

Direct and reverse IV on FBK sensors at different temperatures



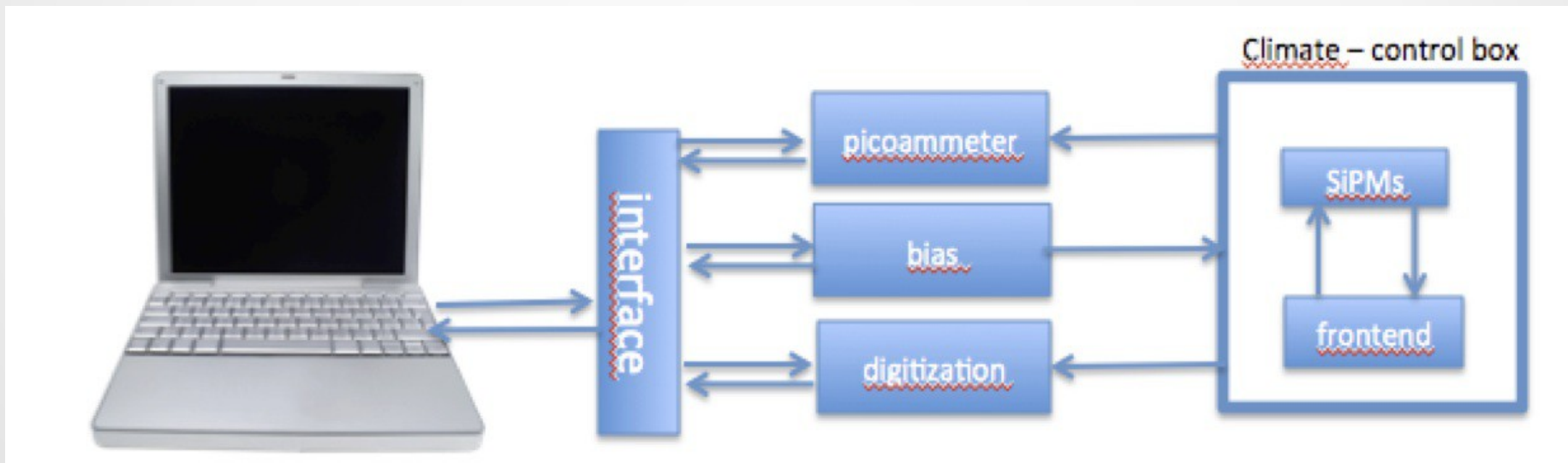
Stella Carlo
University of Udine & INFN sec. Trieste gr. Udine

Outline

- Goal
- Experimental setup
- Sensors & measurements
- Results
- Next steps
- Conclusions

Goal

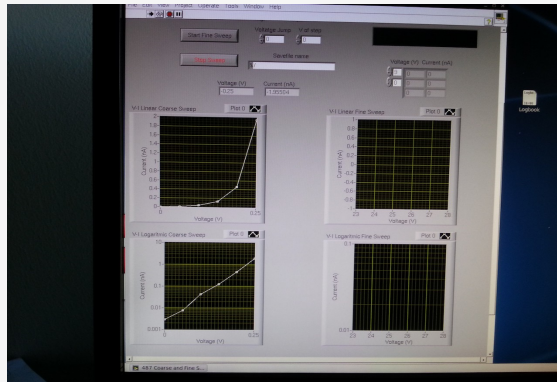
“We work to realize a semi-automatic test station”



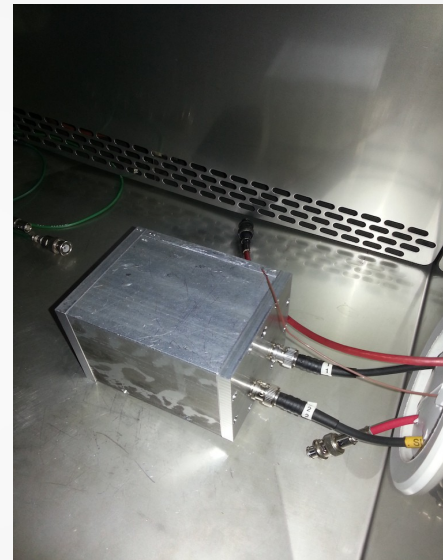
Experimental setup

“At the present we have a manual test station with Software DAQ”

