Characterization and Calibration of 2nd Gen AGIPD Electronics

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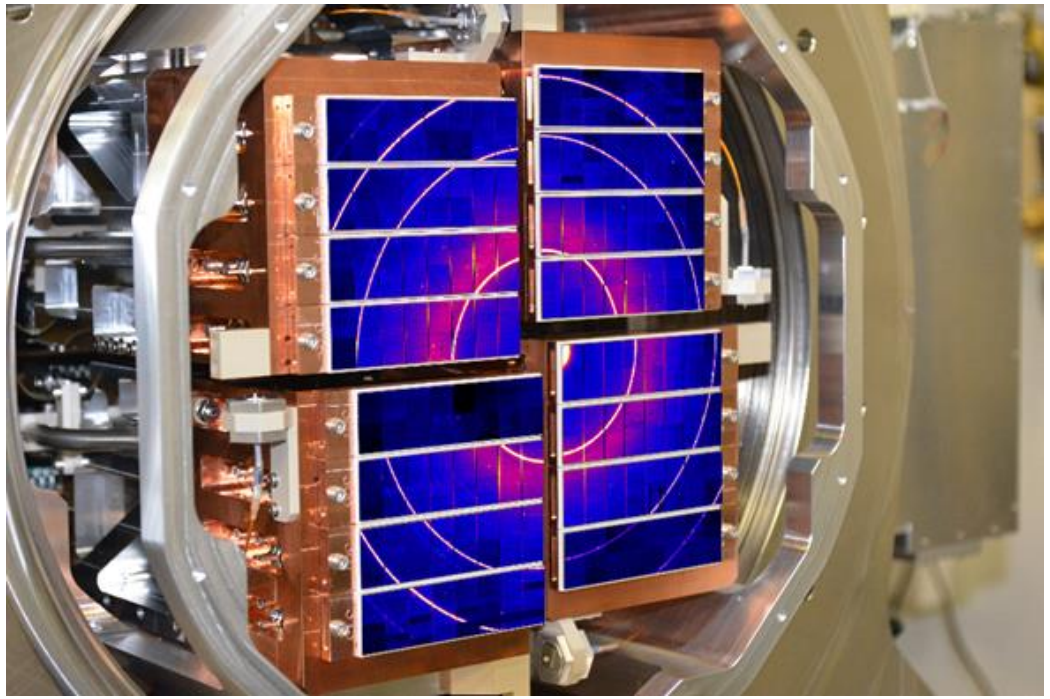
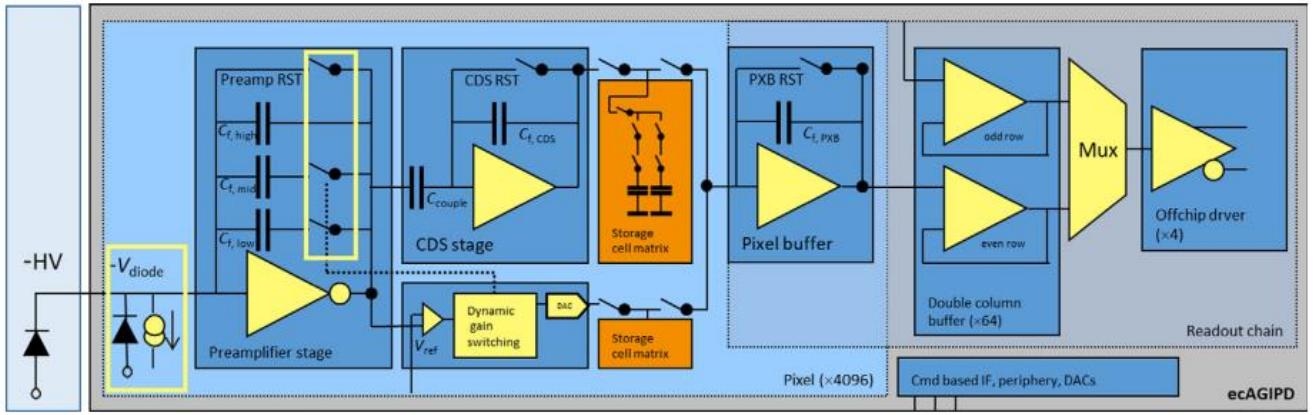
The AGIPD

- the Adaptive Gain Integrating Pixel Detector
- developed for EuXFEL
- fast, low noise, integrating
- 2 detectors installed
- new version developed



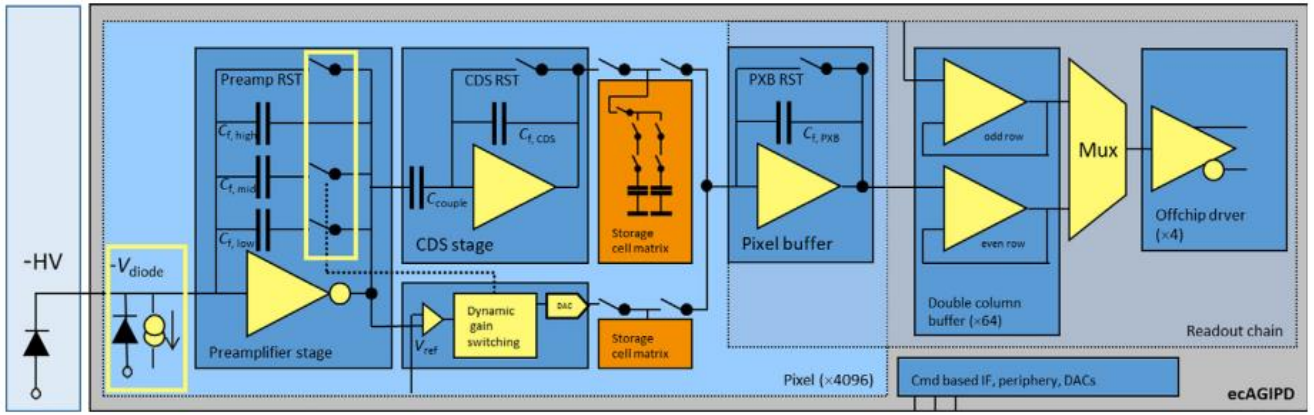
The AGIPD - adaptive gain switching

- charge-sensitive preamplifier
- 2 additional feedback capacitors
- globally adjustable
- HDR



