

APPLICATION Note # 2

DANTE: Easy set-up guide to read your radiation detector



Abstract

The DANTE Digital Pulse Processor (DPP) can be coupled with a large variety of X and Gamma rays detectors, such as SDD, HpGe, CdTe, CZT, etc. Depending on the output voltage characteristics of these detectors, the parameters of DANTE can be adjusted to optimize spectra acquisitions. In this document, we present a step-by-step guide on how to setup these parameters.

Perform a Spectrum Acquisition

By launching the DANTE software, the user gets access to a GUI constituted by five different windows selectable by the corresponding five tabs on the left: “Settings”, “Configuration”, “Acquisition”, “ROIs” and “Calibration” [Figure 1].

After selecting the Configuration tab, connect DANTE via USB and wait until all boards are displayed at the bottom of the Configuration window. From this window, the user can finely tune the DPP to optimize the acquisition by changing the “Input”, the “Fast Filter” and the “Energy Filter” parameters.

Default parameters can be used for a first measurement. To start an acquisition, click “Configure” and wait until all the enabled channels are ready.

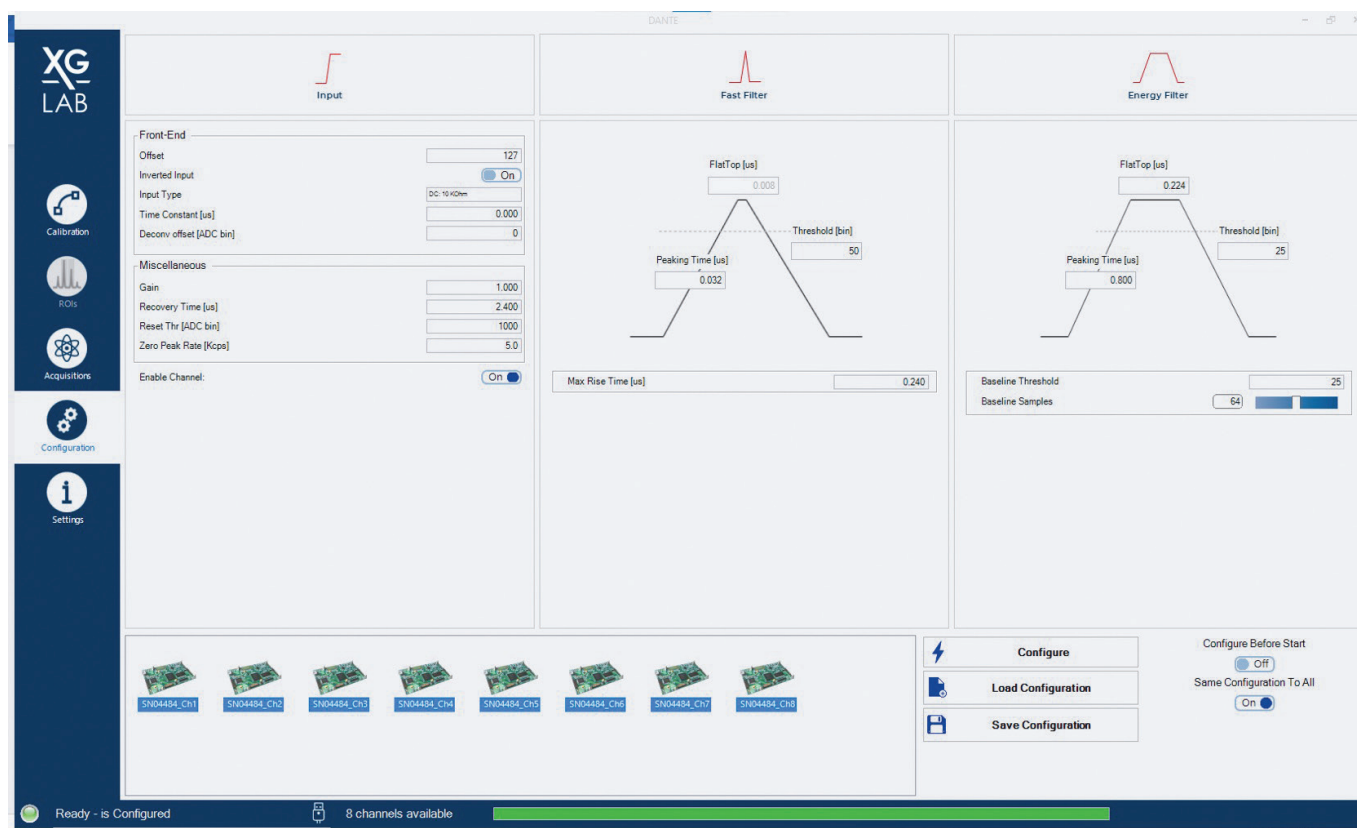


Figure 1. Configuration Window in the DANTE acquisition software.

