

# **RD50-MPW2 jitter measurements**

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# RD50-MPW2

Resistivity 1900  $\Omega\text{cm}$

Non-irradiated

Active pixel matrix

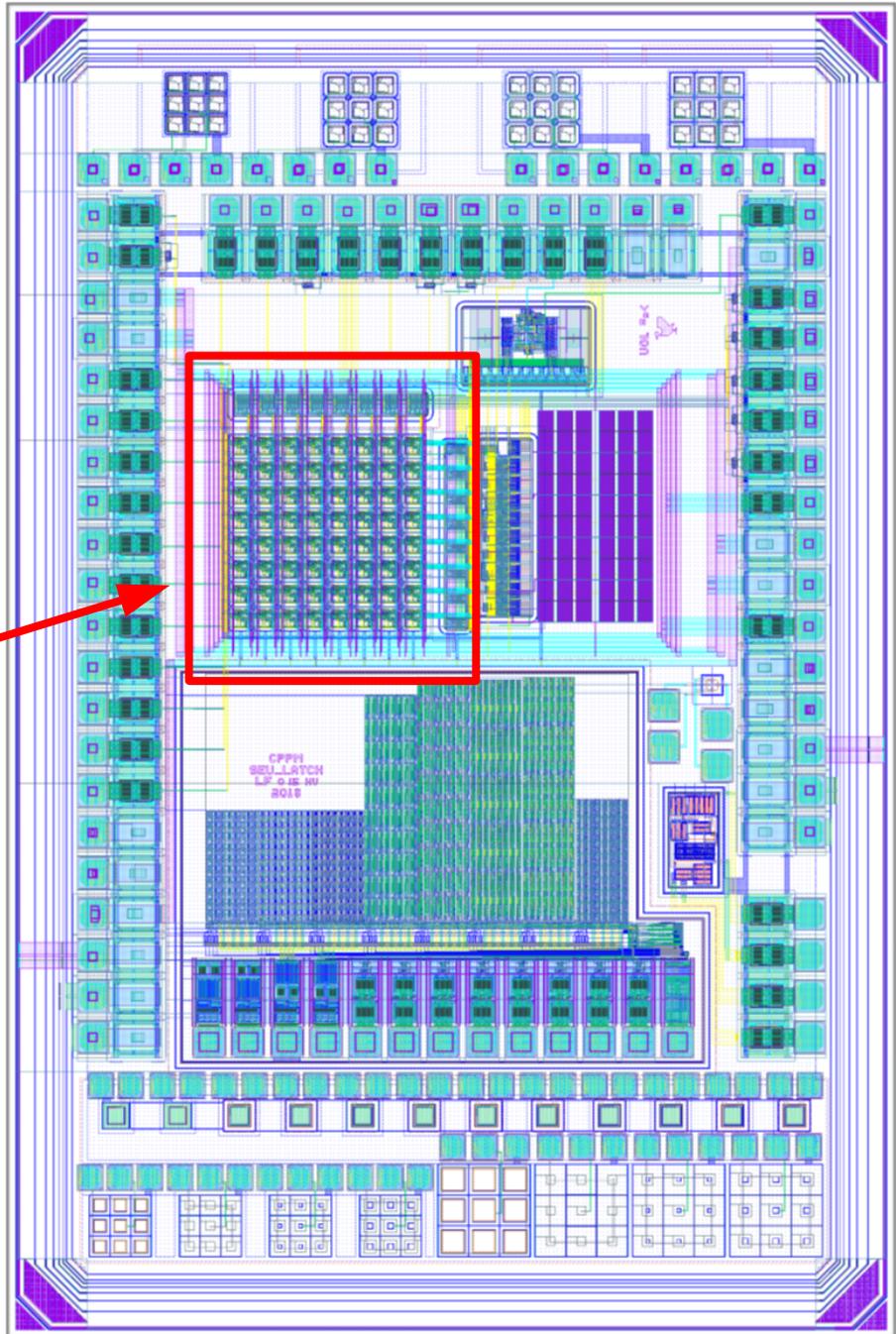
