Sweep Like a Pro

11:15 – 12:00

May 25, 2022

CONNECT 2022

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Chief Product Owner, TestStand

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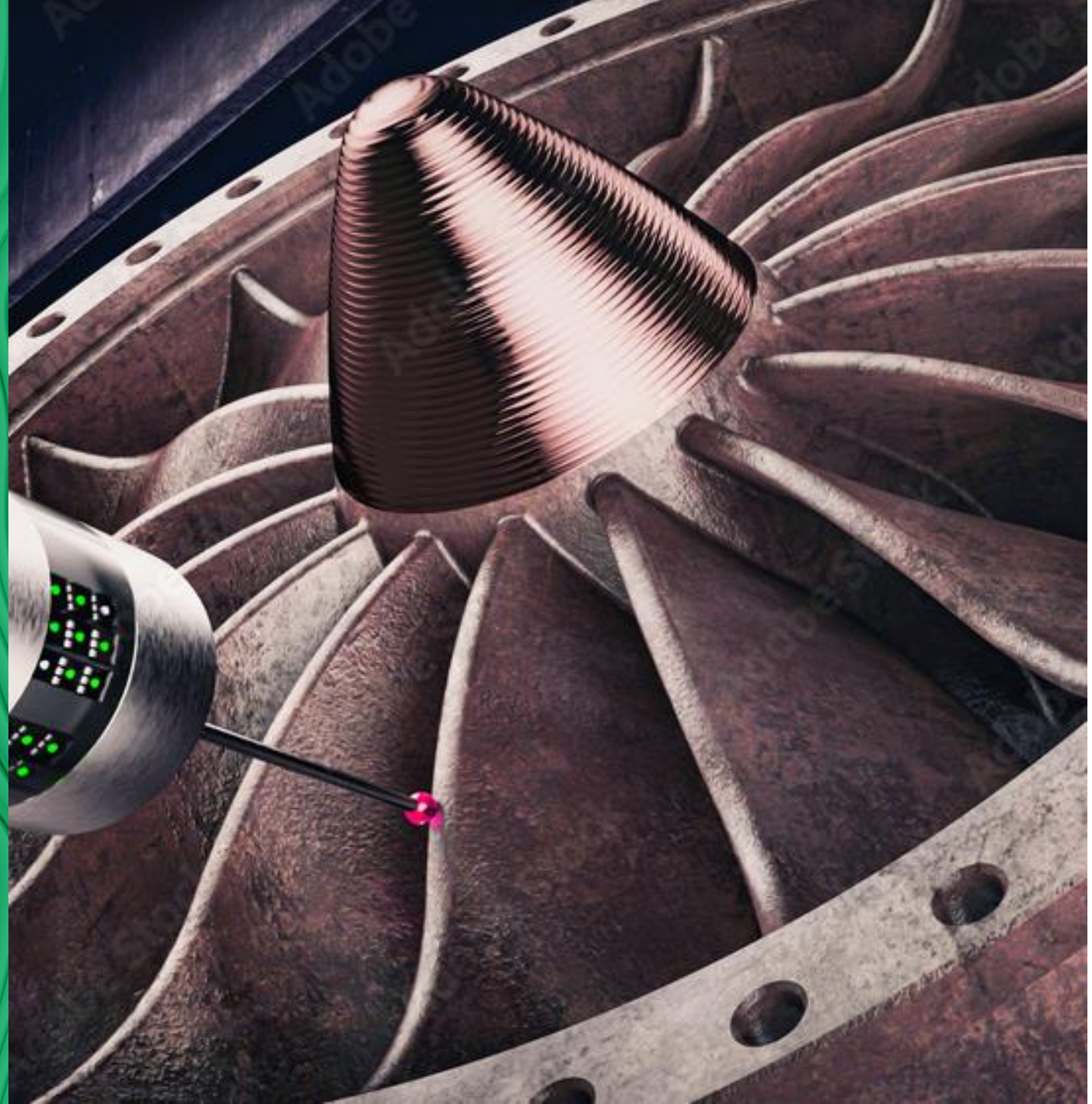
Agenda

- Why Sweep
- Inputting Sweep Parameters
- Nesting sweeps
- Sweep Strategies
- Test Vector Table
  - Conditions-Parameters and the Captured Values - Measurements
- Exporting Results

Why Sweep

Let’s consider an example to get us on the same page



Seeking Understanding

Exploring and Probing

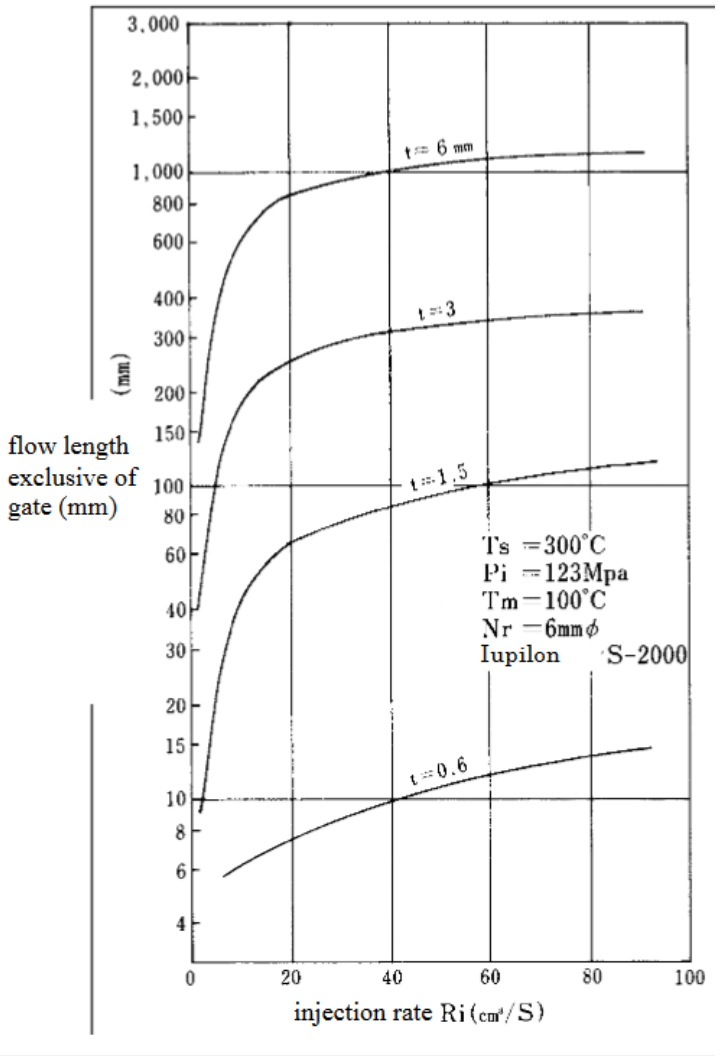
No matter the device under test, you need to look at **how it works** under a **variety of conditions**.

