

The background features a grid with various technical plots, including a circular target with a crosshair, a bar chart, and a line graph. A blue square marker is positioned on the grid, with a vertical orange line extending upwards from it. The text is overlaid on the right side of the grid.

Application of second-tier VNA calibration with Cascade Microtech WinCal XE™

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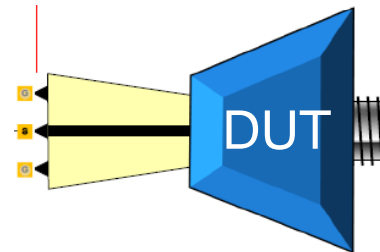
■ What is Two Tier Calibration?

- Two Tier Calibration of a Vector Network Analyzer is a technique that allows two calibration error sets to be combined into one resulting error set for the VNA error correction.
- This technique solves VNA calibration problems that are not easily solved by one calibration error set alone.

What sort of problem will Two Tier Calibration help me to solve?

- When you have a device under test that has mixed port connections you will run into a dilemma to complete the calibration with one set of calibration standards.
- The most common example of a DUT with mixed ports is one with a coaxial port on one side and a probed port on the other side.
- Another example would be a device with a different probe pitch on each port.
- The dilemma is finding a “Thru” calibration standard to use for the calibration of the VNA between such ports. Short, Open, and Load standards for the VNA calibration of the two ports are rather simple. The “Thru” is the issue.

How will I finish my thru calibration!&#\$ ☹️



Can't I just use S-Parameters of the Thru to complete the calibration?

- You face the same dilemma, how to measure the S-Parameters of the Thru, assuming a suitable thru exists at all. This is like the Chicken and the Egg; Which came first?
- For the example of a DUT with a coaxial port and a probed port, you could complete a 2-port VNA calibration if you had the S-Parameters of a second probe to use as the calibration Thru.
- Even though Cascade Microtech provides S-Parameters for probes we manufacture, your best VNA calibration should include your cable to probe connection, and your VNA sweep setup (number of points, frequencies, IF bandwidth, etc).
- Effectively the Two Tier Calibration yields the S-Parameters of the Thru, thus solving the dilemma.
- And you'll see that Two Tier Calibration is a simpler procedure.

■ Two Tier Calibration Procedure

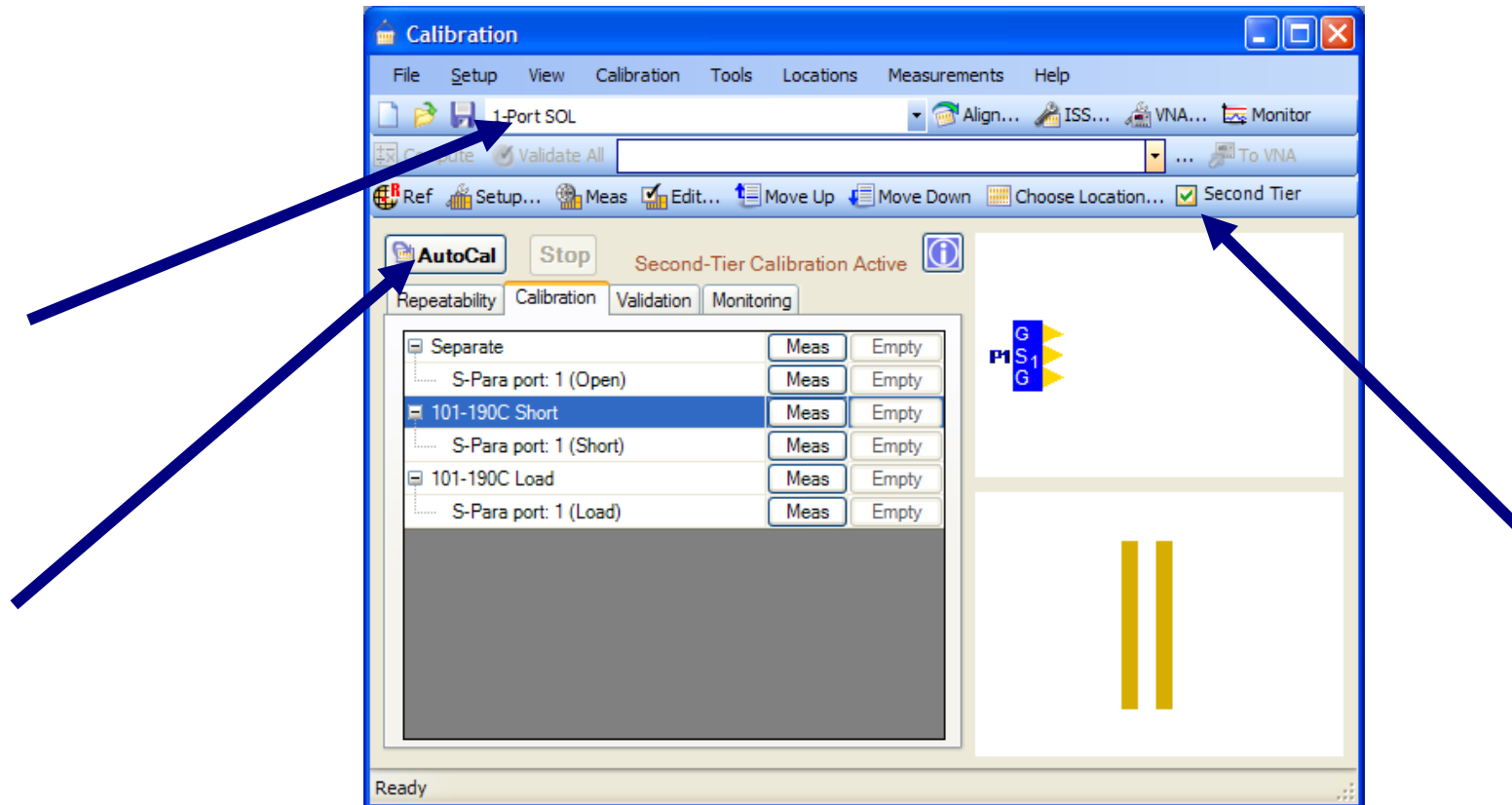
- For the common example of a DUT with a coaxial port on one side and a probed port on the other side, here is the procedure:
 - From the front panel of the VNA, complete a full two port coaxial calibration to the ends of the two VNA test port cables using coaxial calibration standards or an electronic calibration module.
 - Connect one VNA test port cable to the probe you are using to contact the probed side of your DUT.
 - Within the WinCal XE calibration menu select “Second Tier”.
 - And then complete a 1-Port calibration to the tip of the probe using Short, Open, and Load calibration standards.
 - Finish by sending the probe calibration error terms to the VNA, which will combine the existing two port calibration already in the VNA with the additional probe calibration.
 - The result is you have the VNA calibrated now to your two desired reference planes, coax on one side and probe tip on the other side.

