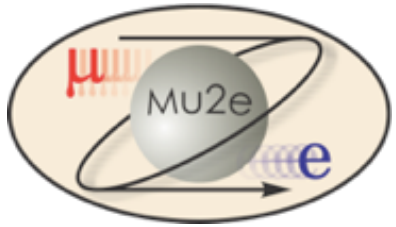


Mu2e SiPMs test

Muse outreach program for university student

Eleonora Diociauti | LNF & Università degli studi di Tor Vergata

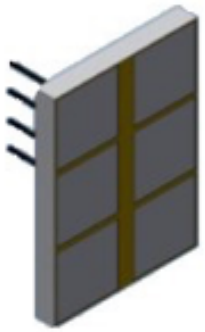
Measurement description

Each group will measure the SiPM I-V curve for :

- 1 not irradiated SiPM
- 1 irradiated SiPM at different temperatures (20 – 15 – 10 - 5 ˚C)

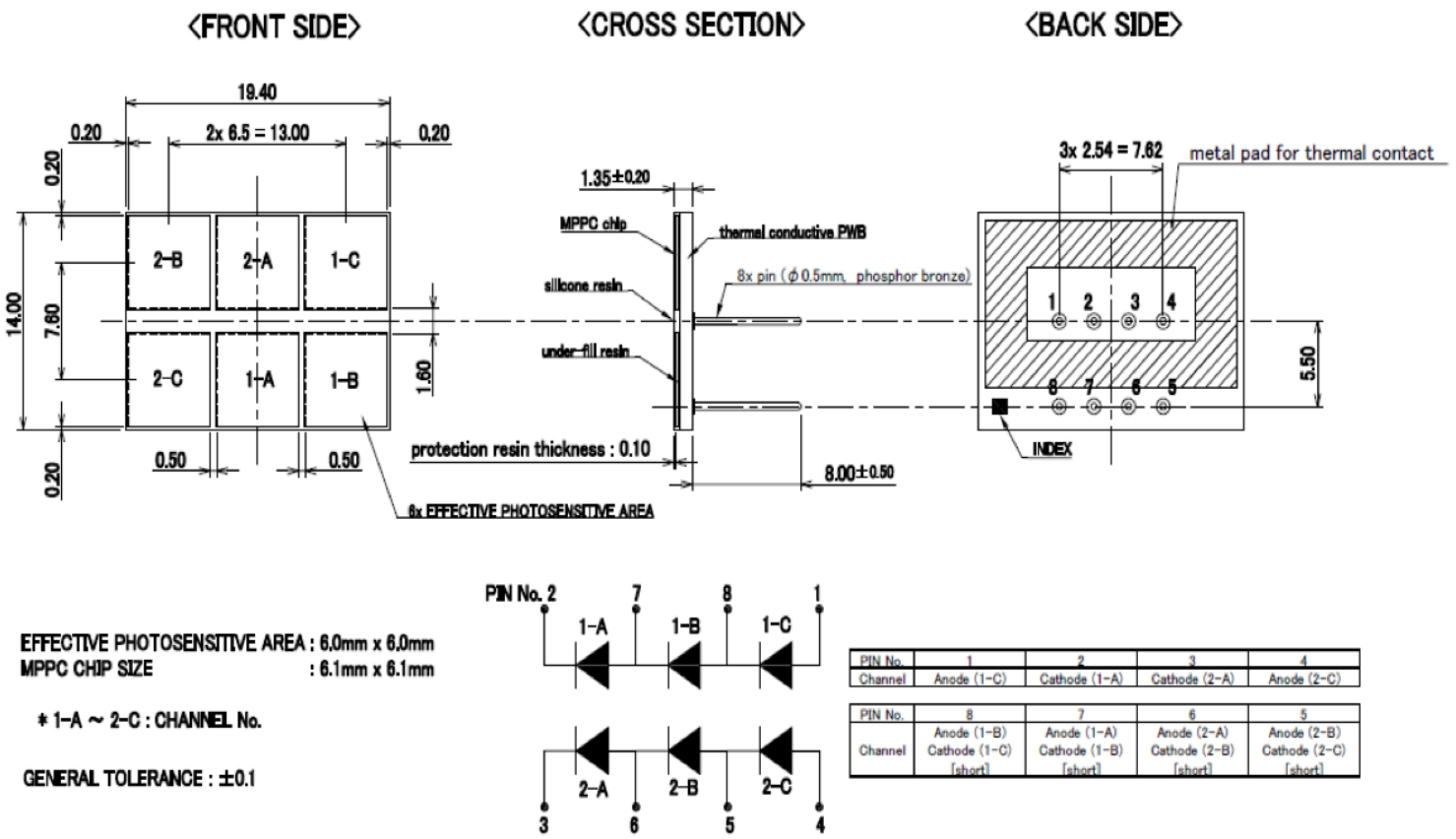
Mu2e SiPM (1)

