

SiPMs IV Curves Procedure

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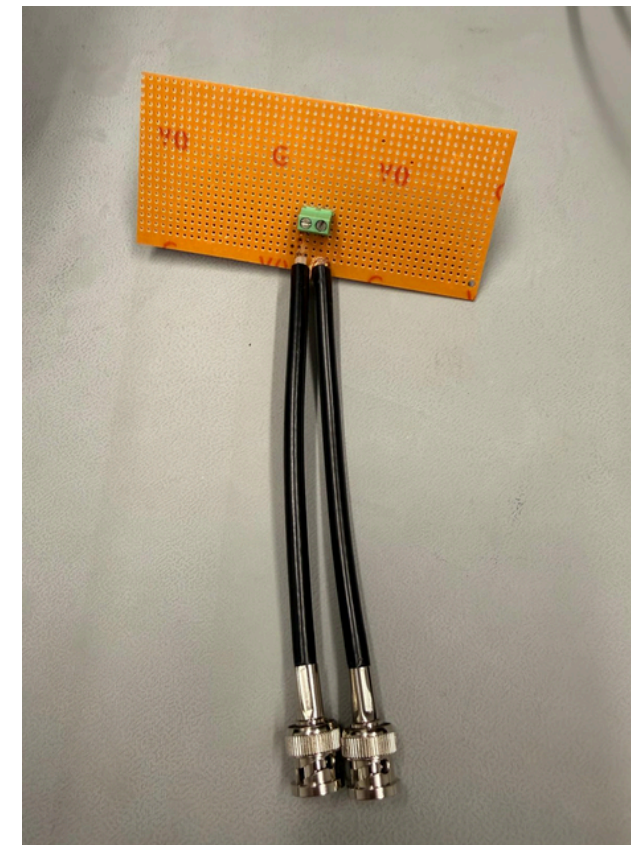
MAY 2026
UNIVERSITY OF MANCHESTER

