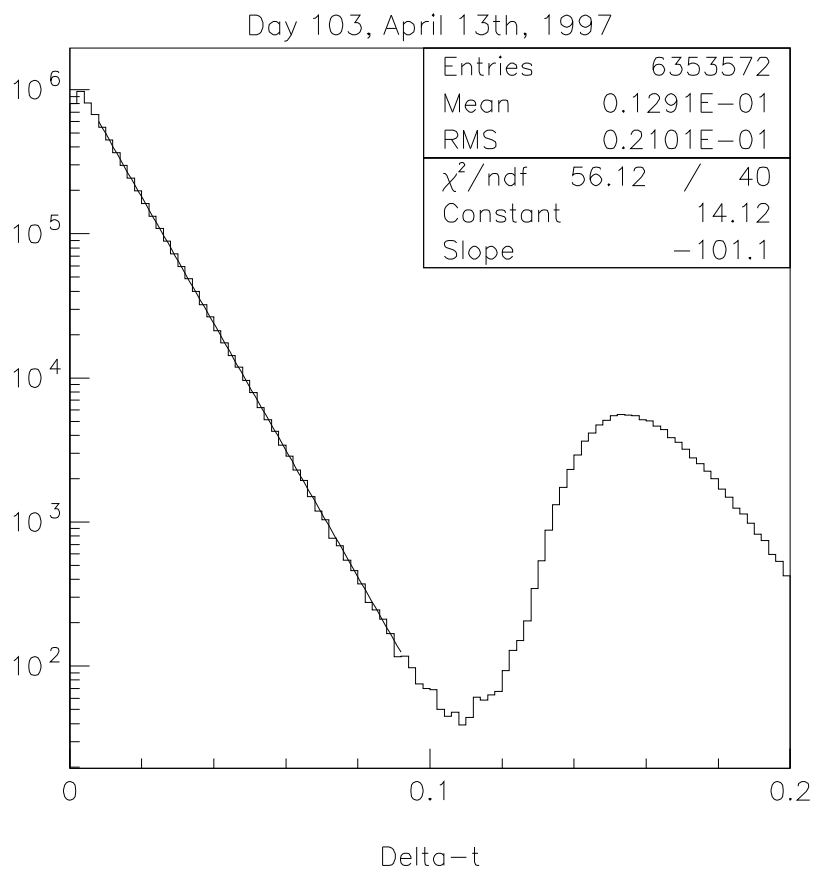


Data

- 1997: One day of raw data
- 1998: Two days of raw data
- 1999: Fifth of a day of raw data
- 2000: Full sample of raw data processed!
- 2001: not done
- 2002: Minimum bias files from Wisconsin

