SPS proton Irradiation Tests at JSI

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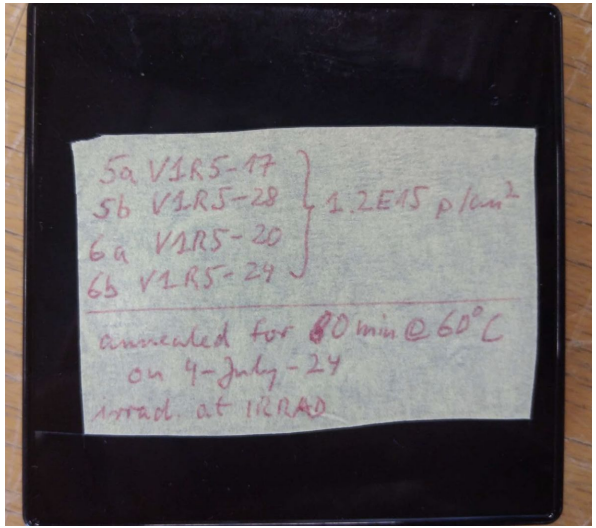
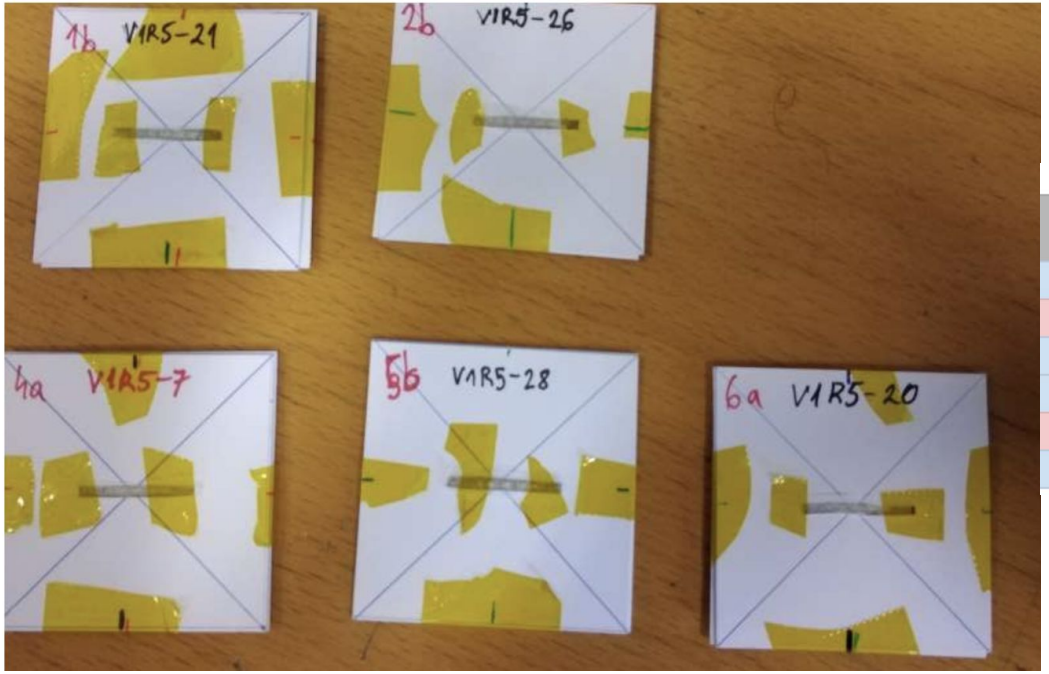
CERN SPS 24 GeV proton irradiation testing at JSI



- **Proton Gaussian beam narrow (FWHMx = 7.8 mm, FWHMy = 9.7 mm)**
- **Wafer V1R5 irradiated**
- **Samples irradiated to fluences up to: 4e14 p/cm^2 , 8e14 p/cm^2 and 1.2e15 p/cm^2**
- **IV-CV, TCT and Sr90 measurements were carried out at JSI**
- **Samples annealed for 80 min @ 60 ℃**
- **V_{gl} before irradiation is estimated ~25 V at room temp (@CERN ~27 V) for this wafer**

