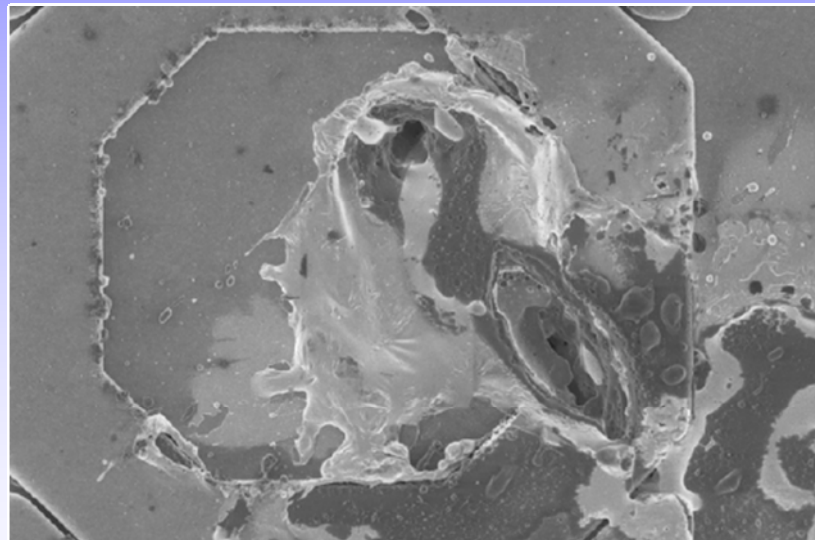


Discharge protection for MPGDs

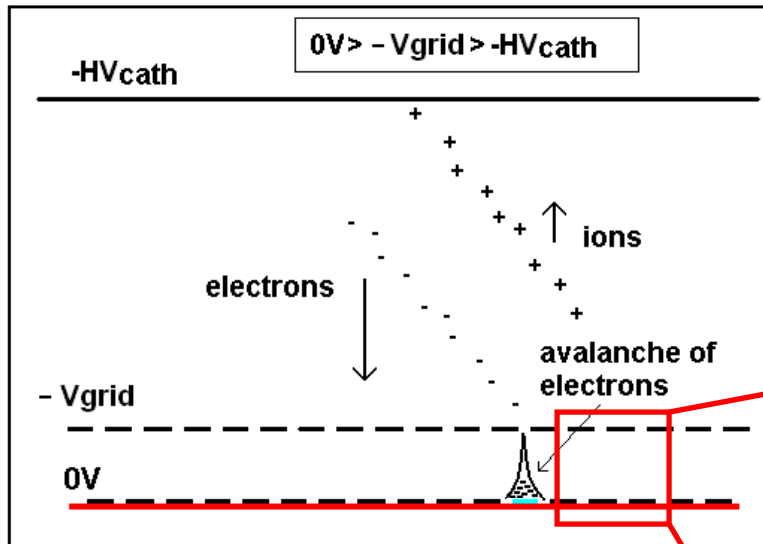
Martin Fransen, Nikhef



Outline

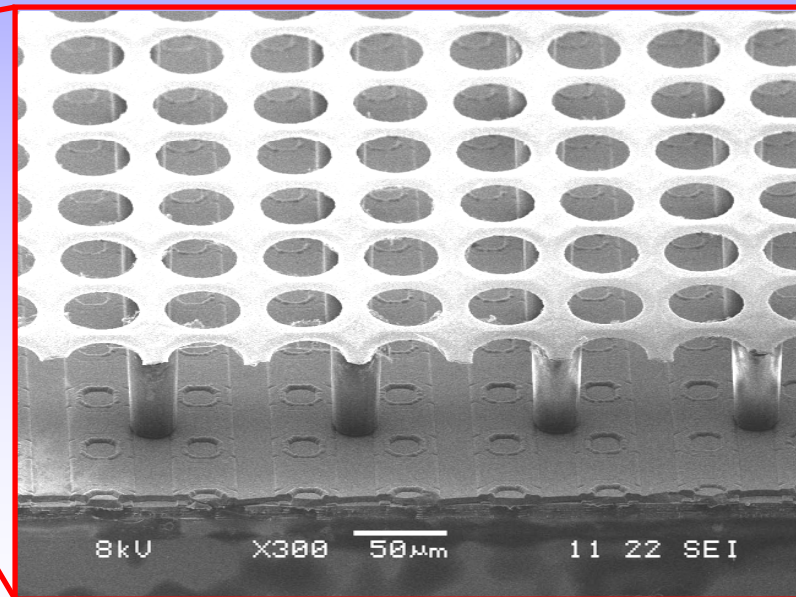
- What does/is SiProt.
- Results with SiProt.
- Issues for further research.

