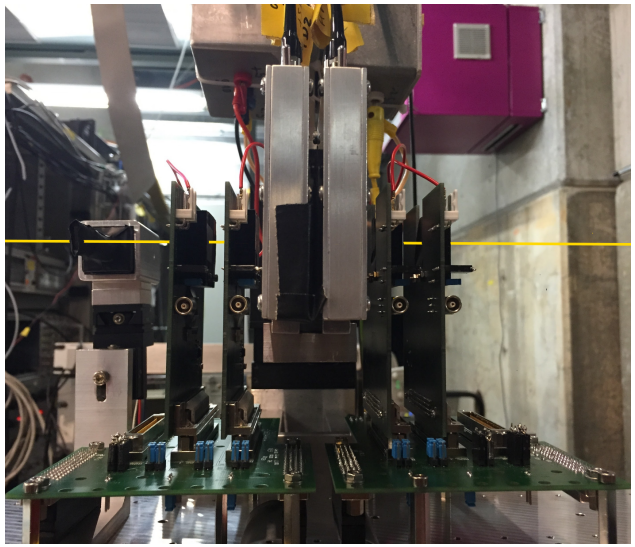

Rate Pad Analysis Summary (I)

Michael Reichmann

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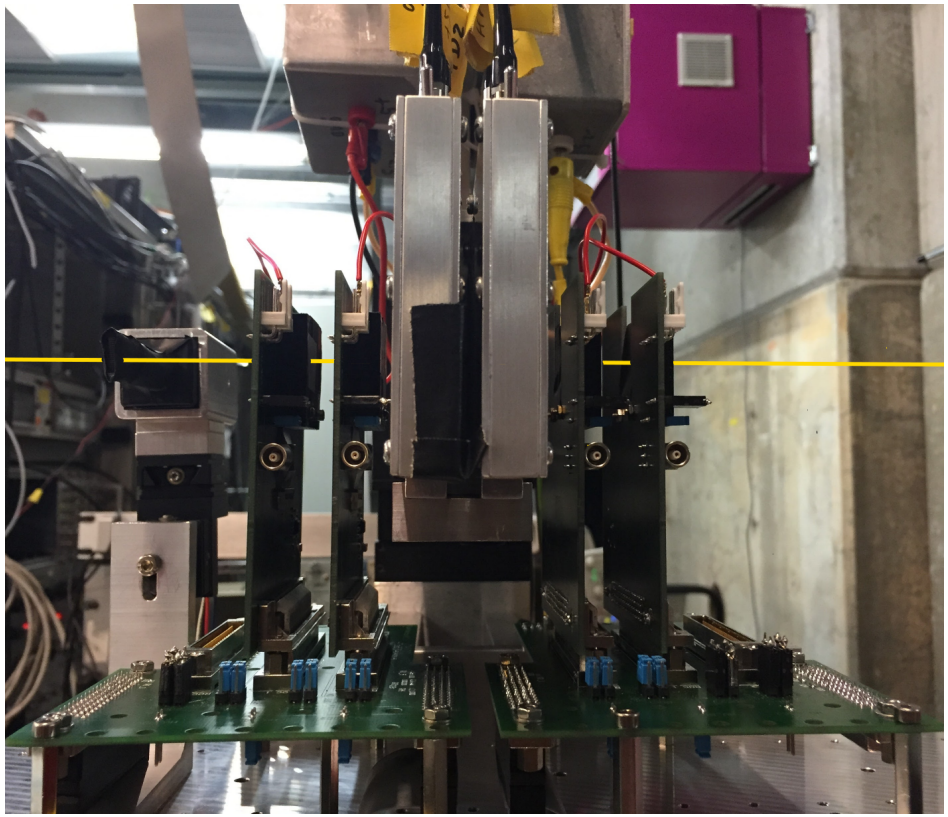
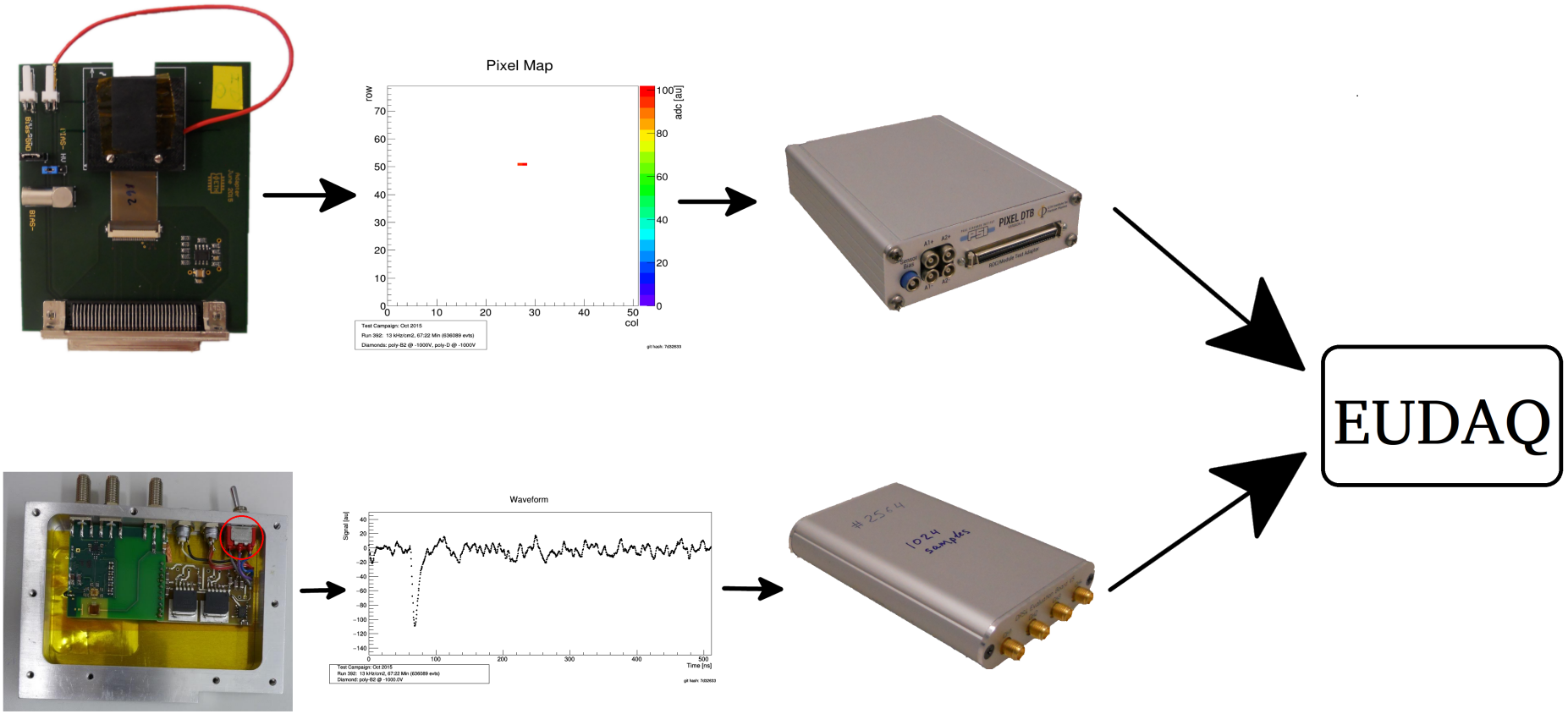
Section 1

Introduction

- analysis fully applicable for all pad runs of the PSI August and October 2015 beam test data
- tested diamonds
  - August: II6-97, II6-B2, S129, poly-B
  - October: II6-97, II6-B2, S129, poly-D, 2A87-E, IIa-3
- examples during this presentation either show S129 or II6-B2 of the October beam test data
- need to extend analysis to PSI May 2015 beam test data
  - same dataformat
  - less precise timing (no scintillator)
  - different run logging



