

TPA Laser Experiment MPW2 Preliminary Results

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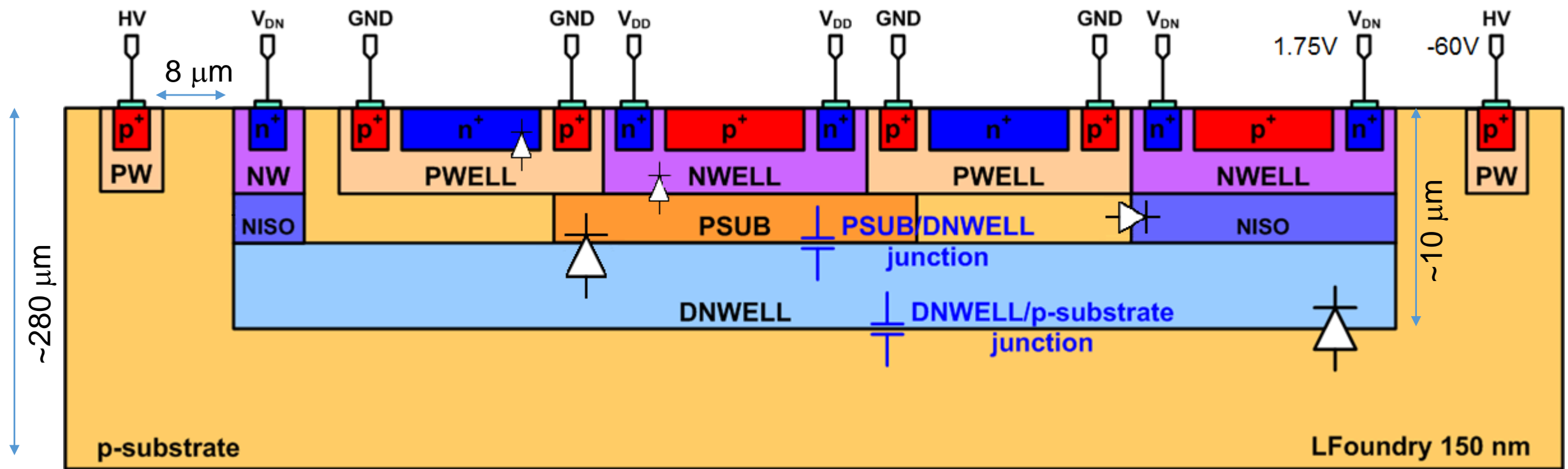
^c TU Dortmund University



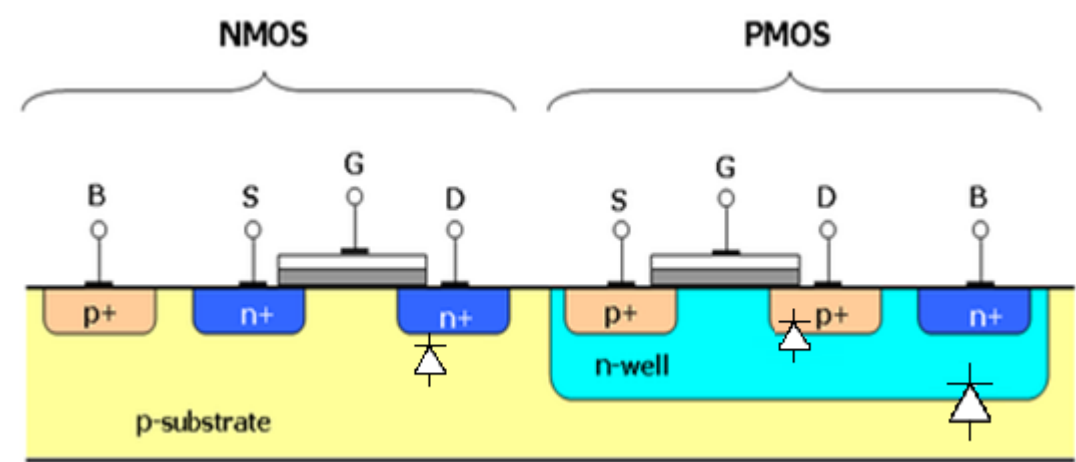
July 21th 2022 <https://indico.cern.ch/event/1184355/>

