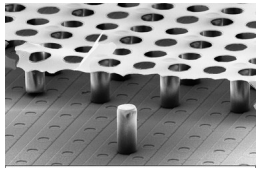

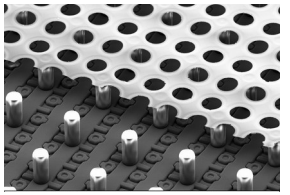

Application of Timepix4-based GridPix in IAXO

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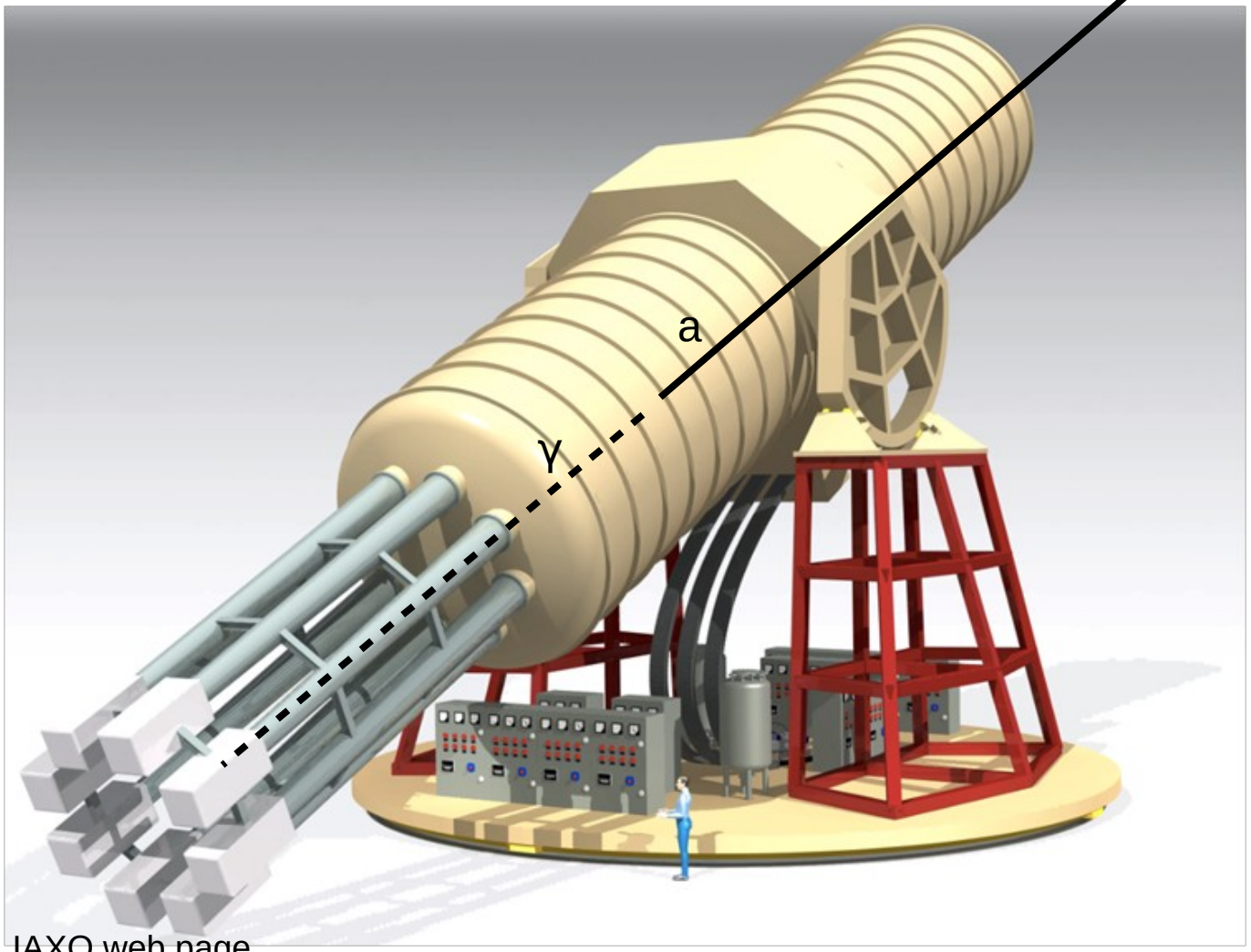
University of Bonn

