VXD Test Beam 2014

DEPFET Meeting 19.3.14

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For the test beam crew

EUDET Tracking

2nd eudet arm

1st eudet arm

260 mm

20 mm 19 mm

PXD

20 mm 25 mm

PMT

20 mm

70 mm 8 mm

Dry box
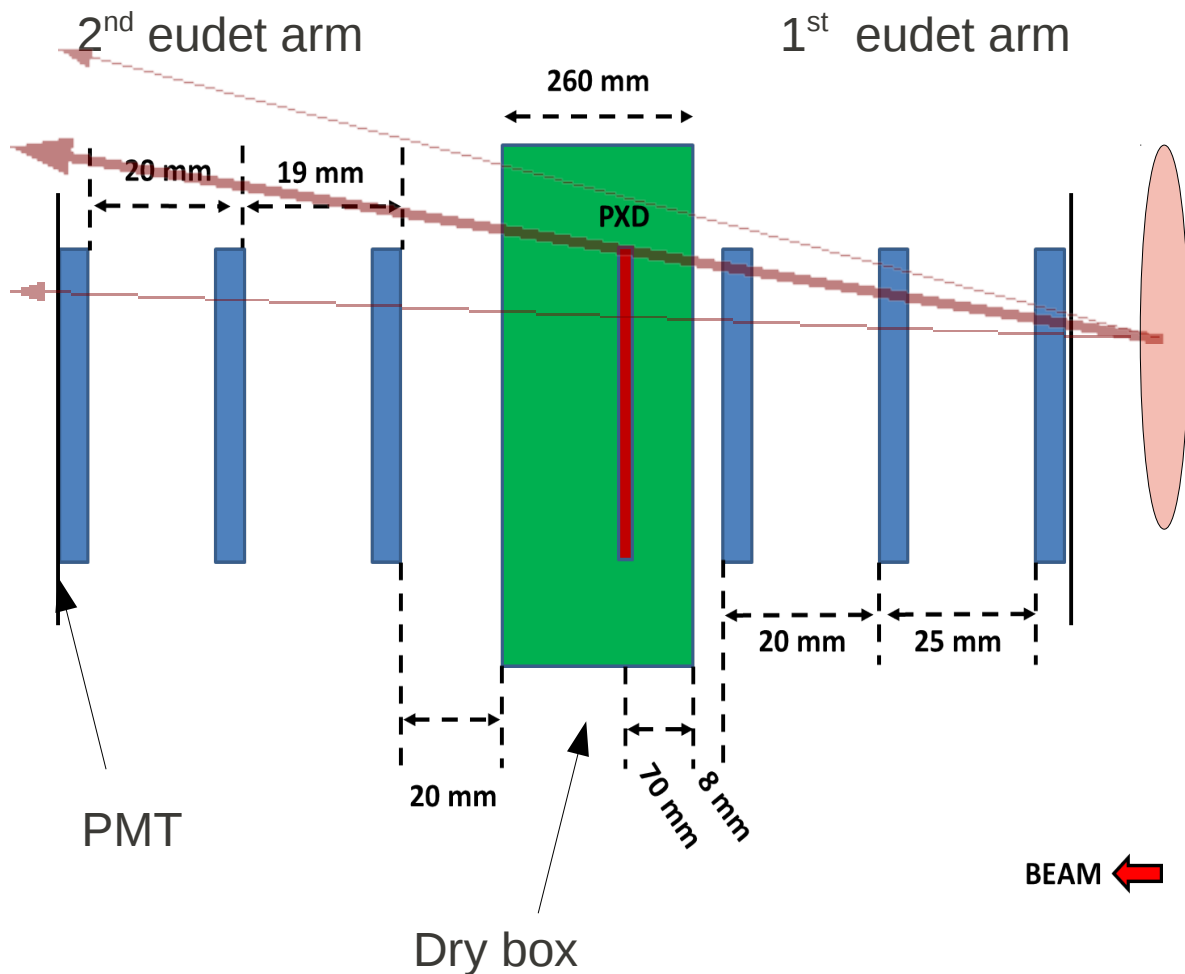
BEAM

:- 6 eudet layer, 3um error

:- trigger PMT's before and
   after eudets

:- triggered track: 6hit eudet hit(!)

:- beam axis misaligned to
   Telescope axis

:- low track multiplicity in eudet

:- Spy Mode:

DHH-> BonnDAQ->EUDAQ

:- No Onsen ROI filter

:- Spy mode can now be merged
   In Basf2.

Analysis Overview

- Focused on eudet runs without magnetic field
  - Only eudet tracks can tell us depfet resolution
  - SVD extrapolation error much too large
- Focused on DEPFET detector performance
  - Landau, efficiency, fake rate, ...
- EuRun 183 (Monday, 27.1., morning)
  - Layer 2 installed (J00)
  - 3GeV beam; magnet off
  - All M26 layers working
  - 2DCD/DHP on, 8ADU ZS
  - 360k events
- EuRun 183 is representative (checked other runs before and after)

Firing Rate

Firing Frequency

Trigger Area

No Hits!!