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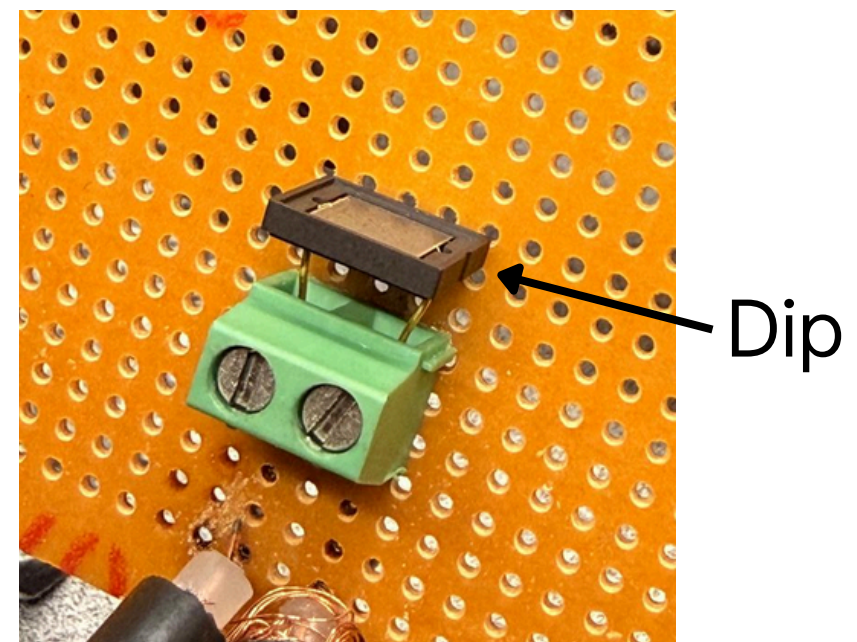
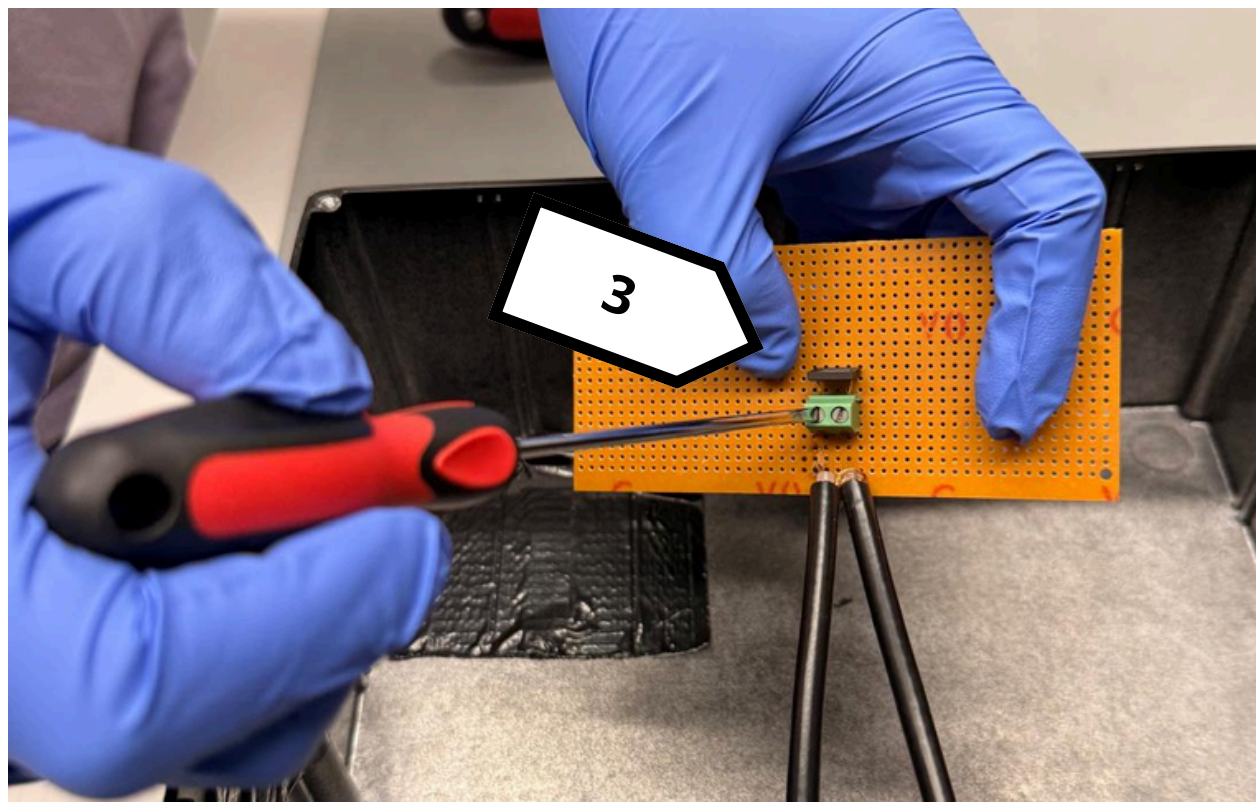
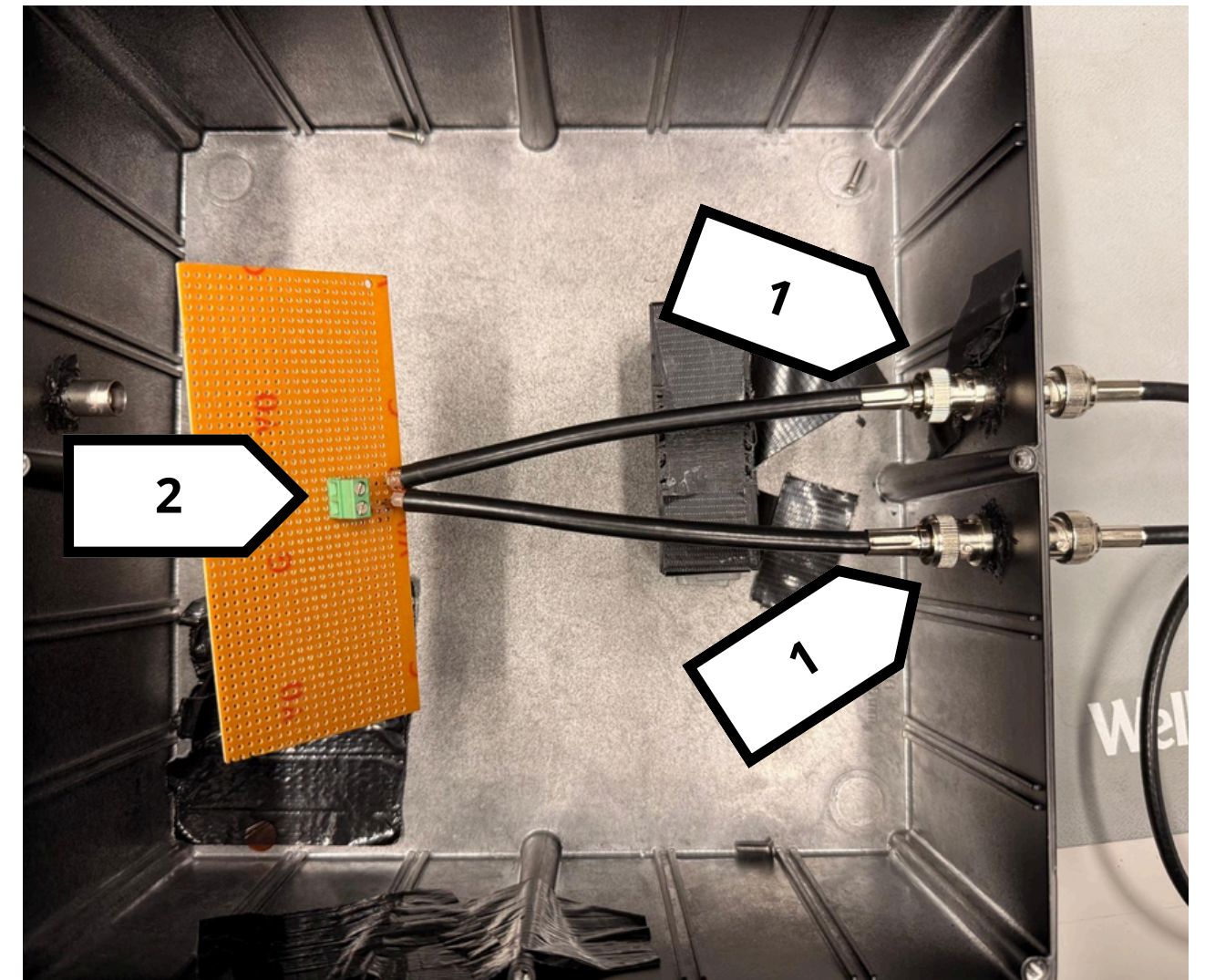
What you will need

- Keithley 6487 Picoammeter/Voltage Source
- Black Box
- SiPM holder board
- 2 Screwdrivers
- Coaxial cables
- SiPMs