- Mu2e SiPMs are made of a 2x3 matrix (6 cells) of 6x6 mm^2



  - Parallel arrangement of two groups of three cells biased in series
  - 2 SiPM per crystals to ensure redundancy
  - Fast signal for pileup and timing resolution
- Operational voltage of a single 6x6 mm^2 cell: $\mathbf{V_{op}=V_{br}+3V}$

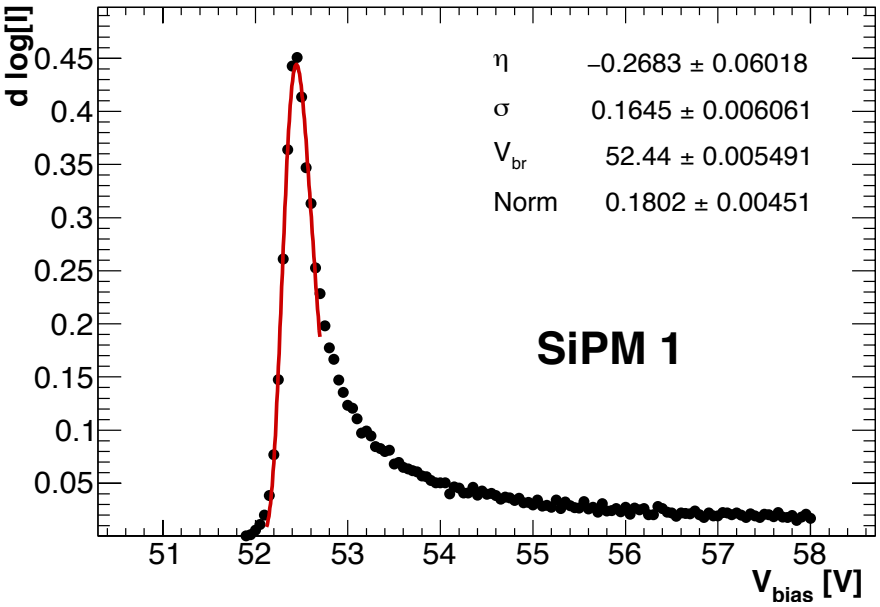
Mu2e SiPM (2)



PIN No.	1	2	3	4
Channel	Anode (1-C)	Cathode (1-A)	Cathode (2-A)	Anode (2-C)

PIN No.	8	7	6	5
Channel	Anode (1-B) Cathode (1-C) [short]	Anode (1-A) Cathode (1-B) [short]	Anode (2-A) Cathode (2-B) [short]	Anode (2-B) Cathode (2-C) [short]

