The Quadropix DEPFET concept

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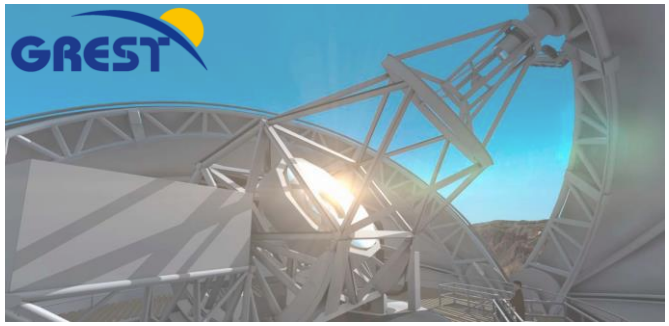
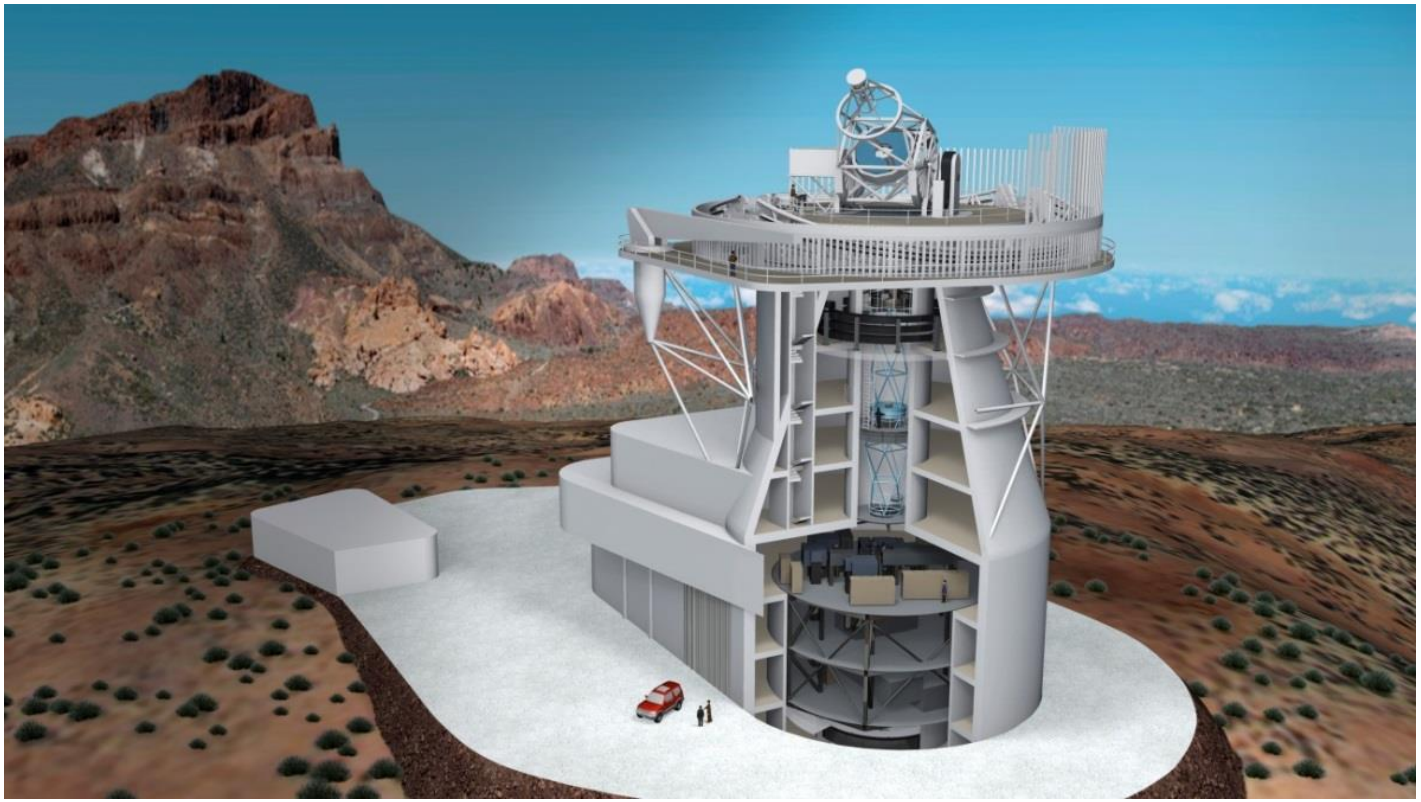
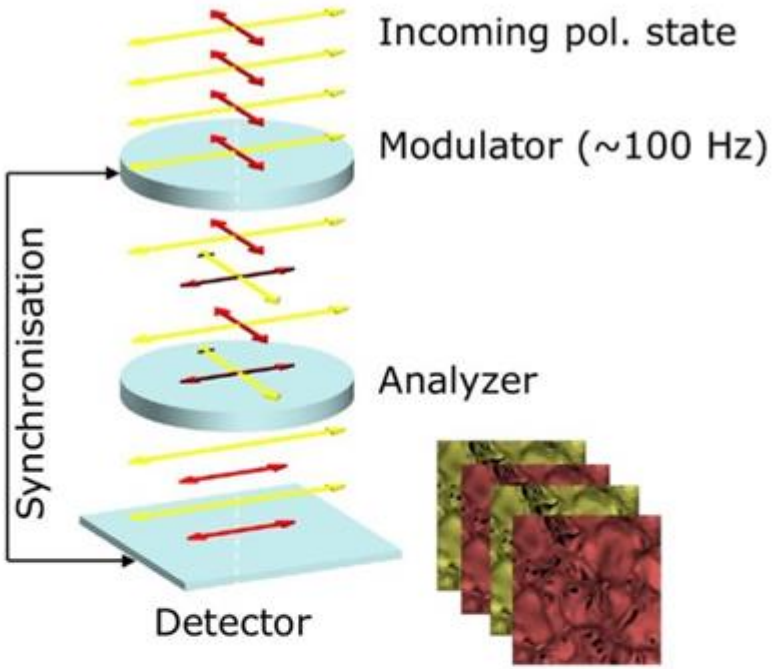
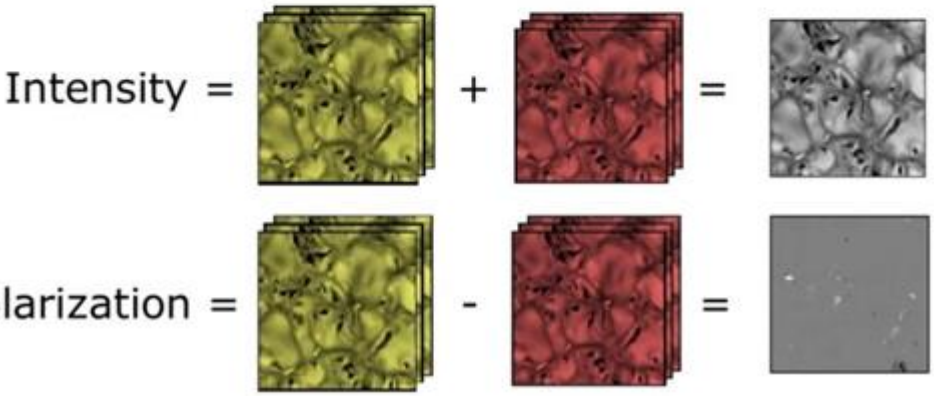
GREST - Getting Ready for the European Solar Telescope



