RD50-MPW2 jitter measurements

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RD50-MPW2

Resistivity 1900 Ωcm

Non-irradiated

Active pixel matrix
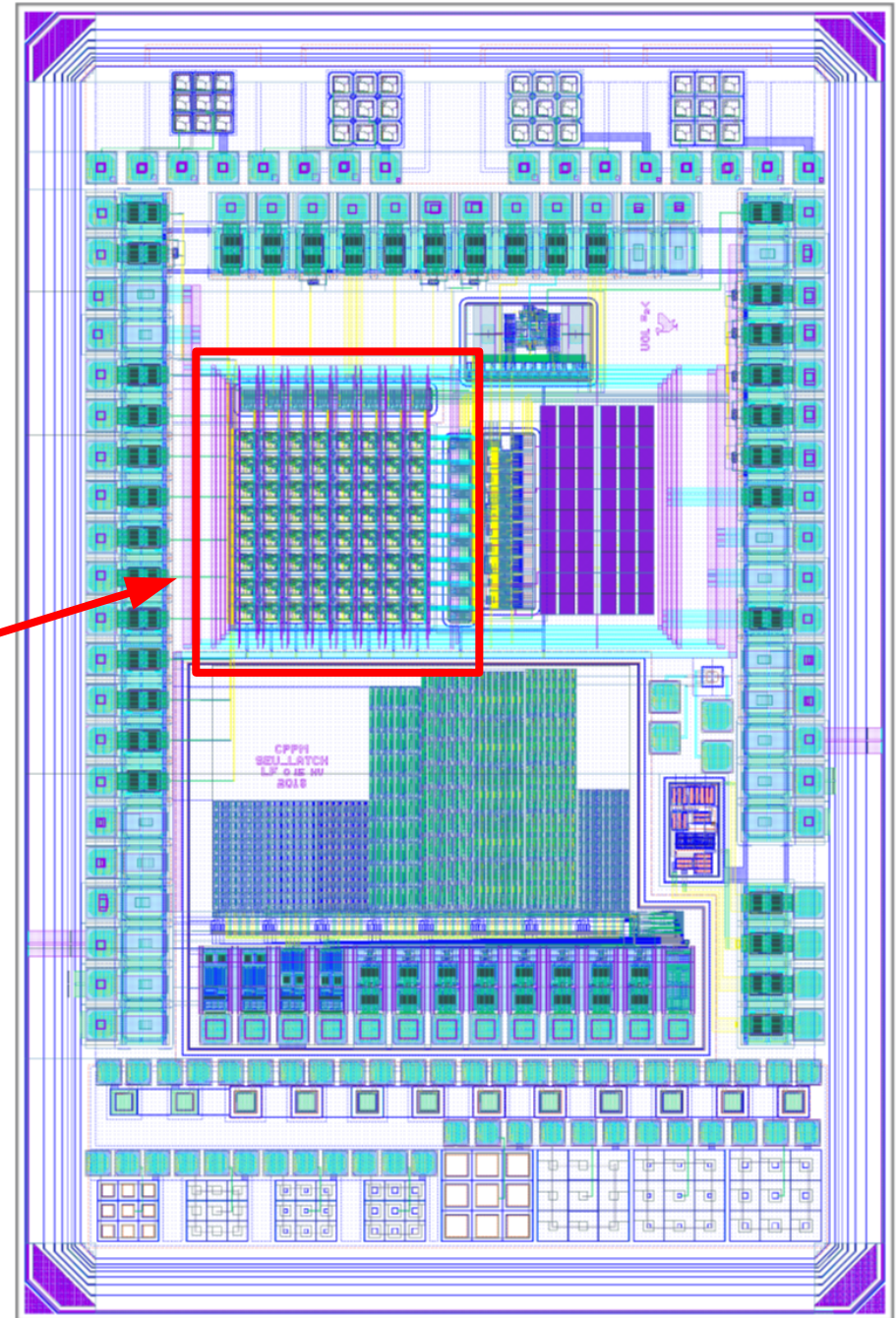
Continuous-reset pixel