Gridpix detectors



- Micromegas (old method).
- Integrated grid (InGrid) is applied by post processing a chip. (V.M. Blanco Carballo and S.M. Smits, University of Twente)

- Drift volume $E = \sim 0.1-1 \text{ kV/cm}$.
- Grid.
- Gain region $E = \sim 80 \text{ kV/cm}$
- Timepix chip.

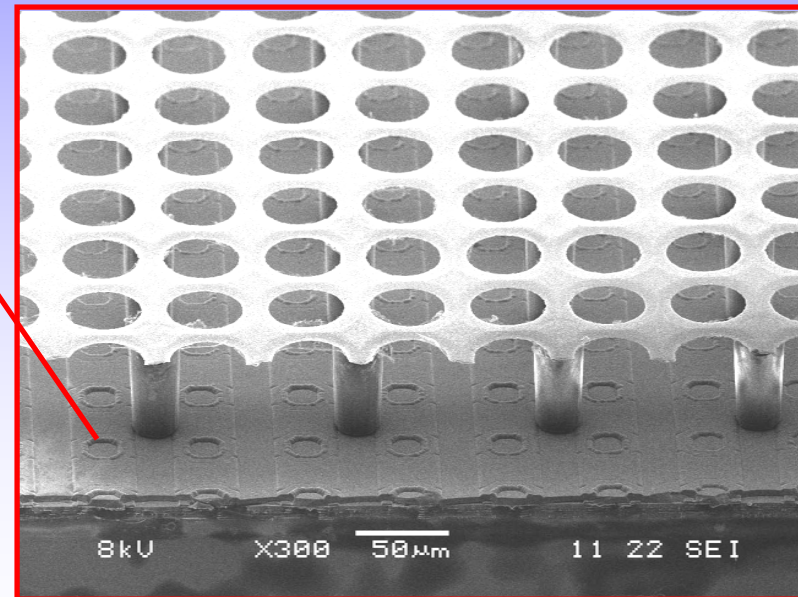


Gridpix detectors

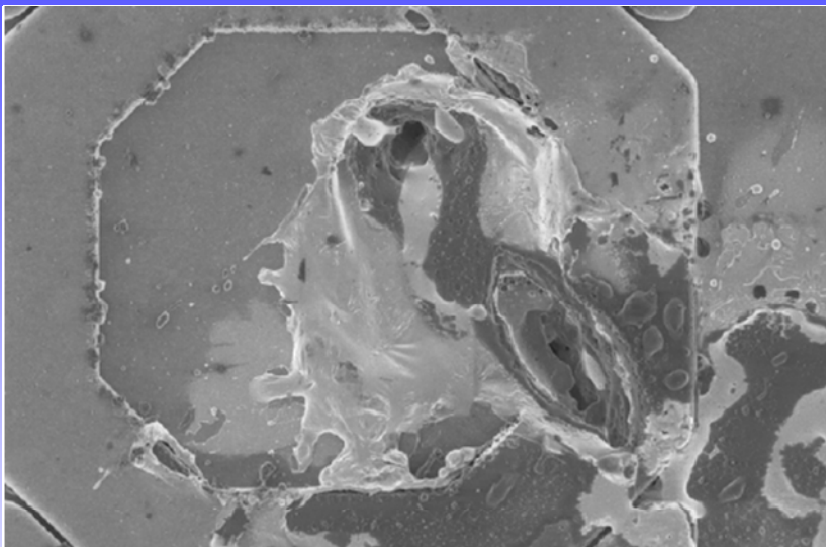


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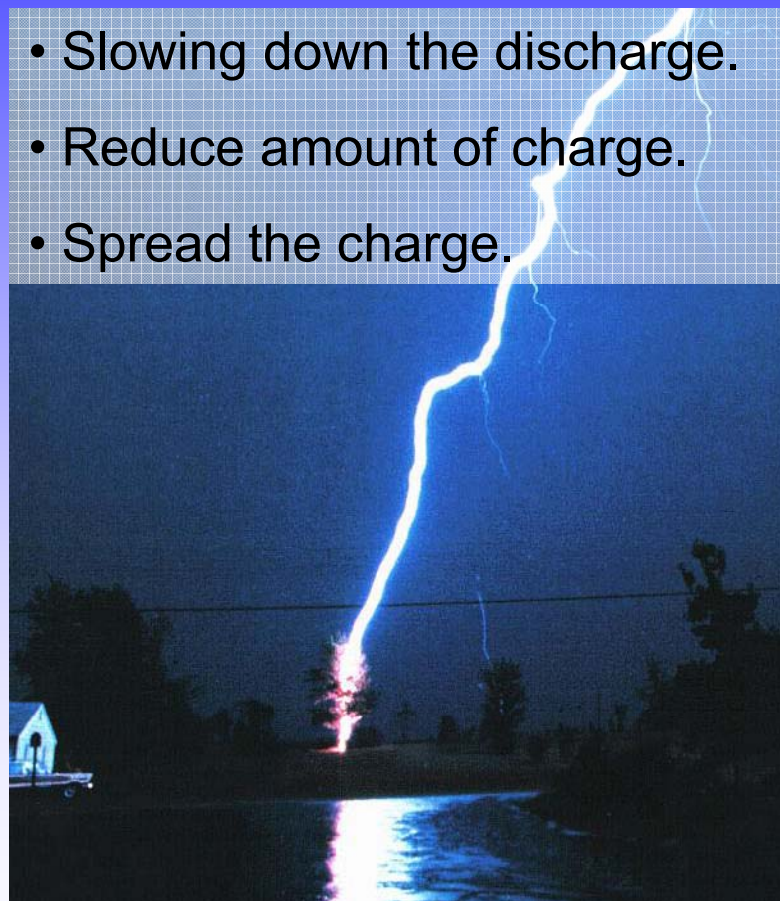


