

Introduction
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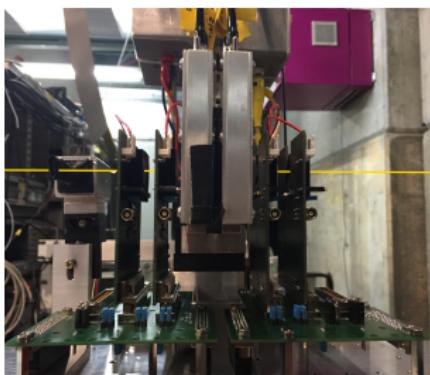
EUDAQ Converter
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Telescope Analysis
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Cuts
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Analysis I (Waveforms)
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Rate Pad Analysis Summary (I)

Michael Reichmann

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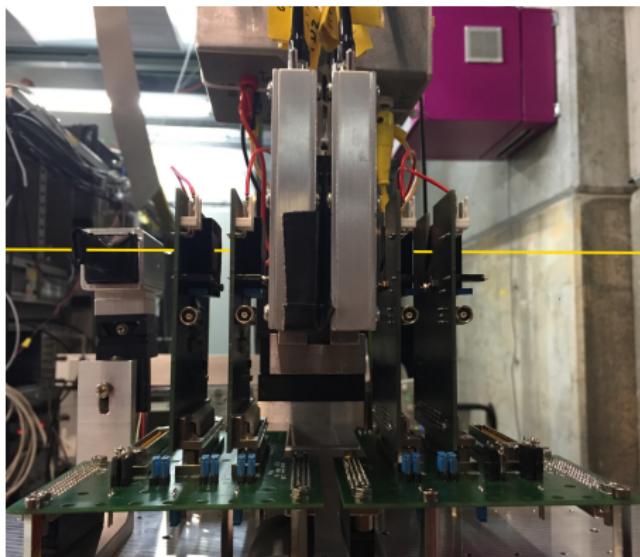
Section 1

Introduction

Applicability

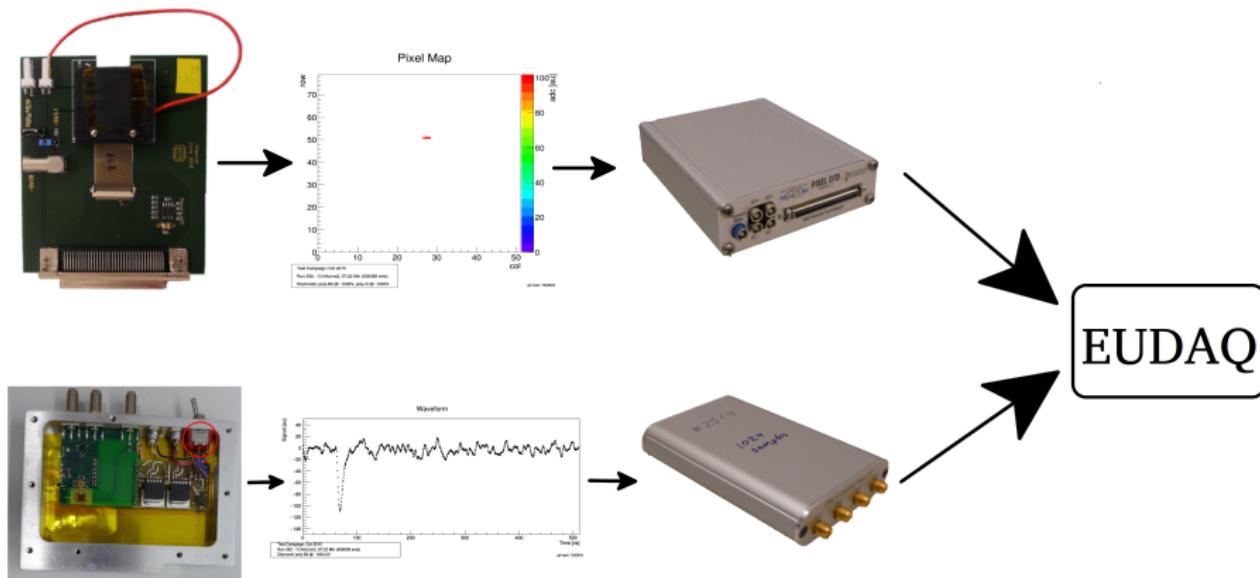
- analysis fully applicable for all pad runs of the PSI August and October 2015 beam test data
- tested diamonds
 - ▶ August: II6-97, II6-B2, S129, poly-B
 - ▶ October: II6-97, II6-B2, S129, poly-D, 2A87-E, IIa-3
- examples during this presentation either show S129 or II6-B2 of the October beam test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