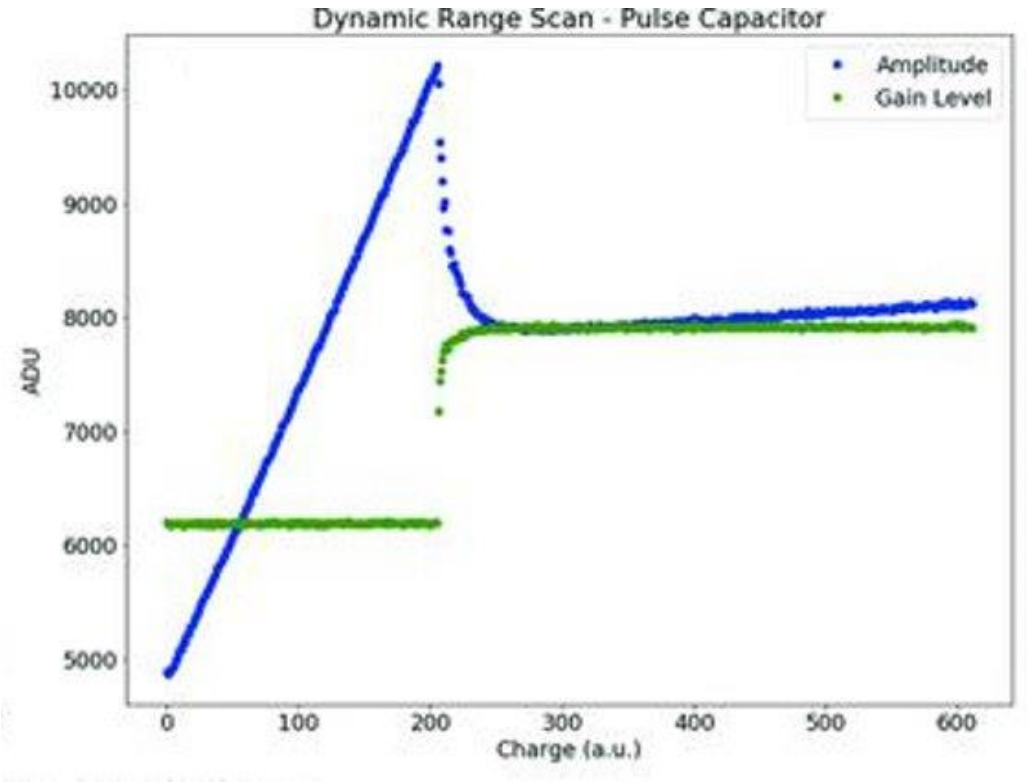
The AGIPD – memory

- in-pixel memory
- high-speed
- 2 separate pieces of information are stored



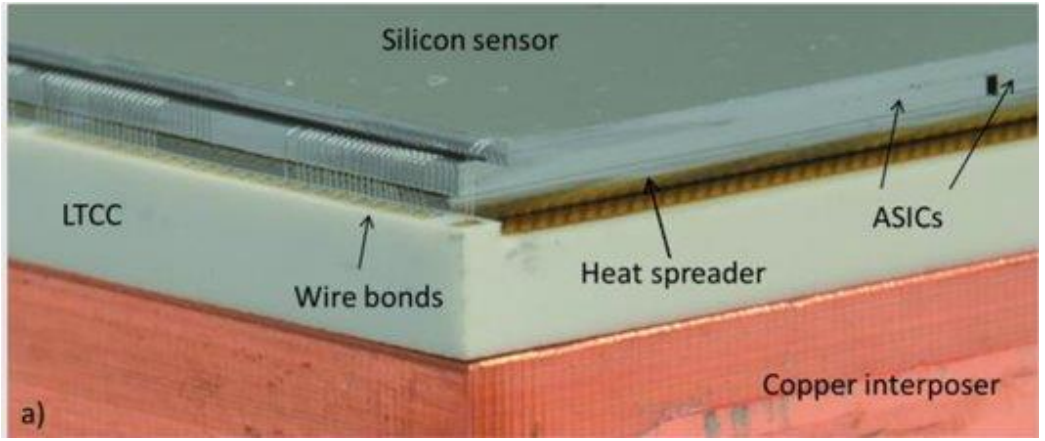
The AGIPD – pulsed capacitor

- scans the dynamic range
- amplitude of
  a voltage step applied
- for calibration procedure



