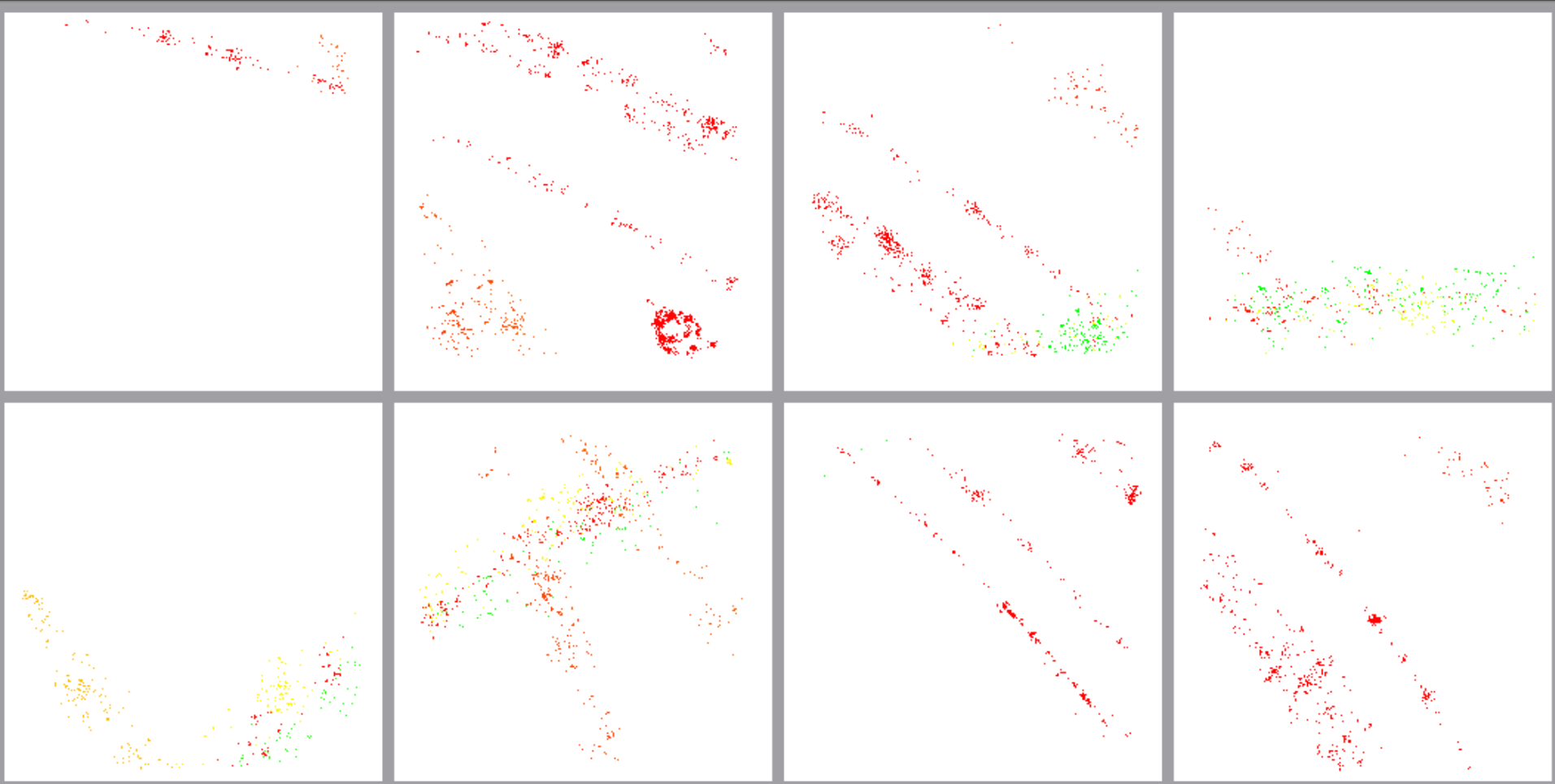


# The Pixel-TPC: Next Steps



Involved institutes: UBonn, CEA Saclay, UKyiv, NIKHEF, USiegen

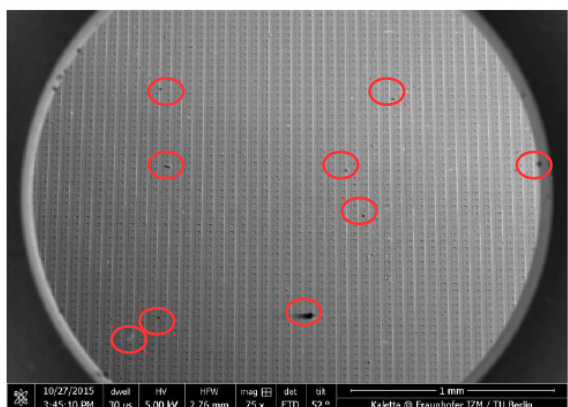
# Advantages of the Pixel-TPC

- ~100% single electron efficiency
  - maximum possible information about the primary ionization in x-y
  - z-resolution (currently) limited by sampling frequency
- identification and removal of  $\delta$ -electrons
- low occupancy
- robust against gain (T,p) changes
- excellent double-track resolution
- resolution ~independent of track direction (no  $\varphi$  dependence)
