METAS VNA Tools II - Tutorial
Perform a SOLT Calibration with the Test VNA

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1 Introduction

Along with this document comes a video tutorial, see Figure 1, that can be found at www.metas.ch/vnatools. The text below is just a transcript of the video tutorial with the time stamps referring to the time line of the movie.

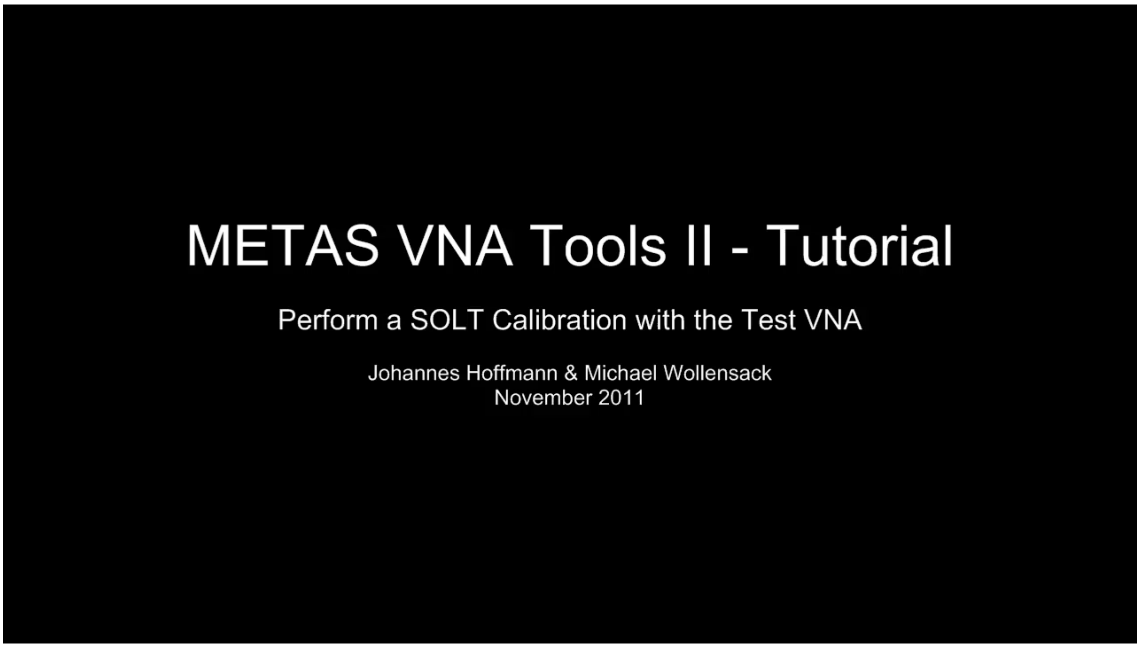

Figure 1: Video

The following steps describe the typical use of VNA Tools II:

1. Specify a new project path in the Navigation Bar.
2. Collect measurement data and protocol the measurement process in the Measurement Journal.
3. Configure a VNA calibration and compute the error terms in the tabular page called Calibration Config.
4. Set up the configuration of the error correction and error-corrected the raw measurement data.
5. Visualize the error-corrected data in the Data Explorer.

2 Project Path

00:55 The first step in VNA Tools II is to specify the global root path.

01:01 It can be specified in the navigation bar on the top.

01:04 By clicking on Browse, one can specify a directory, see Figure 2.

