
X-ray Study Status

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Outline

- **X-ray test summary**
- **MultRad160 machine**
- **Plan**

X ray test summary

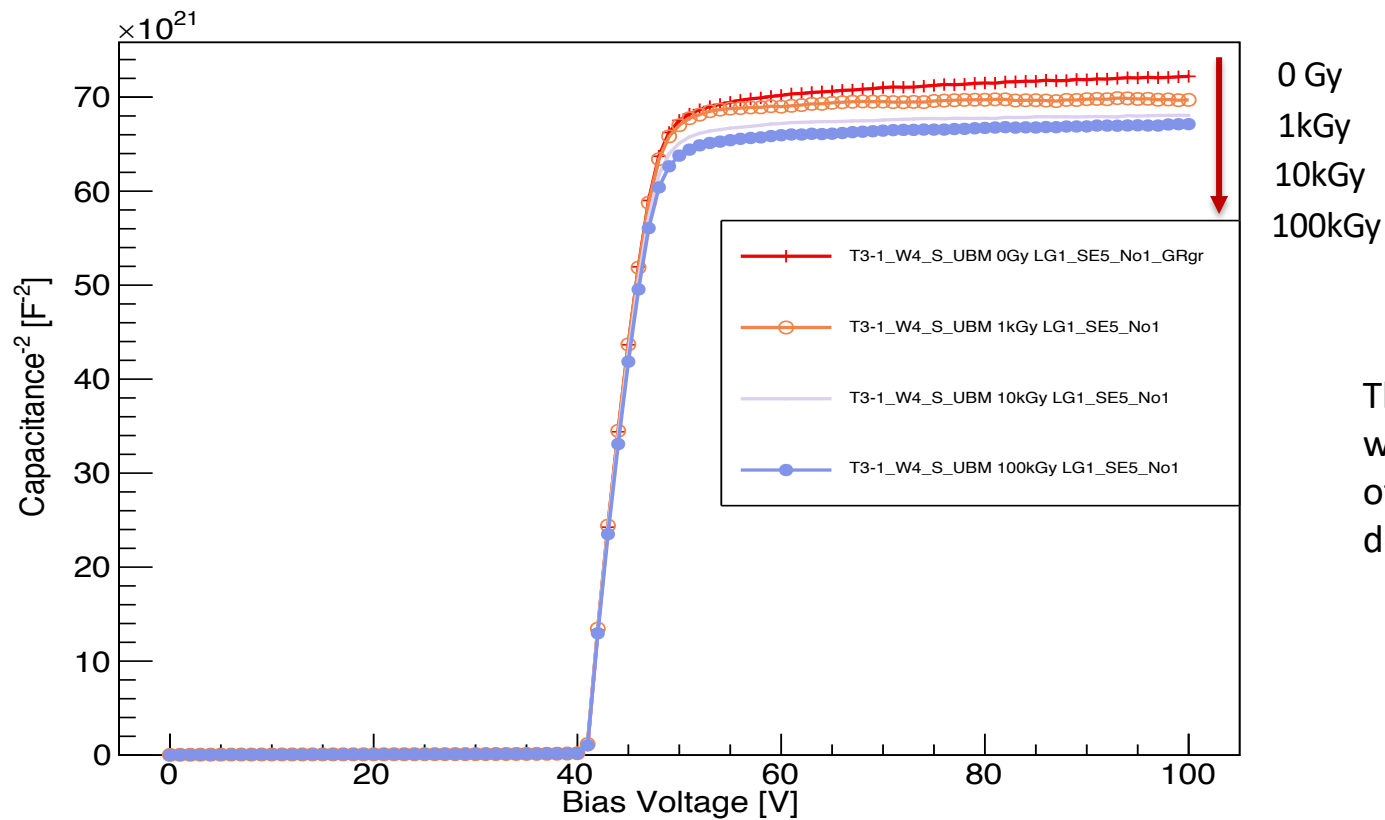
- **Test sensors:**
 - W17 T3-2 single pad with UBM LG1_SE5 (2)
 - W4 T3-1 single pad with UBM LG1_SE5 (2)
- **Test setup :**