- dE/dx through cluster counting
- factor o(100) more space points than pad-based r/o → handles for data-driven corrections

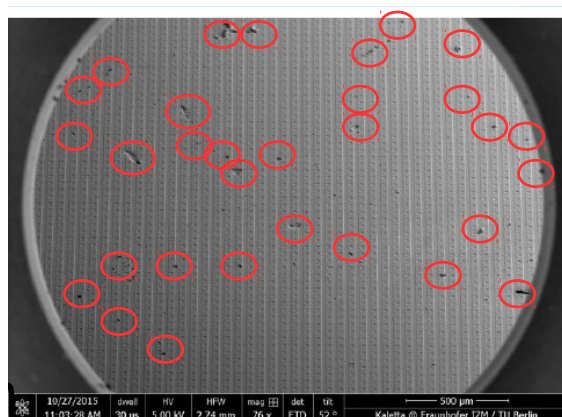
# Improving the InGrids

- IZM-7: first production batch of Timepix wafers entirely processed at IZM
- No conceptual changes of process but
  - More rigorous cleaning and inspection before SiN deposition
  - New machine for SiN deposition

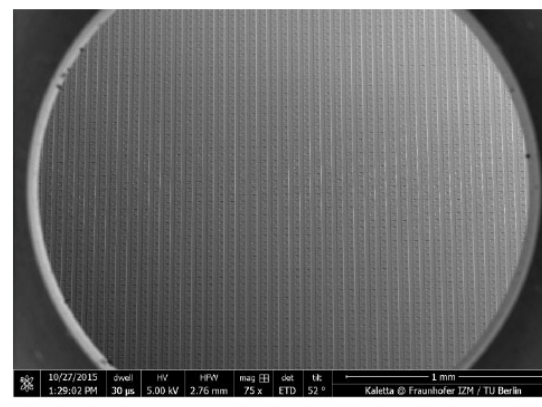
IZM-5



IZM-6



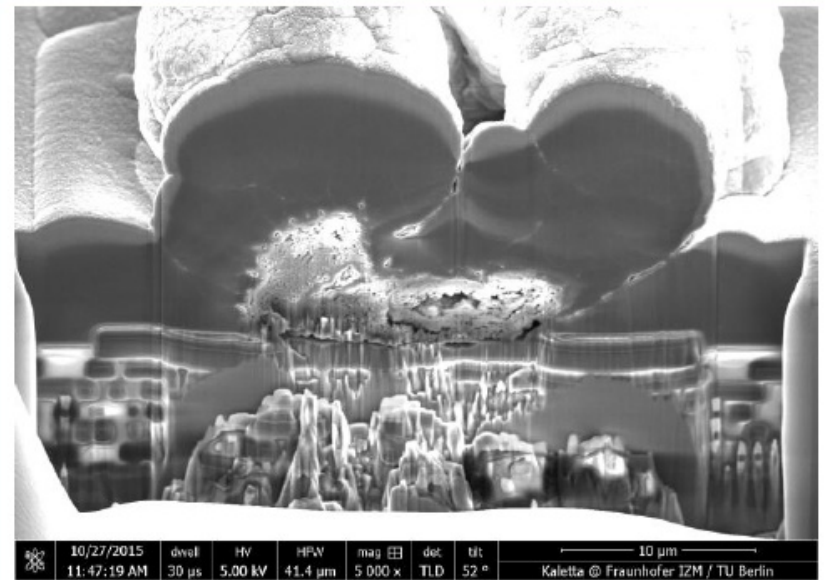
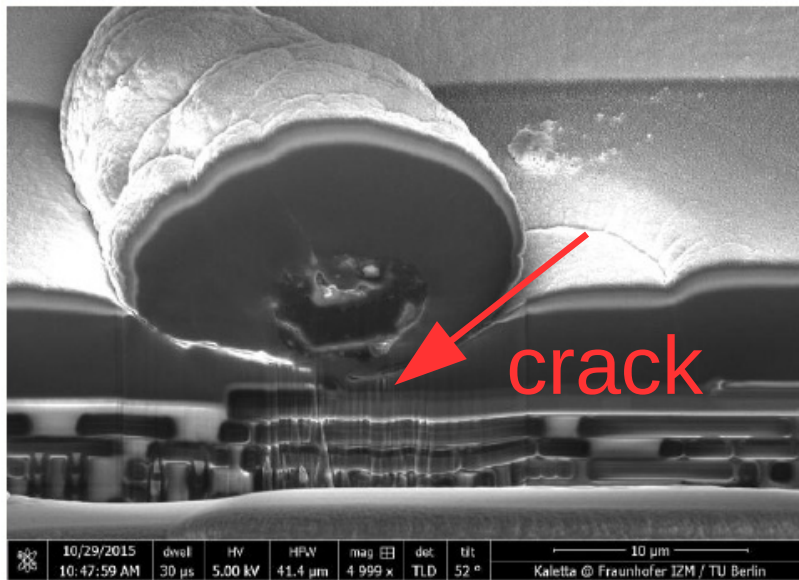
IZM-7



