VATAGP3_1 tests

This is a report of the first measurements than Vera and myself made on the VATAGP3_chip. The frontend settings were the default as specified int he chip “manual”. That is: mbias=1000mV, vfp=-600mV, vfss=+300mV, vfsg=-400mV

First we try to determine the optimum hold delay by measuring the amplitude of a calibration pulse at different values of the delay. The result is shown in Figure 1. The peaking time of the slow shaper is, according to that, ~1.25 µs.

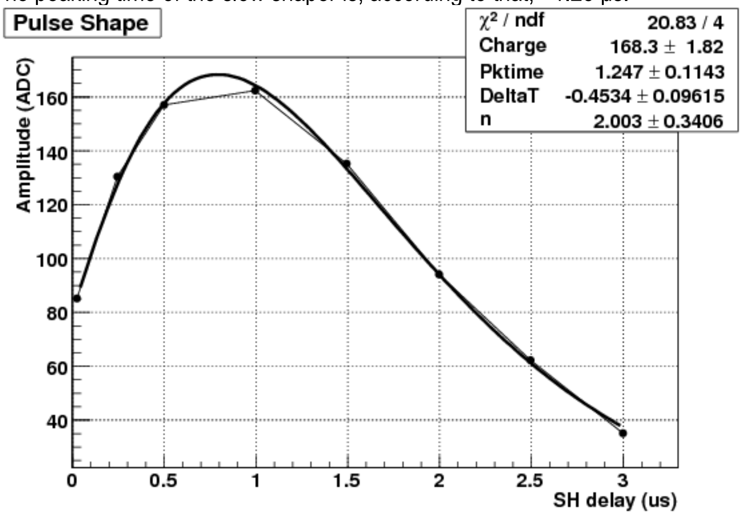

Figure 1: . Pulse shape

This is the first surprise, since the manual says it should be 4 µs.

Next we try to calibrate both the slow and the fast shapers with an external pulse. Figure 2 Shows the result of the threshold and pulse amplitude scans on a given channel: The linearity is pretty good for both shapers, but for small amplitude values the s-curves are not very clean and, therefore, spoil the linearity due to problems making the s-curve fit.