Gridpix detectors



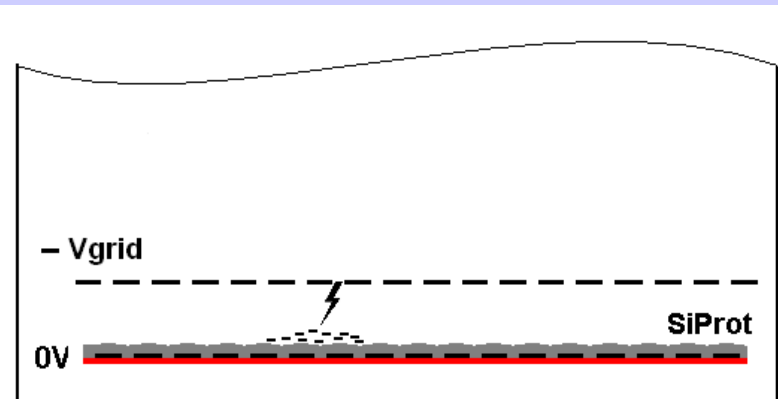
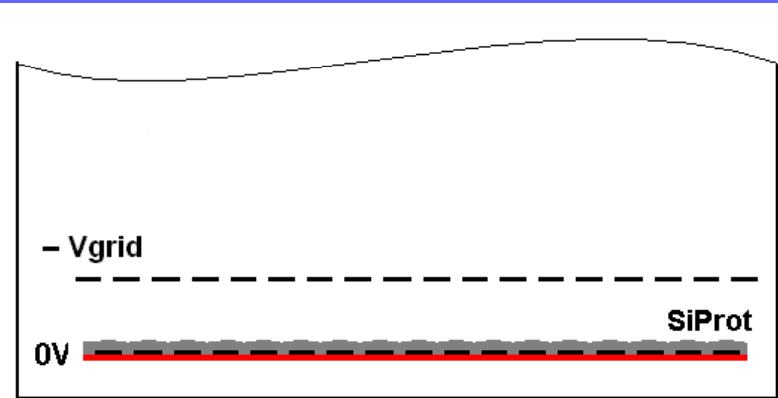
- Drift volume $E = \sim 0.1-1 \text{ kV/cm}$.
- Grid.
- Gain region $E = \sim 80 \text{ kV/cm}$
- Timepix chip.

- Slowing down the discharge.
- Reduce amount of charge.
- Spread the charge.