Setup



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

Datataking



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

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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

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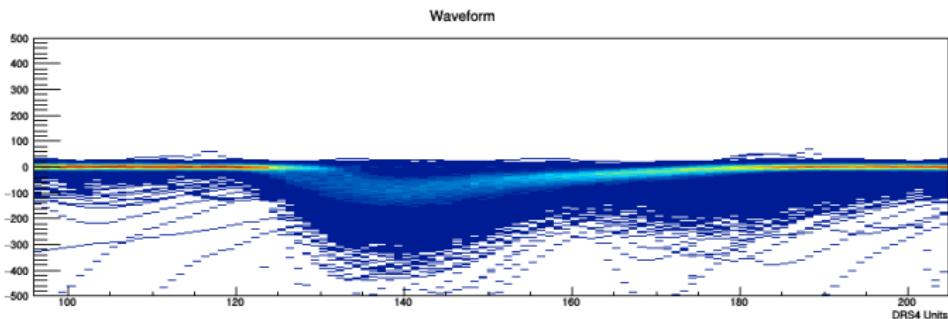
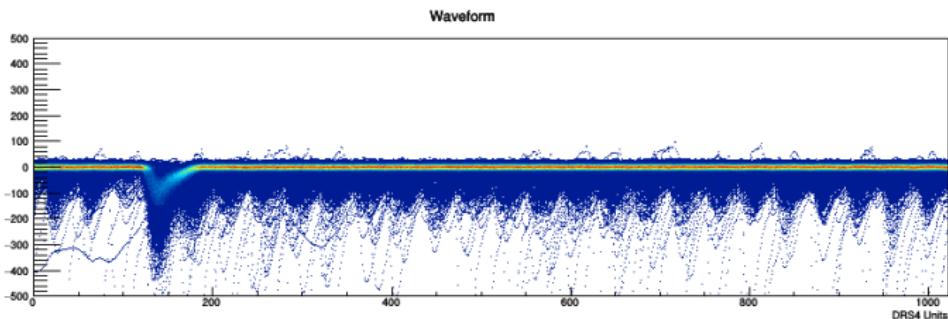
Definition of the PeakSearchRegions

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 (preferably 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

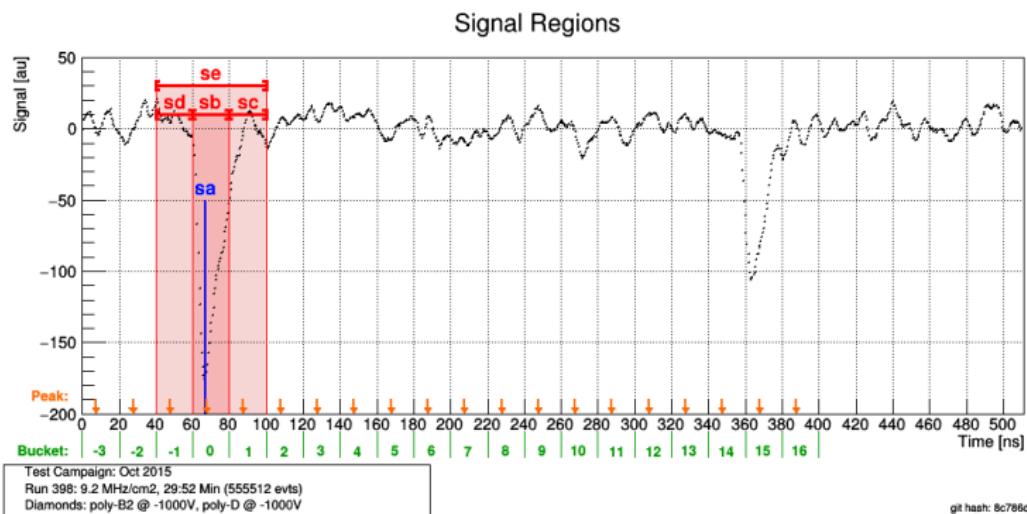
Waveforms

Signal



- Signal Region: [120, 160]