Software DAQ



Aluminium shielding box



Climatic chamber



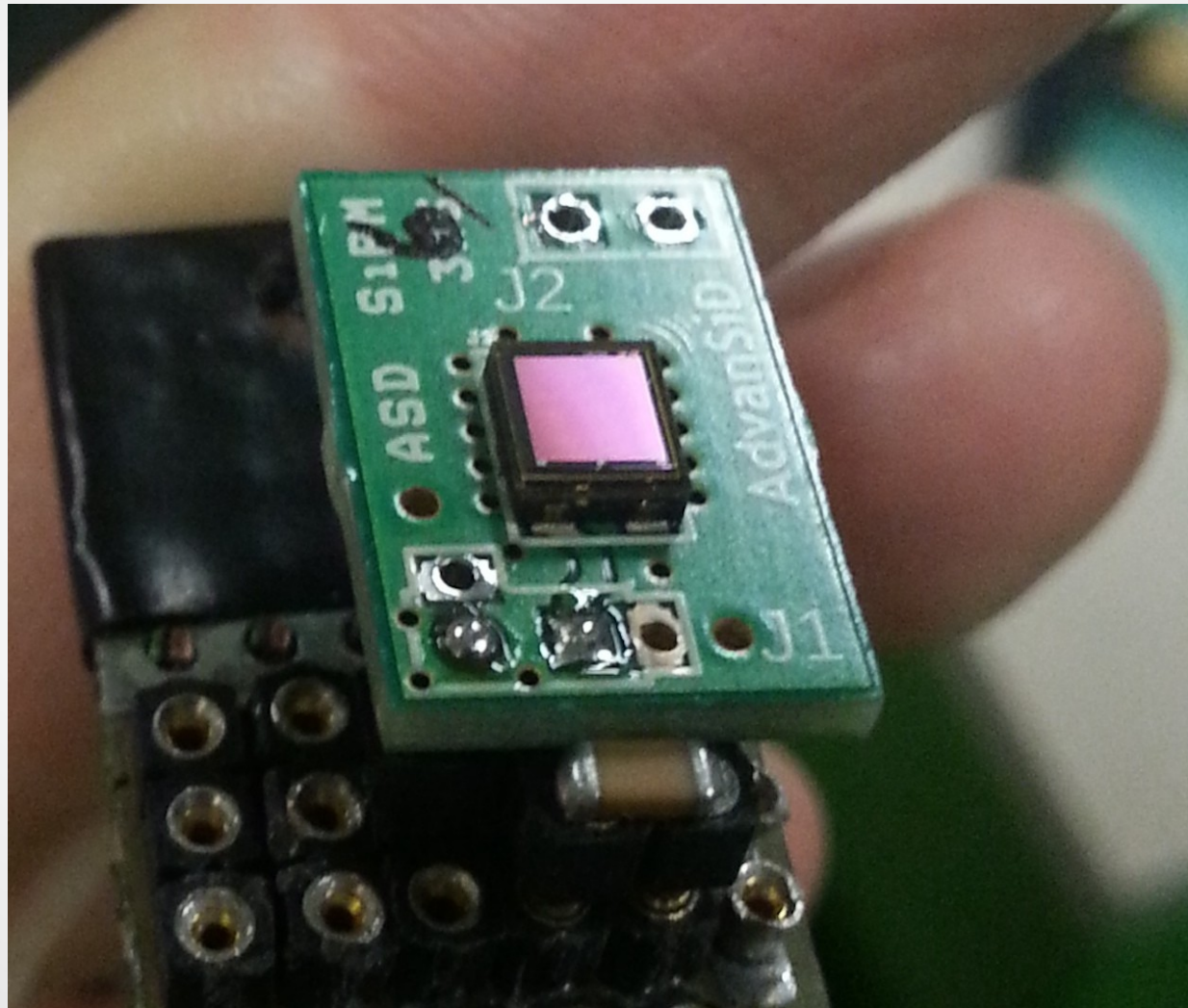
Picoammeter voltage source



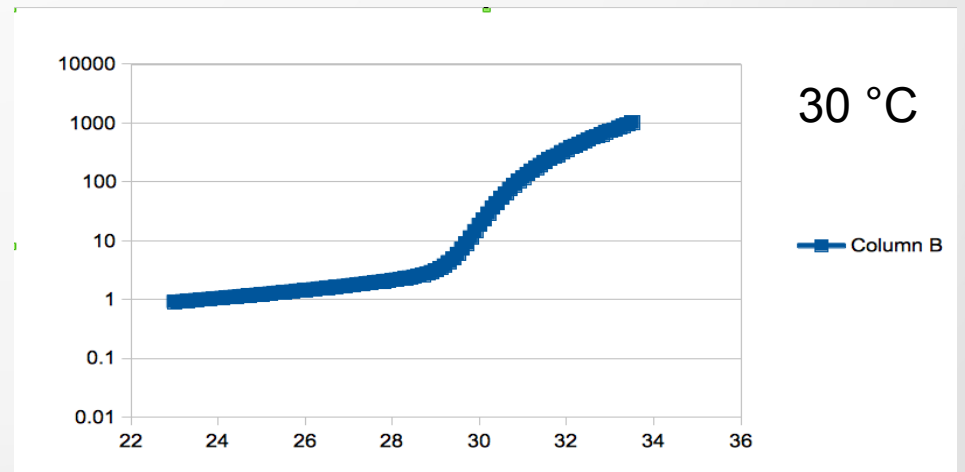
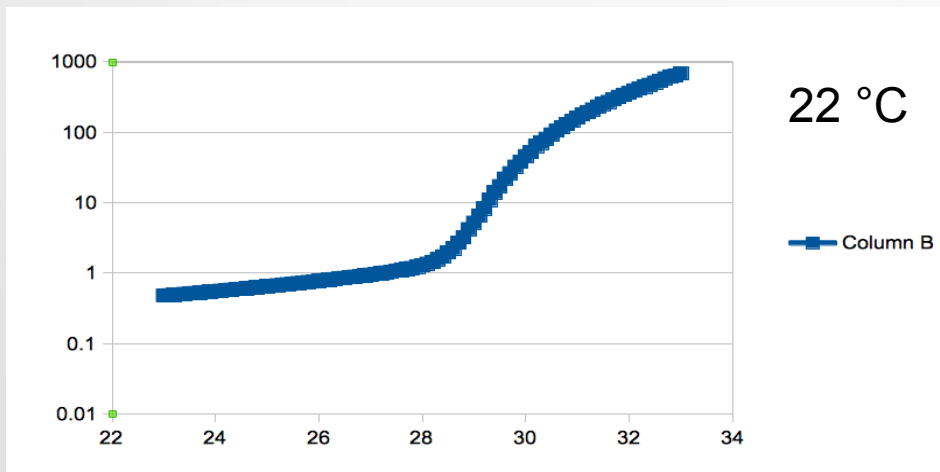
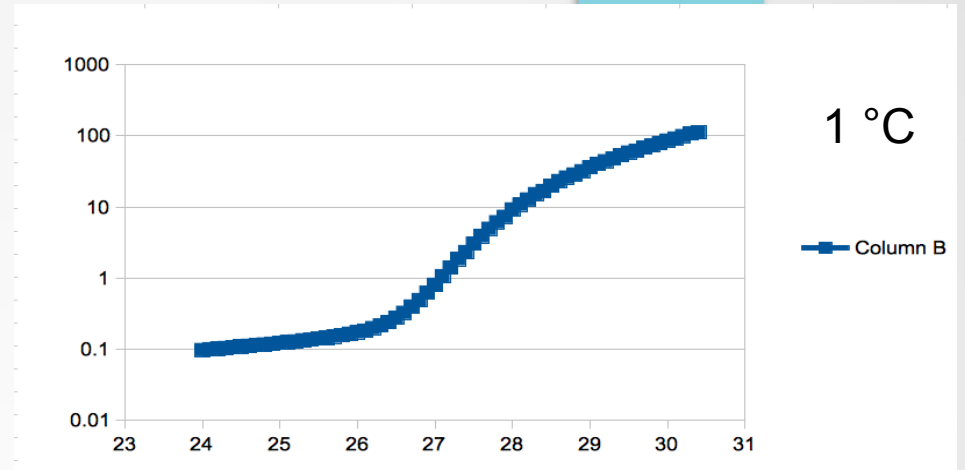
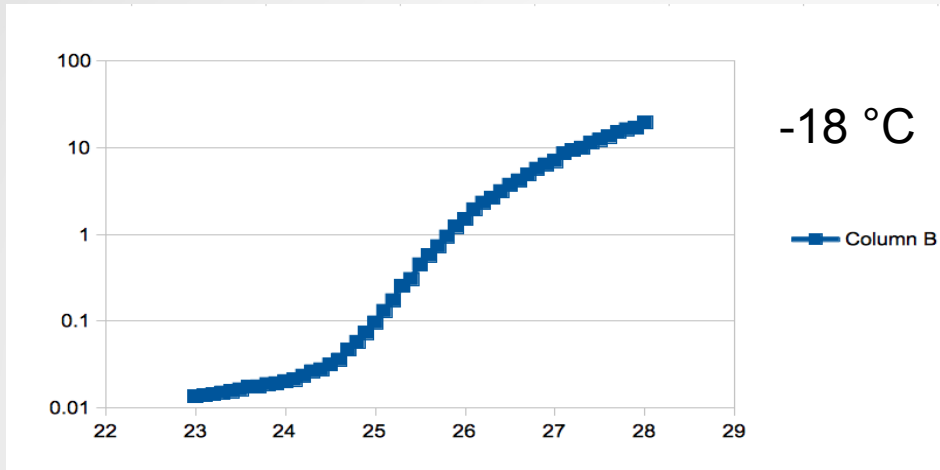
Sensors & Measurements

- Sensors:
 - FBK RGB 3x3 with 25 μm cells
 - FBK NUV 4x4 with 50 μm cells
 - Hamamatsu 3x3 50 μm cells (Preliminary)
- Measurements
 - Direct VI curve @ 4 temperatures (-18, 0, 21, 30 °C)
 - Reverse VI curve @ 4 temperatures (-18, 0, 21, 30 °C)