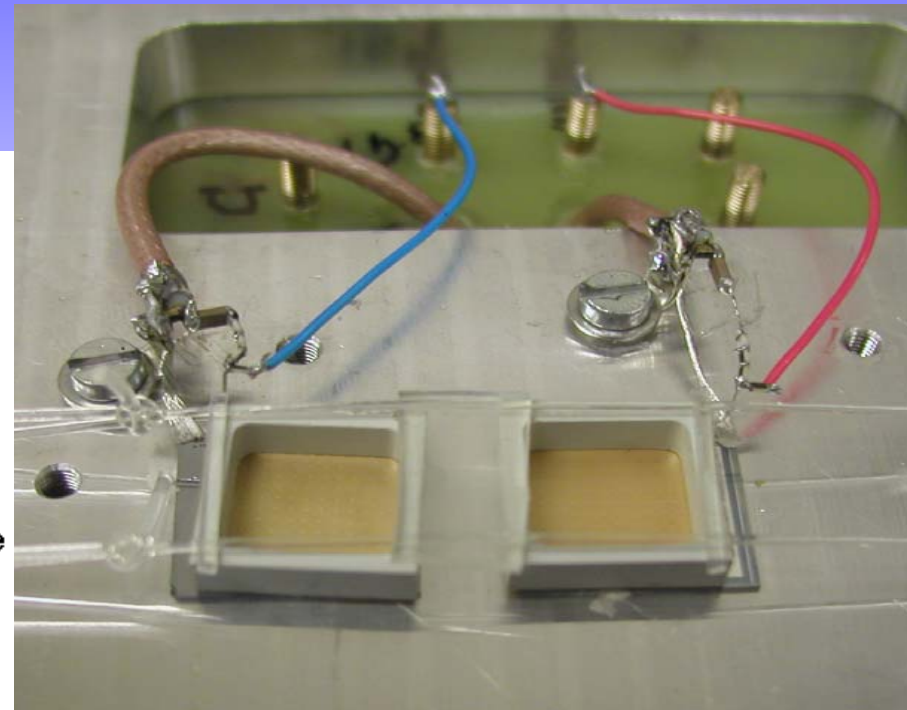
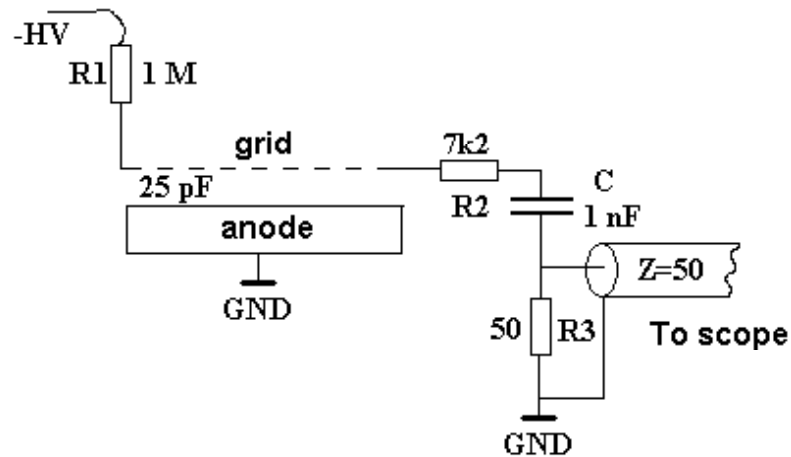
Silicon *Protection*, SiProt

- High resistive material → quenching of discharges.
- Some conductivity to prevent net charge build up.
- Deposit on the chip without killing the electronics. (IMT Neuchatel).
- First tests in 2005 on dummy anodes.
- First applied on Timepix chips end 2006.



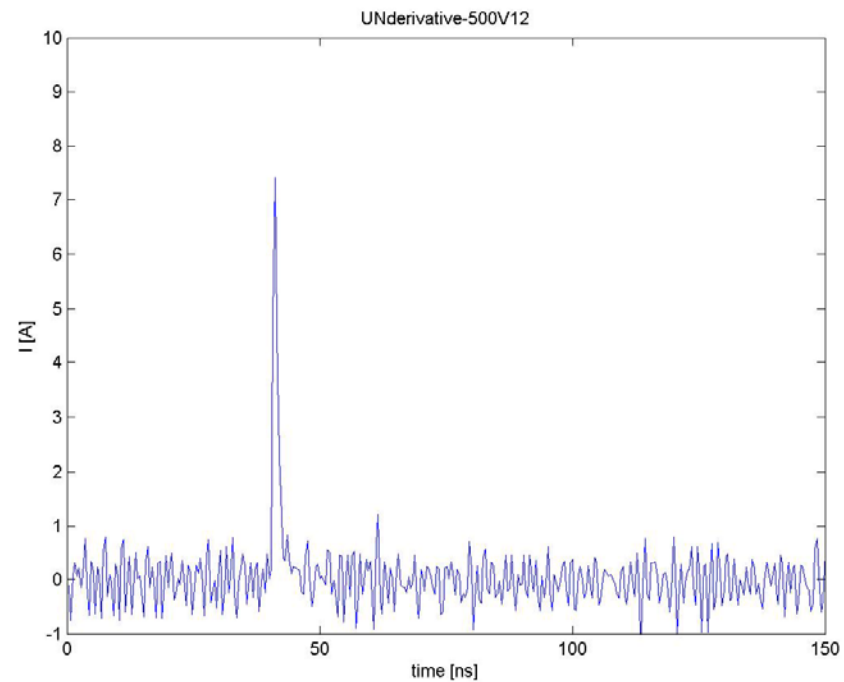
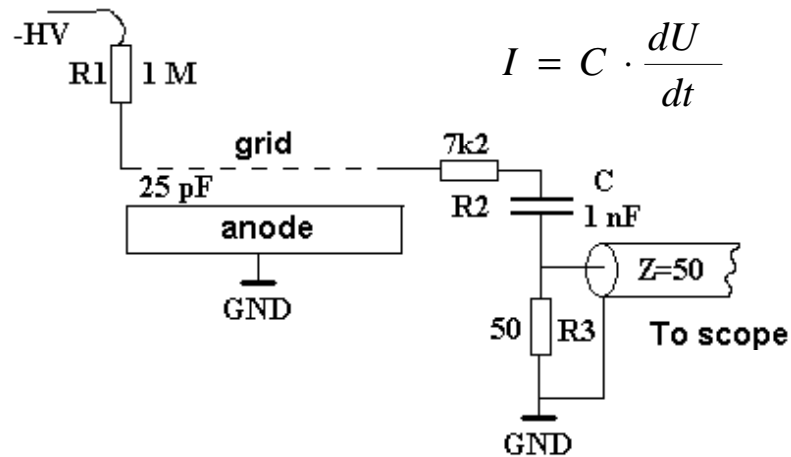
Dummy anode tests