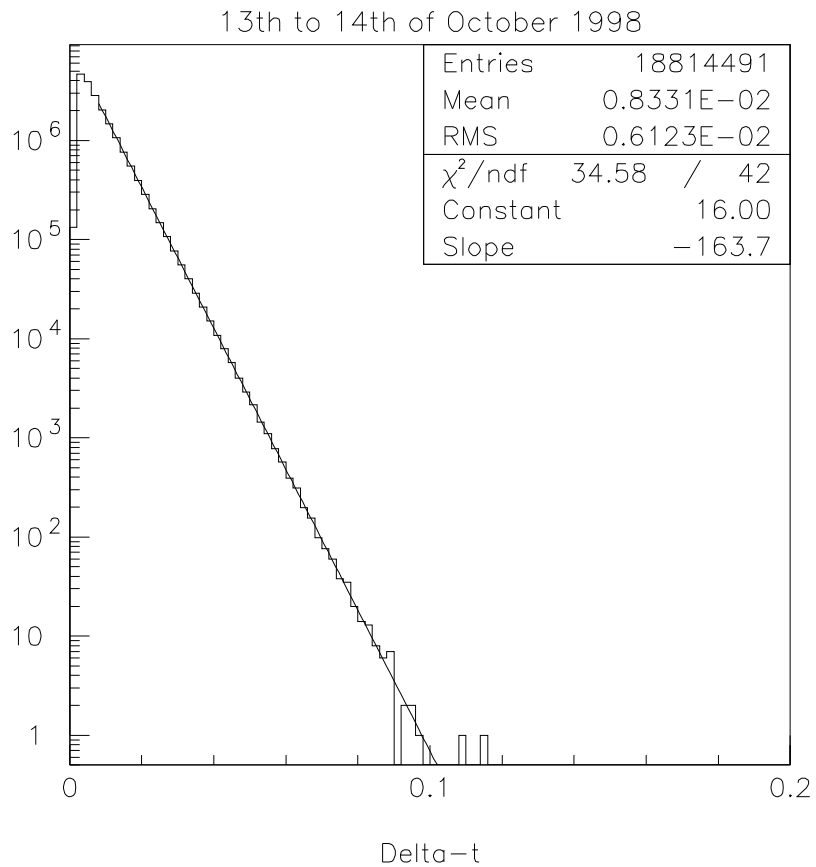
1997 data

As many of you remember the situation in 1997 was not ideal. Have not optimized analysis but correct live-time rather than dead-time for the events in the bump.



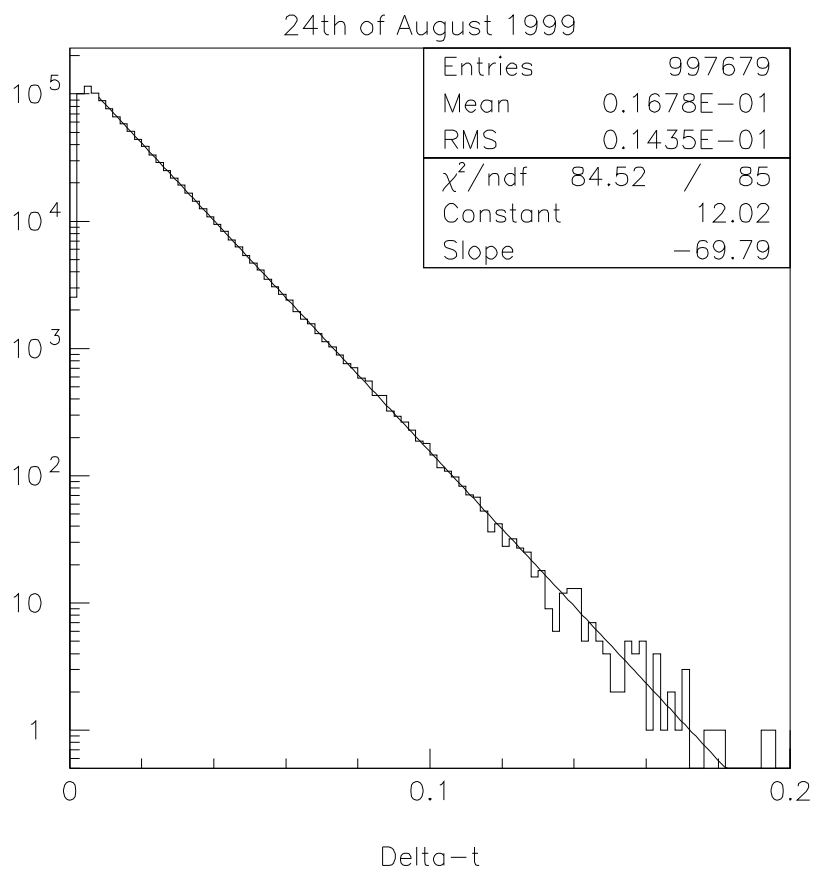
1998 data

The 1998 raw data we had available looks perfect although rate was high and dead-time quite big ($\approx 30\%$).



1999 data

The limited amount of 1999 raw data we had available looks good. Rate half of the one in 1998 and dead-time $\approx 16\%$.