Brainstorm TPX4 GridPix
Nikhef
07.04.2020

UNIVERSITÄT BONN

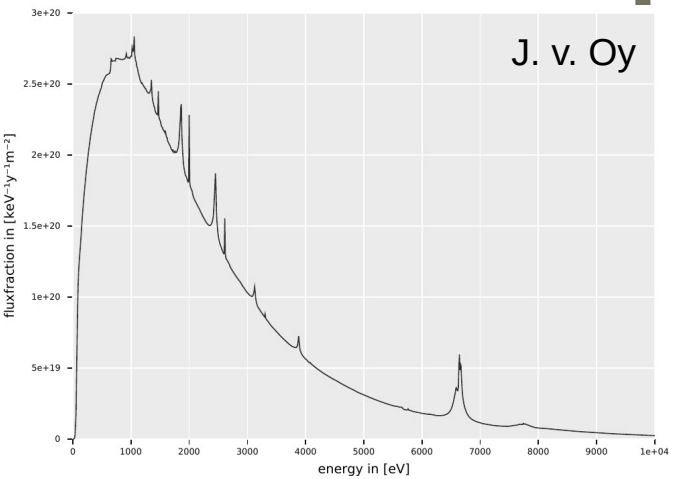
IAXO

Helioscope for search of axions emitted by the Sun.

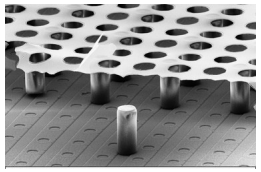


IAXO web page

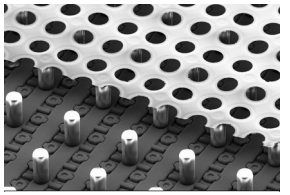
Axions convert into X-ray photons with energies up to 10 keV

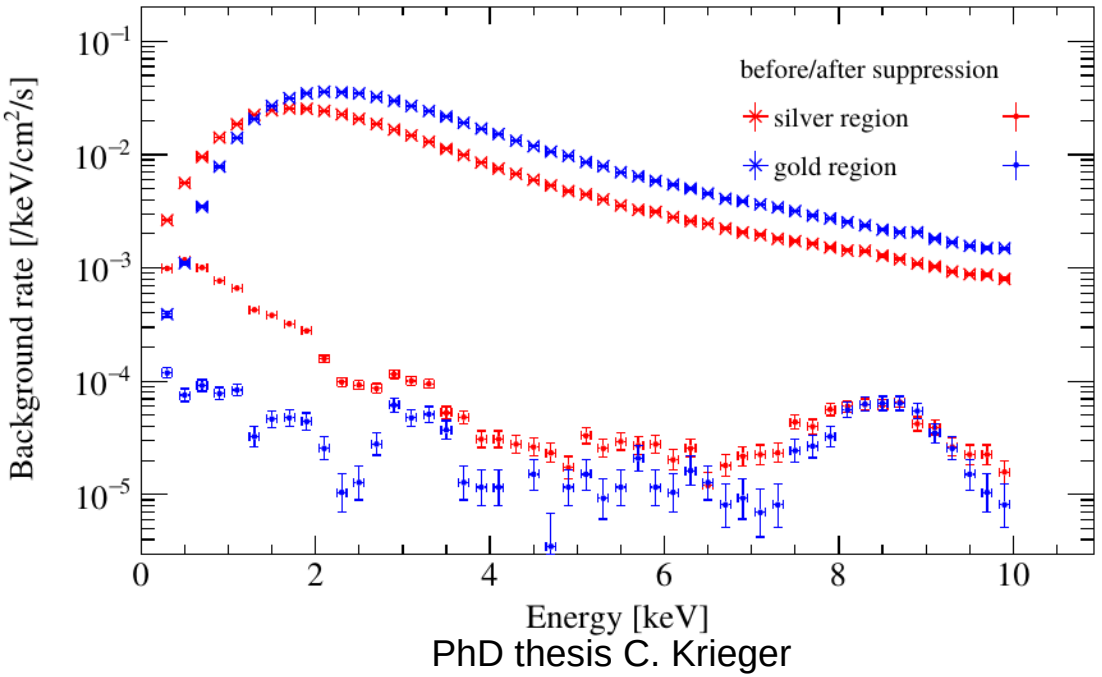


Need a X-ray detector with:
- high radiopurity
- good distinction between X-rays and tracks