- 3 μm SiProt



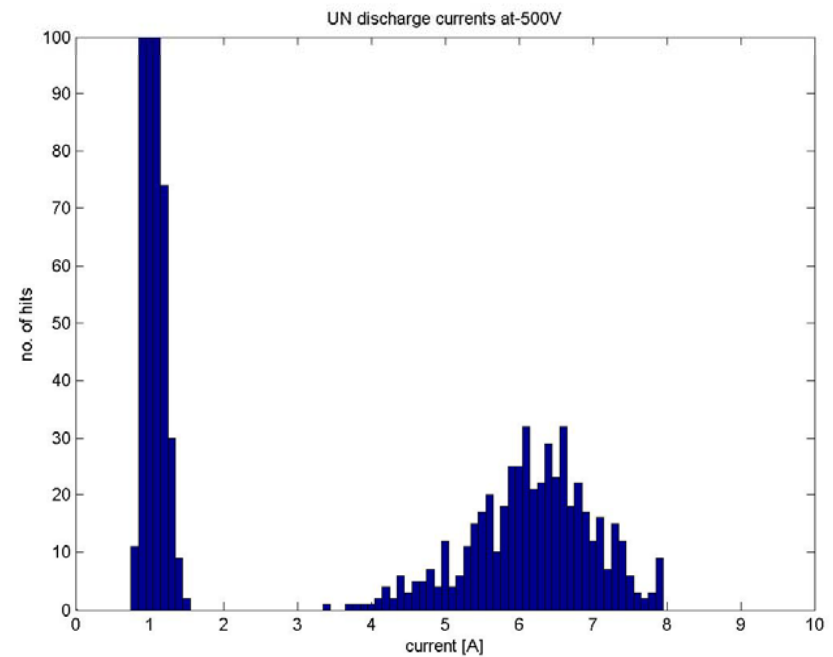
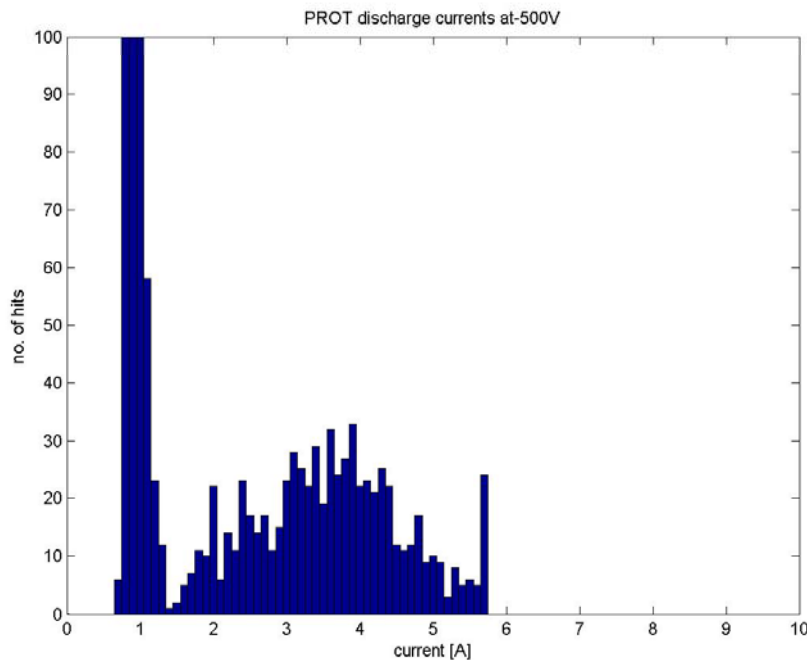
Dummy anode tests