Baseline = 900 mV

Threshold = 950 mV or 1000 mV

V_{bias} = -100 V

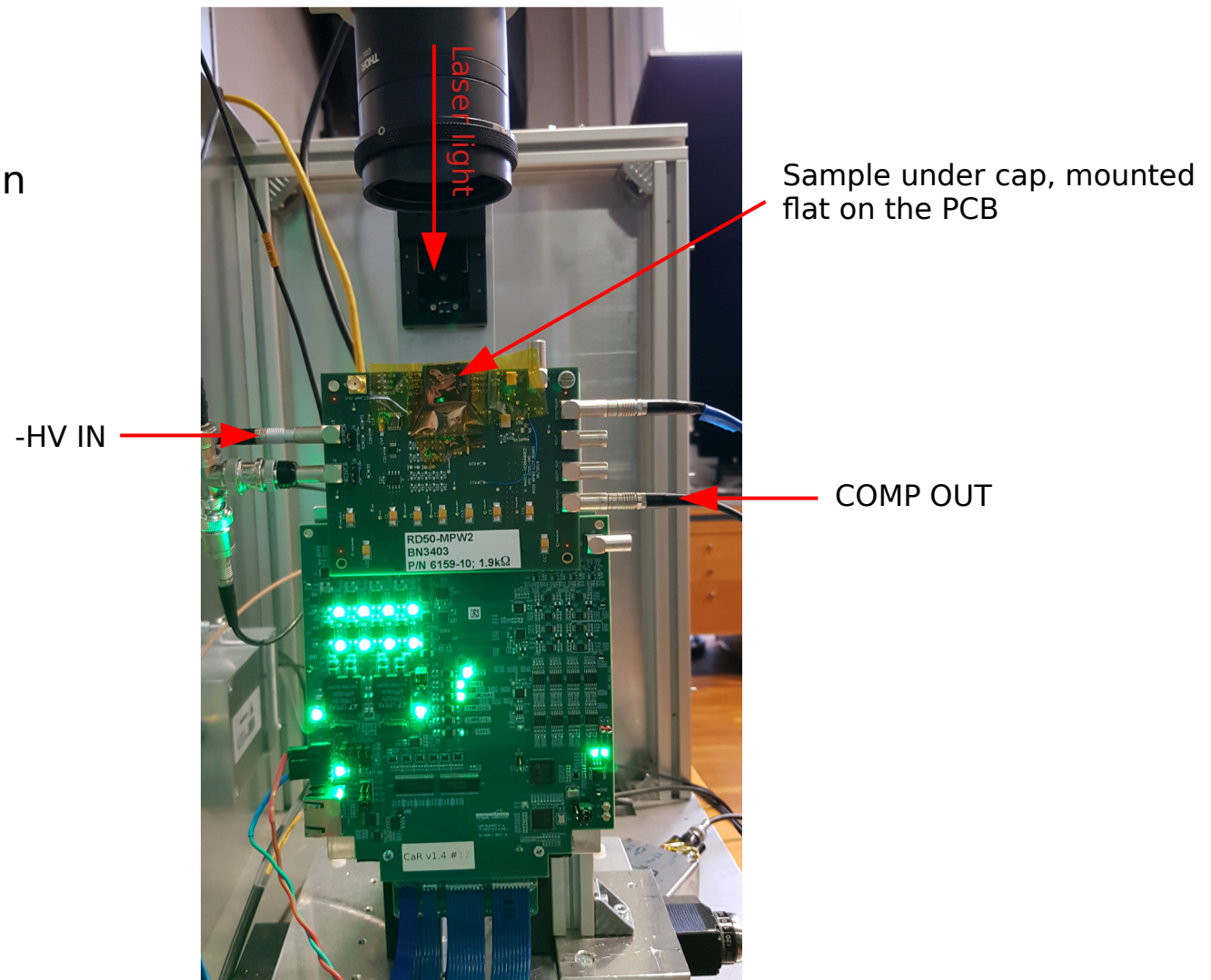Time over threshold proportional to injected charge

