wavedeform

WaveDeform is a linear algebra-based algorithm for deconvolving the DOM response to photons. Using a non-negative linear least squares algorithm (Lawson and Hanson, 1973), it deterministically deconvolves the SPE response function from the waveforms recorded by the DOM's FADC and ATWD digitizers. Unlike other algorithms, it deconvolves the response from both digitizers simultaneously, improving the accuracy of the fit and preventing edge effects at the boundary of the ATWD.

- Release Notes

Arguments

1. Waveforms (default: CalibratedWaveforms)

   Name of the input waveform series map, containing waveforms from all digitizer channels (including SLC hits).

2. Output (default: WavedeformPulses)

   Name of output pulse series map.

3. SPEsPerBin (default: 4)

   This controls the number of basis functions to place in the range of each waveform. For example, if SPEsPerBin is set to 3, the ATWD will be unfolded with pulses spaced 1.1 ns apart, comparable to the PMT transit-time spread. The greater the number of SPEs per bin, the greater the time resolution, until the fundamental limit is reached around SPEsPerBin of 5.

   The time required by the NNLS algorithm is (very roughly) proportional to SPEs^3. Thus, the speed of the algorithm can be increased substantially at the price of accuracy by reducing the number of unfolded SPEs, and vice versa.

4. Tolerance (default: 9)

   This controls the stopping tolerance of the algorithm, in the amplitude of the gradient of the least-squares residual. When the improvement per PE of allowing one more non-zero pulse drops below this number, the algorithm will terminate. Larger numbers will produce a faster, coarser fit using fewer pulses, and smaller numbers will provide a slower, better fit with more.

6. NoiseThreshold (default: 2)

   Consider waveform bins that are fewer than this many ADC counts from baseline as noise. Set the bin values to 0 and reduce their weight by a factor of 4.

7. BasisThreshold (default: 3)

   When building the array of basis functions, require a waveform bin with amplitude at least this number of ADC counts above the baseline within the full-width-half-maximum

of the basis function in order to include in in the unfolding matrix.

8. WaveformTimeRange (default: “CalibratedWaveformRange”)

   Name of maximum time range of calibrated waveforms for this event

9. DeweightFADC (default: true)

   Reduce the weight of FADC data during the initial ATWD window if we have ATWD data.

10. ApplySPECorrections (default: false)

    Scale the unfolded charges using fits to the SPE charge spectrum provided by I3DOMCalibration

Code Review

- Reviewed by A.Olivas 4/7/15
- Documentation
- Code