Continuous-reset pixel

Baseline = 900 mV

Threshold = 950 mV and 1000 mV

$V_{\text{bias}} = -100 \text{ V}$

Time over threshold proportional to injected charge

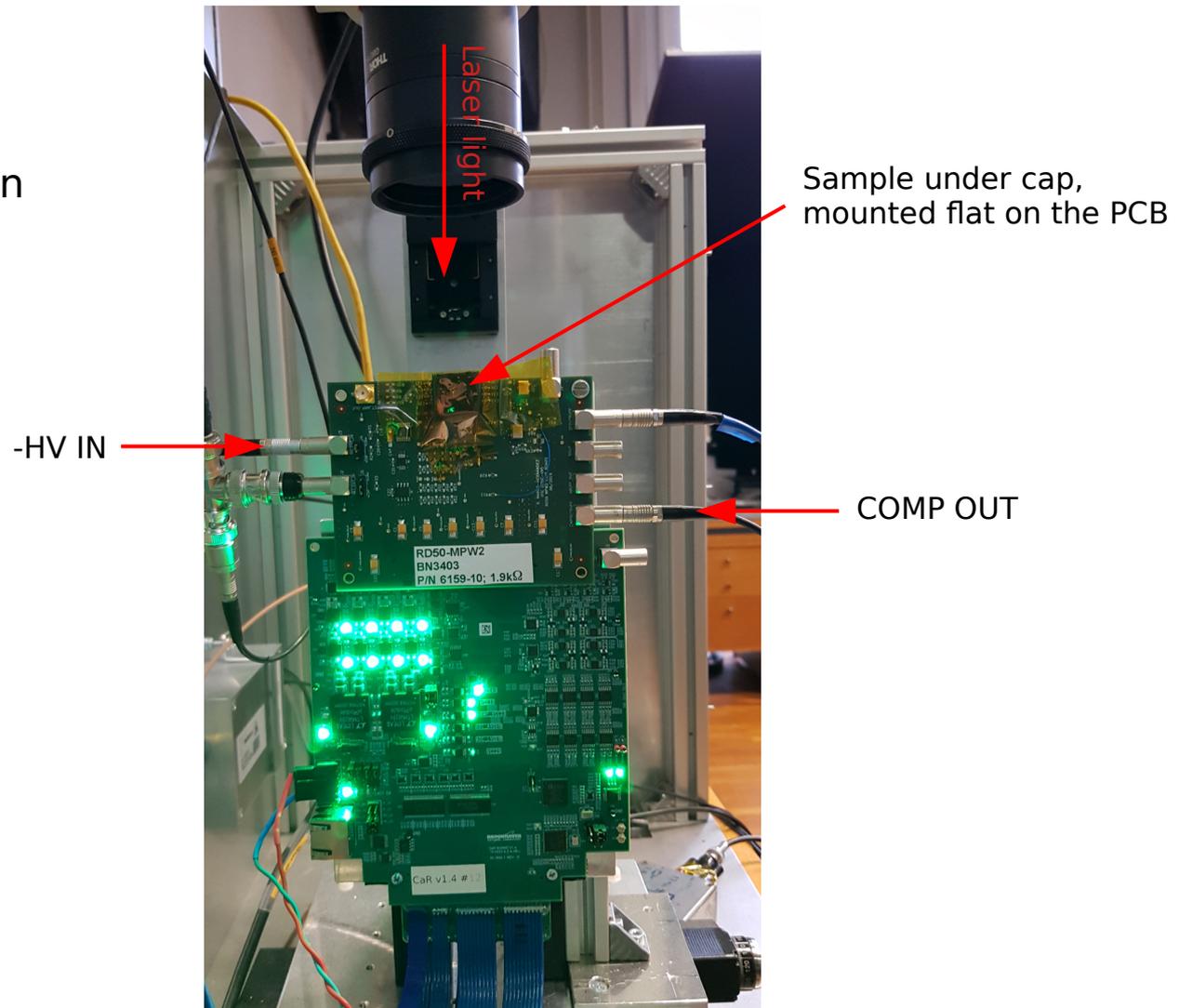