- 3 μm SiProt



Dummy anode tests

- 3 μm SiProt

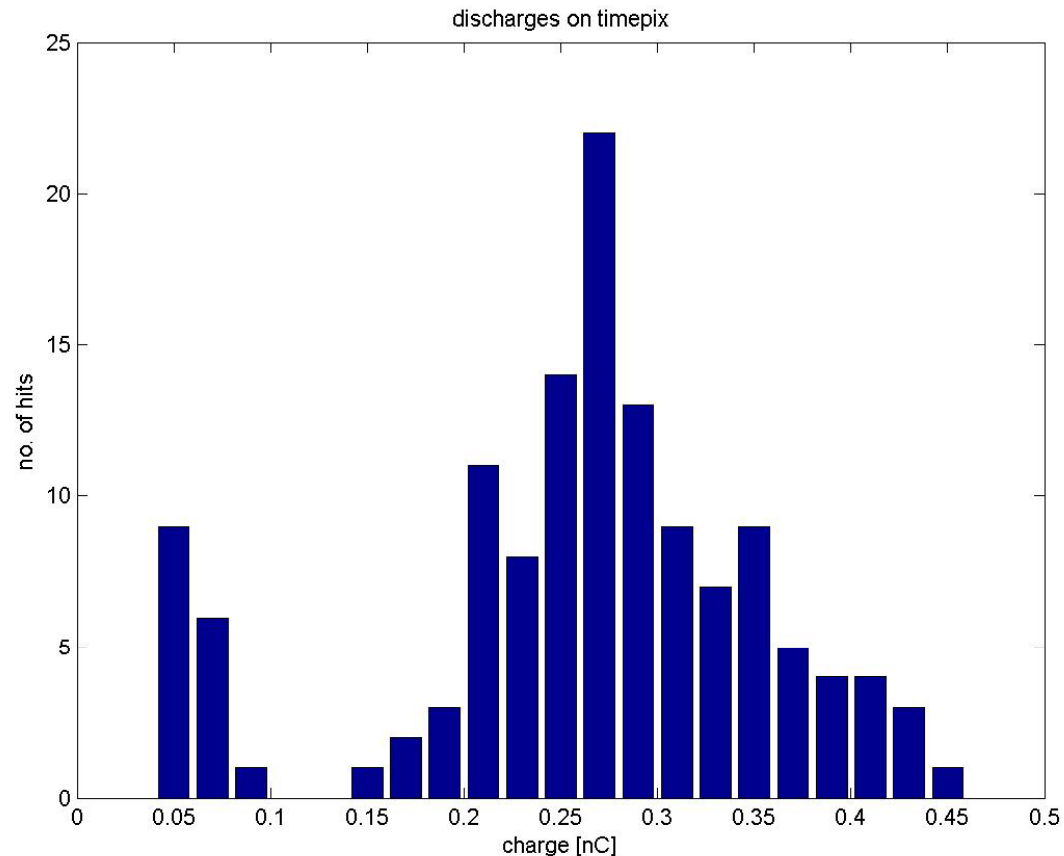


20 μ m SiProt on Timepix (1)