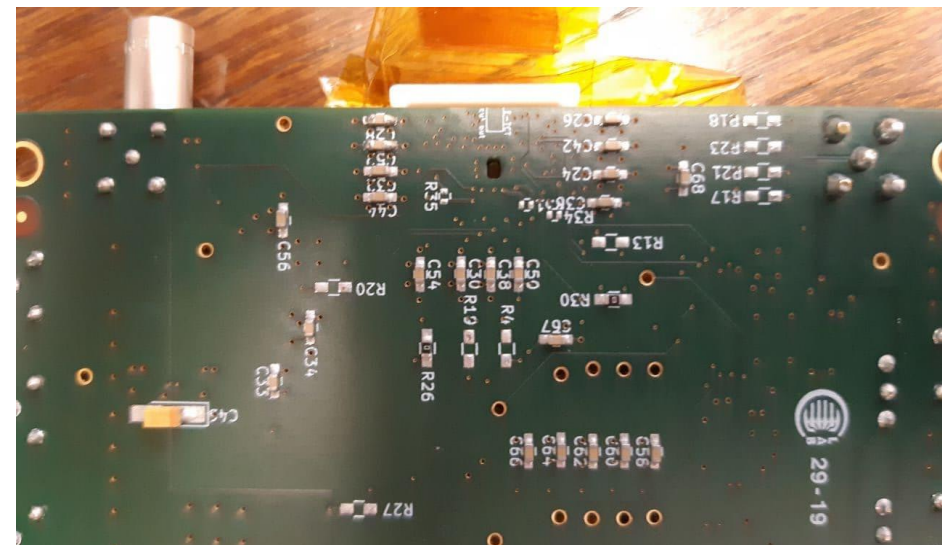


General Description

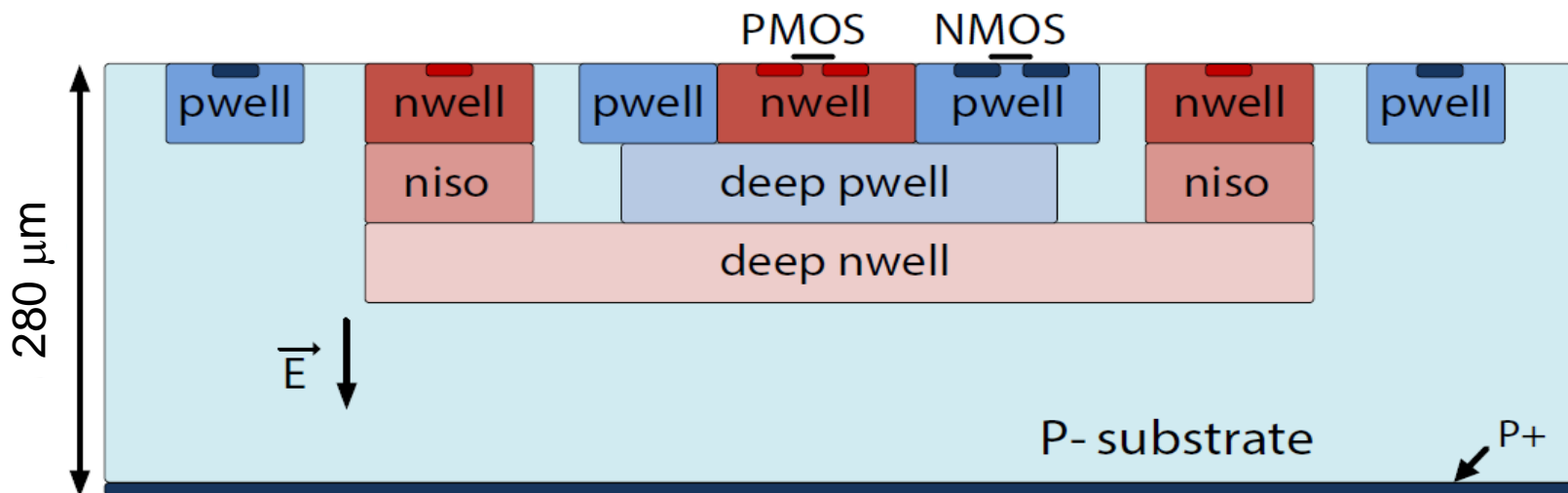
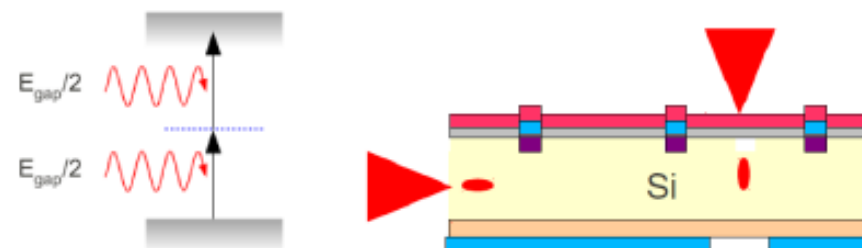
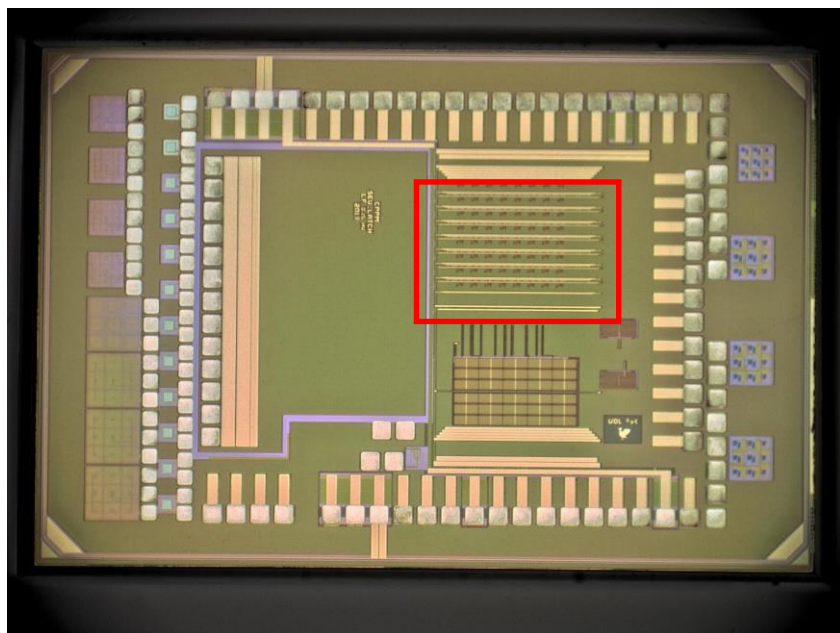


The experiment purpose is to get signals from the chip under femtosecond TPA laser excitation at different chip depths (z-scan mode). The hope is to get signals from every pixel layer in order to classify them as proper detections (dnwell-psubs diode), parasitic detections (other inter-layers reverse biased pn diodes) or single event effects (laser voxel in the electronics zone, near to the die Surface, signal produced by the pn isolating diodes between the diffusion and the embedding well)





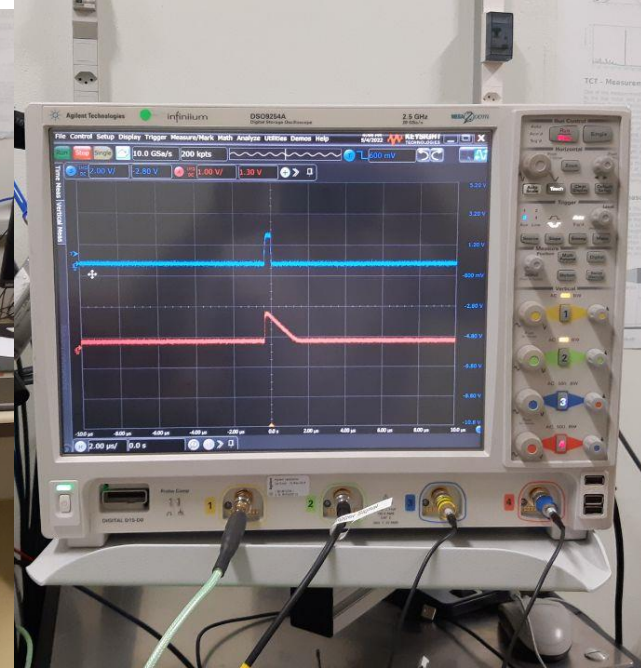
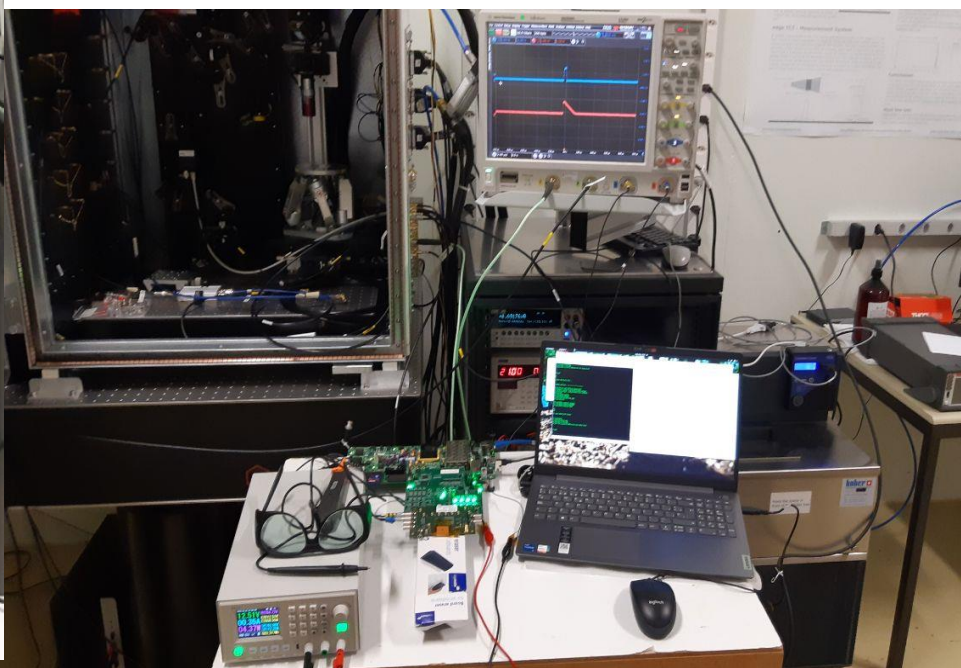
The MPW2 card has a window to the MPW2 chip, designed for backside laser illumination. At 1550 nm, 400 fs, the silicon is transparent below a light intensity threshold so the photoionization (light absorption) happens only around the focus point (voxel volume). A z-scan means to precisely position the voxel volumen along different die depths, also moving the beam along the pixel area. That way any particular volume can be excited to generate a signal in the collecting electrodes.