# Setup

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

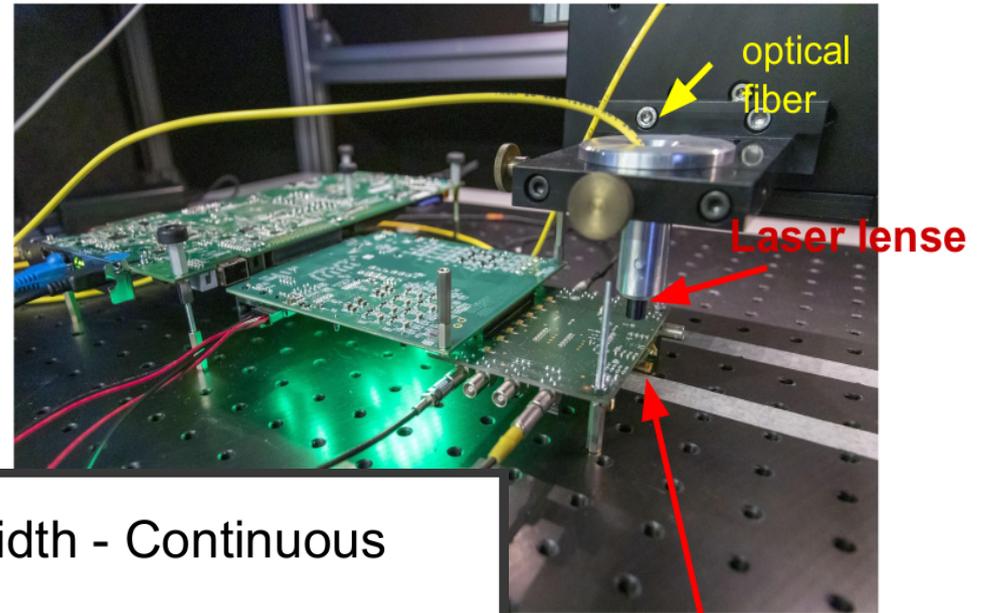
Edge-TCT configuration

1060 nm (IR) light



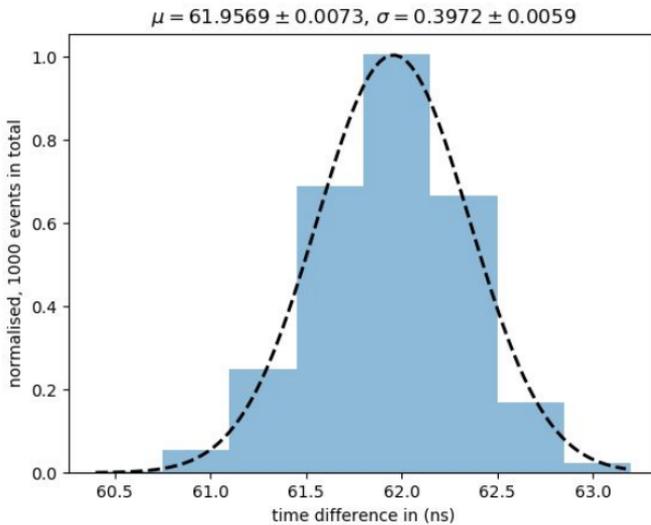
# Similar measurements at the Nikhef Institute