no visible defects any more

# Improving the InGrids

- likely cause for damage/destruction of chips:



# Improving the InGrids

- First two chips from IZM-7 work and are very robust

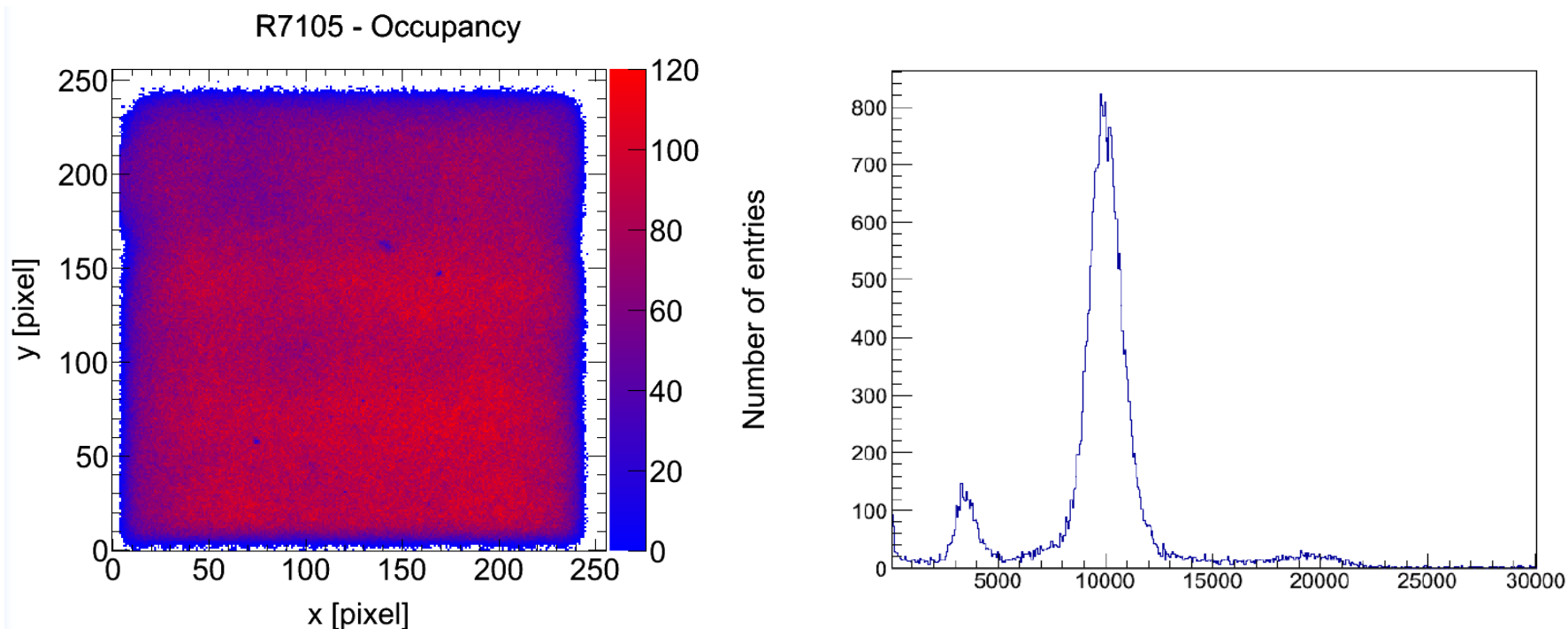


Fig. 1: GridPix E2-W69: left occupancy plot, right: charge spectrum of an X-ray gun with a titanium target