GPS-problems in 2000 data

- Very regular pattern with problems in first ≈ 1330 events of each run (file with index 000) having three big Δt 's and $\approx 700 \Delta t = 0$ (happens once inside a file)
- Bug in day shift coming too early (15 cases in 2000 data) creating two big $\Delta t \approx \pm 86400$
- In three cases the time sequence moves backwards!

See web-pages for all details

<http://www.physto.se/walck/amanda/livedead/data2000.txt>

2000 data

With the kind acceptance of the DESY group we have extracted timing (and trigger) information for all 2000 data in Zeuthen bringing home only a limited amount of information (**EM**- and **TRIG**-cards).

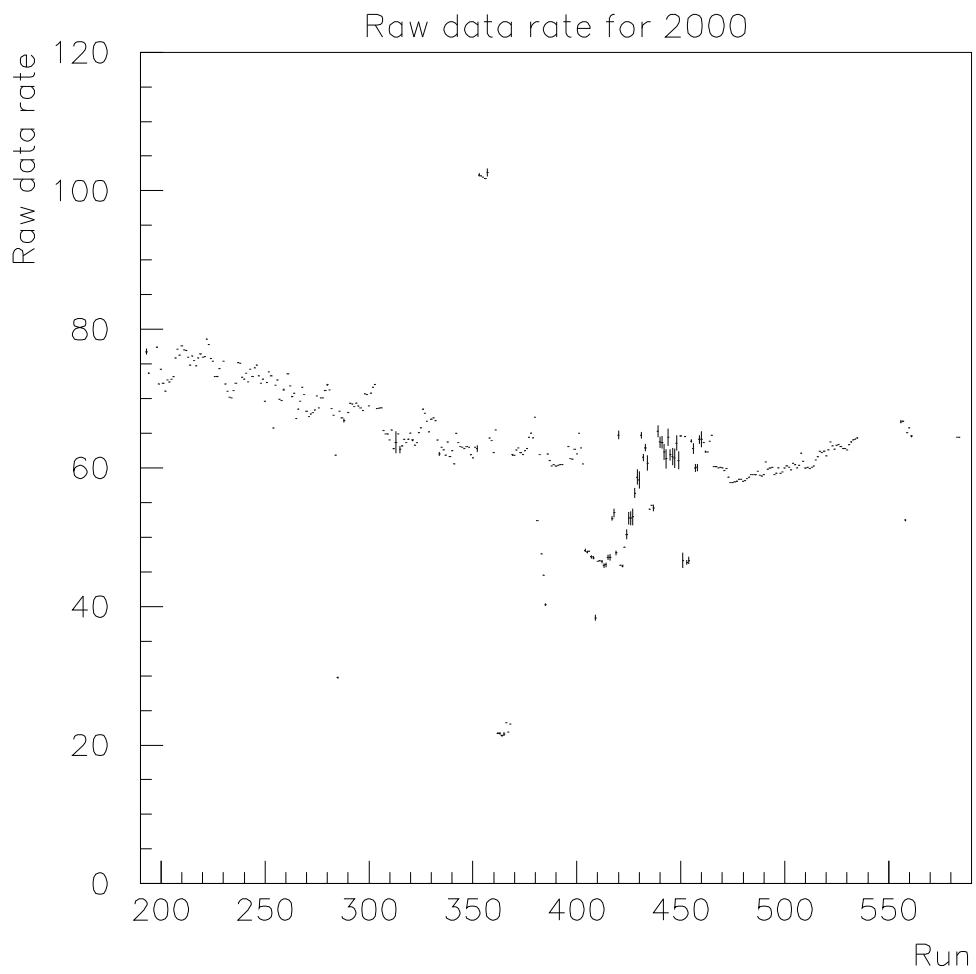
With this data-base we make statistics on live- and dead-times per file, per run etc. We could later investigate rates further looking at trigger information (not done yet).

