ALiBaVa

A brief overlook of Liverpool software changes, common issues and questions.

A. Affolder, A. Greenall, I. Tsurin, G. Casse, V. Chmill, M. Wormald, *H. Brown*

Overview of the Talk

- This talk will cover some of the issues we've seen in Liverpool with the Alibava system, and how we solved them

- Also covers commonly encountered issues

- Brief introduction to the analysis

- Discussion on calibrating the system

- A look at some of the important additions in the Liverpool macro and their applications (specifically with debugging the system)

Introduction to the Analysis

- More detail available at http://tinyurl.com/alibava or twiki

- Most important canvas is the one on the right, which is generic to all Alibava macros

- Please note that x-axis on the Landau is actually ADCs not electrons! We have manually coded out the gain so we measure a result in ADCs and convert by hand to electrons.
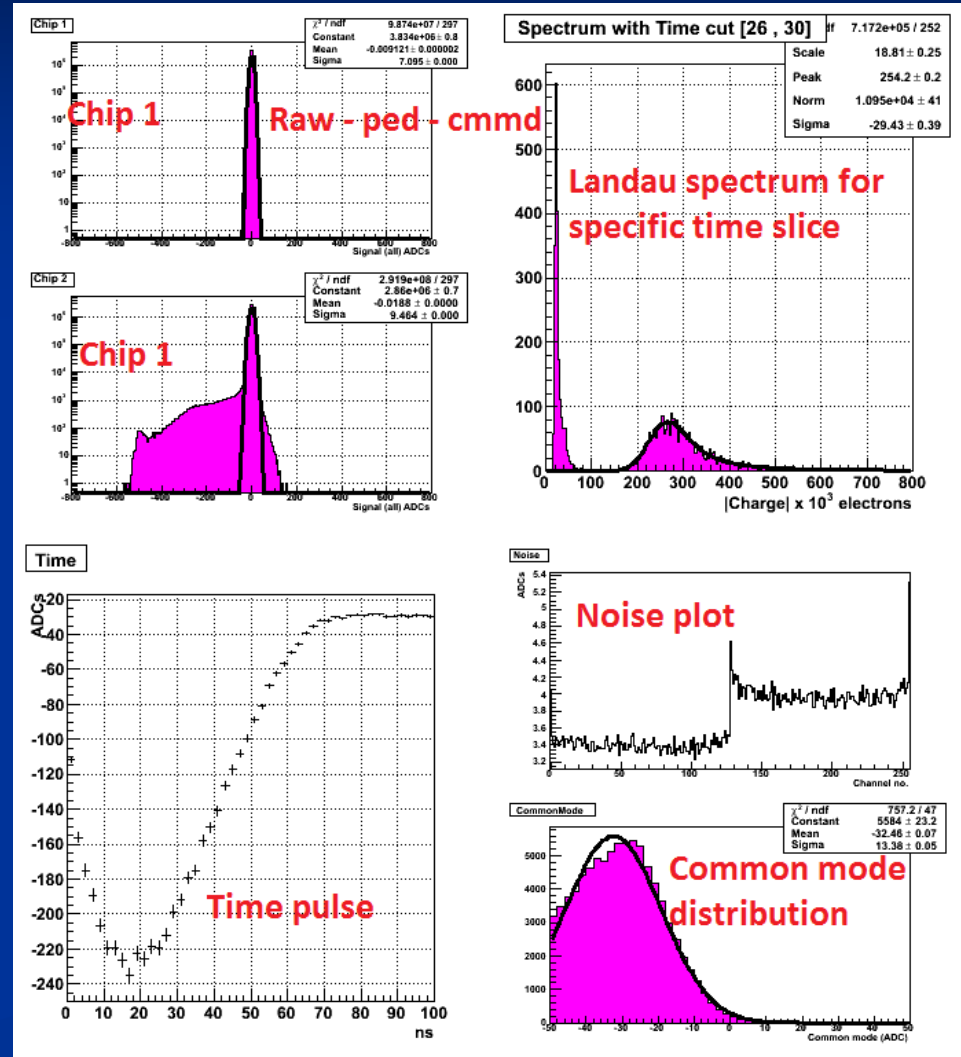
Known Issues

- Only a small number of known issues with the Alibava system:
    - 1) Running the Beetle chip on non-default settings
    - 2) Calibration (using the internal calibration pulse) on non-default settings

Some brief definitions

- Gain – Number of electrons we obtain per ADC. Very dependent (~50%) on the initialization settings used

- Peak of the pulse shape – a ten nanosecond window (peak +/- 5 nanoseconds) around the highest value of the pulse with respect to time. This cut is used for the Landau spectrum on the analysis canvas.

