Advanced Electrical Test Using NUFAB Probe Station

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NUANCE
Northwestern University Atomic and
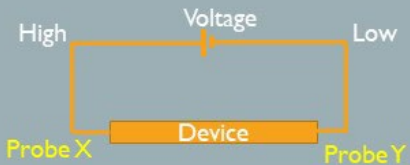Nanoscale Characterization Experimental Center

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The Probe Station
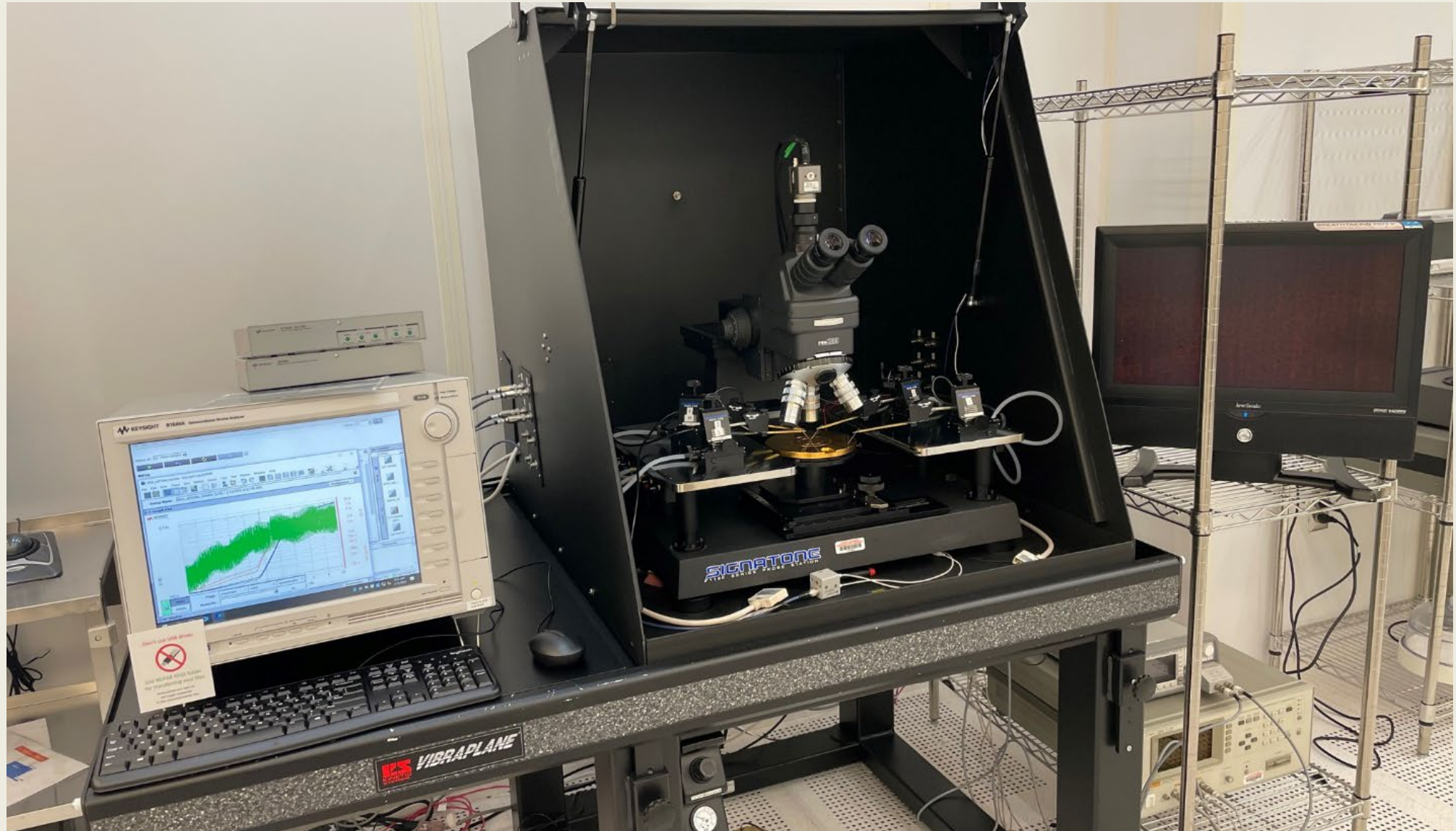
The Four Basic Programs