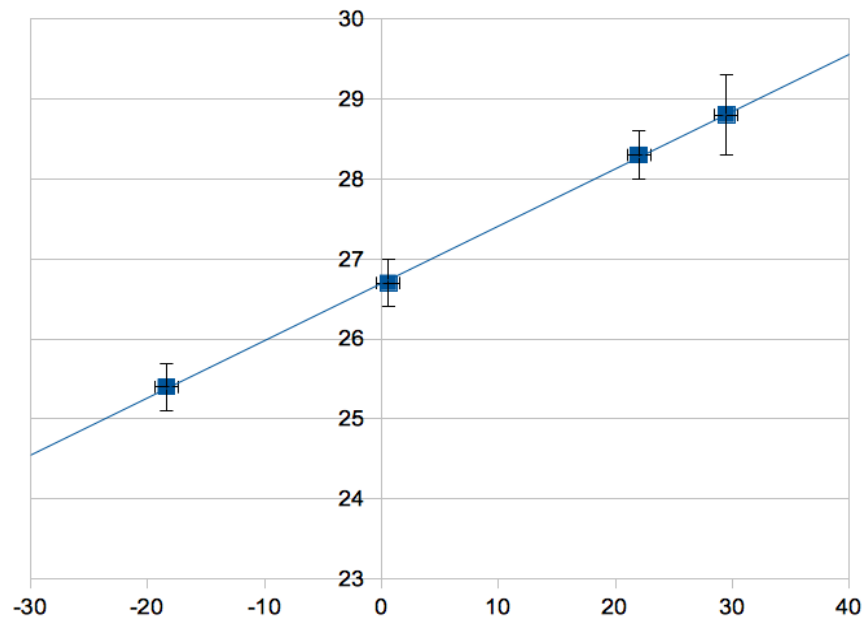
FBK RGB 3x3 25 μm



IV reverse FBK RGB 3x3 25 μm



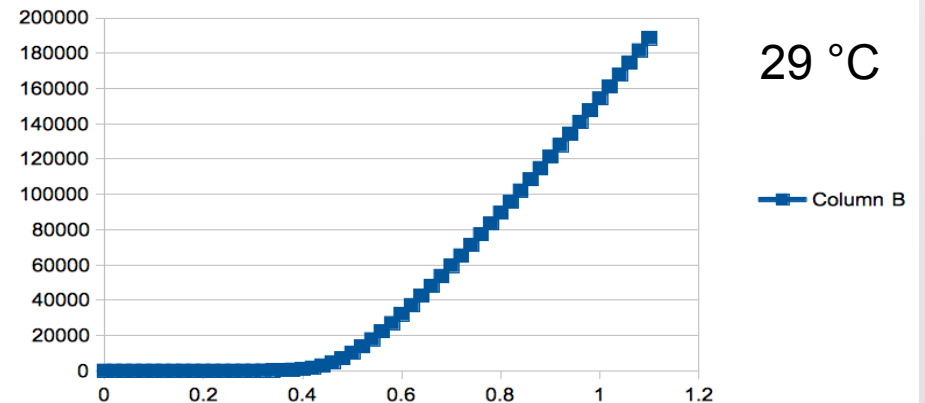
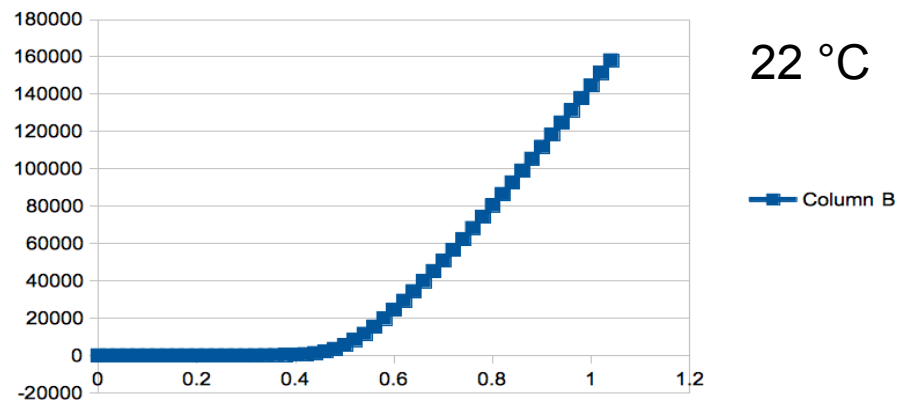
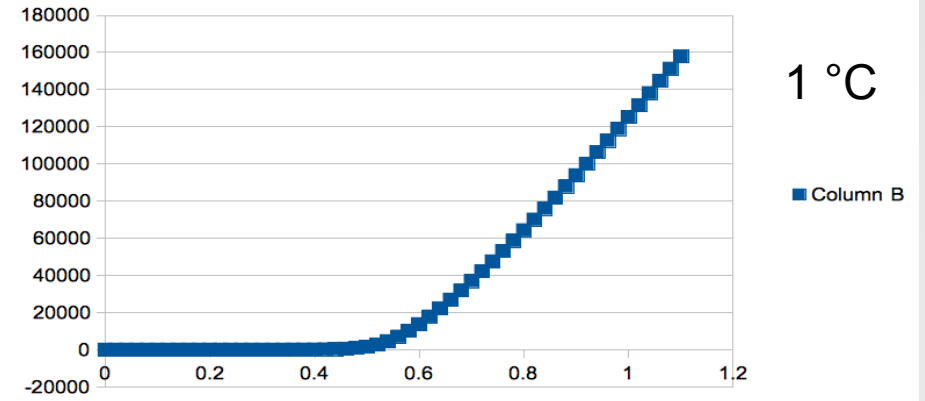
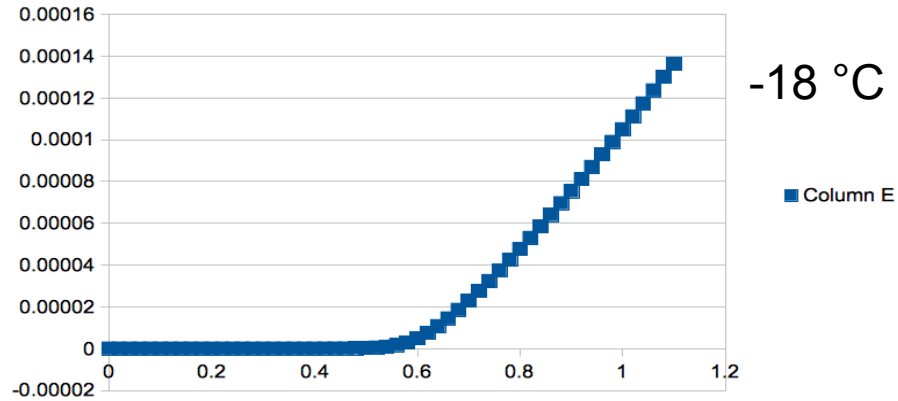
Breakdown voltage vs Temperature



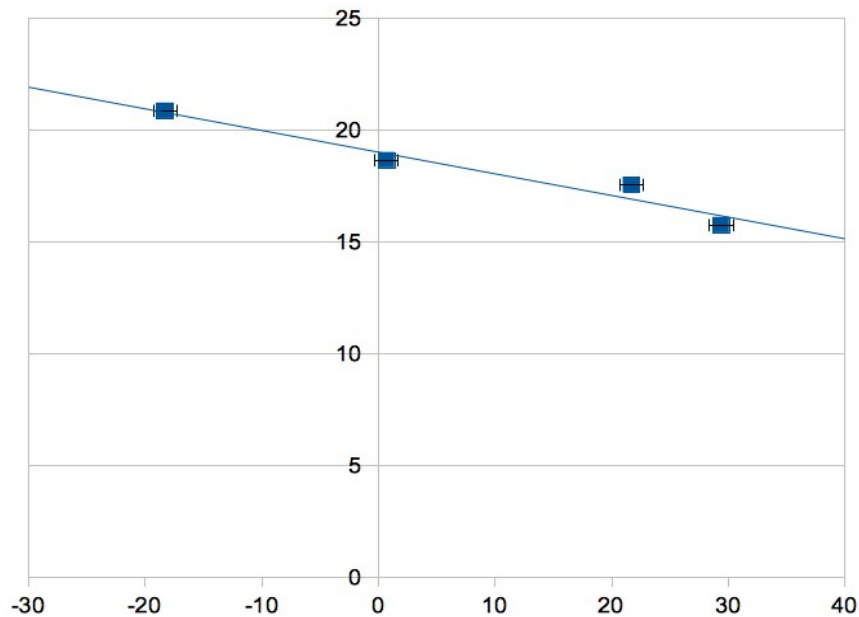
T (°C)	Vbd (V)
-18	25.4
1	26.7
22	28.3
30	28.8