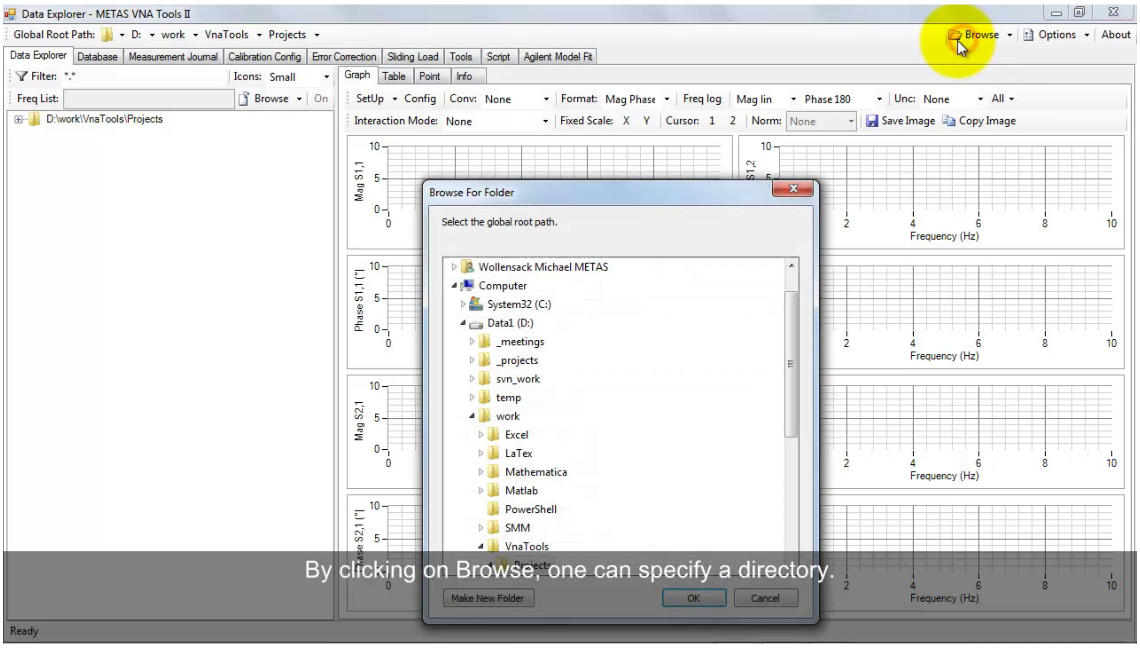

Figure 2: Project Path

01:09 By clicking on Make New Folder, a new folder can be specified, in this case `Example_02`.

01:16 By clicking on OK, the folder is created.

01:20 Now the global root path is set.

3 Measurement Journal

01:36 The next step is to select the Measurement Journal tab.

01:41 First we can select a VNA Device.

01:46 This will be in this case a Test VNA. A Test VNA is an artificial VNA which just serves for test proposes.

3.1 VNA Settings

01:55 Next we can Open the device and Add VNA Settings.

02:02 Here we can click on Preset.

02:06 This dialog would allow to specify the Switch Terms and the Error Terms of the VNA, but we go with the standard settings and click on OK.

02:17 Next we can specify the Sweep Mode, which will be a Segment Sweep.

02:23 In the Segment Table we can specify the maximum frequency to be 50 GHz.

02:33 Next we specify the IF Bandwidth to be 10 Hz.

02:44 We can save this Segment Table to the VNA by clicking Set Segment Table.

02:51 By clicking on OK, we can save this entry to the journal, see Figure 3.