- End 2007
- α radiation

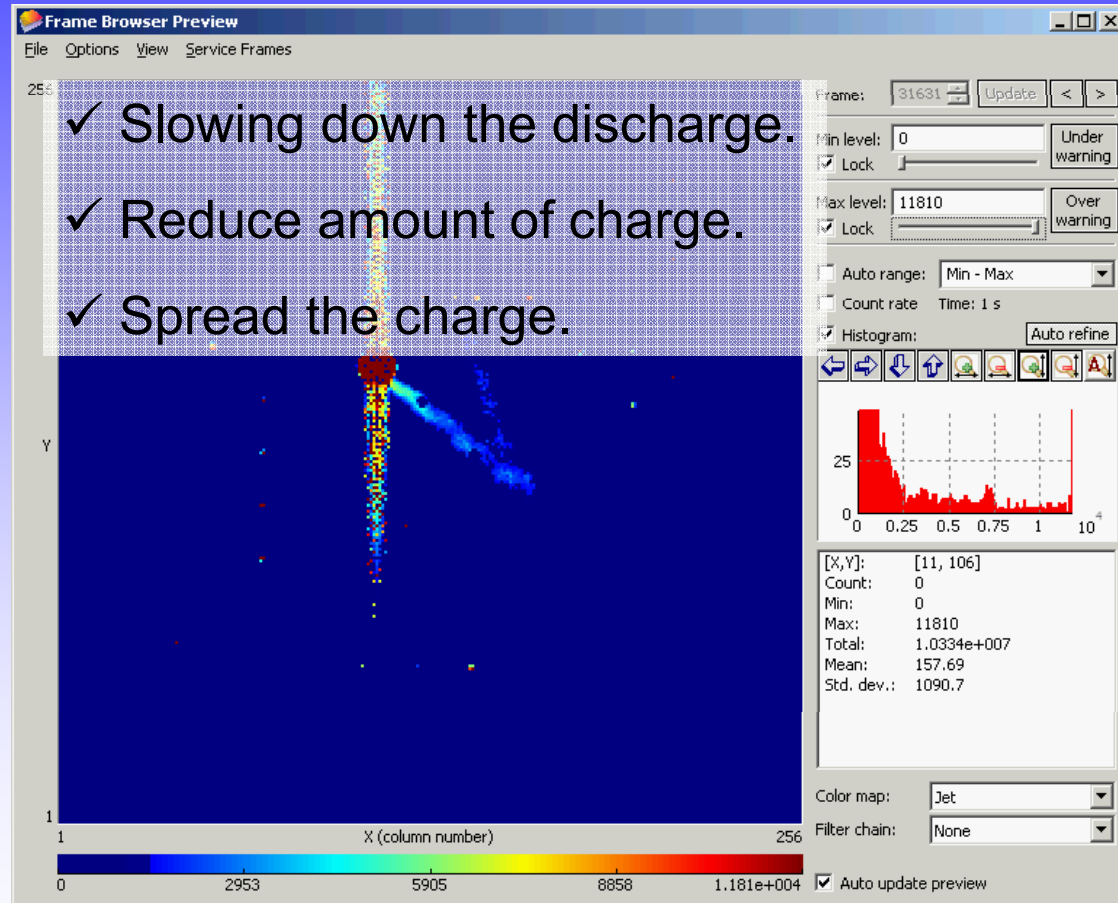
$$Q = CV$$

- $C_{\text{grid}} = \sim 25 \text{ pF}$
- $V_{\text{grid}} = \sim -420 \text{ V}$
- $Q = \sim 10 \text{ nC}$
- $\sim 0.3 \text{ nC}$ measured !
= $\sim 5 \text{ pC}$ per pixel
- Medipix 3 with input protection!



20 μ m SiProt on Timepix (2)

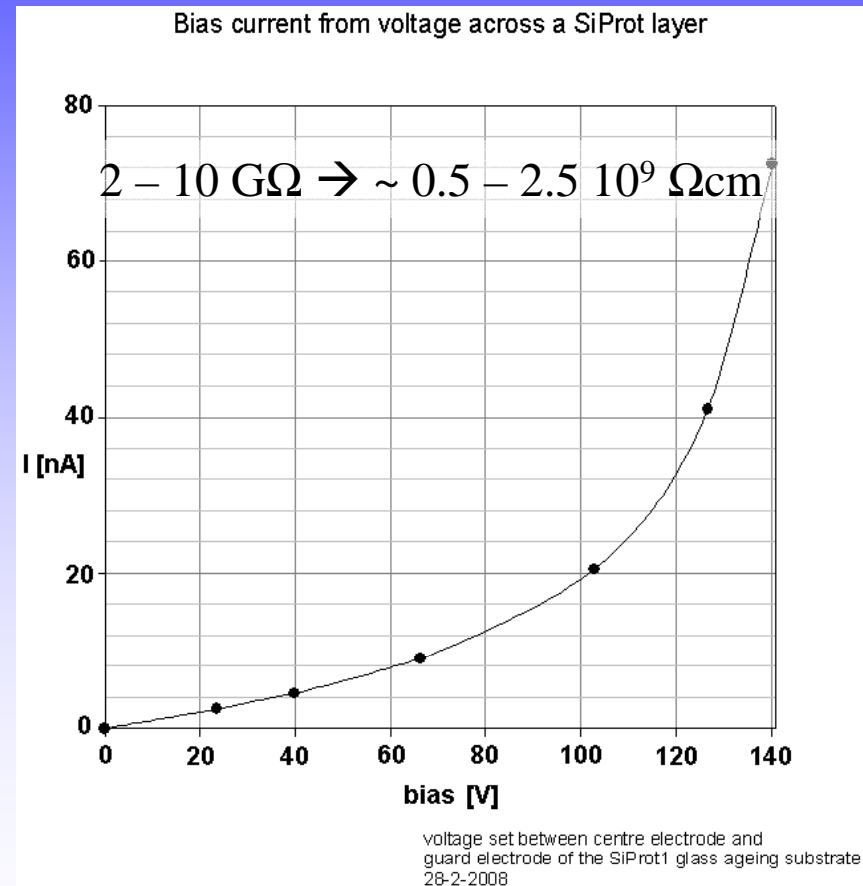
- ✓ Slowing down the discharge.
- ✓ Reduce amount of charge.
- ✓ Spread the charge.



