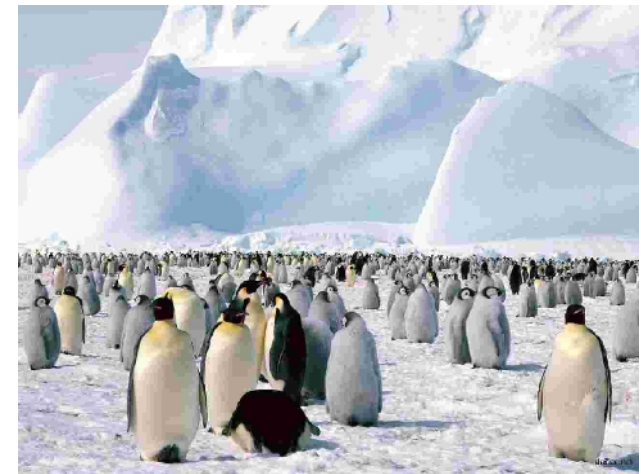


Integrated Component Characterization Environment “ICE”

“Do now with instruments
what you could do for years with
your nonlinear simulator”

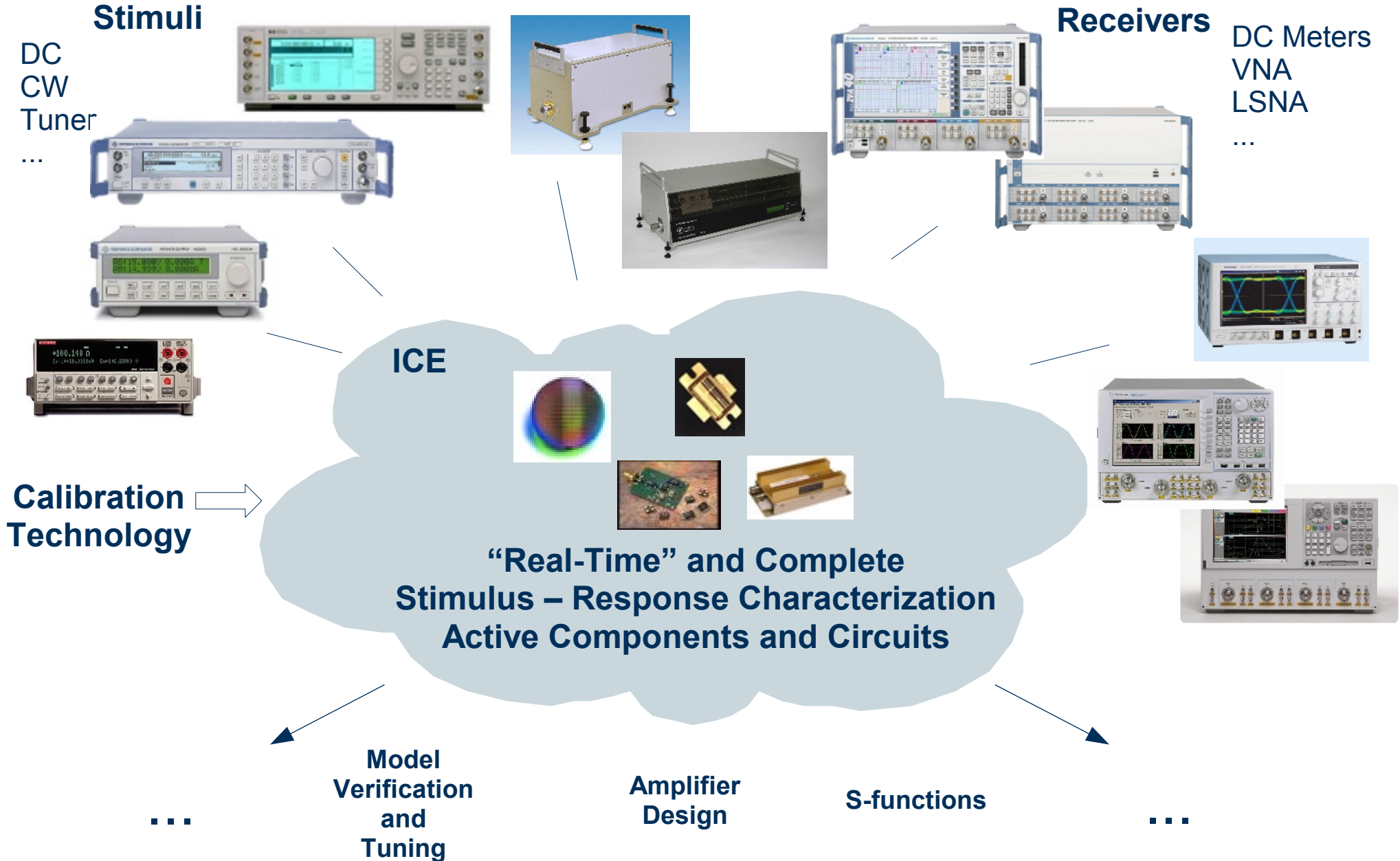


Outline

- Introduction
- Receivers and Analyzers
- Absolute Calibration Techniques
- Deembedding
- Ranging
- Configurable test-sets
- Tuners
- Record a replay measurements
- Pseudo real-time displays
- Build your own measurement setup
- Remote connection to test environments
- On-line help
- Architecture
- Driver support and applications
- Conclusion

- Want to try?

Integrated Component Characterization Environment