Unfocused laser  
Long laser pulses  
Backside injection

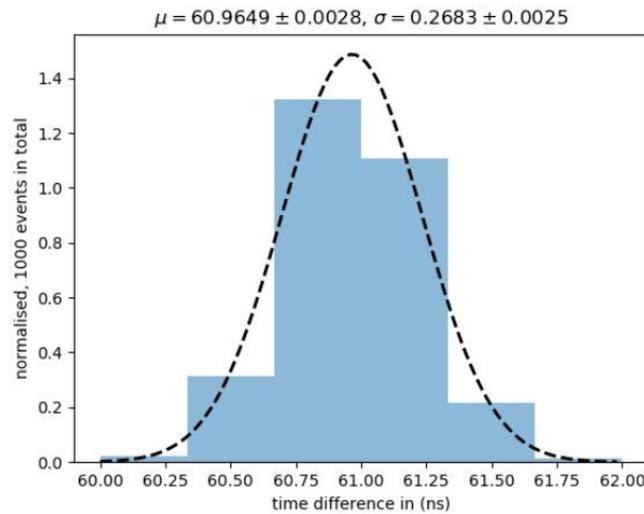


## Time resolution for two different pulse width - Continuous

11ns wide injected laser pulse - Continuous pixel



17ns wide injected laser pulse - Continuous pixel