Pixelman software: IEAP, Prague

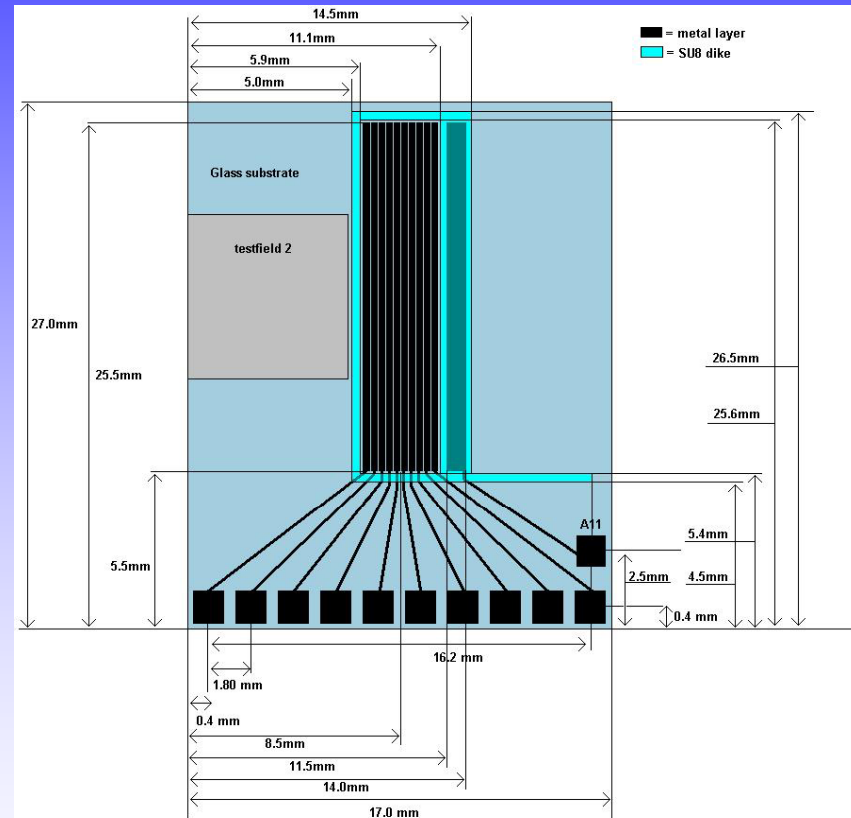
Further research (1)

- Charge spread \rightarrow hits in adjacent pixels \rightarrow error in primary charge.
- Ageing, radiation damage, IV curves. (F. Hartjes)
- Optimize thickness in terms of safety and signal performance.



Further research (2)

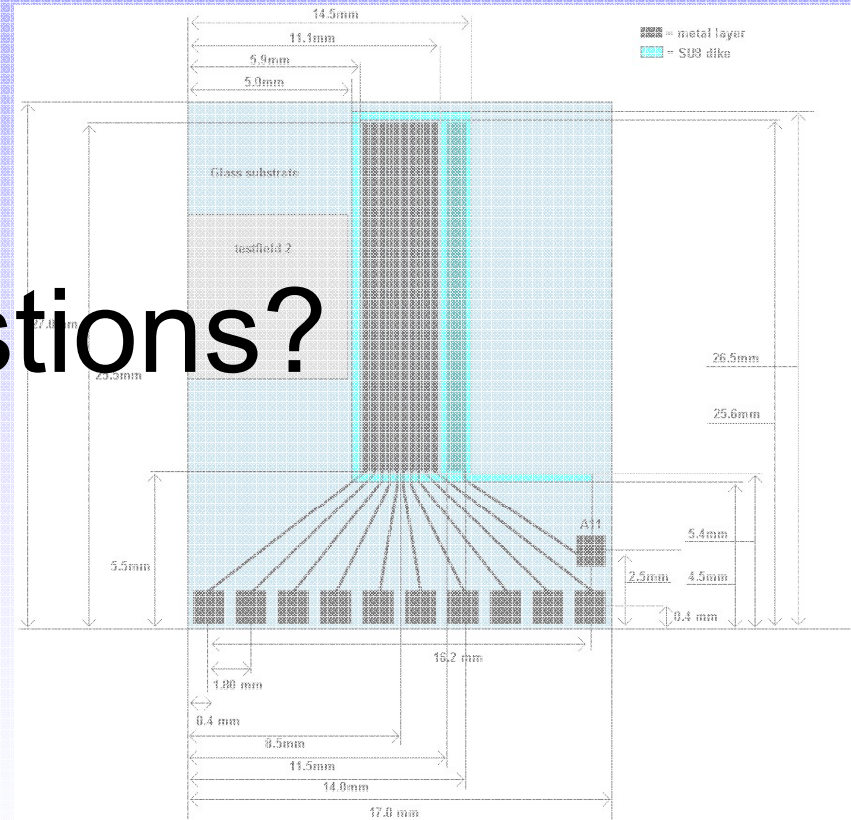
- Foolproof test structures.
- To quantify:
 - Time of discharge
 - Amount of charge
 - charge density distribution
- As function of:
 - SiProt thickness
 - Gas mixture
 - Voltage
- Search for high resistive ingrid material. (MESA+ Twente)



Further research (2)

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Questions?



Test structure read out

