

Characterisation at -20°C before and after irradiation of 2x2 APDs from a new batch

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Meeting 03/11/2017

Irradiation campaign

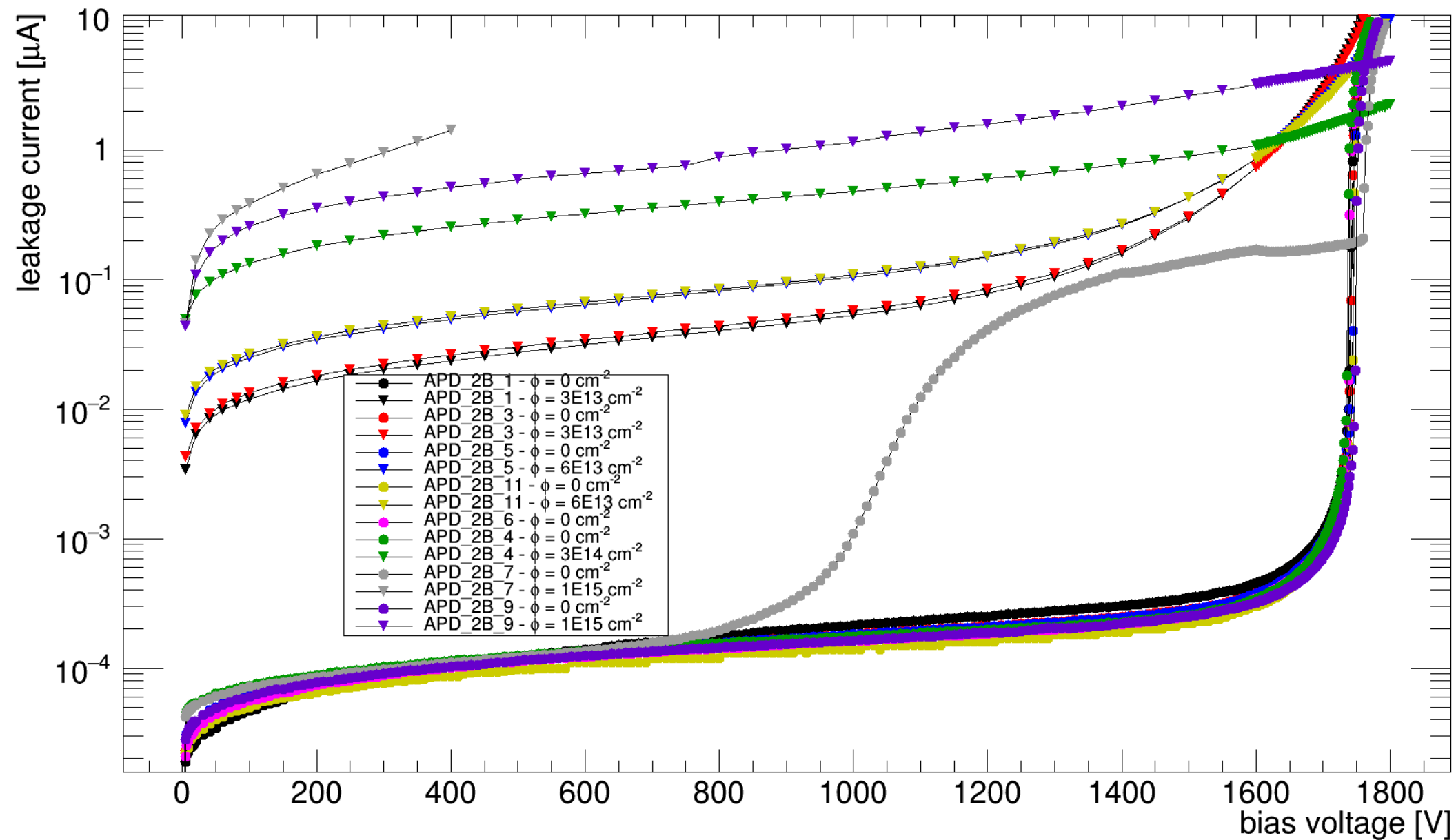
- The samples were sent to the Jožef Stefan Institute (Ljubljana-Slovenia) for neutron irradiation.

Fluence	N° of samples	Sample name
3E13 n/cm ²	2	APD_2B_1/3
6E13 n/cm ²	2	APD_2B_5/11
3E14 n/cm ²	2	APD_2B_6/4
1E15 n/cm ²	2	APD_2B_7/9

Measurement conditions IV curves

- Measurements before and after irradiation for all samples.
- Biasing from the back (cathode).
- Temperature:
 - IV: 20°C, 10°C, 0°C, -10°C, and -20°C.
 - In this presentation only the measurements at -20°C are shown.
- Compliance set to 10 μA .

IV curves at -20°C



Measurement conditions TCT

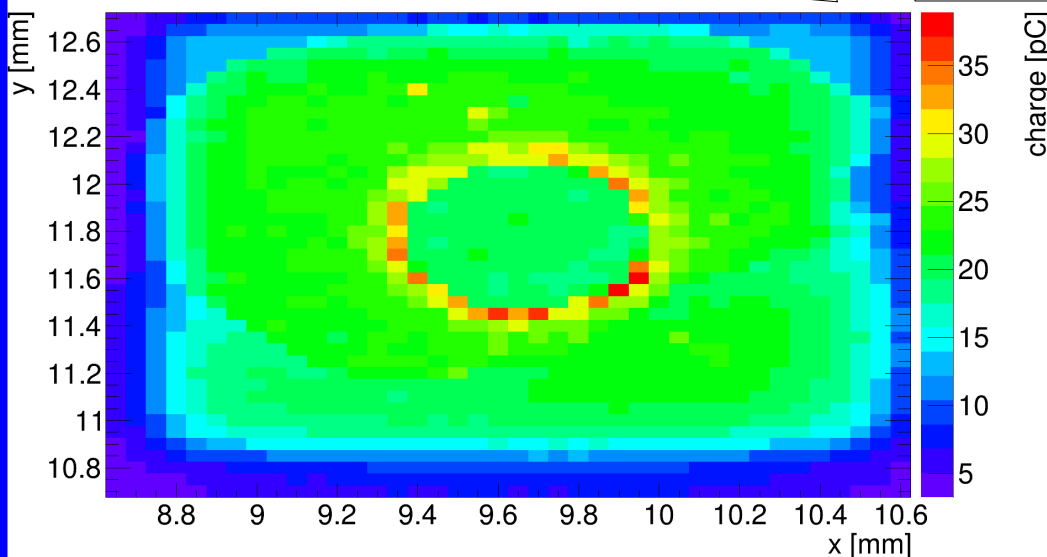
- Measurements before and after irradiation for all samples.
- Temperature: -20°C .
- 10 dB effective amplification.
 - 40 dB amplifier.
 - 30 dB attenuator (before the amplifier).
- Bias T: 4.4nF and 1 M Ω .
- Laser intensities (peak power):
 - Red $\approx \mu\text{W}$
 - IR $\approx \mu\text{W}$
- Read-out and biasing from the back (cathode).
- Compliance set to 10 μA .