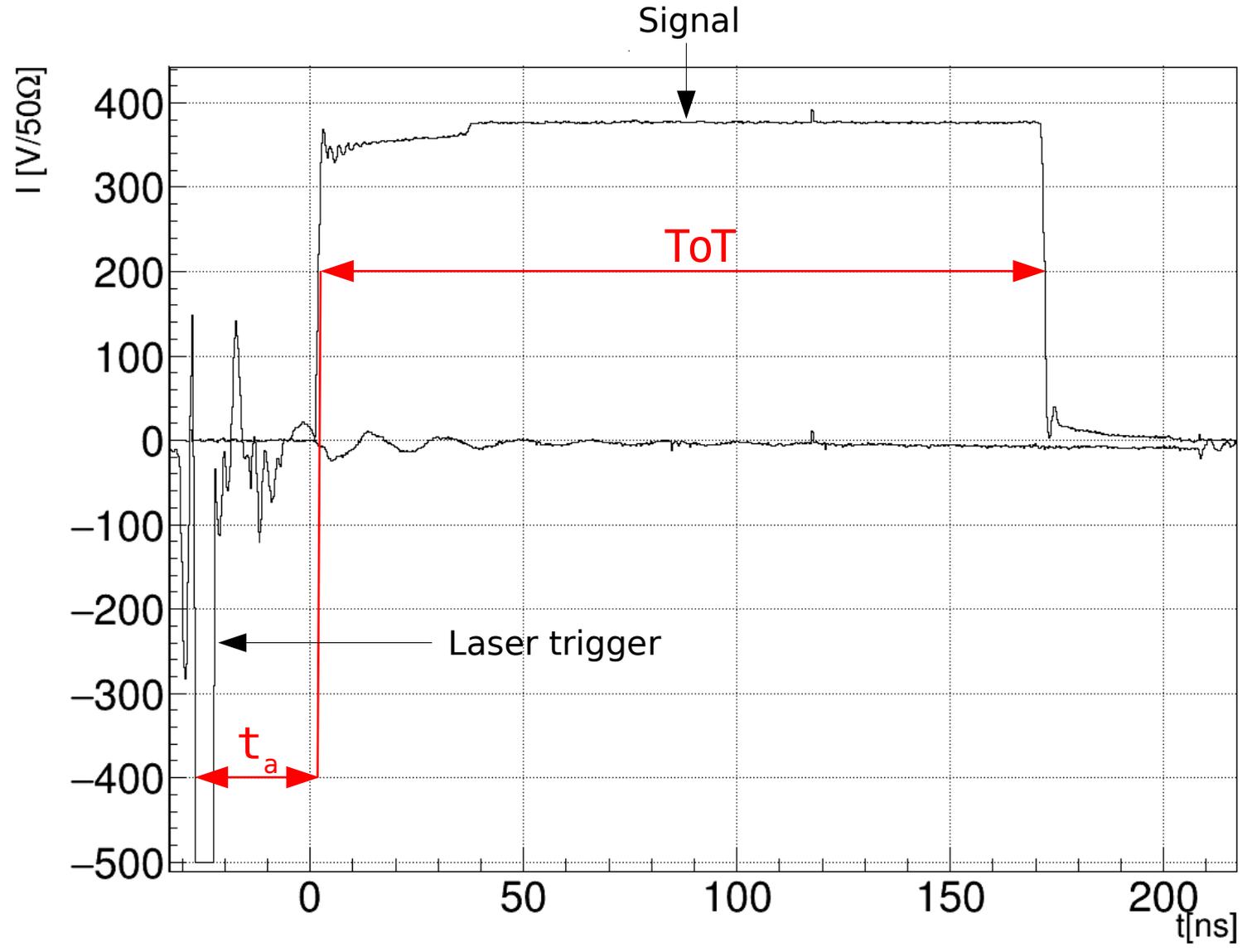
BL= 900, TH=1000, Bias Voltage = -60V

errors = errors from the fitting analysis

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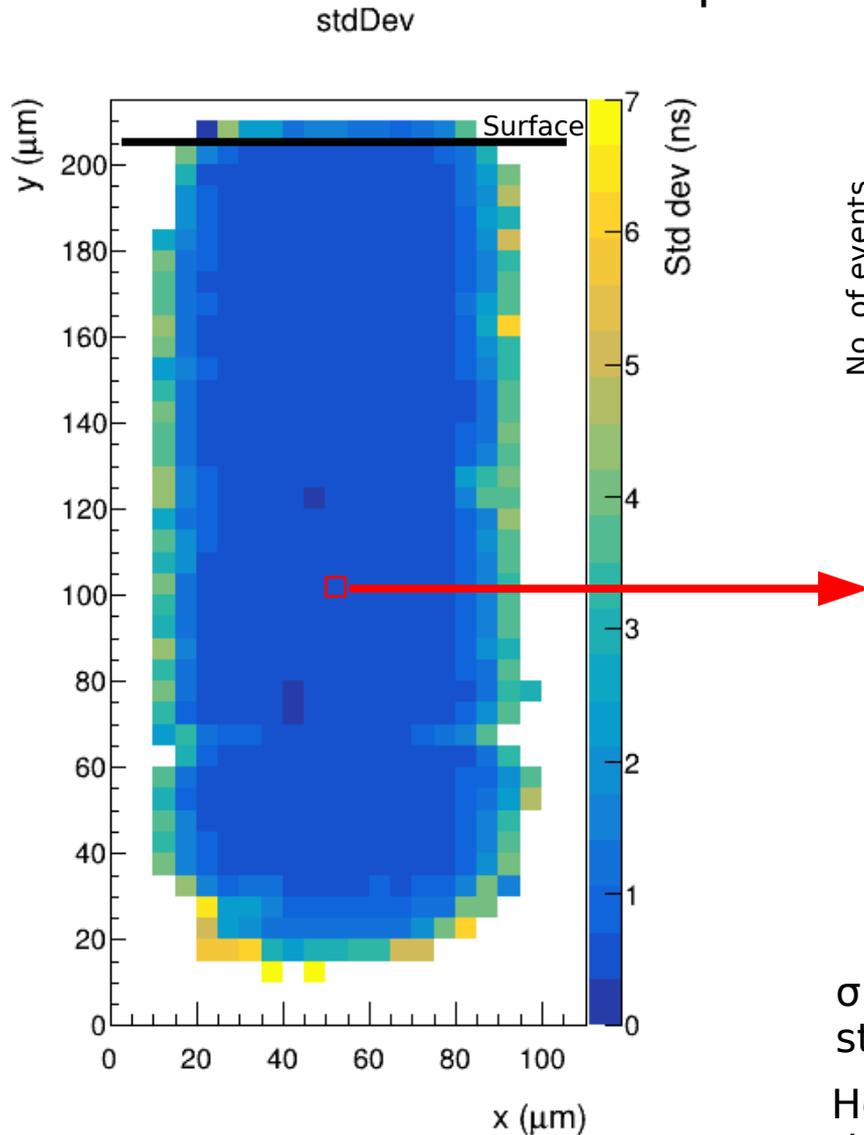
# Measurements