Then select the Acquisition window from the corresponding tab on the left, press “Start” and a 10-seconds spectrum is acquired [Figure 2]. The time of acquisition can be changed as needed.

In the next sections, a fast procedure to tune the “Input” parameters and start performing acquisitions with DANTE in a fast and easy way is provided. “Fast filter” and “Energy filter” are part of advanced settings and we invite the user to carefully read the dedicated sections on the DANTE User Manual.

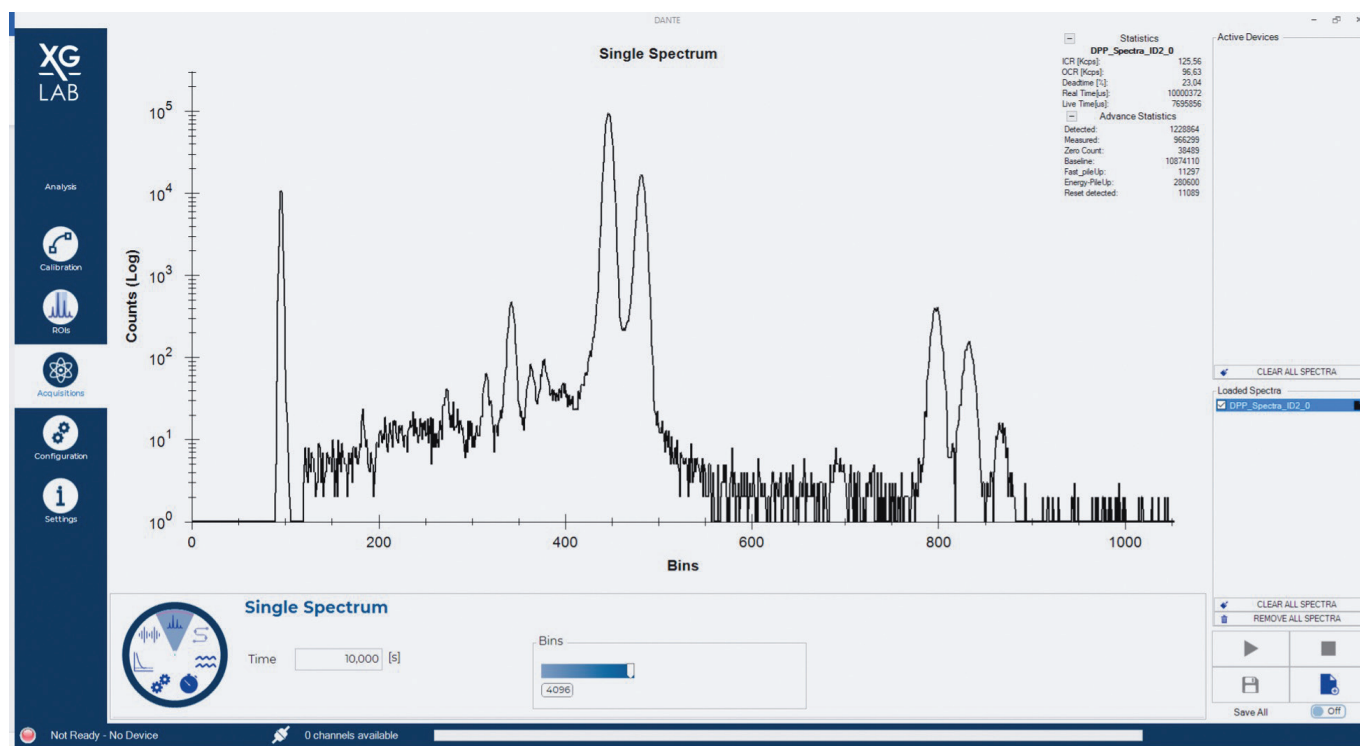


Figure 2. Acquired 10-second spectrum obtained with DANTE ICH coupled with an SDD detector and an Iron-55 source.