- four analogue CMS Pixel planes connected to a Digtial Test Board (DTB)
- two diamond pad detectors connected to a DRS4 Evaluation Board
- a scinitallator for precise timing



- EUDAQ saves event based data stream as binary file
- require conversion to readable data (i.e. ROOT)

Section 2

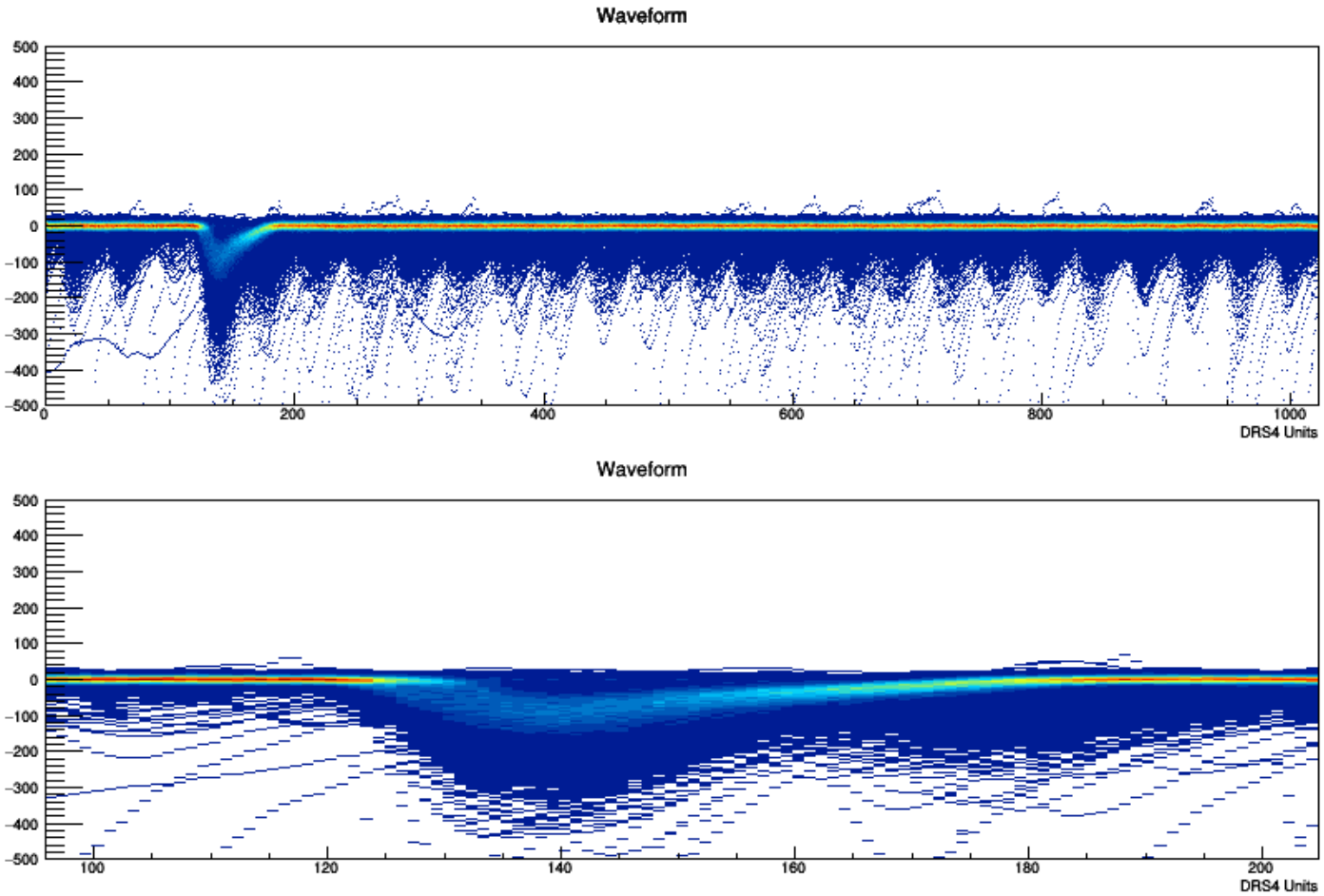
EUDAQ Converter

- EUDAQ already has a converter for binary files (e.g. for CMS Pixel events)
- had no converter for drs4 events
- wrote our own drs4tree converter based on the existing stuff by Felix (various iterations)
- goals of the converter:
  - conversion of the binary data into an (event based) root tree
  - extraction of pulse height information of the Signal, Pedestal and Pulser
- idea for signal extraction:
  - look for the maximum amplitude of the waveform within a predefined interval
    - **PeakSearchRegion** (short: Region)
  - integration of the waveform around this maximum value within another given interval:
    - **IntegralRange**
- define a user-defined number of **PeakSearchRegion** and **IntegralRanges** in a configuration file