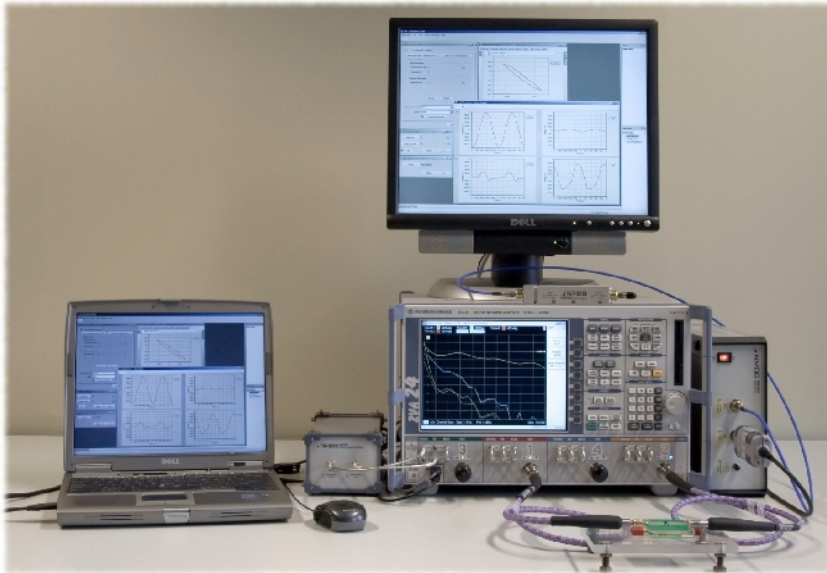


Integrated Component Characterization Environment

- Pseudo real-time active component characterization and tuning
 - Allows to use different stimuli in pseudo real-time
 - Measures accurately the voltage and current behaviour (V/I) at the ports of a device under test
 - Visualises in pseudo real-time the V/I measurements and derived specifications in different formats to gain insight in component behaviour

- Base platform for applications, solving specific customer problems
 - DC IV Characterization
 - Harmonic Distortion Analysis
 - S-functions
 - ...