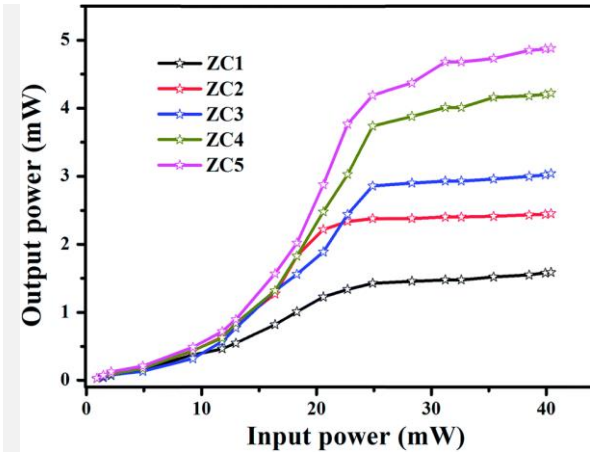
Some of those conditions need to **change continuously**, say the base current of a transistor.

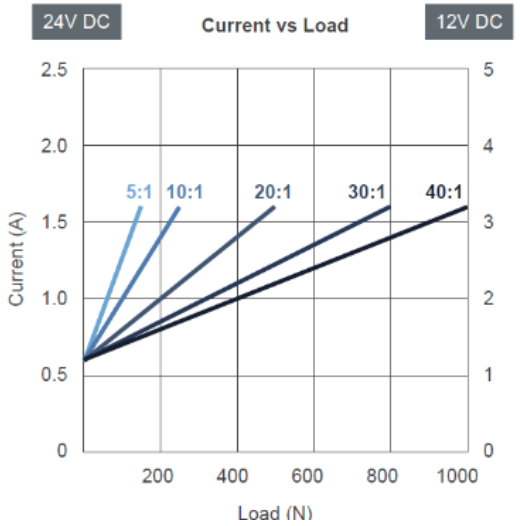
Other conditions need to be **set and held** while you change other parameters. Like, the temperature of a chamber or the position of a robotic arm.

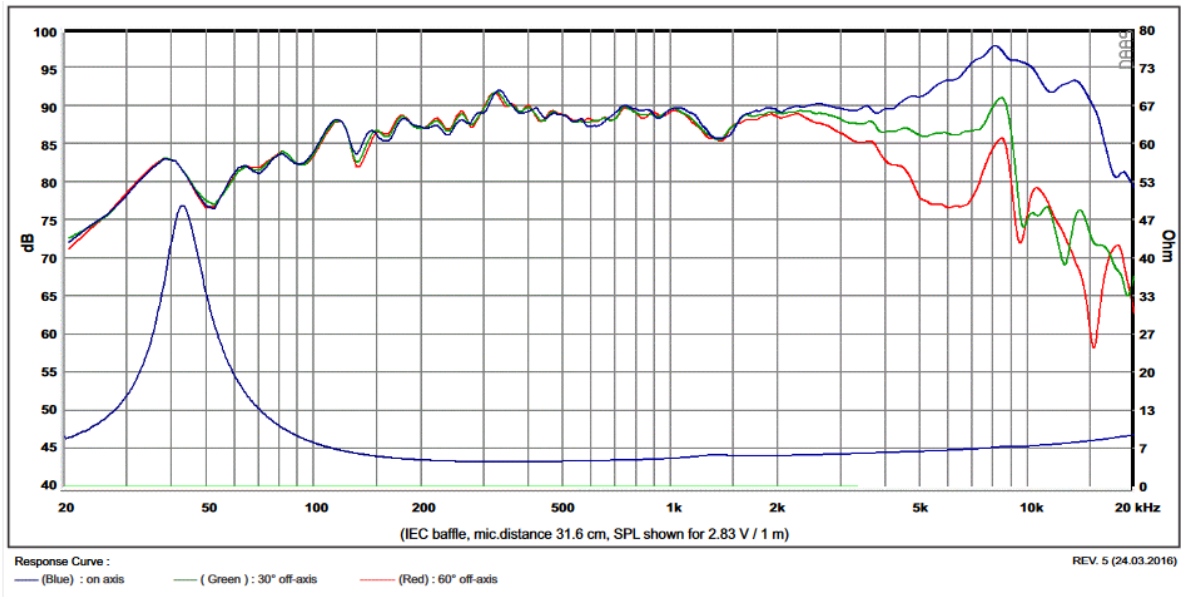
When you seek to validate a design, we want to **support you** as you **probe deeper** by sweeping parameters and **collecting** associated **measurements**.

Examples in Every Industry

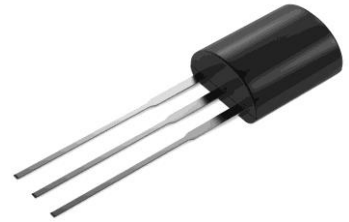








Case Study



The 2n2222a transistor

Let's explore the 2n2222a transistor, a part that most of you may have encountered in school.

In order to validate the design of the part and provide characterization details, engineers needed to detail how it worked under a variety of conditions by nesting sweeps, use different sweeping strategies, fine tuning the set of values to explore, taking measurements, and plotting those results.