# Improving the InGrids

- First two chips from IZM-7 work and are very robust

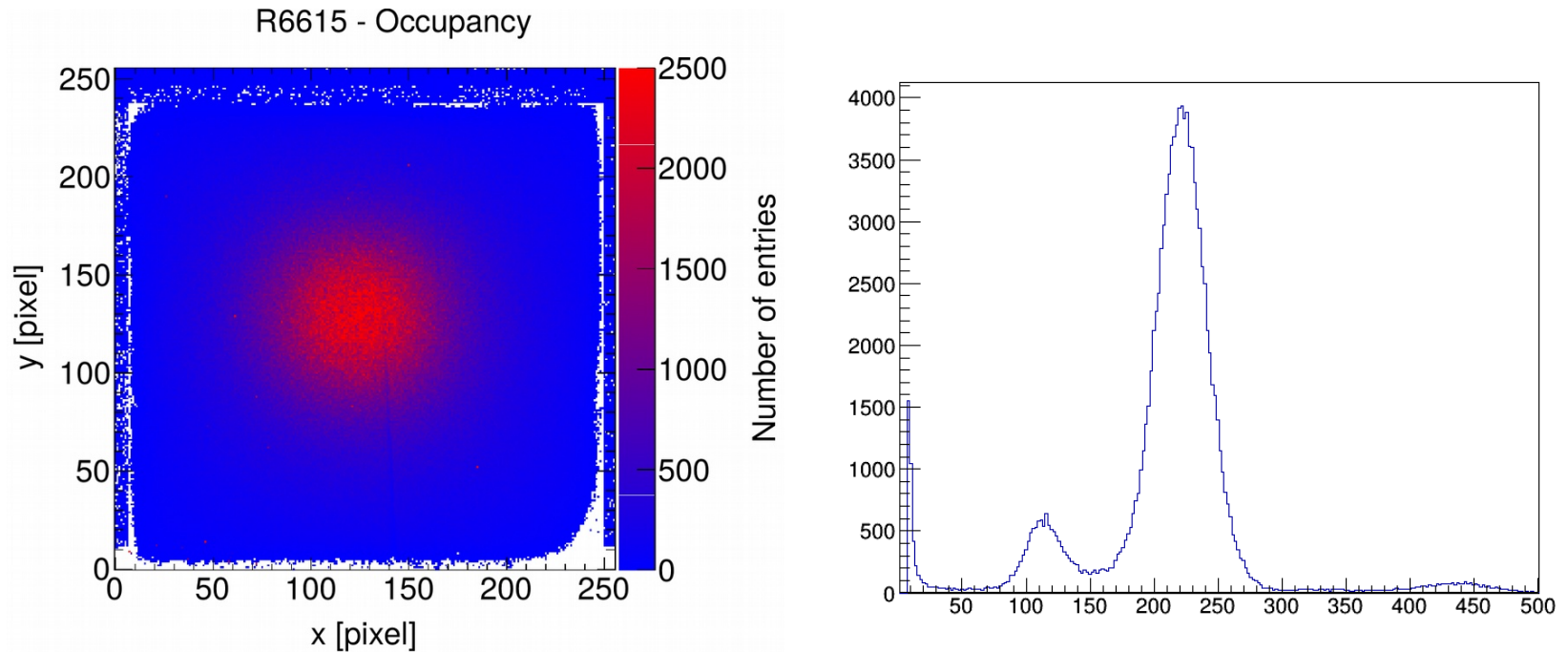


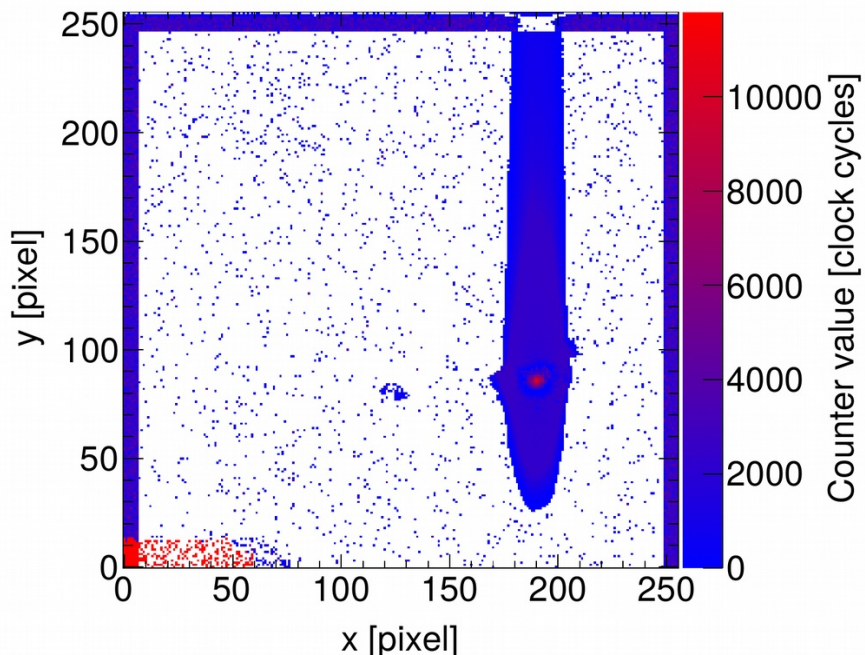
Fig. 2: GridPix G2-W66: left occupancy plot, right: pixel spectrum of an  $^{55}\text{Fe}$ -source