5

Initialization Settings - Characterization

- Different settings correspond mainly to front shaper voltage; Default – 0V, 'Kazu' (LHCb VELO testbeam settings) - 1V.
- Dramatic signal to noise effect; 45 on default, 75 on Kazu.
- We decrease noise from 700 electrons to 300 electrons.
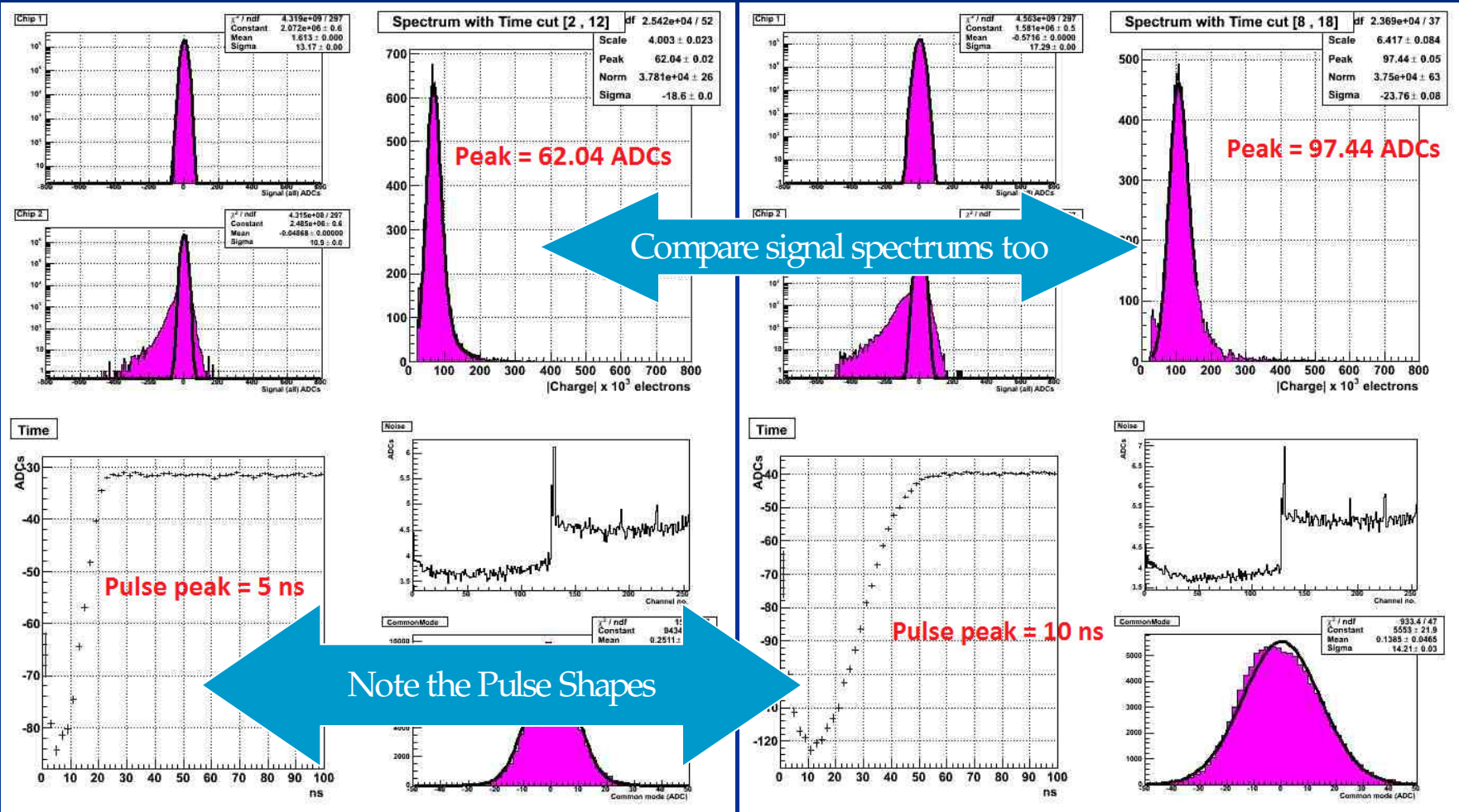- Dramatic change in signal to noise ratio means we can see signal at lower voltages

Loading Initialization Settings

- There is an interactive settings tab in the GUI for the Beetle chip where you pass the values you want
- However, this does not load the settings onto the chip! It generates a last.ini in the /bin folder for you to load on next time.
- Load settings by ./alibava-gui settings.ini
- Pre-made settings files and pulse graph samples available on website/Twiki.