Example in TestStand: ..\Examples\Interfacing with Hardware\Transistor Characterization using Sweep Loop Step

P2N2222A

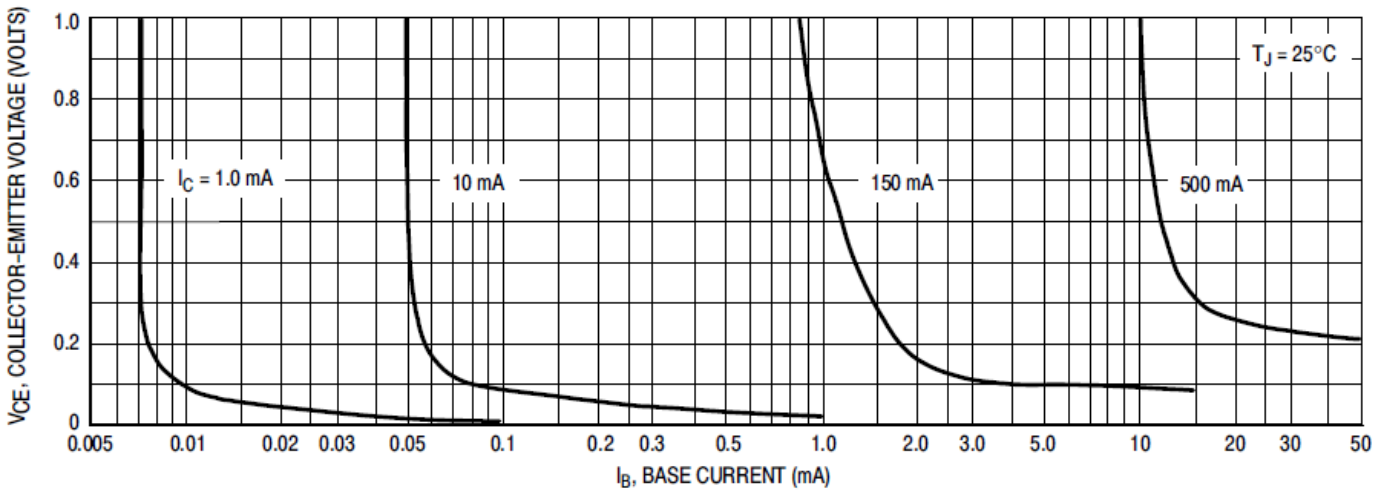


Figure 4. Collector Saturation Region

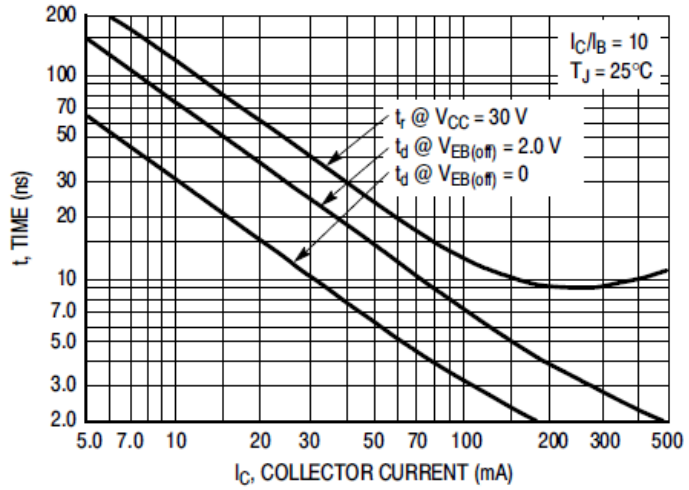


Figure 5. Turn – On Time

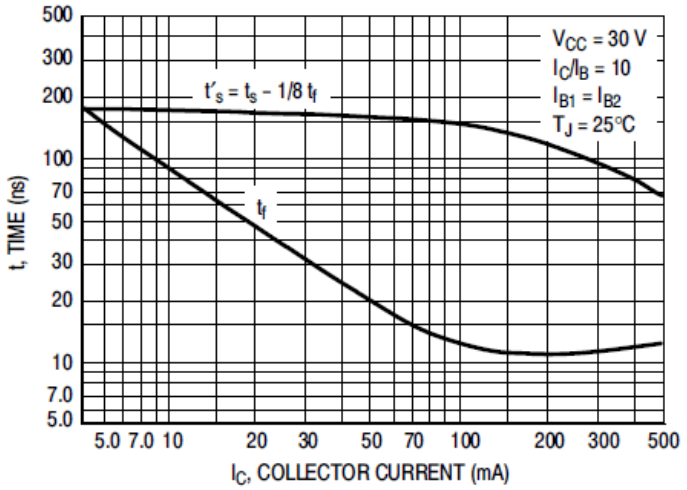


Figure 6. Turn – Off Time

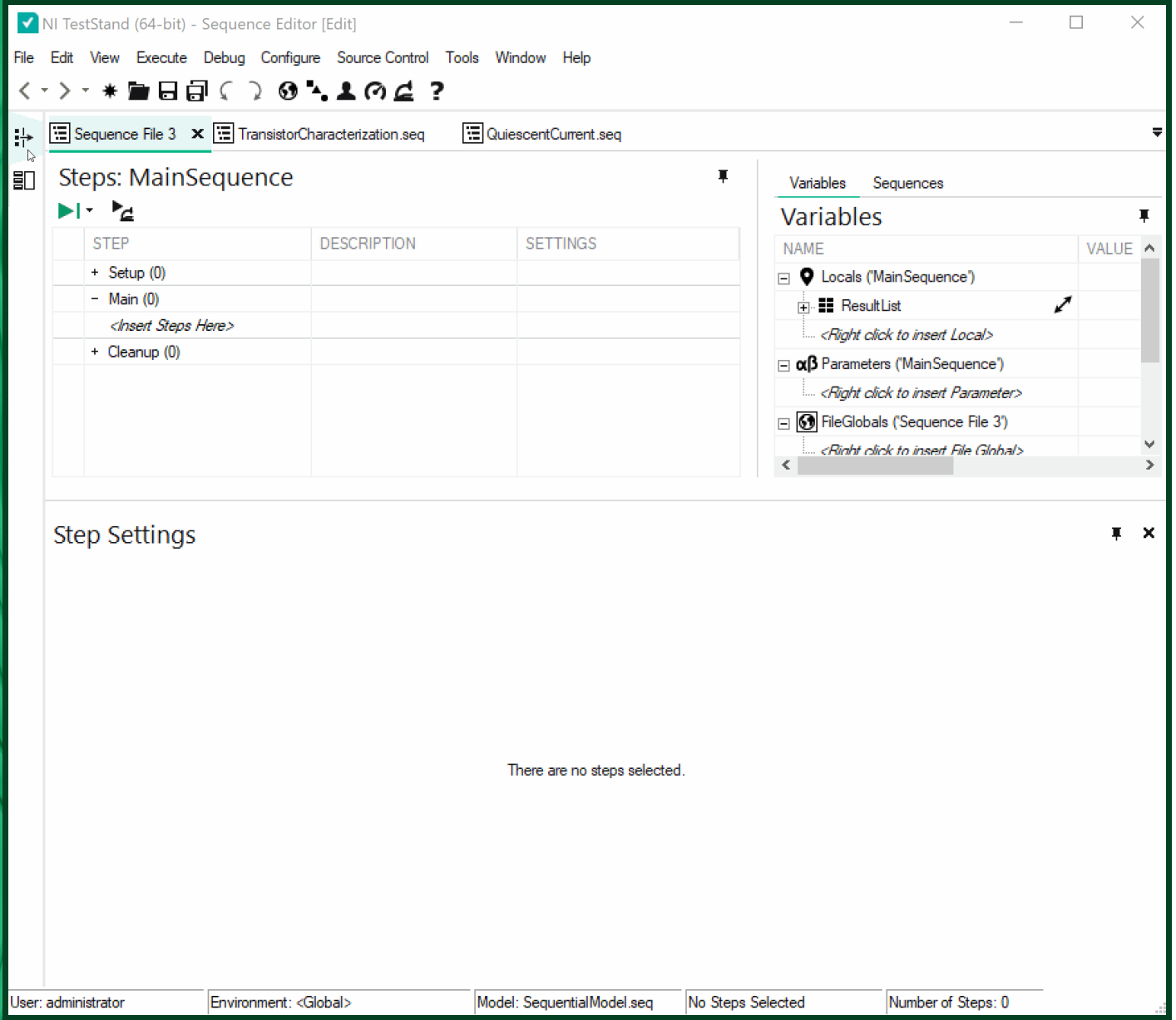
https://www.onsemi.com/pdf/datasheet/p2n2222a-d.pdf

Sweep Parameters

Importing and Automatic Variables

Creating Parameters

Multiple ways to add and manage



Can represent both stimulus and response

Manually enter parameter names

New variables are created automatically

Import parameters from CSV

Automatic variable names update as you update them in the sweep loop step

Use instrument attributes from InstrumentStudio sessions

Nesting Sweeps

Support for Nested and Parallel Sweeps