2-point IV
- Quick connection check
- Diodes
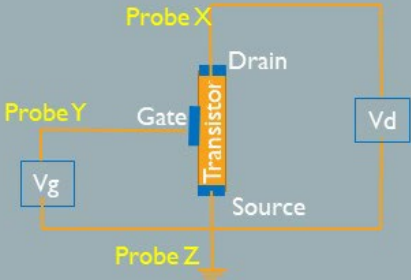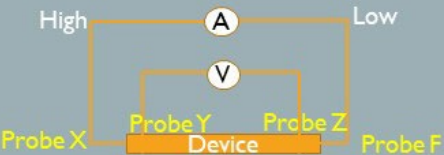
3-point IV
- Transistors

4-point IV
- Low resistors, e.g metal films/stripes, doped Si

CV
- Capacitors
- Dielectric materials

Outline

- Four-point IV
- Double-looped three-point transistor IV
- Pulsed two-point IV
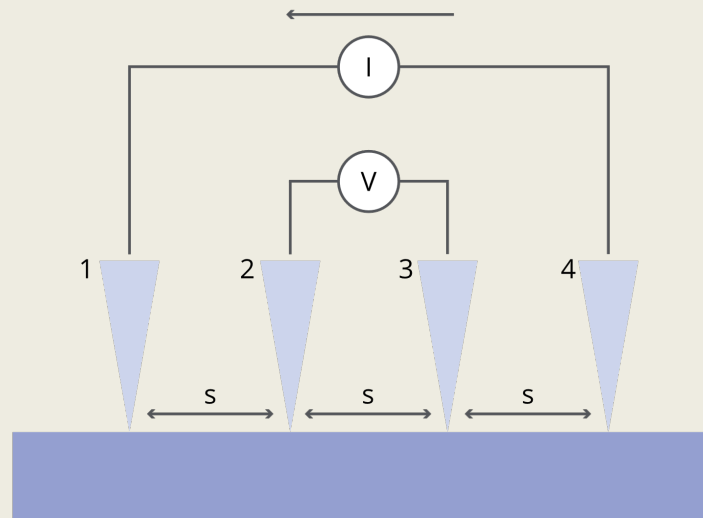- Arbitrary waveform and high-speed IV
- RF probes

The 4-point IV
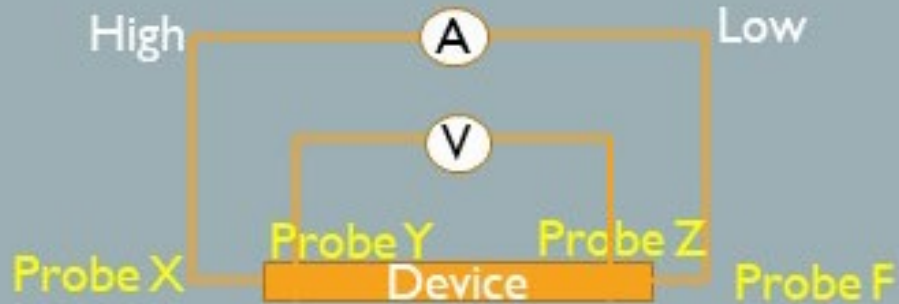
Why use it?
- Eliminate contact and wire resistances from the measurement
- Sheet resistance

How to use it?