Homogeneity Analysis

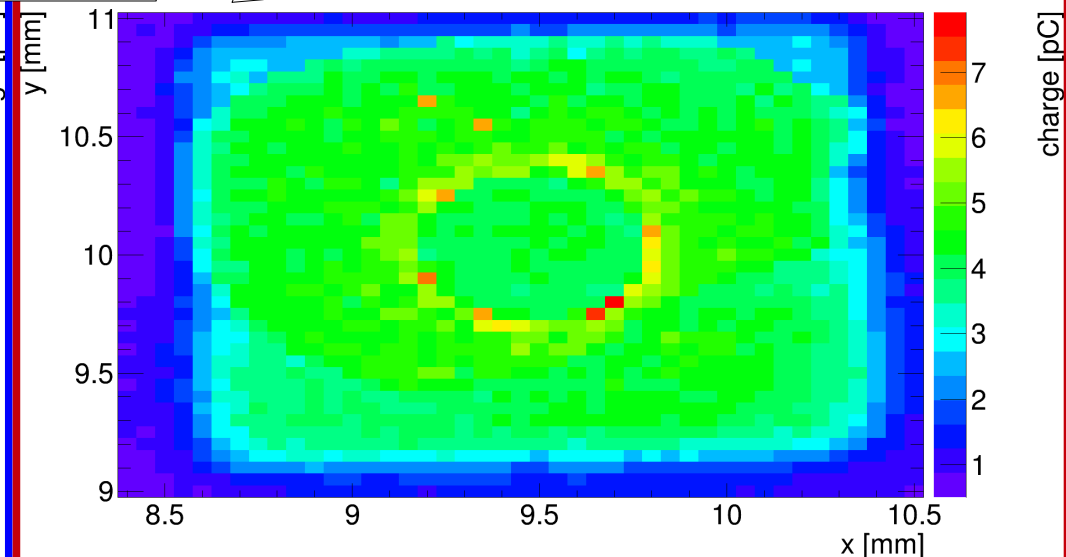
Charge collection XY scans

XY scans at 1700 V, -20°C

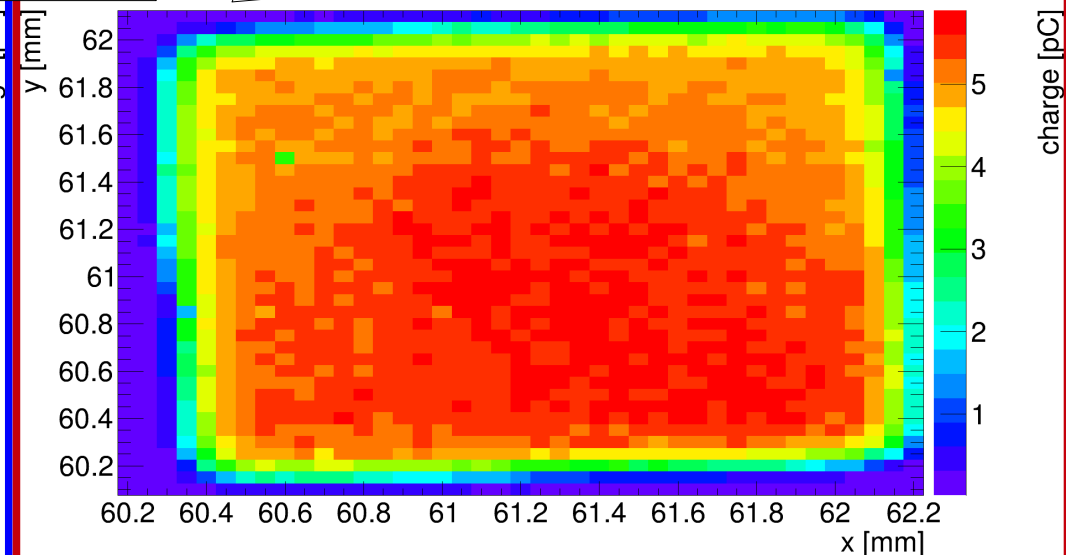
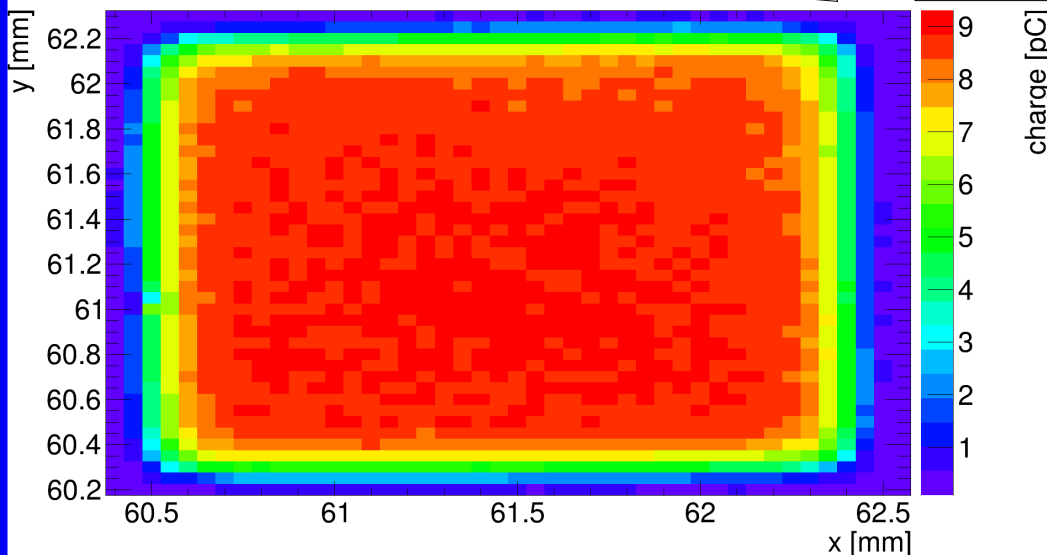
Before irradiation



After irradiation $3 \times 10^{13} \text{ n/cm}^2$

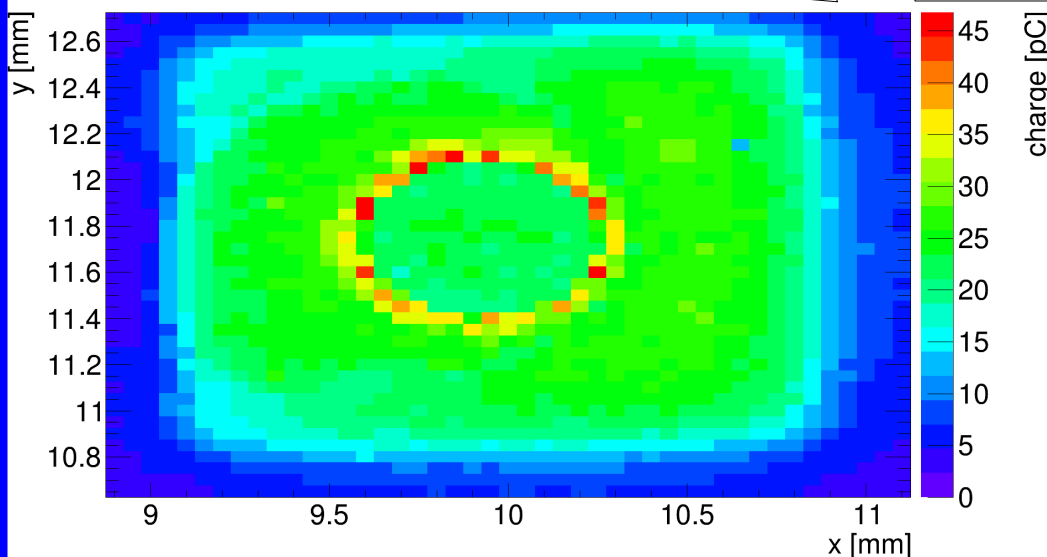
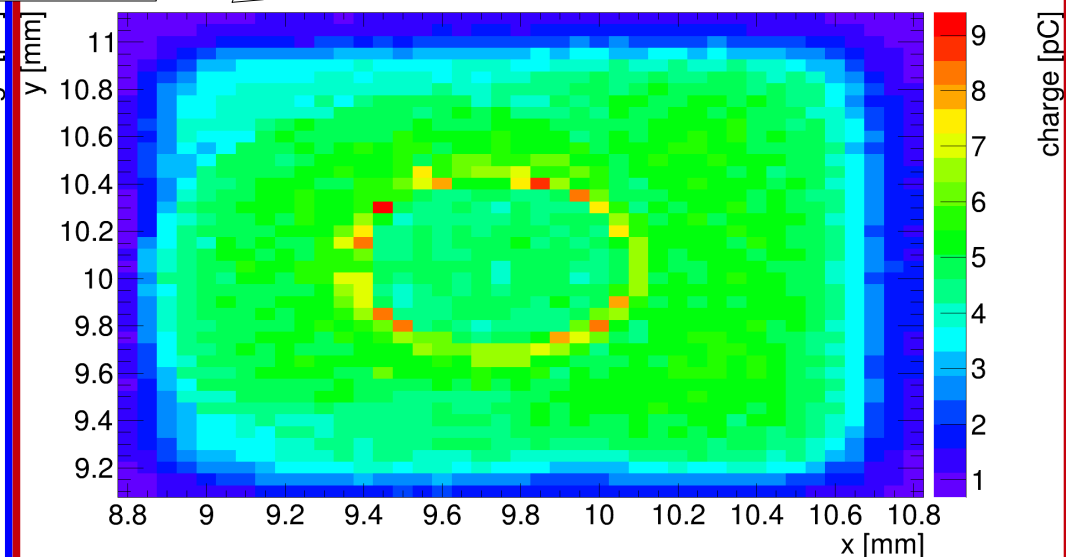


Red TCT

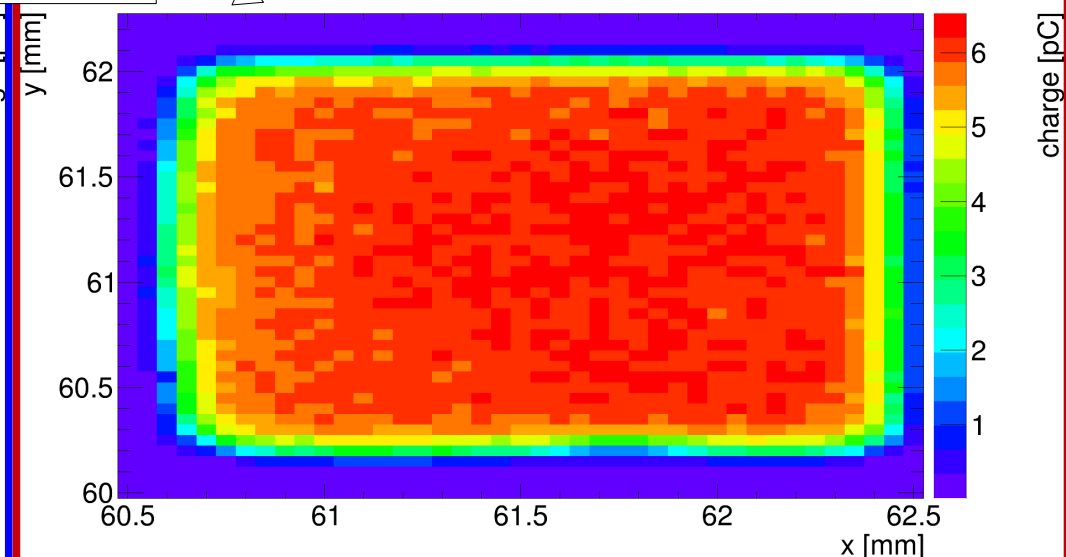
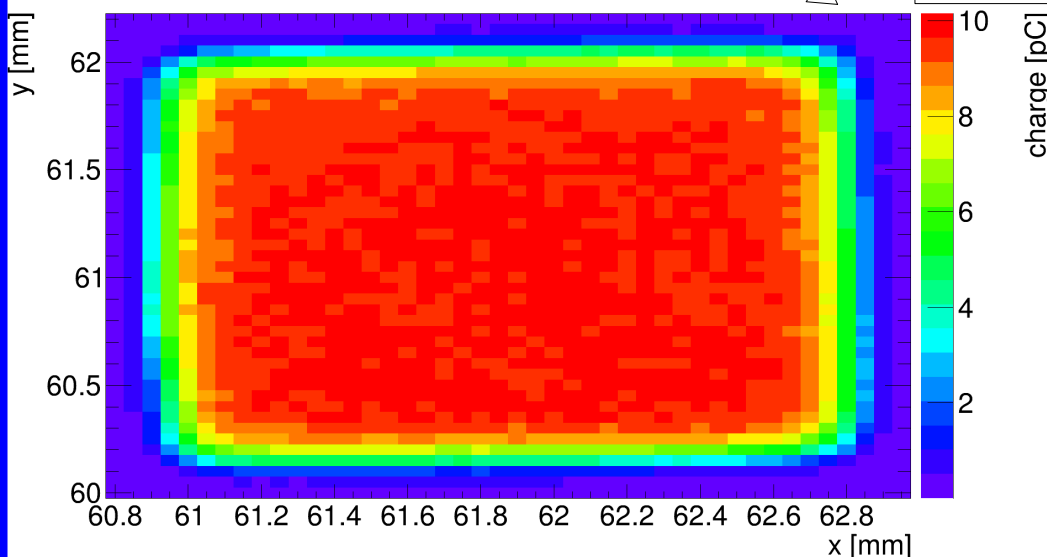