Configuration: Input Parameters

By selecting the “Waveform” mode in the Acquisition window it is possible to inspect the output of the detector connected to DANTE.

For a correct spectrum evaluation, the waveform should be a positive ramp or sawtooth signal [Figure 3], where the positive steps on the ramp correspond to collected photons [Figure 4].

The “Input Type” of DANTE can be set to DC coupling if the detector output is a pulsed-reset type and its dynamic falls within $3V_{\text{peak-to-peak}}$ or to AC coupling if the detector output is a continuous reset type or if it has a larger dynamic. Let us review the two cases.



Figure 3. Positive ramp or sawtooth waveform. The correct DC coupled waveform.

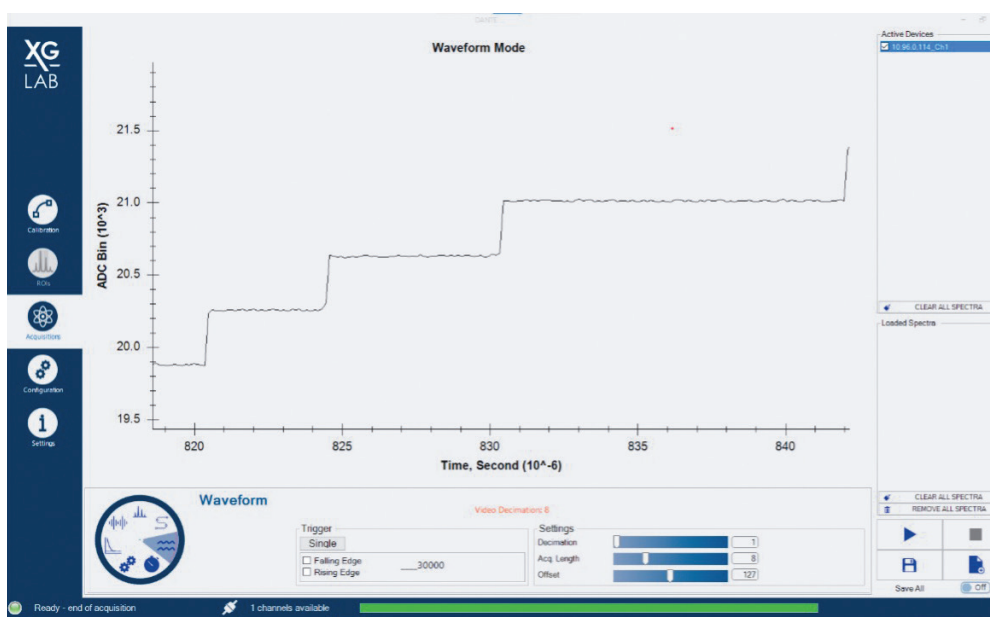


Figure 4. Steps forming the positive ramp. Each step corresponds to a collected photon.

DC Coupling

1. In the Configuration window select DC 10kOhm as Input Type, move to the Acquisition window, select Waveform mode and press start.
2. If the waveform is reversed (negative ramp), go back to Configuration and select **"Inverted input"**.
3. If the waveform saturates in the upper or lower part [Figure 5], modify the **"Offset [ADC bin]"** to adjust the level within the dynamic range of DANTE.
4. Move to "Spectrum" mode in the Acquisition Window and perform a spectrum acquisition.



Figure 5. DC coupled saturated waveform detail.

AC Coupling

1. In the Configuration window select AC 22us as Input Type, set the “**Time constant [us]**” equal to 0, move to the Acquisition window and press start. A Waveform like **Figure 6** should be obtained. Exponential signals corresponding to collected photons on a baseline.
2. Go back to the configuration window, set the time constant to 22us and adjust the **deconvolution offset** so that its value is slightly lower than the baseline.
3. Go back to the acquisition window and verify if the waveform matches a positive ramp with steps. If the deconvolution offset value is too high or too low, the waveform slope will be affected [Equation 1].

$$\begin{cases} \text{negative slope} \longrightarrow dec_{off} > dec_{opt} \\ \text{positive slope} \longrightarrow dec_{off} < dec_{opt} \end{cases}$$

Equation 1: deconvolution offset super and suboptimal leads to incorrect slopes.