- Breakdown voltage temperature sensitivity = $72 \text{ mV/}^\circ\text{C}$

IV direct FBK RGB 3x3 25 μm



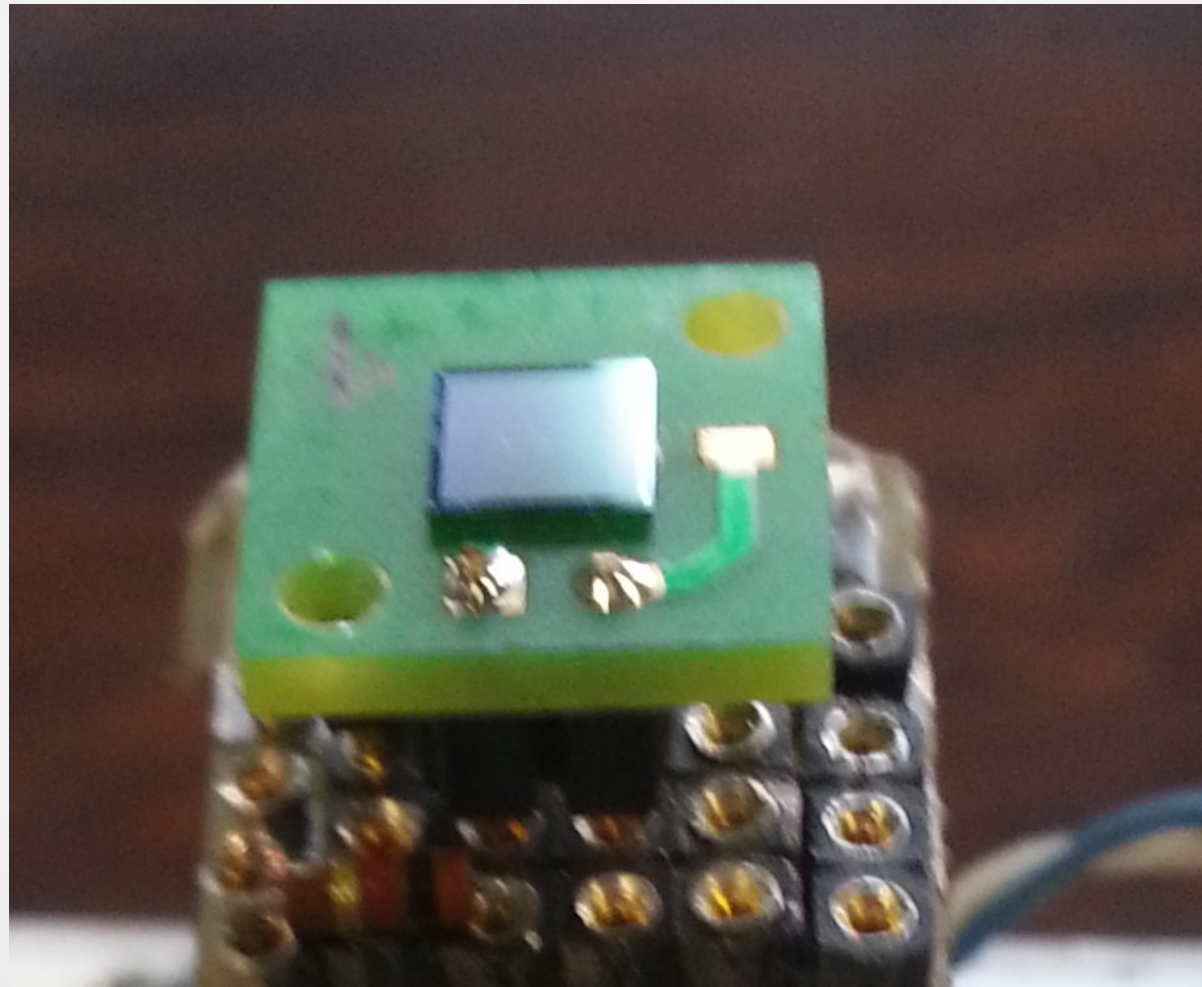
Cell resistance vs Temperature



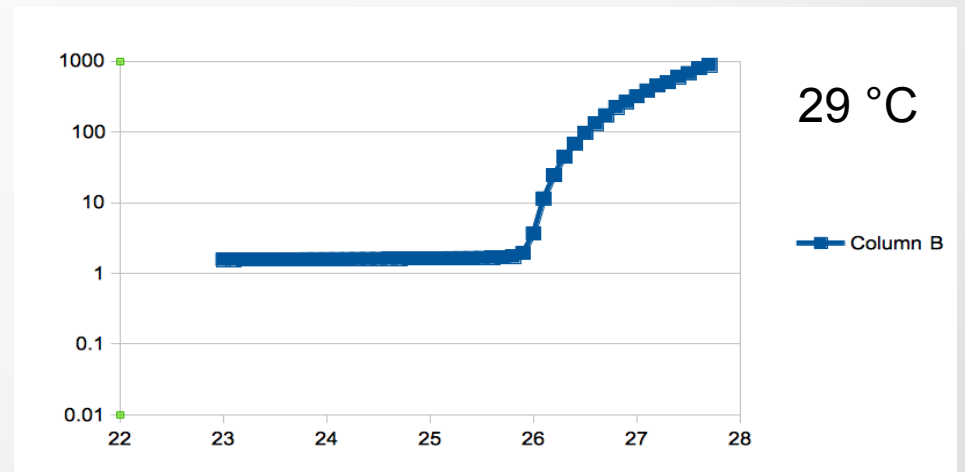
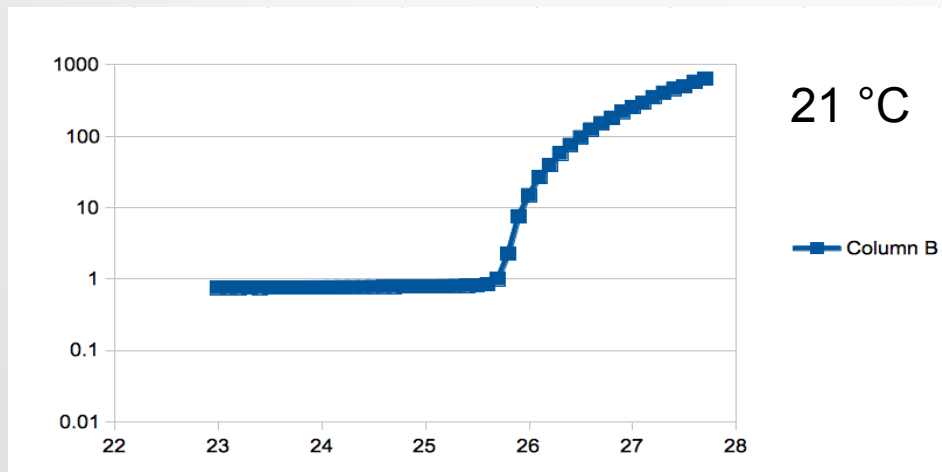
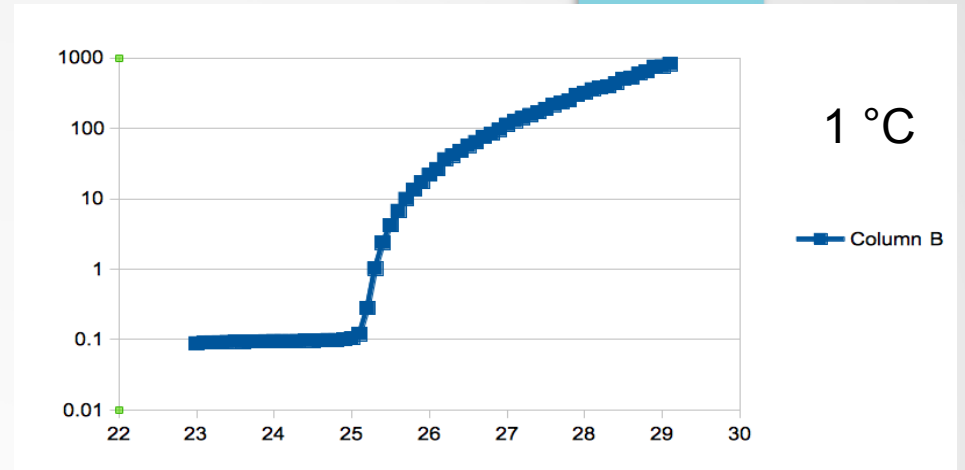
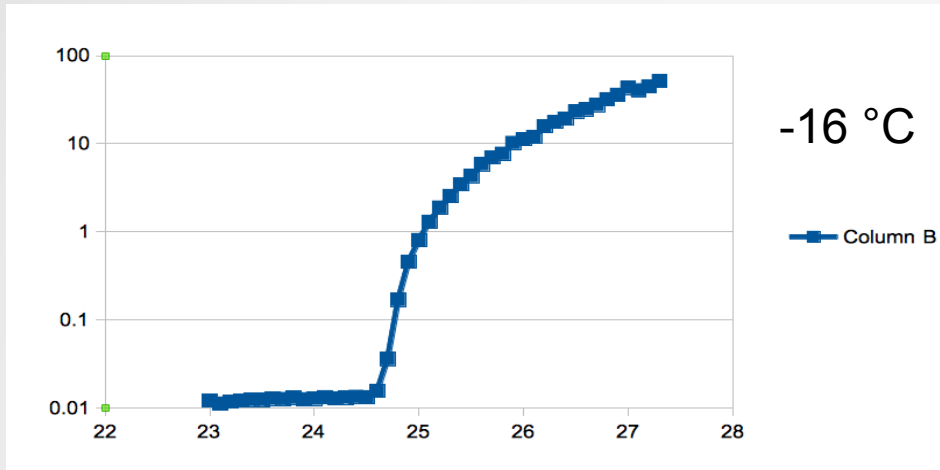
T (°C)	R cell (MΩ)
-18	25.4
1	26.7
22	28.3
29	28.8