Details are available at web-site

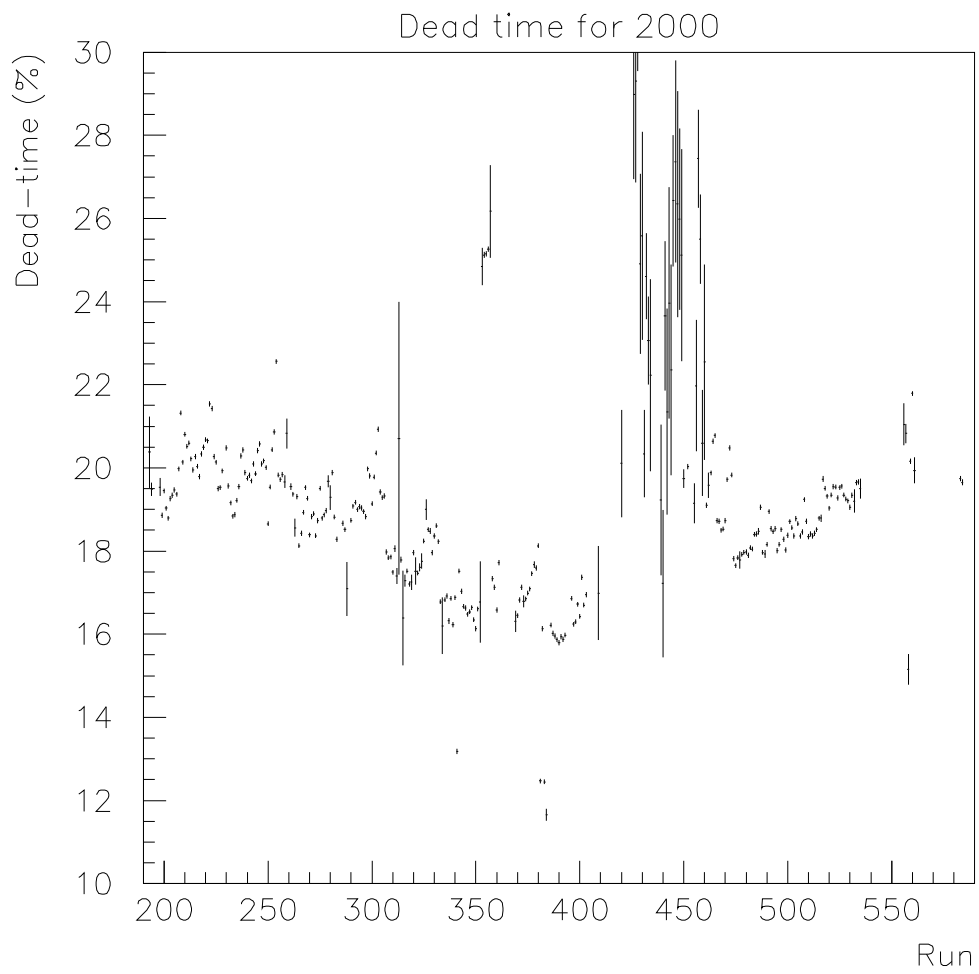
<http://www.physto.se/~walck/amanda/livedead/>

If useful for people making analysis may make data-base (or just a simple tex file) with the important quantities per file and run. Ideas welcome!