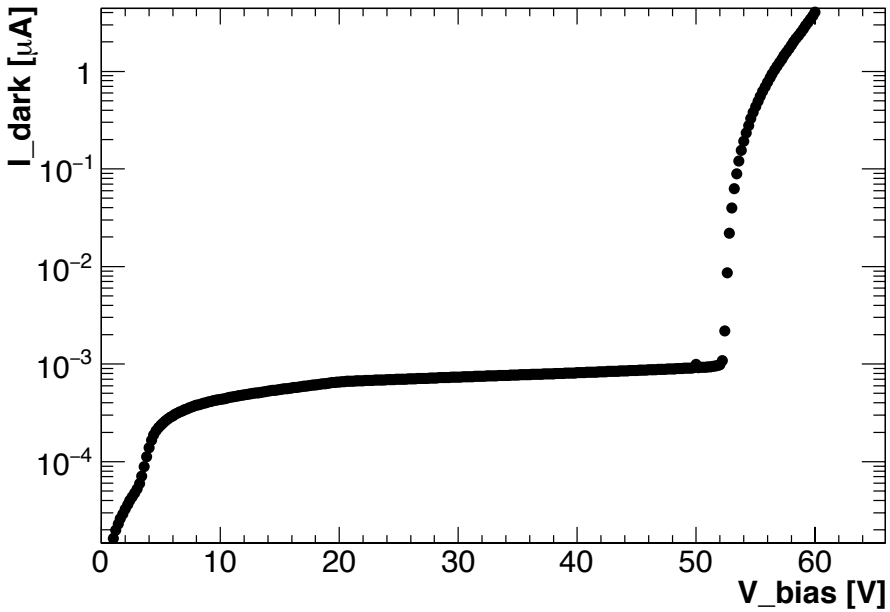
I-V curve and V_{br}



- **$V \ll V_{br}$:** I monotonically increase with V
- **$V \sim V_{br}$:** I increases more rapidly with each voltage step, reaching the highest rate of increase when V = Vbr
- **$V > V_{br}$:** Geiger mode, gain is linearly proportional to ΔV

If V>Vbr I increases faster the linear. Total increase rate of I is between V^n and e^V. Calculating derivative of I curve in log scale **the local maximum value is Vbr**