DCD1 (64cols)   DCD2 (64cols)
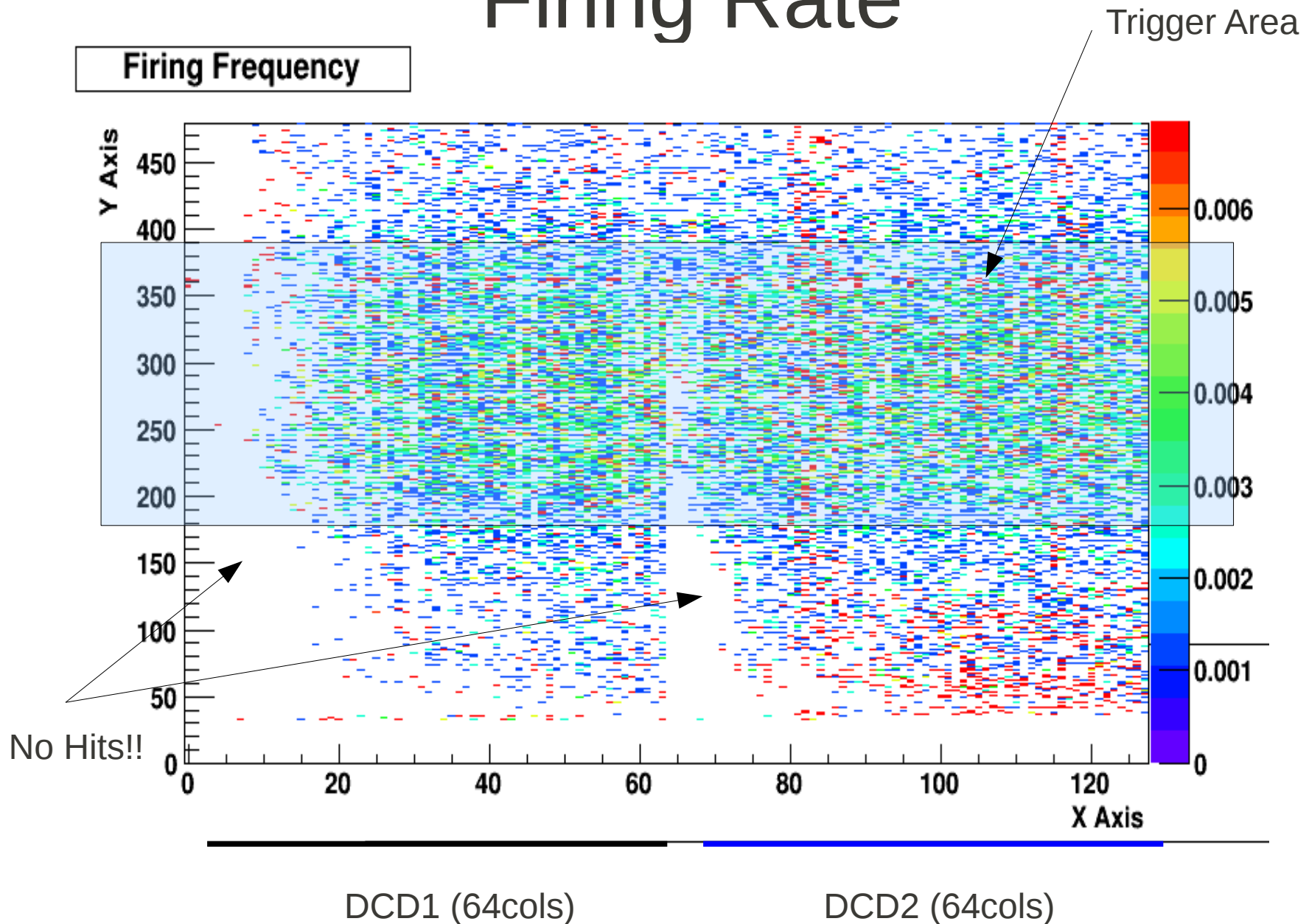
Hot Pixel Map