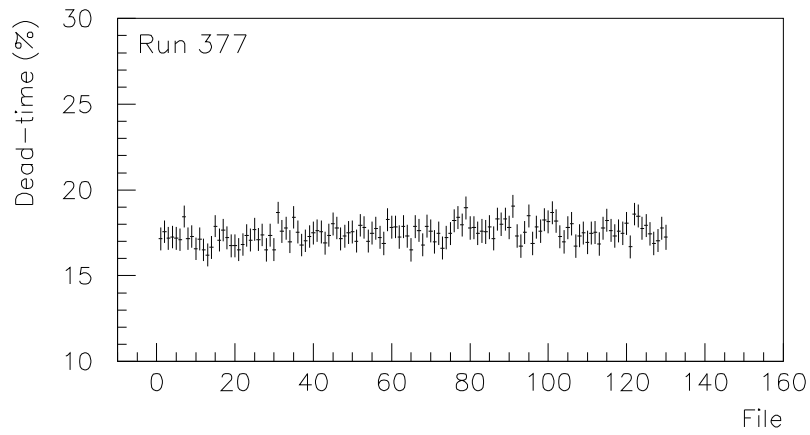
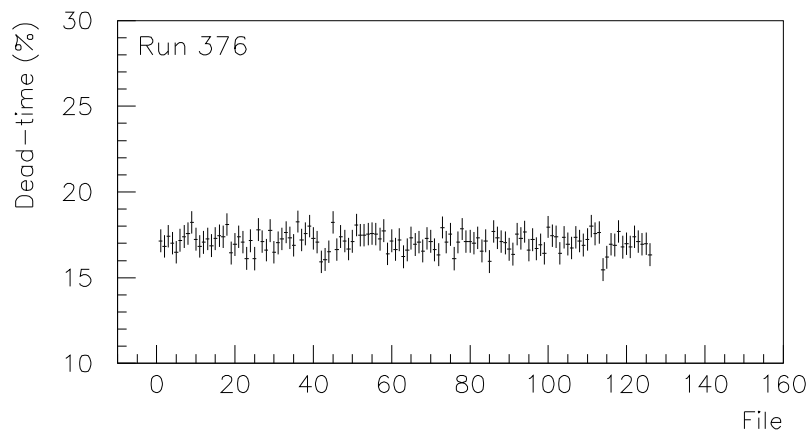
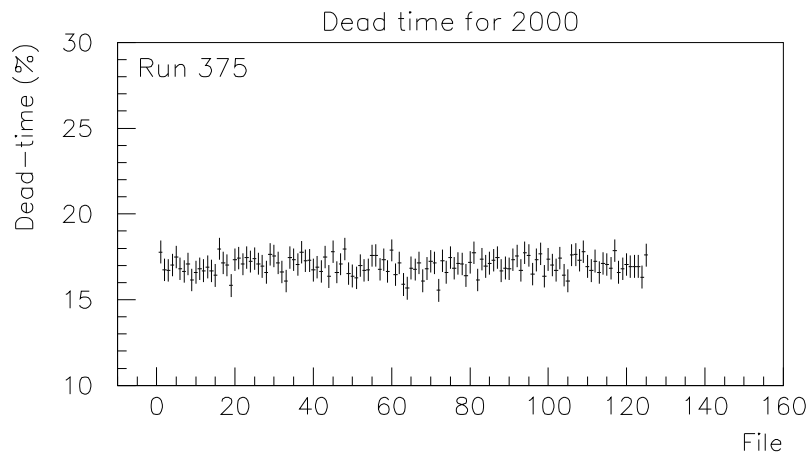
Rates for 2000 data