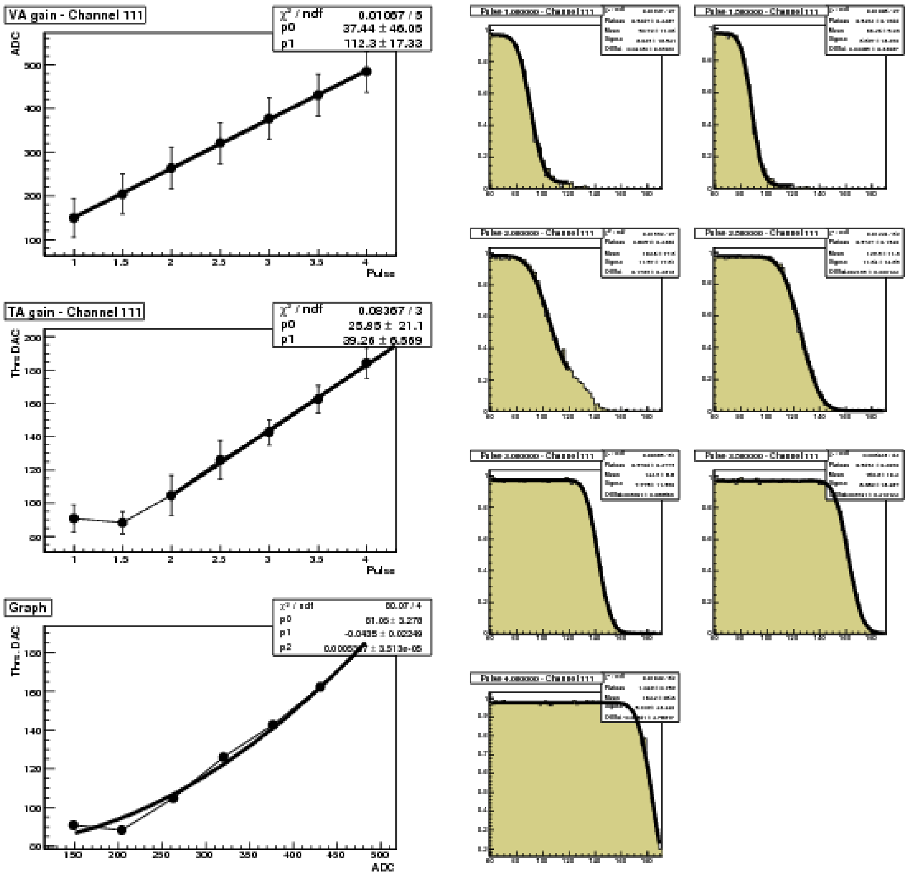

Figure 2: Results of calibration from one channel

The pulse amplitude is measured in V, but it went through and attenuator and afterwards through the voltage divider on the PCB, so we will have to find the correspondence with keV using a source.

The problem for small amplitudes is more evident in some other channels, like the one shown in Figure 3.

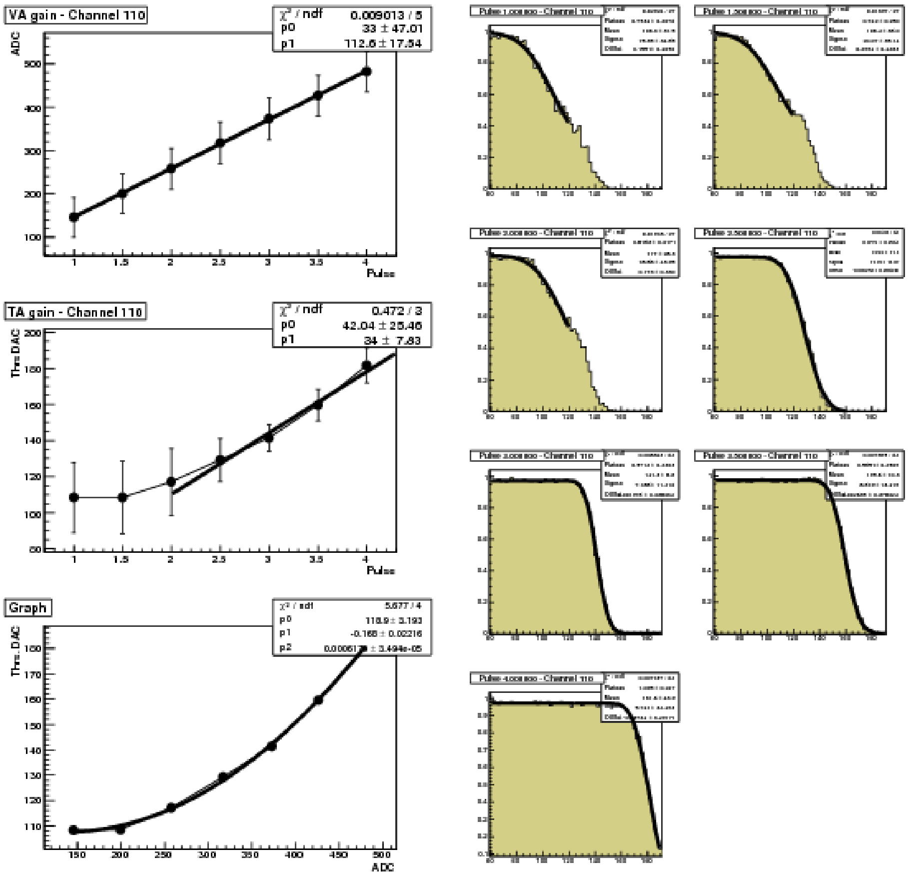

Figure 3: Results from the calibration for a pulse with problems at low amplitude pulses.

The gain of both shapers for the channels that we measured is shown inFigure 4.

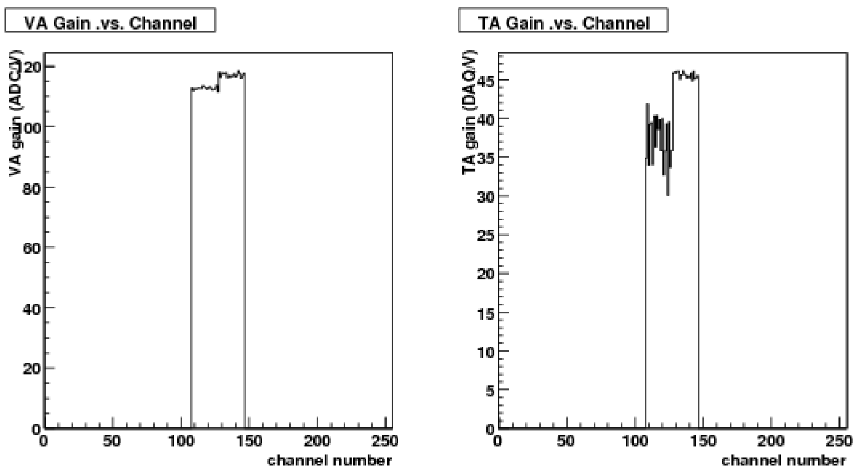

Figure 4: Gain of the VA and TA across the channels that we measured.