Difference Between Settings

Default Settings

Kazu Settings

Peak = 62.04 ADCs

Peak = 97.44 ADCs

Compare signal spectrums too

Pulse peak = 5 ns

Pulse peak = 10 ns
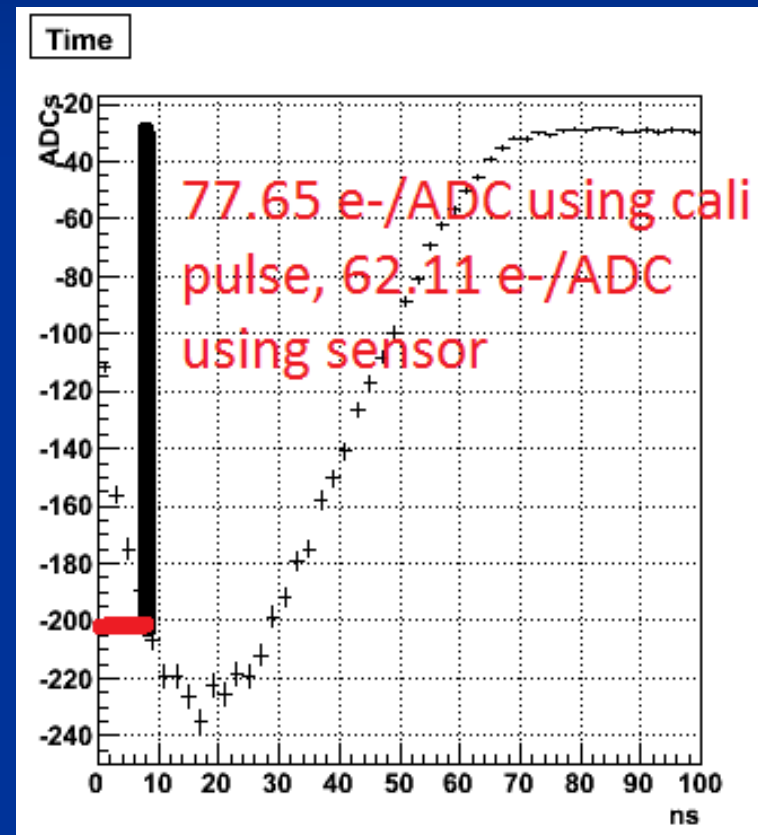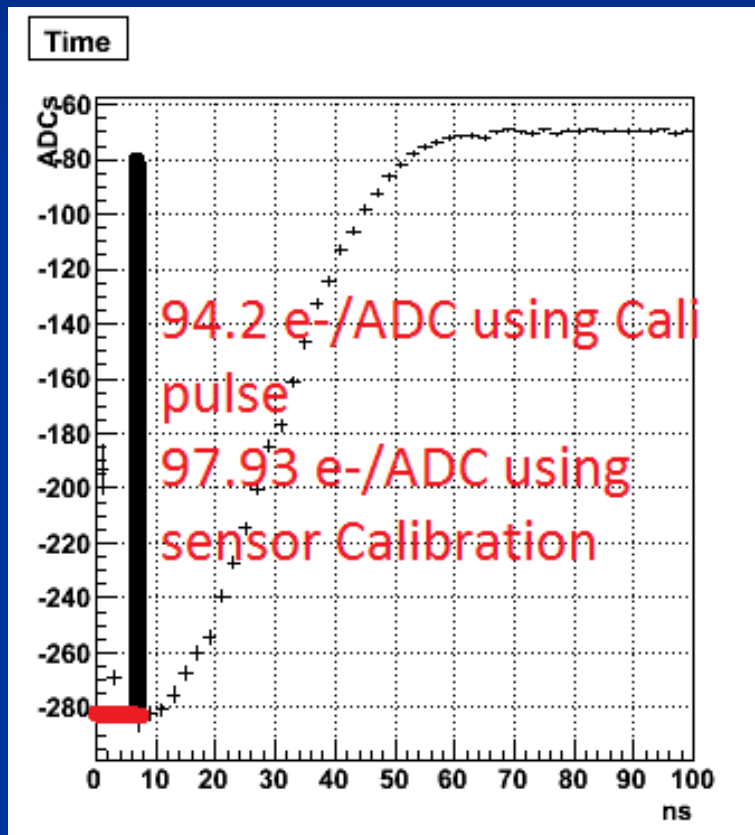
Note the Pulse Shapes

Calibration Issues

- The internal calibration pulses are timed in well for default settings (see prior time spectra). This gives us 24,000 e- from 300 microns of silicon (as expected) at both warm and cold temperatures.