Dead-time for 2000 data



Good examples



GPS-problems in 2002 data

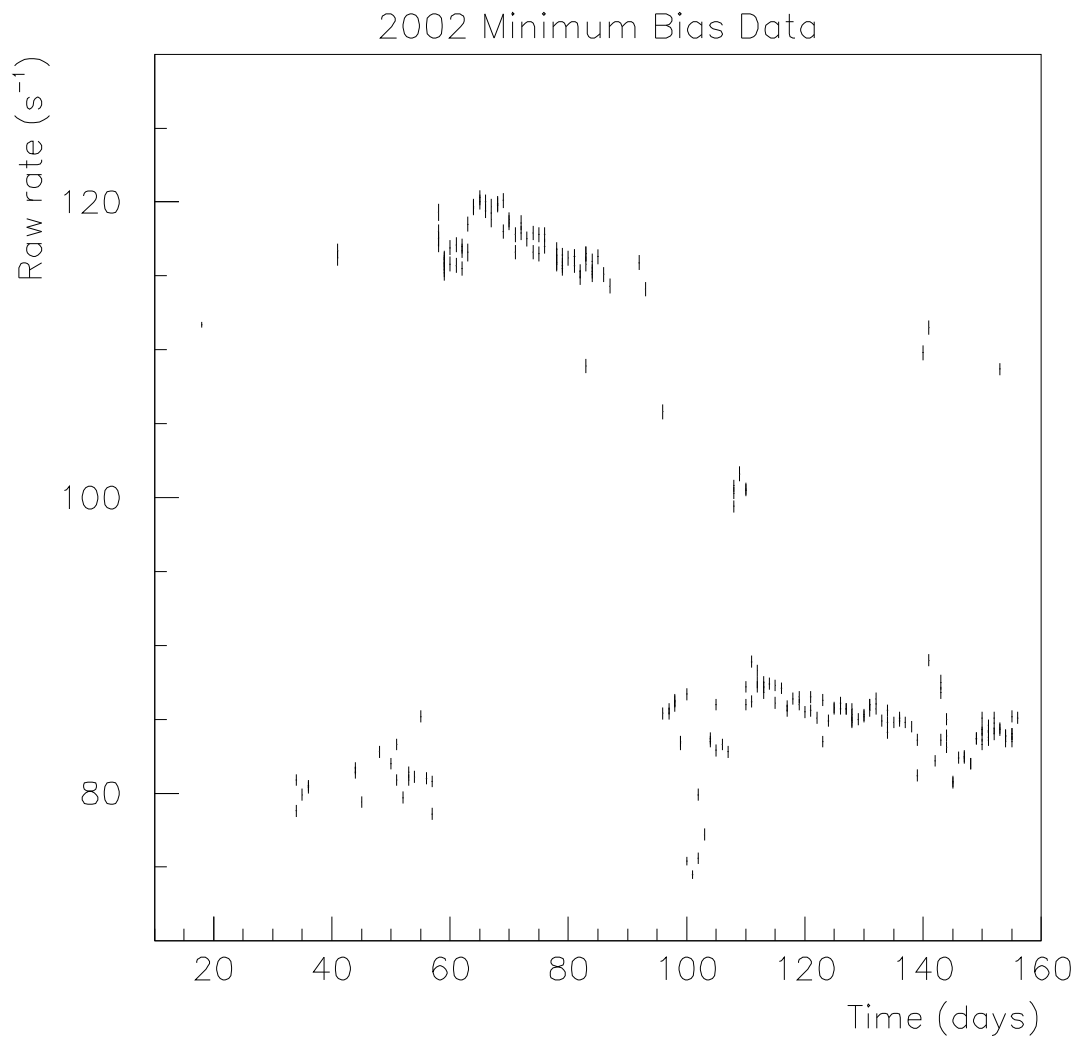
For selected files with minimum bias data from 2002 the only remaining problem seems to be with the first Δt in each run (file index 000) i.e. the time between event 0 and event 1.

Note: In investigations of 2000-data using reader options to reveal all GPS clocks this was seen in one of the alternative clocks.