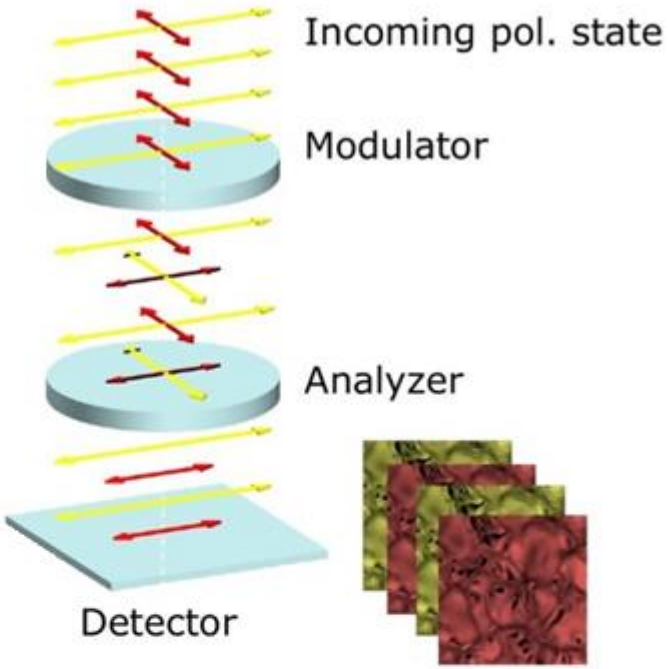


GREST

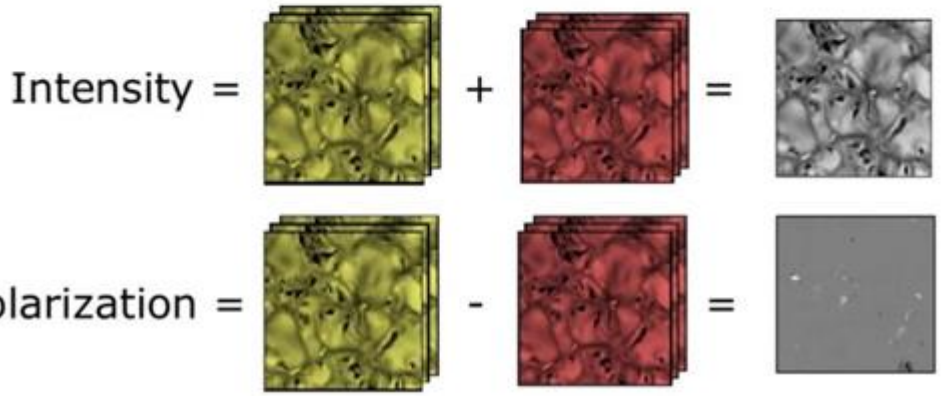

Incoming pol. state
Modulator (~100 Hz)
Synchronisation
Analyzer
Detector


Intensity =
+
=
Polarization =
-
=

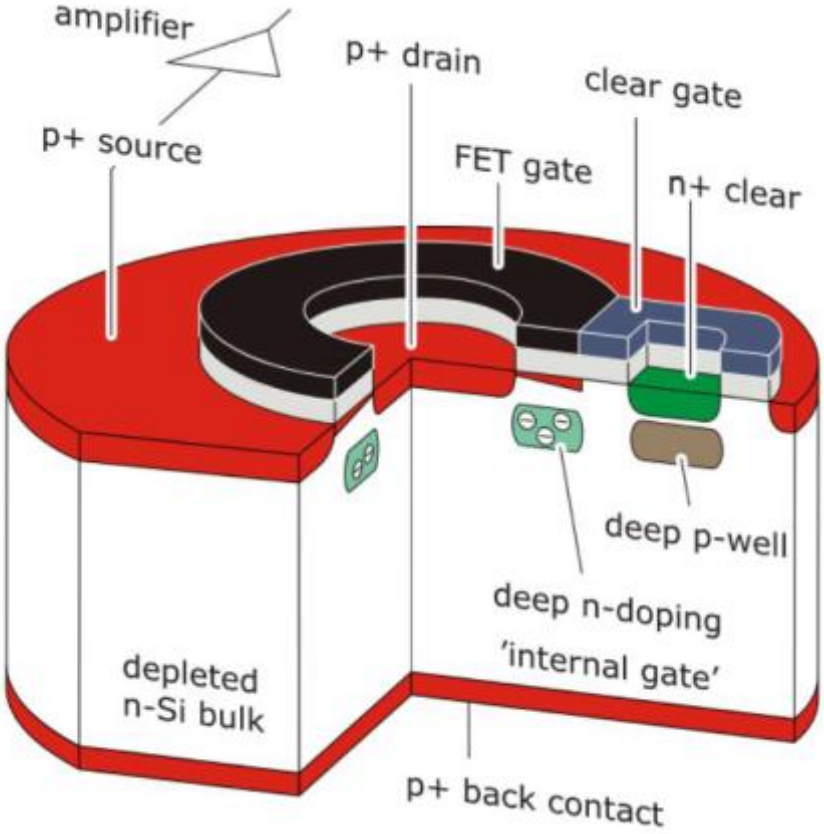
GREST

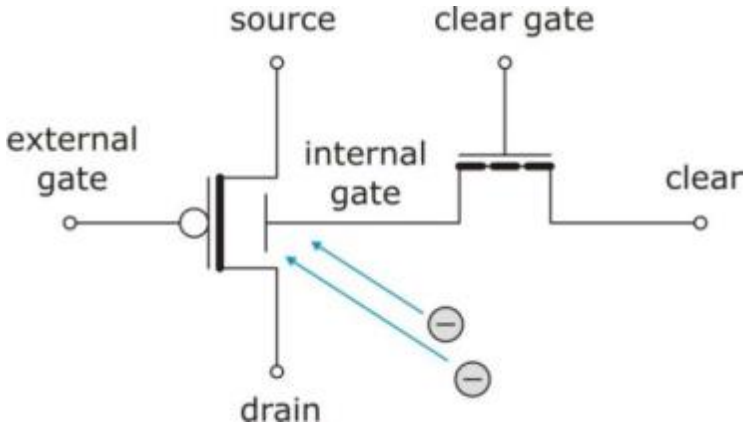


Modulation ~ 10 kHz
Frame-Rate ~ 400 Hz



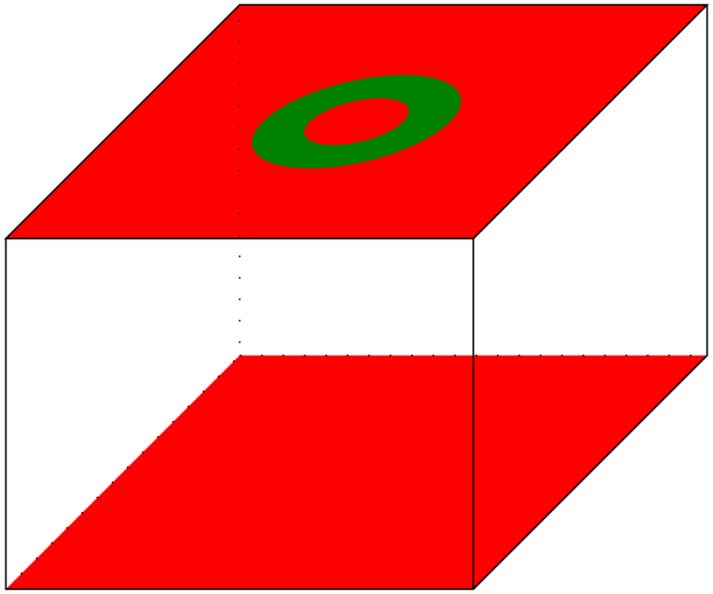
DEPFET

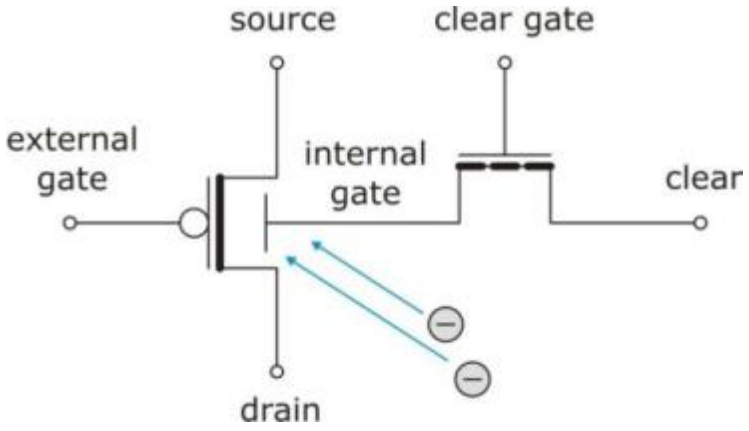




intrinsic amplification
low noise
backside illumination
100% fill-factor

DEPFET





intrinsic amplification
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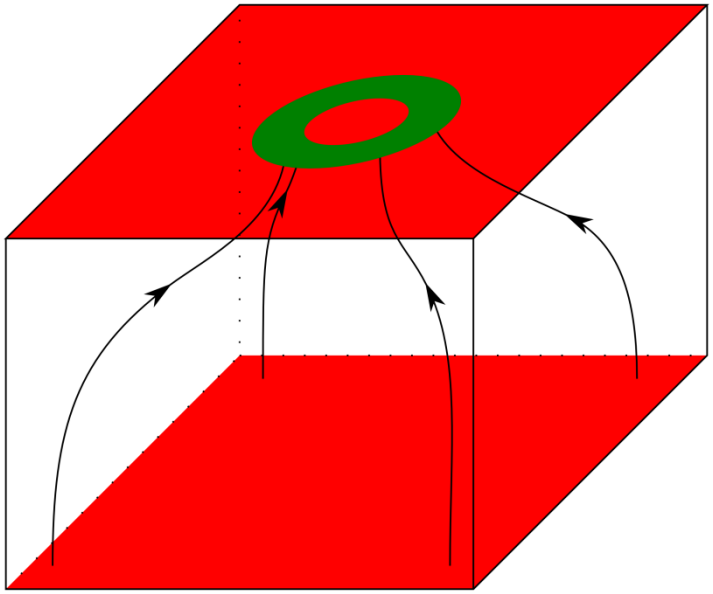
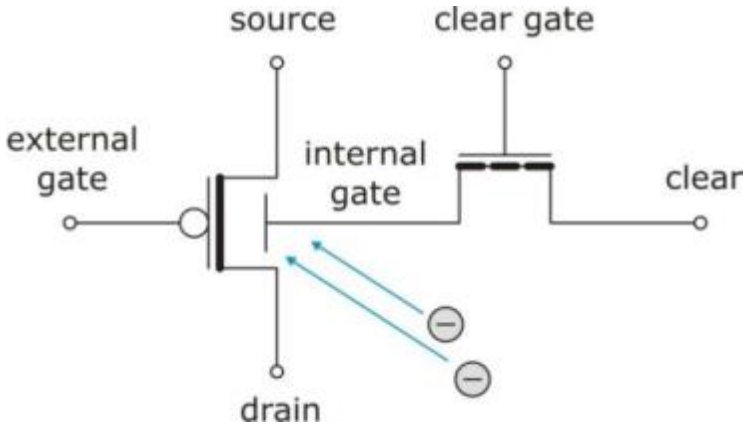
DEPFET