Setup

Goal: Determine the jitter of the comparator output rising edge and its positional dependence within the depleted region.
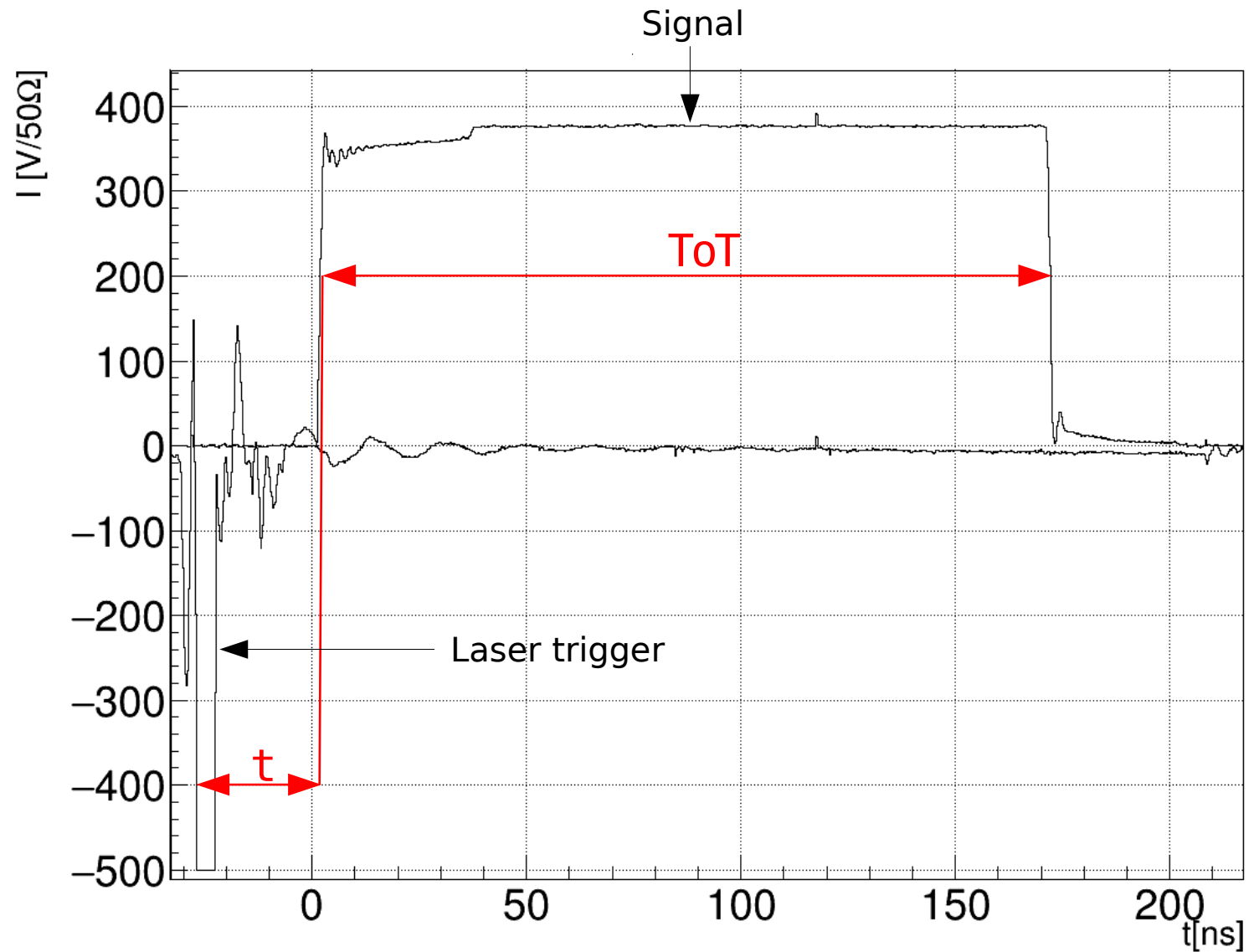
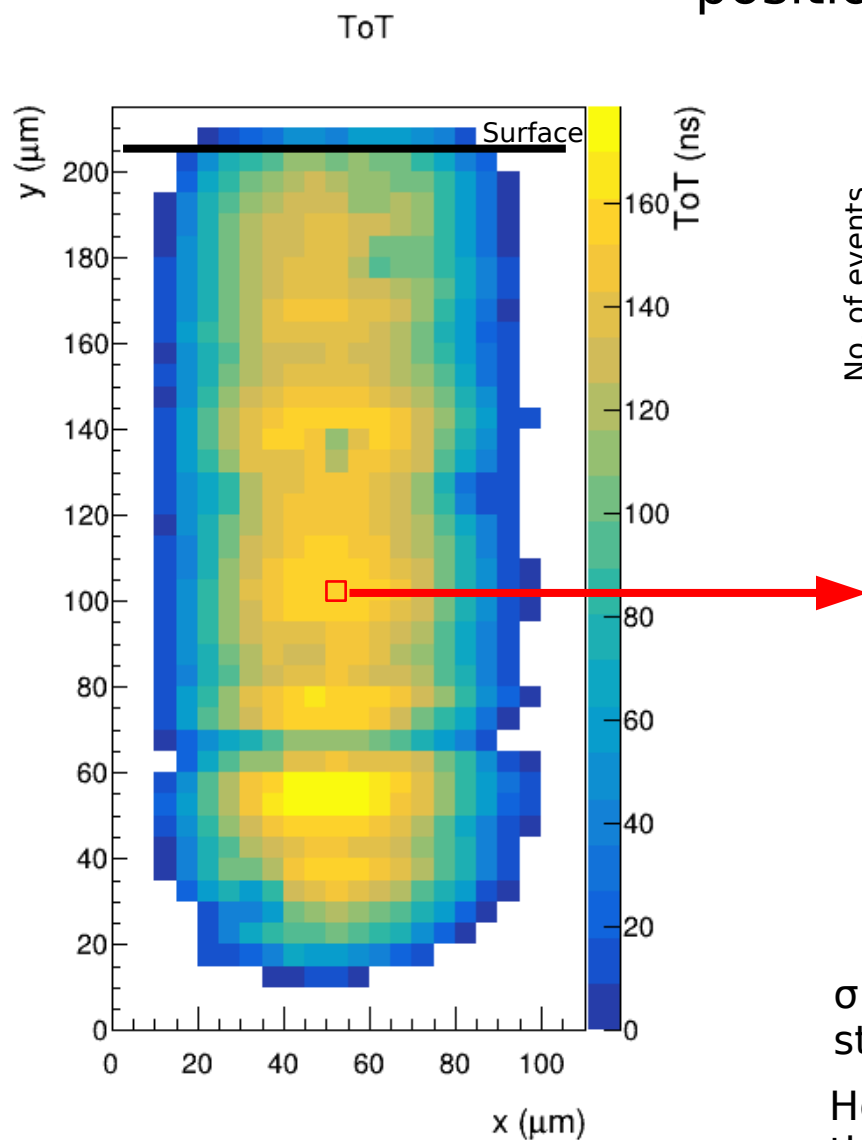Edge-TCT configuration