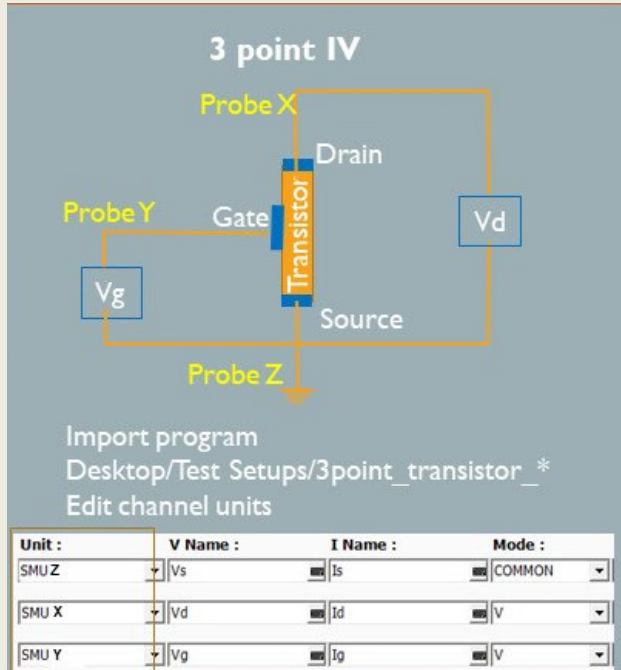$$R_S = \frac{\pi}{\ln(2)} \frac{\Delta V}{I} = 4.53236 \frac{\Delta V}{I}$$

$$\rho = R_S . t$$

Double-looped 3-point transistor IV

Why use it?
Automate 3-point IV

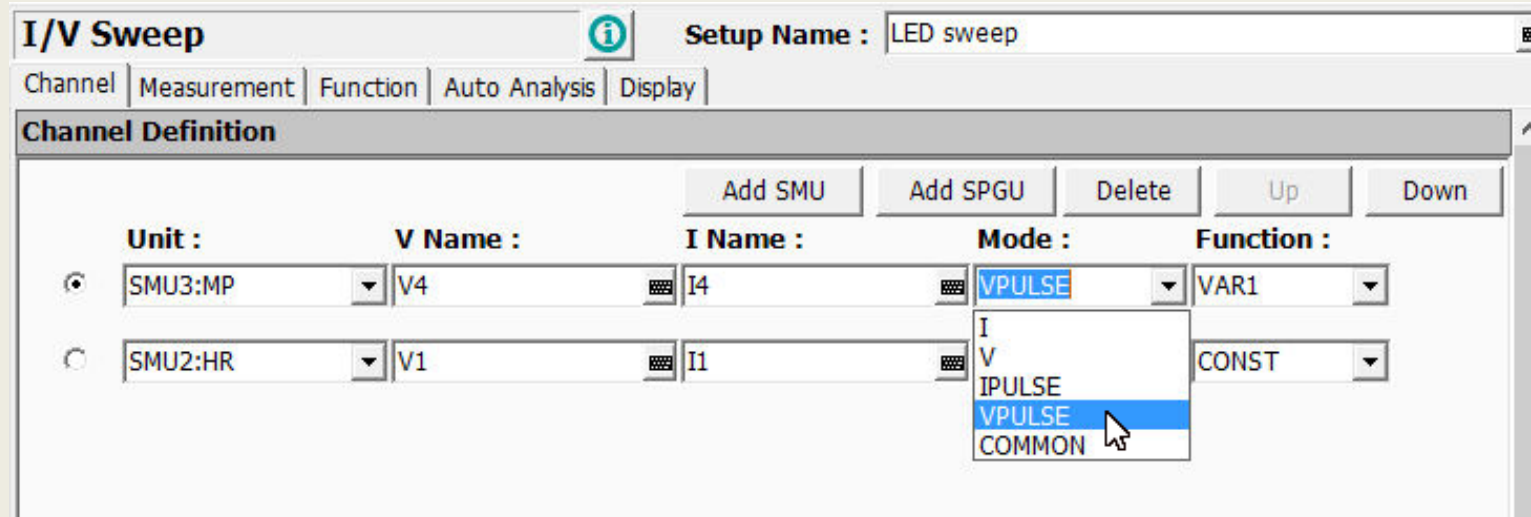**How to use it?** Load existing program from application
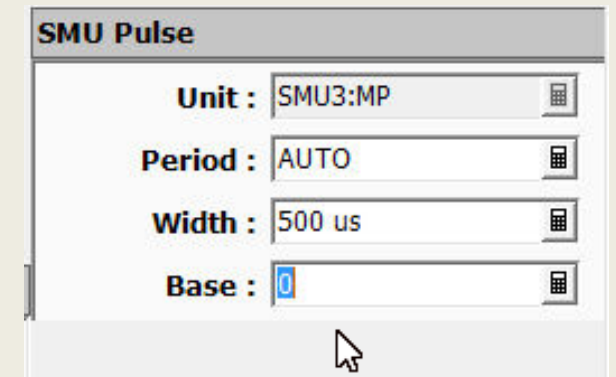
Pulsed 2-point IV