XY scans at 1700 V, -20°C

Before irradiation

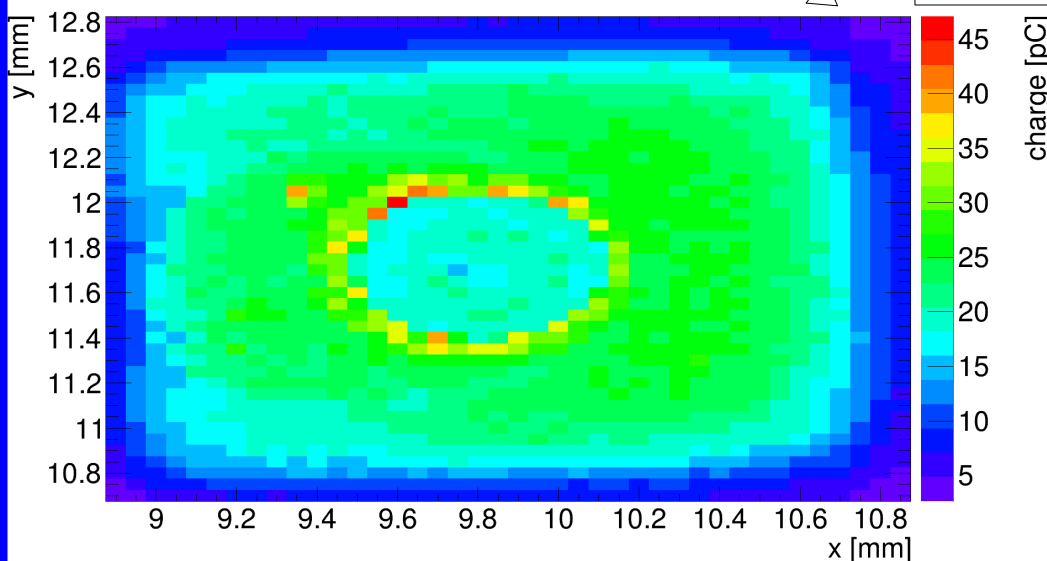
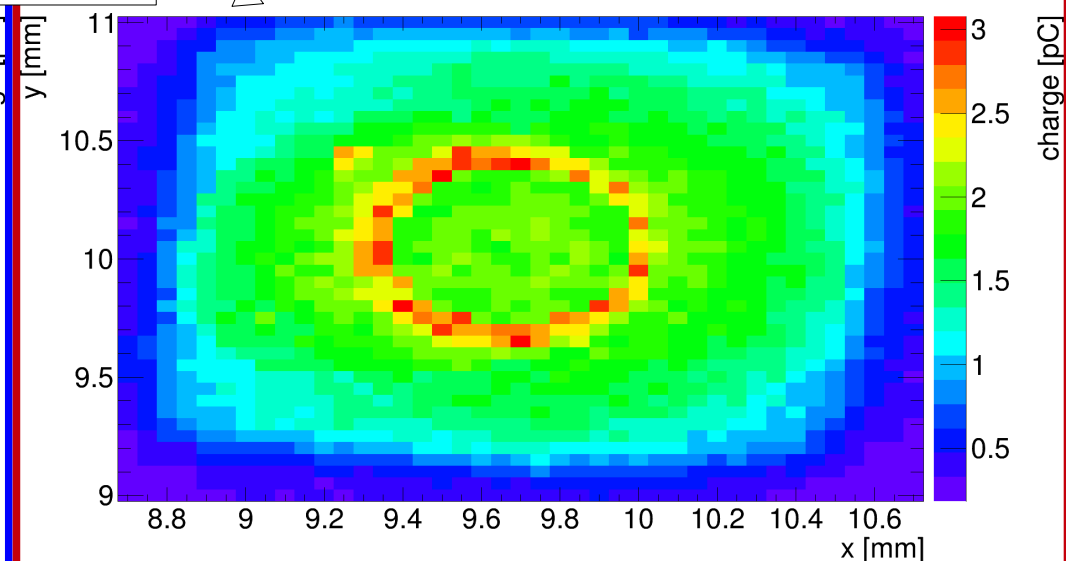
After irradiation $3 \times 10^{13} \text{ n/cm}^2$ 

Red TCT

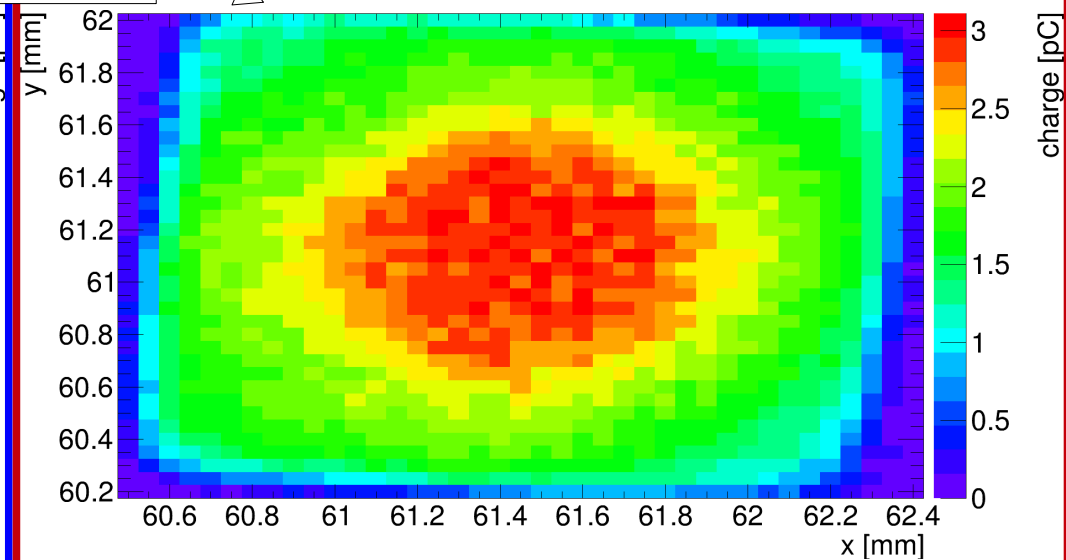
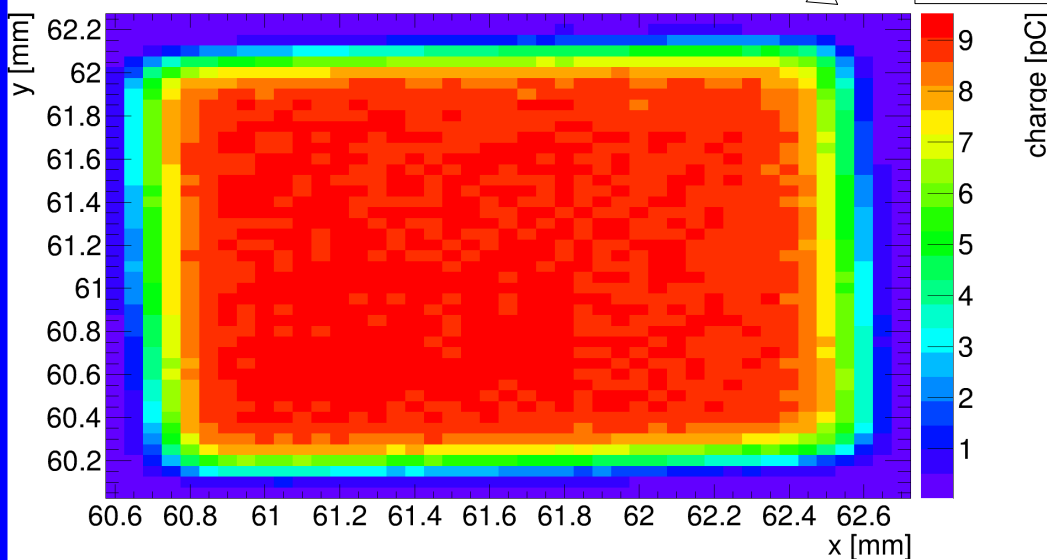