- Cell resistance temperature sensitivity = $-97 \Omega / ^\circ\text{C}$

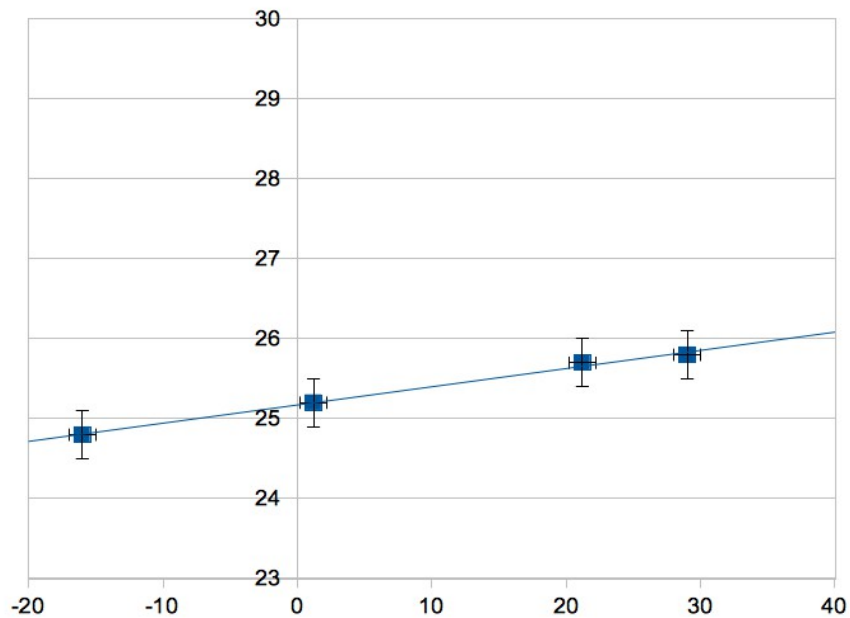
FBK NUV 4x4 50 μm



IV reverse FBK NUV 4x4 50 μm



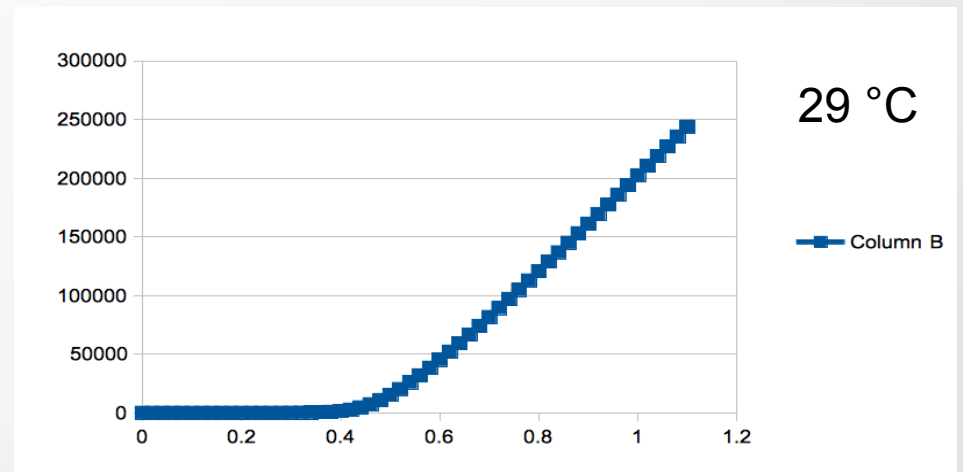
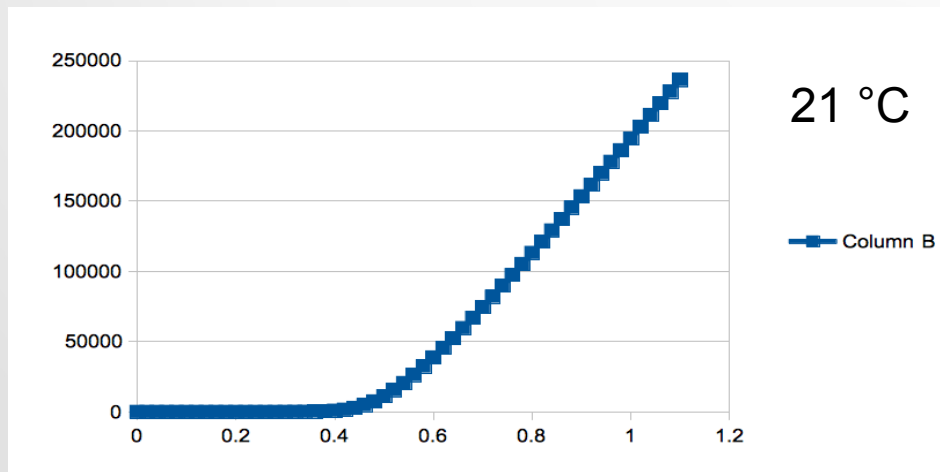
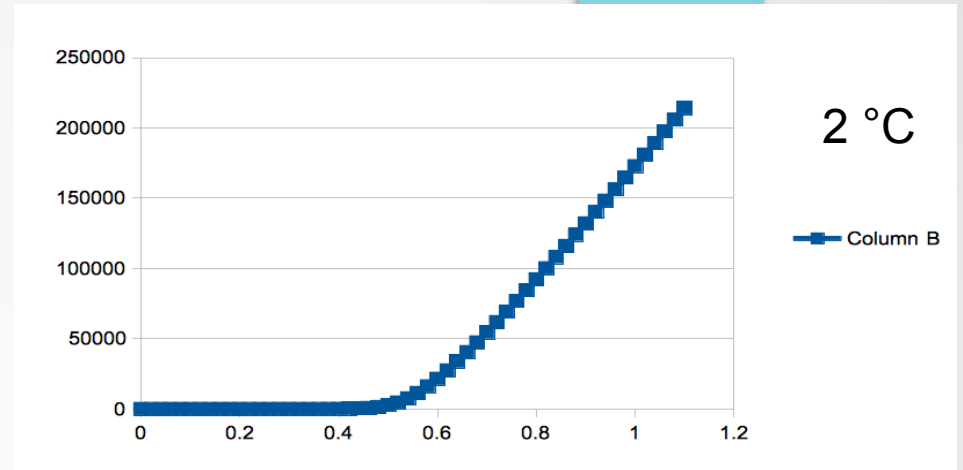
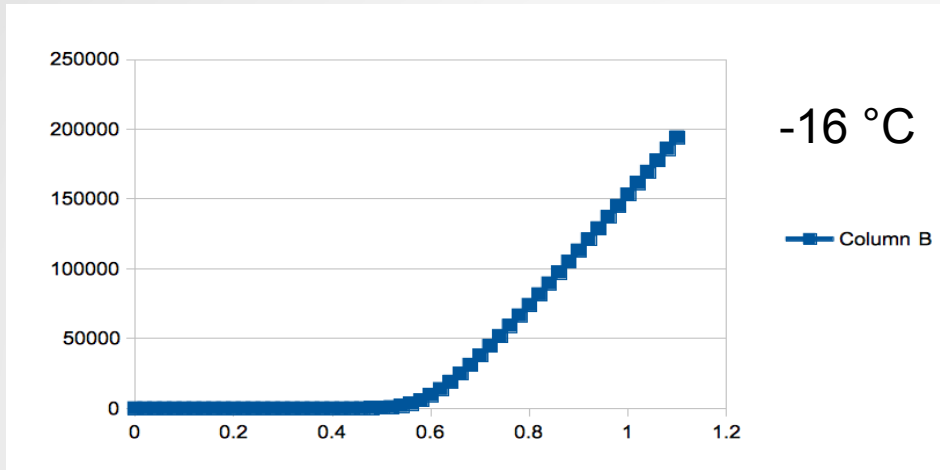
Breakdown voltage vs Temperature



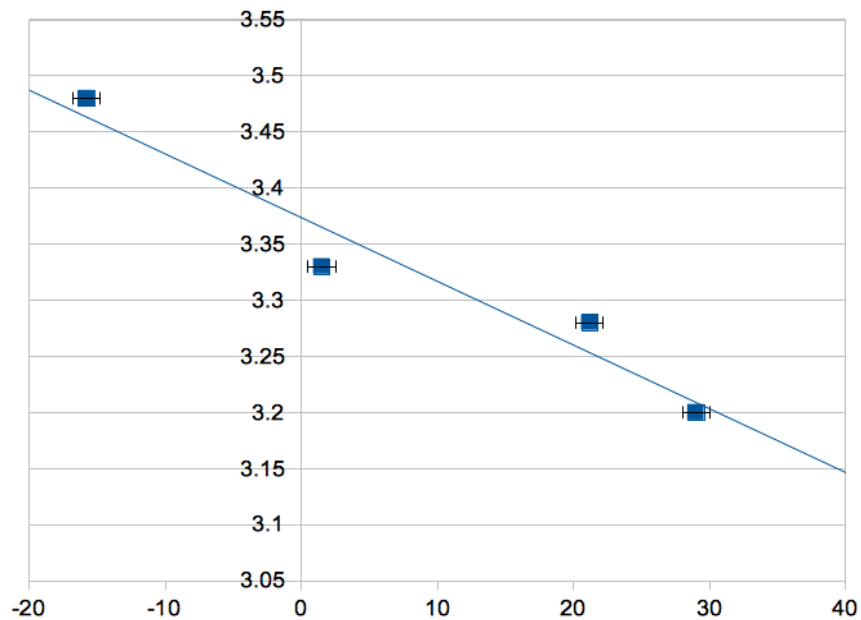
T (°C)	Vbd (V)
-16	24.8
1	25.2
21	25.7
29	25.8