■ How does it work?

- Marketing: “It works great!”
- Engineering: “Measurement of three standards, Short, Open, and Load at the tip of the probe provides three (complex) equations with three unknowns (complex): S_{11} , S_{22} , and $S_{12} \cdot S_{21}$. The last product is pulled apart by square root with a root selection (sign ambiguity) solved by a provided estimate of thru delay and an algorithm that refines the estimate progressively through the data. The end result is all 4 S-parameters of the probe are determined. It works great!”

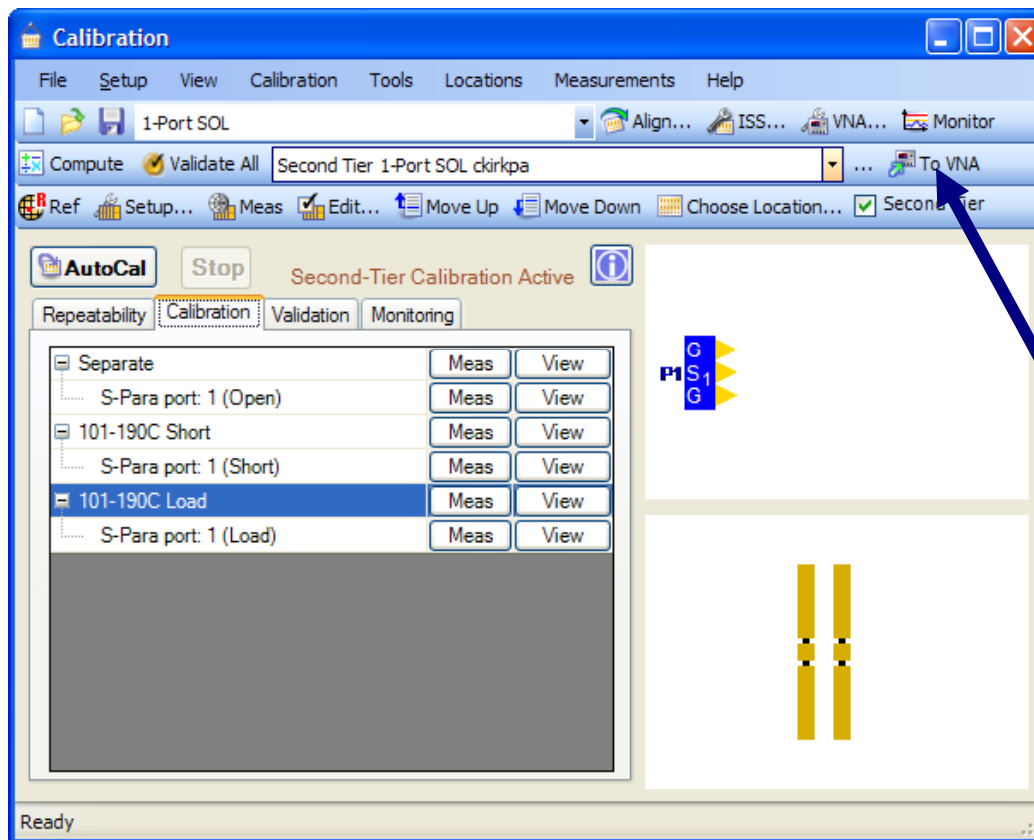
■ Step by Step for This Example

- After finishing the two port coaxial calibration of the VNA from the instrument front panel, proceed with WinCal XE as shown below.



■ Step by Step for This Example

•Finish by sending the probe calibration error terms to the VNA, which will combine the existing two port calibration already in the VNA with the additional probe calibration. After this step is complete you are done with the calibration! See how simple it is.



WinCal XE

■ More about this Superior Microwave Tool

- Visit www.cascademicrotech.com/wincal for more information
- FREE DEMO VERSION
 - Unlimited data viewing, manipulation and display
- FREE TRIAL VERSION
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 - Academic discount available
 - Visit our booth for a demo