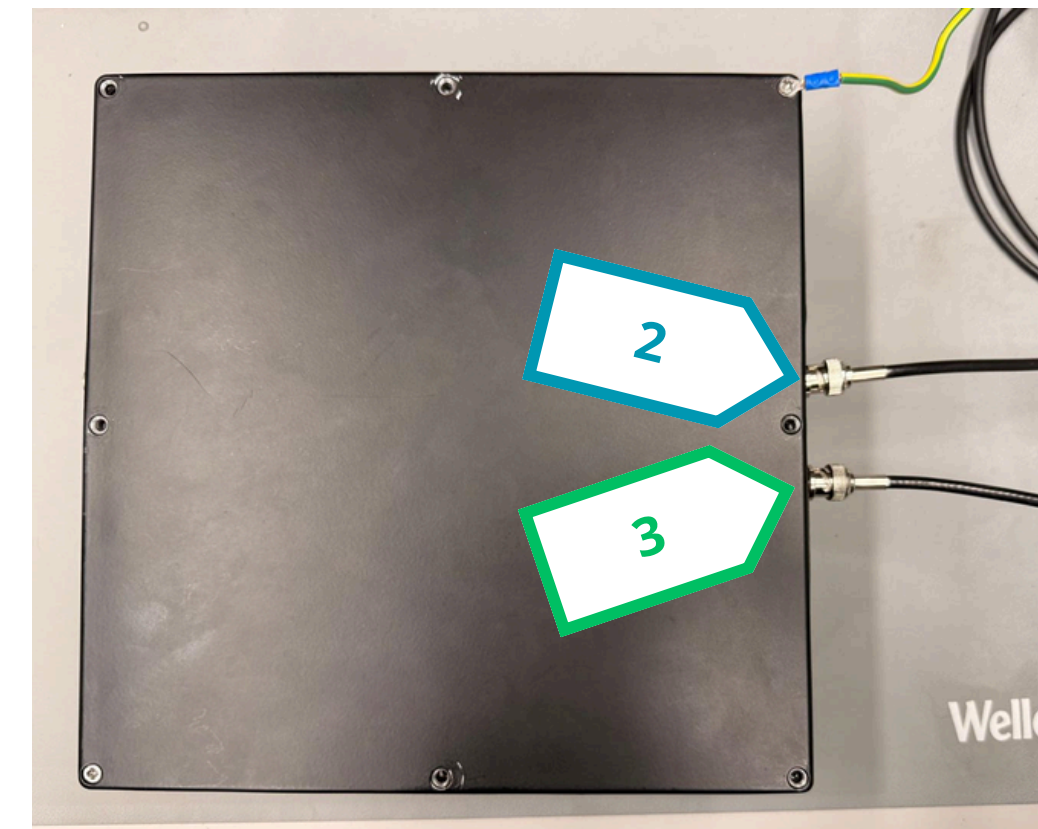
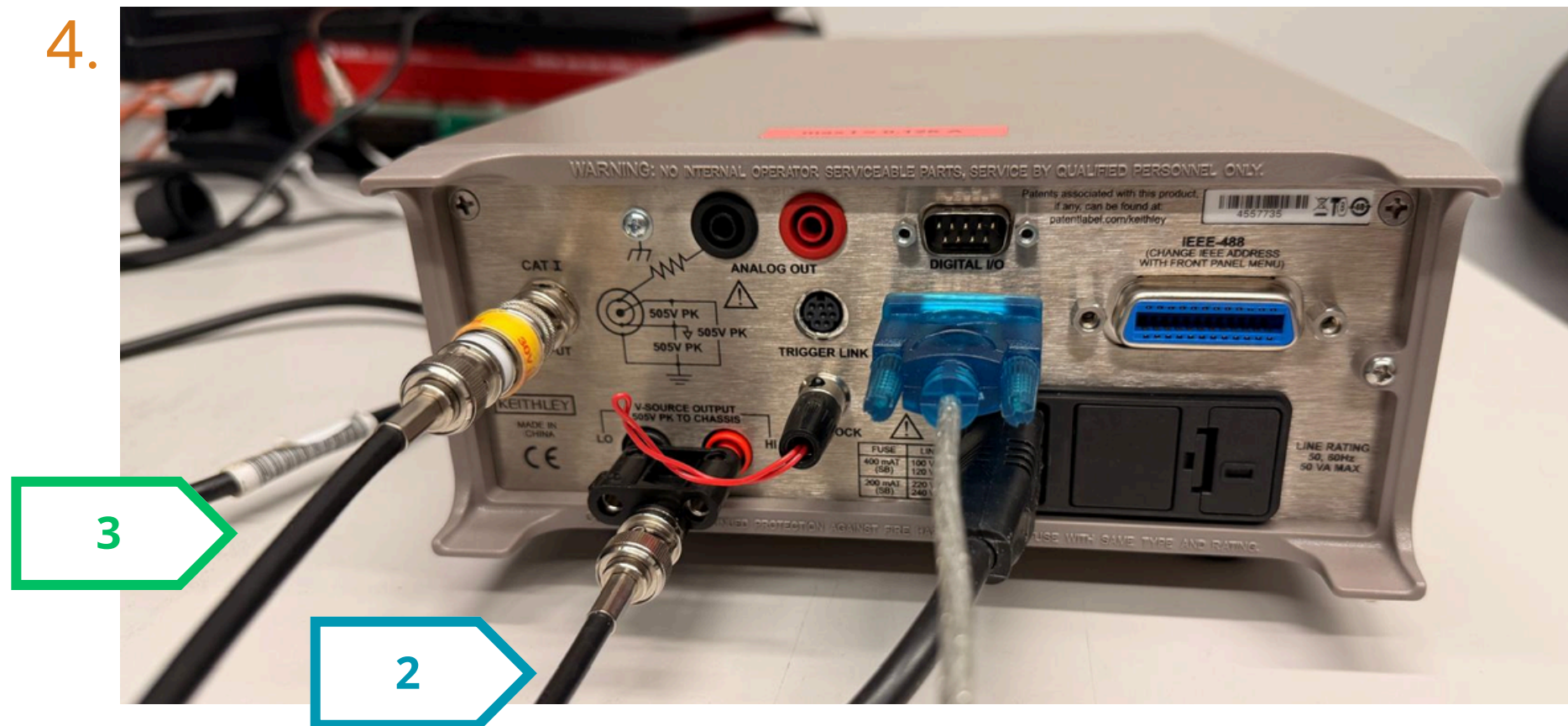