TID(Gy)	Test temperature(Celsius)	MultRad160 setup		Dose Rate (Gy/min)	Filter
1k	19	160kV	25mA	30	0.5mm Al
10k	20-25	160kV	25mA	30	0.5mm Al
100k	25-30	160kV	15mA	174.5	0.09mm Al

X ray Test Summary

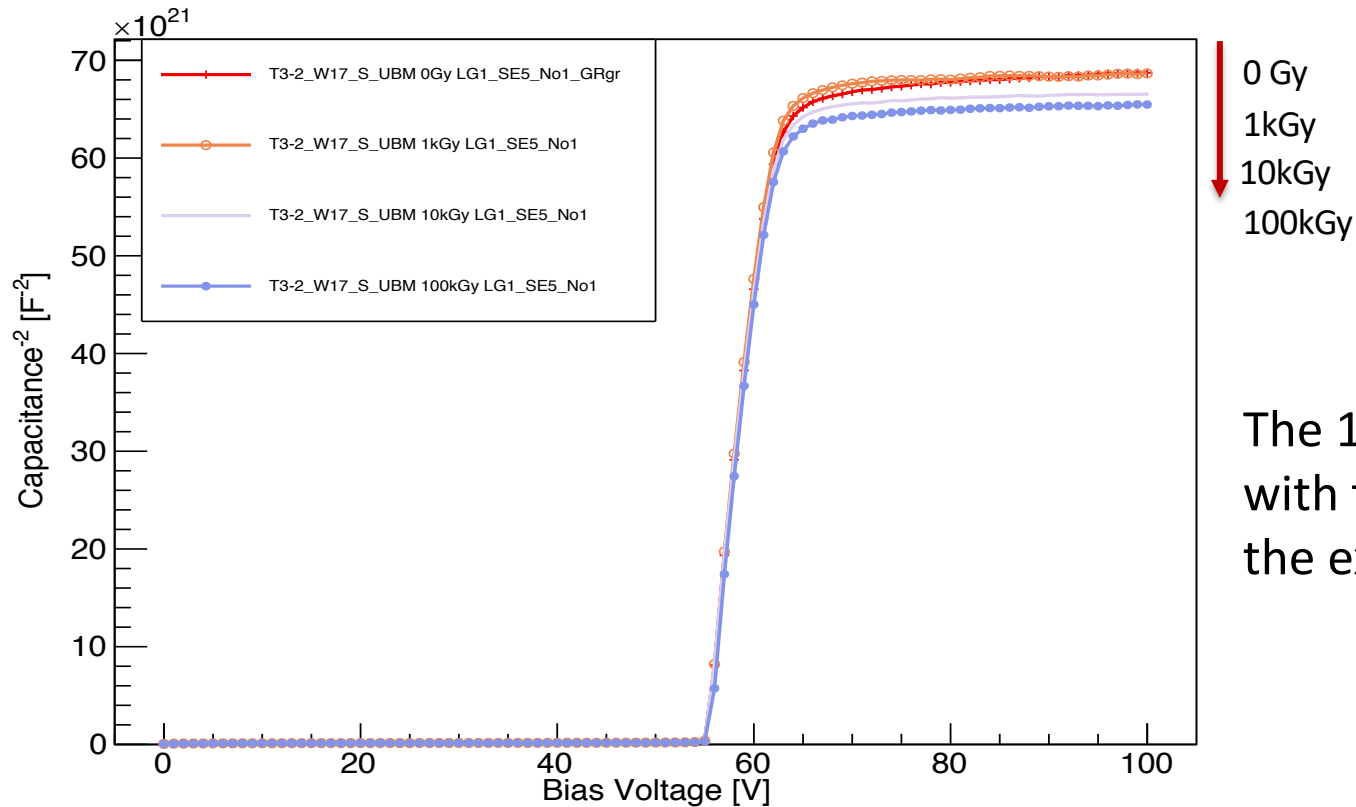
Results of the irradiated sensor test

1/C² VS Bias for HPK-UBM-3.1-W4



The $1/C^2$ decreases with the increase of the exposure dose.