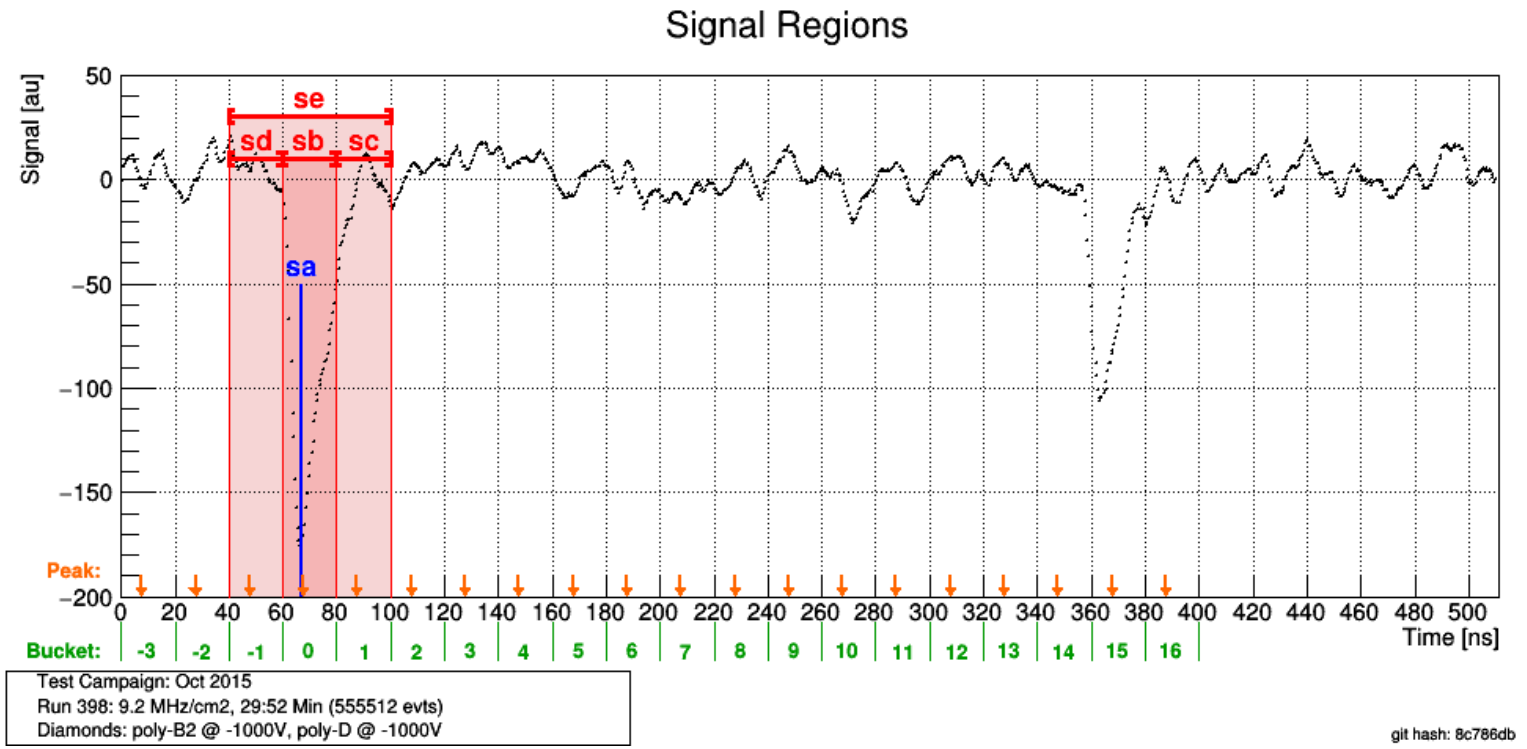
Regions

- define **PeakSearchRegion** (and **IntegralRanges**) for every stable setup (i.e. same trigger logic) during a beam test
- **Regions** found by visual inspections of some raw waveforms
  - waveforms extracted by small script that grabs n waveforms from a single run (preferrably low rate)
  - waveforms already have the pulser flag
  - proven that the position of the waveform is very stable for the same setup
- Pedestal Region:
  - chosen relative to the most probable Signal Peak Position
  - put at the position one particle bunch (bucket) (20 ns or 40 DRS4 Units) before the triggered signal peak (almost no signals there)
  - thus fixed position for the integration (still called Region)
  - reason: catch the full signal if there is still one (and be able to cut for it)
- may define other regions as reference