XY scans at 1700 V, -20°C

Before irradiation

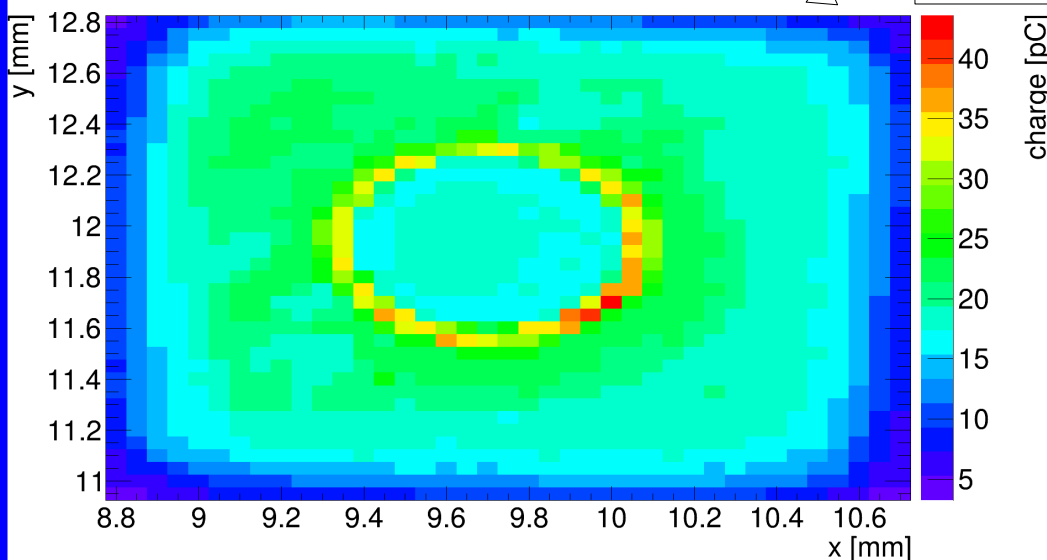
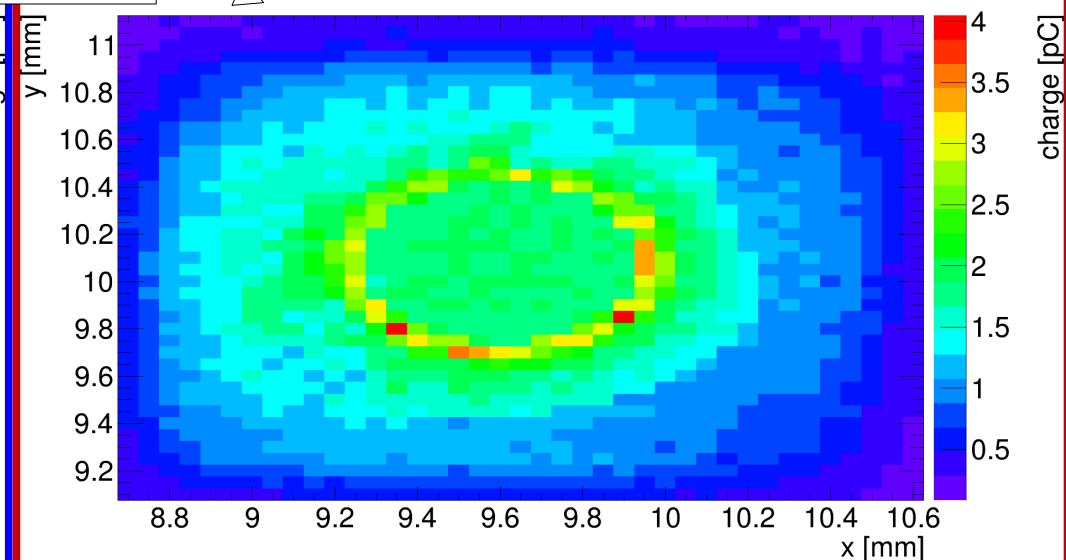
After irradiation $6 \times 10^{13} \text{ n/cm}^2$ 

Red TCT

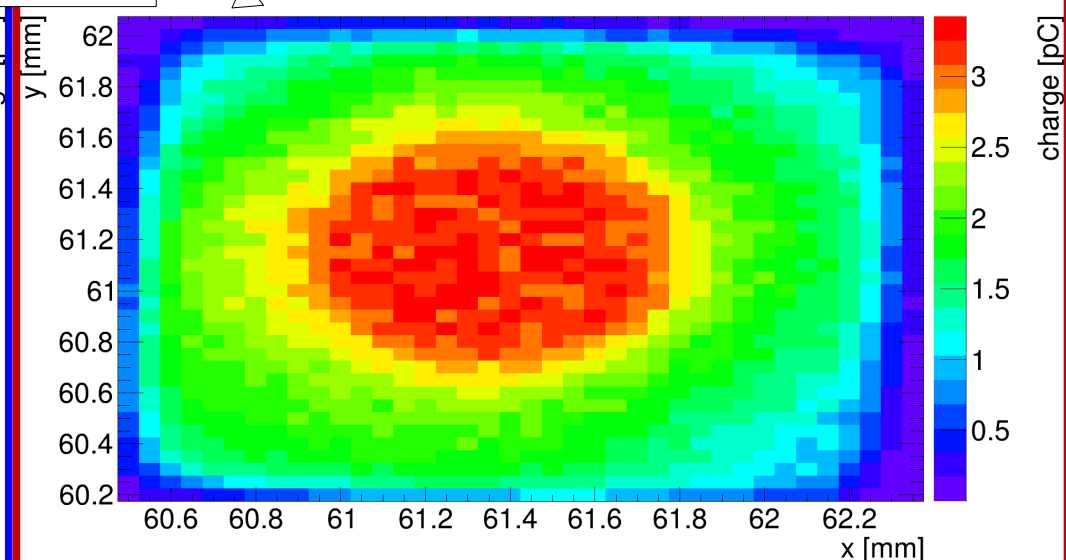
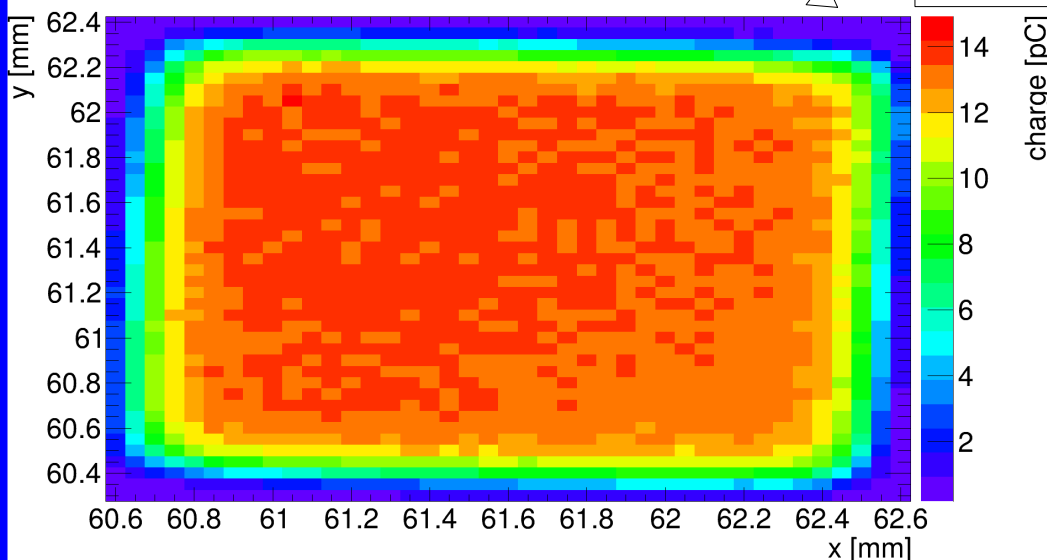


XY scans at 1700 V, -20°C

Before irradiation

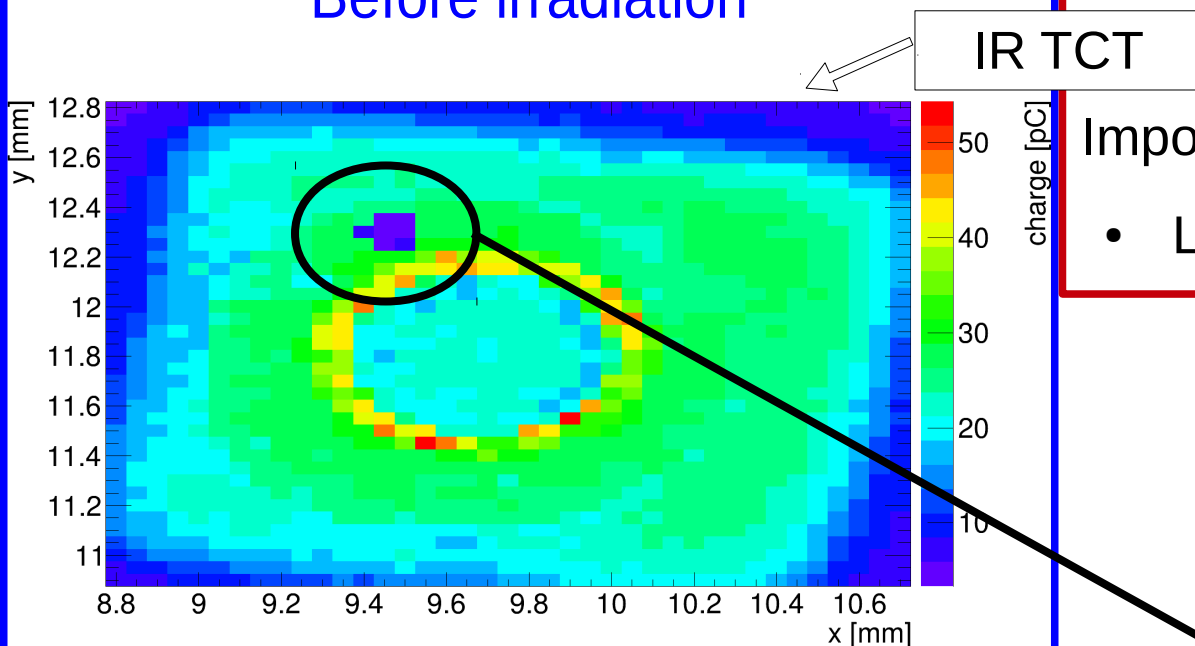
After irradiation $6 \times 10^{13} \text{ n/cm}^2$ 