Explore the spectrum

Understand the IV Curves of 2n2222a

Explore an array of temperatures

Need to explore V_{CE} across a range of values

- V_{CE} is set with **two** parameters
  - V_{CC} and V_E

Also need to change I_C

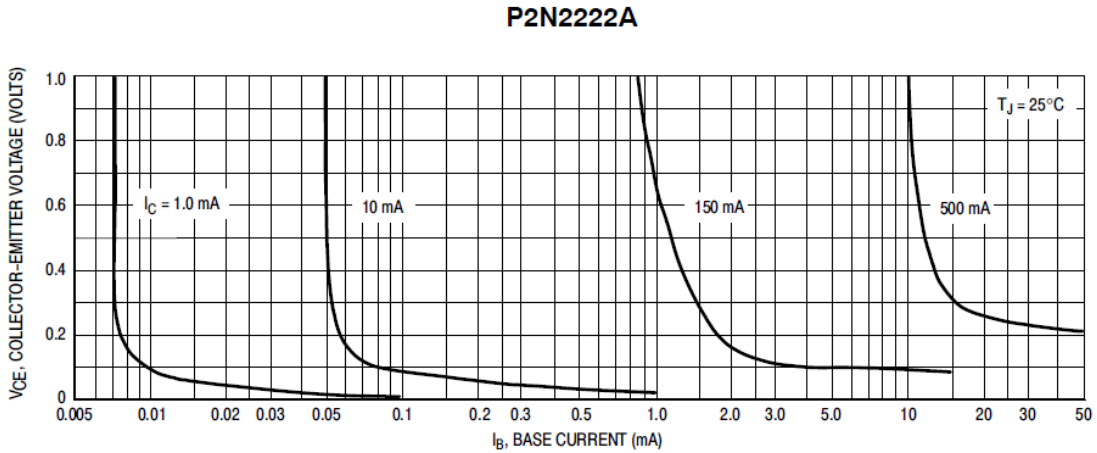


Figure 4. Collector Saturation Region

```
for (each Temp)
    Set Temp
    for (range of VCE)
        Set VCC
        Set VE
        for (each IC)
            Set IC
        end
    end
end
```

Step Settings for Sweep Transistor - Voltage and Current

Sweep Parameters | Input | Output | Loop Information | Properties

TEST VECTORS: 228 TOTAL

		PARAMETER NAME	TYPE		PARAMETER VALUE/SESSION	[COUNT], {RANGE}
☑	0	Temp	123	☐	Locals.Temp	[3] {-55 - 125}
☑	1	Vcc	123	☐	Locals.Vcc	[2] {5 - 15}
☑	1	Ve	123	☐	Locals.Ve	[2] {4 - 5}
☑	2	Ic	123	☐	Locals.Ic	[38] {0.1 - 501.1958979517}