Signal

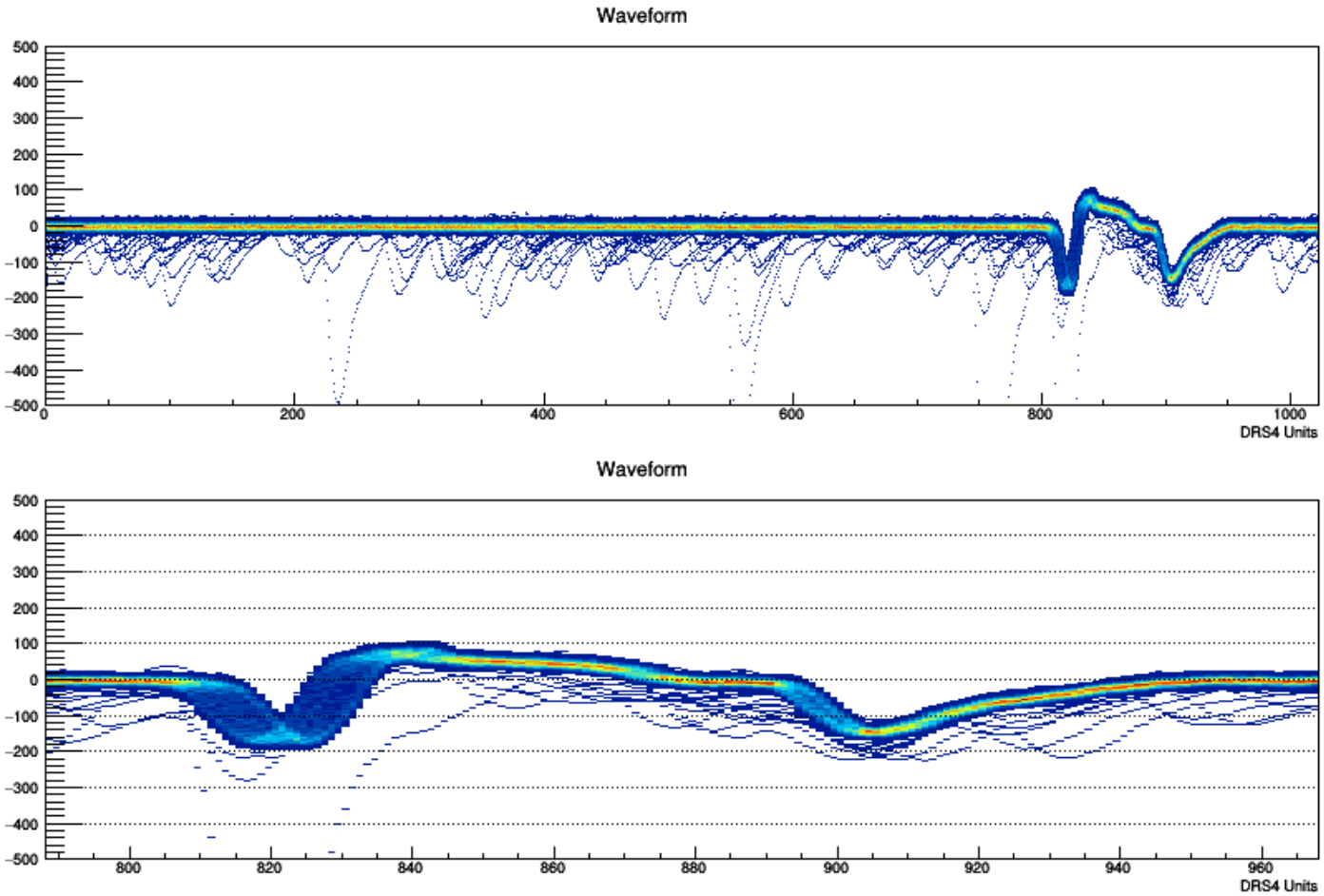


- Signal Region: $[120, 160]$