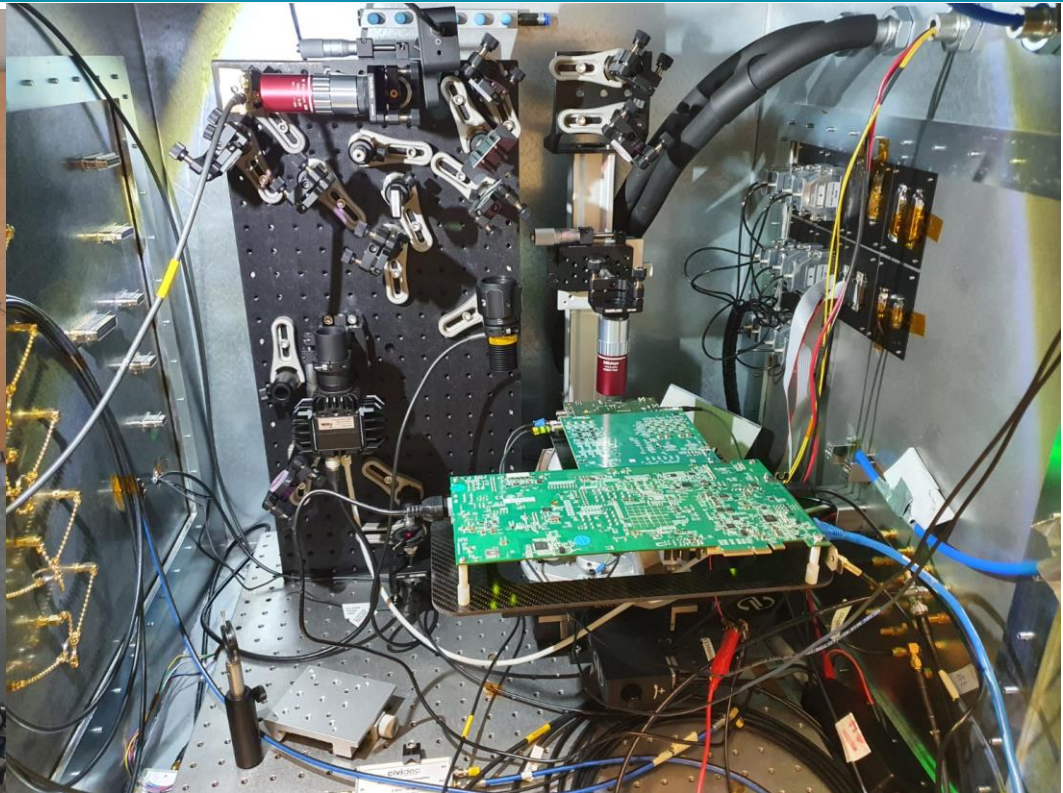


General Description



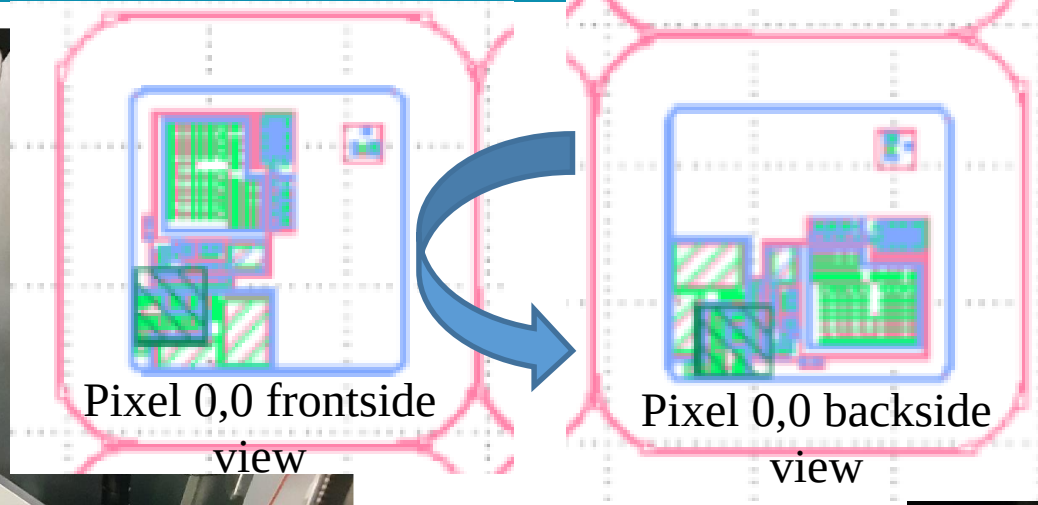
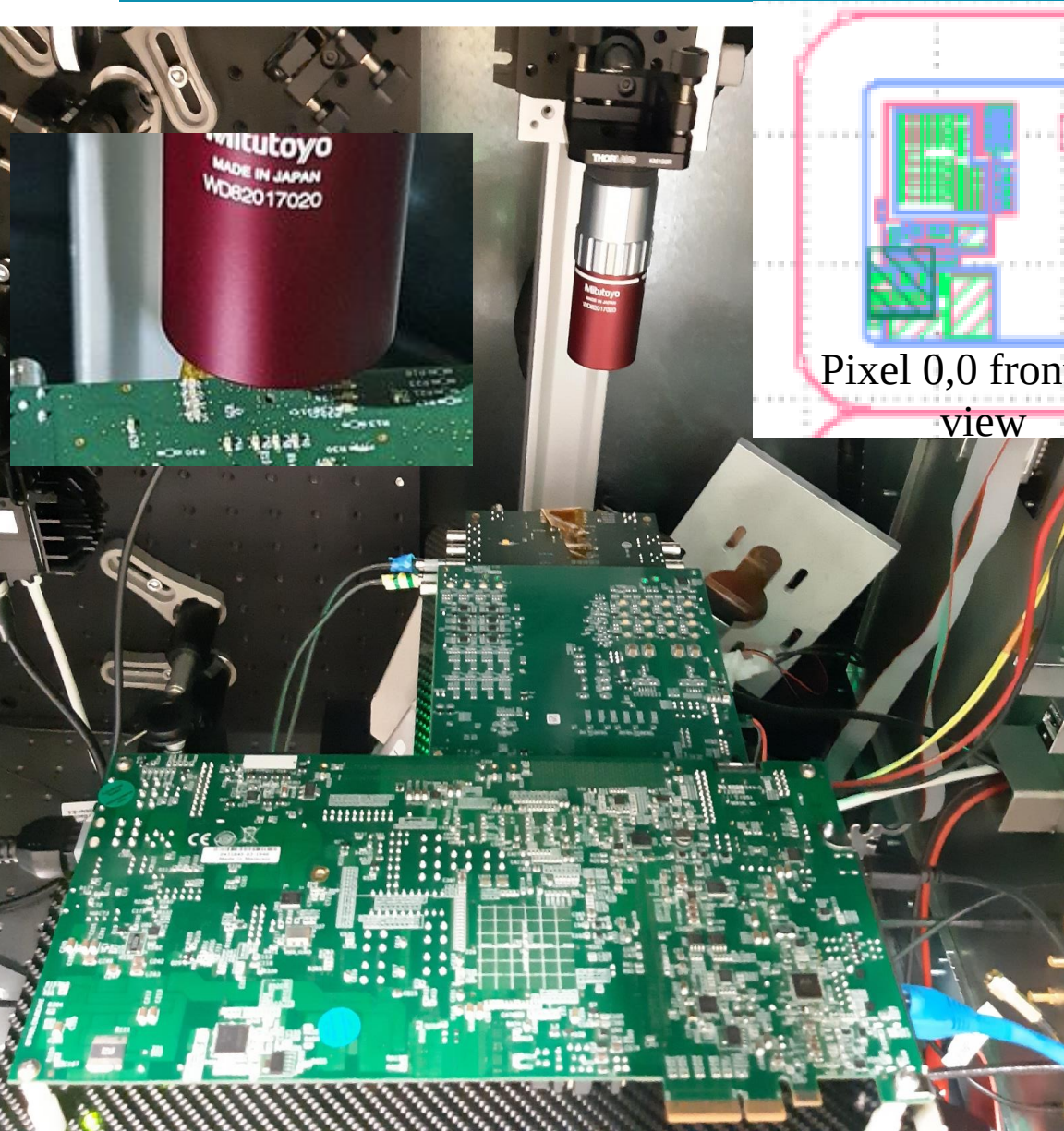
SSD Laser for TPA
1550 nm, ~400 fs,
magnetoacoustic pulse
picker (selectable single
shots). Different depths
by focusing, different
XY positions by a hexa-
pod platform, EMI iso-
lated, batiment 28
basement@CERN