Why use it?

- Test devices operated by pulsed voltages
- Avoid self-heating
- Minimize trapped charges

How to use it?

- Modify the basic 2-point IV program

Pulse with basic 2-point IV
Minimum width: 0.5 ms

Too long? Semiconductor pulse generator unit SPGU

Semiconductor Pulse Generator Unit (SPGU)

Application example: high power devices such as high electron mobility transistors (HEMTs)

Features

- Width down to 10 ns
- Leading and trailing time down to 10 ns
- Flexible settings
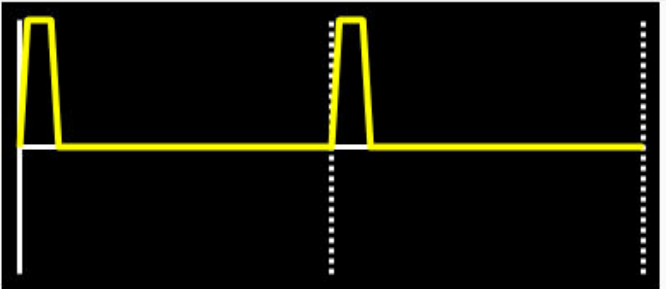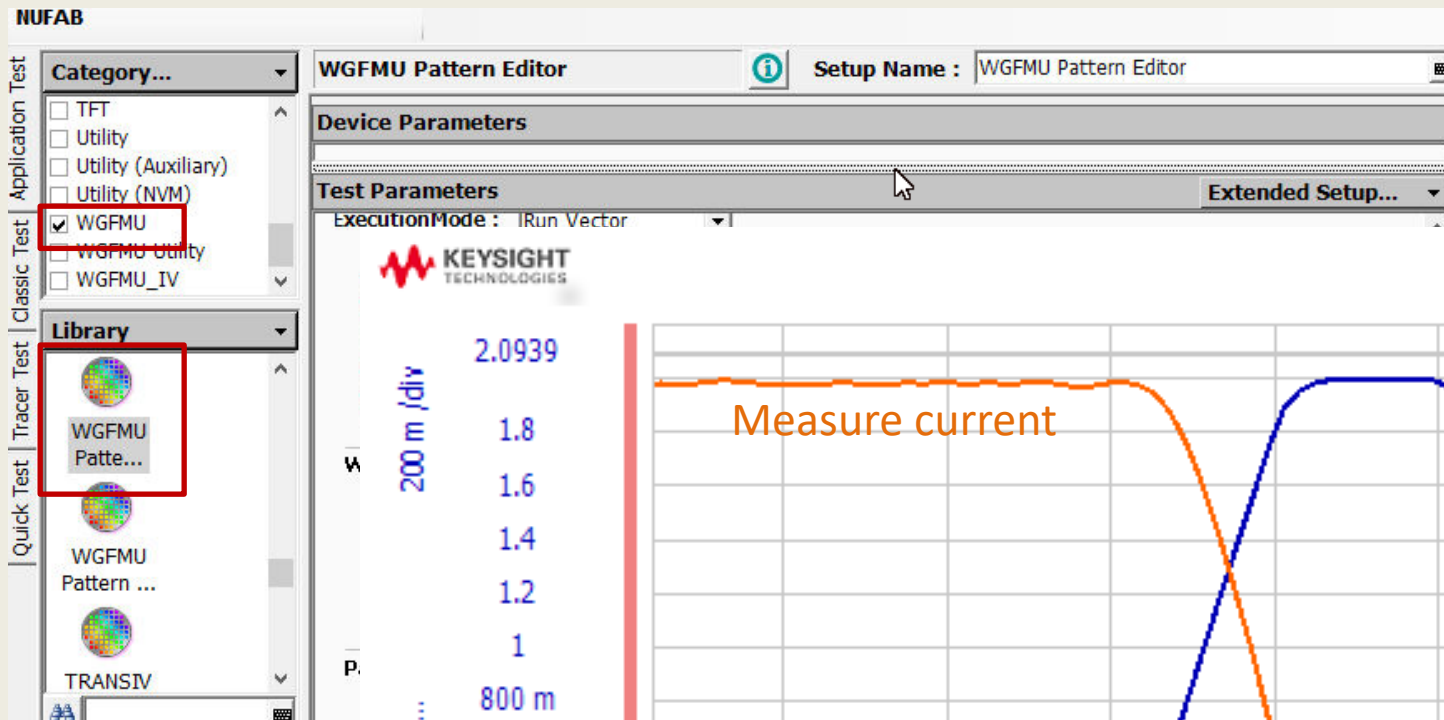- Only output pulses
  No measurement during pulses