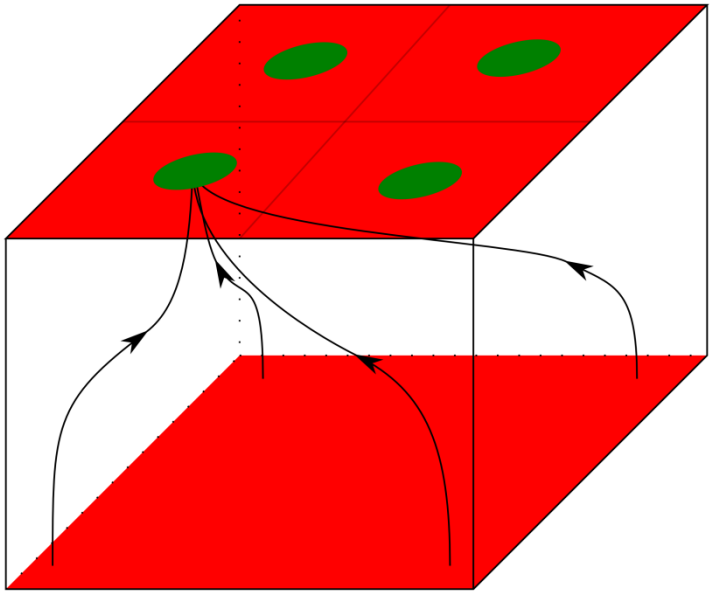


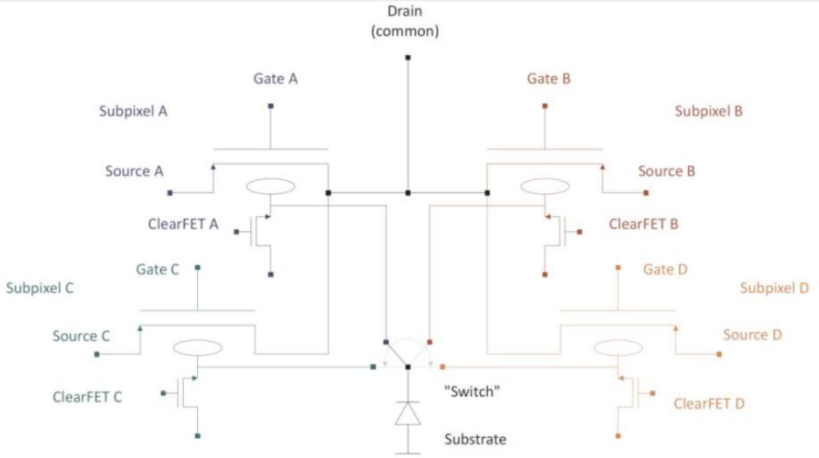


intrinsic amplification
low noise
backside illumination
100% fill-factor

Quadropix

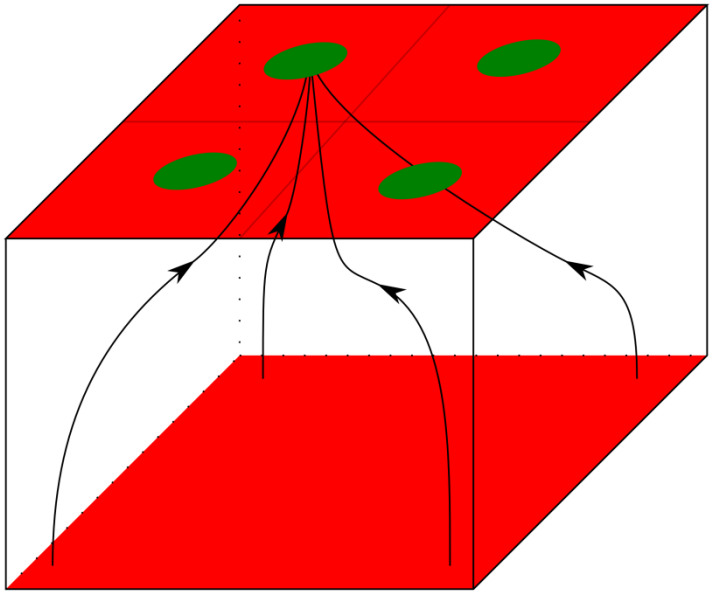
four storage areas
fast modulation

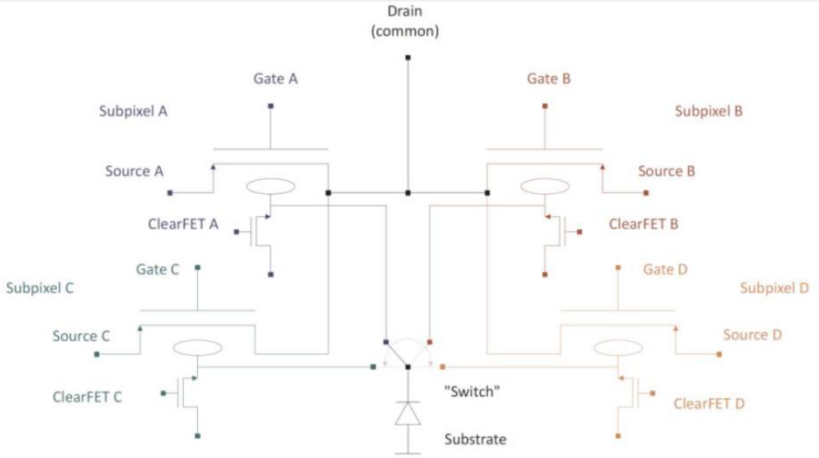




Quadropix

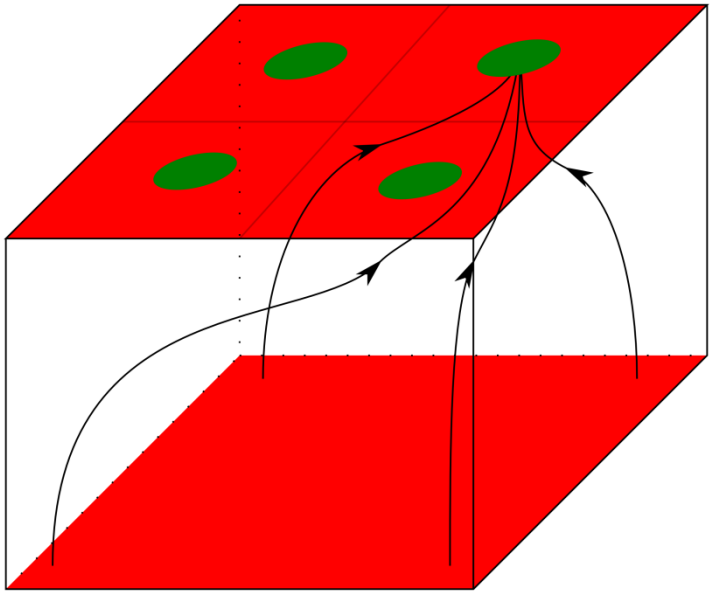
four storage areas
fast modulation

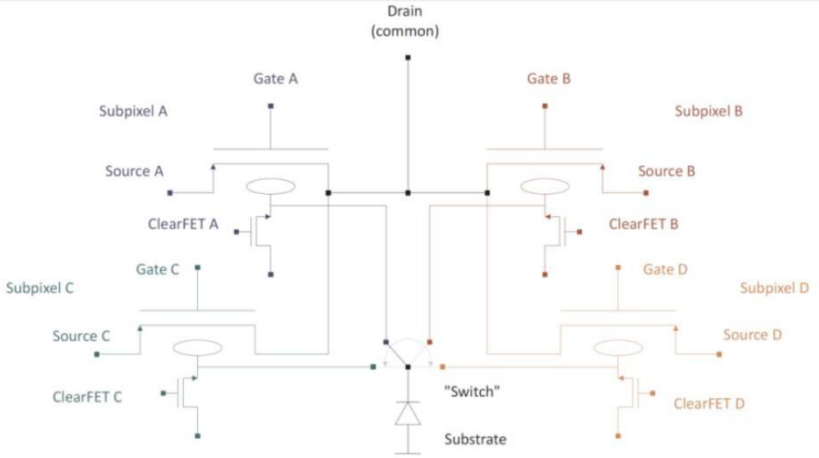




Quadropix

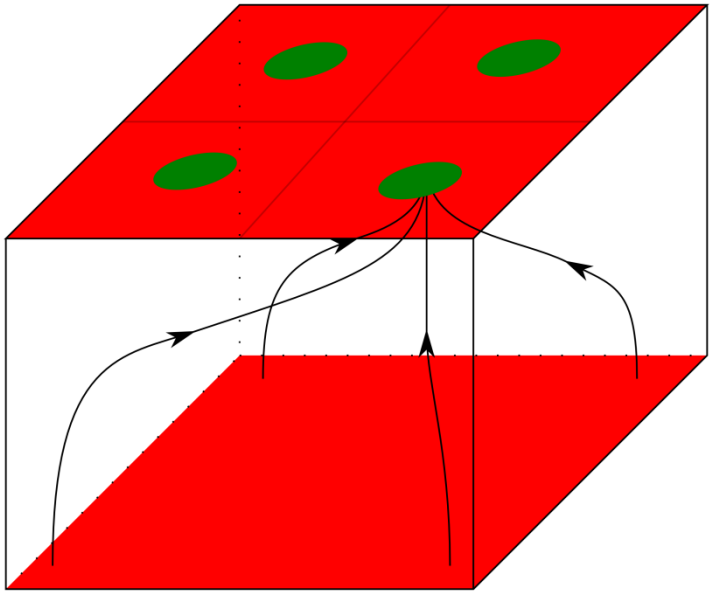
four storage areas
fast modulation

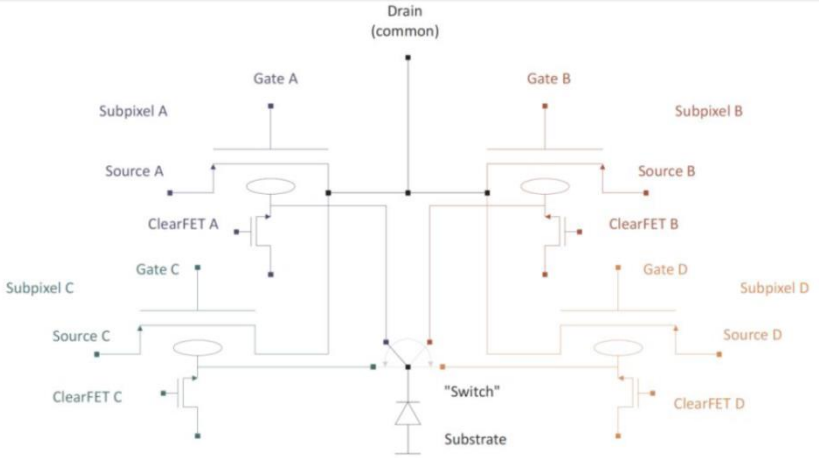




Quadropix

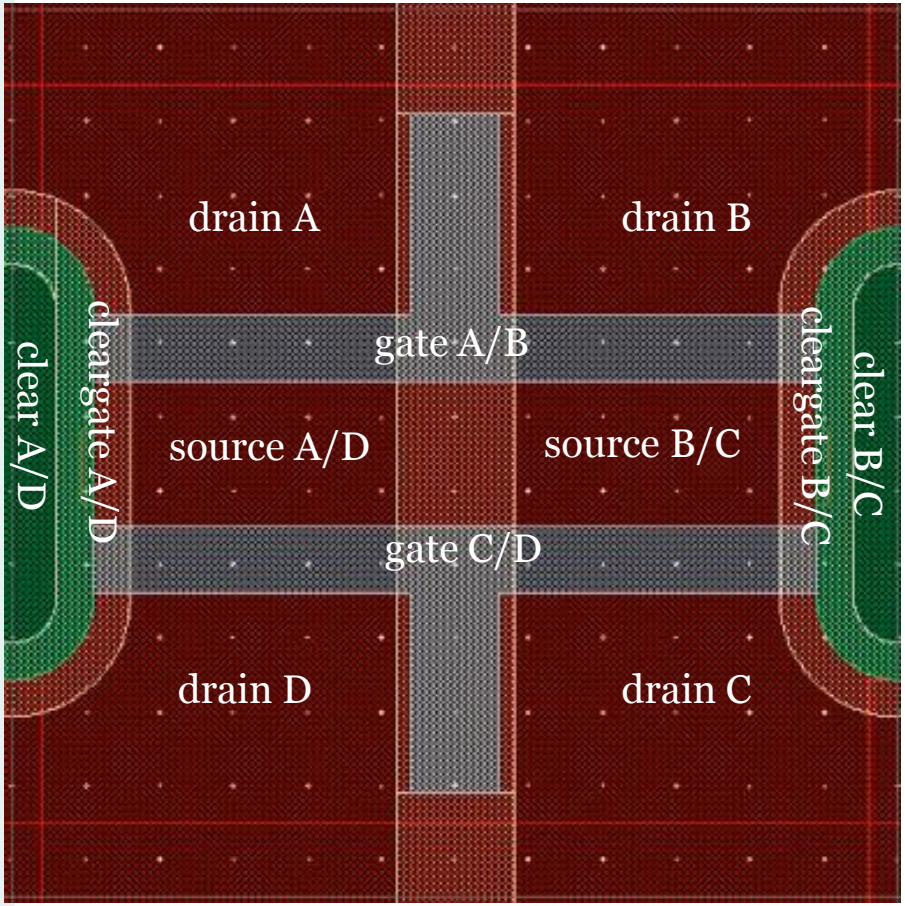
four storage areas
fast modulation

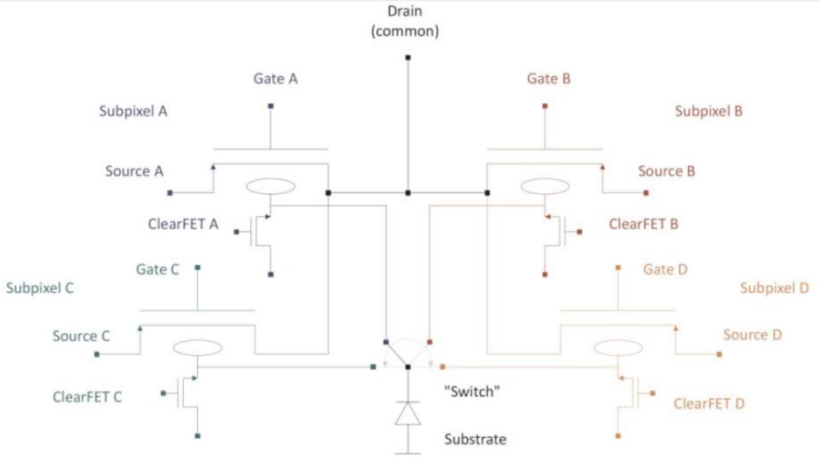




Quadropix

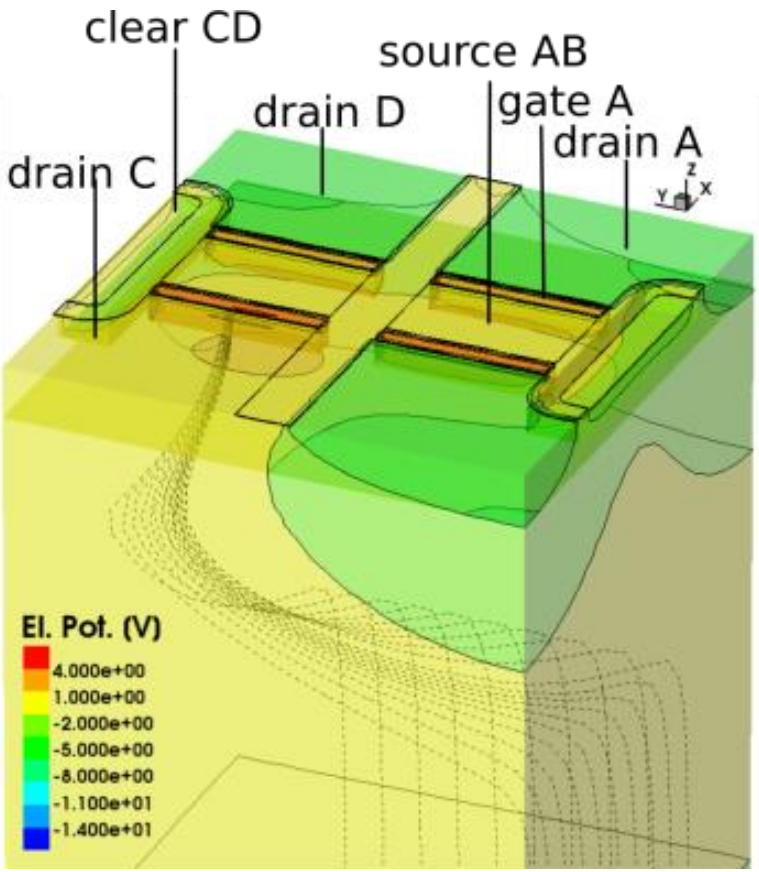
four storage areas
fast modulation



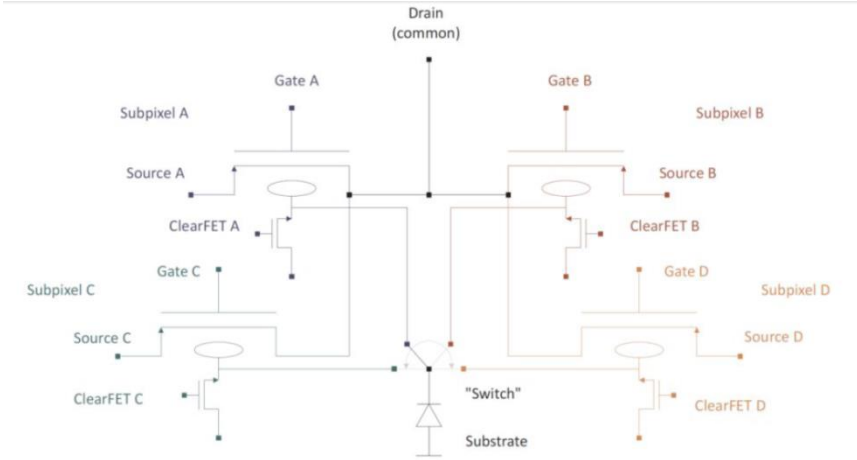


TCAD simulations

four storage areas
fast modulation



for details see: Bähr et al „Advanded DePFET concepts: Quadropix“
https://doi.org/10.1016/j.nima.2017.10.048