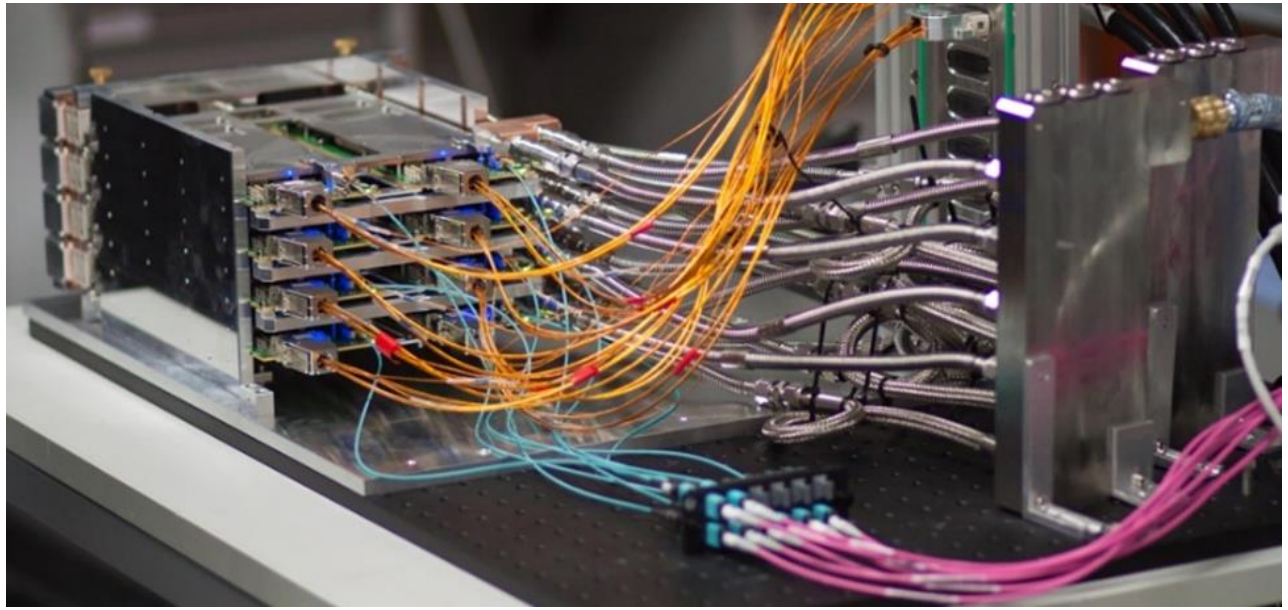
The AGIPD - FEM

- The Front-end module
- silicon p-on-n type sensor
- cooling blocks



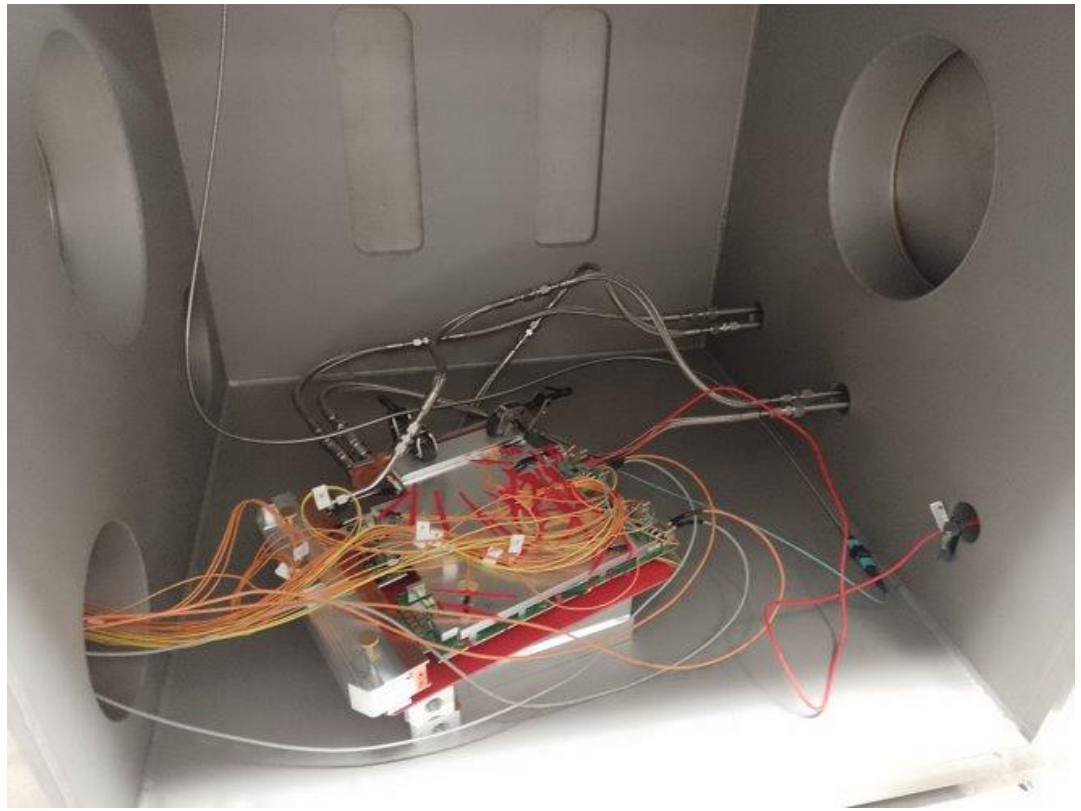
Objective

- investigate linearity of high gain stage of AGIPD



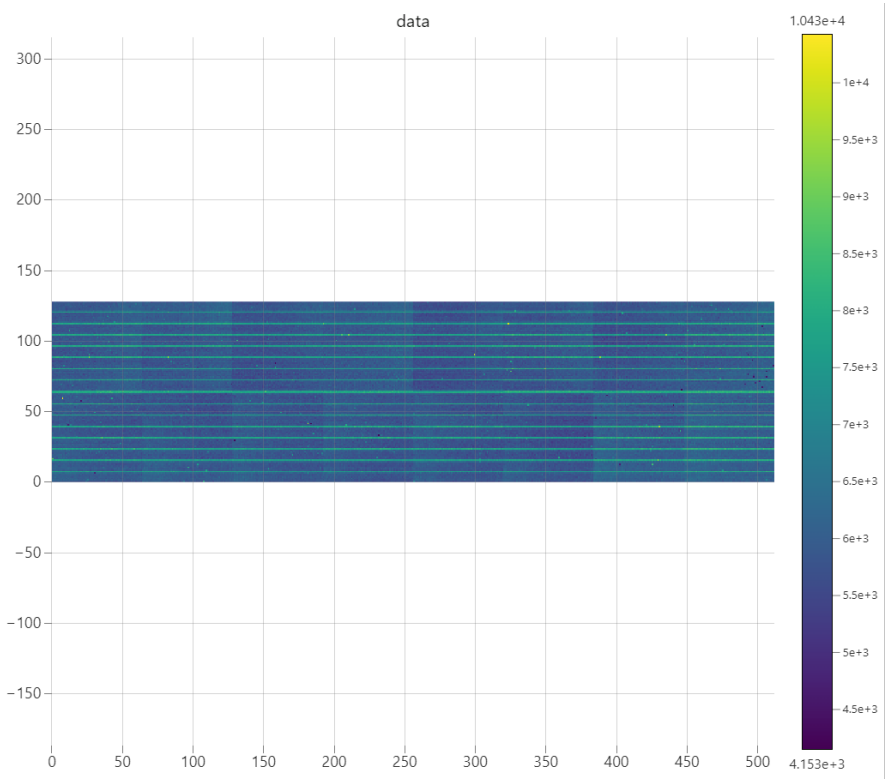
Experimental setup