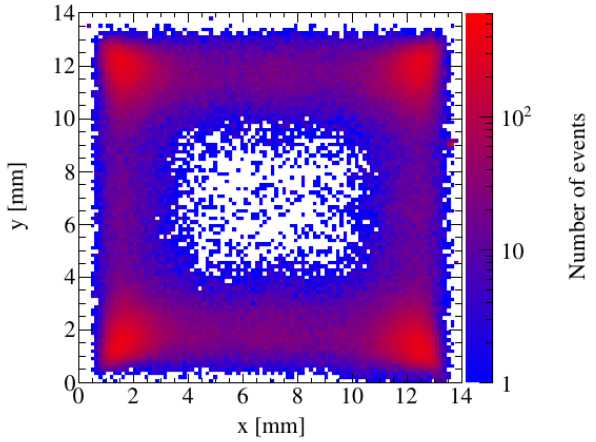


Experience from CAST

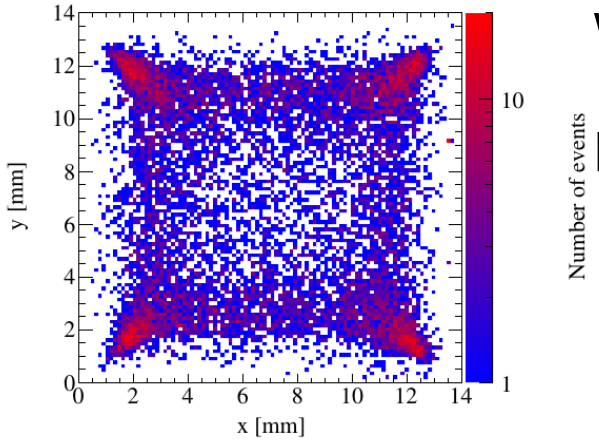




PhD thesis C. Krieger



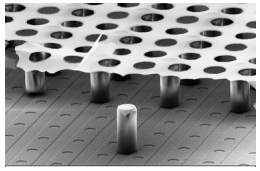
(a) E_γ < 2 keV



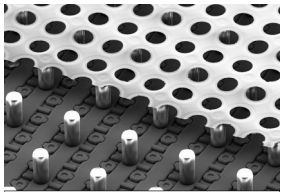
(b) E_γ > 2 keV

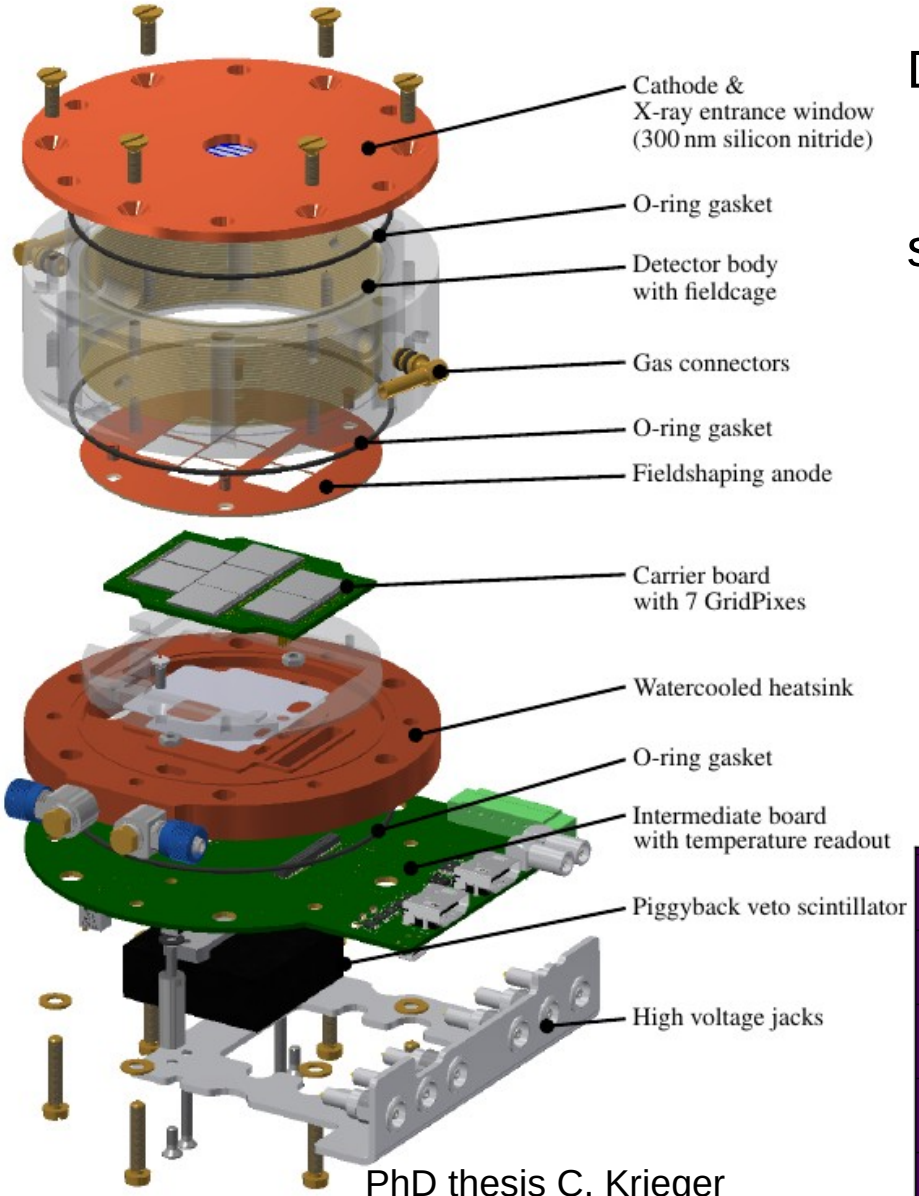
Data analysis of the 2014/15 data showed very efficient background suppression except for low energies and a 8-9 keV peak (Cu fluorescence + cosmics line).