px_y:px_x {status!=0 && cycle==3}
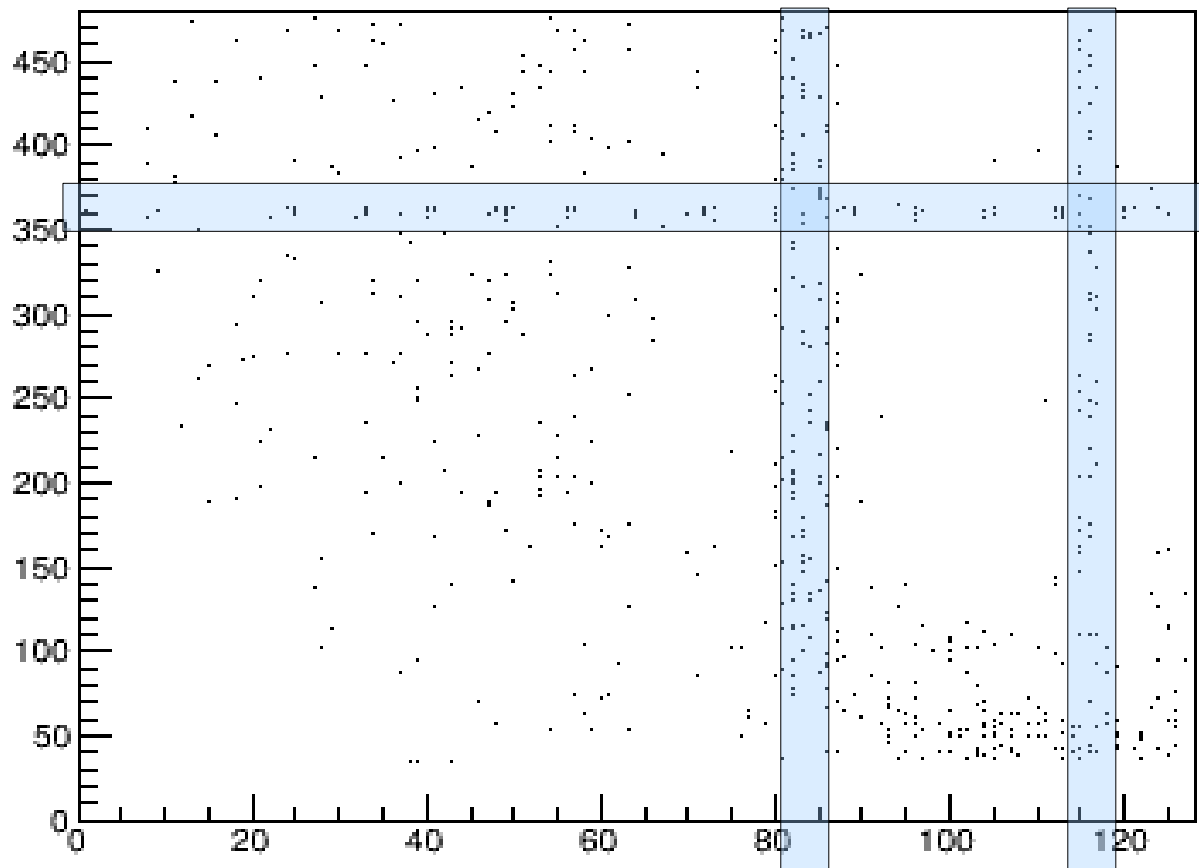
Hot==More than 1hit in
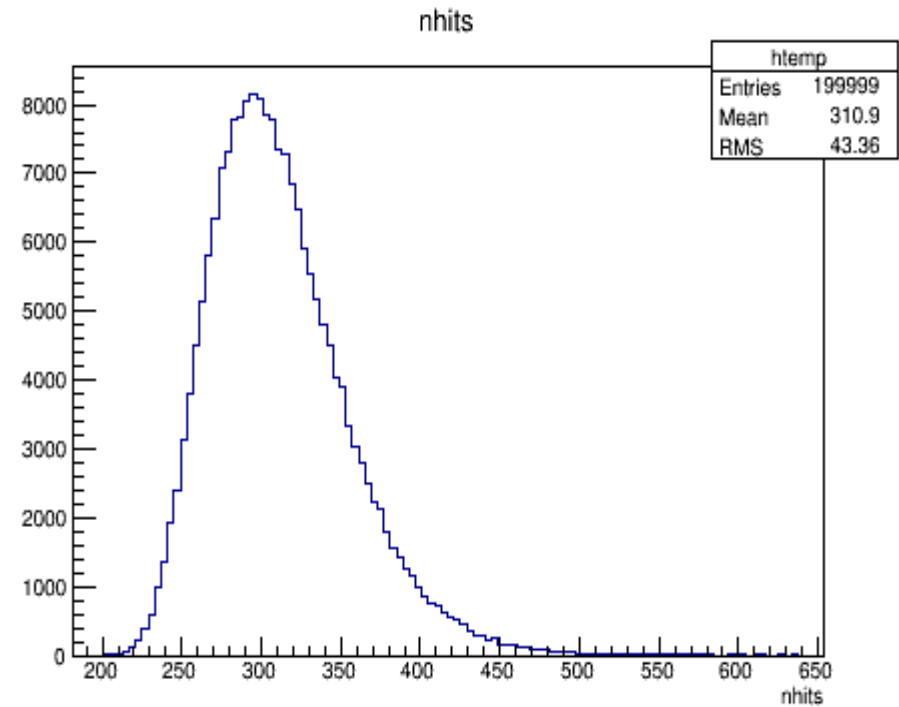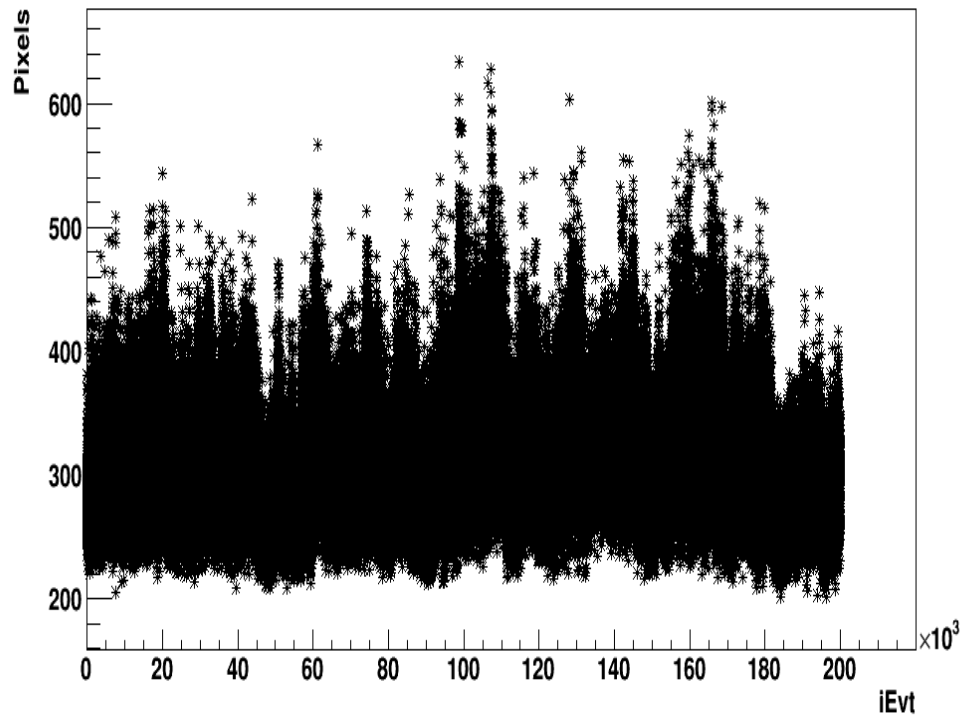100 triggers

Around 1% of channels
Masked (ZS= 8ADU)

Bad channels dominate
The dhp event size
(→ next slide)