- When we move the time peak, we sample too early in the peak which artificially inflates our gain (same number of electrons for significantly lower ADC values). See next slide

Calibration Timing Issue

Timing of the calibration pulse is a big issue. We assume full charge collection but measure these off peak (less ADCs) which cause us to get more e-/ADC than expected.

94.2 e-/ADC using Cali pulse
97.93 e-/ADC using sensor Calibration

77.65 e-/ADC using cali pulse, 62.11 e-/ADC using sensor

Calibration Solution

- To get around this problem we calibrate using unirradiated sensors of known thicknesses, and a Sr-90 source to work out the gain at given temperatures and Beetle initialization settings.
- Across several daughterboards the gain is consistent to + /- 2%. [62.11, 61.14, 63.61 e-/ADC]

Liverpool Macros Available on my website

- Additional functionality provided mainly in the form of:
    - A) Variable bin range fitting for the Landau spectrum
    - B) Distribution of hit location (channel number) versus frequency – helpful debugging tool
    - C) Variable time slice analysis on Landau (important for different initialization settings)
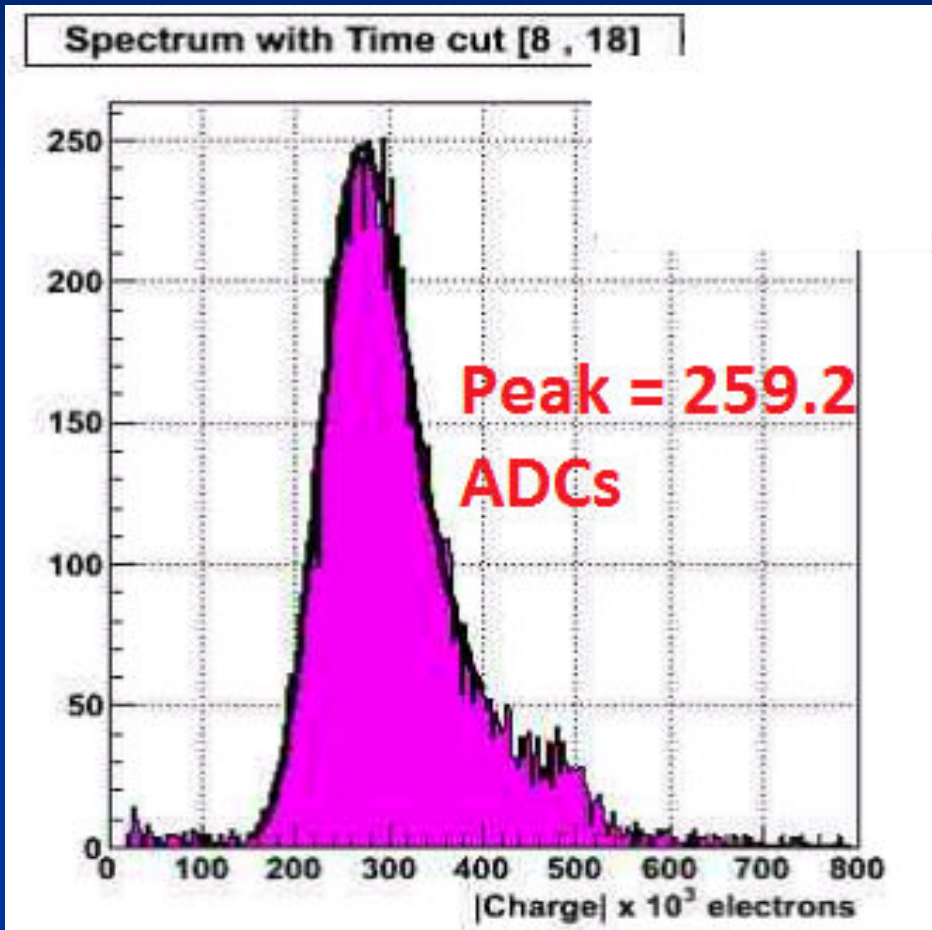   - D) Masking

Unmasked hit locations

Masked hit locations

13

Variable Bin Range Fitting

Spectrum with Time cut [8 , 18]