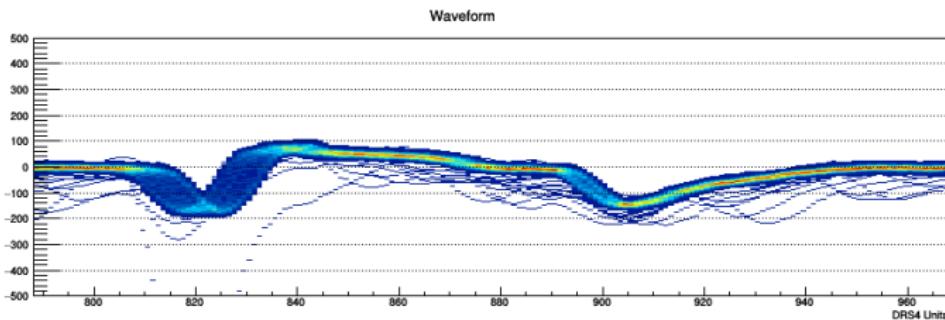
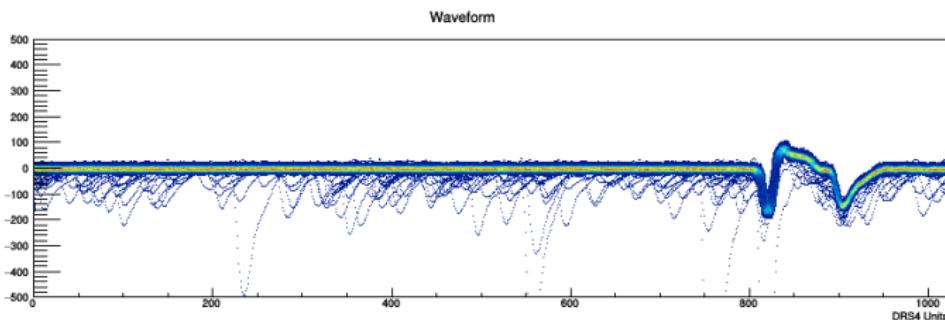
Waveforms



- final choice of the regions
- explanation later

Waveforms

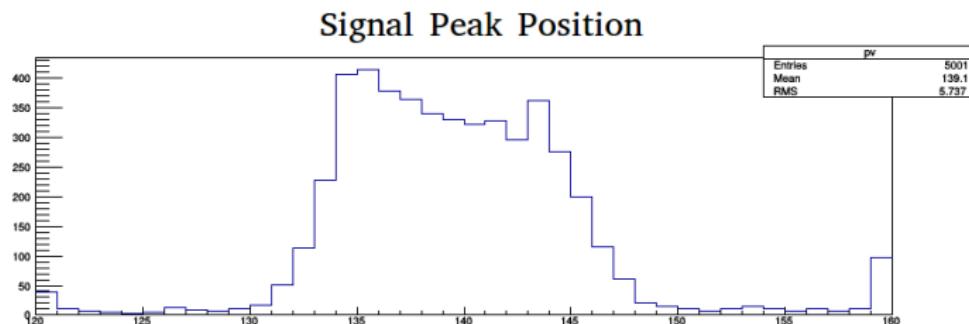
Pulser



- Pulser Region: [880, 940]

Waveforms

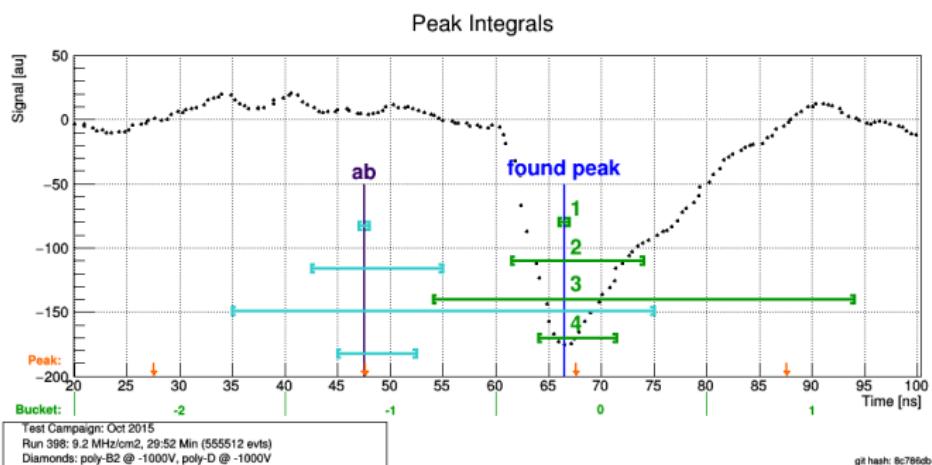
Pedestal



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

Definition of the Integral Ranges

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 → Analysis Part
 - ▶ [8, 12]: Integration from 8 DRS4 Units before and 12 DRS4 Units after the found peak

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Section 3

Telescope Analysis



Tracks

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Track Angle

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Section 4

Cuts



Tracks



Signal

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Section 5

Analysis I (Waveforms)



Pedestal

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Signal



Pulser

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Section 6

Analysis II



Beam Profile



Signal Peak Positions in Time



2D Signal Maps



Diamond Currents