ICE supports different receivers / analyzers



Rohde&Schwarz ZVA/T

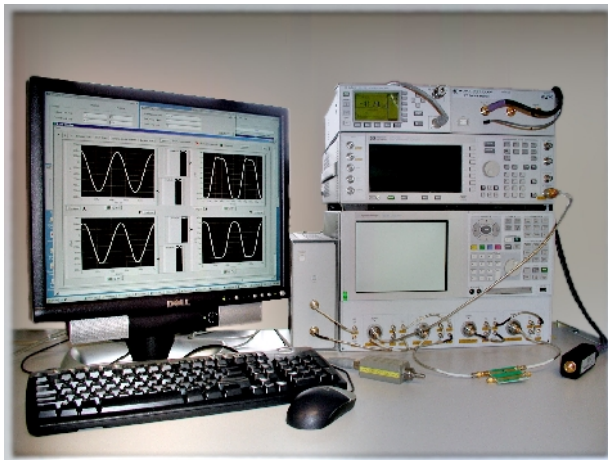


Tektronix HF Oscilloscope (*) powered by NMDG

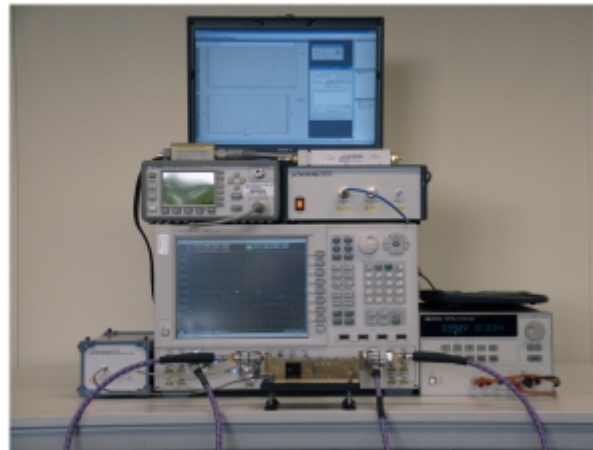


Maury MT4463,

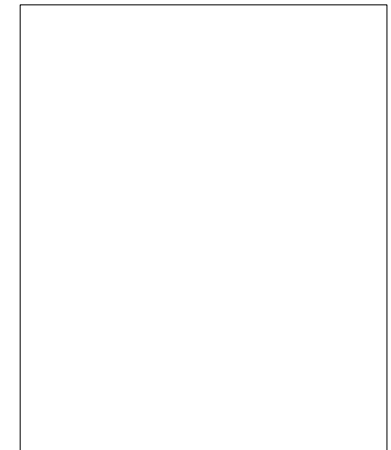
powered by NMDG



Agilent PNA-L



Agilent PNA-X



More to come...

(*) Courtesy of On Semiconductor

ICE supports absolute calibration techniques

- Absolute Calibration Techniques (connectorized, in-fixture and on-wafer)
 - Relative VNA calibration techniques
 - Power calibration
 - Phase calibration

- ICE complements the calibration capabilities of the given receiver / analyser to provide absolute calibration techniques, adapted to the type of measured signals

- When not available with receiver / analyser, NMDG sells a phase calibration kit



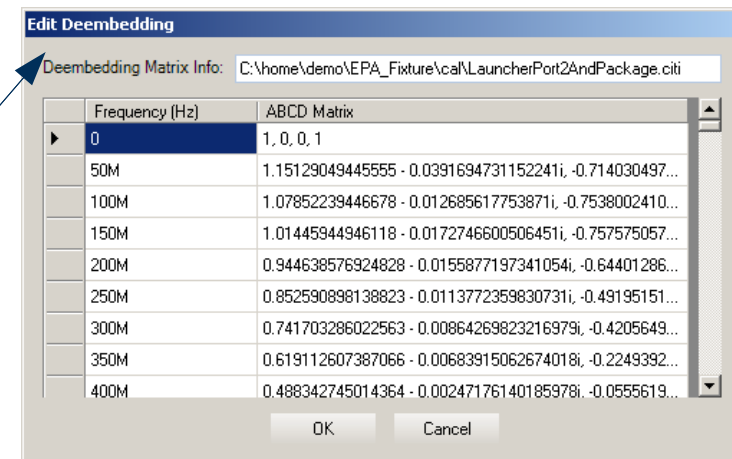
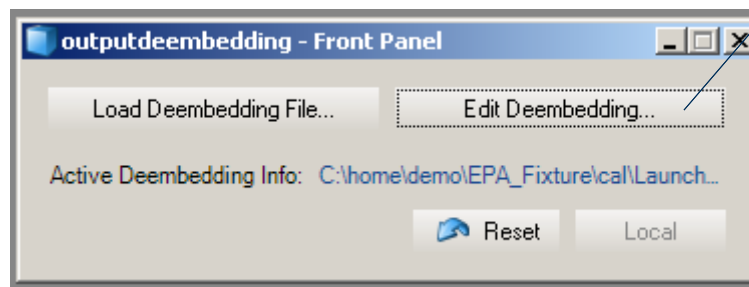
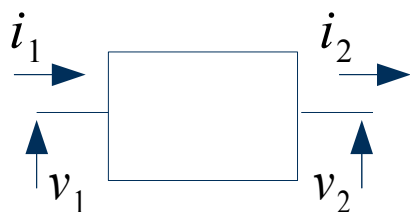
On wafer calibration