The average response curve of the channels on chip 0, which is where the sensor is connected are shown in Figure 5:

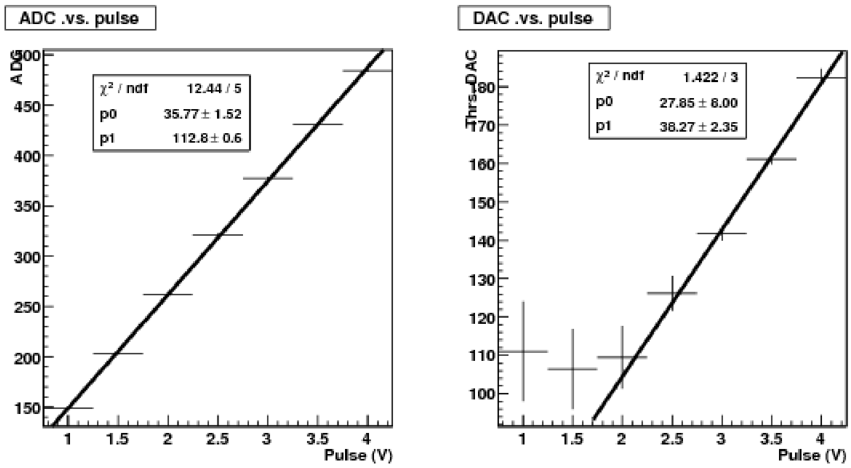

Figure 5: Average response curves of both shapers.

Next we took a ^{133}Ba source and made a threshold scan, staying always the same amount of time for each threshold value. The spectrum for all the channels is shown in Figure 6.

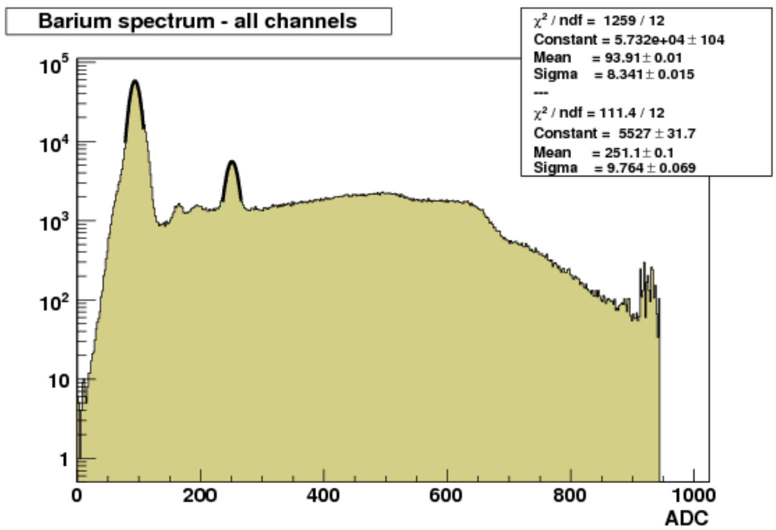

Figure 6: Ba spectrum

The two peaks correspond to the 30 keV X-ray line and the 80 keV gamma line.

Figure 7Shows the gain spread on the channels connected to the detector. The average value is 3.15 ADC/keV, with a spread which is well below the 1% level.