Arbitrary Linear Waveform Generator (ALWG)

Why use it? Simulate certain external conditions without the need of having the actual condition.

ALWG and fast measurement unit(WFGMU)

Why use it?
ALWG and high-speed measurement at the same time
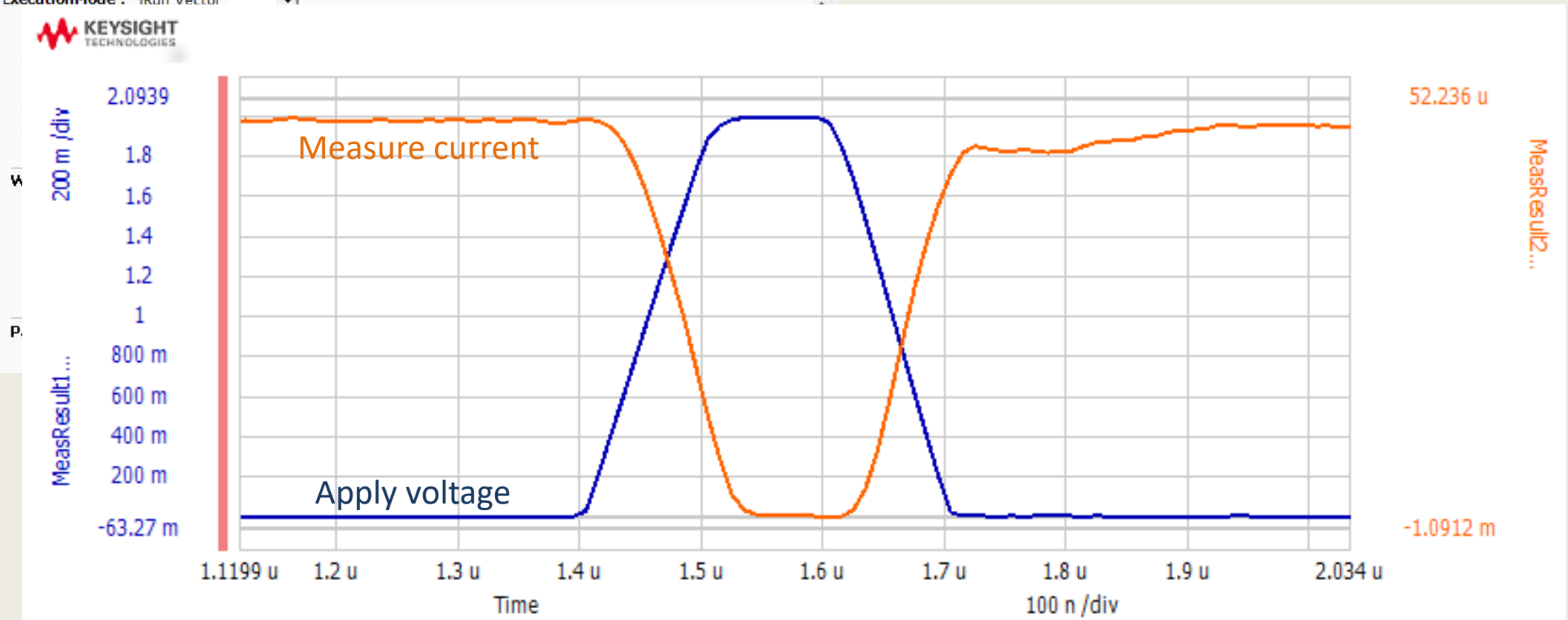
RF probes