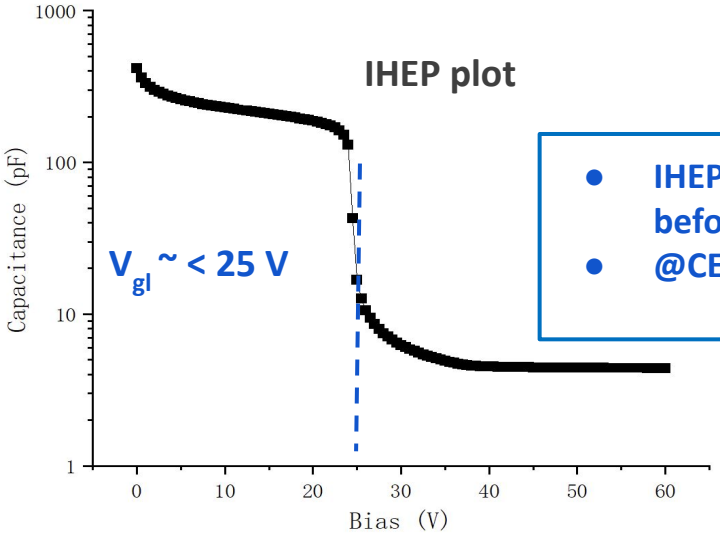


Wafer V1R5			
Board	Sample	Complementary card	Complementary sample
1a	V1R5-19	1b	V1R5-21
2a	V1R5-16	2b	V1R5-26
3a	V1R5-52	4a	V1R5-7
4b	V1R5-25	4a	V1R5-7
5a	V1R5-17	5b	V1R5-28
6a	V1R5-20	6b	V1R5-24

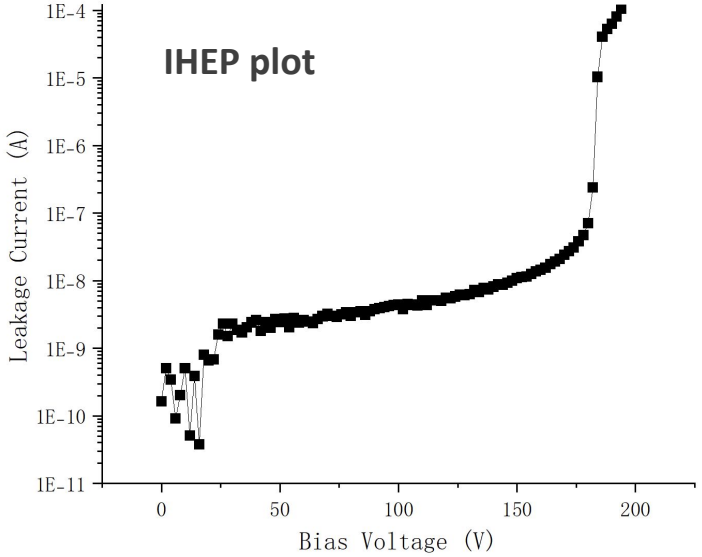
- 1×1 LGAD and PIN structures are overlapped to ensure identical irradiation conditions for accurate comparison.
- Front (LGAD) and back (PIN) cards enable simultaneous measurements, improving dosimetry precision.

	Fluence (1e14 neq/cm2)	IV LGAD2 (next to 1x1)				2.94E+14		TCT
		Vgl	Vfd	Vbd (500 nA)	I(PIN) at 20C, Vfd	fluence	Vgl1	Vgl2
Jan 2024								
V1R5	20WS11010005XY							
V1R5-18	0	24.7	57	180	5	1.47E+15	24.7	24.1
V1R5-22	0	24.3	37	175			24.0	24.0
V1R5-42	0	24.6	37	197			24.3	24.1
V1R5-50	0	24.4	38	197			23.8	24.0
V1R5-52	0	24.5	40	200			24.4	24.3
V1R5-49	0	24.5	38	207			23.9	23.9