I-V curve and V_{br}

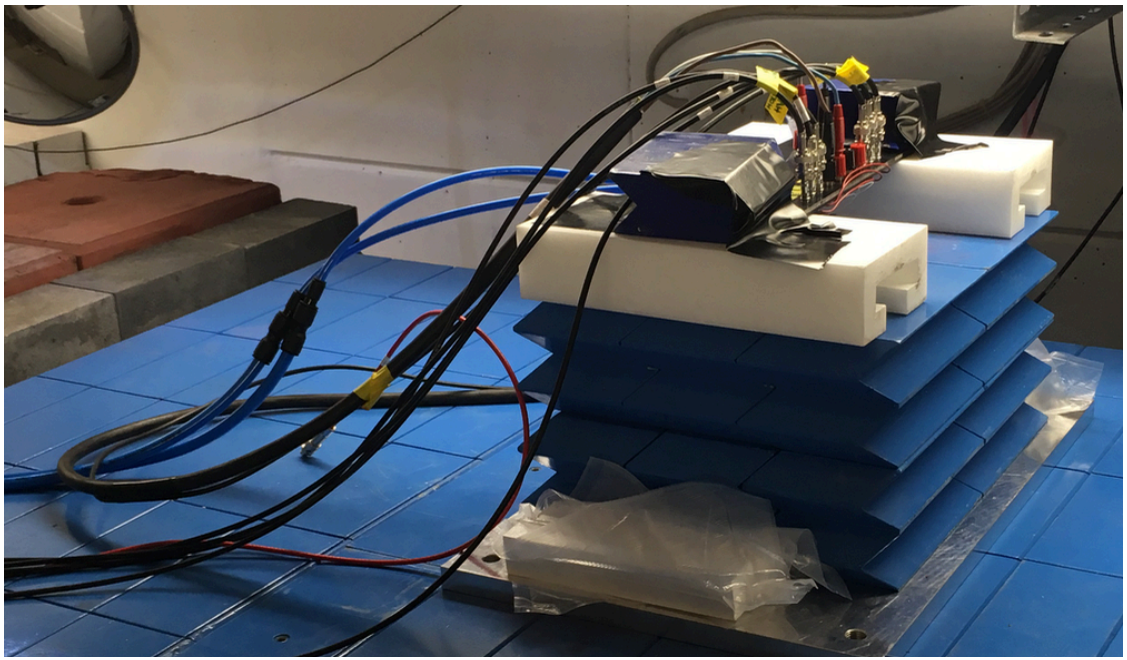


- **$V<<V_{br}$:** I monotonically increase with V
- **$V\sim V_{br}$:** I increases more rapidly with each voltage step, reaching the highest rate of increase when V = Vbr
- **$V>V_{br}$:** Geiger mode, gain is linearly proportional to ΔV

If V>Vbr I increases faster the linear. Total increase rate of I is between V^n and e^V. Calculating derivative of I curve in log scale **the local maximum value is V_{br}**

Irradiation measurement

- Each SiPMs have been tested @ HZDR (Dresden,Germany)
- Total flux ($8x10^{11}$ n_{1MeV}/cm^2)



- **3 Sipm tested at the same time**
- Single cell current acquired with a Keythley
- Chiller+ Peltier cell
- T_{back} monitored with a PT 100

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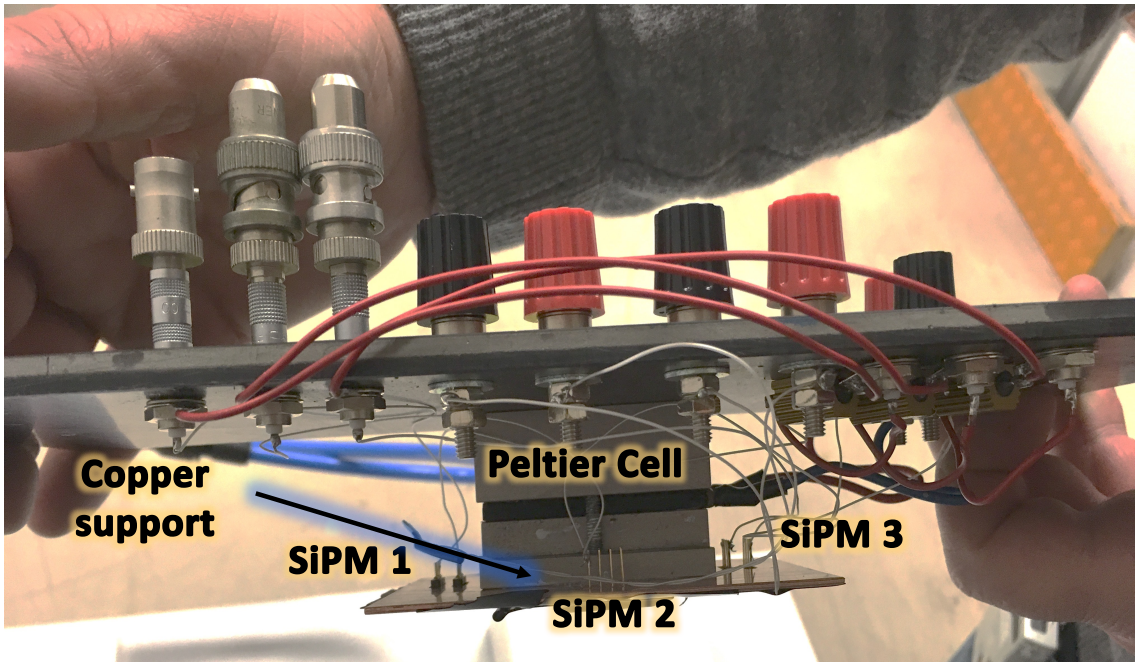