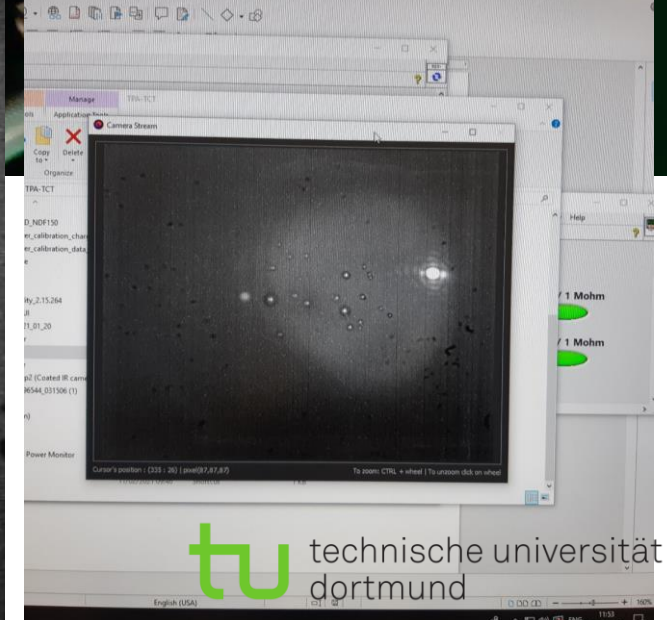
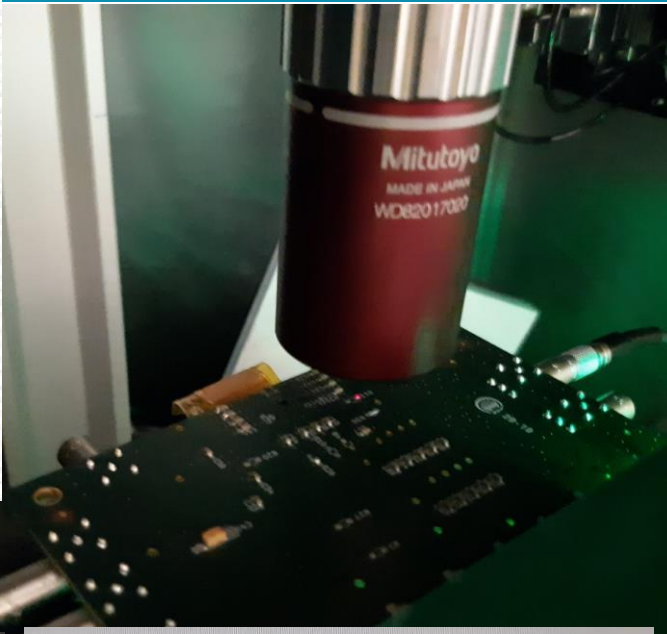
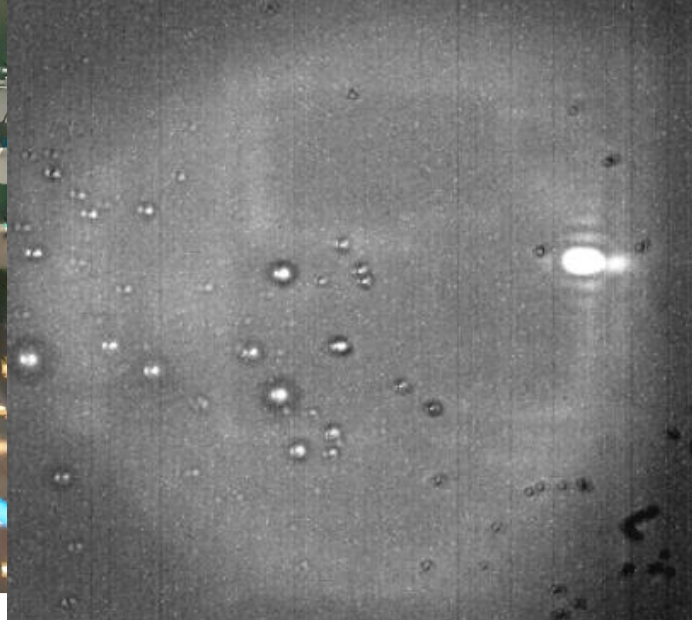


MPW2 + Caribou + FPGA
in the setup, mounted on a
costume made rigid carbon
fibre holder manufactured
by Ruddy Constanzi (SSD,
CERN)

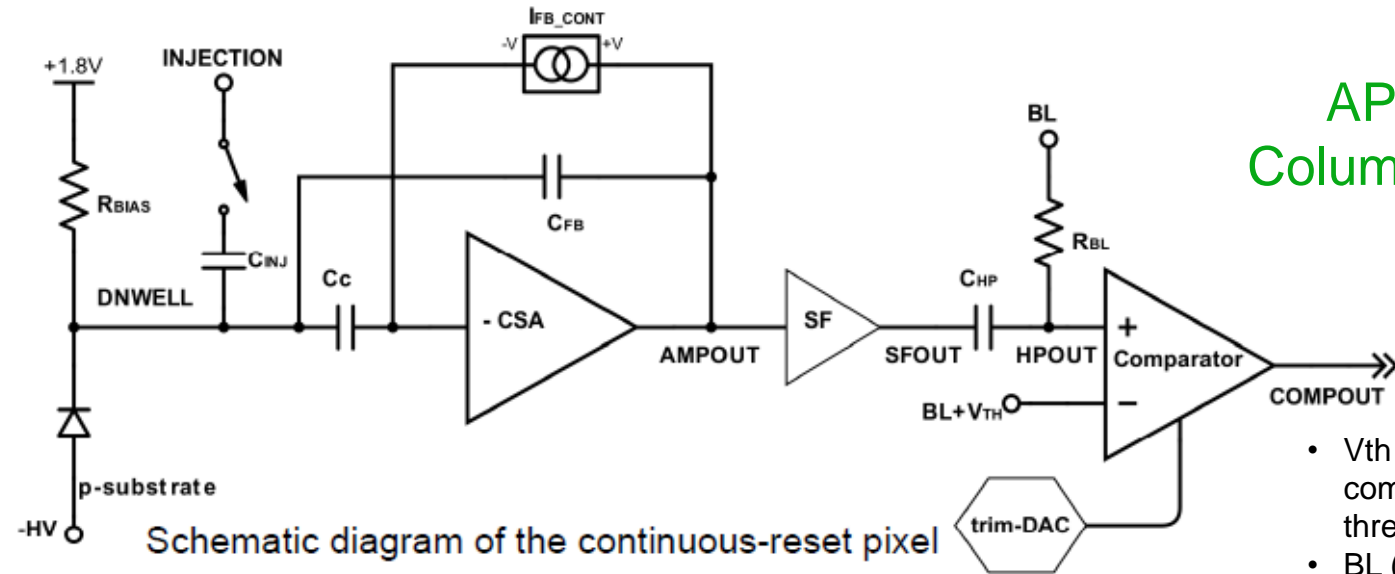
Locating the target (backside shot)



Pixel 0,0 under the IR microscope (backside)