JSI results before irradiations @ 20 ℃

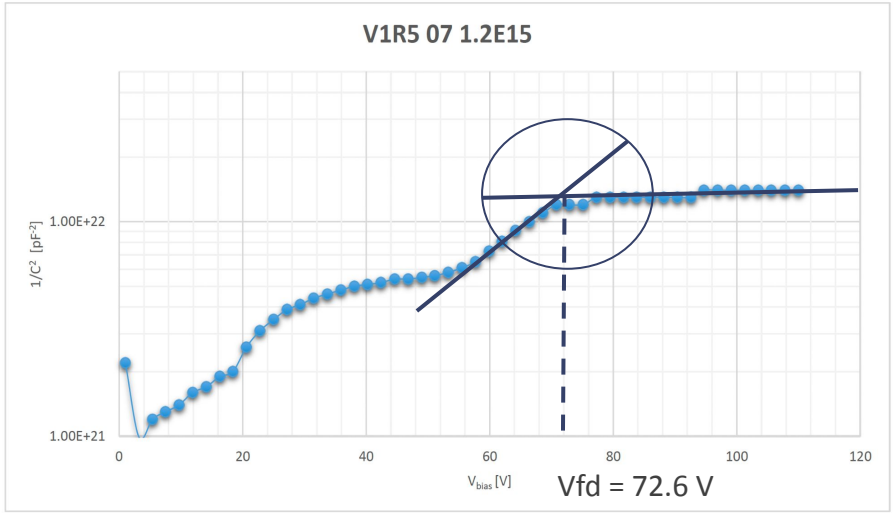


- IHEP IV curves for wafer 5 before irradiation @ 20 ℃
- @CERN ~27 V

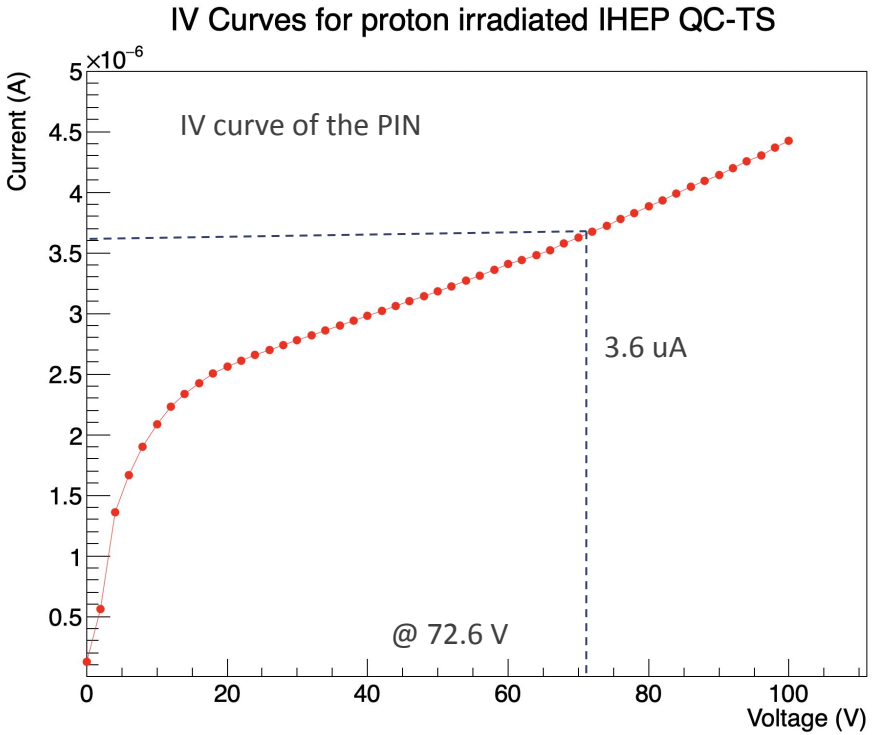