1060 nm (IR) light

Laser light

Sample under cap, mounted flat on the PCB

-HV IN

COMP OUT

RD50-MPW2
BN3403
P/N 6159-10; 1.9kΩ

CaR v1.4 #

Measurements

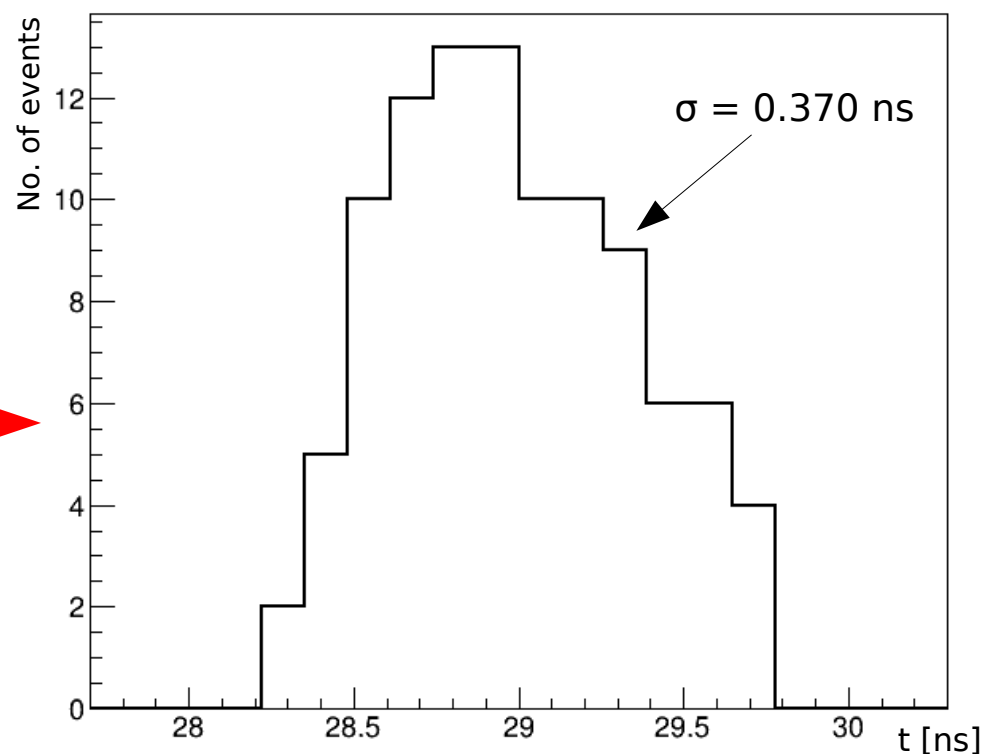Thresholds:
200 mV signal
-400 mV laser

Measurements

100 waveform samples at each position

ToT

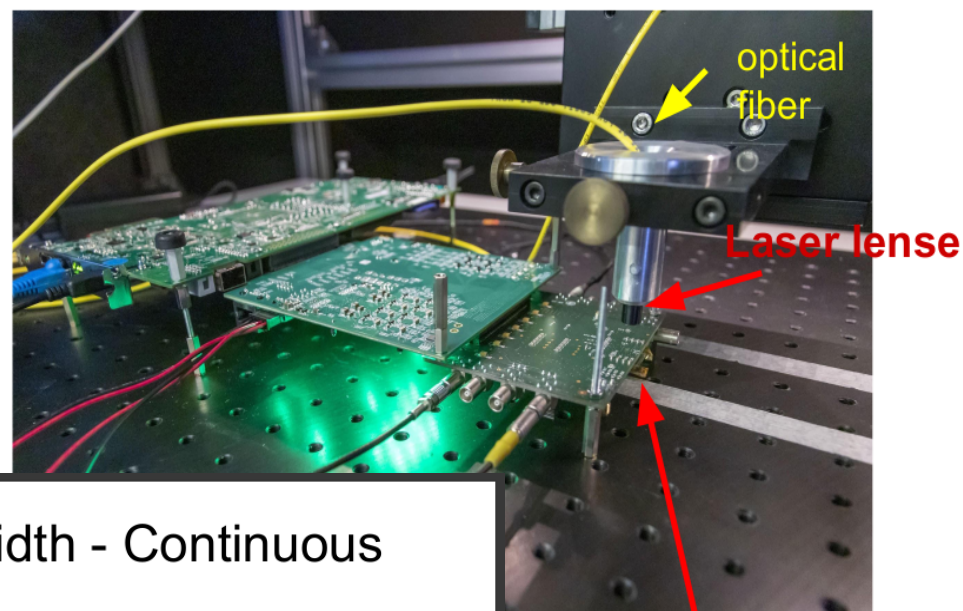Time distribution of signal rising edge

σ = 0.370 ns

σ of spread calculated as the sample standard deviation
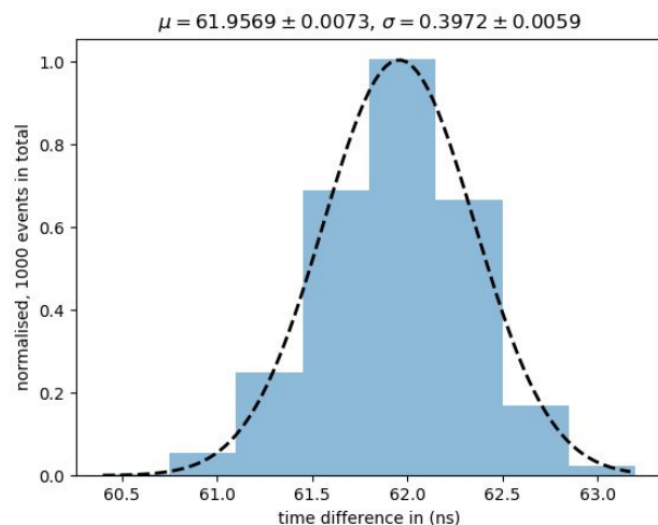
How does the spread depend on the signal strength?