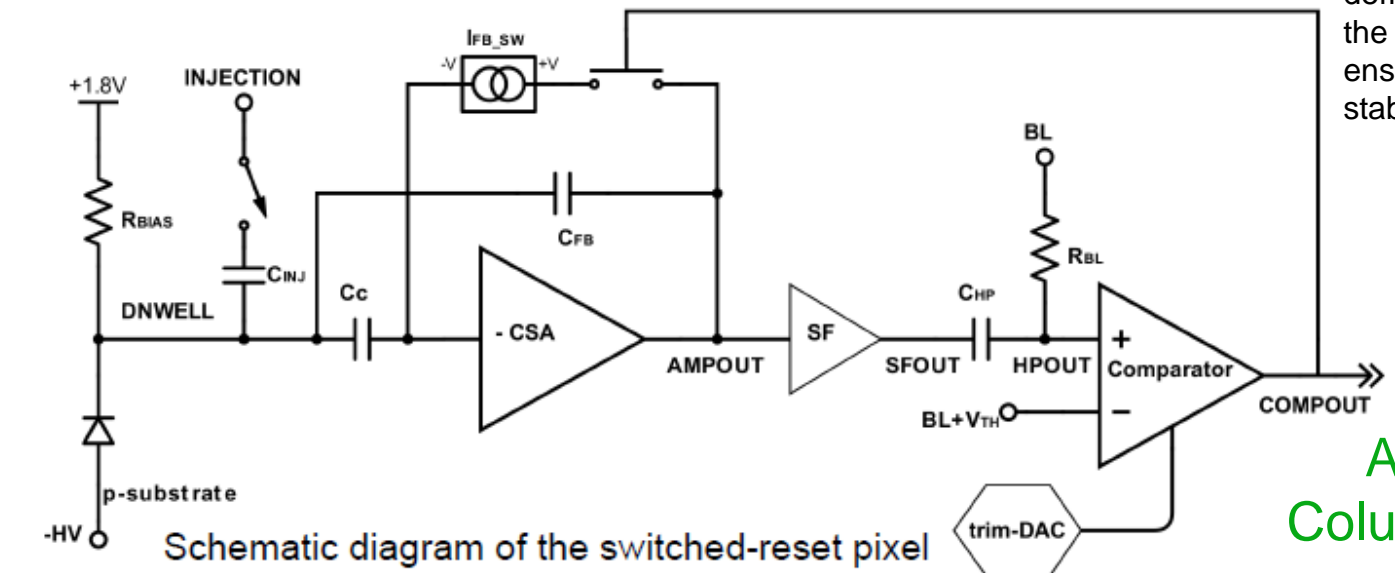
MPW2 Pixels



Schematic diagram of the continuous-reset pixel

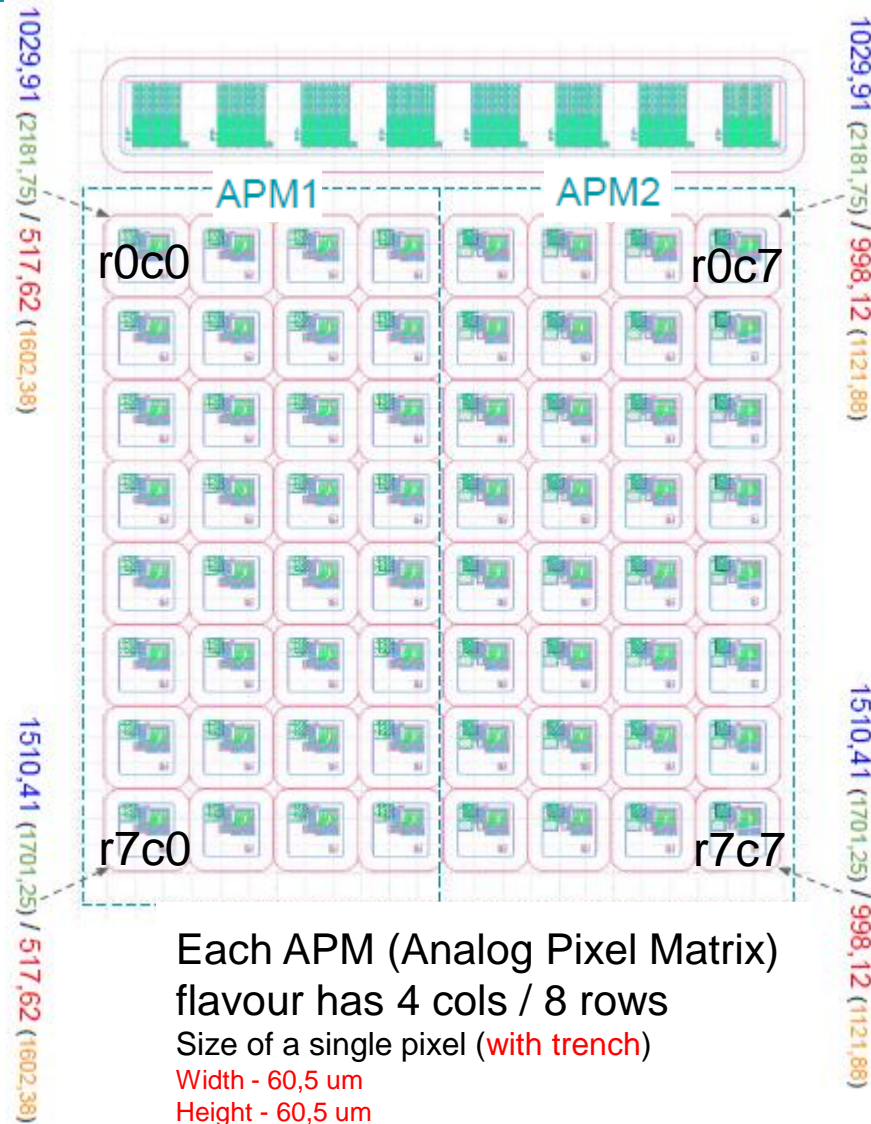
APM1
Columns 0-3

- V_{th} defines the comparator threshold
- BL (baseline) defines an offset to the analog output to ensure signal stability



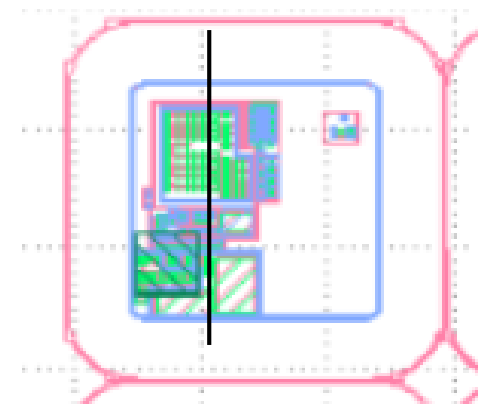
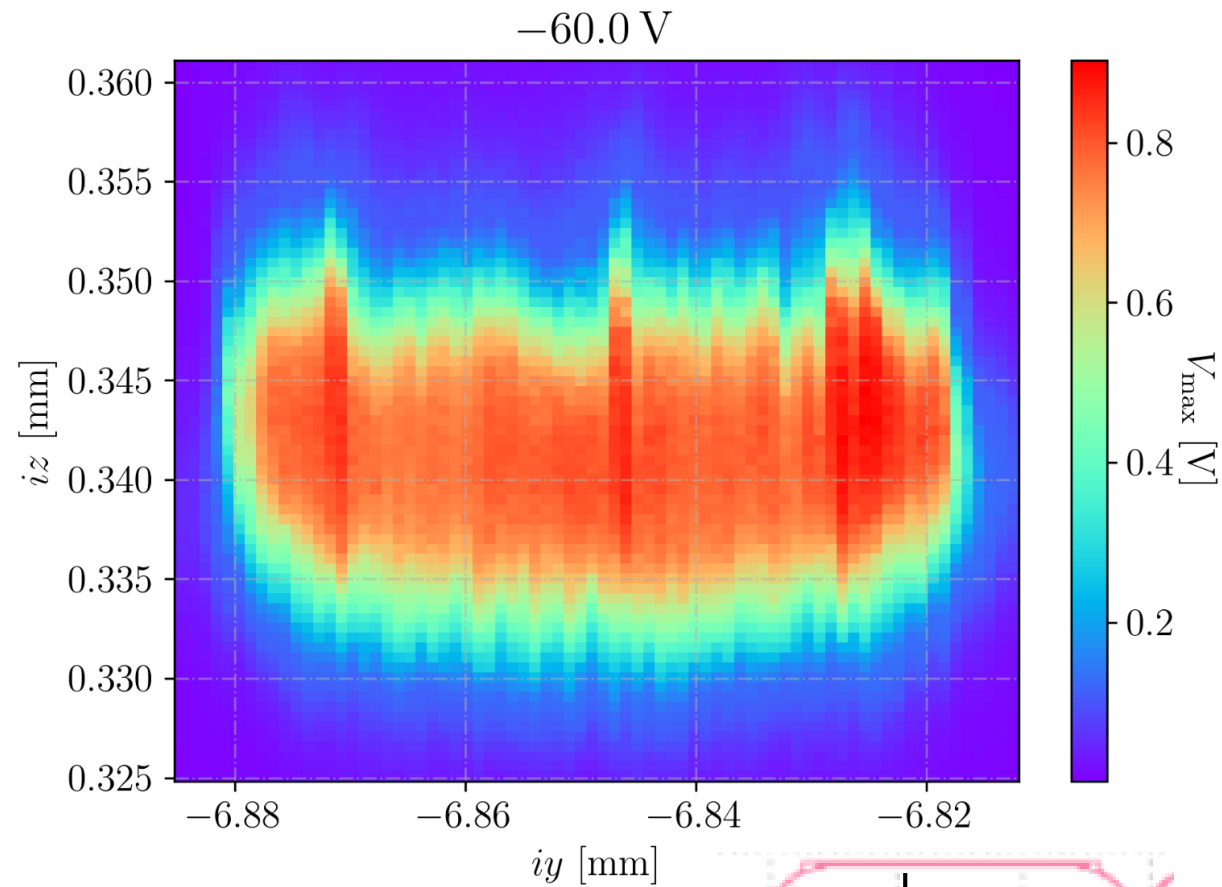
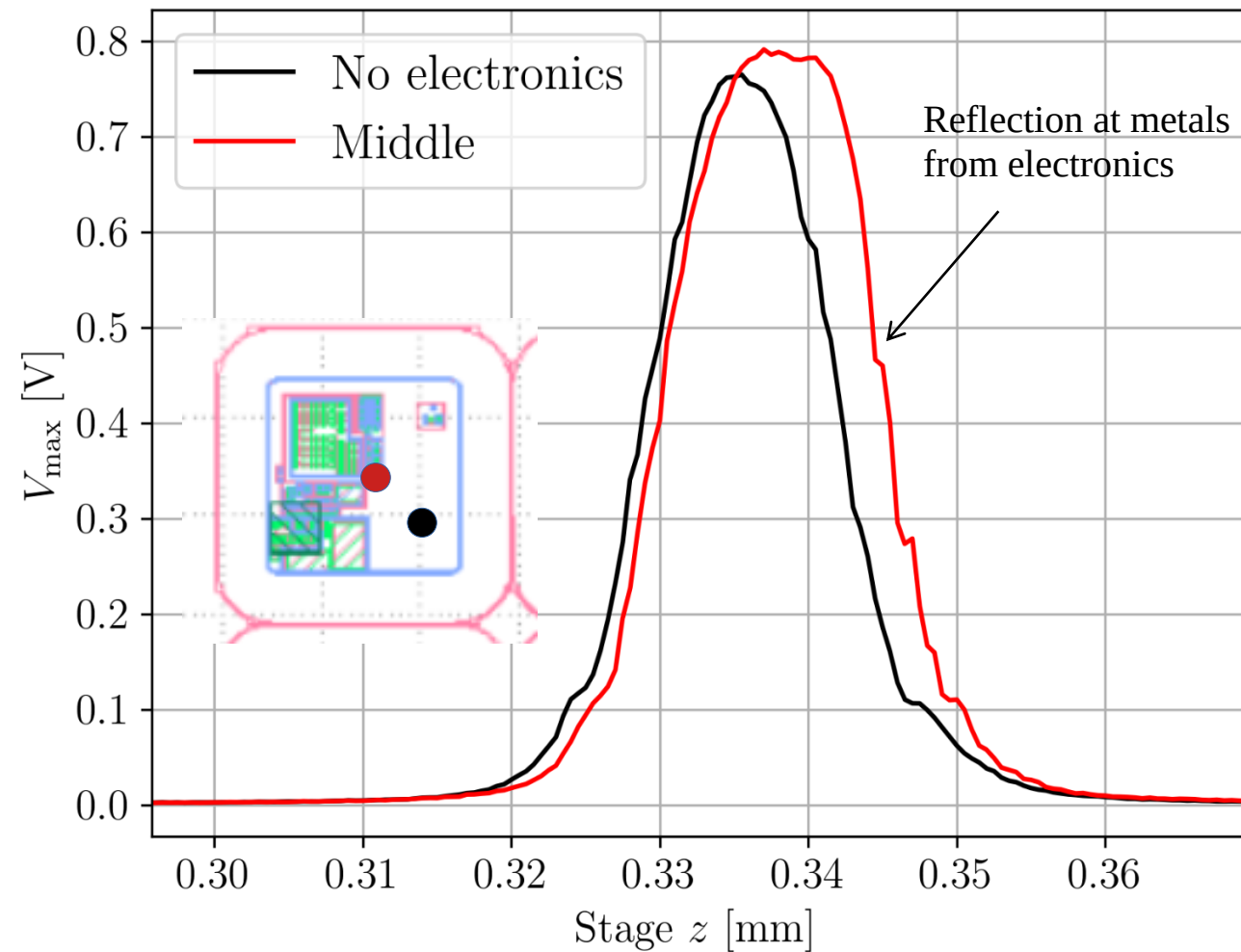
Schematic diagram of the switched-reset pixel