- separated cooling system for FEM and for ROB
- booster pump used with lower temperatures
- fibre feedthrough to take data



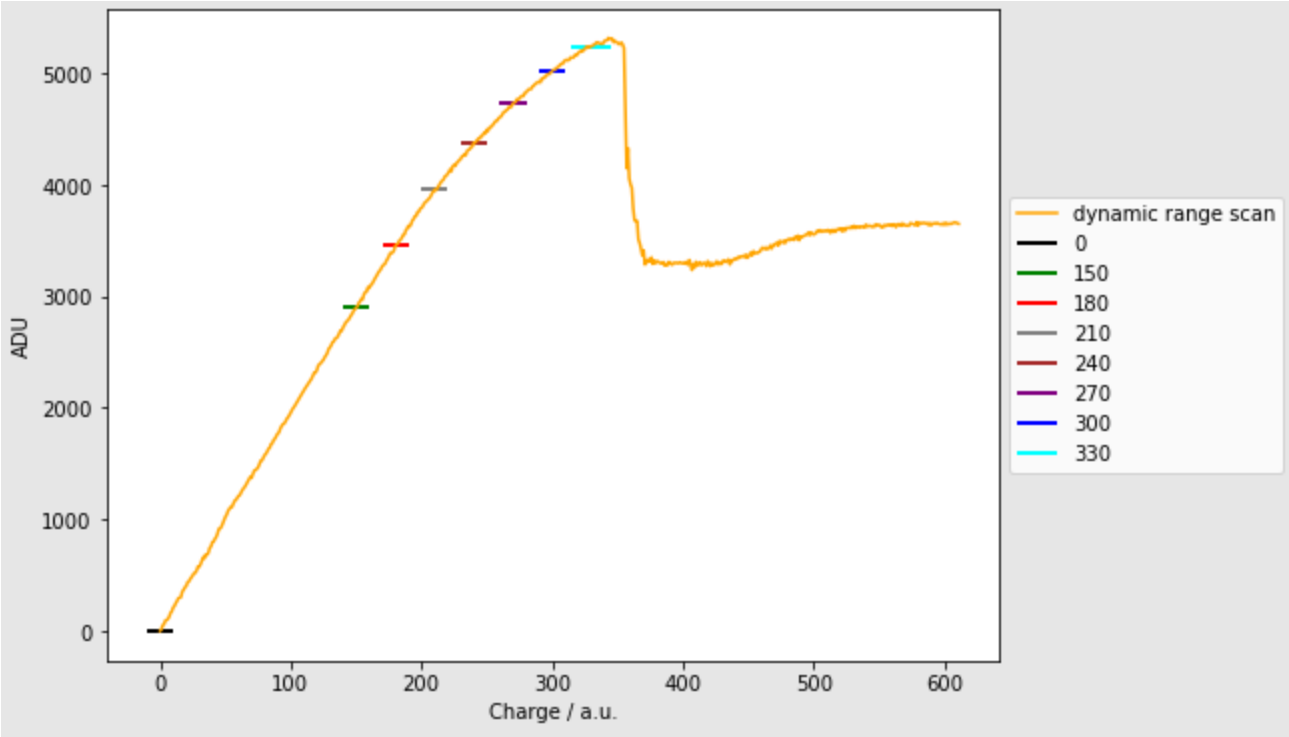
Measurement

- charge injected into every 8th row with pulsed capacitor
- from 15°C to -50°C with step 5°C
- in vacuum chamber