Cal Element	Source(s)	Terminator(s)	Additional Cal Element
4... Port 1 (STIM side)			
<input type="checkbox"/> Short [Show] [Measure]	2		Line
<input type="checkbox"/> Open [Show] [Measure]	2		Line
<input type="checkbox"/> Load [Show] [Measure]	2		Line
<input type="checkbox"/> PowerMeter [Show] [Measure]	2		Line
<input type="checkbox"/> Phase Ref [Show] [Measure]		2	Line
4... Additional Calibrations			
<input type="checkbox"/> RelativeErrorCoefficients [Show] [Measure]			

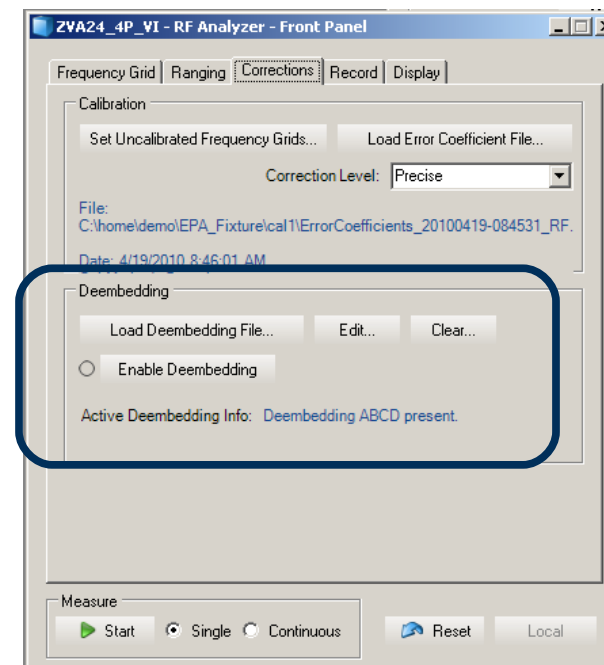
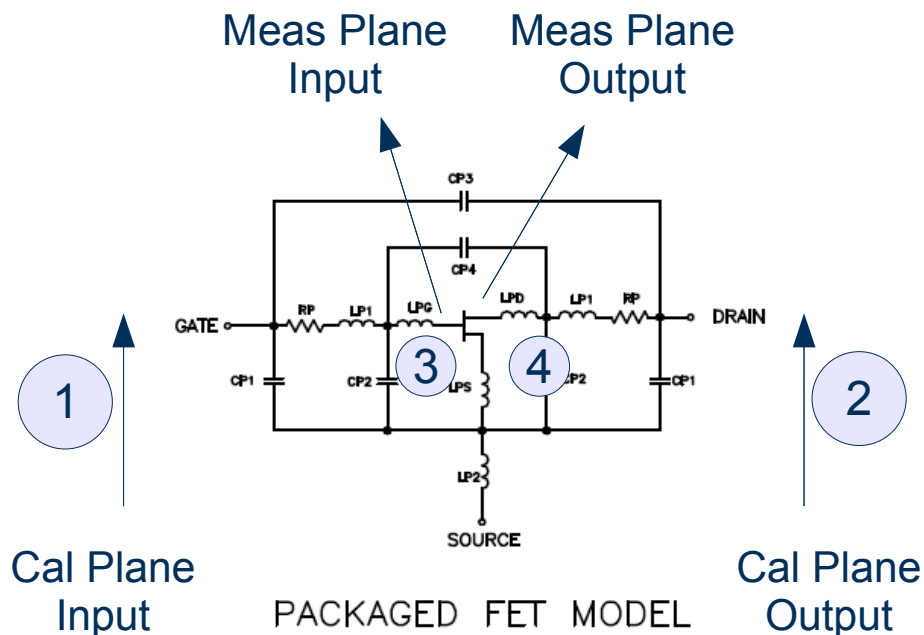
Performed by network analyser
Performed by ICE for oscilloscope / MT4463