APM2
Columns 4-7



Each APM (Analog Pixel Matrix) flavour has 4 cols / 8 rows
 Size of a single pixel (with trench)
 Width - 60,5 um
 Height - 60,5 um
 Size of a single pixel (without trench)
 Width - 39,68 um Trench_w - 20,3 um
 Height - 39,68 um Trench_h - 20,3 um

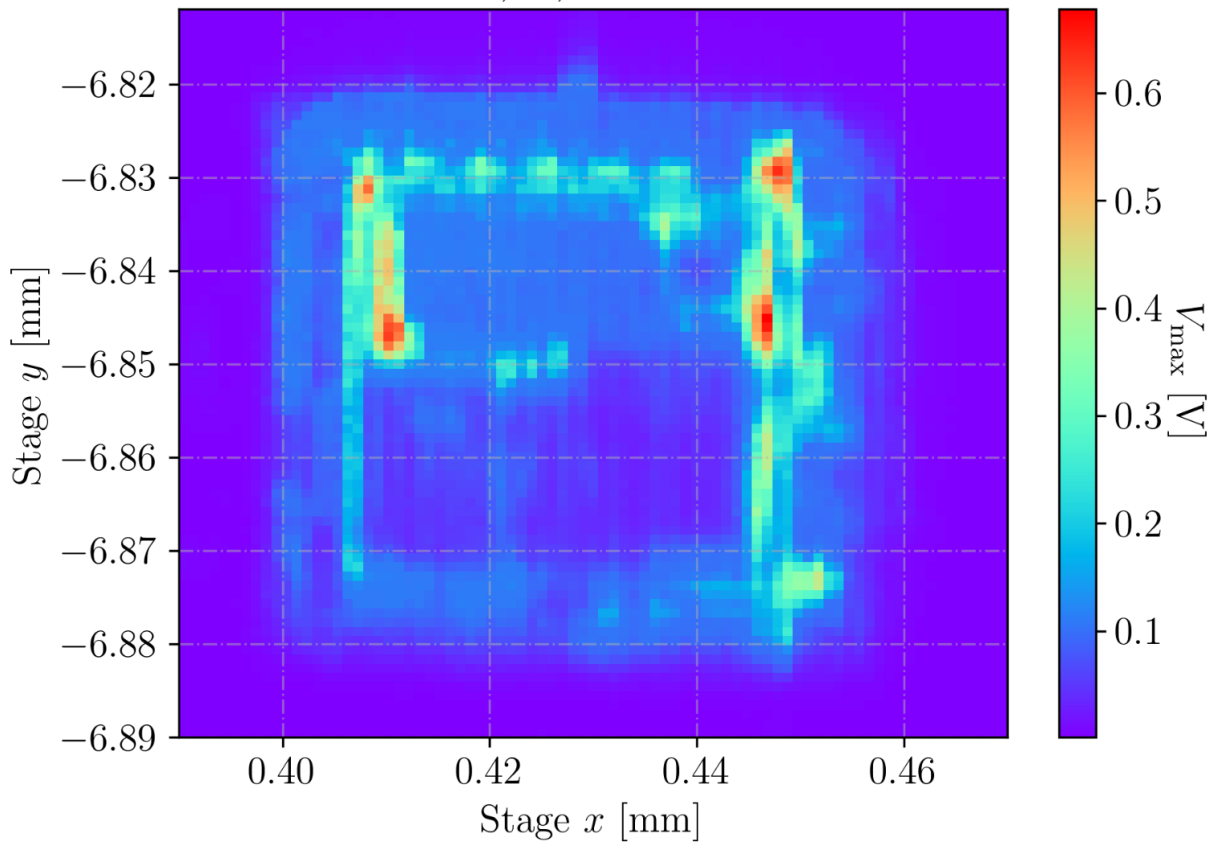
Pixel 0,0 (APM1)