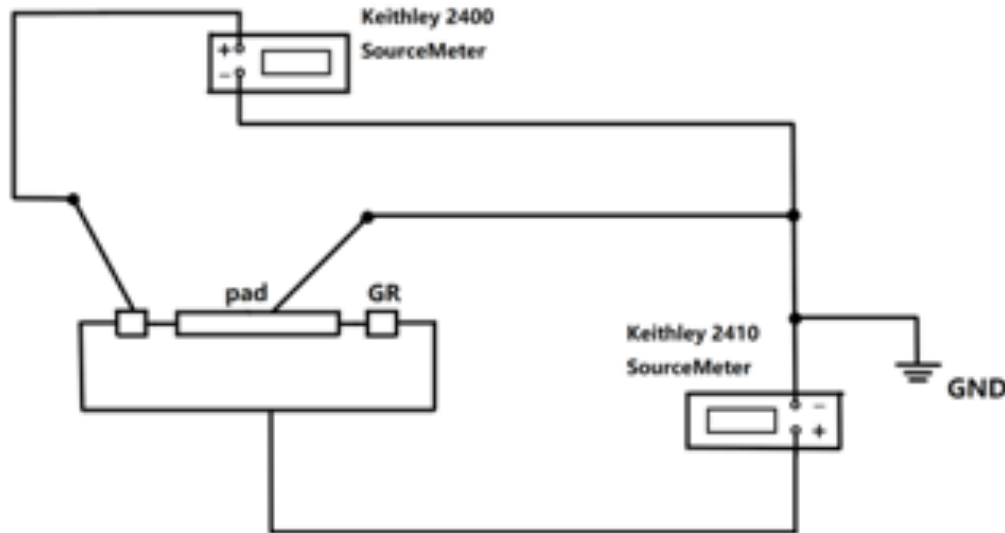
$1/C^2$ VS Bias for HPK-UBM-3.2-W17



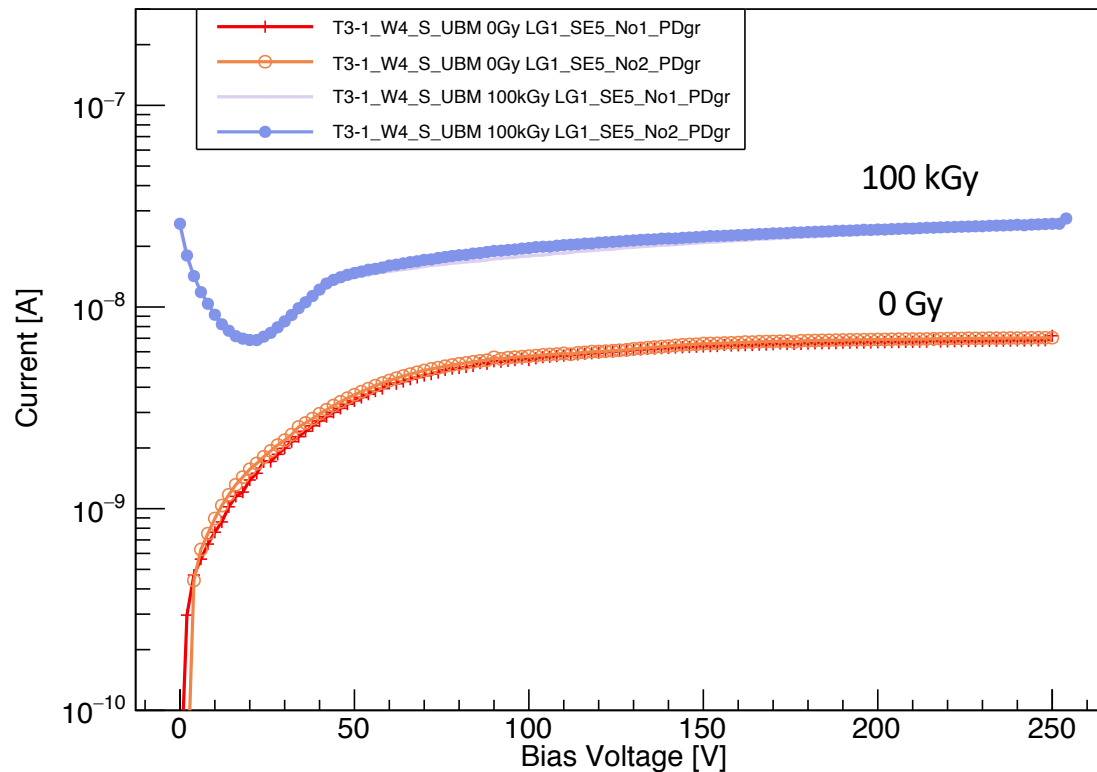
The $1/C^2$ decreases with the increase of the exposure dose.