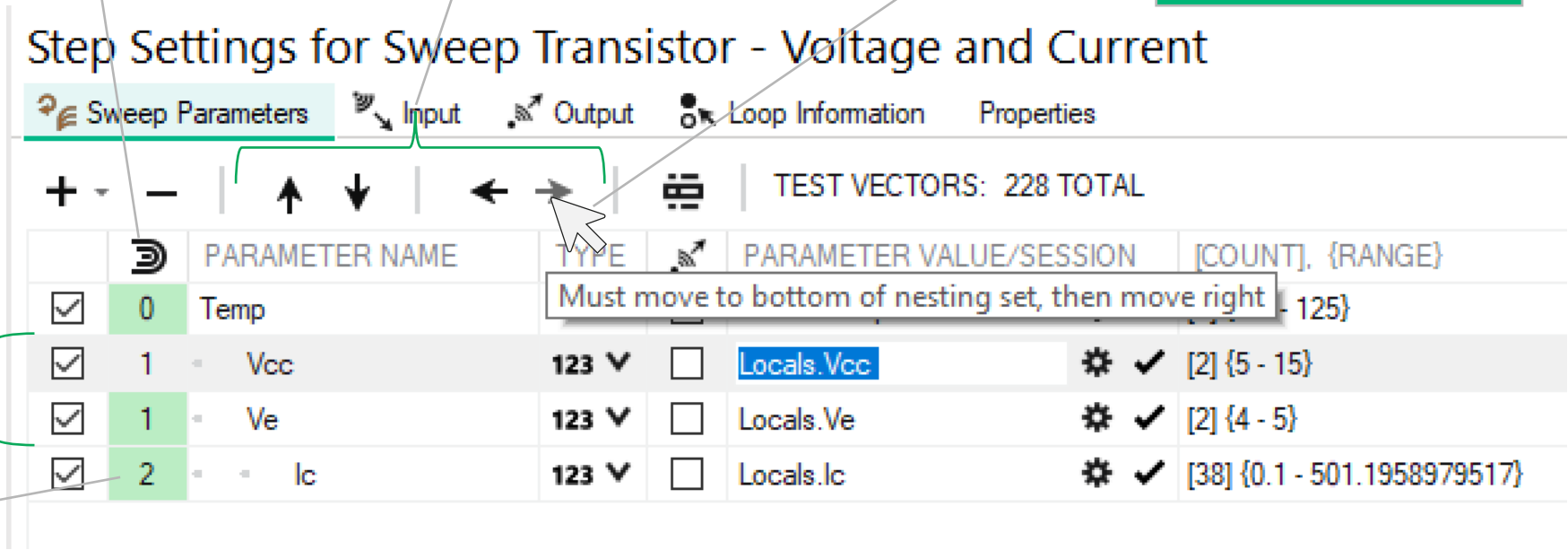
Loop nesting level

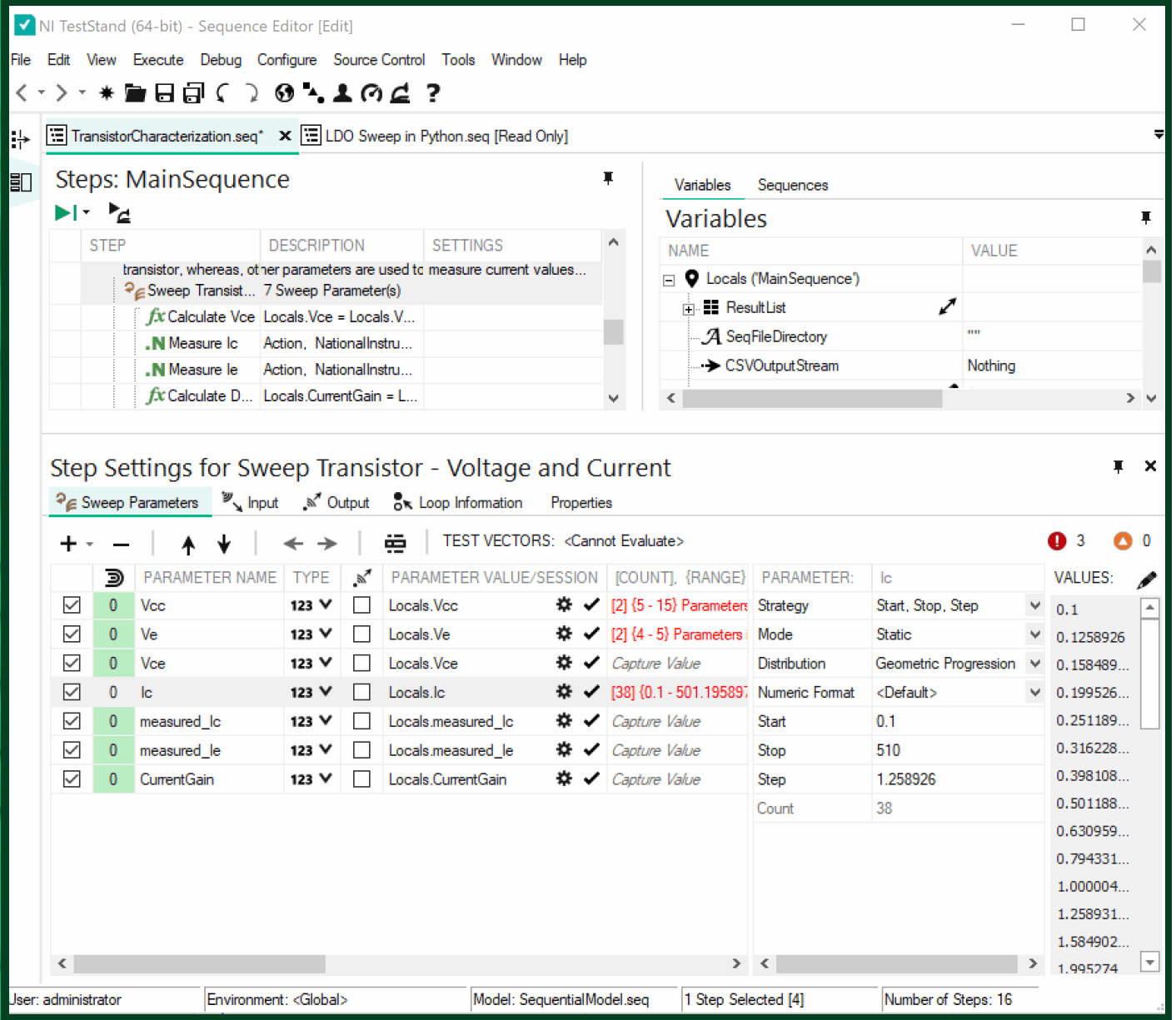
Use to control order and nesting

Hover over controls for tips

Vcc and Ve increment together

Inner loop





Nesting Sweeps

Control and group

Multi-level nesting

Each step supports a top nesting level

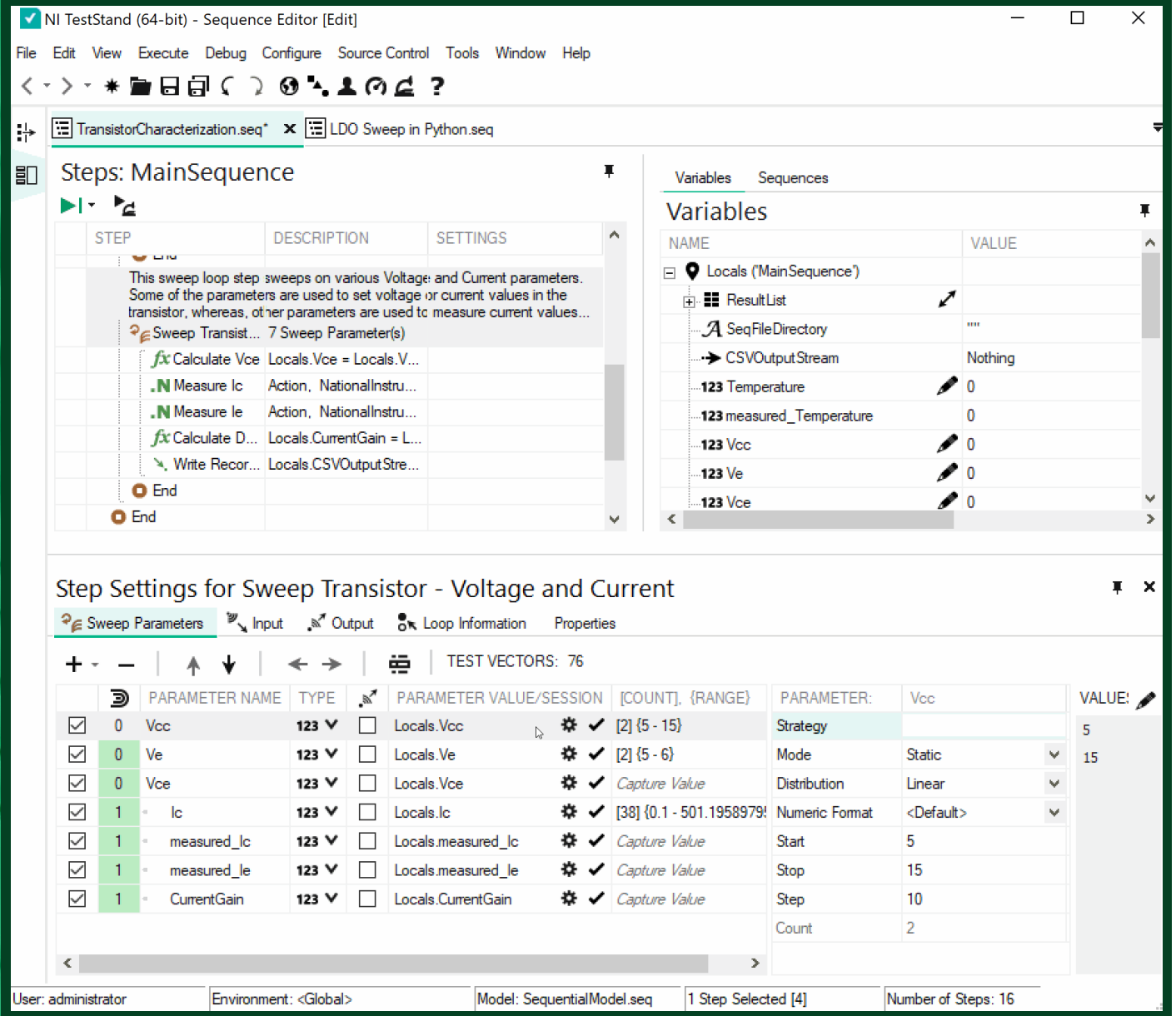
Use multiple sweep steps in a sequence