Thresholds:  
200 mV signal  
-400 mV laser

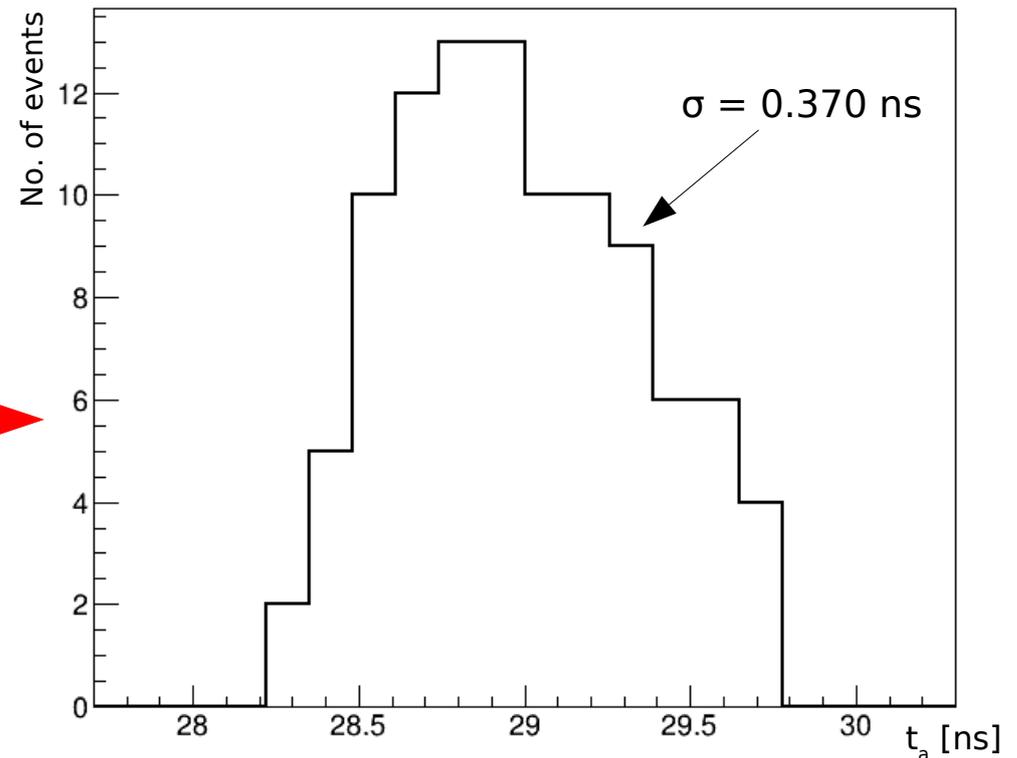


# Measurements

100 waveform samples at each position



Time distribution of signal rising edge



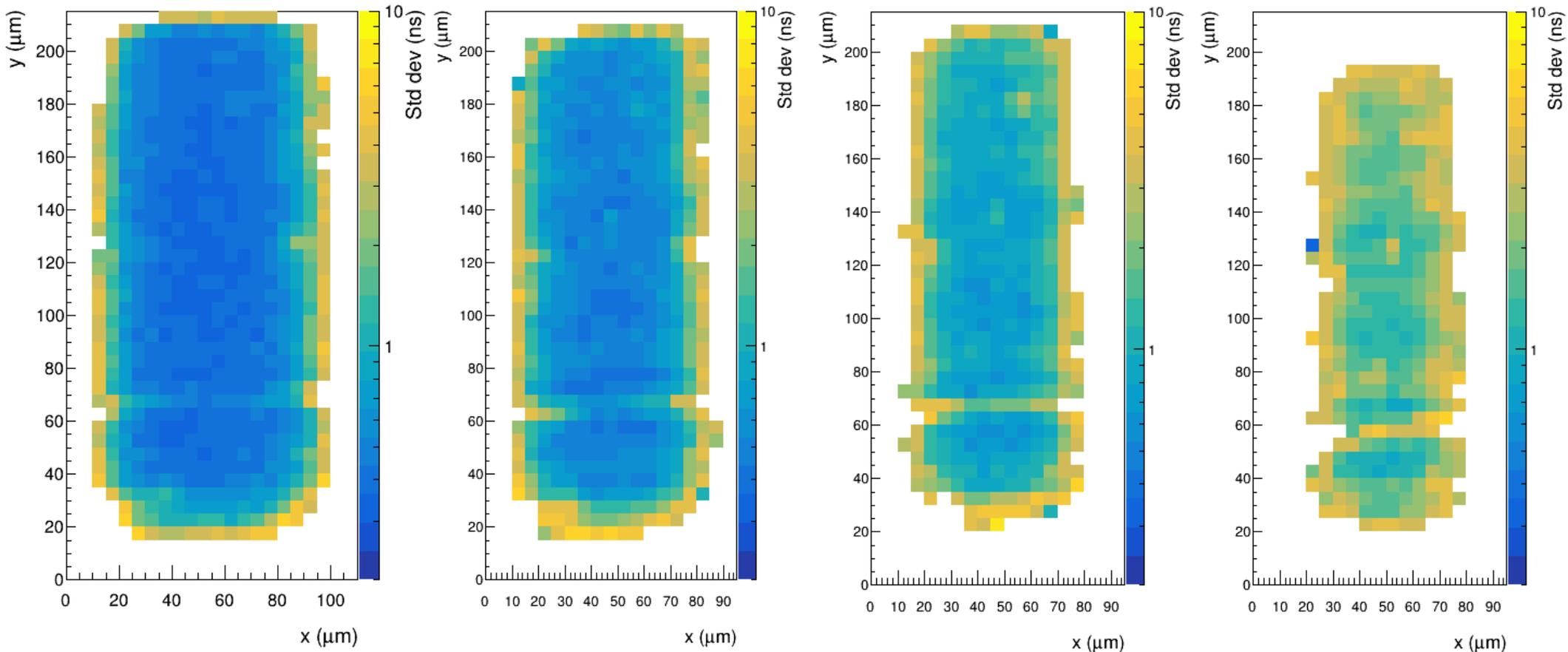
$\sigma$  of spread calculated as the sample standard deviation

How does the spread depend on the signal strength?