- Breakdown voltage temperature sensitivity = $23 \text{ mV/}^\circ\text{C}$

IV direct FBK NUV 4x4 50 μm



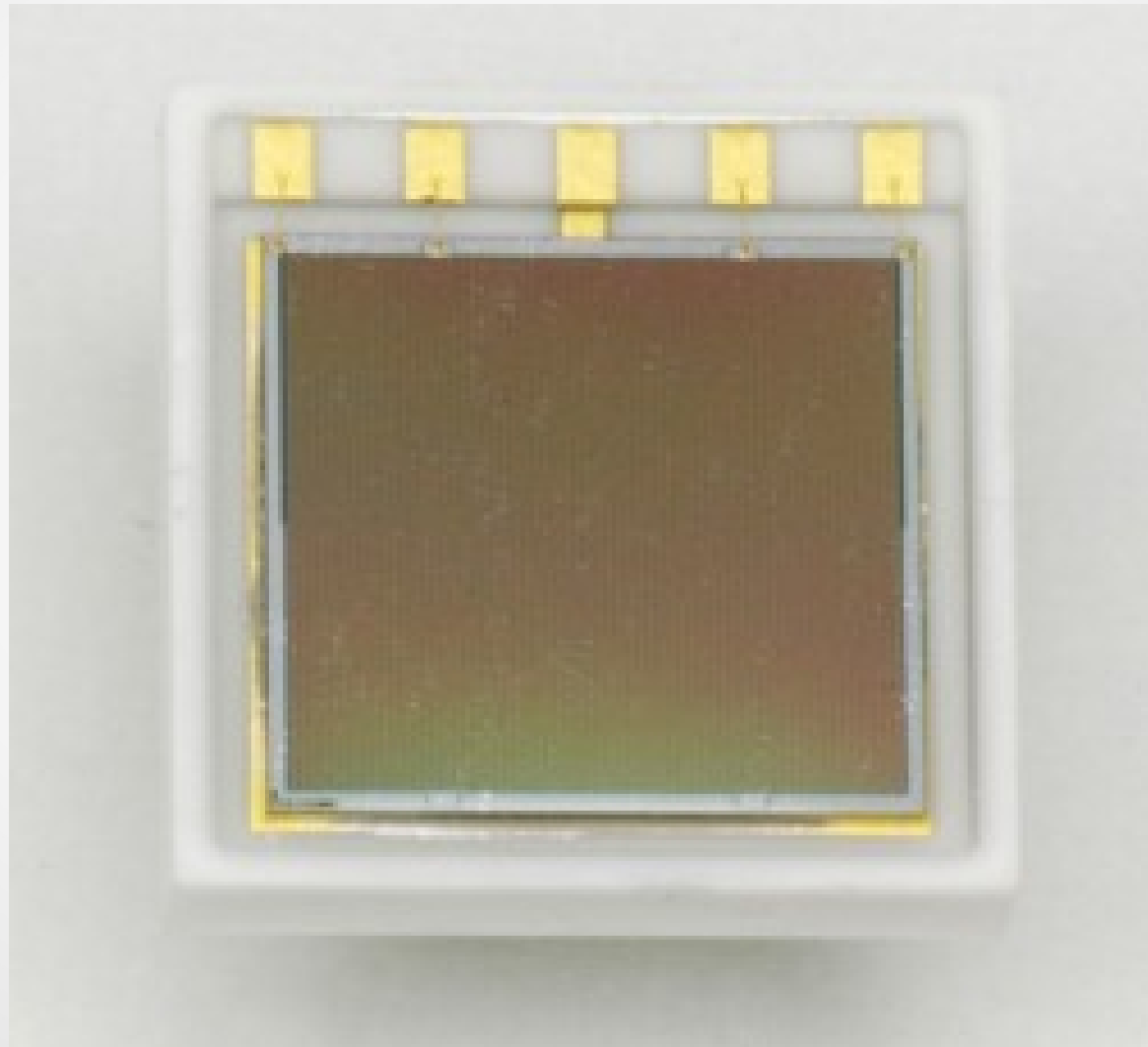
Cell resistance vs Temperature



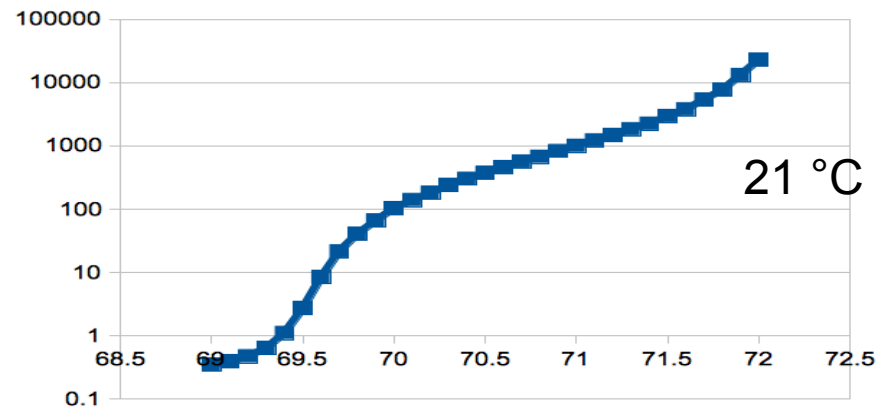
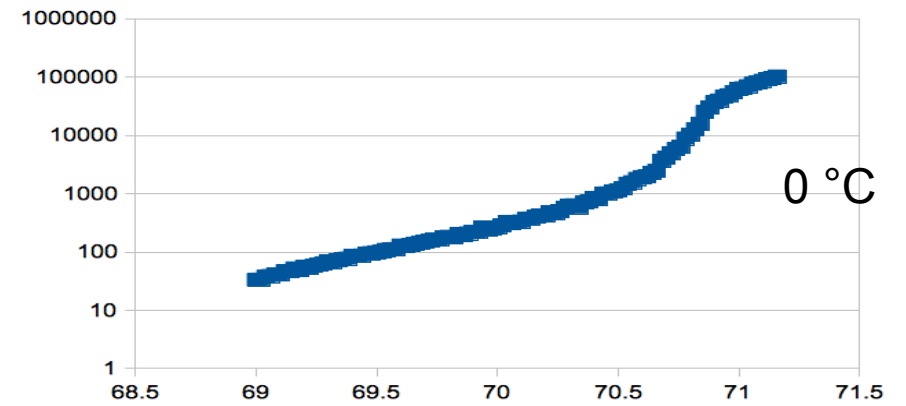
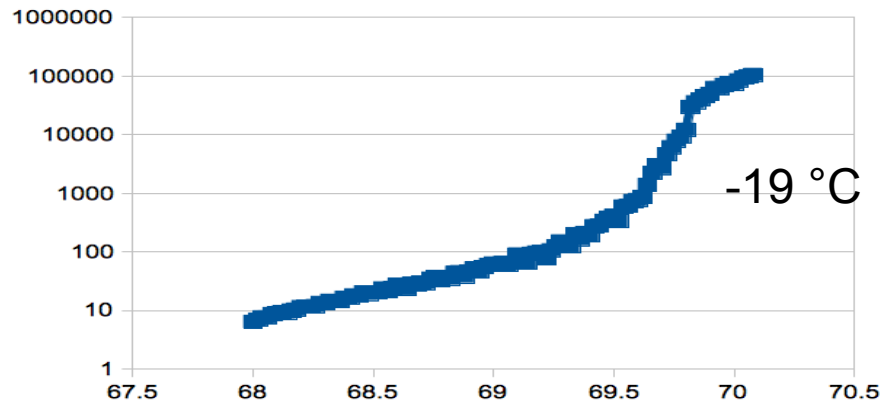
T (°C)	R cell (MΩ)
-16	3.48
2	3.33
21	3.28
29	3.2