Red TCT



XY scans at 1700 V, -20°C

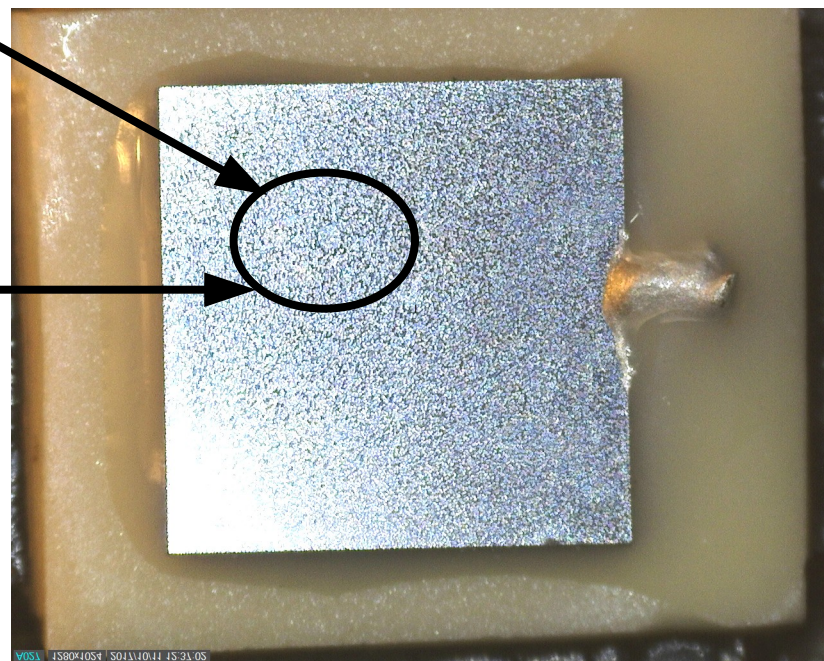
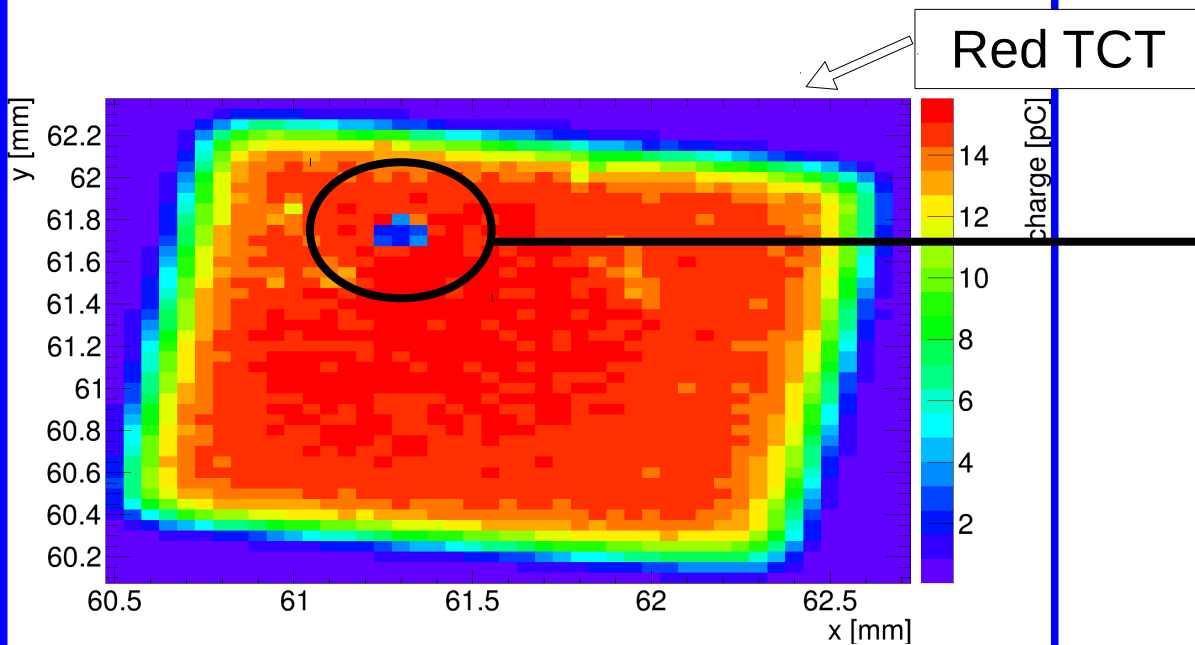
Before irradiation



After irradiation $3 \times 10^{14} \text{ n/cm}^2$

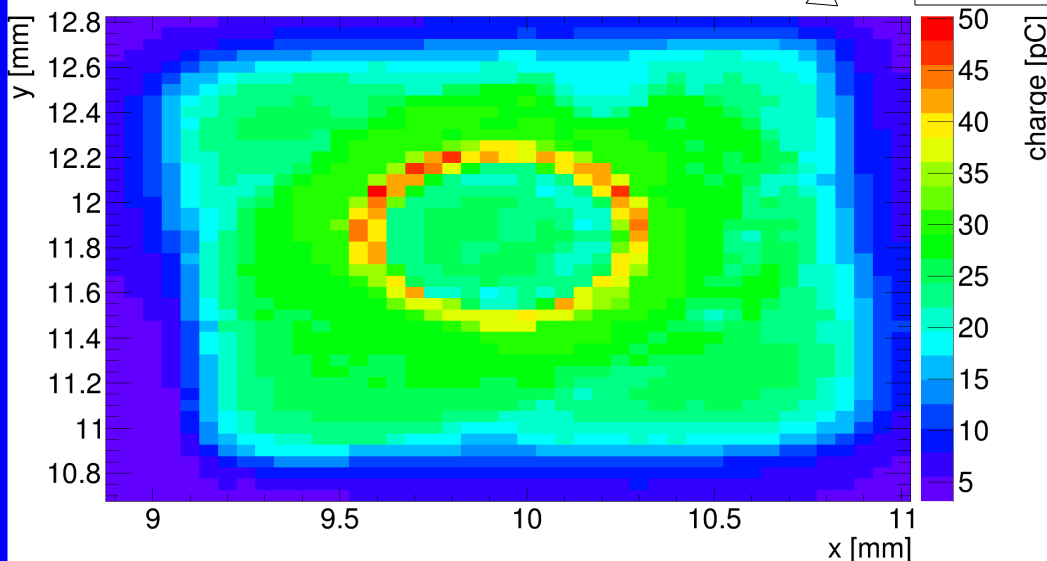
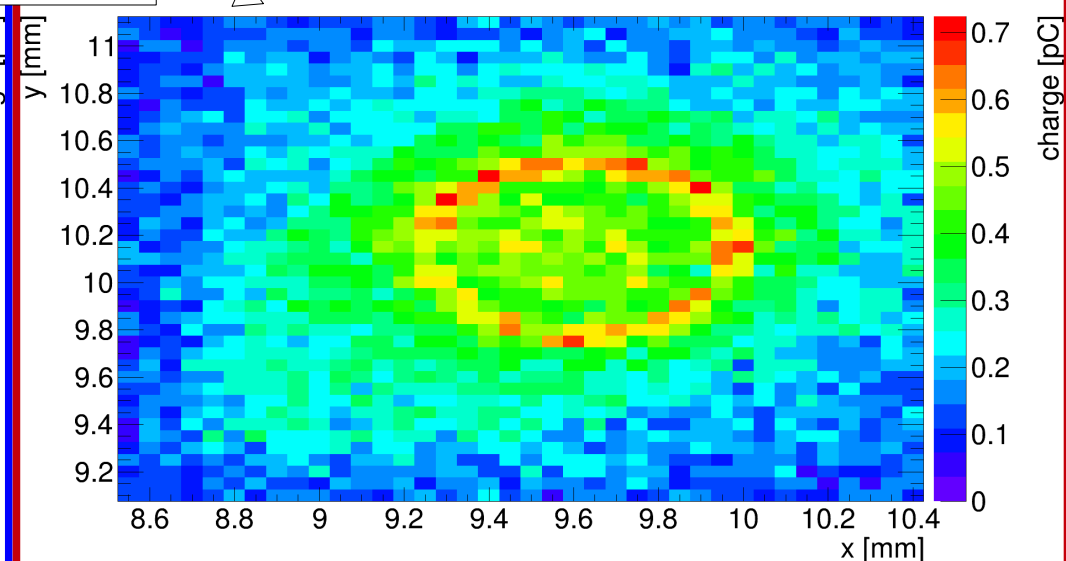
Impossible to perform the measurements.

- Leakage current $> 1.5 \text{ mA}$ at $\sim 7 \text{ V}$.

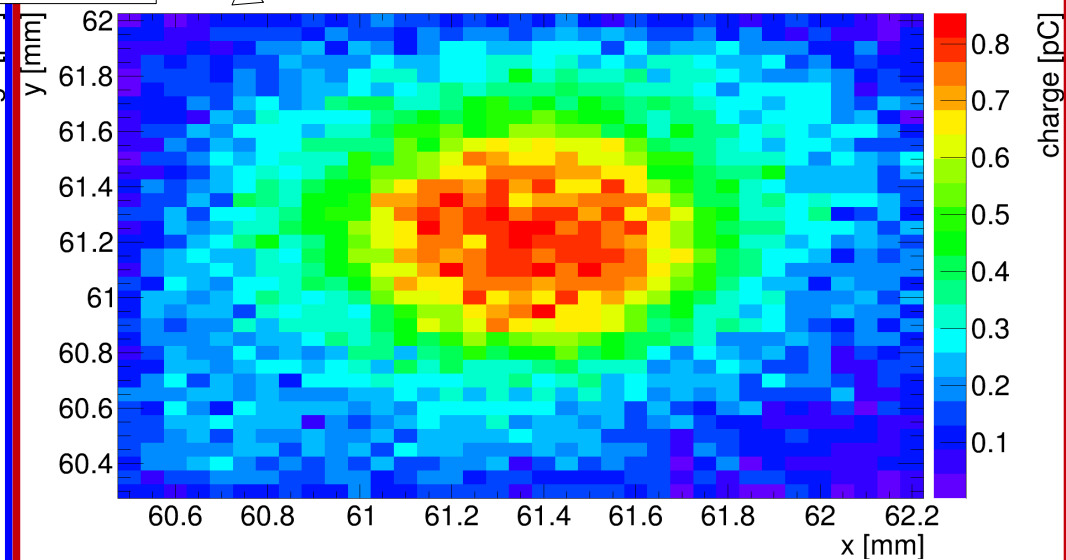
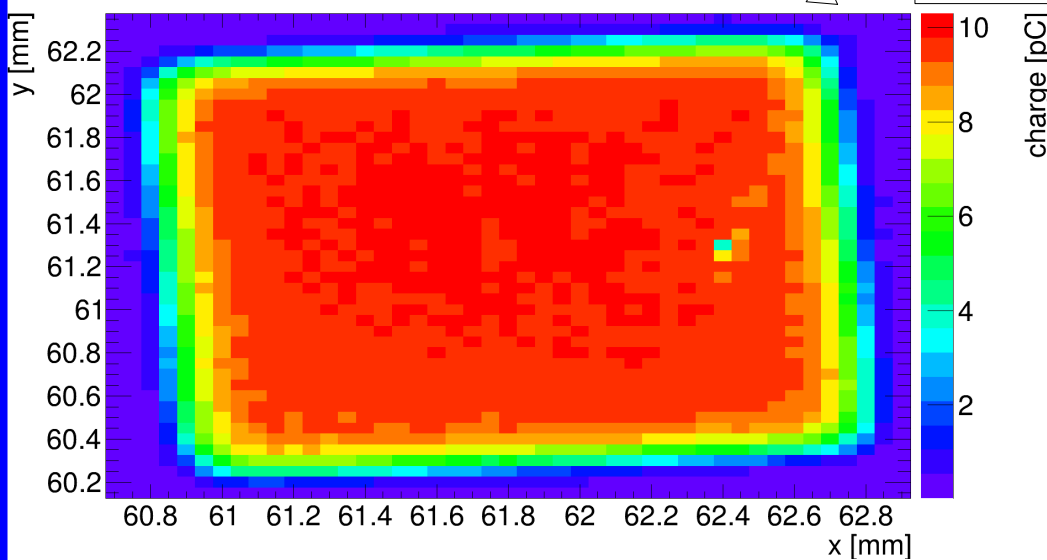