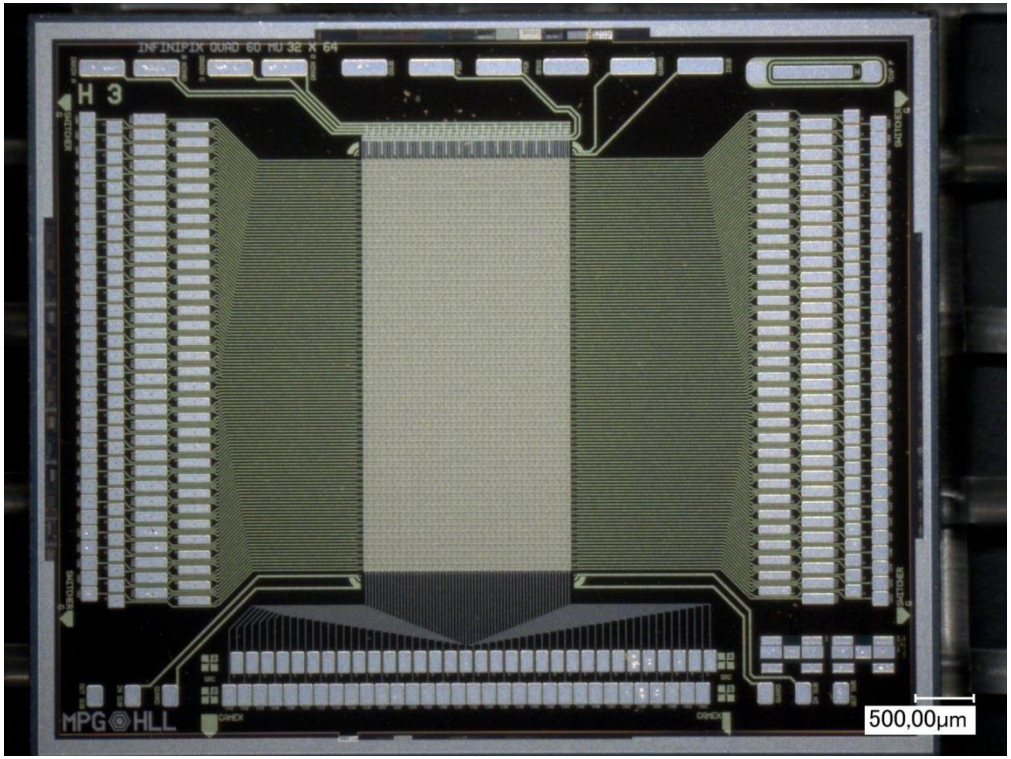
standard: limited operation window
asymmetric charge collection
-> considerable polarimetric crosstalk