Algorithm

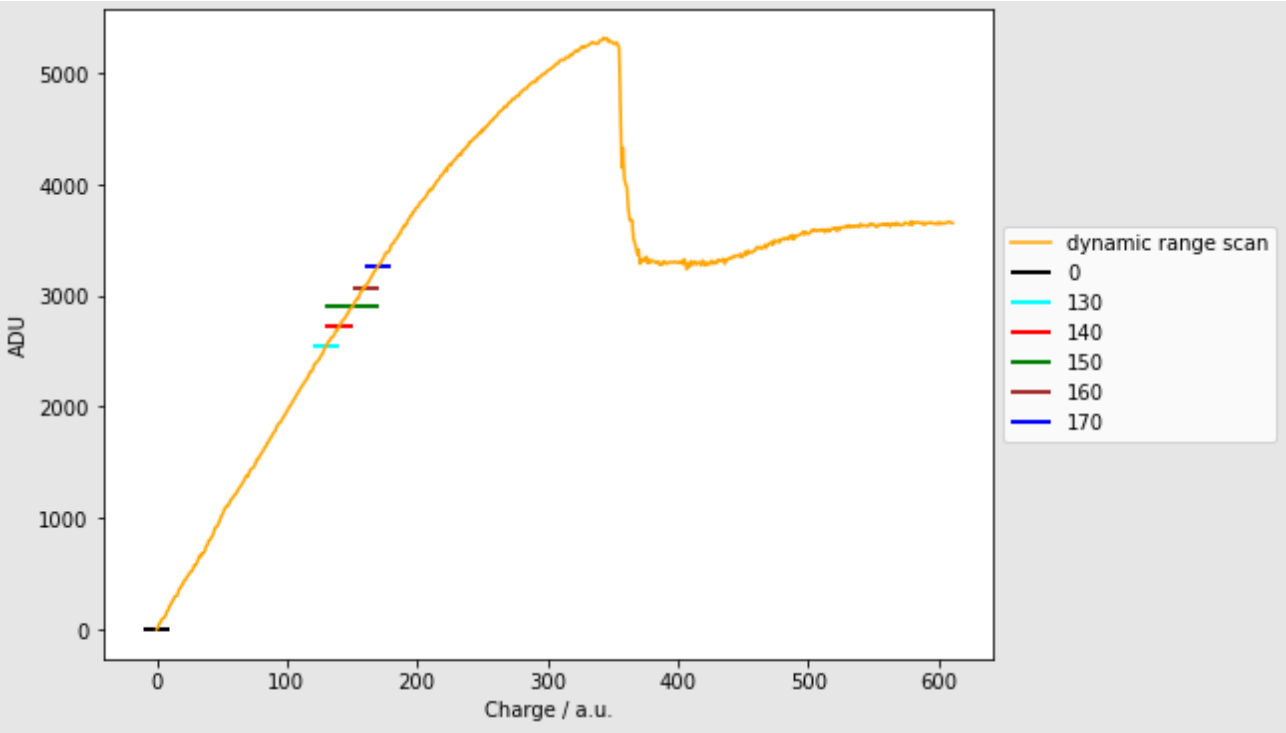
n points of dynamic range scan → linear fit → correlation coefficient → n = n + 30



→ some different correlation coefficients

Algorithm

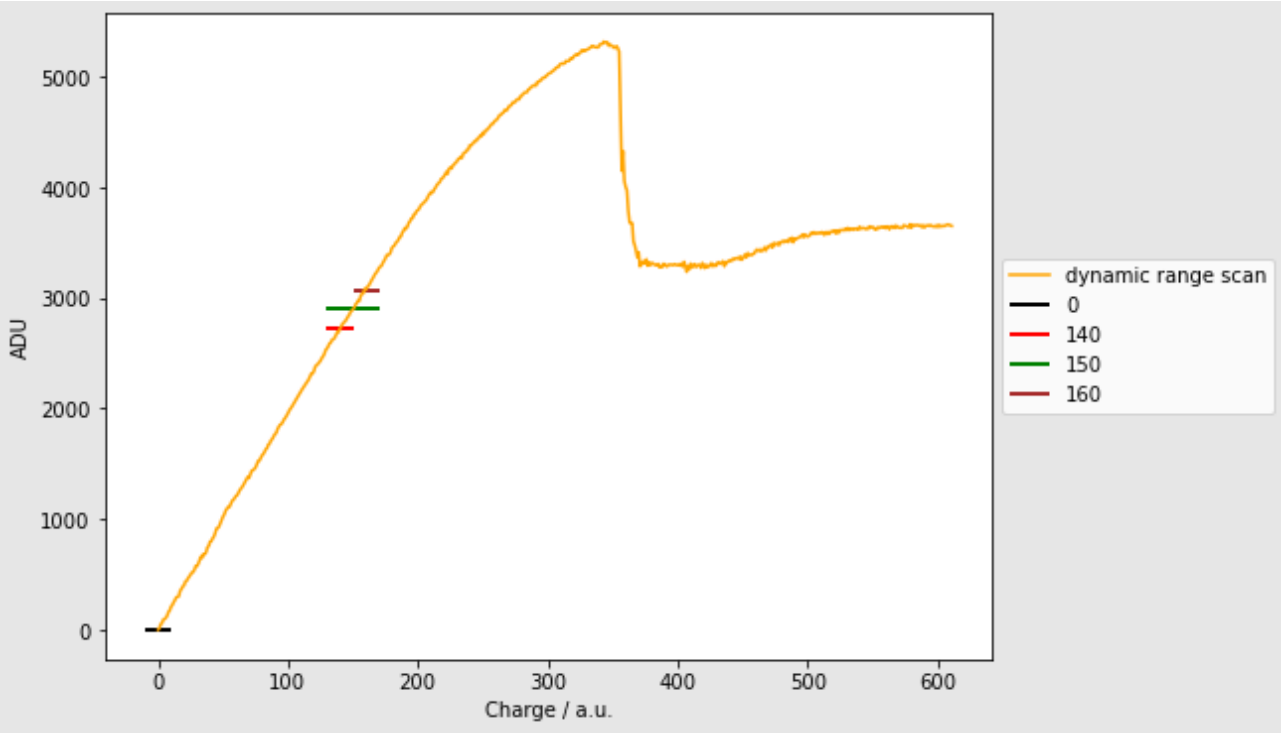
n points of dynamic range scan → linear fit → correlation coefficient → n = n + 10