In particular remaining events were clustered in the corners.
→ assumption that these are partially detected tracks.



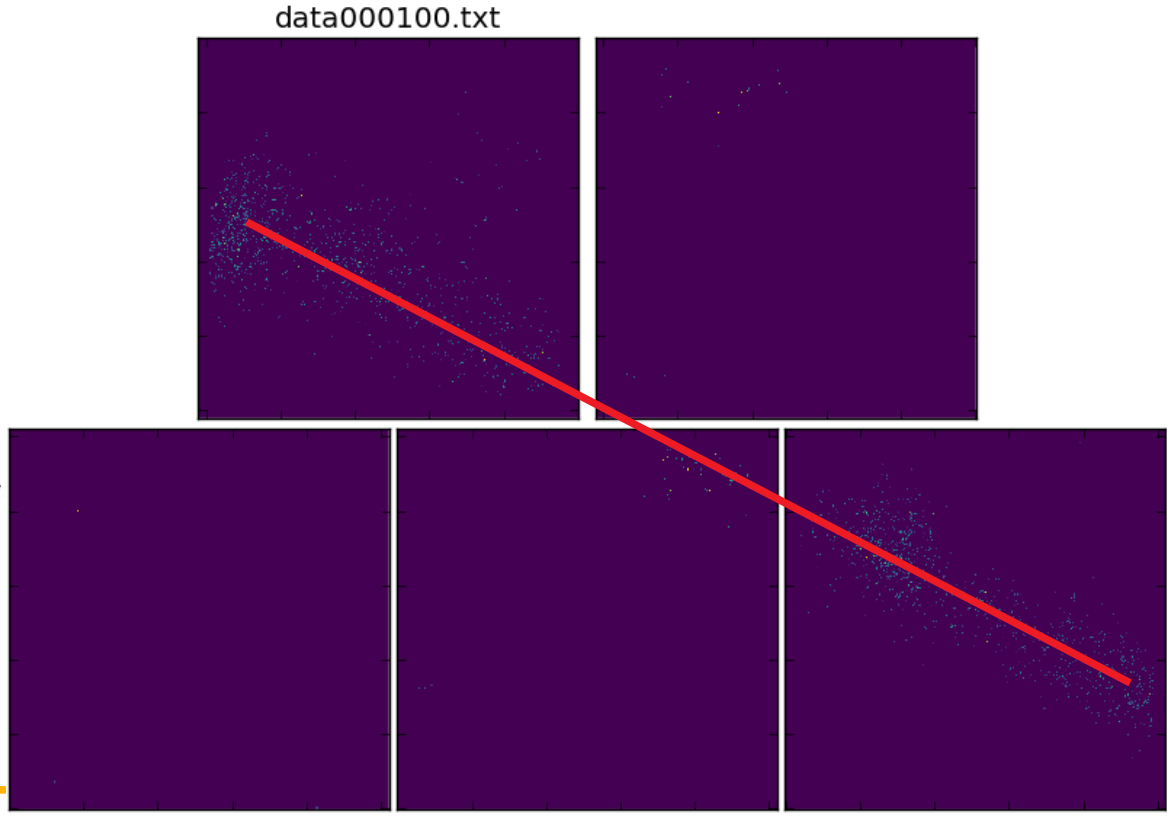
Solution in CAST





PhD thesis C. Krieger

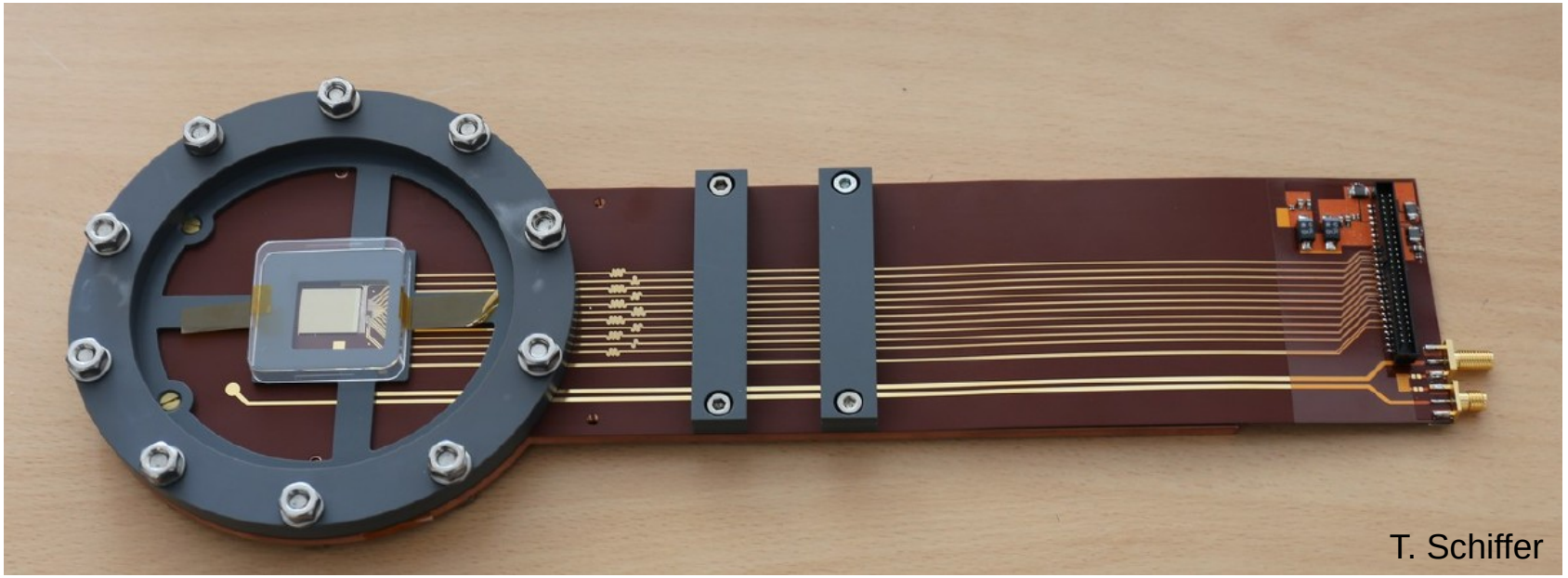
Detector modifications for 2018/19 data taking
- 6 veto GridPixes around central GridPix
- 2 veto scintillators (Piggyback visible on right side)
- Signal decoupled from grid and recorded with FADC for time information



Timepix3 -based GridPix

Sofar planned: single GridPix based on Timepix3
Benefits:
- continuous readout (sofar 2s frames with 0.2 s readout → 90 % efficiency)