Guard Ring Test

- **Motivation:** How dose the Guard Ring affect the irradiation hardness of sensors ?
- **Measurement:** the behavior of the Guard Ring after irradiation, set the Guard Ring as the sensor

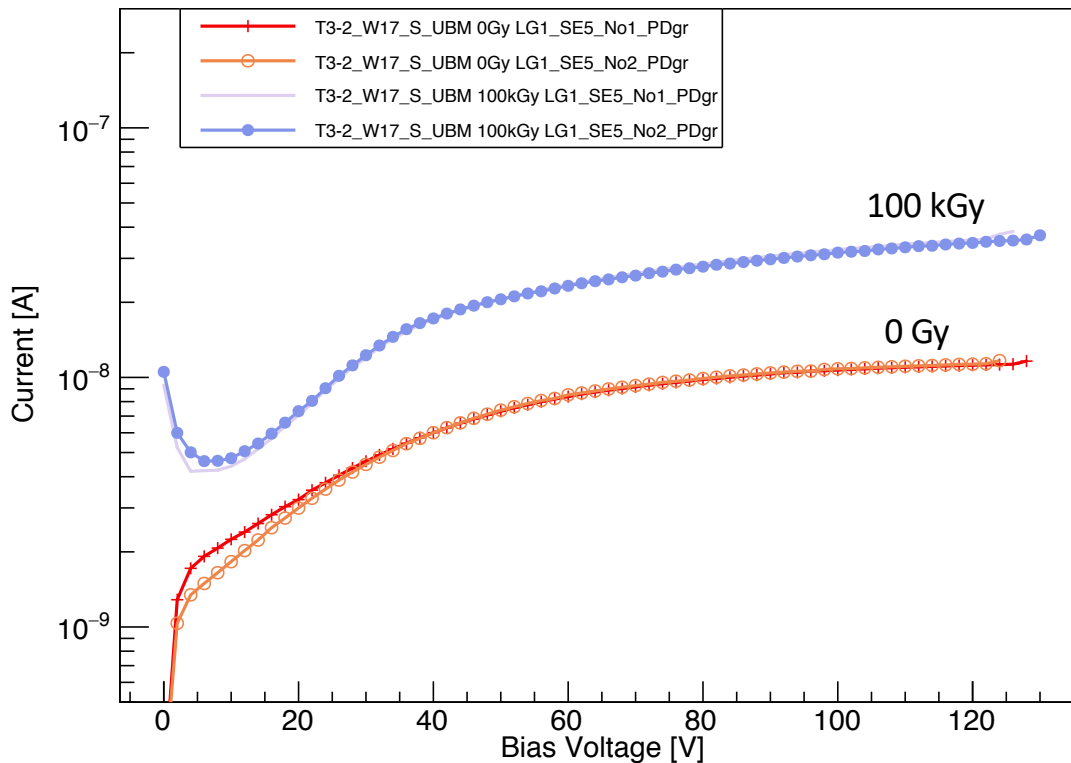


Guard Ring IV for HPK-UBM-3.1-W4 with pad ground



The current of Guard Ring at 100kGy increases **≥ 4 times** compared the current at 0Gy.

Guard Ring IV for HPK-UBM-3.2-W17 with pad ground



The current of Guard Ring at 100kGy increases **≥ 3 times** compared the current at 0Gy.

MutlRad160 machine

Increase the Dose Rate of MutlRad160

- Increase the Dose Rate of MutlRad160 from 30Gy/min to 174Gy/min
 1. Decrease the distance between the silicon sensor and the source
 2. Use thinner Al filter: 0.09mm
- Long exposure time achieved by
Set the lower current of the MultRad160



Could achieve 1MGy in 12 days!