→ another 4 different correlation coefficients

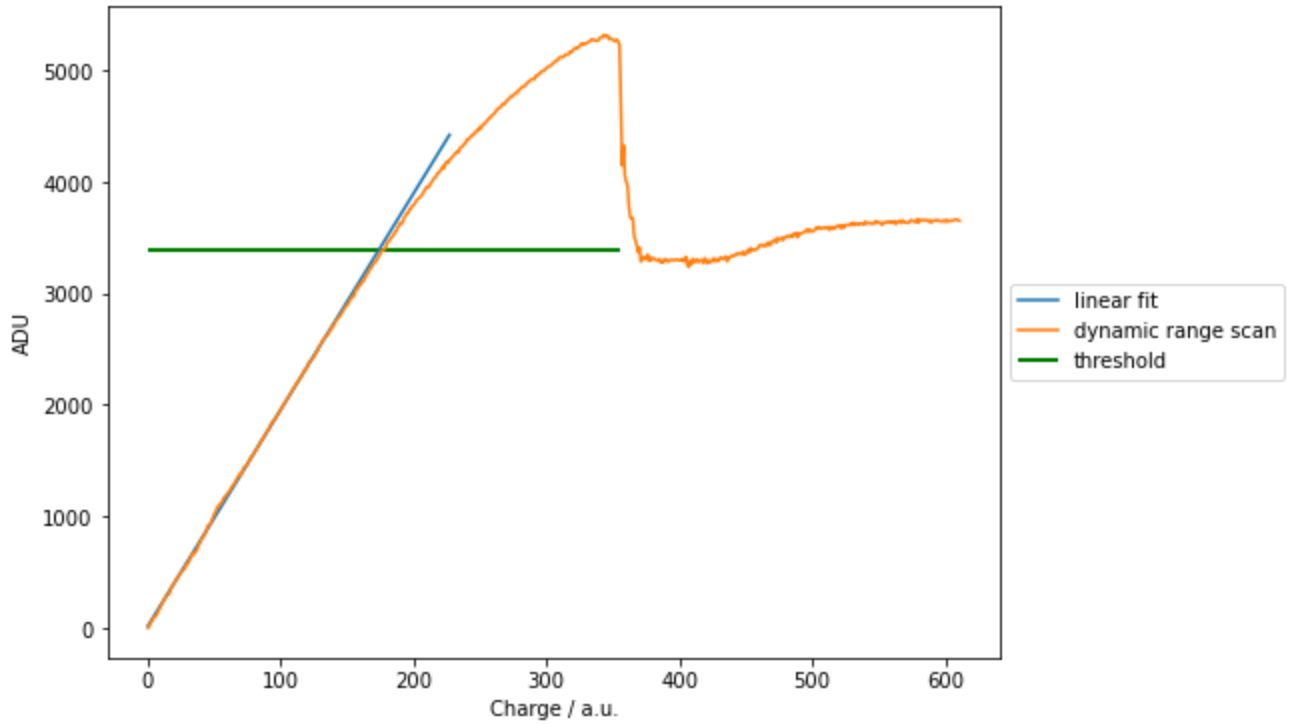
Algorithm

n points of dynamic range scan → linear fit → correlation coefficient → n = n + 1