- Cell resistance temperature sensitivity = $-6 \Omega/^\circ\text{C}$

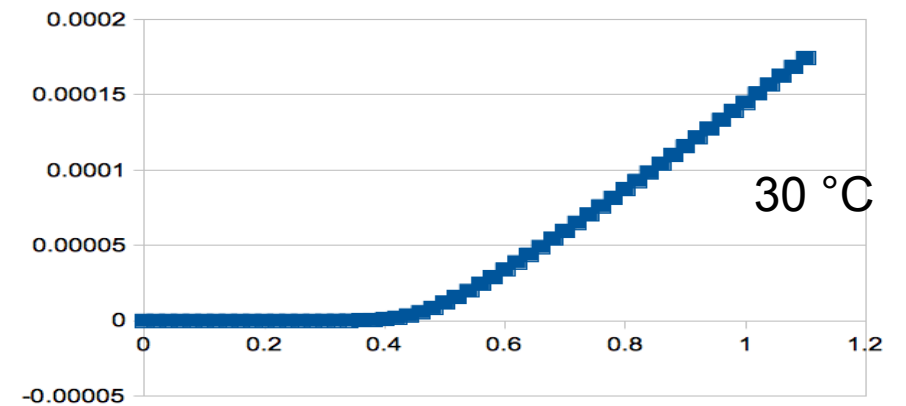
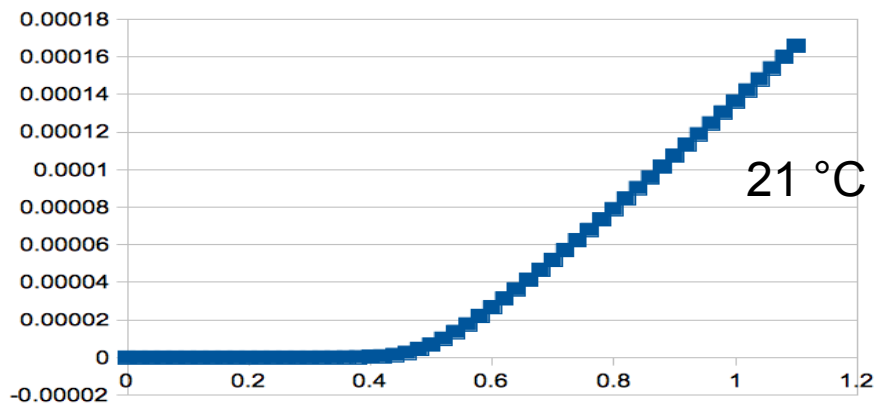
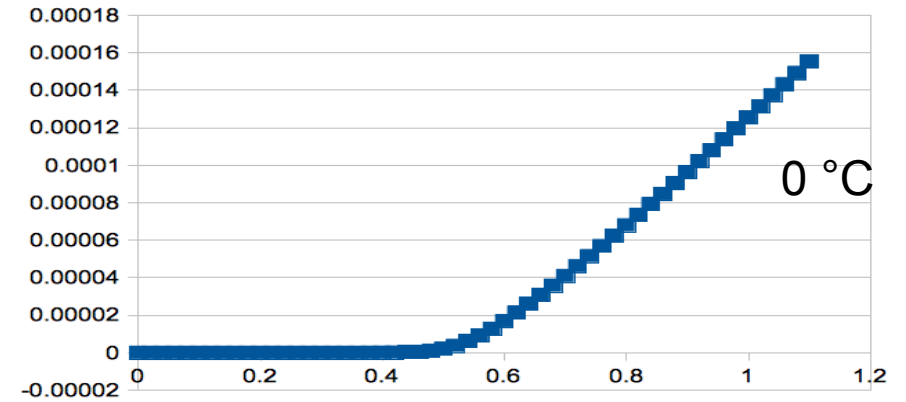
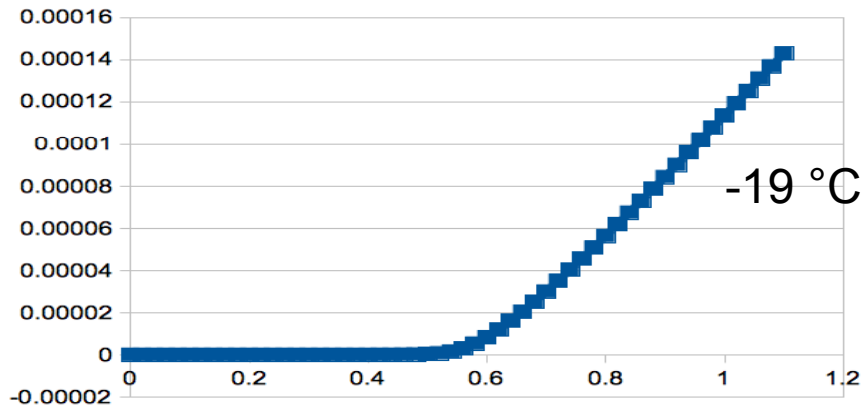
Hamamatsu 3x3 50 μm (Preliminary)



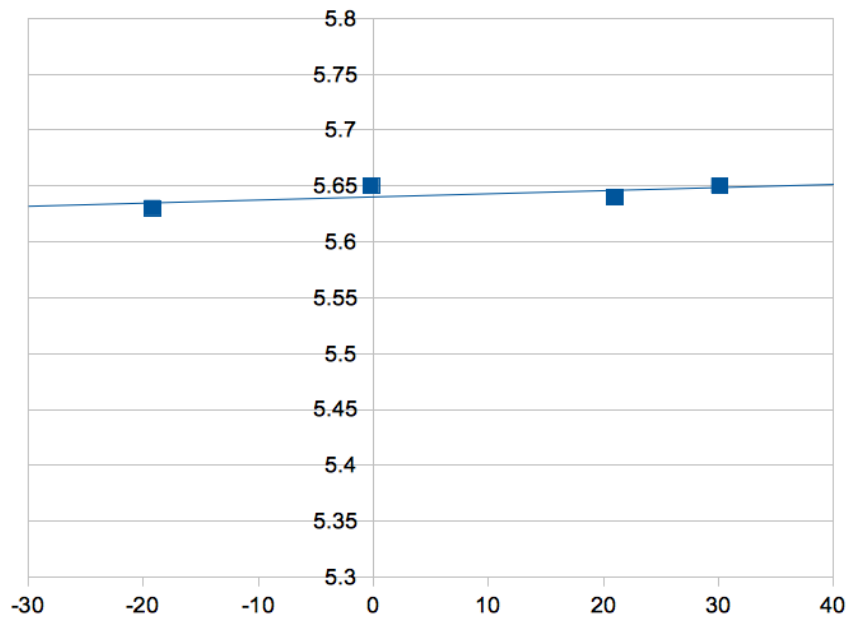
IV reverse Hamamatsu 50 μm



IV direct Hamamatsu 50 μm



Cell resistance vs Temperature



T (°C)	R cell (MΩ)
-19	5.63
0	5.65
21	5.64
30	5.65

- Cell resistance temperature sensitivity = $0.3 \Omega / ^\circ C$

Dark Count (Oscilloscope Theft Problem)

To know the dark count... you need the oscilloscope

Università di Udine, furto nel laboratorio di Fisica

I ladri si sono introdotti in pieno giorno nel polo scientifico dei Rizzi e hanno rubato 4 oscilloscopi usati dai ricercatori per guardare i segnali elettrici. Non è escluso che si tratti di un colpo su commissione. Il danno ammonta a circa 40 mila euro.

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di *Giacomina Pellizzari*

+T -T



UDINE. Furto all'università di Udine. I ladri, in pieno giorno, sono entrati nel laboratorio di fisica situato al primo piano nel polo scientifico dei Rizzi, e da qui hanno asportato quattro oscilloscopi usati da fisici e informatici per osservare i segnali elettrici. Trattandosi di attrezzature molto particolari non è escluso che si sia trattato di un furto su commissione. Il danno ammonta a circa 40 mila euro.

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Next steps

- Finish the IV measurements (work in progress)
- Dark Count and Cross-Talk vs T (work in progress)
- Afterpulse vs T
- Gain (for single photo-electron)
- Dynamic characterization

Conclusions

Although we have experienced some minor problems we are proceeding to produce an efficient semi-automatic test station for static and dynamic characterization.

We plan to have new data for the next meeting

Thank you for listening

Backup

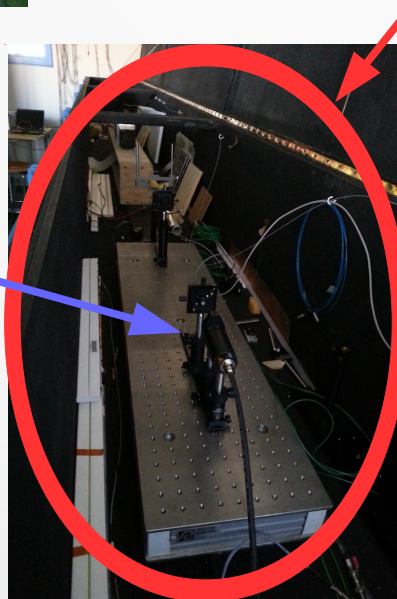
Infrastructure

Climatic Chamber



Picoammeter voltage source

Darkbox



MHz picosecond laser



Assorted daq electronics