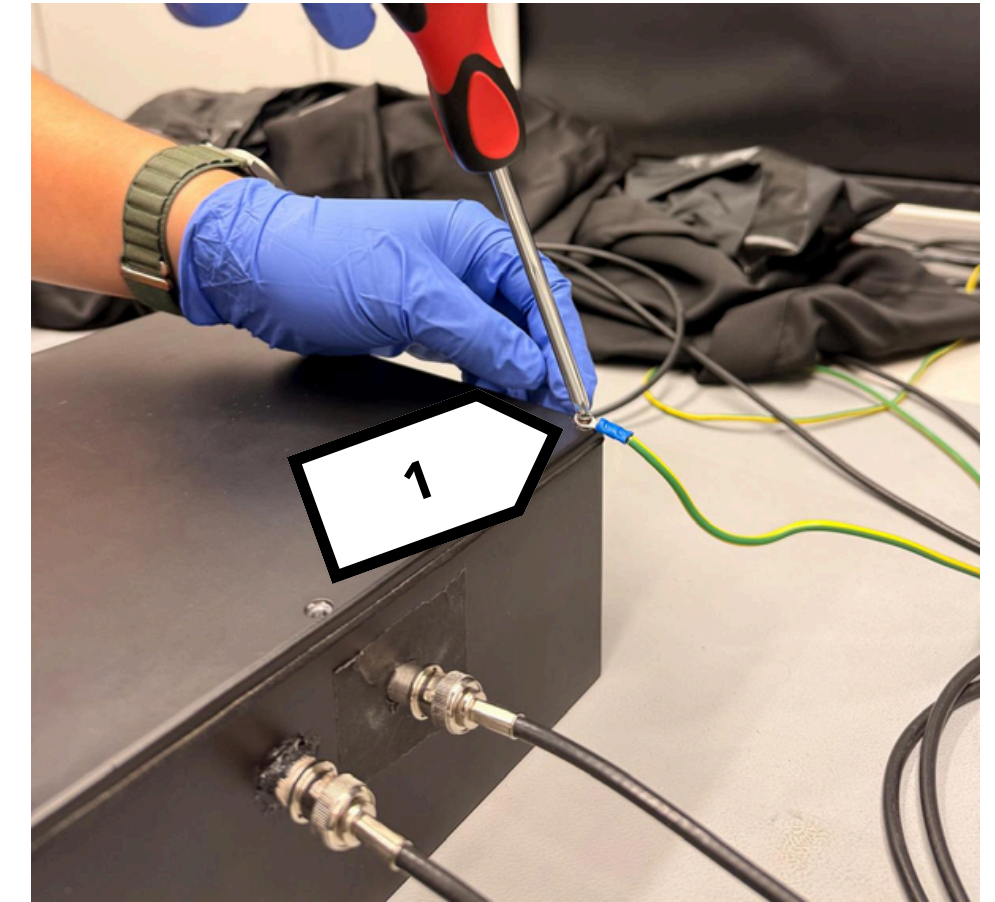
Step 1 : Setup