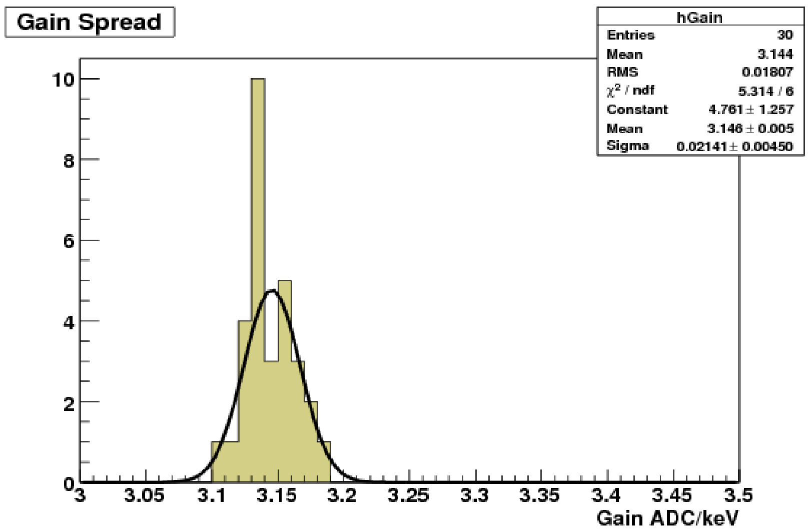

Figure 7:

With a gain of 3.15 ADC/keV, the noise measured on the peaks in Figure 6 turns out to be ~2.5-3keV.

The threshold scan is shown in Figure 8. The scurve of the 30 keV X-ray line is clearly visible, but the one of the 80 keV peak requires a bit more or "imagination".

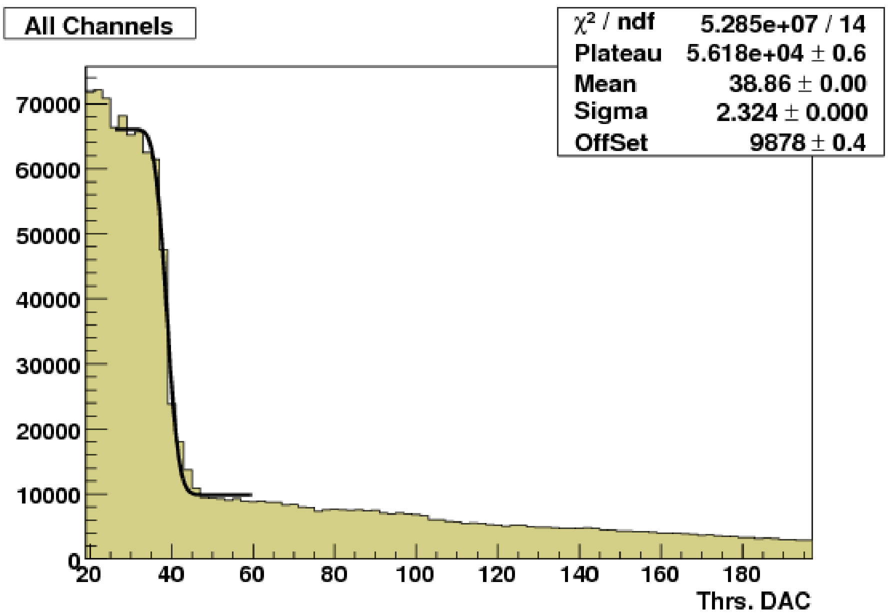

Figure 8:

We can however look at the spectrum measured at different thresholds, as show in Figure 9, to figure out an approximate position for that peak in the scurve.

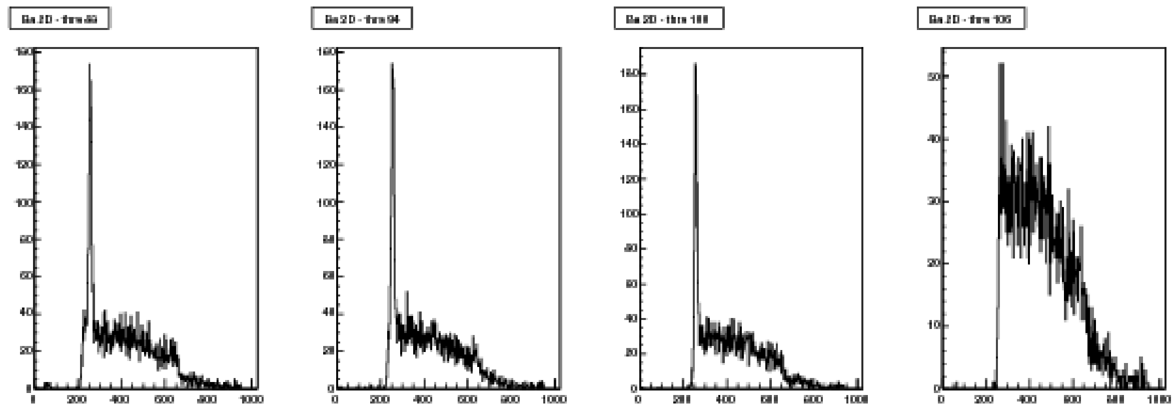

Figure 9: Spectrum at different thresholds: DAC=88,94,100,106.