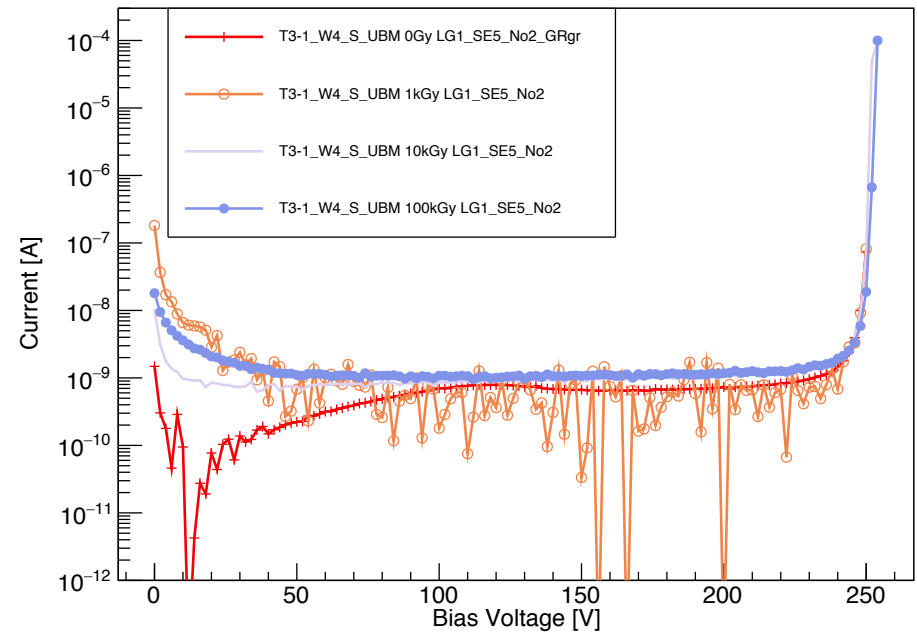
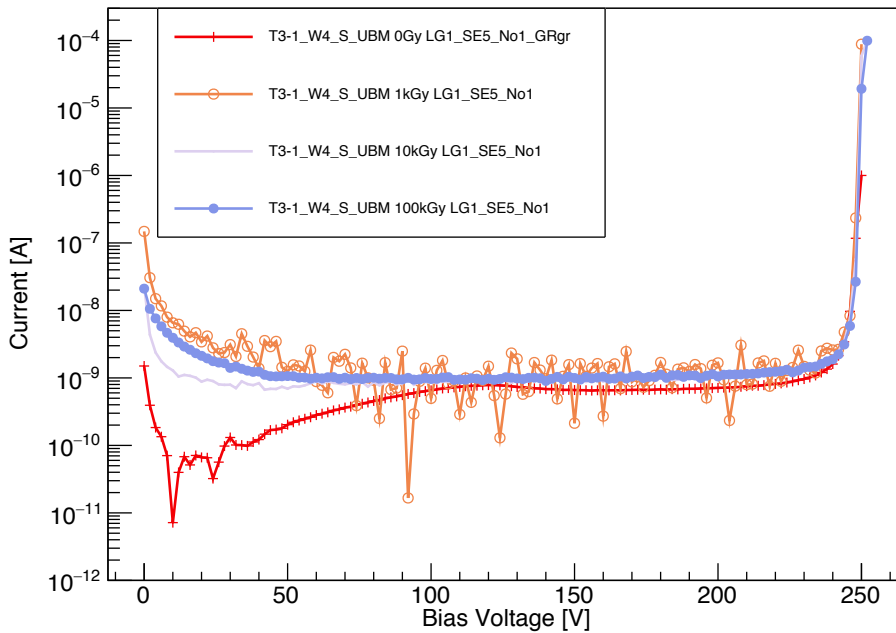


Plan

- Understand the test results
- More critical parameters:
 - The gain, Charge collection
- To 1MGy, 2MGy, 3MGy
- Choose other sensors for X-ray test (**any idea?**)
 - 2x2(inter-pad capacitance change?), NDL sensor?