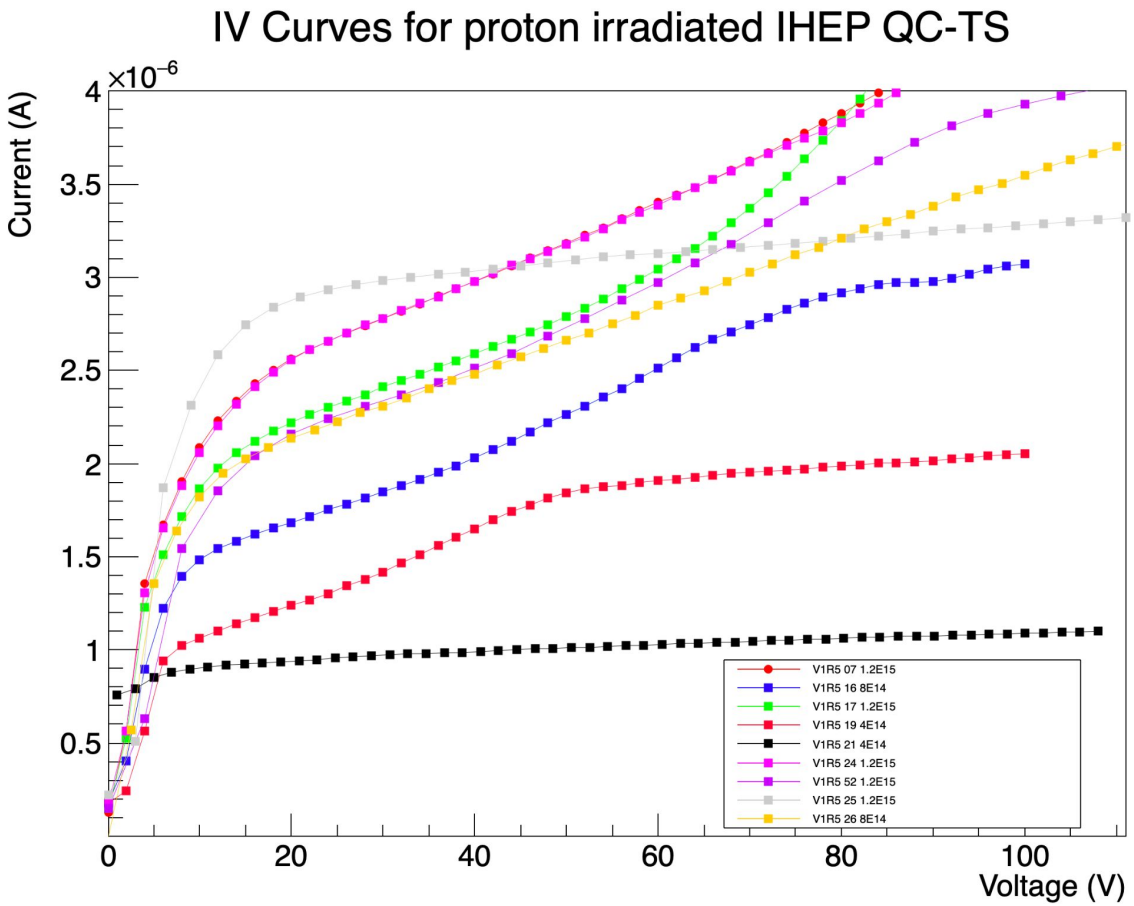
Wafer 5 before irradiation

Dosimetry evaluation



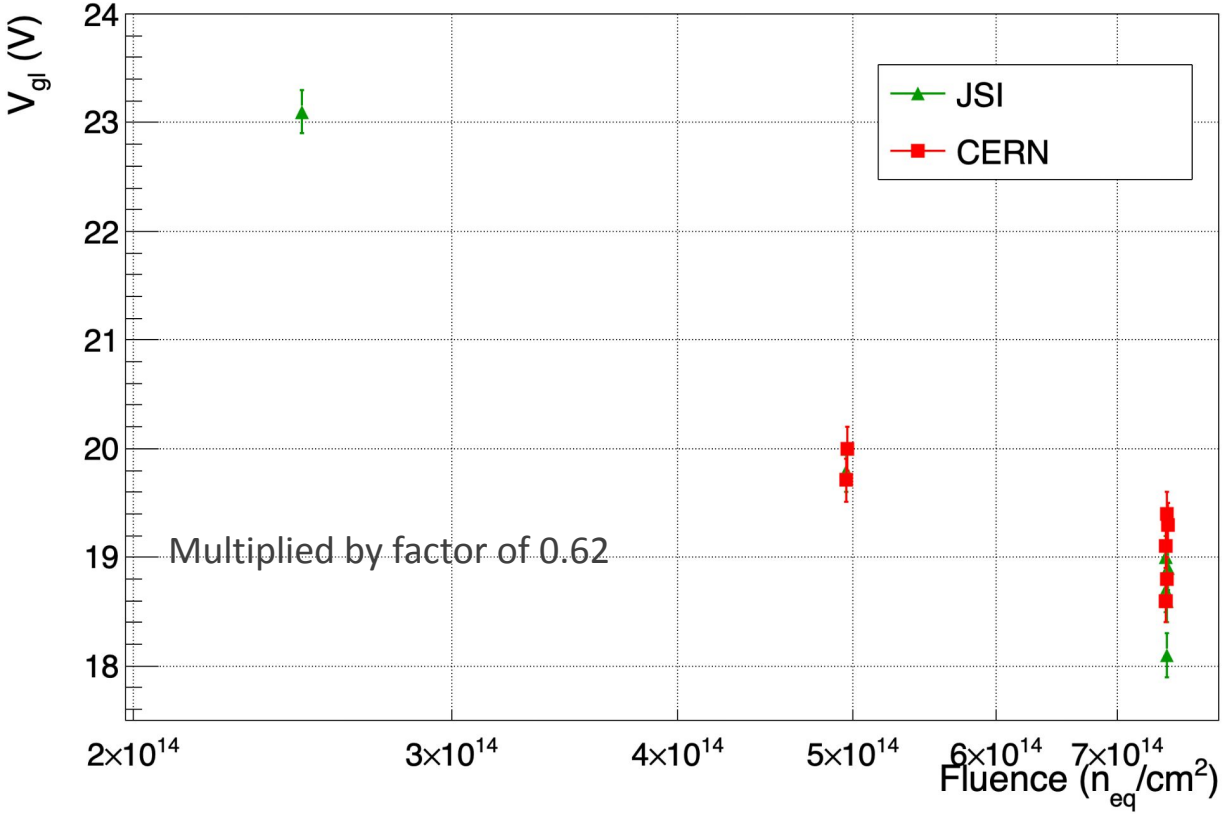
CV curves from 1x1 LGAD with GR connected