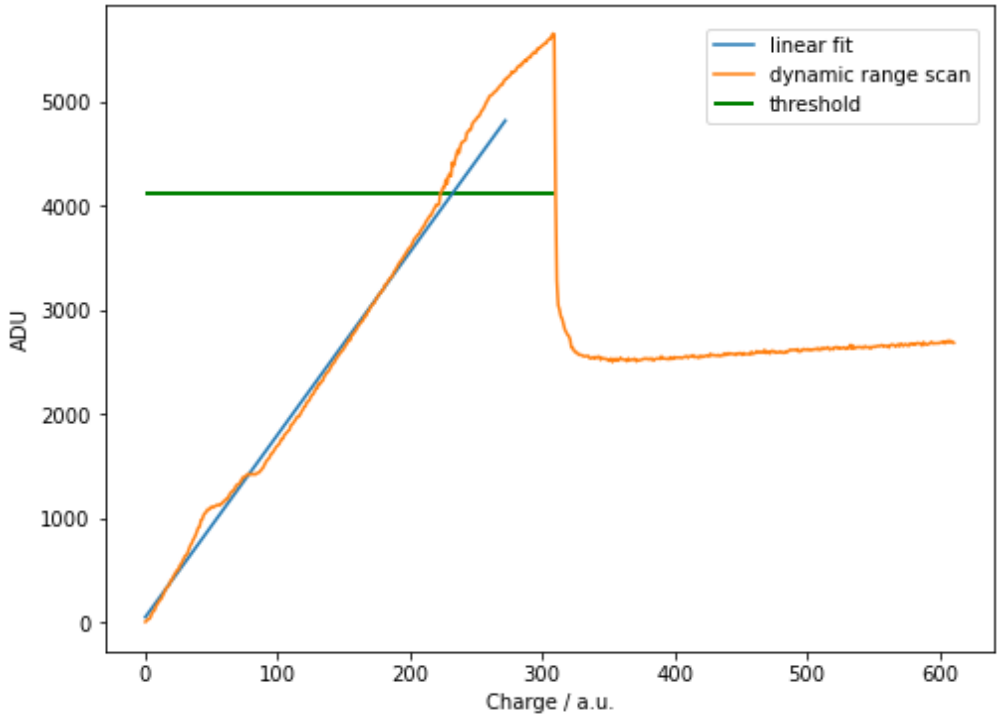


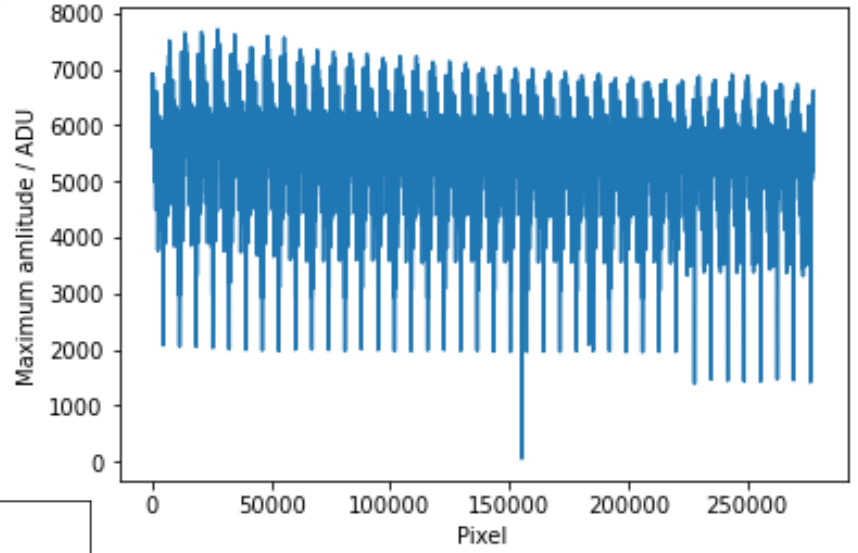
→ another 9 different correlation coefficients

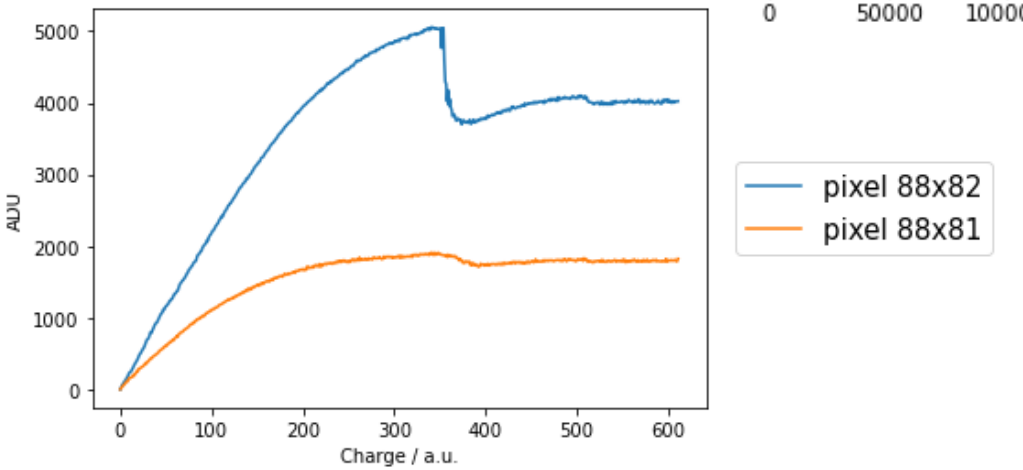
Algorithm


5000
4000
3000
2000
1000
0
ADU
0
100
200
300
400
500
600
Charge / a.u.
linear fit
dynamic range scan
threshold