Worst areas marked

Event Size (DHP) vs. Time

:- The beam intensity is really flat
:- Almost all of it is DEPFET noise!!
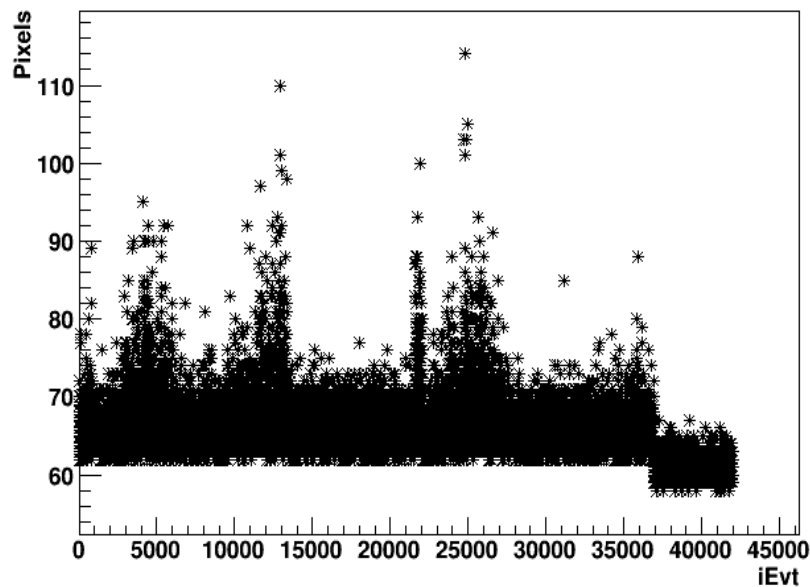:- Hot Pixel Killer very effective to get rid of it.