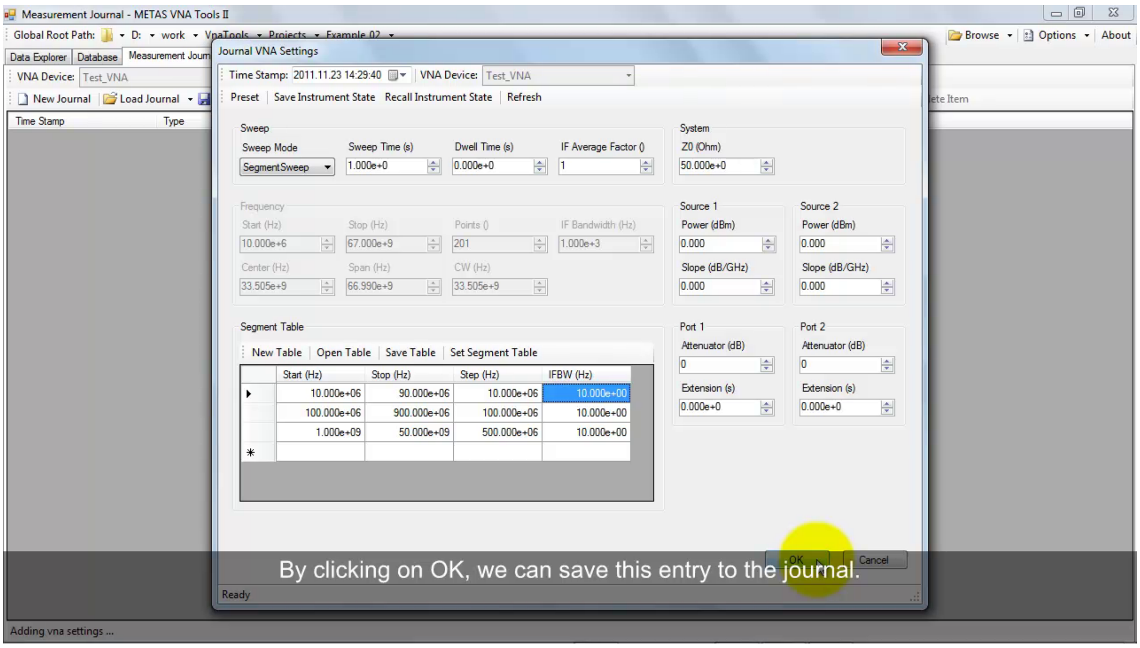

Figure 3: VNA Settings

02:58 For saving the complete journal, we click on Save Journal and save it as `Journal_01.vnalog`.

3.2 Cable and Connector

03:12 Next we can select a standard cable. This will be a 2.4 mm cable, see Figure 4.

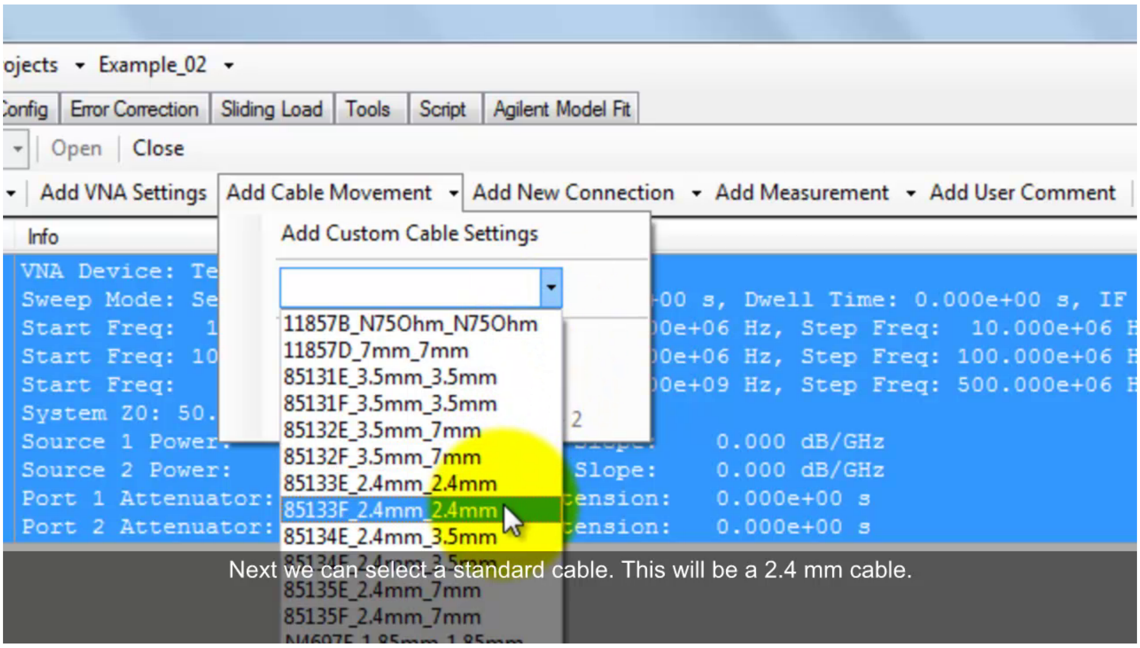

Figure 4: Default Cable

03:23 We can select a standard connector which will be a 2.4 mm connector.

3.3 Measurements

03:30 Next we want to measure opens on both ports. This requires us to move the cables on both ports, to make new connections on both ports, and to collect all S-parameters.