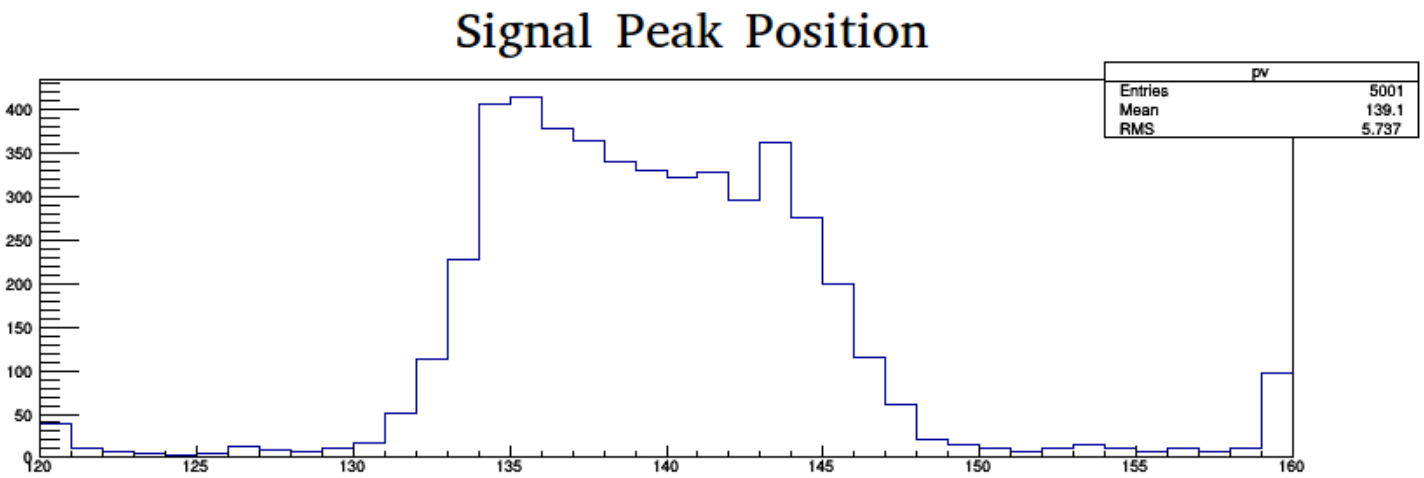
- final choice of the regions
- explanation later