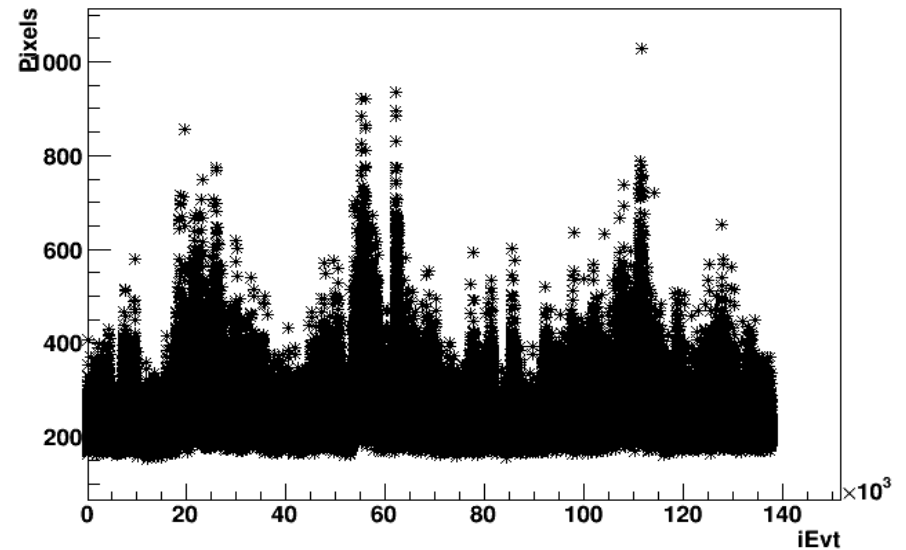# Noise level over beam time

EuRun 115

Thu Jan 23 11:26:46 2014

EuRun 172

Sun Jan 26 ~20:00 2014
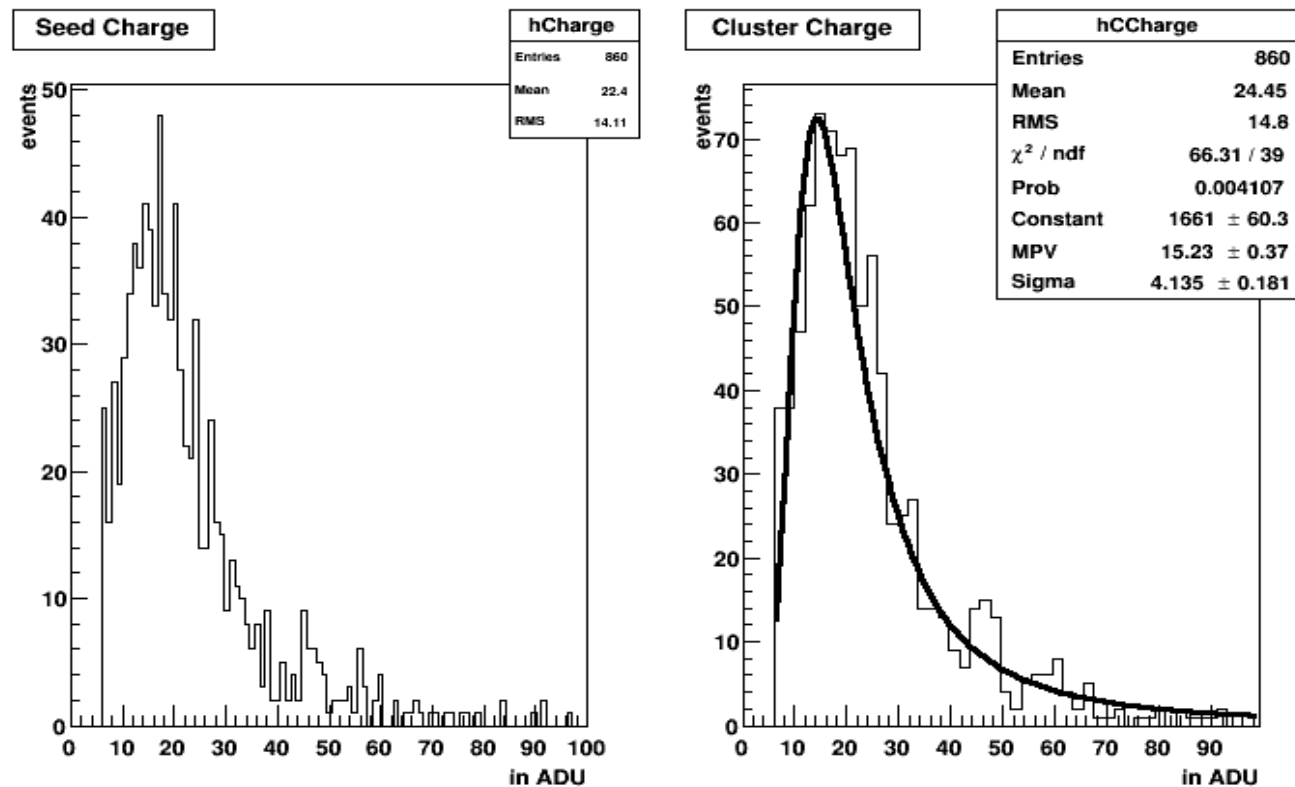

ToDo: We must study noise level as function of our grounding work!!

Landau (EUDET Filtered)

