can be absorbed into "ADC gains" $G_S = 1/75$ and $G_D = 1/600$. These ADCs divide 10 volts into 2^{15} channels.

To compare, we rewrite (2) in terms of a single floating point subtraction,

$$\begin{aligned}\varepsilon^{\text{float}}_{\text{arith}} =& \frac{1}{2}\frac{(N^{\uparrow}_A - N^{\uparrow}_B)(N^{\downarrow}_A + N^{\downarrow}_B) - (N^{\uparrow}_A + N^{\uparrow}_B)(N^{\downarrow}_A - N^{\downarrow}_B)}{(N^{\uparrow}_A + N^{\uparrow}_B)(N^{\downarrow}_A + N^{\downarrow}_B)} \\ =& \frac{N^{\uparrow}_A N^{\downarrow}_B - N^{\downarrow}_A N^{\uparrow}_B}{(N^{\uparrow}_A + N^{\uparrow}_B)(N^{\downarrow}_A + N^{\downarrow}_B)} \equiv \texttt{NNNN}^{\text{float}}/N^{\uparrow}N^{\downarrow}. \end{aligned} \tag{5}$$

Using a similar algebra, the numerator can be written as

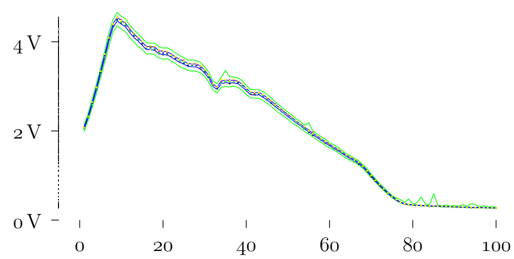
$$\begin{aligned} &\texttt{NNNN}^{\text{int}} \equiv N^{\uparrow}_A N^{\downarrow}_B - N^{\downarrow}_A N^{\uparrow}_B = \\ &= G_S G_D \left(S^{\downarrow}(D^{\uparrow}_A - D^{\uparrow}_B) - S^{\uparrow}(D^{\downarrow}_A - D^{\downarrow}_B)\right) + G_D^2 \left(D^{\uparrow}_A D^{\downarrow}_B - D^{\downarrow}_A D^{\uparrow}_B\right) &(6) \\ &\equiv G_D^2 \left[\frac{G_S}{G_D}(\texttt{S}^{\downarrow}\texttt{D}^{\uparrow} - \texttt{S}^{\uparrow}\texttt{D}^{\downarrow}) + \texttt{DDDD}\right] &(7)\end{aligned}$$

Note that detectors A and B have the same sum signal, $S^{\uparrow}_A = S^{\uparrow}_B$, but the sum signals for the $\uparrow$ and $\downarrow$ pulses may differ.

Let's look in run 52 900, which had 1247 valid spin sequences of polarized neutrons on liquid hydrogen, taken 2006-12-08 near midnight. We will examine the collections $\texttt{S}^{\downarrow}\texttt{D}^{\uparrow}$, $\texttt{S}^{\uparrow}\texttt{D}^{\downarrow}$, DDDD, NNNN for the first pair in the second ring; that is, detectors 13 and 19.

First, read in the sum and difference signals and sanity-check. As a function of time of flight, the sum signal from the second ring is

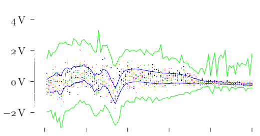
$S_2 =$



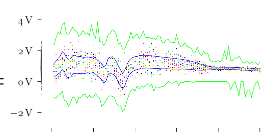
(8)

At each of the 100 time bins, the green curves show the maximum and minimum signals acquired during the run; the blue curves lie 1σ above and below the mean for the time bin over the run; a few individual waveforms are plotted as points, both against time of flight and compressed onto the vertical axis. These ADC signals have been multiplied by $10\,\text{V}/2^{15}\,\text{channels} \cdot 25\,\text{samples} = 1/81920$ to make the unit meaningful. This signal looks well-behaved, as do the difference data,

$D_A =$



, $D_B =$



. (9)