Use nesting inside sweep step

One or more parameters at each nesting level

Sweep Strategies

Explore a variety of pre-defined sweep strategies



Sweep Strategies

Step how you want

Fine tuned control

Standard strategies

- Start, Stop, Step
- Start, Stop, Count
- Linear and Log Progression

Array

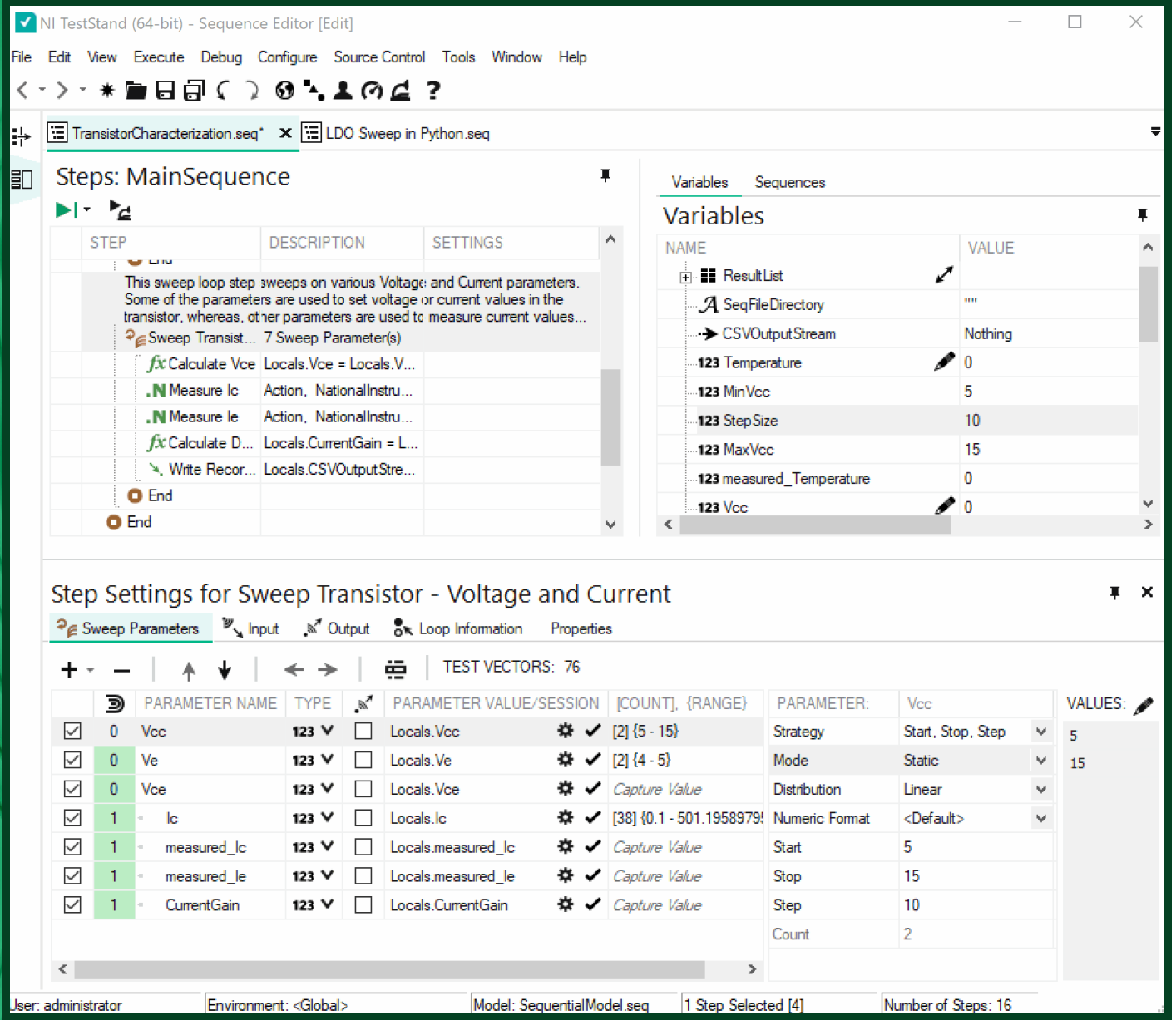
Edit as static array

Stream

- Load custom strategies

Capture Values

- Use to view measurements or variables in Test Vector Table and output data



Static and Dynamic

When to use what and why

Static mode

- Used for values that will not change
- Allows the most control
  - Edit static arrays
  - Enable and disable test vectors and values

Dynamic mode

- Uses TestStand Expressions
- Variables can determine values
- Can change at run time