optimized devices: larger operation window
-> reduced polarimetric crosstalk

thinned devices: minimized polarimetric crosstalk

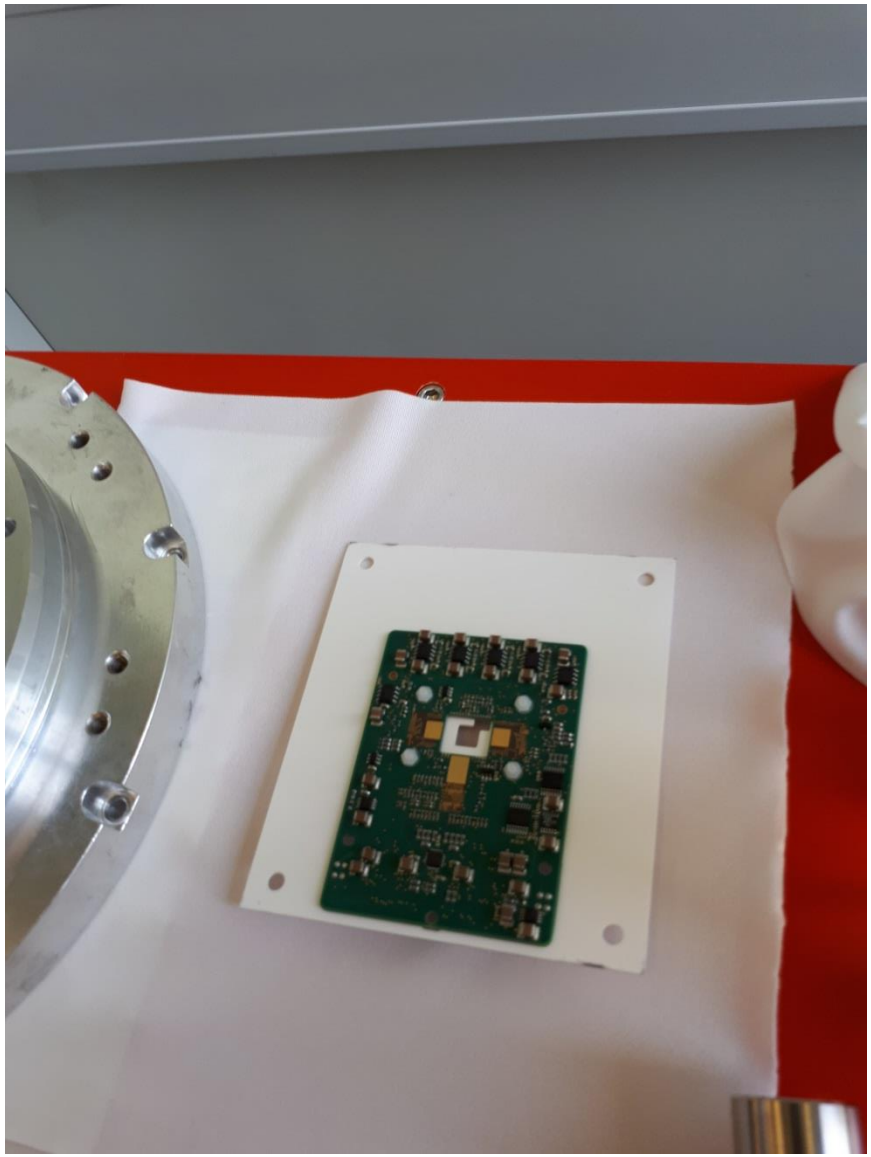
Prototype Sensor

production of first batch finished

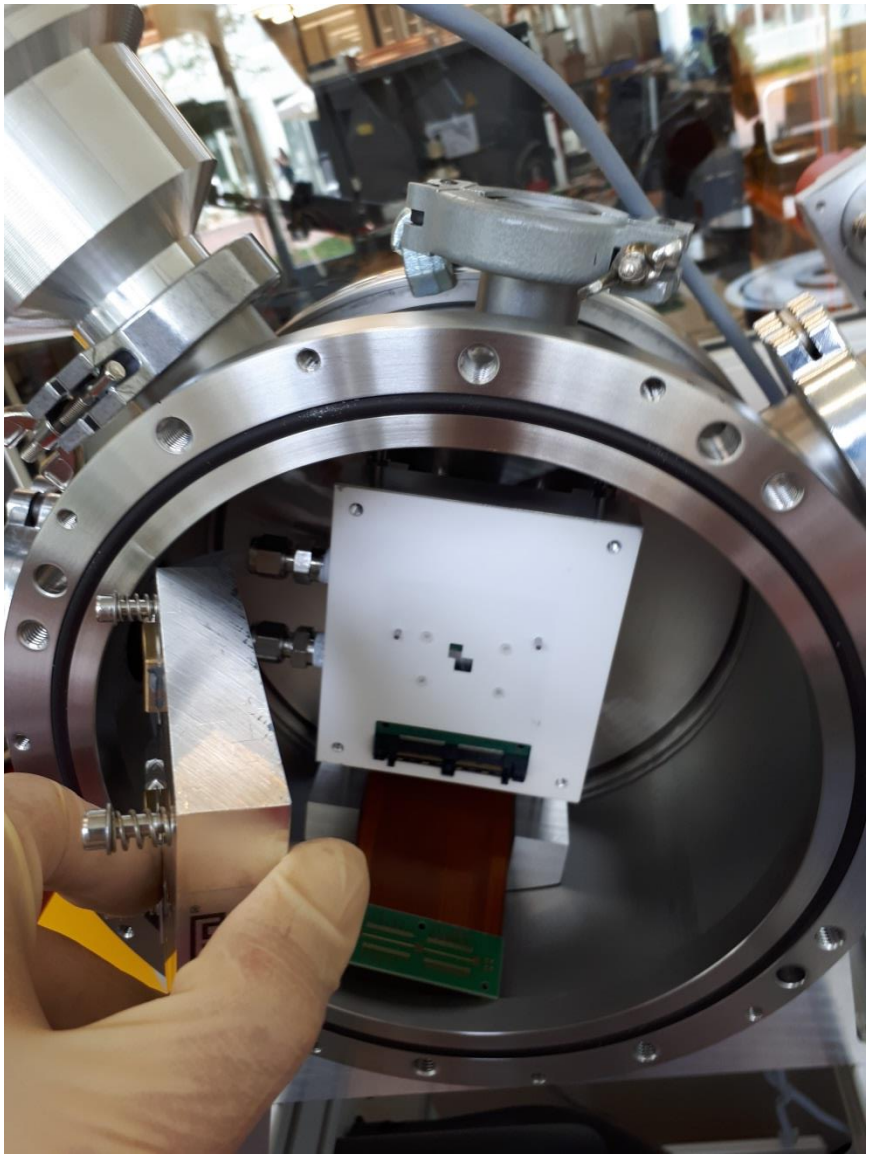


Test Sensor: 64 x 32 Quadropixel
60 x 60 µm² pixel size
450 µm bulk

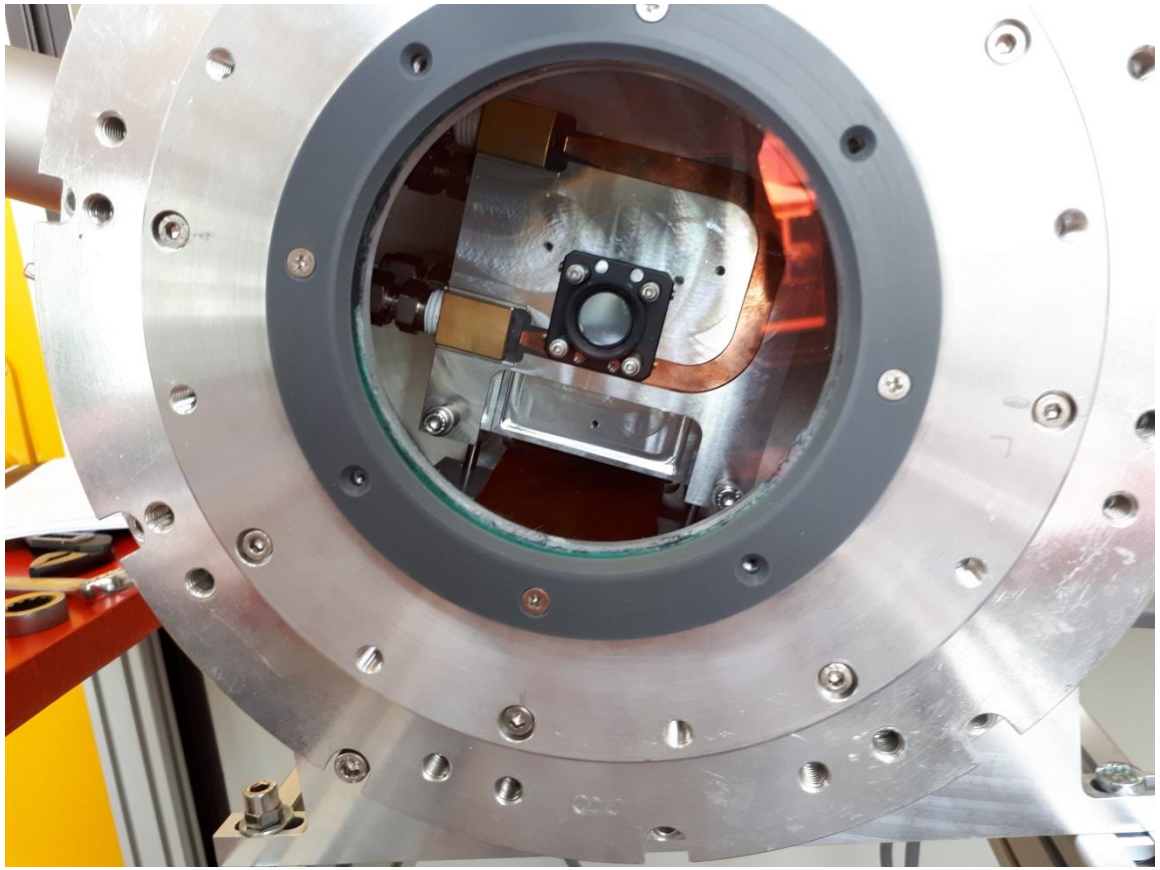
Measurement Setup



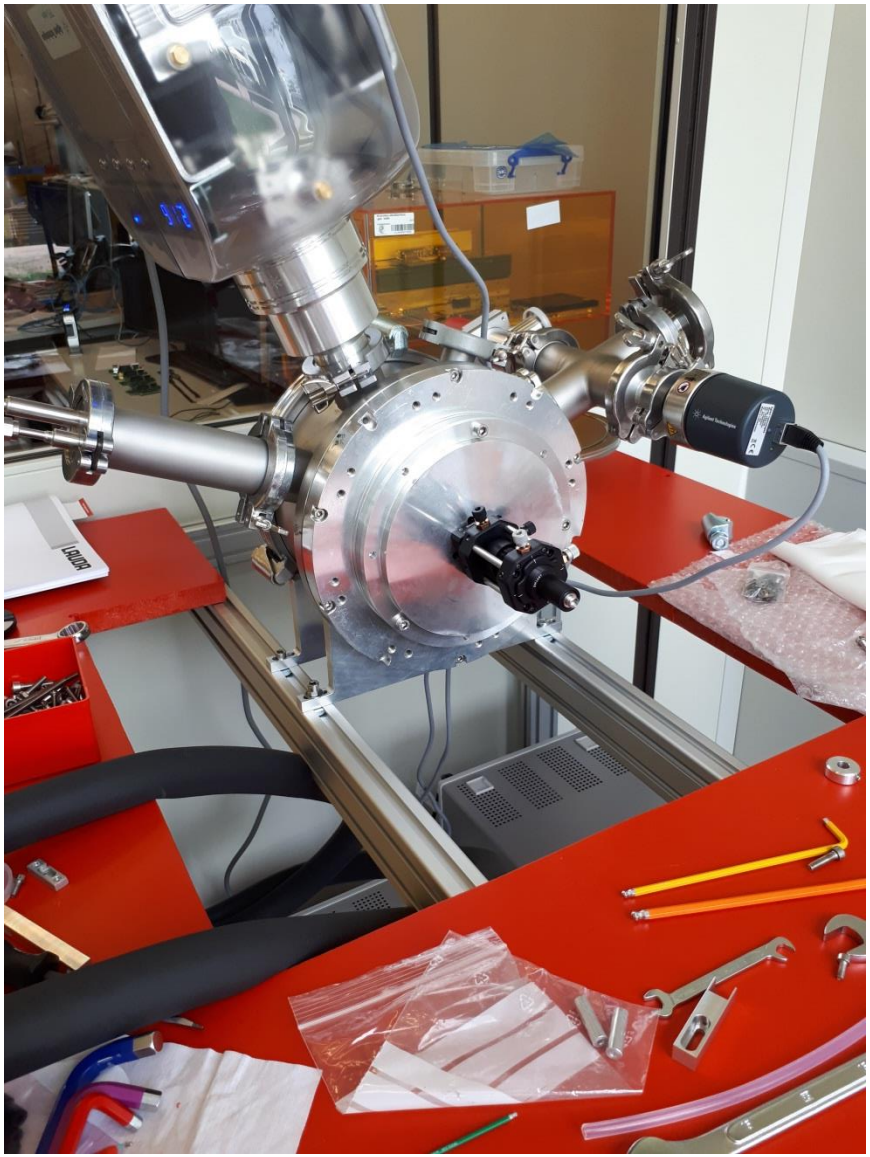
Measurement Setup



Measurement Setup

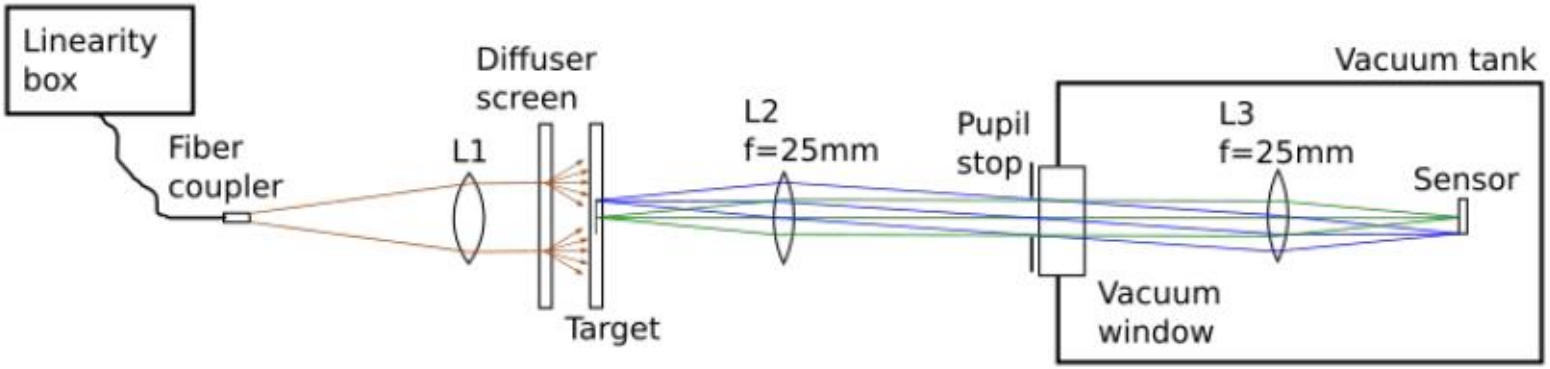


Measurement Setup



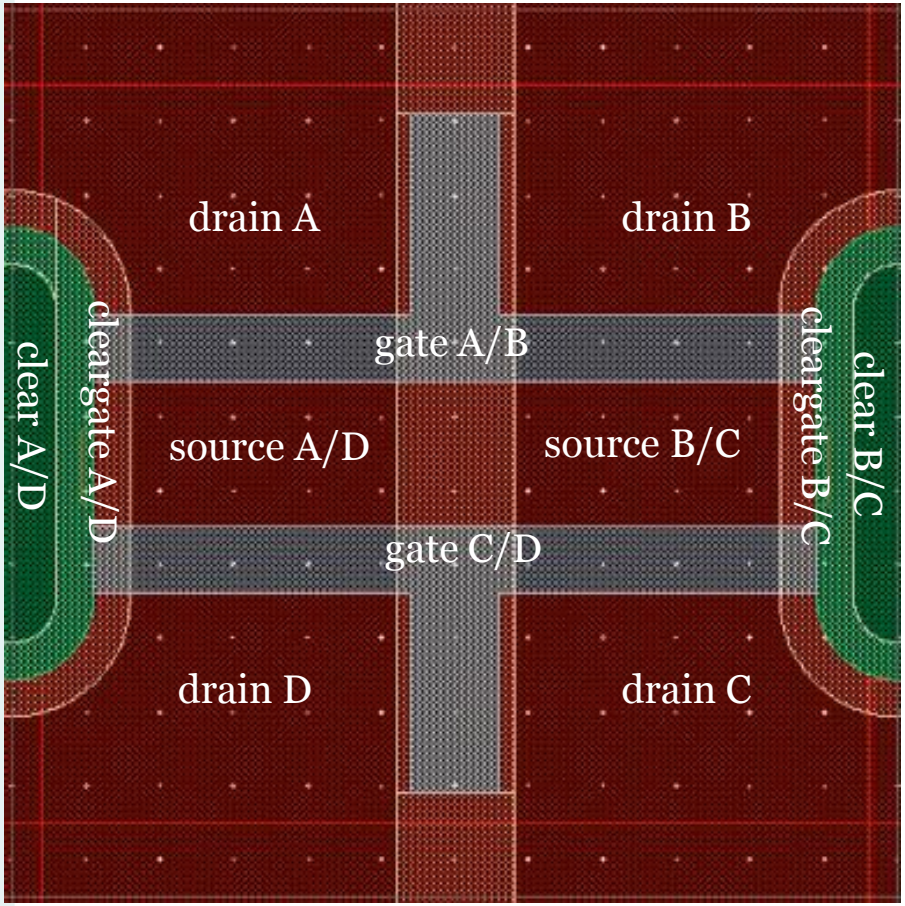
Measurement Setup

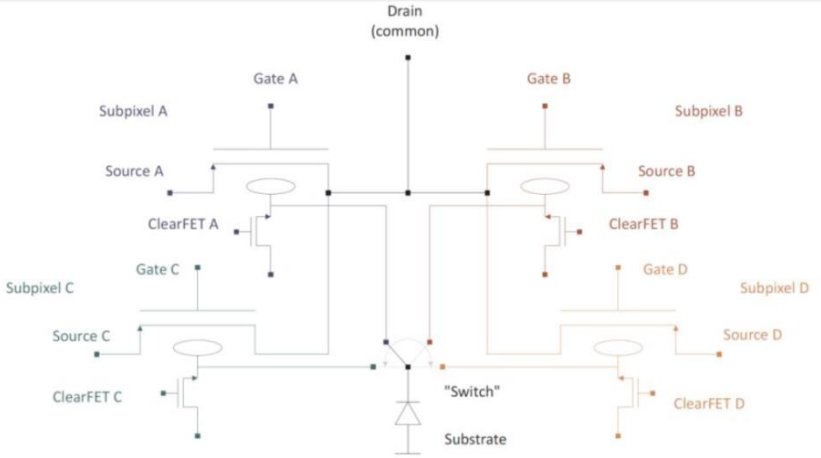
Measurement setup (HLL / MPS)