Eurun 122 (on track) ZS=5ADU
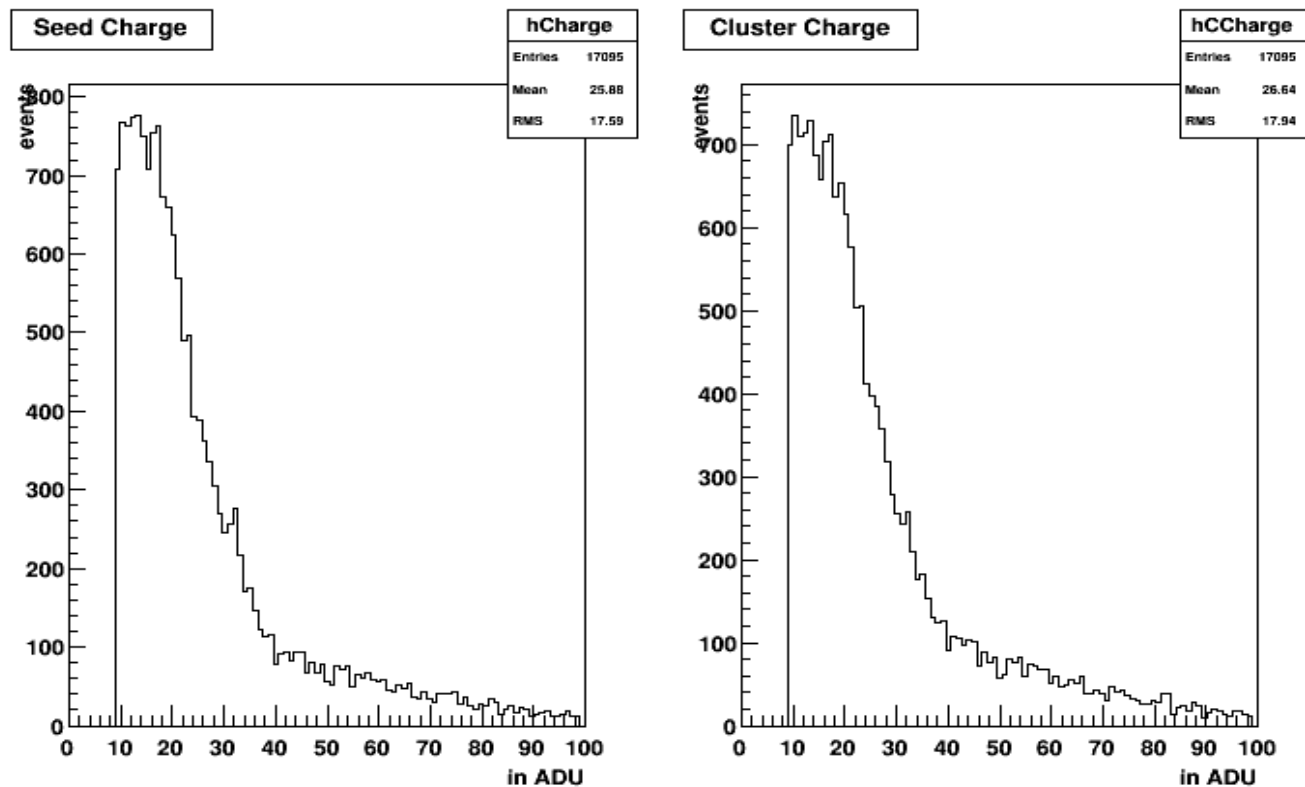

MPV is around 15ADU, Optimized system has noise of ~0.7ADU

f

Landau (EUDET Filtered)
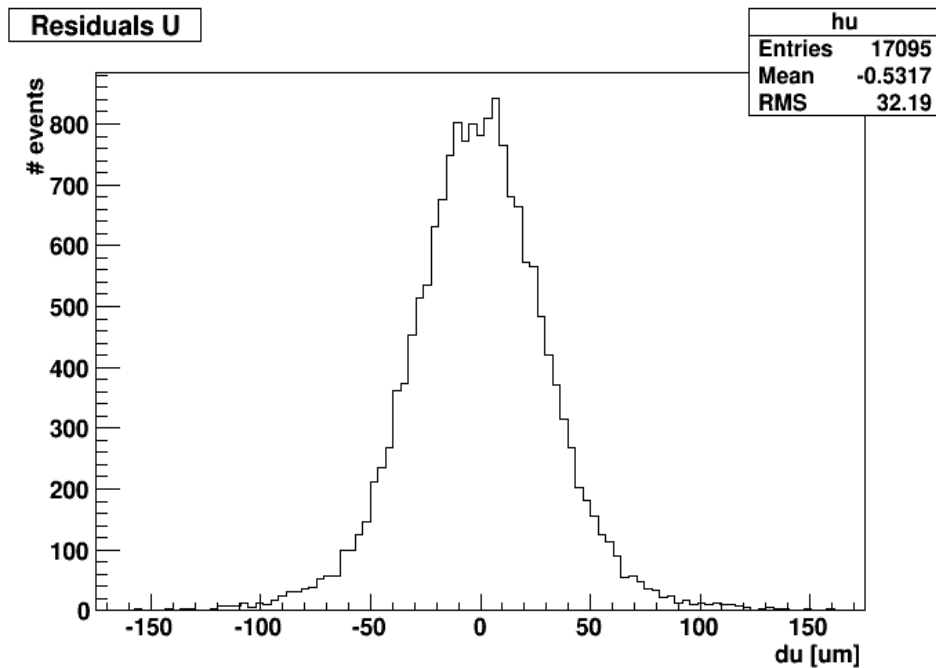
Eurun 183 (on track); ZS =8ADU

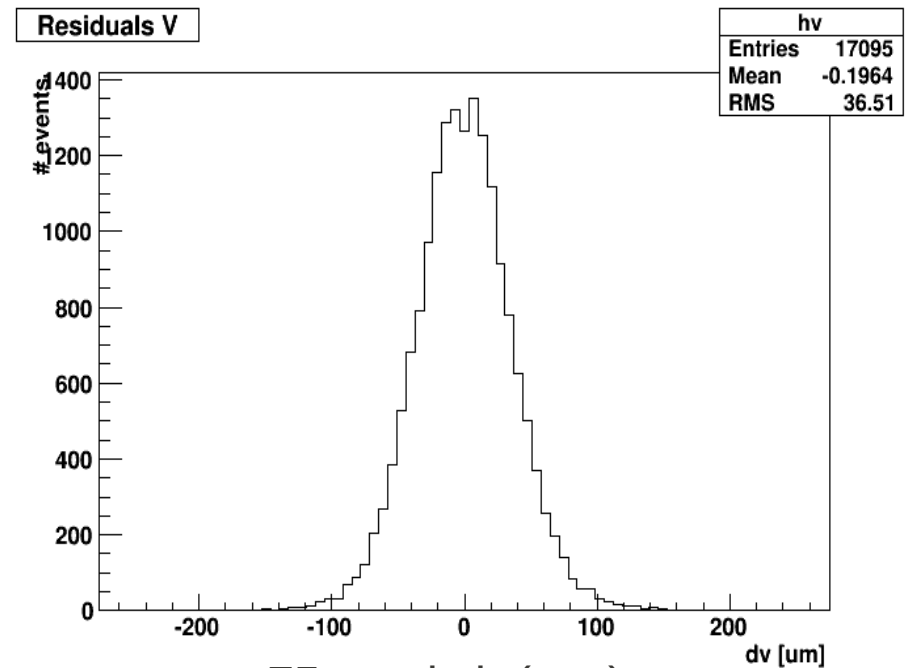ZS=8ADU seems to cut into signal → inefficiency

Residuals

Eurun183 (6hit eudet tracks)

EUDET extapolation error is ~15microns
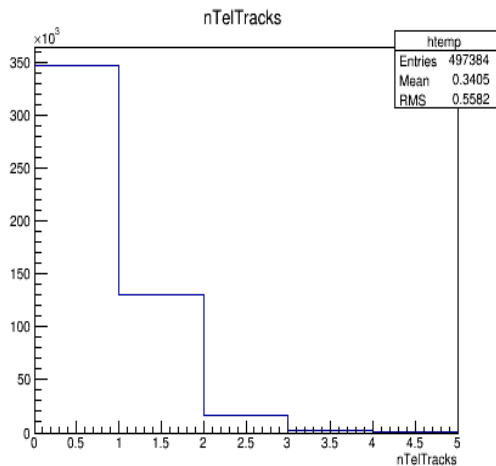
Single pixel clusters → binary resolution

50um pitch (columns)
RMS = 32um (→ exp 21um)