XY scans at 1700 V, -20°C

Before irradiation

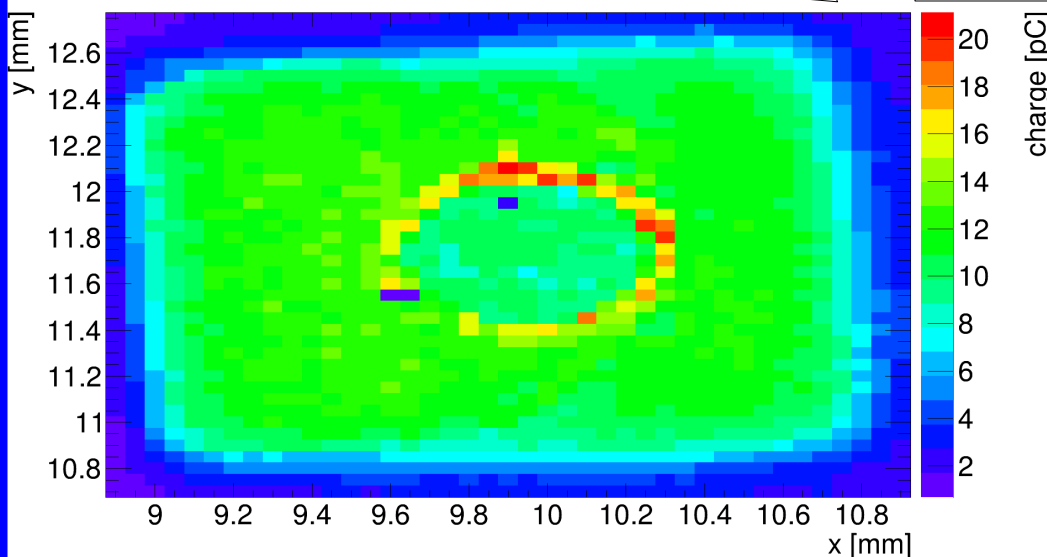
After irradiation $3 \times 10^{14} \text{ n/cm}^2$ 

Red TCT

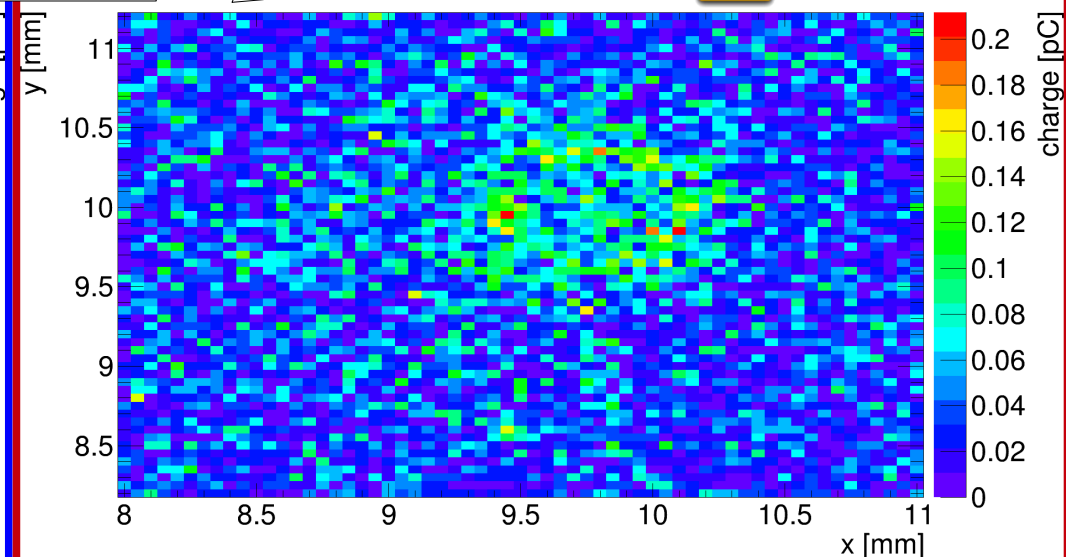


XY scans at -20°C

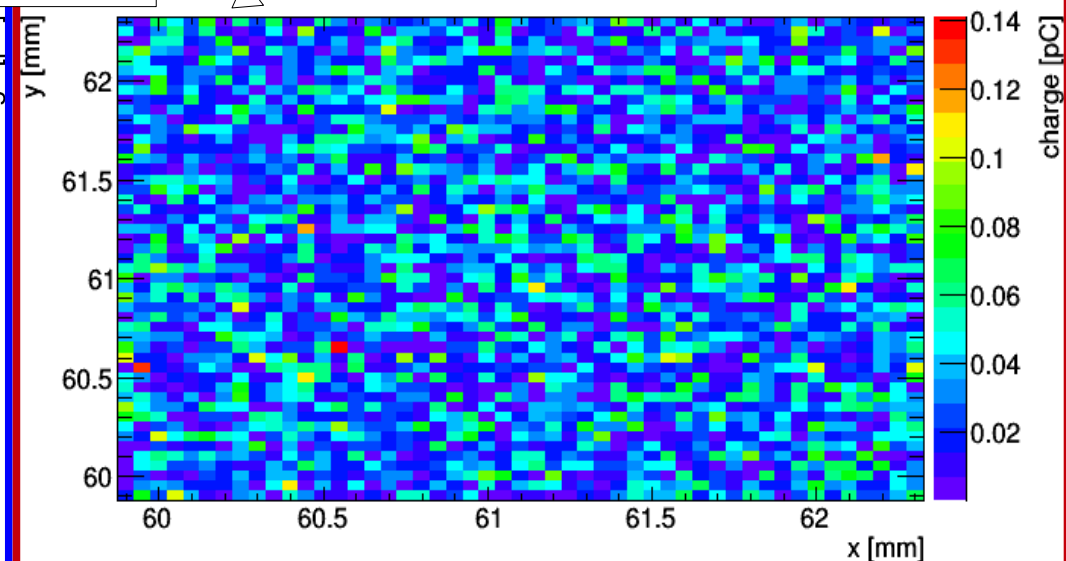
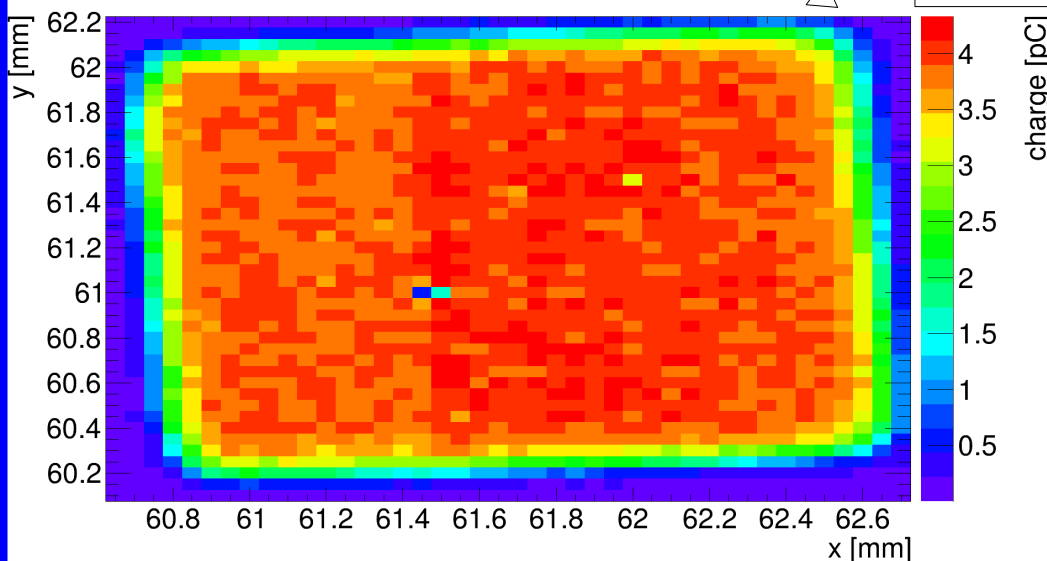
Before irradiation
1700 V