Similar measurements at the Nikhef Institute

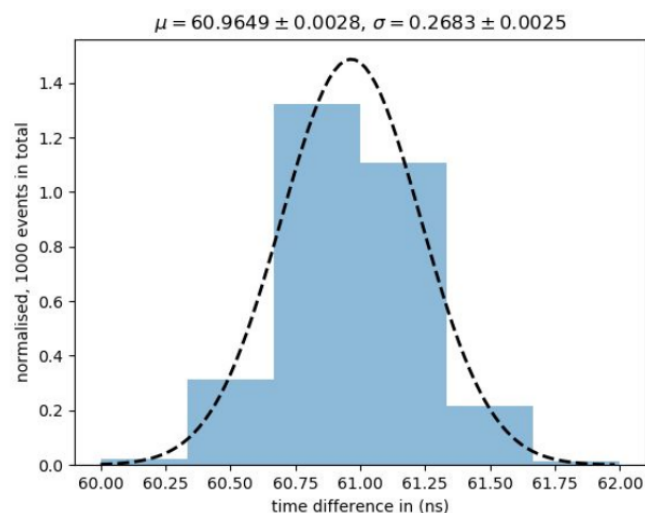Unfocused laser

Long laser pulses

Backside injection

optical fiber

Laser lense

MPW2 chip

Time resolution for two different pulse width - Continuous

11ns wide injected laser pulse - Continuous pixel

$\mu = 61.9569 \pm 0.0073, \sigma = 0.3972 \pm 0.0059$

BL= 900, TH=1000, Bias Voltage = -60V

17ns wide injected laser pulse - Continuous pixel

$\mu = 60.9649 \pm 0.0028, \sigma = 0.2683 \pm 0.0025$
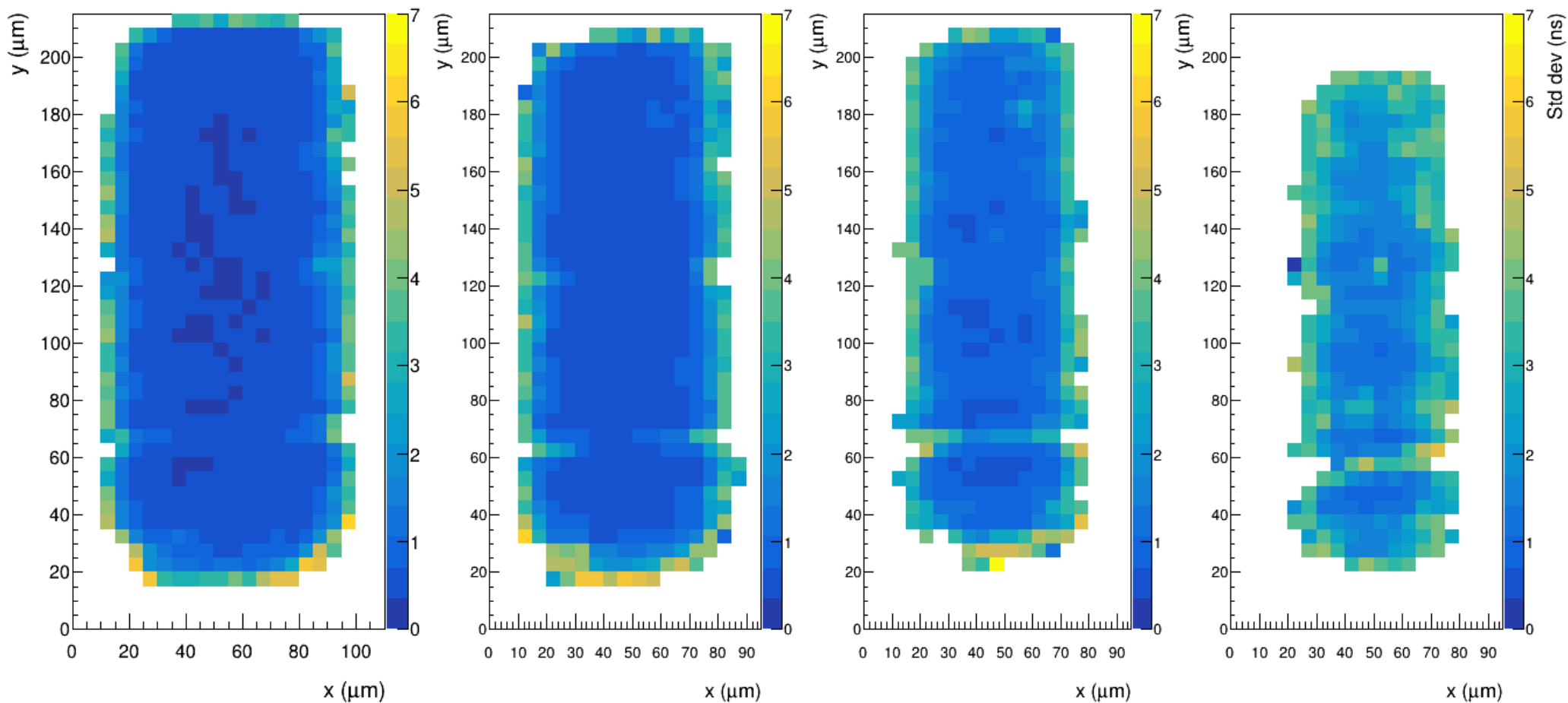