- ToA information, which can hopefully be used to distinguish X-rays from perpendicular tracks without FADC

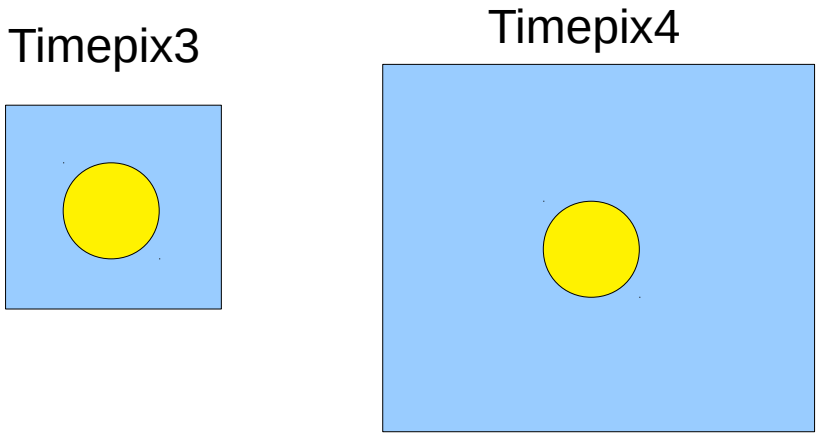
Independent of this: several other developments for a radiopure detector:
e.g. GridPix on kapton carrier



Possible benefits from Timepix4

New telescopes are being designed for babyIAXO (demonstrator for IAXO). Picture size of Sun is still under discussion – currently 6 mm.

→ Veto area around the Sun spot is significantly larger – only 1 GridPix should be sufficient.



Currently it is not obvious that the other improvements (better time resolution and better energy resolution compared to Timepix3) would help in the analysis .