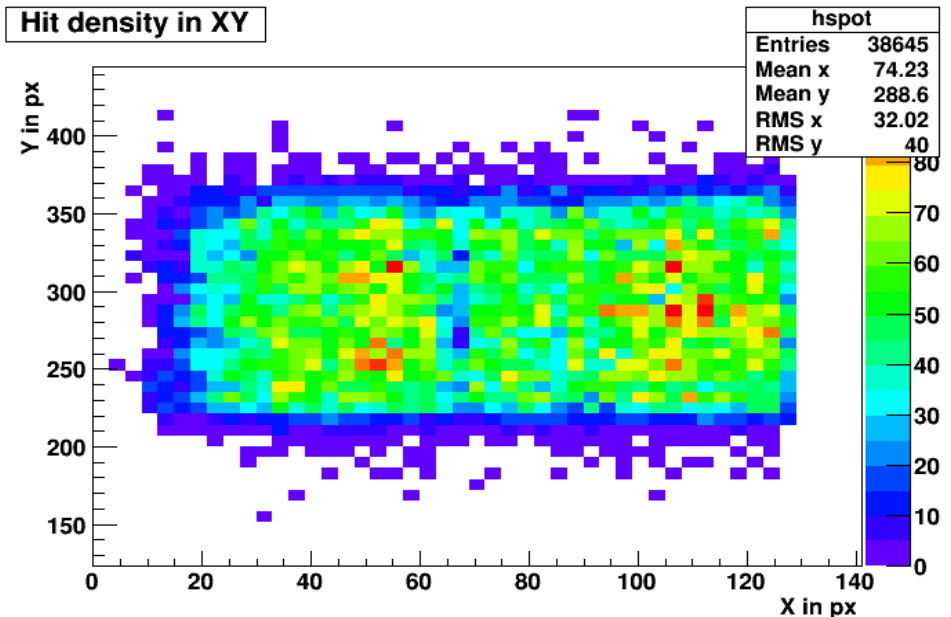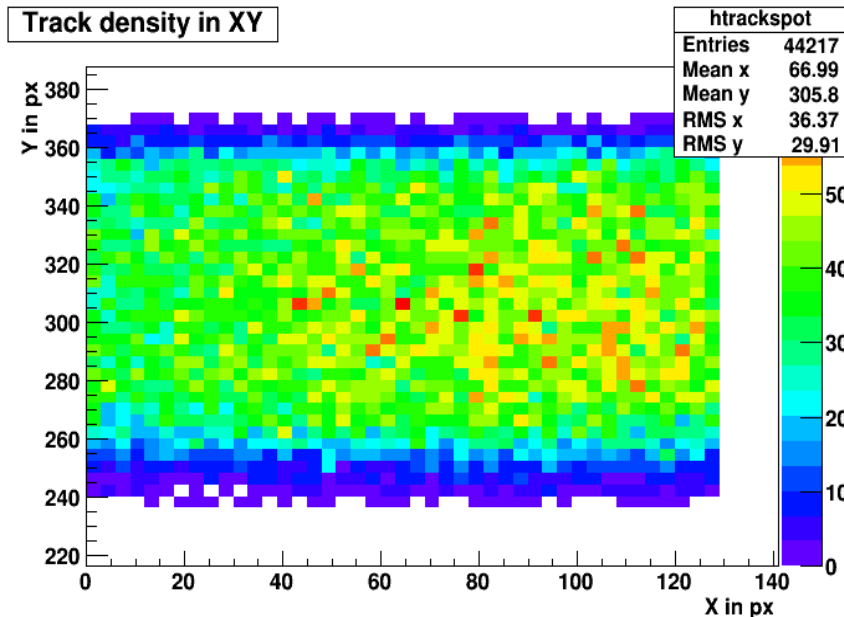75um pitch (row)
RMS = 36um (→ exp 26um)

Efficiency Study

Track with 6 eudet hits used to tag DEPFET hit

:- despite long m26 integration time, mulitiplicity low
:- SVD hits can help a lot for timing

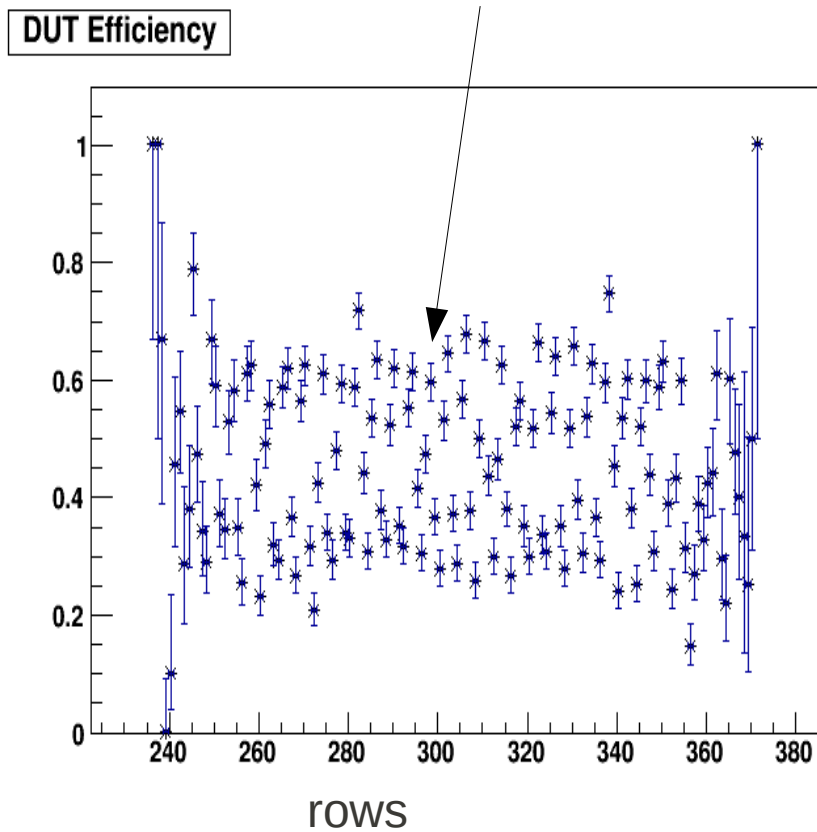6hit eudet tracks extrap to depfet
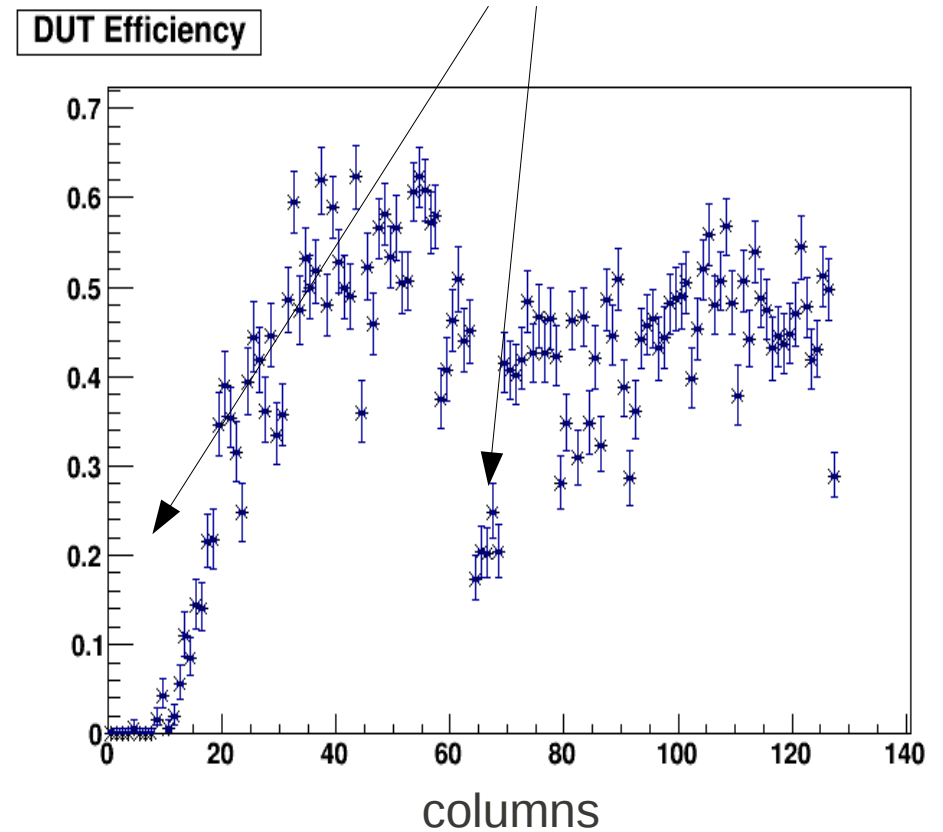(Smooth beam)