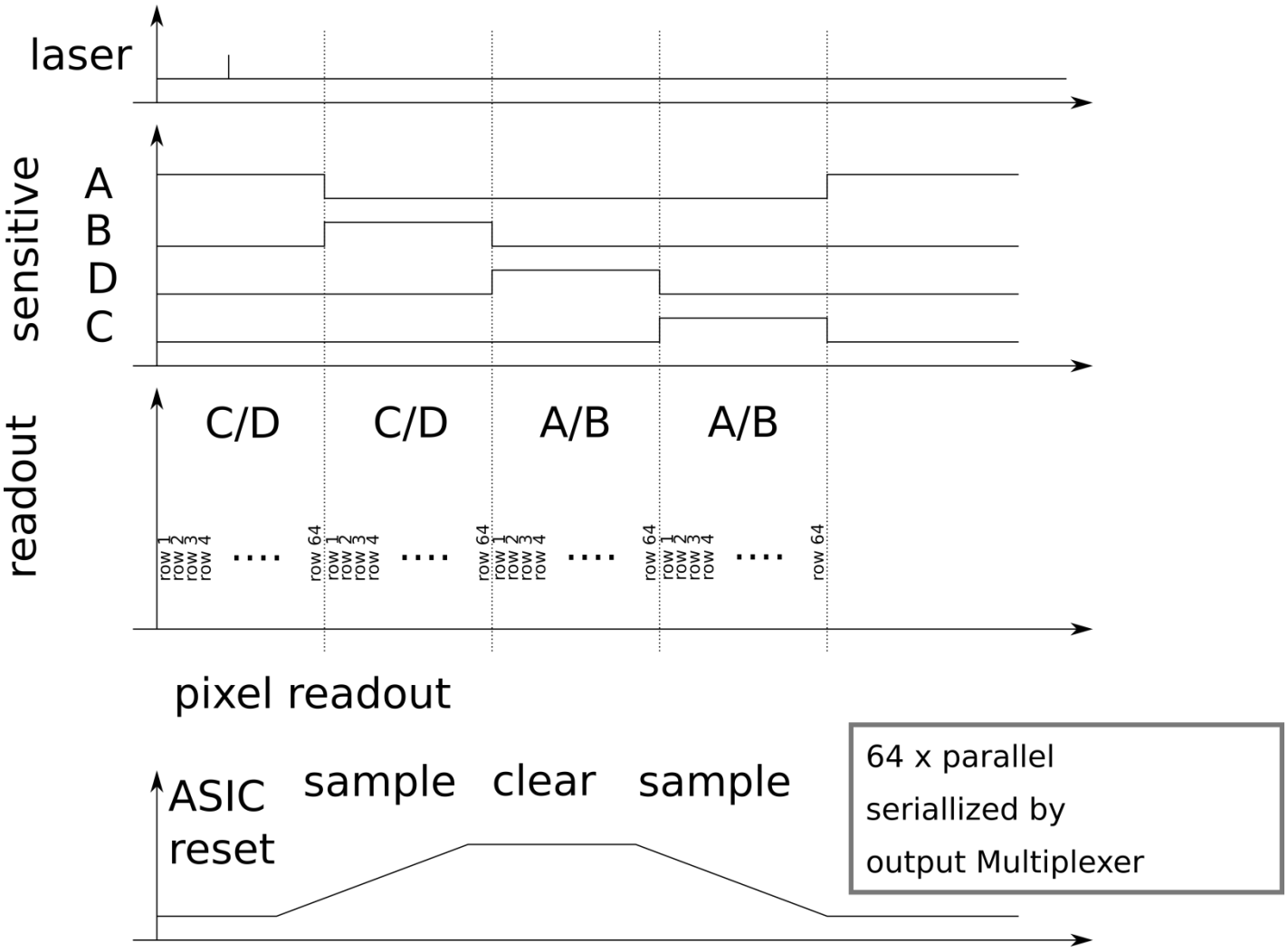
Quadropix

four storage areas
fast modulation



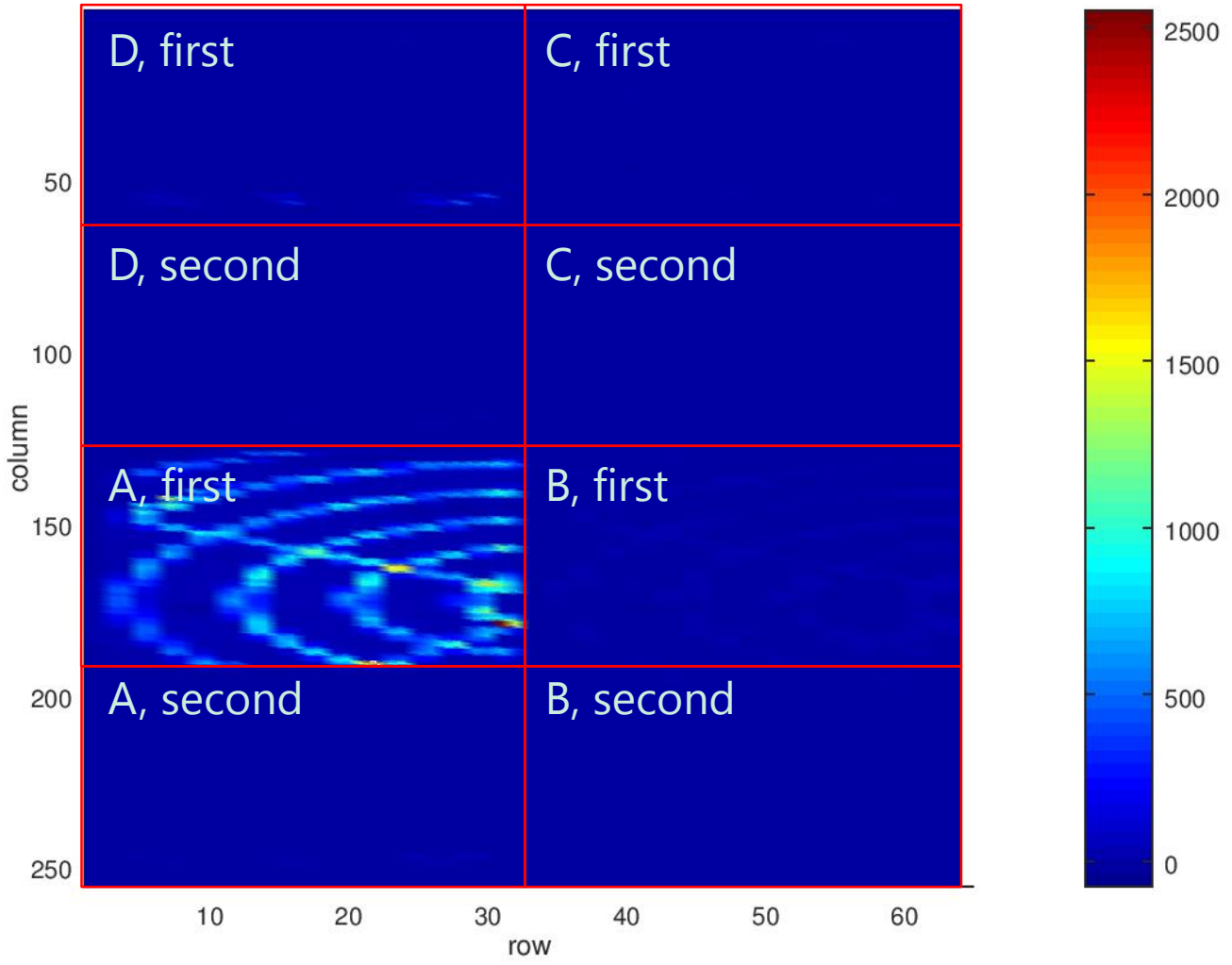


Test Sequence



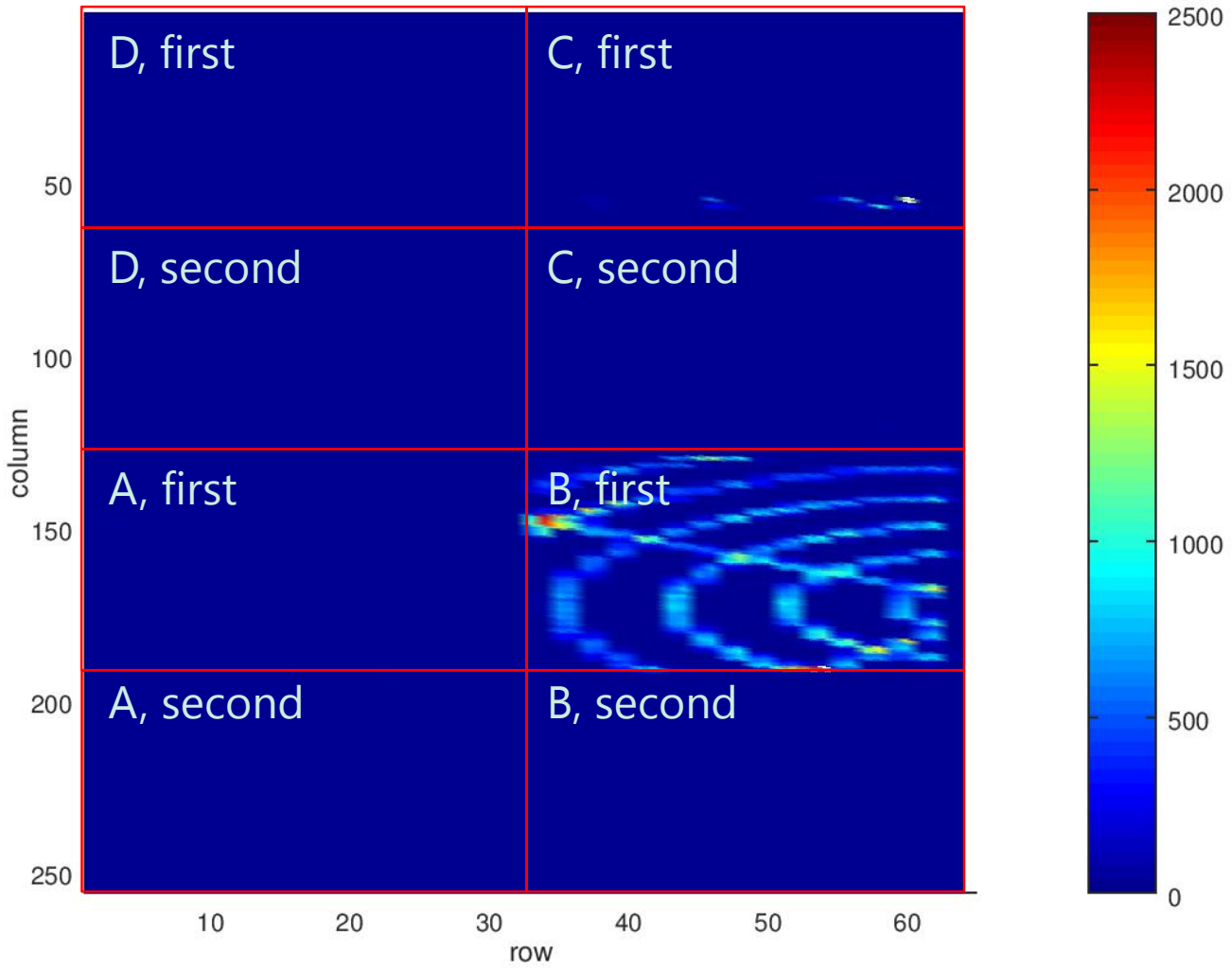
Target Measurement

injection while A collects



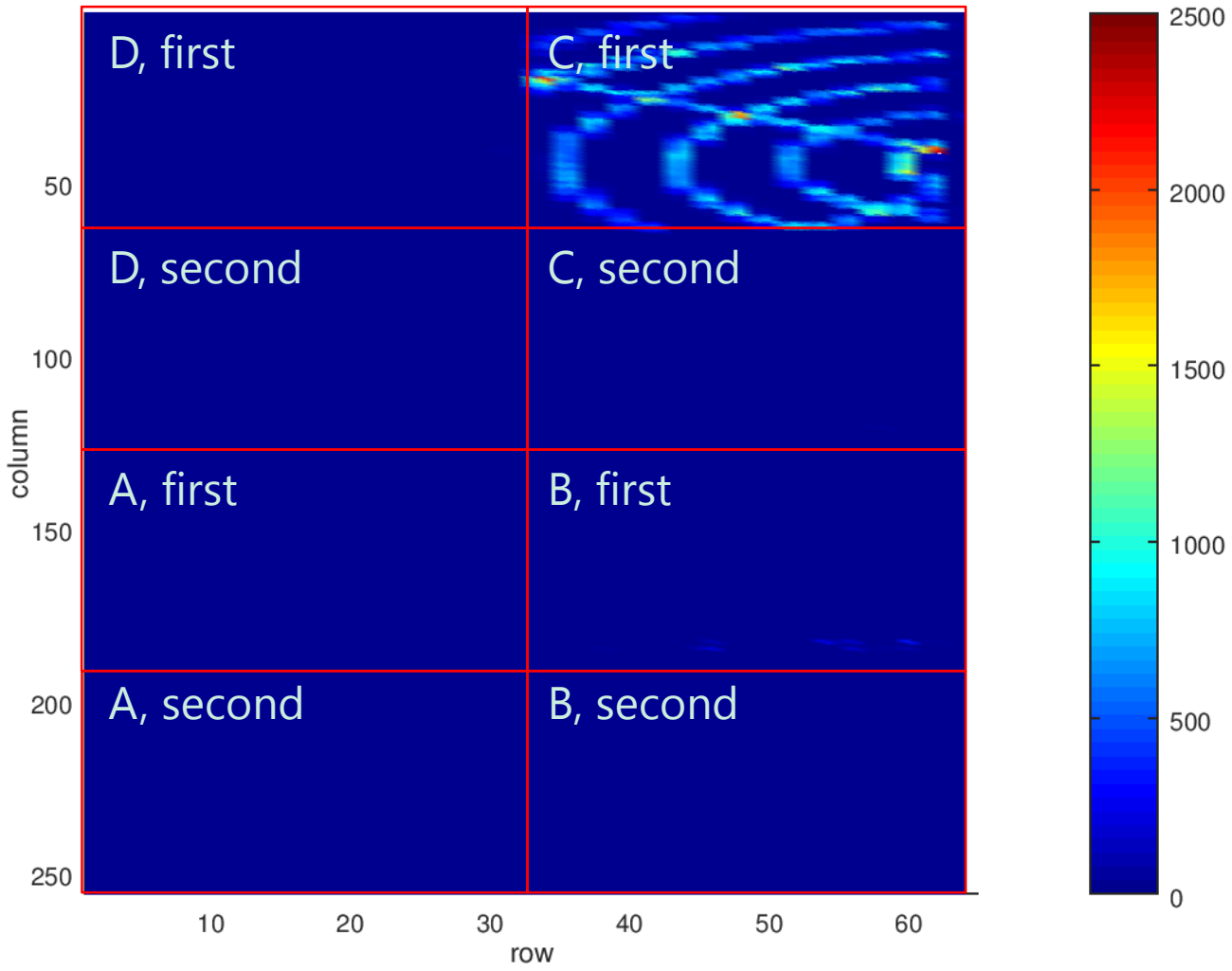
Target Measurement

injection while B collects



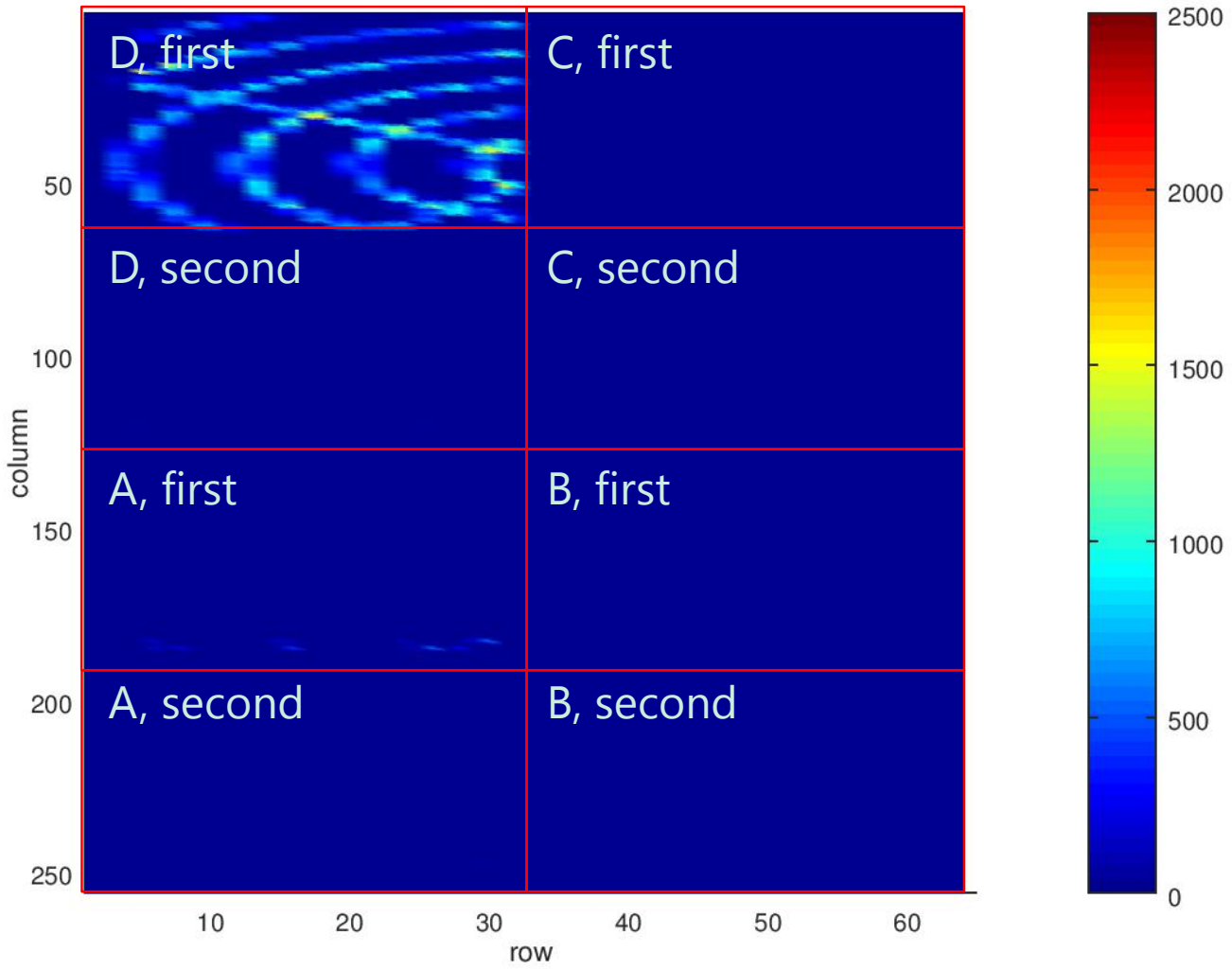
Target Measurement

injection while C collects



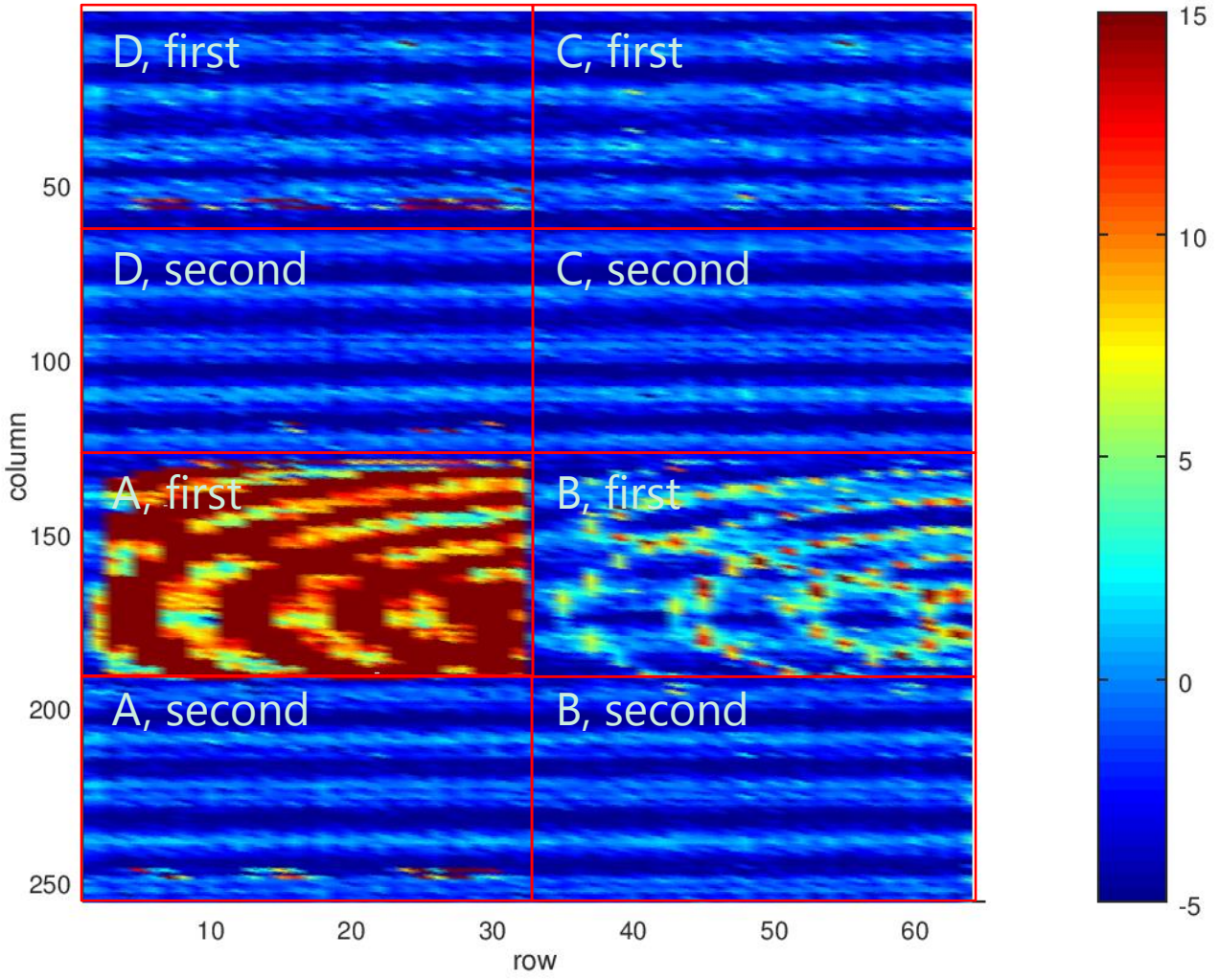