Peak = 259.2 ADCs
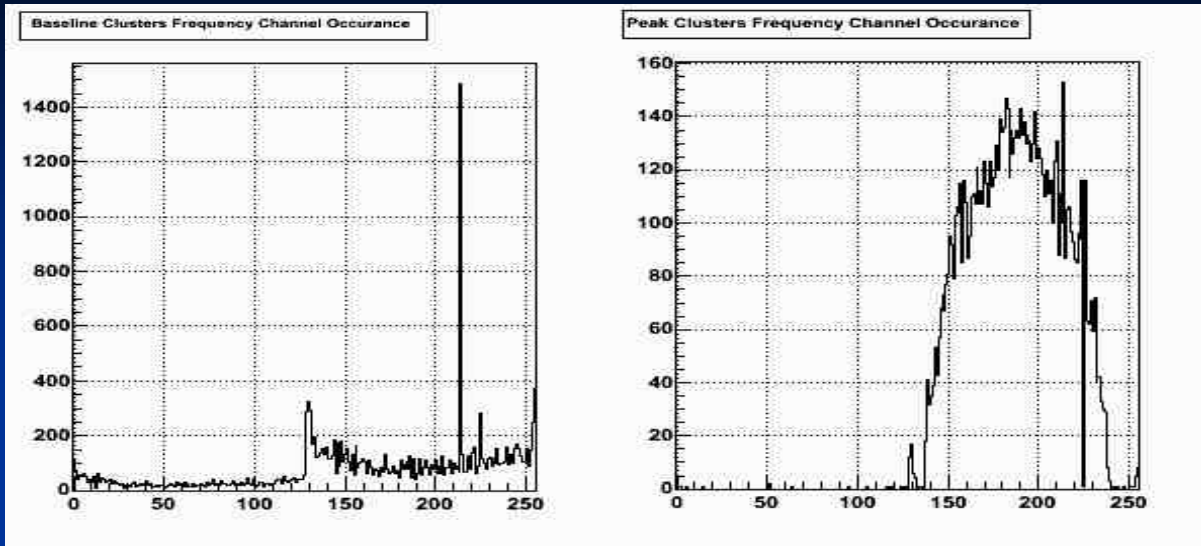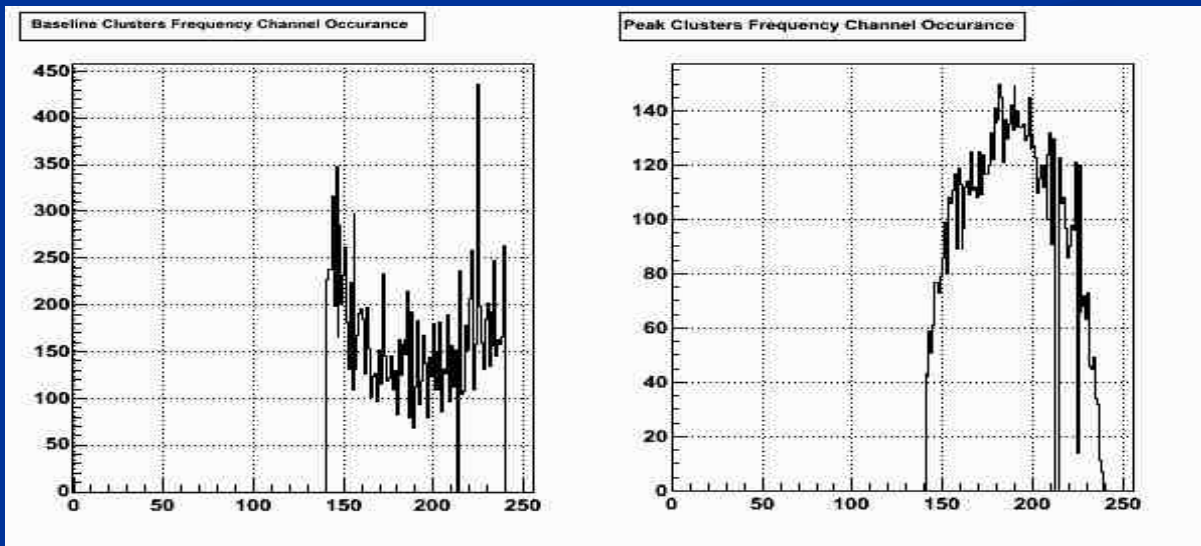
- Allows us to not fit over the noise region, and to stop the fit before it gets too far into the tail, where few events can distort our fits.

- Results taken using the statistics box (provided the gain was calculated via the statistics box) is consistent with data taken from the peaks. As long as the method used is consistent then the values are 100% consistent

Summary and Future

- The Alibava system is a fully functioning readout system with associated offline and online analysis already
- Only two known issues
- Easily adaptable depending on institute requirements as well!
- Less electronics required as compared to SCT-128

- Within our experiences at Liverpool we have confidence in the results produced by the macro suite provided
- Signals correspond to previously measured sensors using SCT-128A.
- Pulse shapes agree with independent measurements, etc
- Would be beneficial if more people signed up to Alibava mailing list