After irradiation $1 \times 10^{15} \text{ n/cm}^2$
450 V* ⚠



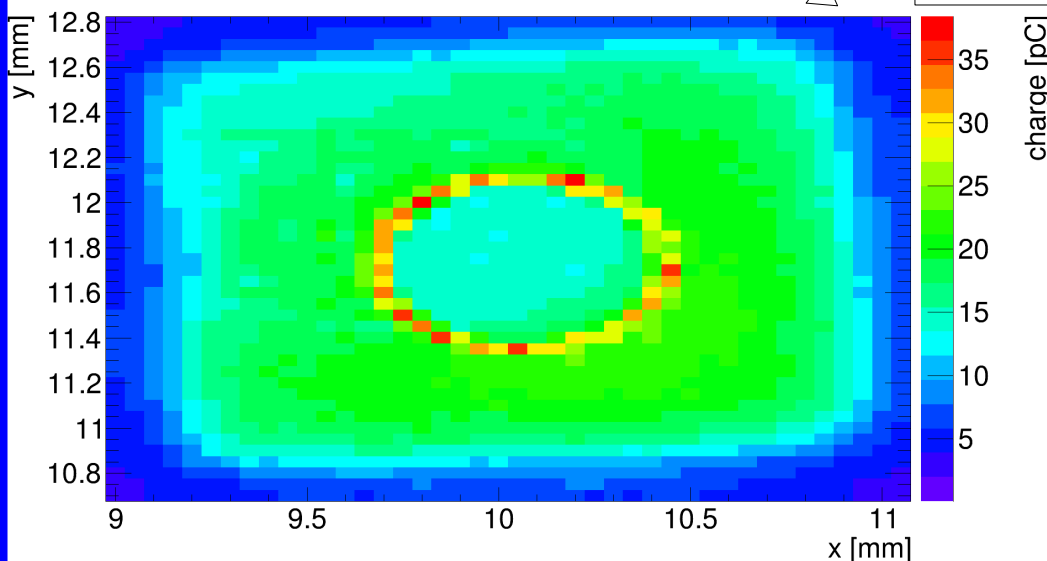
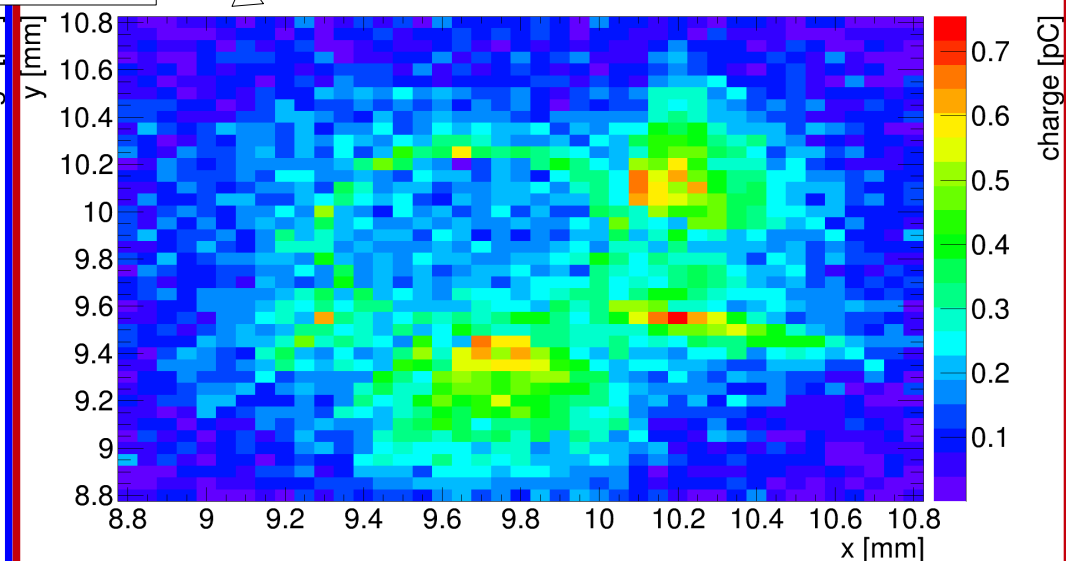
Red TCT



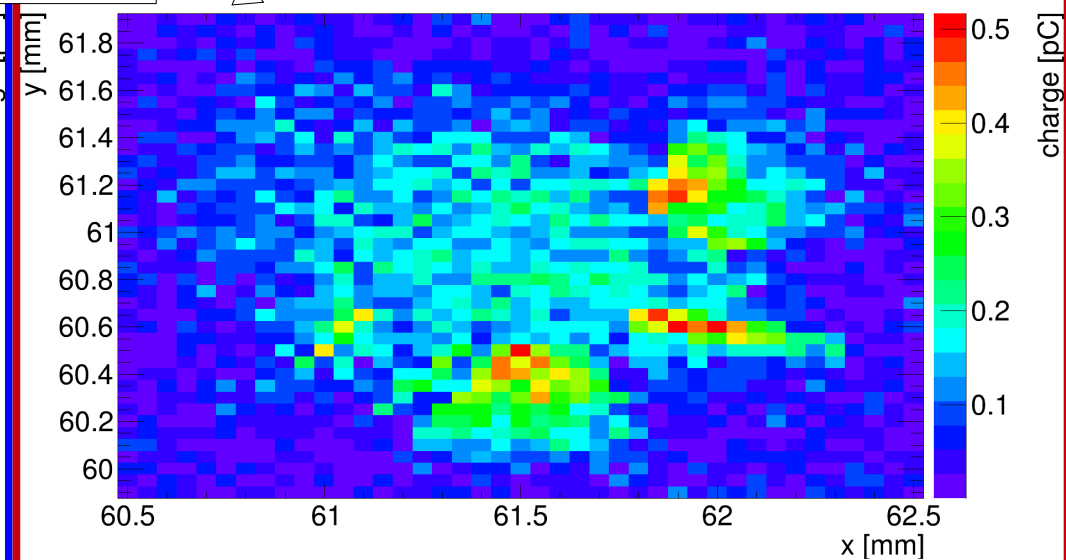
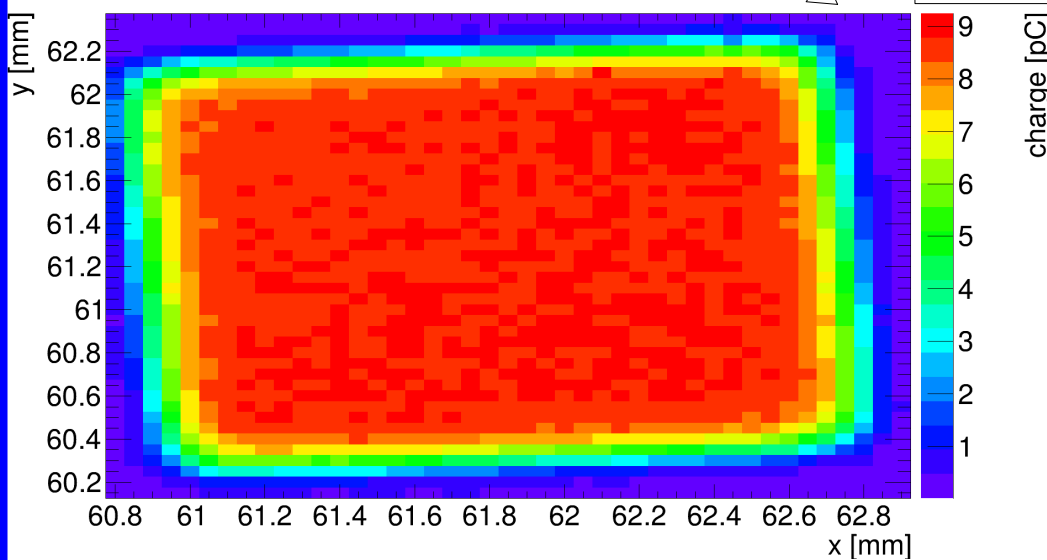
*Reached compliance at ~480 V.