# Results

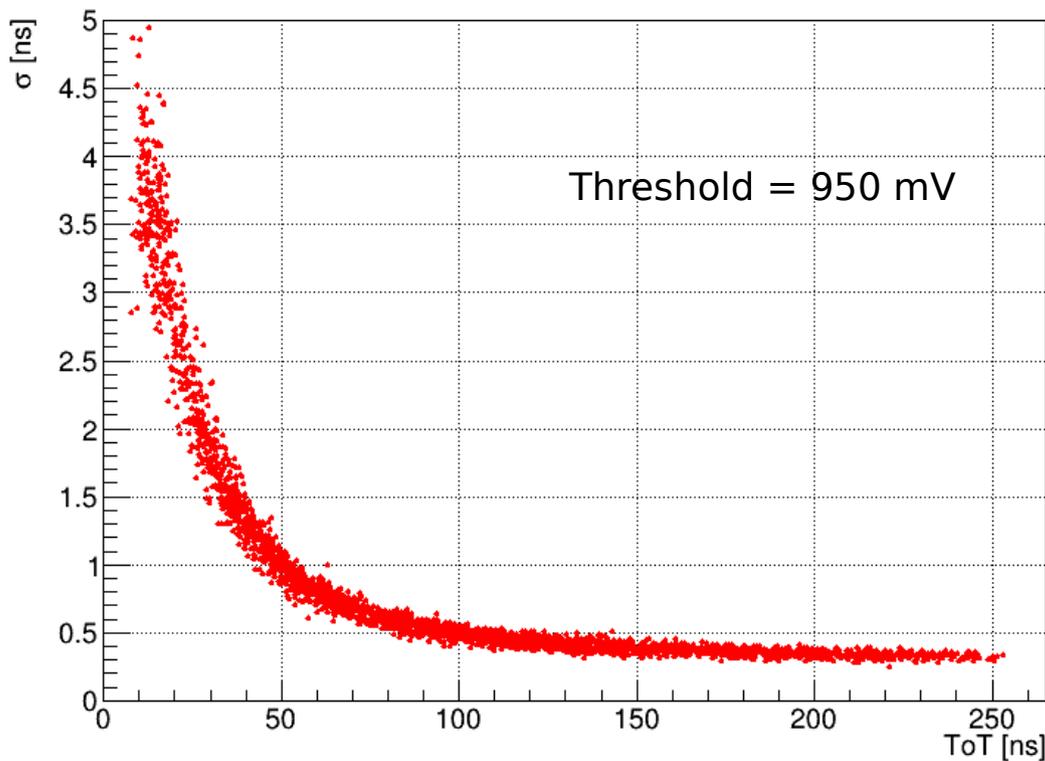
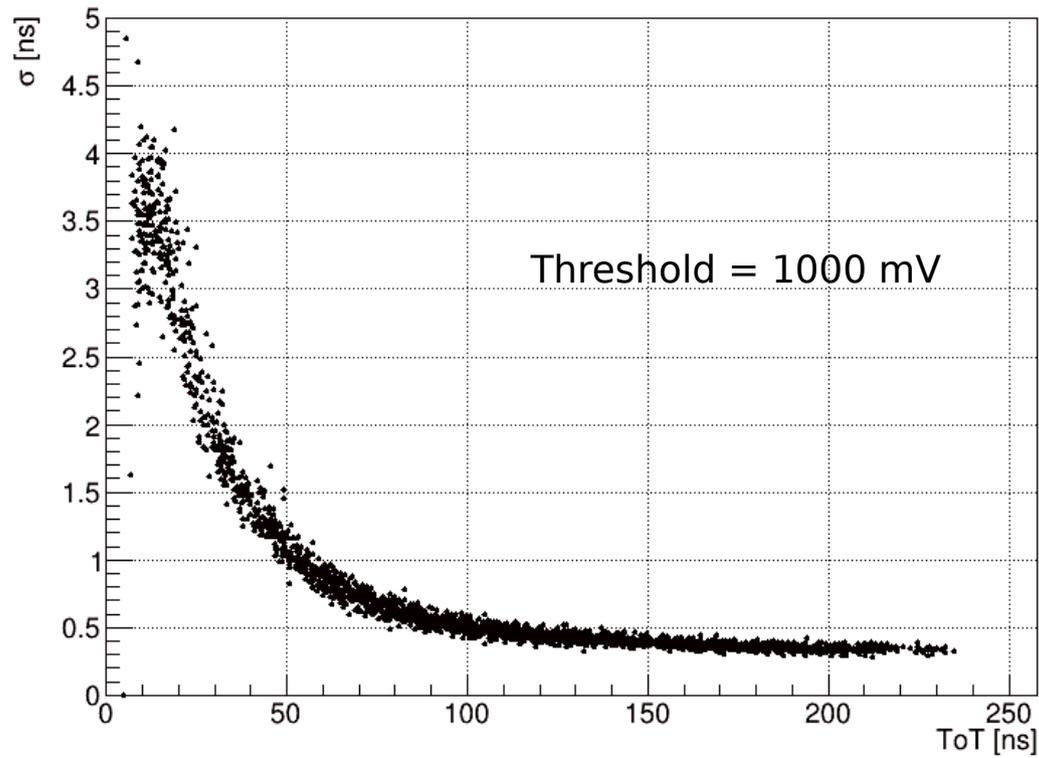
2D scans at different laser beam intensities.  
Jitter uniform throughout the center of the depleted region and increases for weaker pulses.