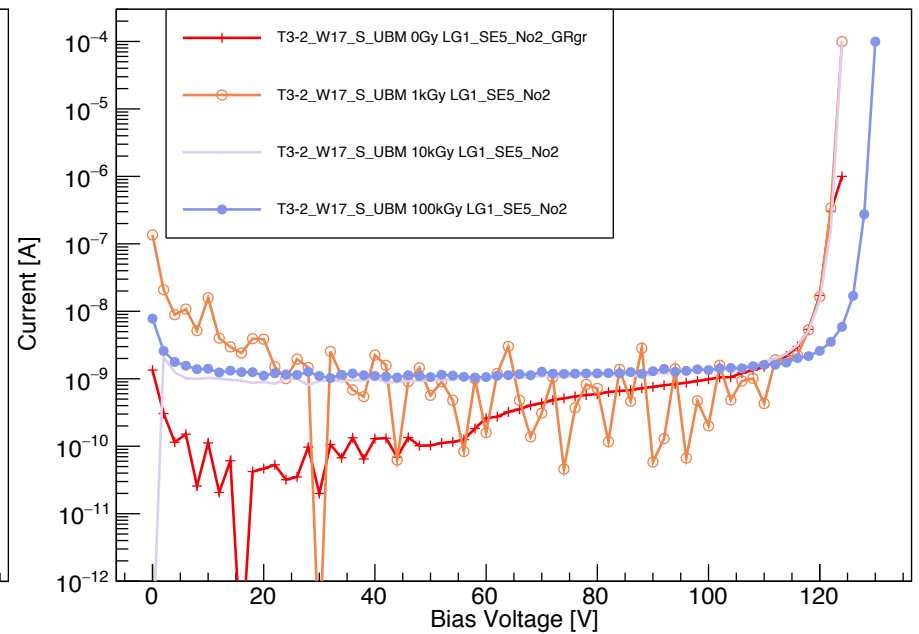
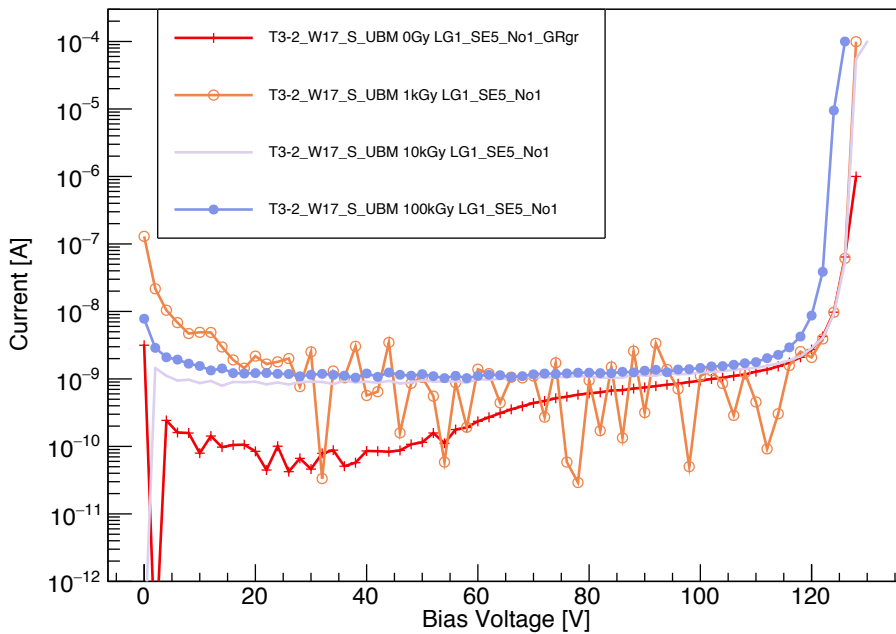
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- **Backup**

IV for W4



- Breakdown voltage didn't change
- Current increases in the low bias voltage region