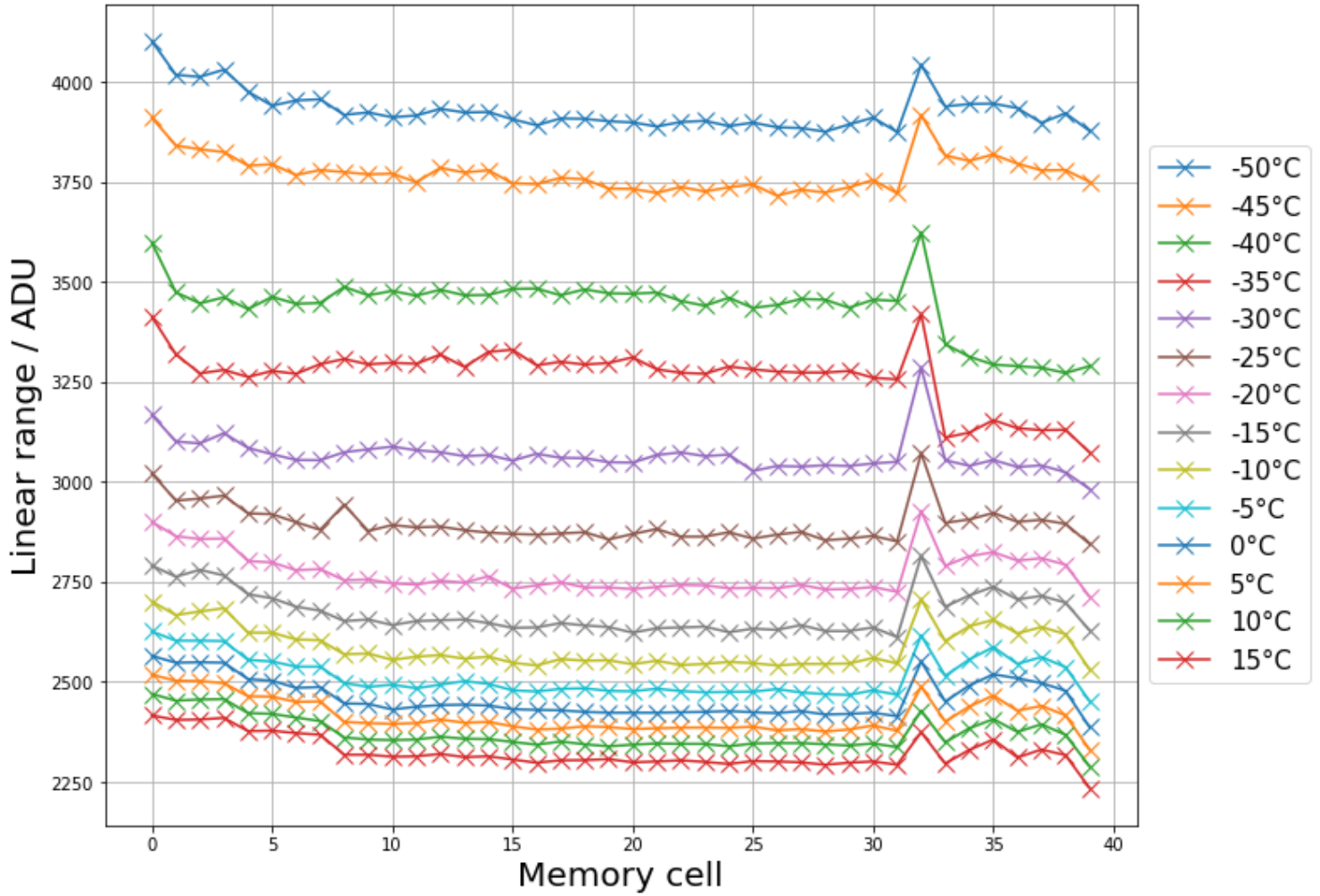
Not properly working pixels



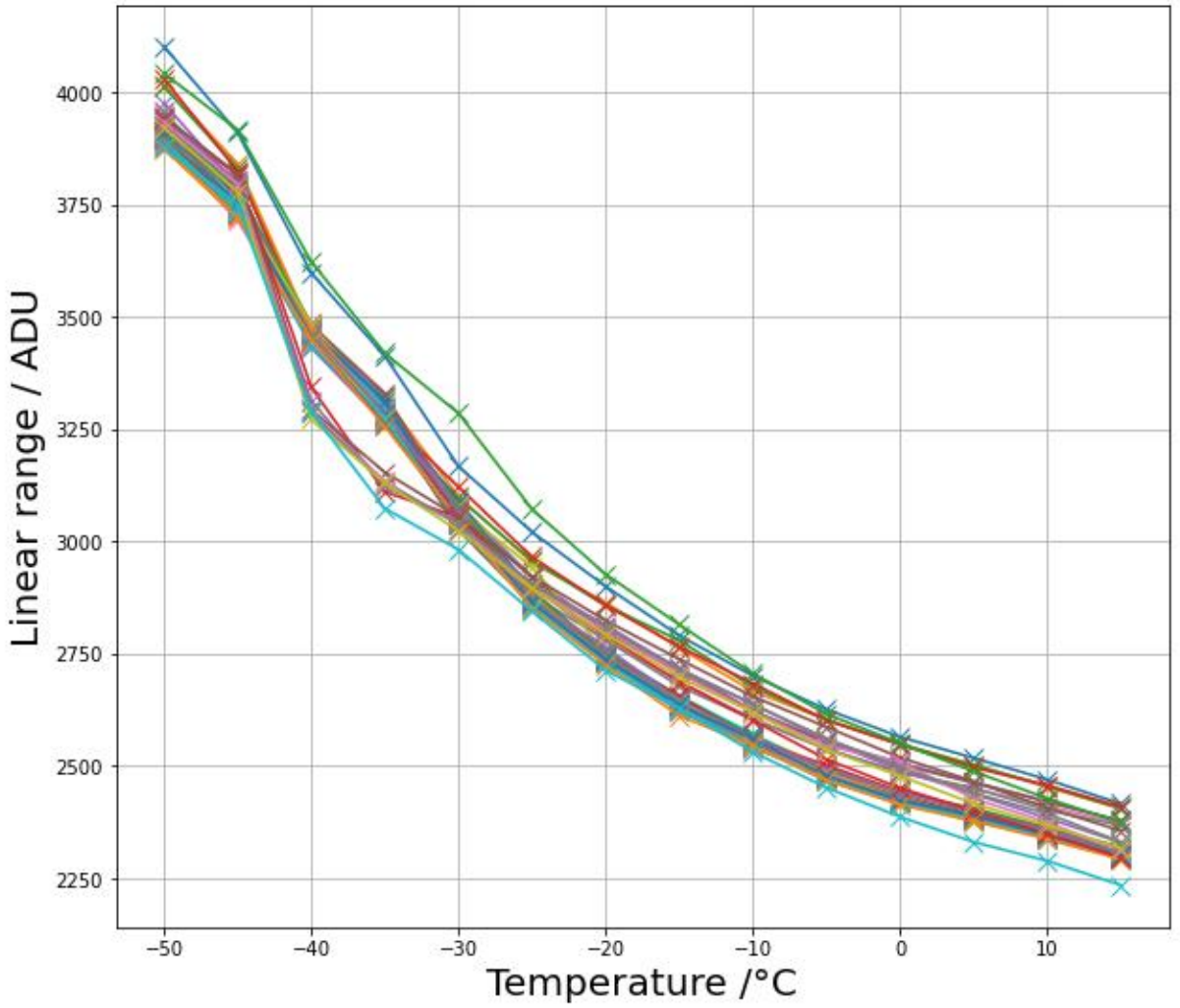




Results and Discussion



Results and Discussion



Conclusion

- Algorithm developed to determine HG linear range of pulsed capacitor dynamic range scan
- Analysis of dynamic range scans of 40 memory cells and 14 different temperatures showed dependency on temperature and memory cells geometry

Outlook

- analyse other rows
- analyse all memory cells
- change ASIC parameters
- improve algorithm

Thank you
for your attention