Pulser



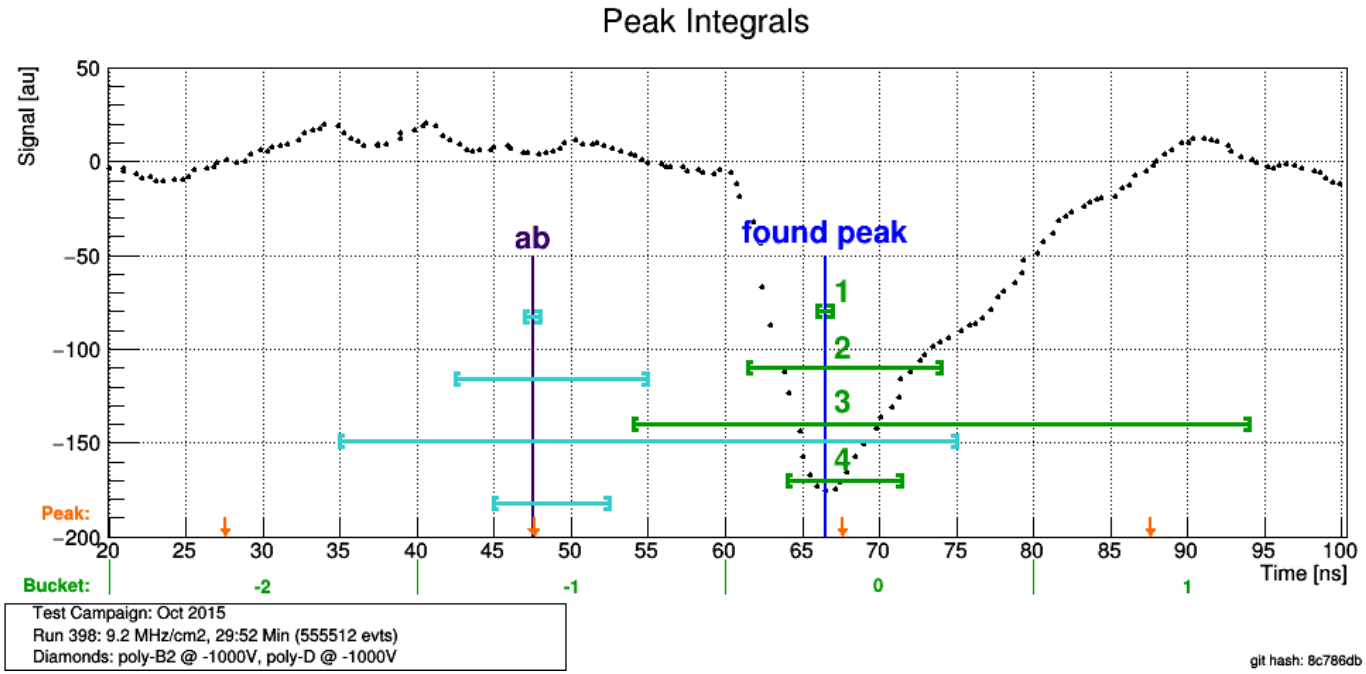
- Pulser Region: $[880, 940]$

Pedestal



- MPV at 135 DRS4 Units
- Pedestal Region: $[95, 96]$

IntegralRange



- applied for every PeakSearchRegions
- great influence on the Signal to Noise Ratio (SNR) (ratio of signal integral over sigma of the pedestal)
- strongly dependend on the shape of the waveform
- best setting found with SNR optimisation $\rightarrow$ Analysis Part
  - $[8, 12]$: Integration from 8 DRS4 Units before and 12 DRS4 Units after the found peak

Section 3

Telescope Analysis

Tracks

χ^2

Track Angle

Section 4

Cuts

Tracks

Signal

Section 5

Analysis I (Waveforms)

Pedestal

Signal

Pulser

Section 6

Analysis II

Beam Profile

Signal Peak Positions in Time

2D Signal Maps

Diamond Currents