errors = errors from the fitting analysis

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Results

2D scans at different laser beam intensities.

Jitter uniform throughout the center of the depleted region and increases for weaker pulses.

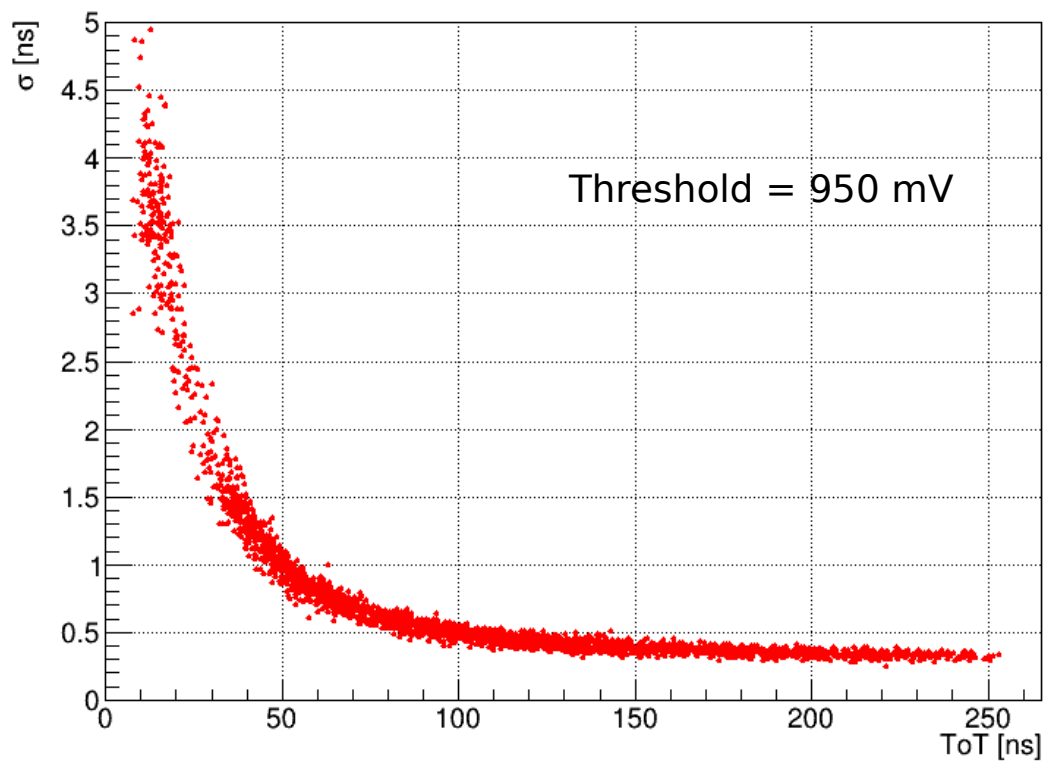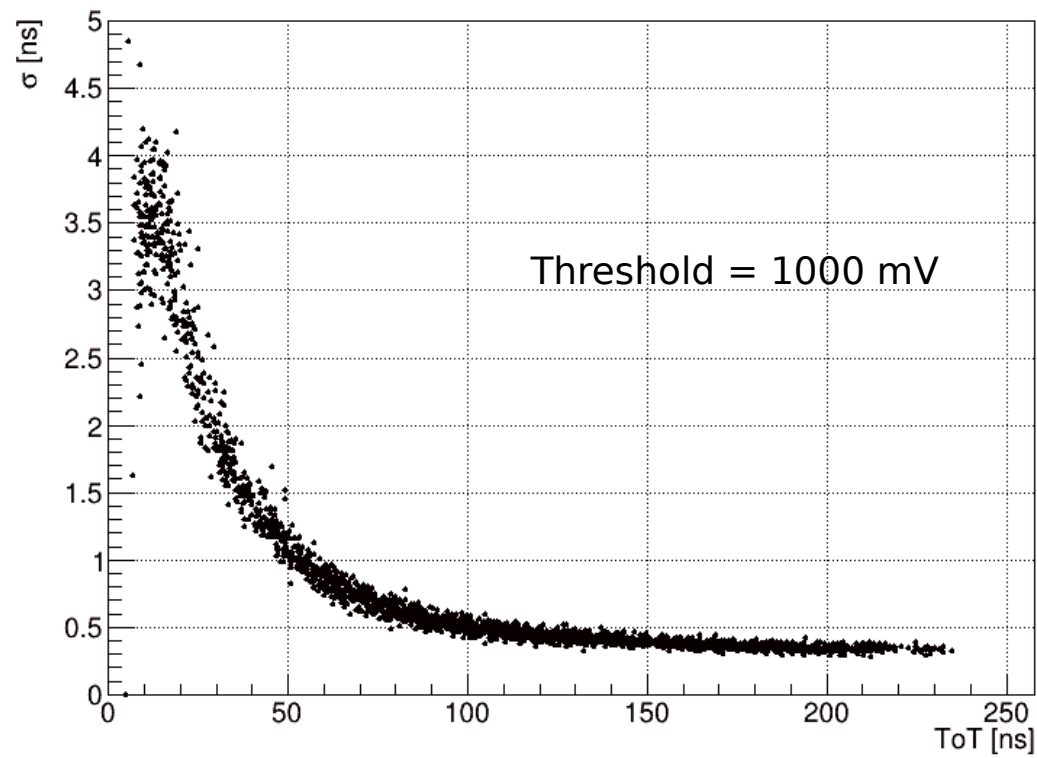Sample standard deviations of 100 waveforms at each position:
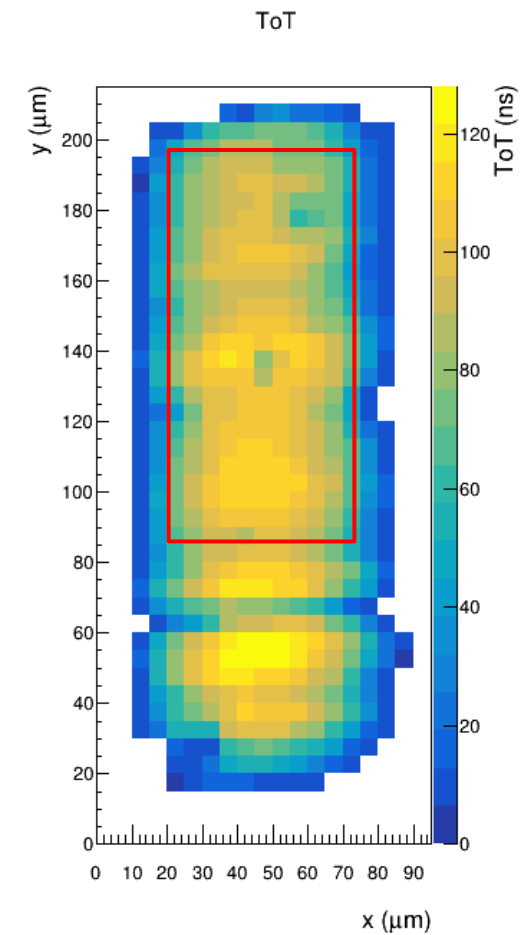

| DAC 40% | DAC 50% | DAC 54% | DAC 56% |

Decreasing beam intensity →

Threshold = 1000 mV

Threshold = 950 mV

Points from a 110 μm x 50 μm area at the center of the pixel

No significant differences between the two thresholds

ToT

Next steps:

Measure ToT calibration: ToT dependence on injected charge
→ We can plot σ vs amount of created charge

Measure jitter via direct charge injection to estimate laser contribution

Measure an irradiated sample ($5 \cdot 10^{14}$ n_{eq}/cm^2)