03:46 Now we select that we want to measure opens.

03:52 Next we create a directory, which will be called `Measurements_01`.

04:05 In this directory, we save the raw measurement data as `Opens_01.sdatb`.

04:15 Next we want to measure the shorts. This requires a reconnection at port 1 and 2 and the collection of all S-parameters.

04:26 Now we select the DUT to be the short.

04:33 The measurement data can be saved as `Shorts_01.sdatb`.

04:42 Next we want to measure the loads on both ports. This requires a reconnection at port 1 and 2 and to collect all S-parameter data.

04:53 We click on Load and save the raw measurement data as `Loads_01.sdatb`.

05:06 The next step is to measure a thru connection. This requires a cable movement on port 2, a reconnection at port 1 and 2, and measurement of all 4 S-parameters.

05:19 Now we select the Thru and save the measurement data as `Thru_01.sdatb`.

05:33 Next we want to measure the switch terms.

05:39 The switch terms can be saved as `SwitchTerms_01.sdatb`.

05:52 Next we measure an attenuator. This requires cable movement on port 2, reconnection at port 1 and 2, and measurement of all 4 S-parameters.

06:06 We select the 20 dB Attenuator as a device under test and save the measurement data as `Att20dB_01.sdatb`.

06:22 Now all measurements are recorded in the measurement journal, and the measurement journal is ready, see Figure 5.

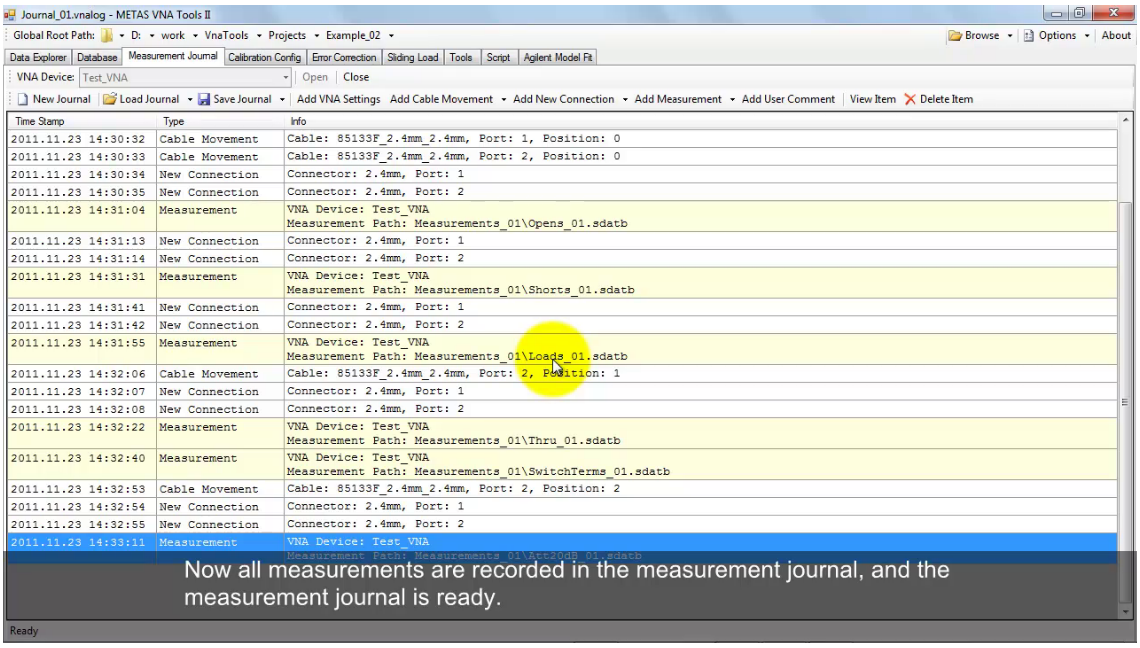

Figure 5: Measurement Journal

4 Calibration Config

06:40 Next we click on the Calibration Config tab.

06:45 We select New and as a Calibration Type we select SOLT.

06:53 This automatically gives us a calibration for port 1 and 2 with reference impedance 50 Ohm, see Figure 6.