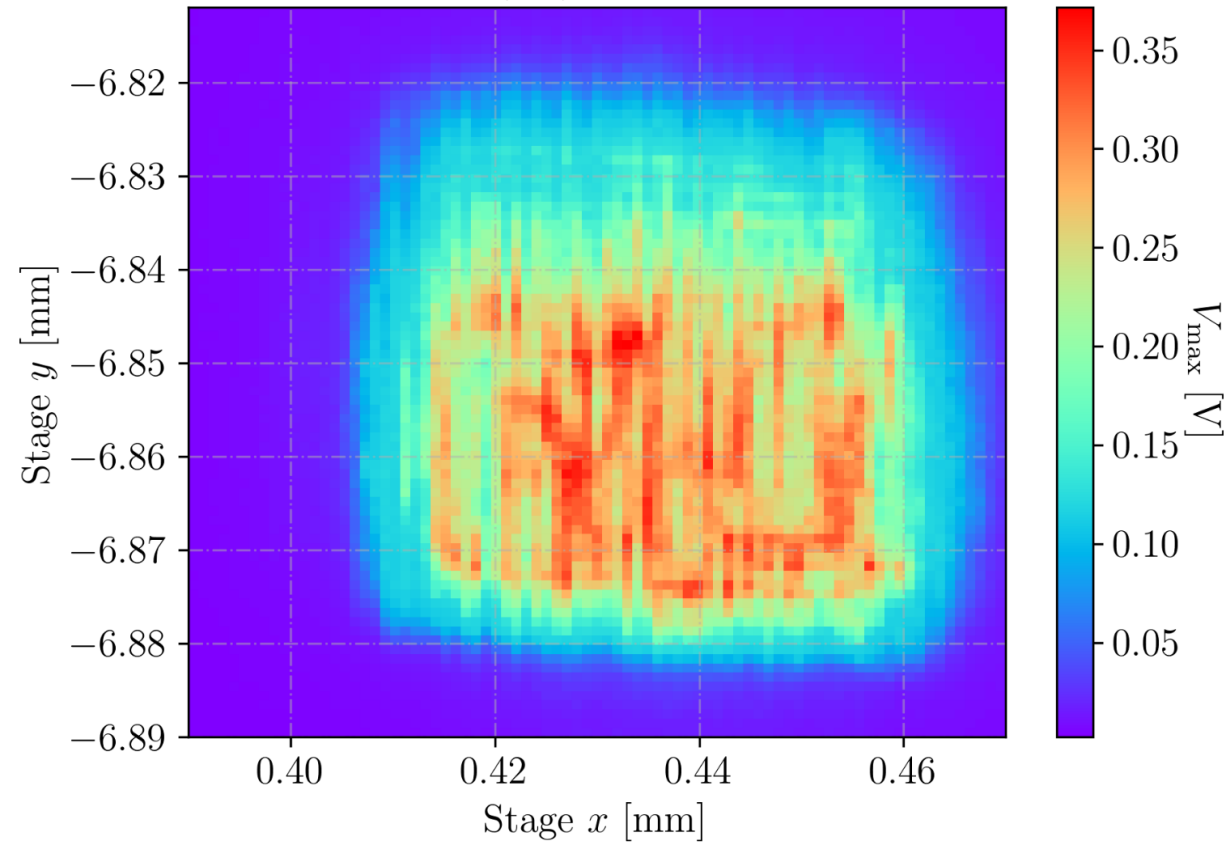
XY-Scan with focus at the top side electronics:

XY-Scan with focus at the back side:

Pixel: r0,c0, Bias: -60.0 V



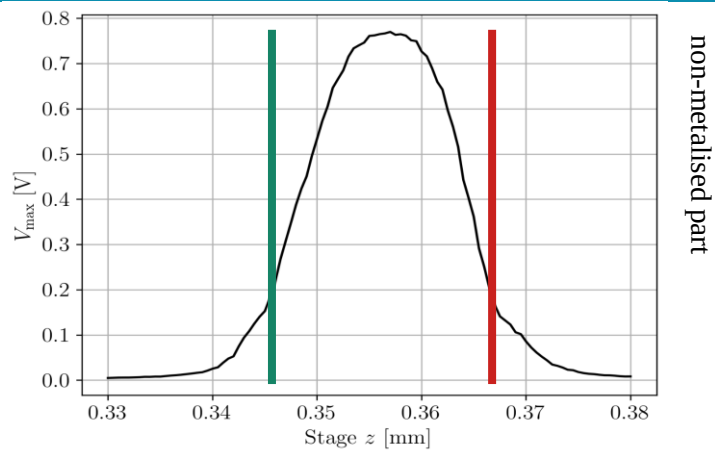
Pixel: r0,c0, Bias: -60.0 V



Pixel 1,1 (APM1)

2022_07_11_16_53_15_MPW2
 2022_07_11_17_14_49_MPW2
 2022_07_11_19_31_19_MPW2

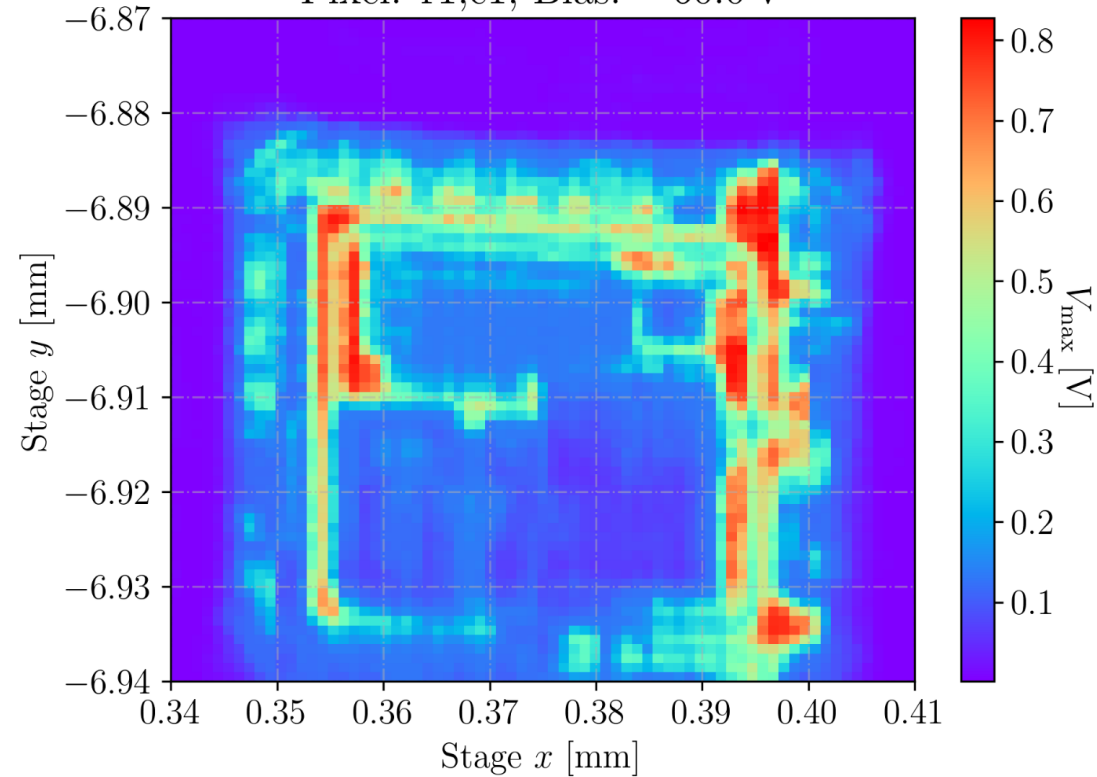
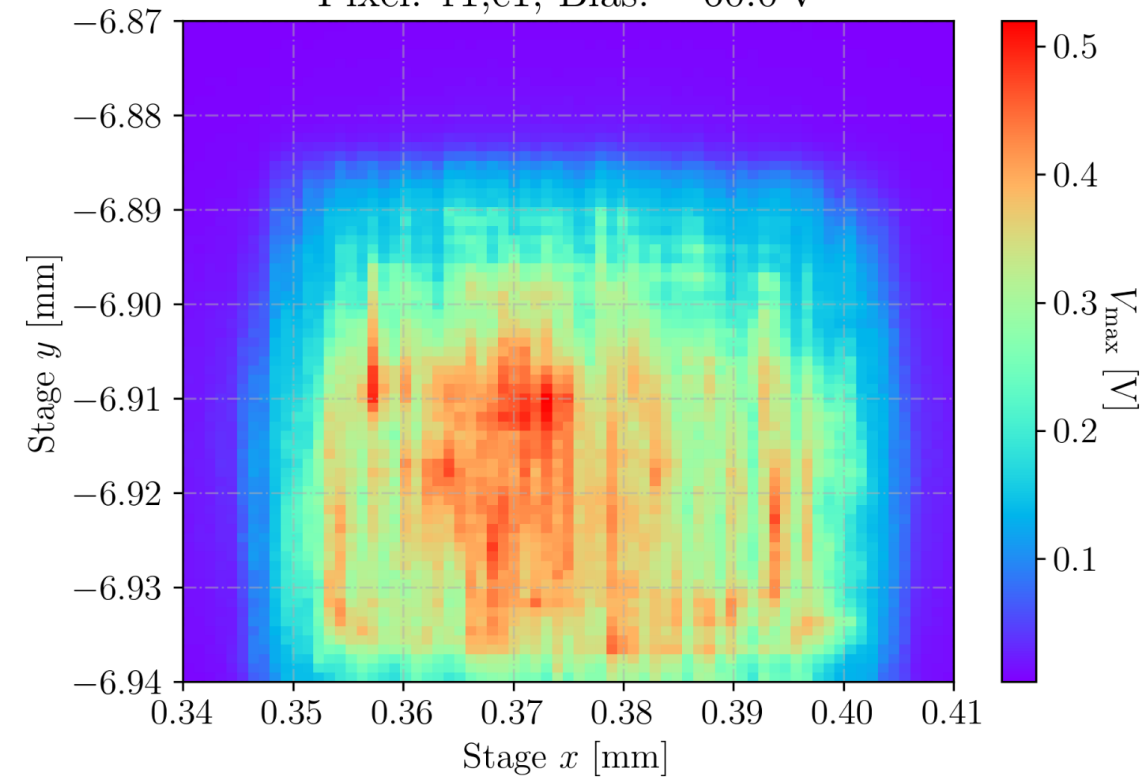
XY-Scan with focus at the back side:



XY-Scan with focus at the top side electronics:

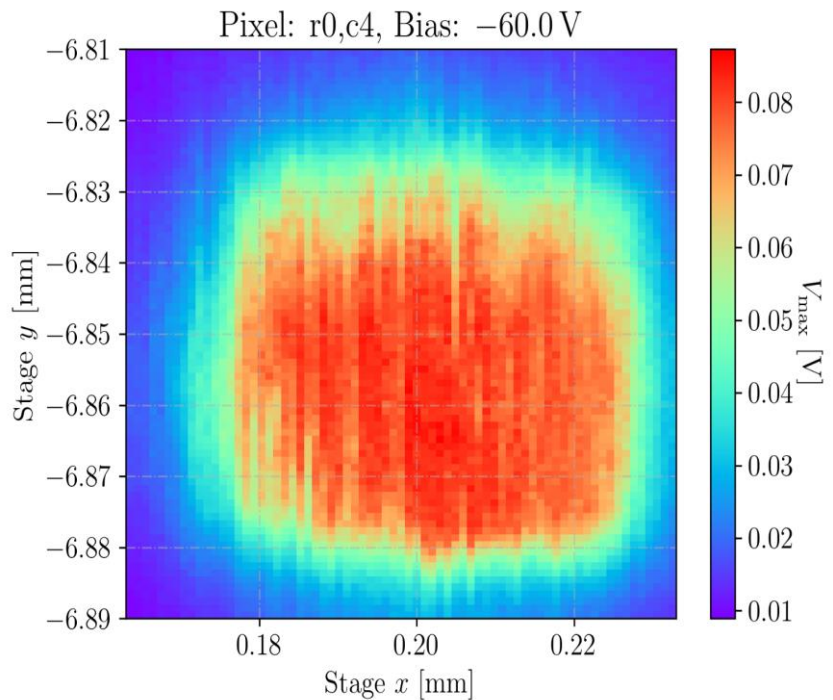
Pixel: r1,c1, Bias: -60.0 V

Pixel: r1,c1, Bias: -60.0 V



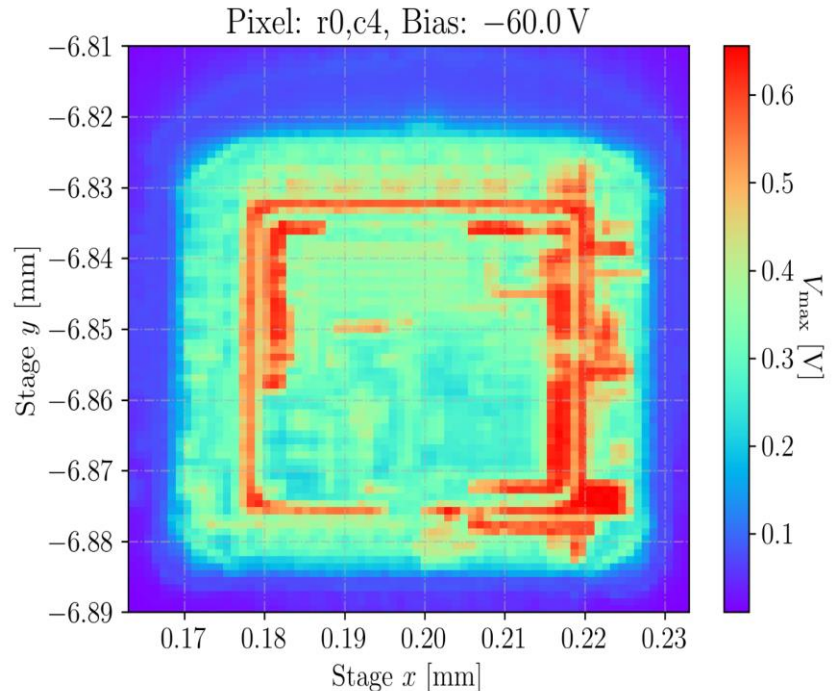
Pixel 0,4 (APM2)

XY-Scan with focus at the back side:

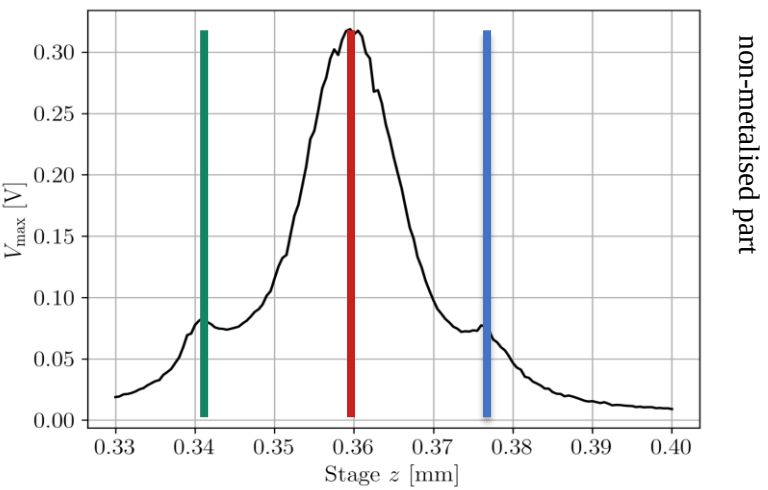
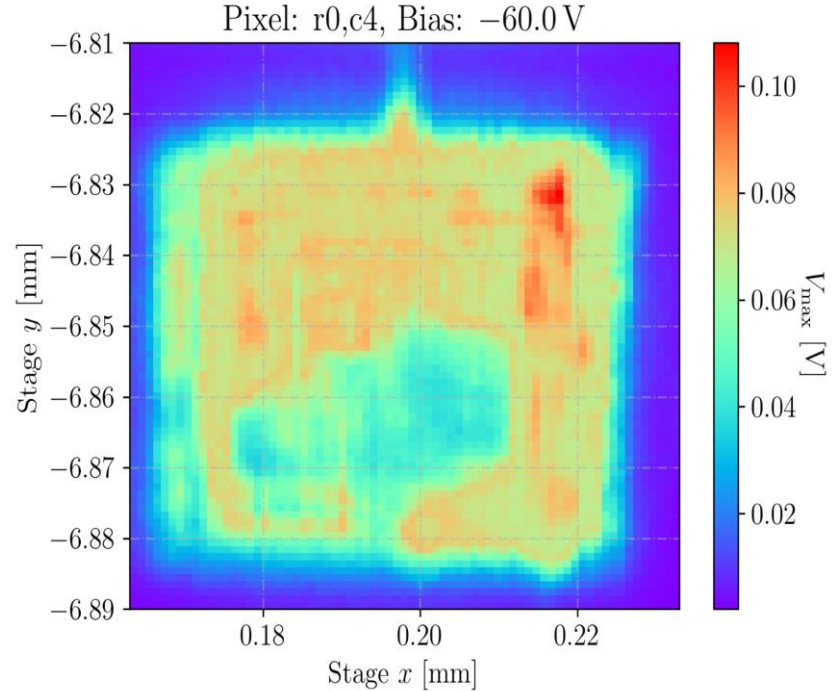


2022_07_13_10_00_30_MPW2
 2022_07_13_10_21_42_MPW2
 2022_07_13_11_35_35_MPW2
 2022_07_13_13_54_27_MPW2

XY-Scan with focus at the middle:
 (nwell ring clearly shown in the response)



XY-Scan with focus at the top side:



Thanks for your attention
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