Sample standard deviations of 100 waveforms at each position in log scale:



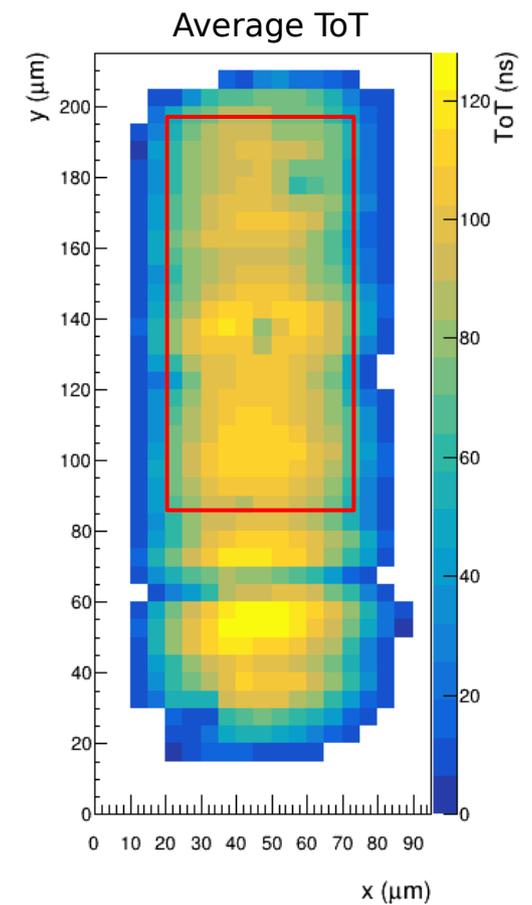
Decreasing beam intensity →

Threshold = 1000 mV



Points from a  $110 \mu\text{m} \times 50 \mu\text{m}$  area at the center of the pixel

No significant differences between the two thresholds



# Conclusions

- Edge-TCT measurements of rising edge jitter for the active pixel at two threshold levels,  $V_{\text{bias}} = -100 \text{ V}$
- Little variation of jitter throughout the center of the depleted region, larger variations at the edges
- For large ToT, jitter is approx.  $\sigma \sim 0.32 \text{ ns}$
- Jitter increases significantly for lower values of ToT (injected charge)
- Comparing with results from Nikhef, the minimum  $\sigma$  is slightly larger ( $\sim 0.32 \text{ ns}$  compared to  $\sim 0.27 \text{ ns}$  at Nikhef). Larger jitter for weaker laser pulses is consistent with Nikhef measurements

Next steps:

Measure ToT calibration: ToT dependence on injected charge

→ We can plot  $\sigma$  vs amount of created charge

Measure jitter via direct charge injection and stability of laser pulses to estimate laser contribution

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

# Backups

Sample standard deviations of 100 waveforms at each position (normal scale):