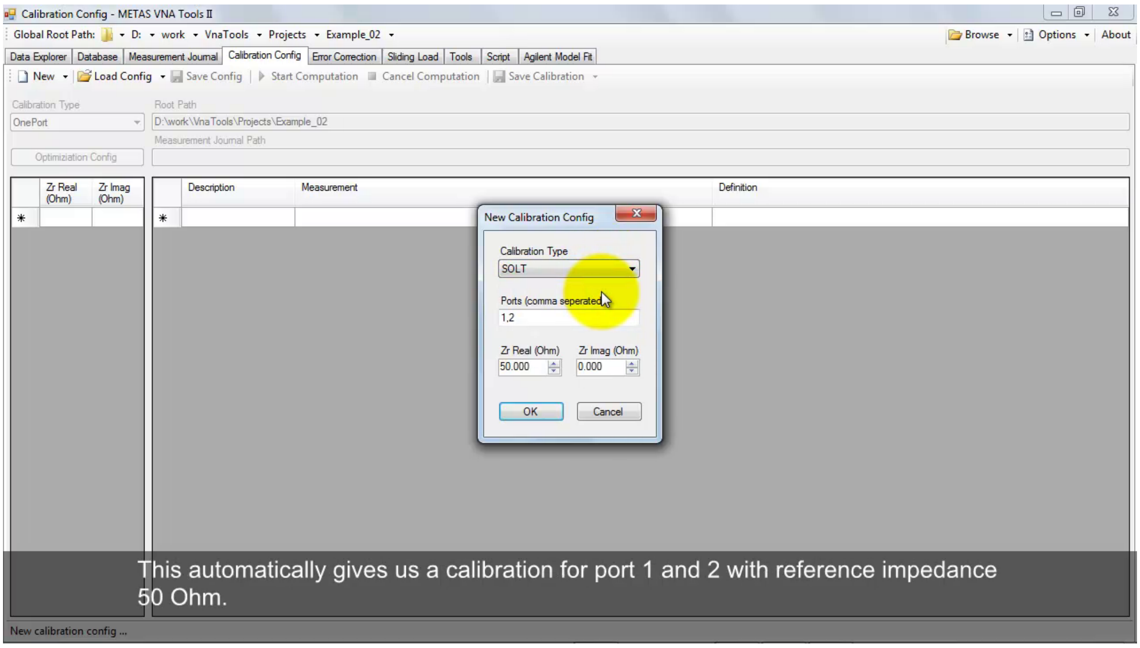

Figure 6: New SOLT Calibration

07:01 By clicking on OK we can define the template.

07:06 Next we specify the Measurement Journal Path. This is the measurement journal be recorded before, `Journal_01.vnalog`.

07:16 Next we define the measurement of the reflection standard 1. This will be the open.

07:25 The second reflection standard was the short.

07:30 The third reflection standard was the load.

07:35 Now we define the definitions of these measurements. This was an ideal open in the first case,

07:45 second an ideal short,

07:50 third an ideal load.

07:56 We can copy these 3 lines to port 2.

08:06 Next we have to define the transmission standard. As a measurement, we select the thru measurement,

08:15 and as the definition, we select an ideal thru.

08:21 Finally we have to define the measurement for the isolation measurement, this will be the loads,

08:29 and the definition is an ideal isolation standard.

08:36 Next we can save the config to `SOLT_01.calcfg`.

08:47 By clicking on Start Computation, the error terms are computed, see Figure 7.