1. Place and plug the SiPM holder board into the box [1] with the SiPM slots facing up [2]
2. Place and screw an SiPM in the SiPM holder board [3], with the side marked with a dip facing the input cable



Step 1 : Setup

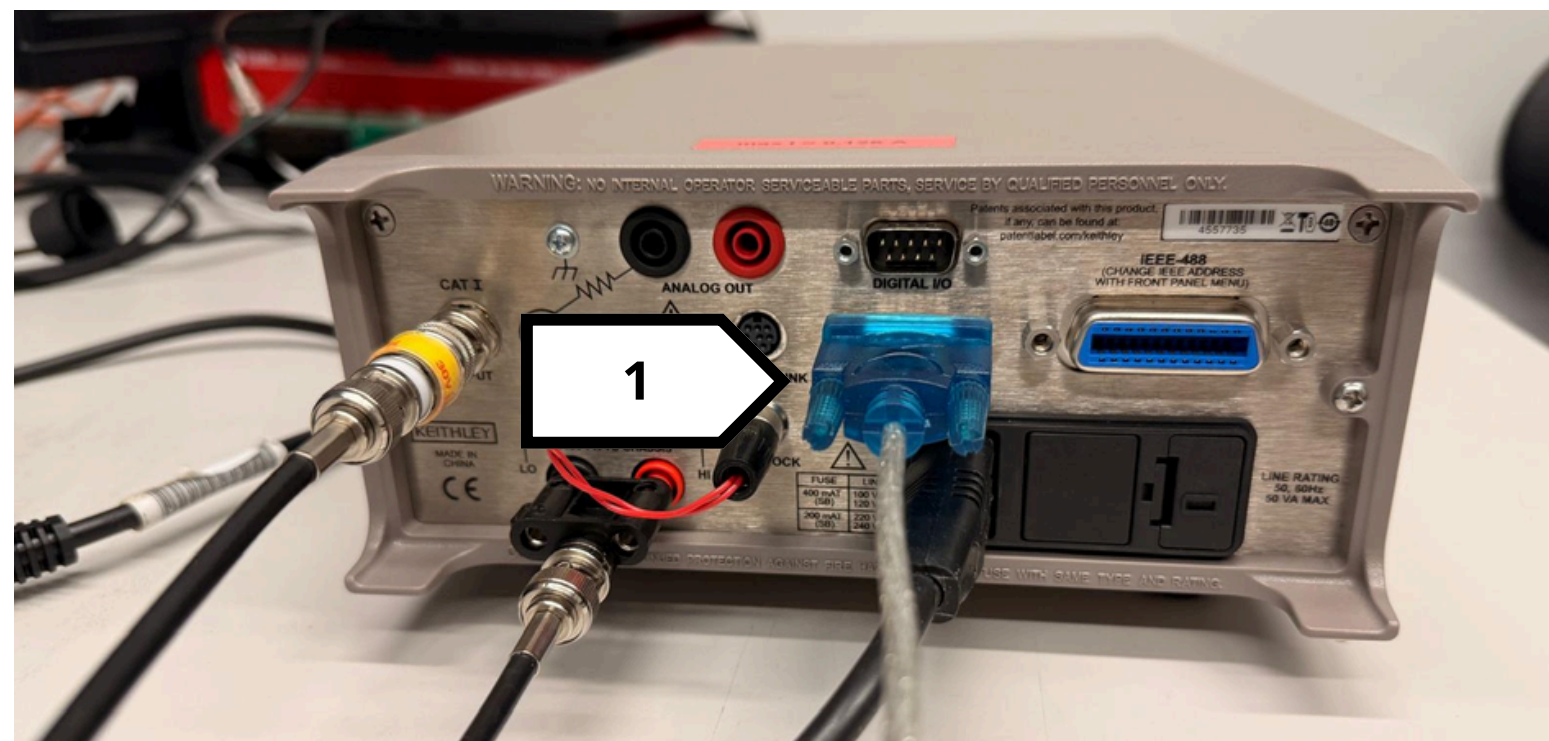
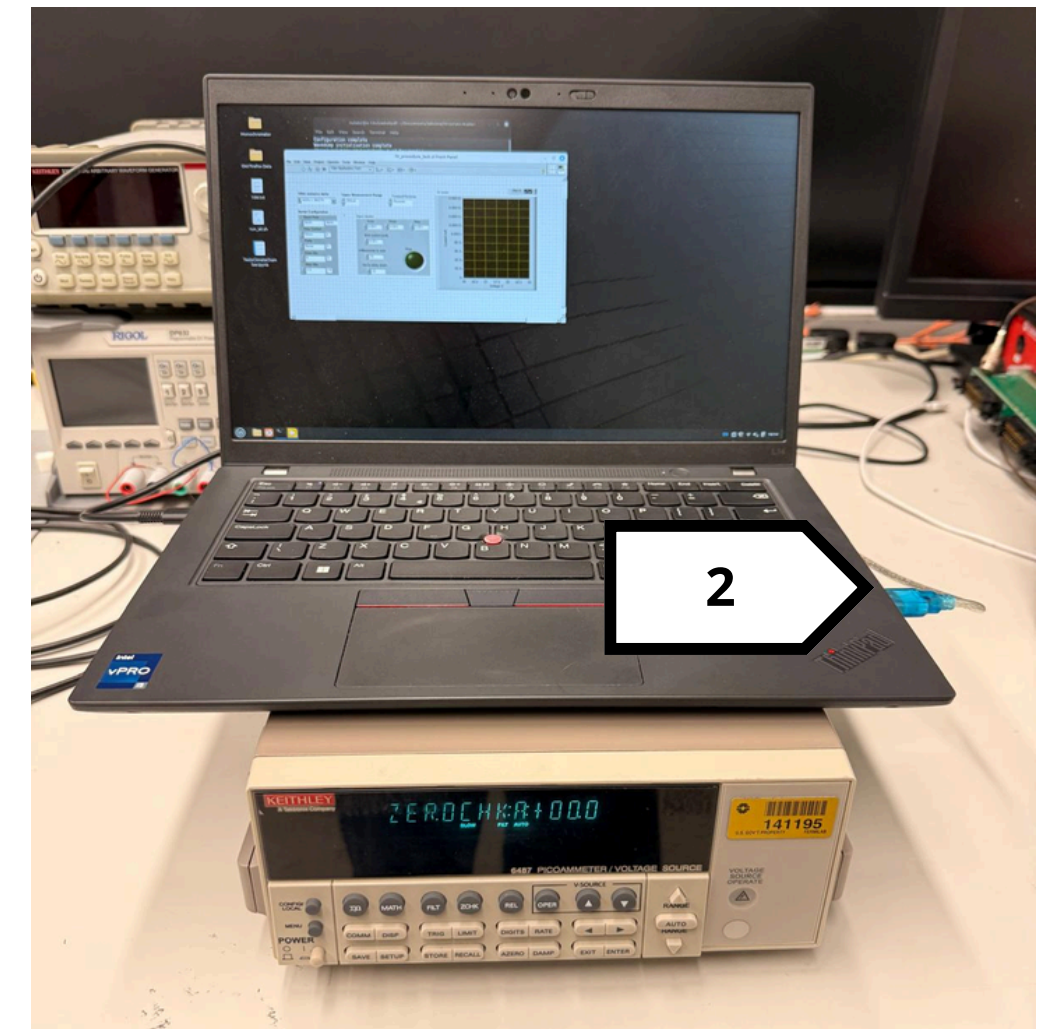
3. Close the box and screw in two corners (the one with the ground connection and the one directly opposite it) [1]
4. Connect the input [2] cable with power [2] and the output [3] cable with the current [3] on the back of the Keithley (source)