Target Measurement

injection while D collects



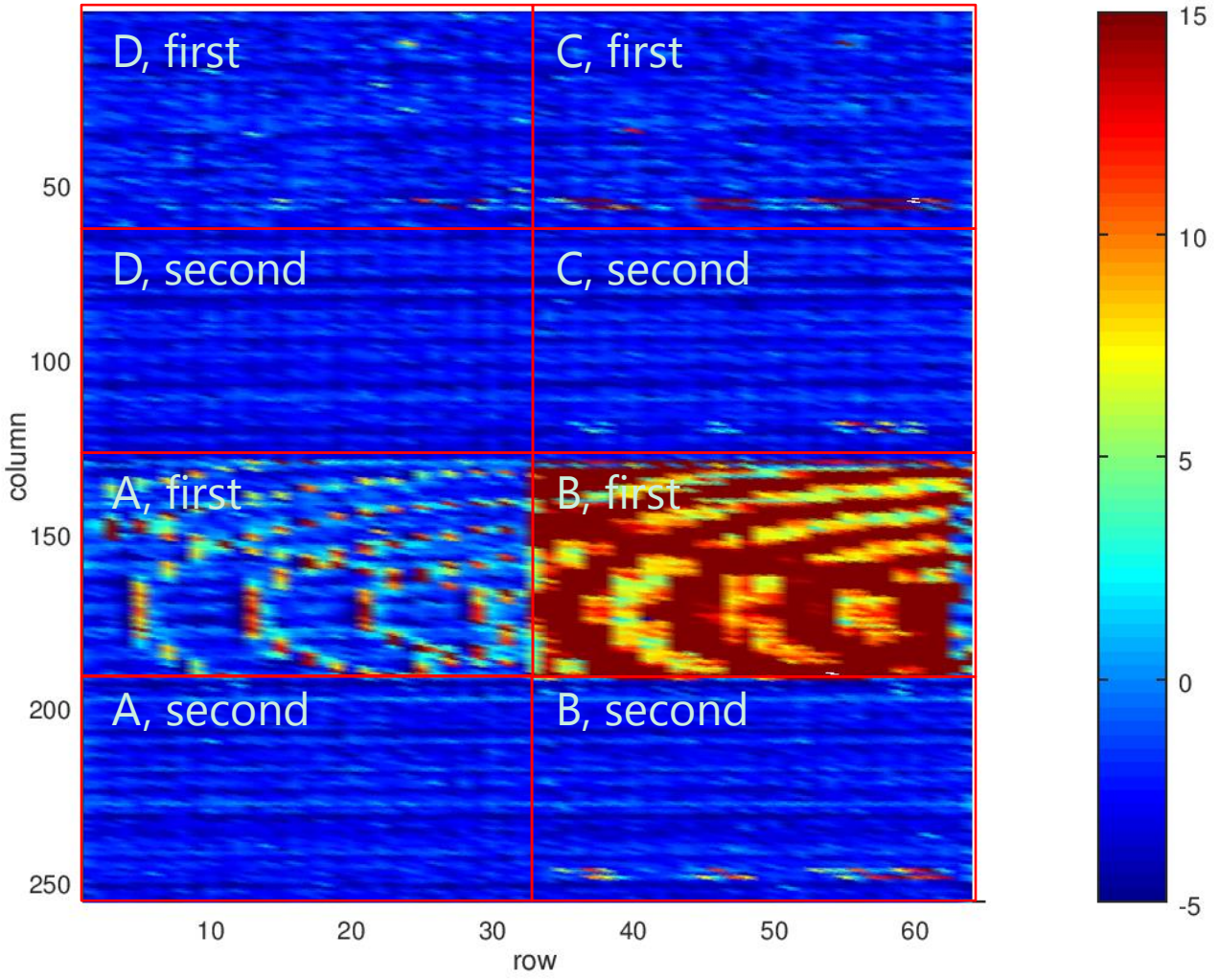
Target Measurement

injection while A collects



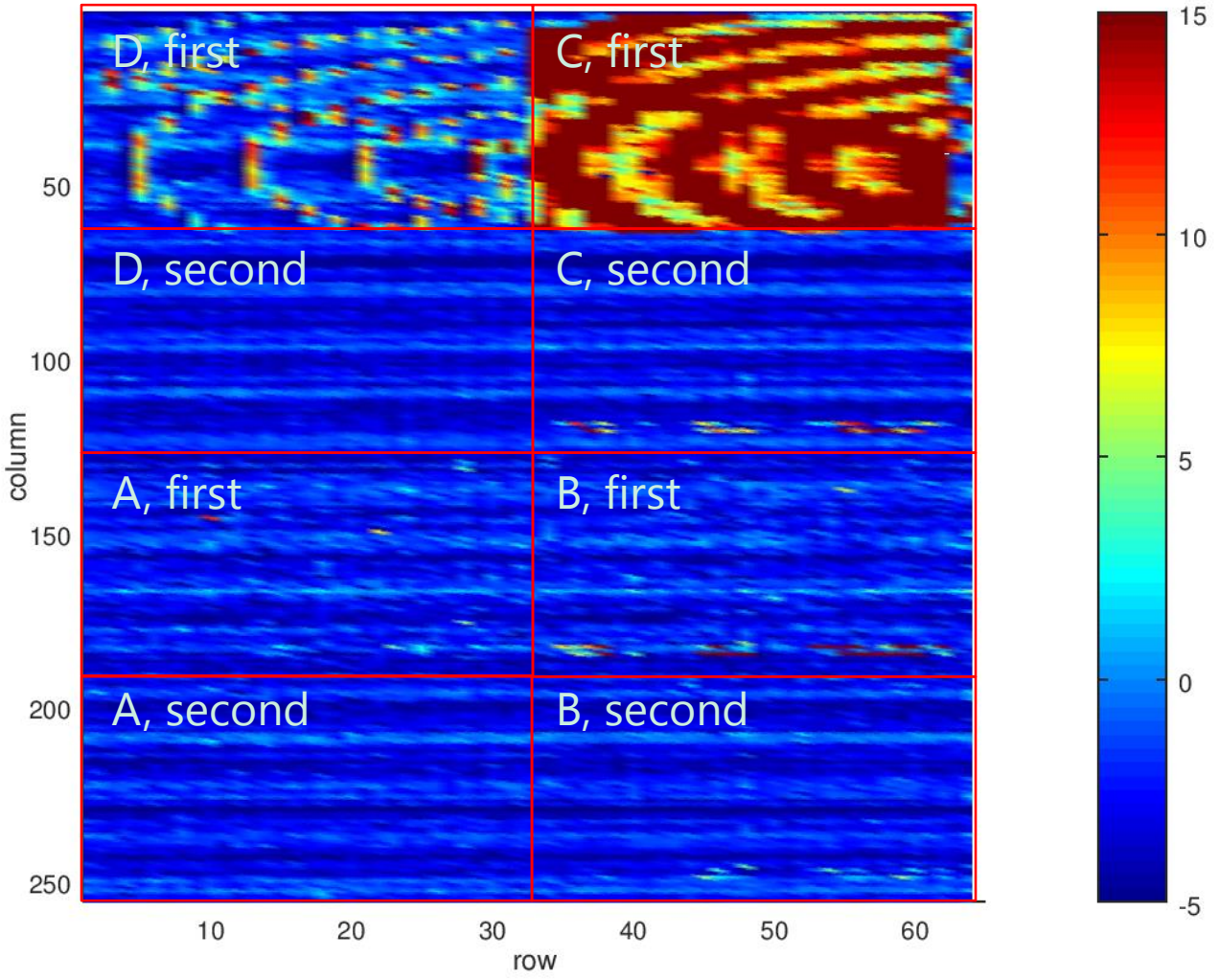
Target Measurement

injection while B collects



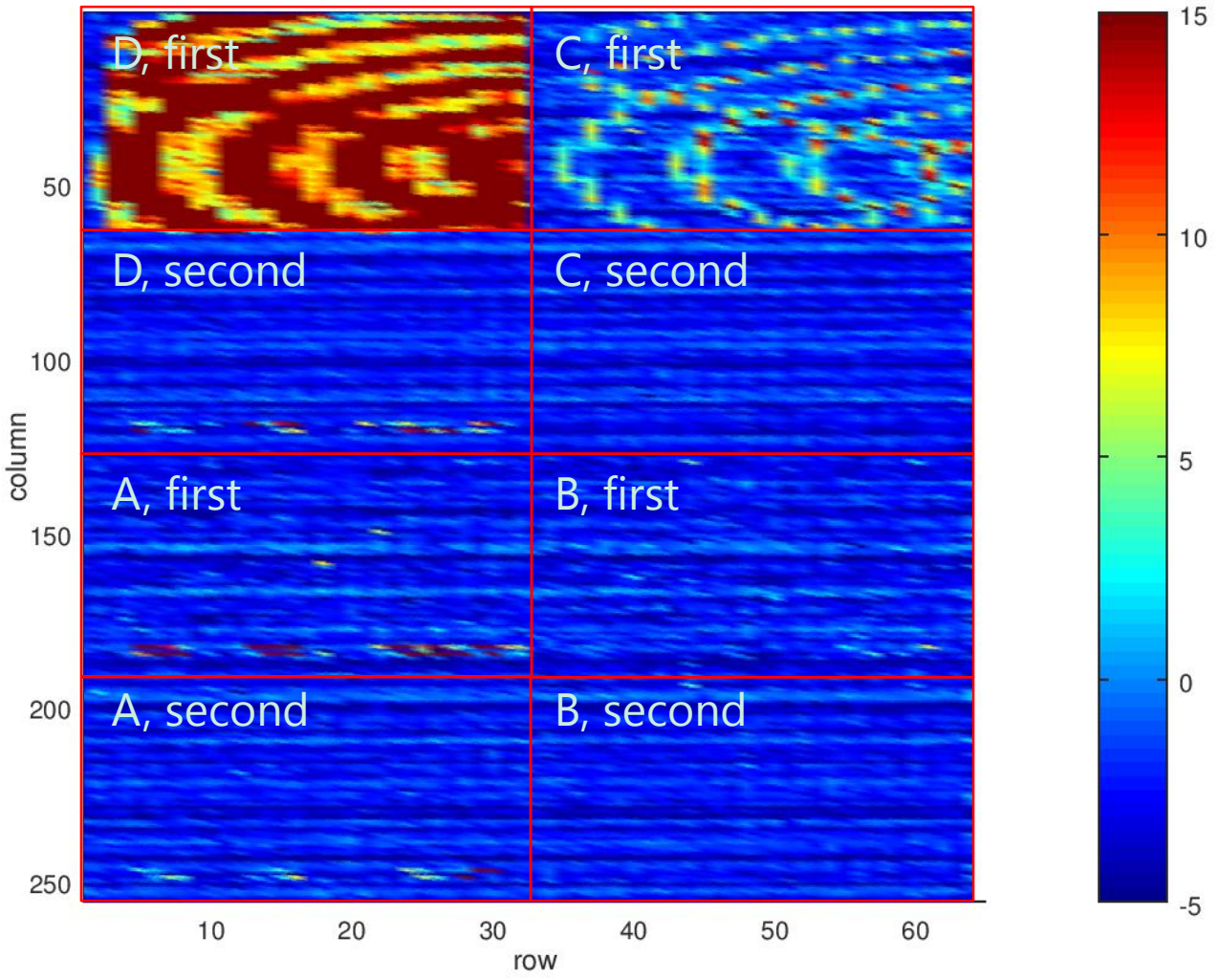
Target Measurement

injection while C collects

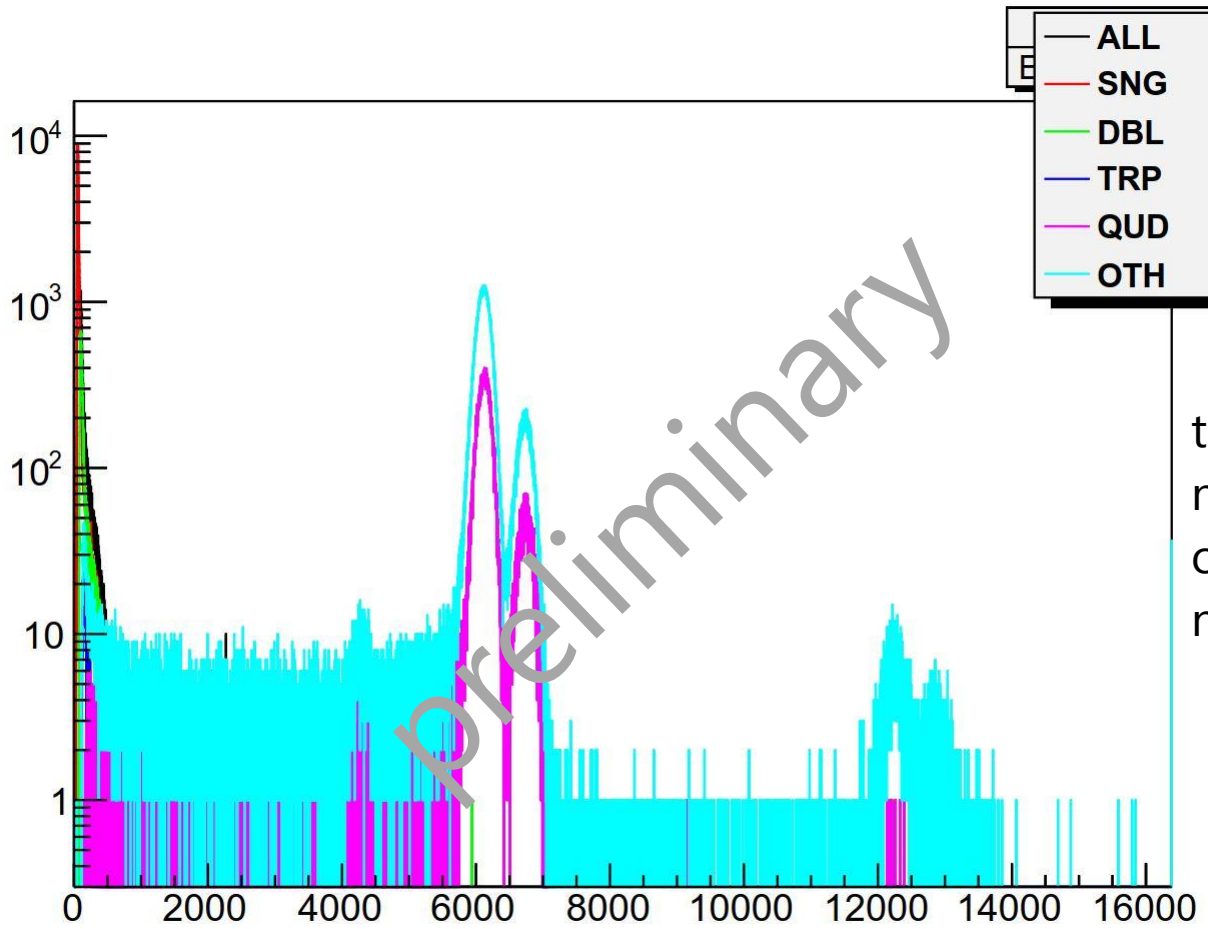


Target Measurement

injection while D collects



^{55}Fe Spectrum



taken at -37°C
not calibrated
only multiple pixel events
noise ~ 3-4 e^-

Conclusion

- Quadropix concept developed at HLL (for use at EST)
- concept functional (parameter optimization ongoing)
- optimization of geometry already investigated by simulations -> possible

Thanks for your attention

This project is supported by the European Commission´s H2020 Programme for the period June 2015 – June 2018 under the Grant Agreement nº 653982