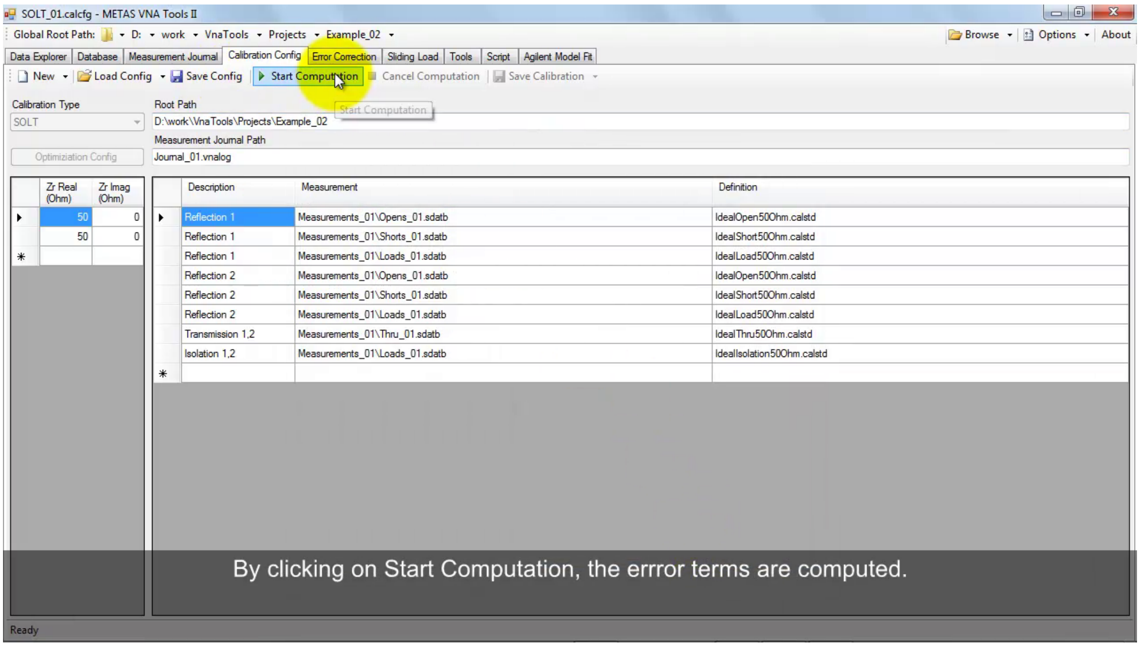

Figure 7: Calibration Config

08:53 Now the error terms are computed and can be saved by clicking on Save Calibration.

09:00 They will be saved under `SOLT_01.calb`.

5 Error Correction

09:22 Next we click on the Error Correction tab.

09:27 In this dialog one can error-correct the raw measurement data.

09:31 First we specify the journal path. This is the journal we recored before, `Journal_01.vnalog`.

09:38 Next we specify the error terms. These are the error terms we computed before, `SOLT_01.calb`.

09:47 Next we specify which measurements to correct.
These are the `Measurements_01`.

09:54 And finally we specify where the output is written to.
This will be `SOLT_01_out`.

10:04 Next we save this configuration by clicking on Save Config,
under `SOLT_01.corcfg`.

10:17 By clicking on Start Computation, we can perform the error correction, see Figure 8.