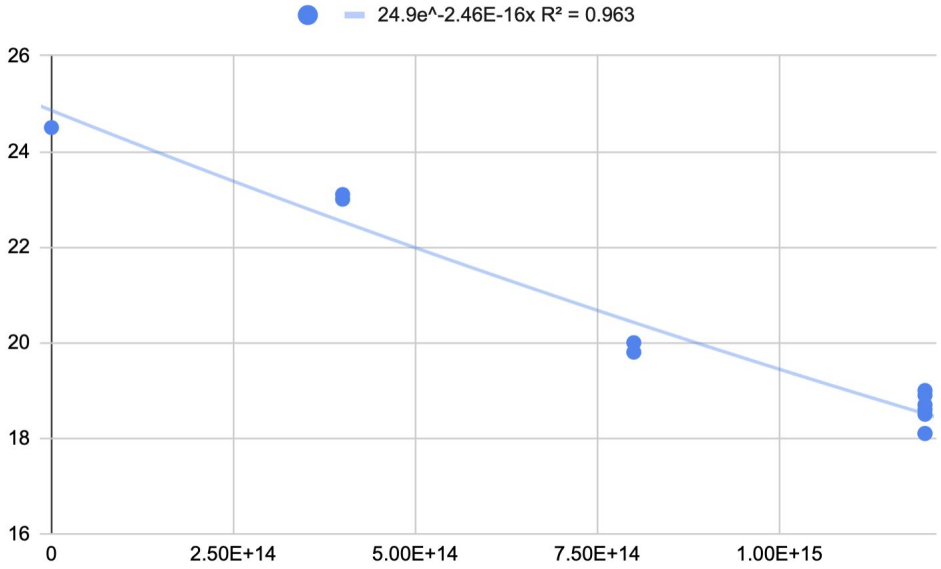


Proton irradiations data

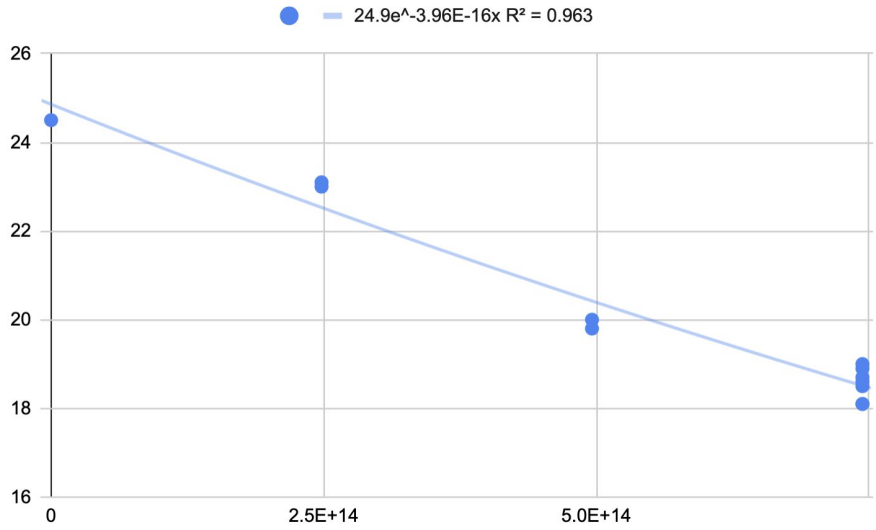
JSI vs CERN CV-IV measurements



- Values are generally in good agreement across the fluence range
- Absolute percent differences range from **0.00% to 4.21%**, with an average deviation of approximately **1.72%**



c=2.46×10−16cm2/p



c=3.96×10−16cm2/neq