- **3 Sipm tested at the same time**
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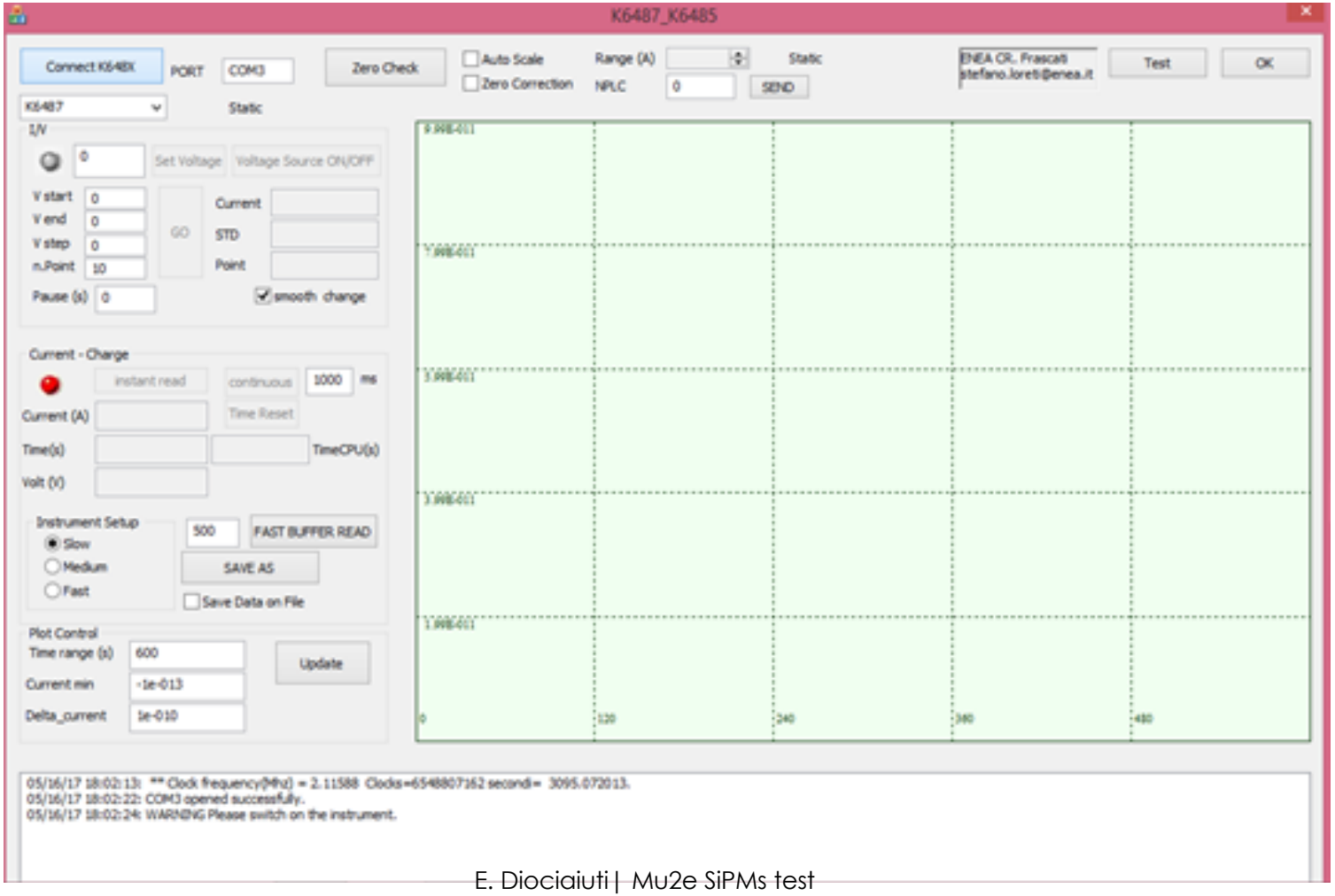
Program you will use..



Ready to start?

- Open the program K648x
- Select COM3 and the Keithley 6487
- Zerocheck and autoscale
- Select the directory to save the data on (MUSE_outreach)
- Select the V_{bias} range and V step