The peak is cut in 2 equal halves at a threshold slightly higher than 100. With that we can estimate the gain of the fast shaper to be about 1.2 DAC/keV. From the fit at the 30 keV s-curve the noise in the fast shaper is about ~2 keV.

The 2 gains measured together with the response curves at Figure 5 allow to move from any unit to keV.

With that, we tried to set the threshold with the smallest stable value with a calibration pulse, scan the pulse amplitude and measure the delay between the FOR and the trigger of the pulse generator. That should give a good estimate of the time walk. The smallest threshold we could set was DAC=30, which corresponds to about 24 keV.

The result is shown in Figure 10. As one can see, the delay vanishes only for signals above 4V, which corresponds to 150 keV. For a 1V (~50 keV) the delay is 105 ns with respect to the fastest signals. As shown in the plot, this Timewalk is compatible with a CR-RC having a peaking time of ~200 ns.

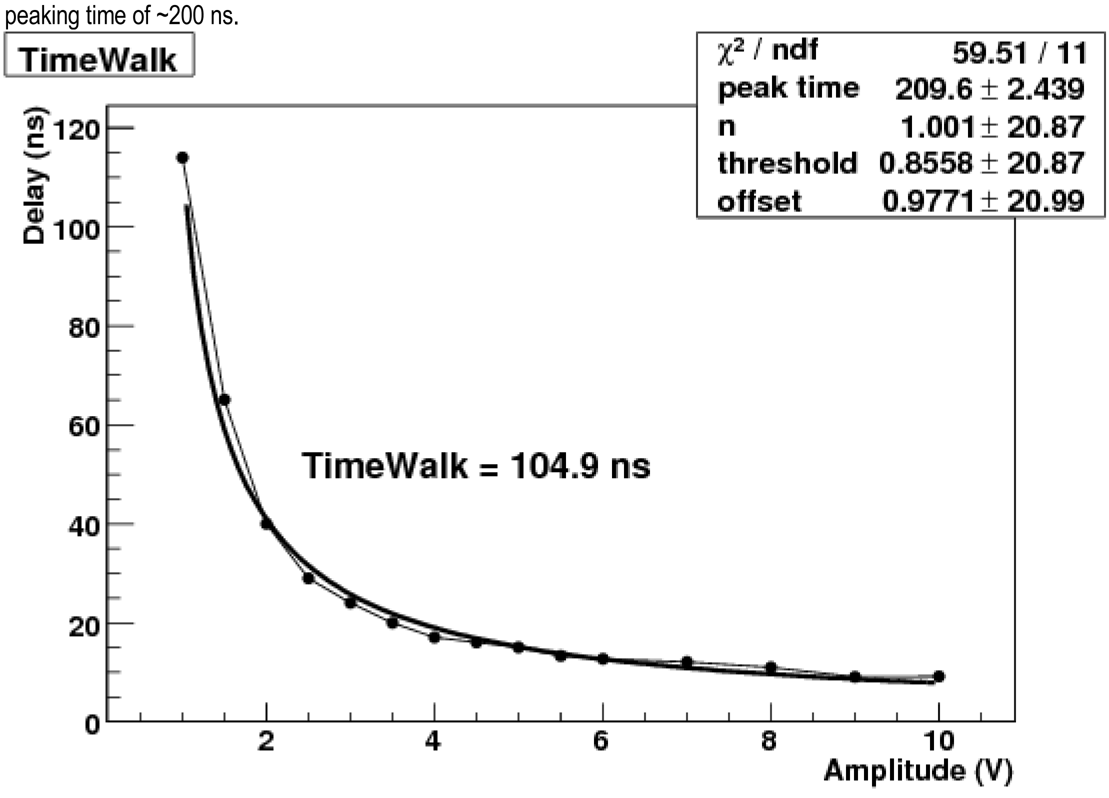

Figure 10: Time walk