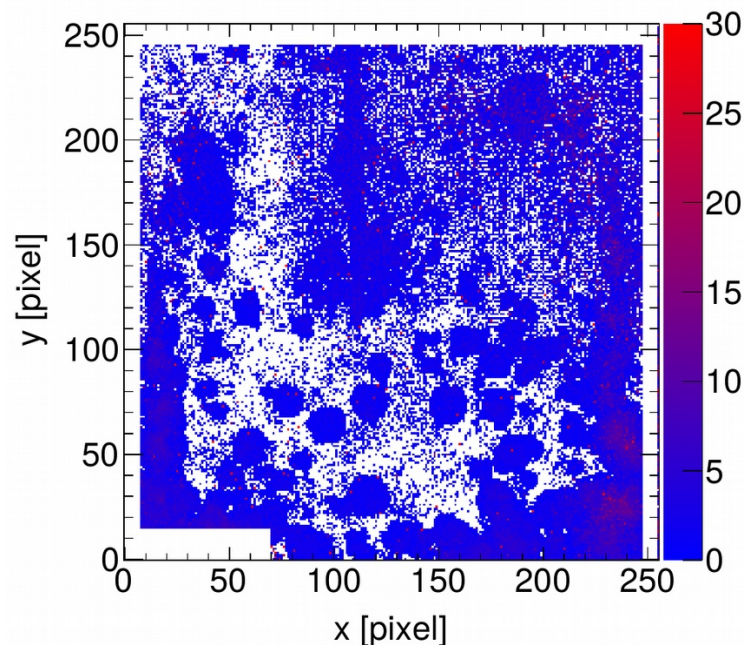
# InGrid Torture

- Chip G2-W66: grid voltage successively increased up to 480 V (Ar/Iso 97.7/2.3) (gain  $\sim 500000$  (?))
- Sparking at rate  $\sim 50$  Hz for several hours, several 100k sparks