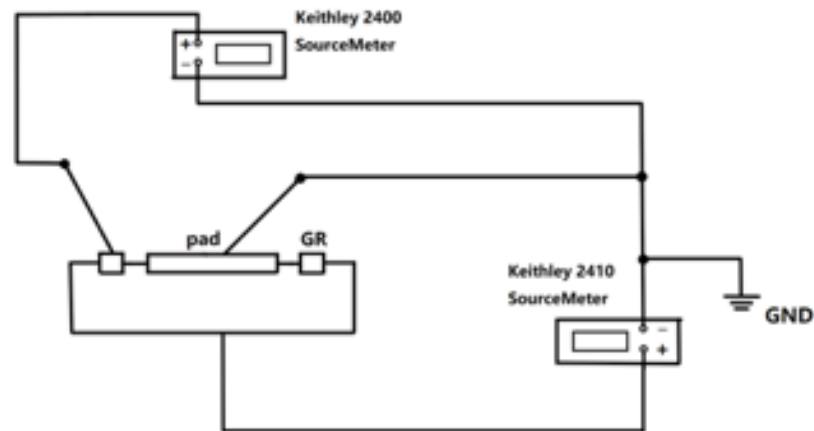
IV for W17



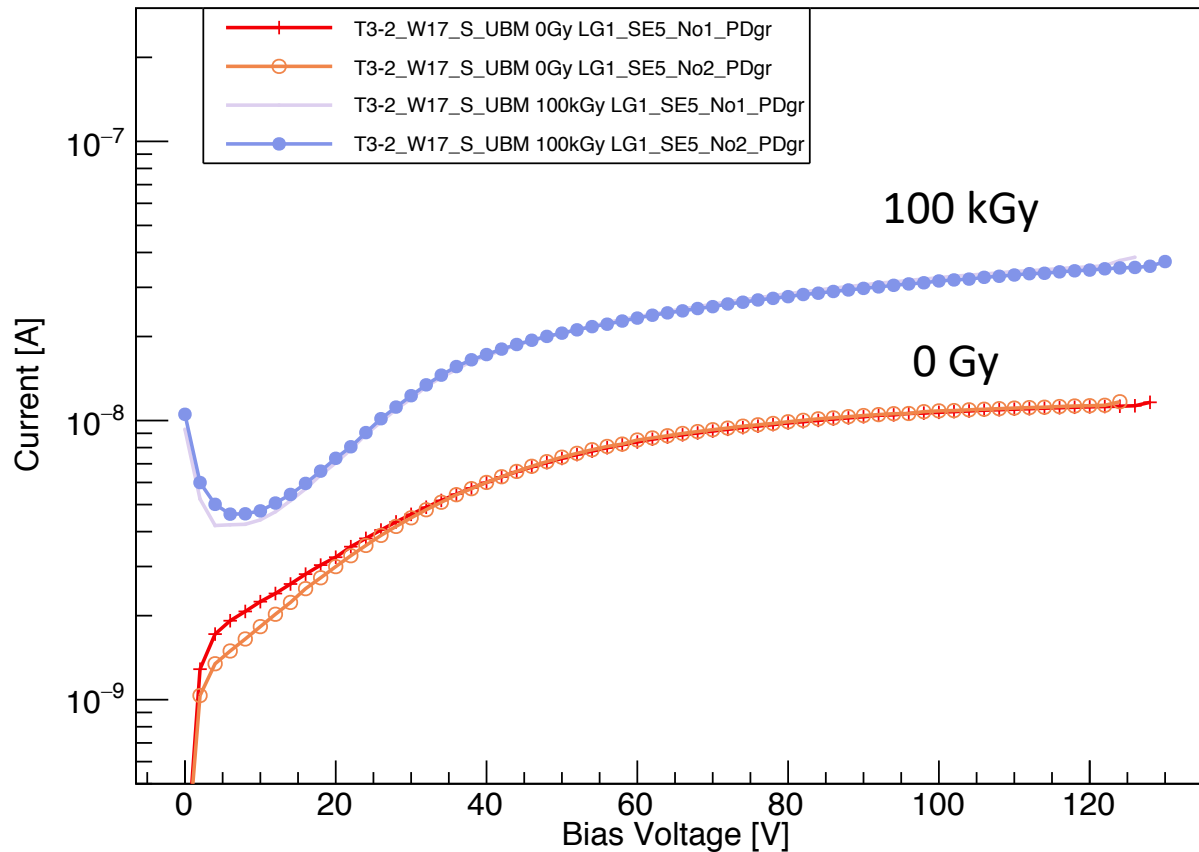
- Breakdown voltage changes: lower for N1 and higher for N2
- Current increases in the low bias voltage region.

With Guard Ring ground

Test Setup



Guard Ring IV for W17 with pad ground



Guard Ring IV for W17 with pad floating