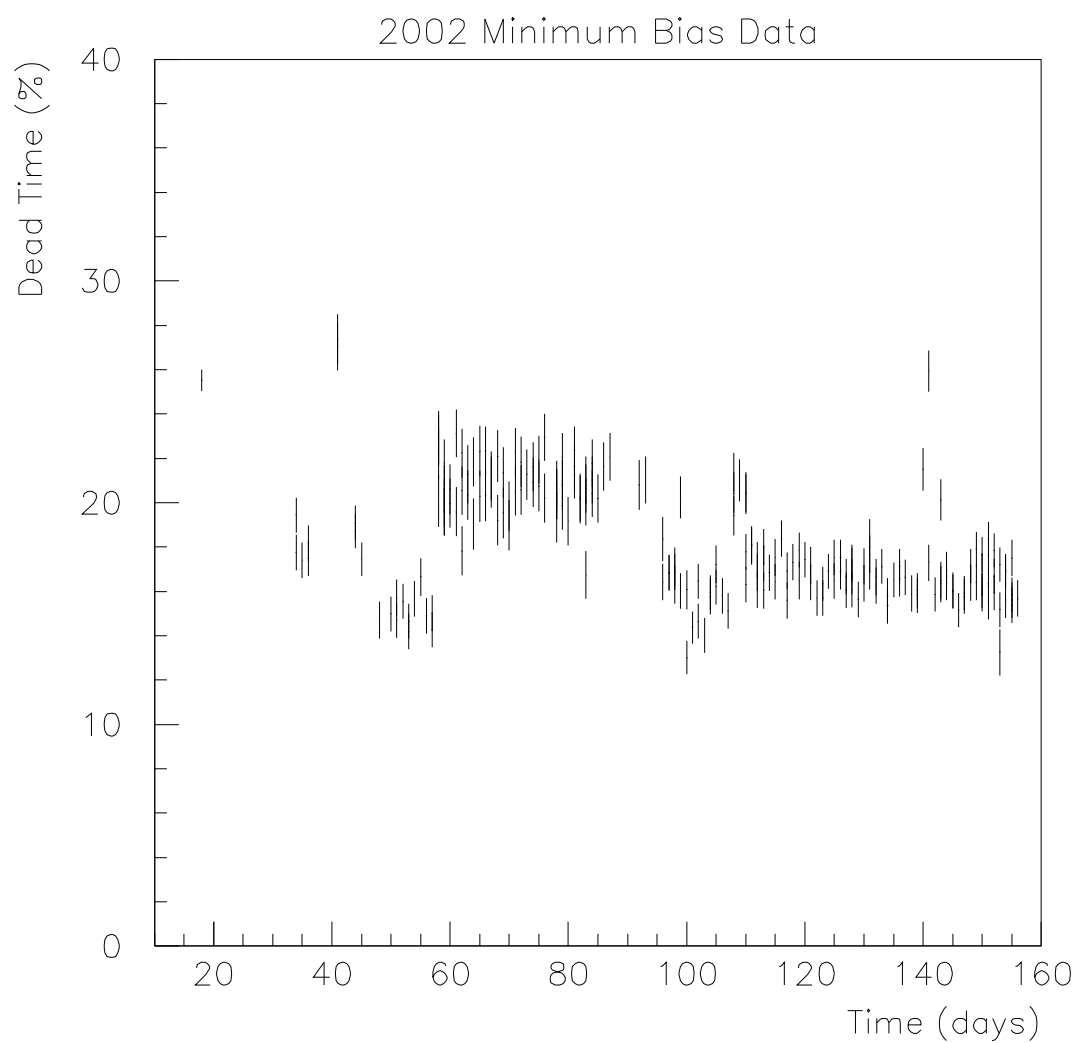
file	Δt_{01} (s)
ab_2002_019_4536_000.data.mu.min_bias.gz	0.017359
ab_2002_035_5303_000.data.mu.min_bias.gz	661.409523
ab_2002_035_5304_000.data.mu.min_bias.gz	77302.475867
ab_2002_036_5338_000.data.mu.min_bias.gz	289.222558
ab_2002_037_5353_000.data.mu.min_bias.gz	1104.675507
ab_2002_064_5561_000.data.mu.min_bias.gz	251.130683
ab_2002_084_5603_000.data.mu.min_bias.gz	530.804357
ab_2002_085_5604_000.data.mu.min_bias.gz	67.401810
ab_2002_152_5729_000.data.mu.min_bias.gz	14428.726054

2002 data

Minimum bias raw data files are put on server in Wisconsin. Bringing these home regularly and making data-base like was done for 2000 data. Raw rate is shown below



... and dead-time ...



Summary

- Dead- and Live-time studied for all years 1997–2000 except 2001.
- Especially 2000 where the full raw data sample has been processed.
- Besides for 1997 the situation is quite ideal besides some annoying GPS problems in 2000 and 2002.
- Could make “data-base” for common usage if regarded interesting.