XY scans at 1700 V, -20°C

Before irradiation

After irradiation $1 \times 10^{15} \text{ n/cm}^2$ 

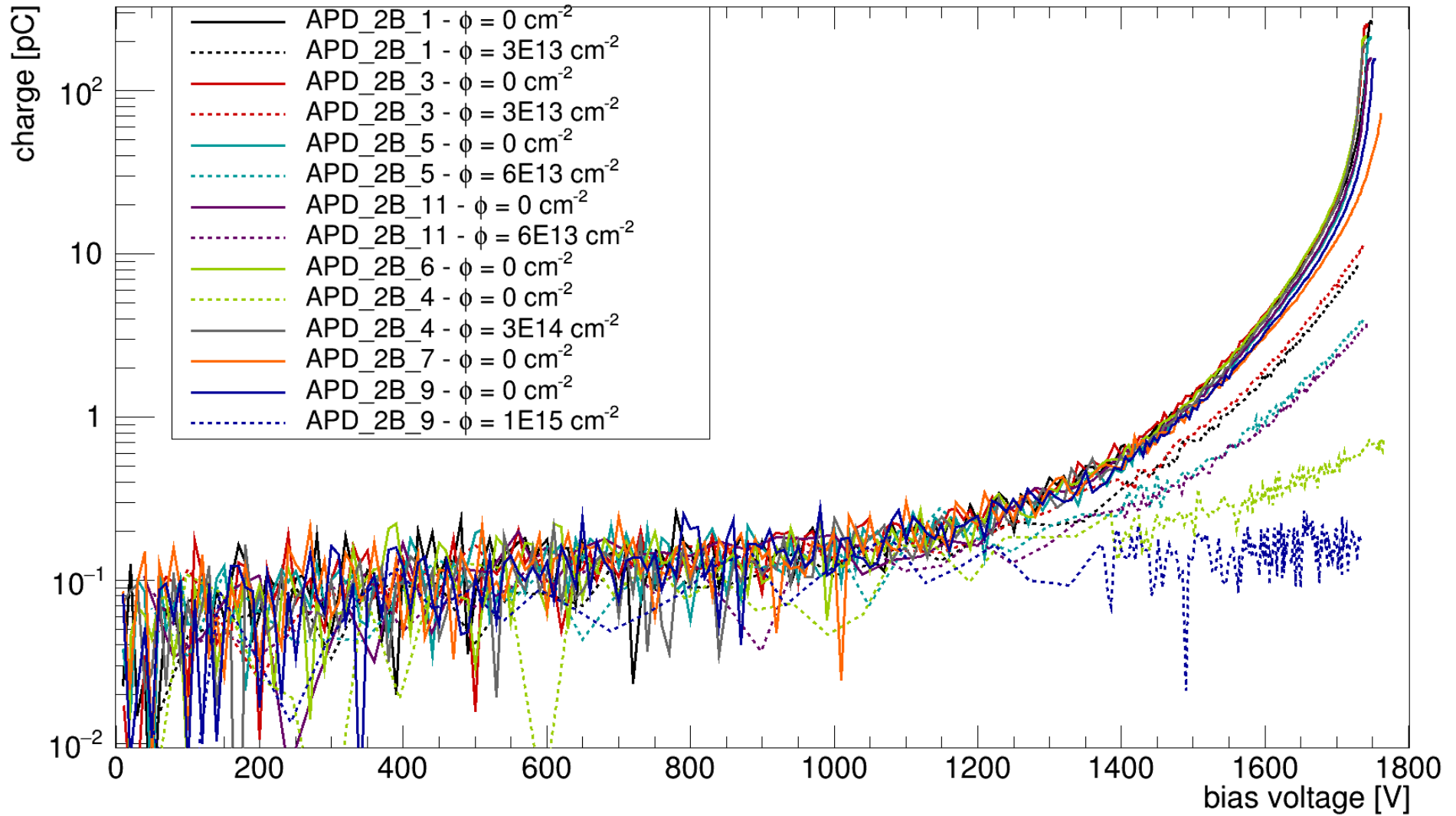
Red TCT



Voltage Scans

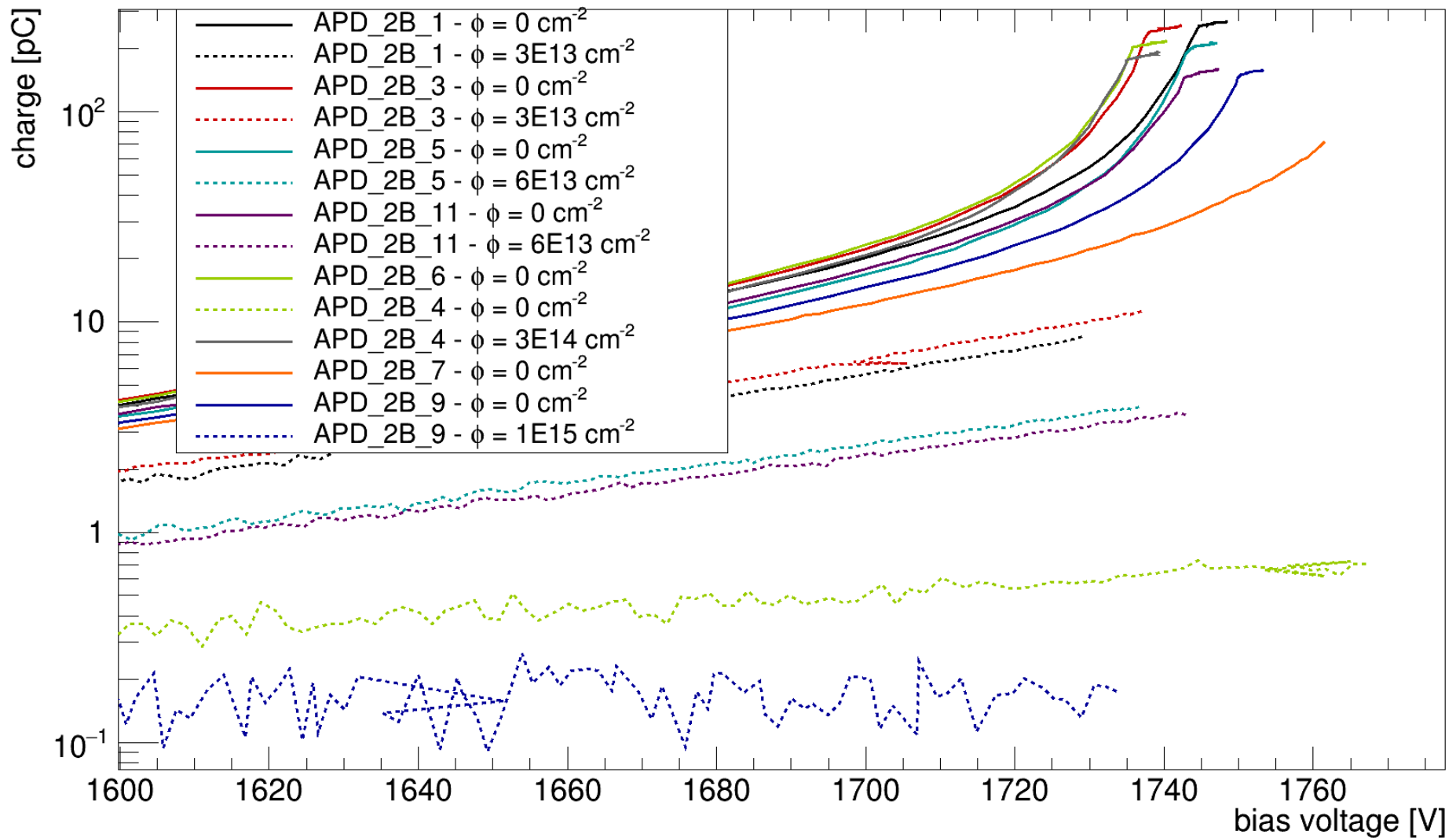
Charge collection vs. bias voltage

IR TCT at -20°C

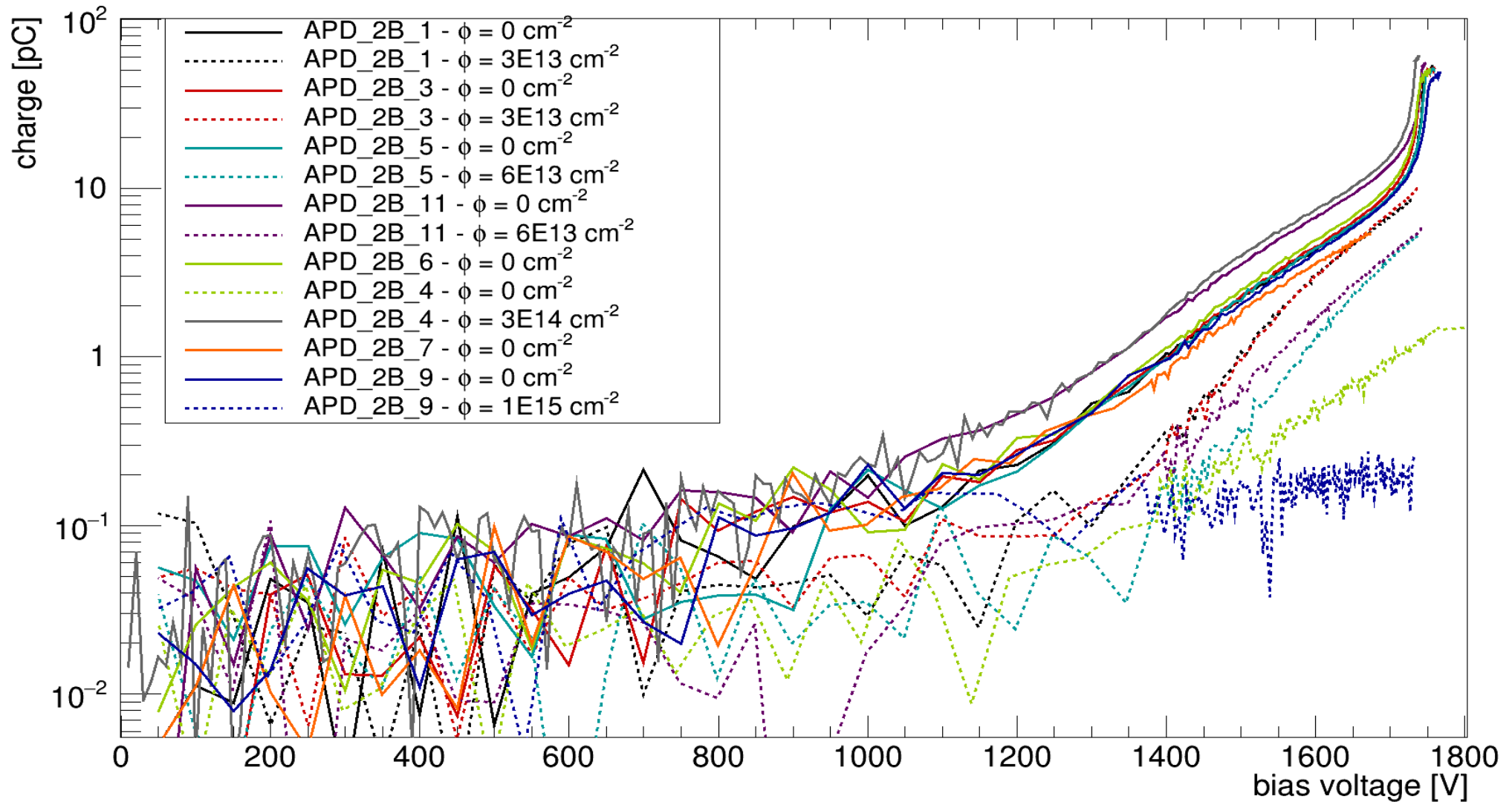


IR TCT at -20°C

Detail at high voltages



Red TCT at -20°C



Red TCT at -20°C

Detail at high voltages