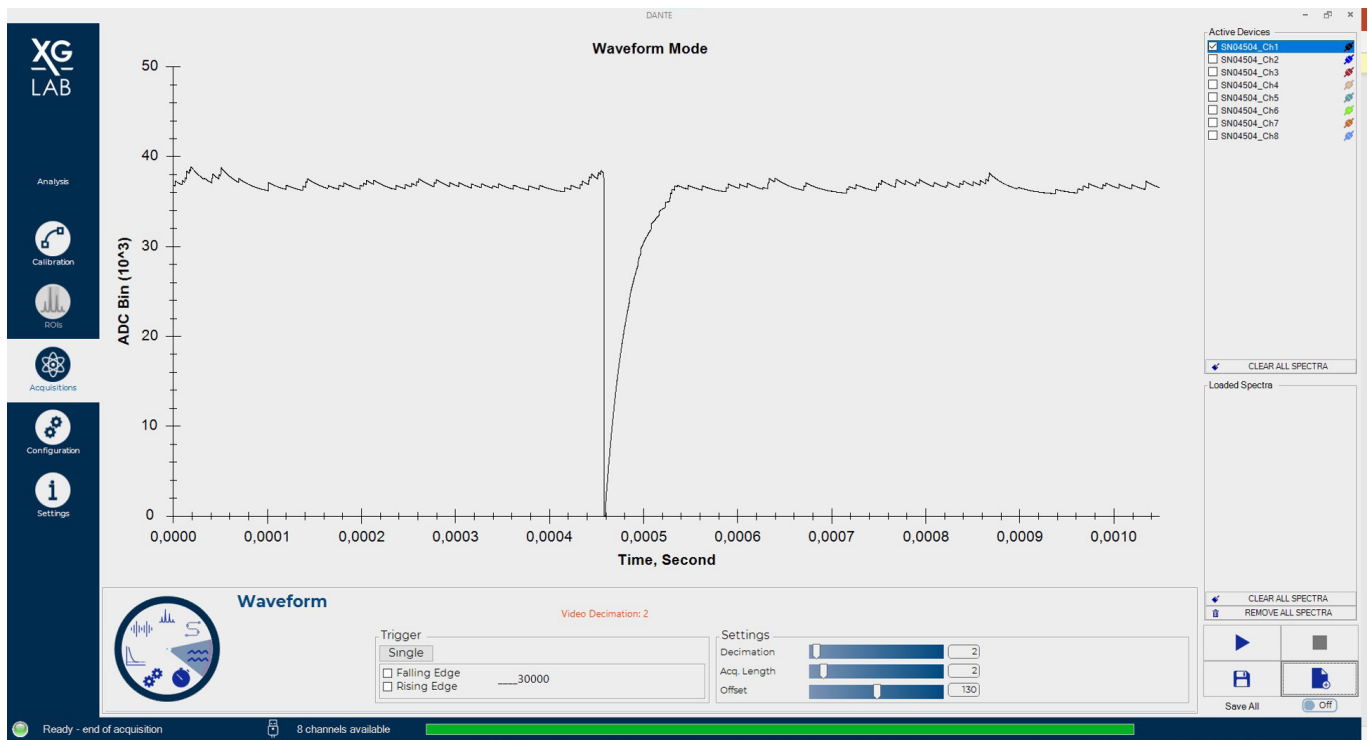


Figure 6. Example of pulsed-reset type detector coupled in AC with DANTE. Small exponential pulses correspond to photons and the big negative exponential pulse corresponds to a reset event.

- Once the waveform resembles the one reported in **Figure 7**, the system is ready to perform a spectrum acquisition.



Figure 7. Deconvolved Waveform in AC. The exponential pulses are converted back to steps and a positive ramp is over posed because of the deconvolution offset value. The big exponential pulse between 0.4ms and 0.5ms (see Figure 6) is deconvolved in a steep reset. The second reset event around 0.6ms is caused by mathematical overflow.

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