Step 1 : Setup

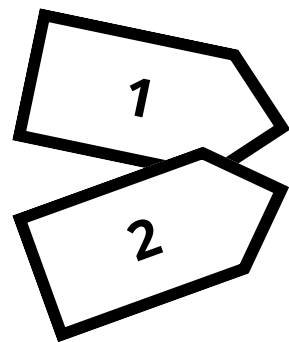
5. Connect the Keithley [1] to the lab's laptop (NULAB1) using the USB port on the right side of the computer [2]. Turn-on the Keithley by pressing the “Power” button [3].

6. Turn on the computer; if you don't have the passwords, ask for them



Step 2 : Opening LabVIEW

1. Open the Terminal
2. Enter : `cd Documents/labview/IV-curves-master/` [1]
3. Then enter : `labview64 IV_procedure_test.vi` [2]
4. The program should open, if not, go directly on the folder and double click on the `IV_procedure_test.vi` file



```
nulab2@e-10ulxw0a9pdf: ~/Documents/labview/IV-curves-master
File Edit View Search Terminal Help
Configuration complete
Wavedump initialisation complete
(base) nulab2@e-10ulxw0a9pdf:~$ cd Documents/labview/IV-curves-master/
(base) nulab2@e-10ulxw0a9pdf:~/Documents/labview/IV-curves-master$ labview64 IV_
procedure_test.vi
```


Step 3 : Settings in LabVIEW

General settings :

1. VISA resource name : ASRL1::INSTR
2. Upper Measurement Range : 200 μ A
3. Bias : Reverse

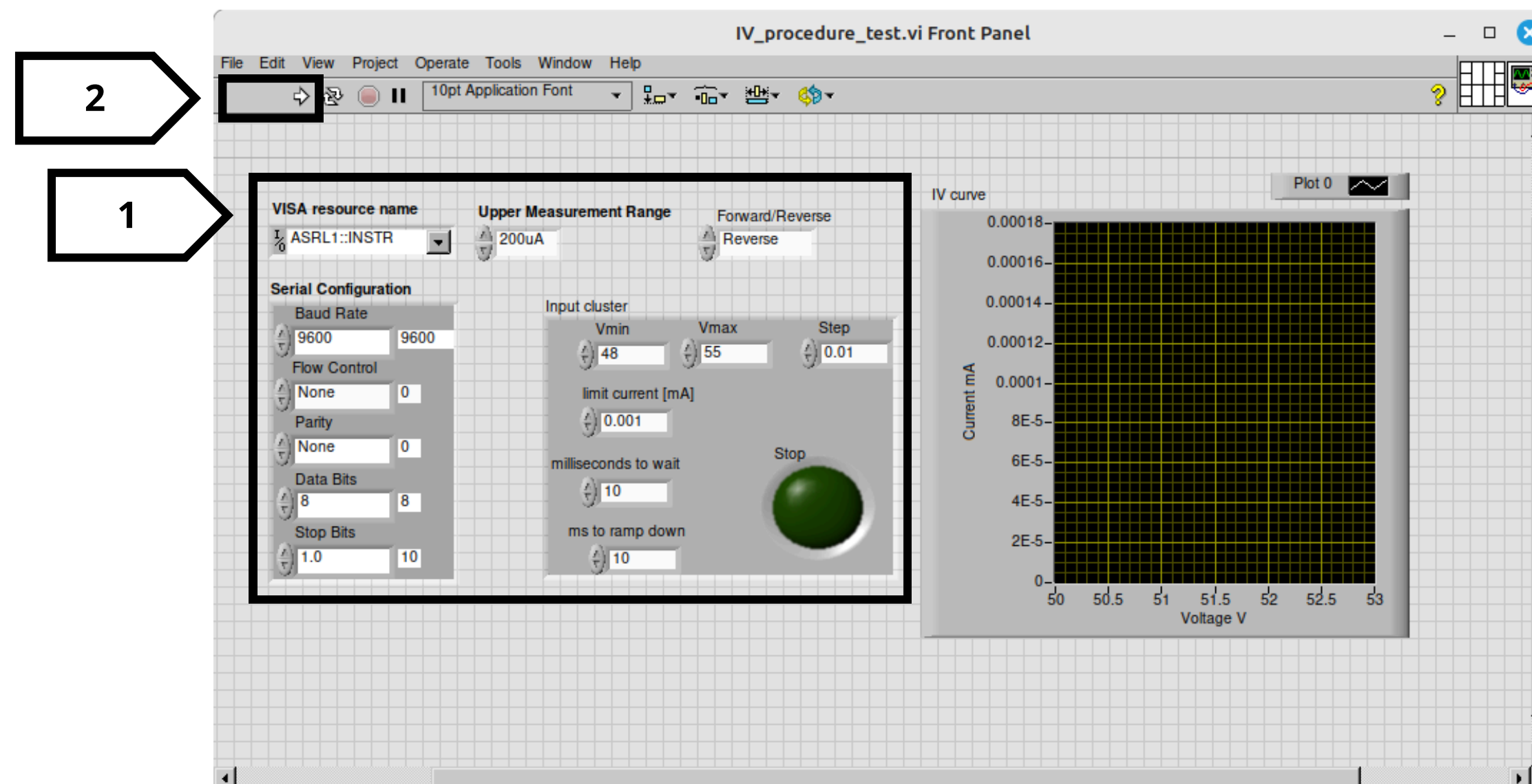
No need to change the Serial Configuration