Why use it?

How to use it?

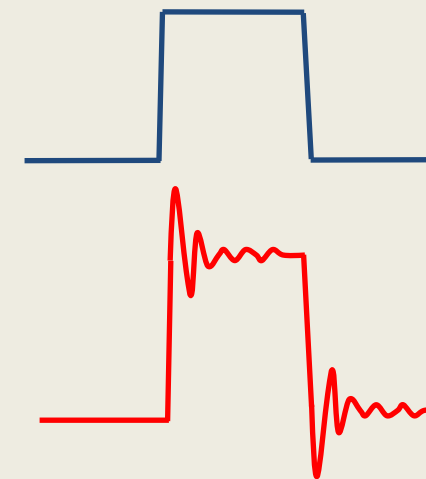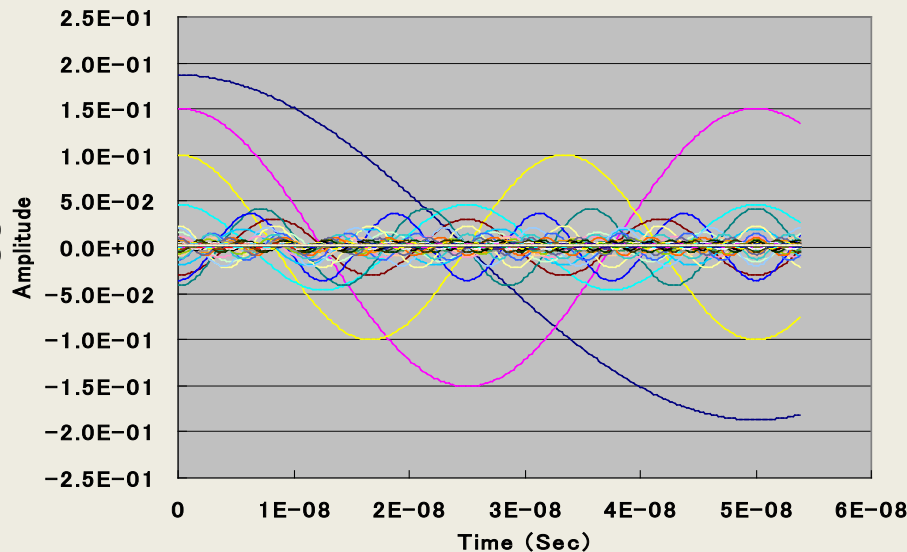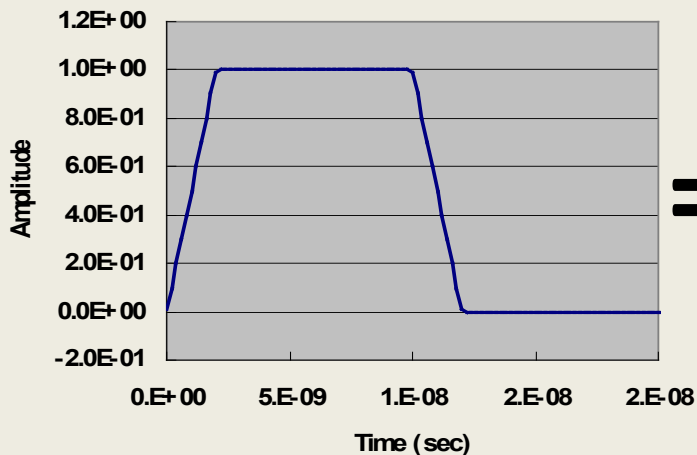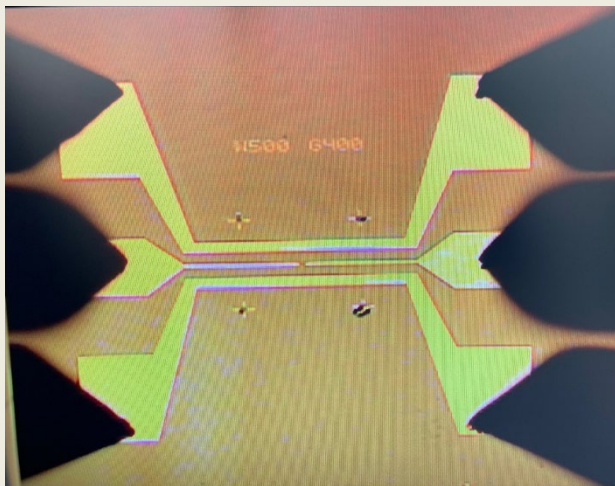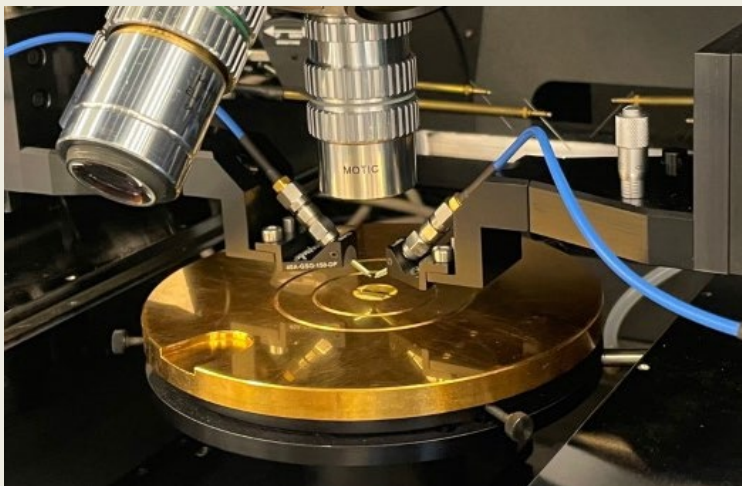- Special positioner, SMA cables
- GSG geometry, 150 um pitch
- Pattern your device terminals accordingly

Summary

- Precise resistance measurement
- Automate 3-point IV
- Introduce pulses to IV measurement
- Short pulses and fast measurement
- Use RF probes

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Upcoming workshop

NUANCE — Northwestern University Atomic and Nanoscale Characterization Experimental Center

KEYSIGHT TECHNOLOGIES

RF Vector Network Analyzer Basics

April 23, 2024 – 9:00 AM–1:00 PM

Technological Institute - Room #B211

Northwestern University, Evanston Campus

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SPGU and IV-t measurement