Table Views

Know what you are sweeping **and** the results

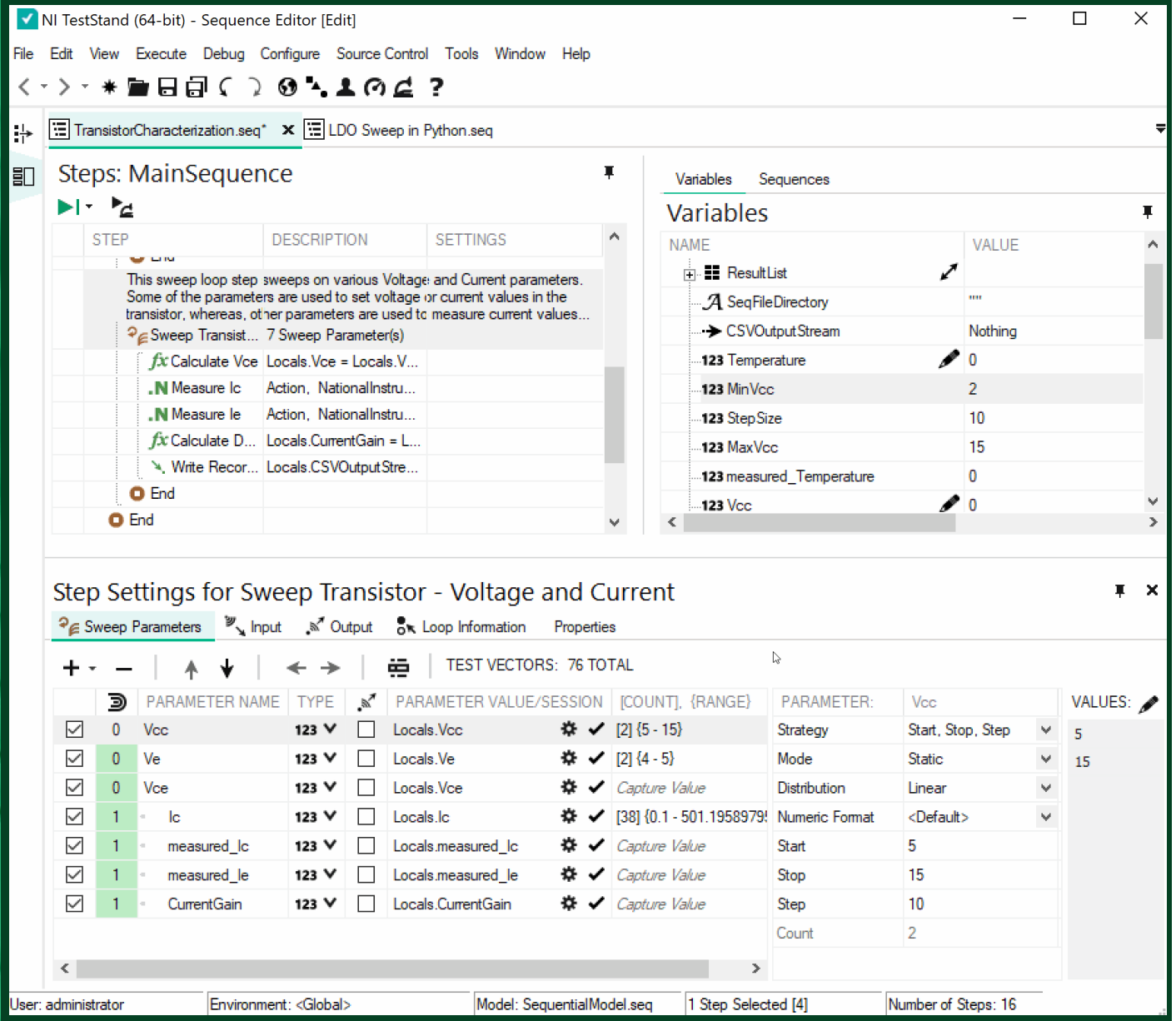


Table Views

Test Vectors and Value Summary

Preview the sweep space

Value Table

- Review all conditions

Test Vector Table

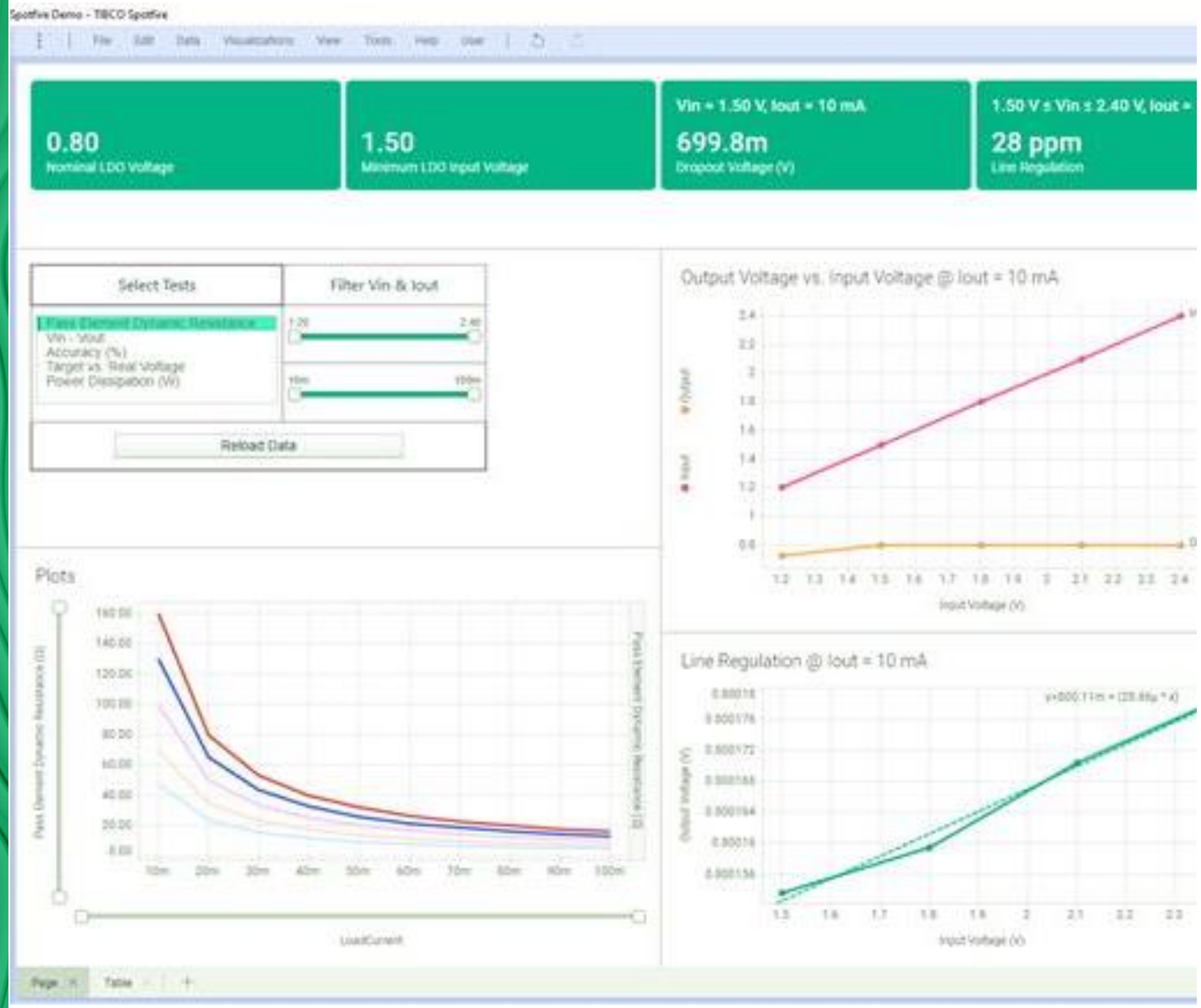
- Filter
- Enable and disable rows (static mode only)

Save to disk

- Before execution
  - To rerun exact same tests
- After execution
  - Archive data, open in 3rd party tools

Exporting Results

Know what you are sweeping **and** the results



Export your data

Digging deeper

Export to CSV

- Stream to disk or database
- Save from Test Vector Table

Use as Input Parameters

Stream

Further analyze the characteristics in external tools

Recap and Questions

Summary and your turn

Recap and Questions

Powerful Sweep Capabilities

Nesting and grouping of parameters

Input manually and automatically create variables

Import from CSV

Many sweep strategies and customizations

Table View to preview data and refine test coverage

Export input and output values together

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https://survey.sogosurvey.com/r/o2CVhf

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