Input Cluster Settings :

1. $V_{\min} = 48V$ & $V_{\max} = 55V$ (to catch the avalanche while maintaining a consistent front section)
2. Step : 0.01 (to be adjusted depending on how much time you have to take the measurements and the definition you want on your curve)
3. Limit current : 0.001 mA
4. ms to wait & ms to ramp down : 10 ms

Step 4 : Data taking

1. Once all the parameters have been properly set [1], turn-off the lab's lights
2. Click on ☒ (if present in the bar), then on the arrow to run the program [2]



Step 4 : Data taking

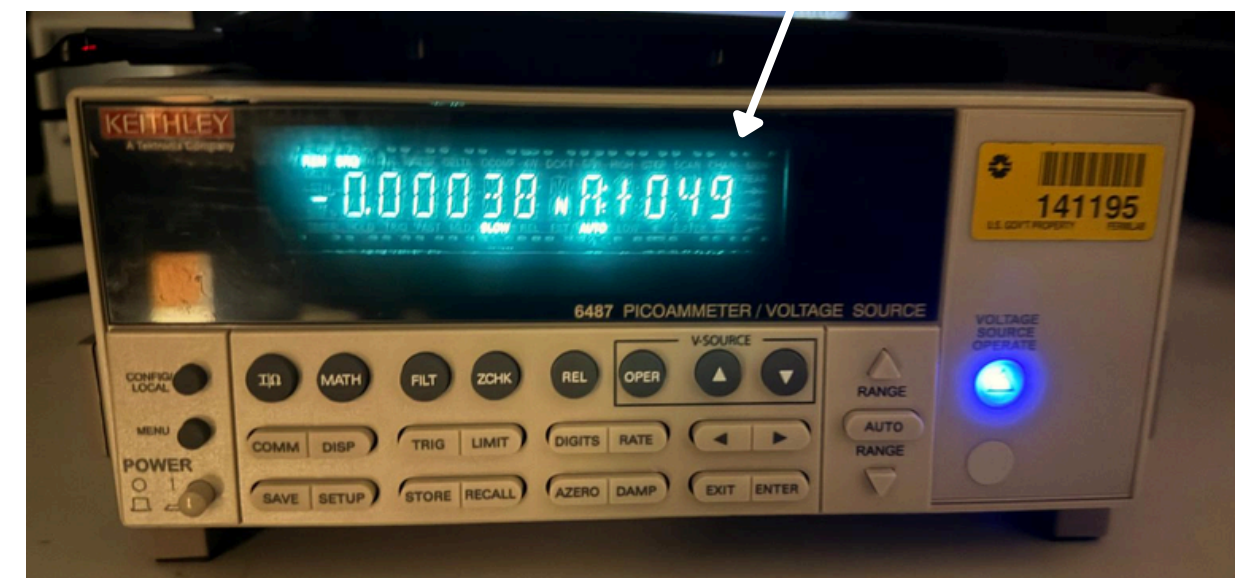
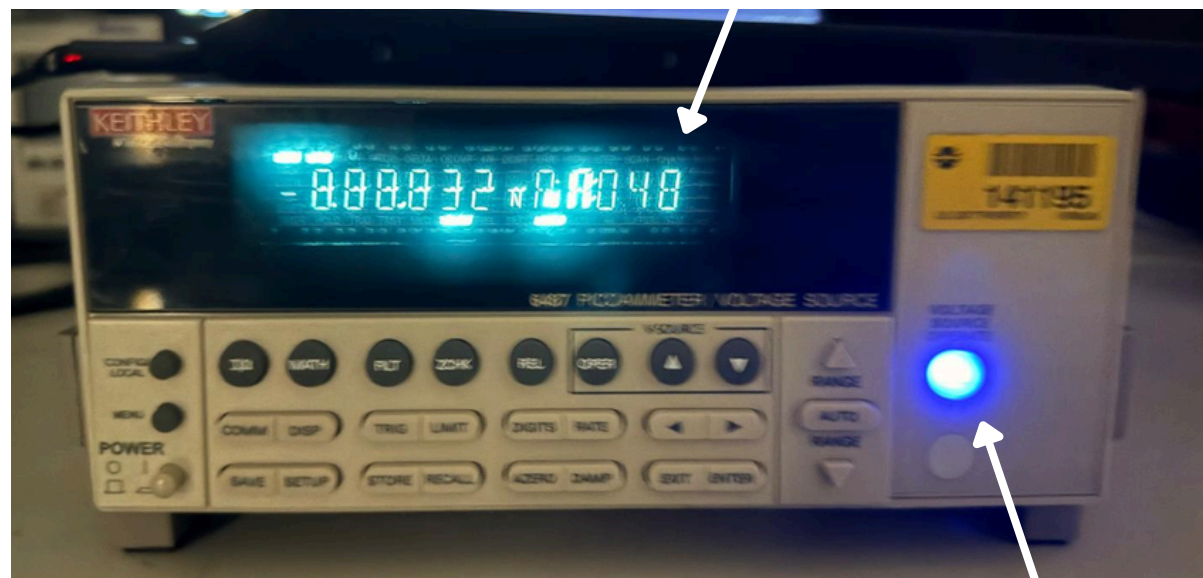
3. When the program starts, the Keithley will usually start making a bit of noise — a small, steady “click” in time with the required steps — until it reaches the selected maximum voltage



Warning:

Only when it's over can we turn the light back on — not before

1



...