R6658 - 000100



R6658 - Occupancy



**SURVIVED!**

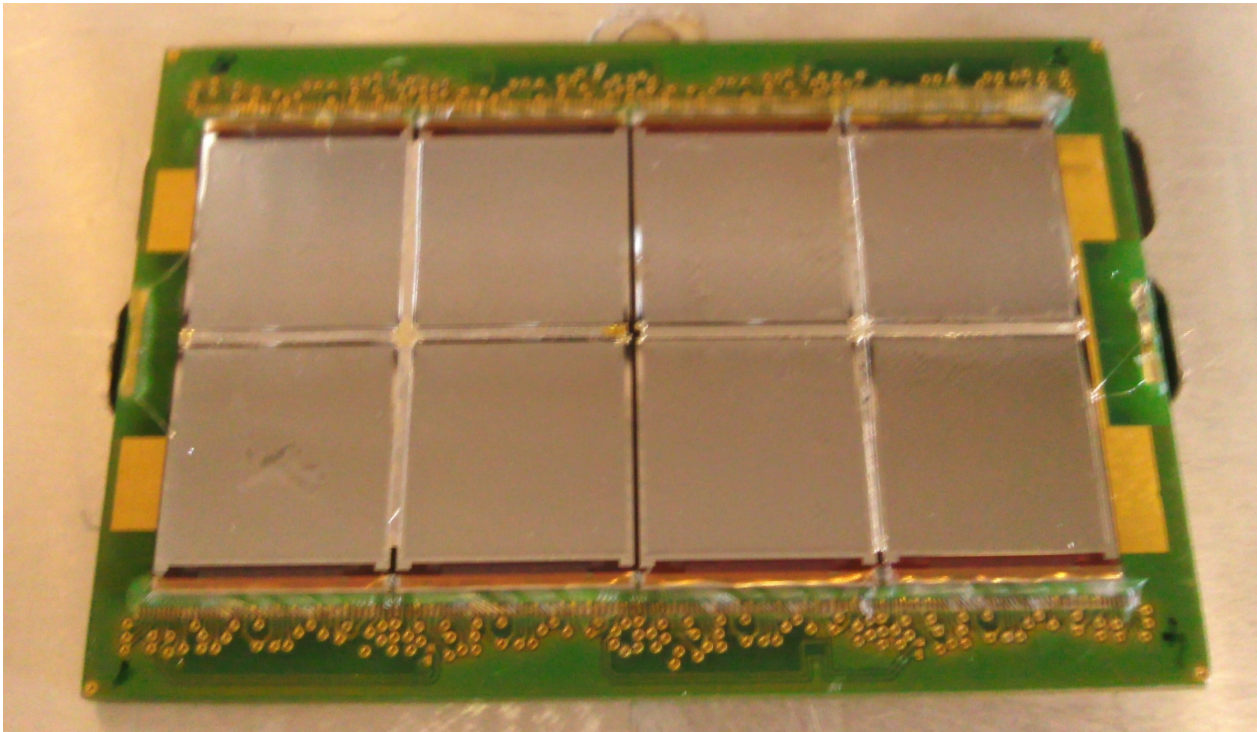
# Timepix3

- Finally, processing of first (low-yield) wafer of Timepix3 is starting
- Expect InGrids this summer
- Improved structure with (somewhat) smaller dyke
- Readout – SPIDR available (but currently for single/few chips)
- Multi-chip readout → SPIDR-based and/or SRS-based ...  
(ongoing, Bonn: PhD Tobias Schiffer)



# Field homogeneity

- Distortions! see Peter Kluit's talk
- Field shaping around the chips?

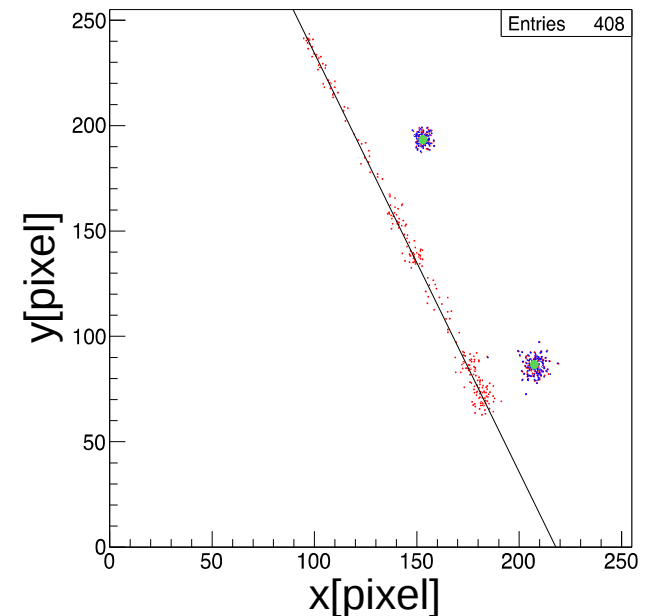


can this be  
„professionalized“  
(hand-glued Al foil)

# Momentum

Since last year:

- fresh BMBF funding (2 PhD positions in Bonn, 1 PhD position in Siegen)
- LEPCOL group at NIKHEF
- joint NIKHEF/Bonn student starting soon
- GridPix applications outside LCTPC
  - CAST/IAXO axions
  - Transition Radiation
  - Neutron Detectors
  - X-Ray Polarimeter



# Next steps

- Consolidate wafer-based InGrid process – IZM-7 looks very promising
- Get Timepix3 InGrids – this summer...
- Get multi-chip readout – critical...
- Improved field shaping needed
- „Engineering“ module development
- Simulation + Analysis! (→ aim for LCTPC paper)

**The Pixel-TPC is too beautiful not to remain  
an option for the ILC TPC!**