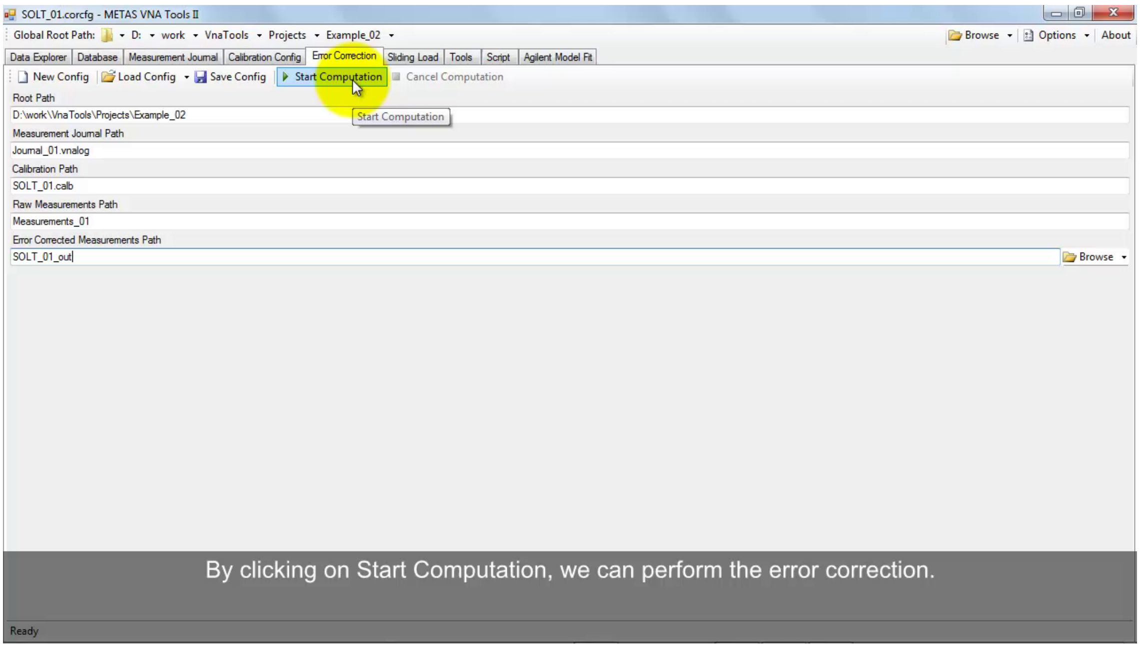

Figure 8: Error Correction

10:26 Now all measurements are error-corrected.

6 Data Explorer

10:42 Next we select the Data Explorer tab.

10:47 In the Data Explorer, one can visualize calibration results.

10:51 We select the directory where the corrected measurement results are.

10:57 Here we select the 20 dB attenuator.

11:00 Now on the right hand side you can see the measurement results.

11:04 On the left hand side reflection at port 1

11:09 and transmission.

11:12 We can display these results with uncertainties.

11:16 We select the 95% confidence interval.

11:22 The grey area is now the 95% uncertainty region, see Figure 9.

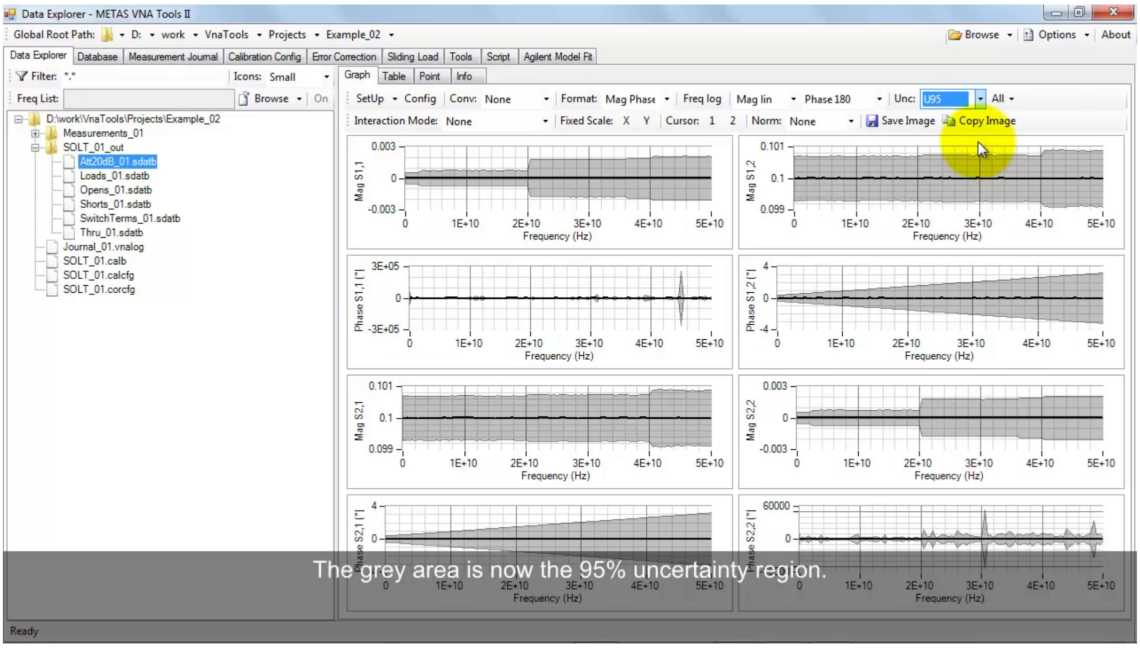

Figure 9: Data Explorer