The blue light means that the
Kenthley is operating

Step 5 : Data storage

The data files will be automatically saved in: Documents/labview/IV-curves-master/Data/Reverse

They are named in the following format: Vmin_Vmax_Step_.txt

Note:

It is recommended to rename them by adding the SiPM number to the beginning of the filename to avoid confusion and mixing up the data: NoSiPM_Vmin_Vmax_Step_.txt

Retrieve the data for analysis by copying the files to a USB drive

— **Step 6 : Shutting down**

1. Turn off the Keithley by pressing the “Power” button
2. Close the LabVIEW program
3. Close the terminal
4. Shut down the computer
5. Open the box and remove the SiPM to store it safely back in its box

Big picture of the IV Curves Analysis Code

The code applies the formula: $(1/I) \times (dI/dV)$

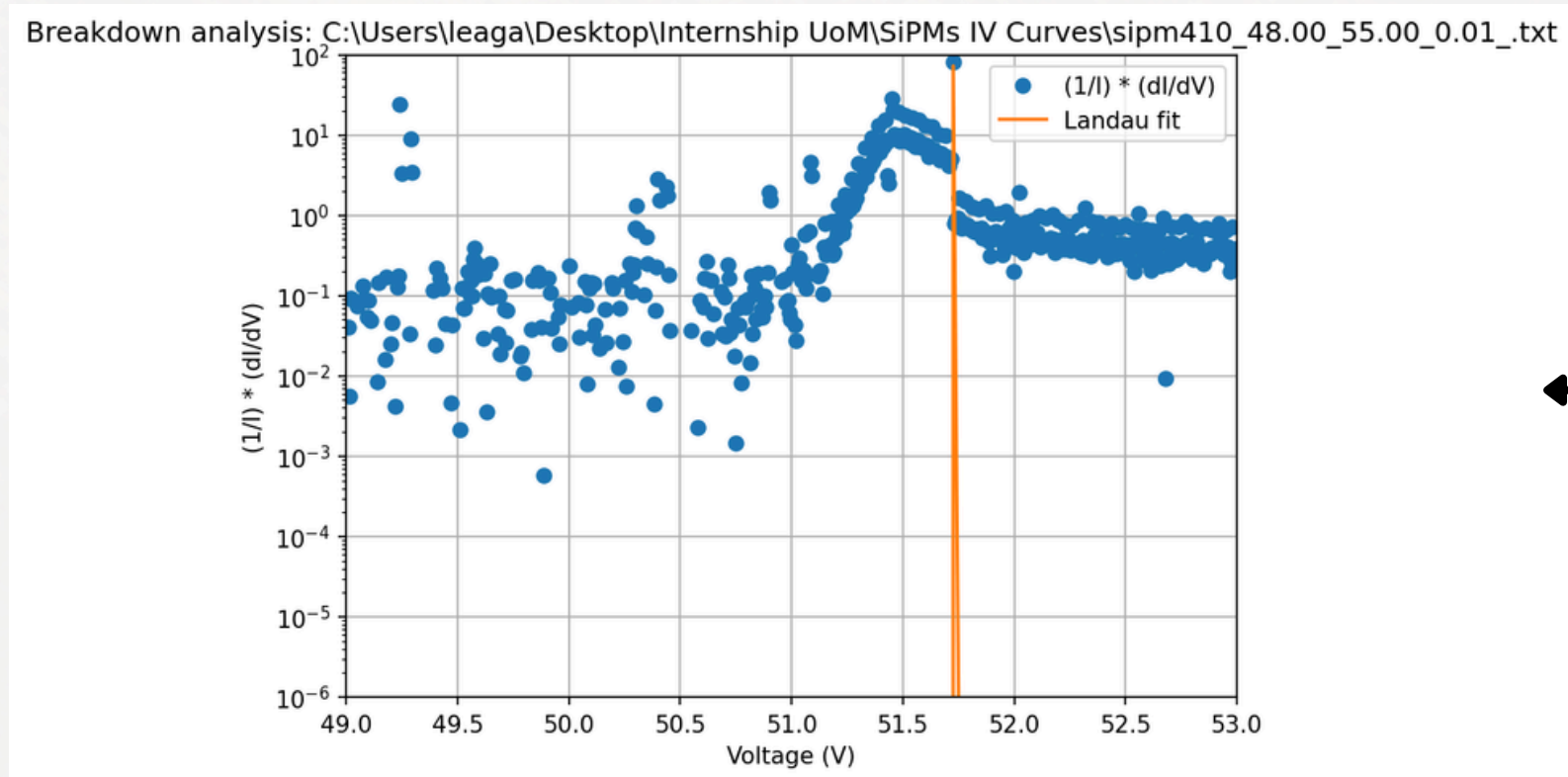
Why this formula?

- When the voltage is increased, the current remains very low (a few nA) as long as it remains below the breakdown voltage
- As soon as the breakdown voltage is reached, the current increases sharply (avalanche)
- The peak of the quantity $(1/I) \times (dI/dV)$ indicates exactly where this transition occurs

Fitted with a Landau distribution

- The peak of $(1/I) \times (dI/dV)$ has a distinctive (asymmetric) shape
- The code fits a Landau distribution to this peak
- The center of this distribution gives the breakdown voltage
- The width gives the uncertainty

What kind of plots to expect ?



← If the SiPM was working and the IV Curves where nice

If the SiPM was not working properly and/or the IV Curves where not nice →