DEPFET hit density (NO ROI)

Hit Efficiency

Not enough stat. for single channel analysis
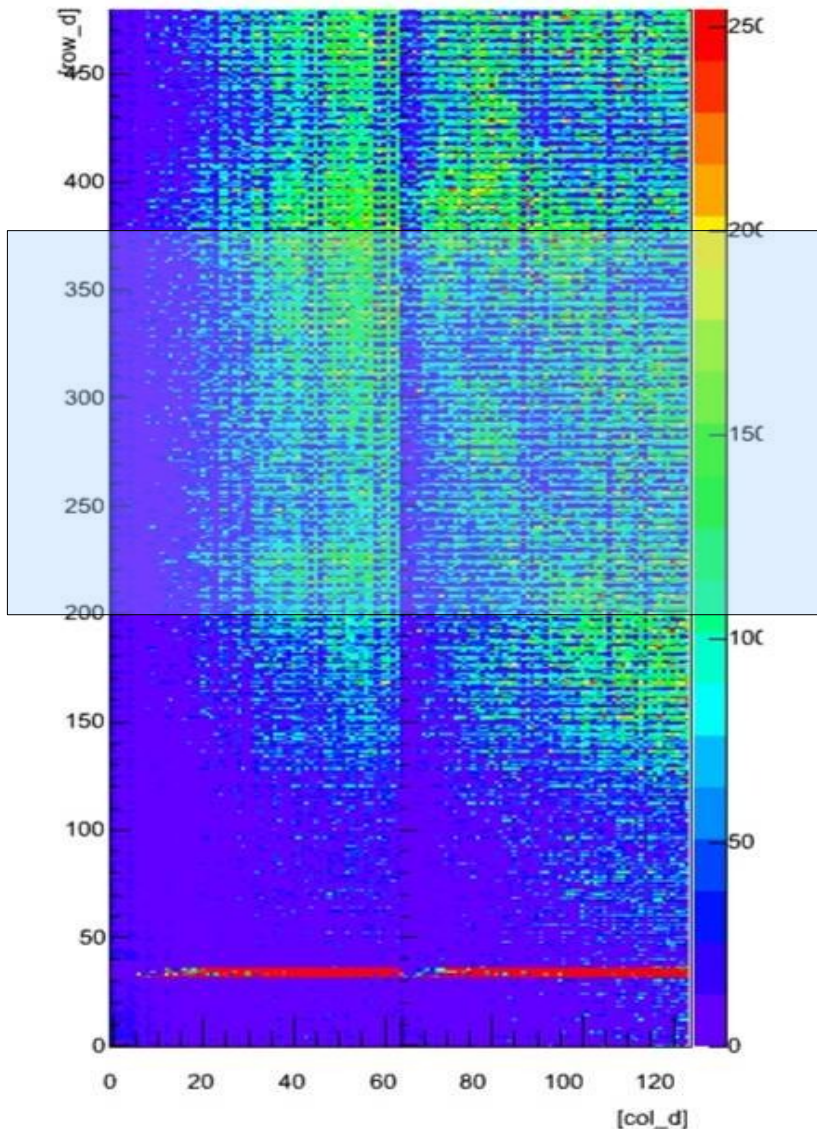Eudet tracks point to correct hit pixel

Row pattern

Inefficient at left borders

rows

columns

Pedestals and Dynamic Range

:- Same coordinates as before

:- Zero pedestal: out of DCD range!!

:- Pedestal variation too strong to operate all sensor

:- There is also a row wise patter in Pedestals.

:- Questions:

A) How much can 2bit pedestal dac help (not used in tb)?

B) How much of pedestal is due to Mechanic stress/ bad optimization?

Summary

- Understand noise level and grounding issues
  - Somehow, we increased noise :(
- Landau and residuals fine :)
  - Measure Gq also in lab to confirm
- Efficiency is affected by very strong pedestal variation :(
  - Try to get 2bit dac working
  - Need additional measurments
- Results should be confirmed in BASF2

Thanks