ICE supports deembedding

- Standard two-port deembedding

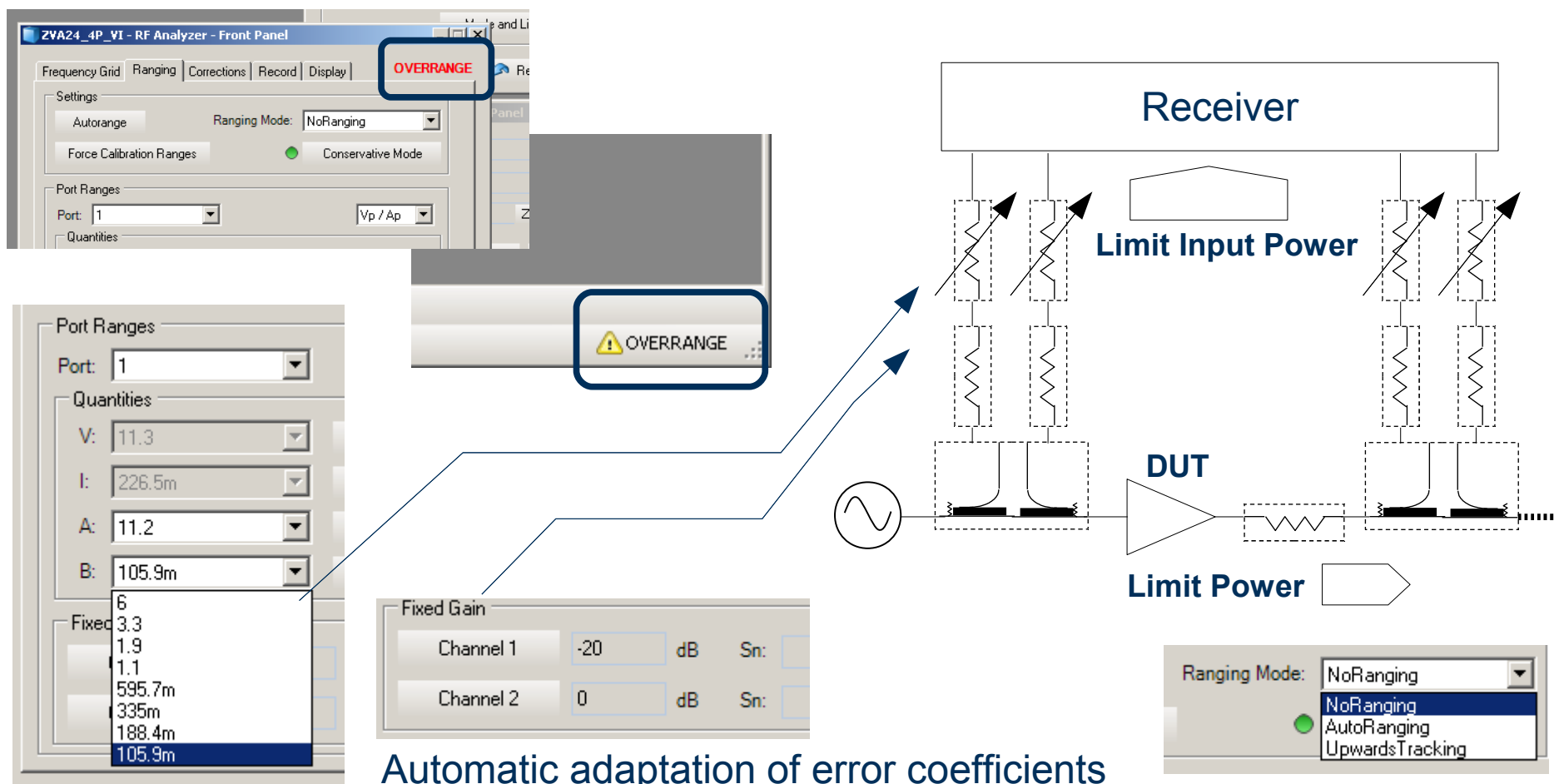


- Four-port deembedding supports parasitics to ground



ICE supports ranging for best measurements

- Characterization of power devices requires proper attenuation
 - Protecting test-set
 - Limiting power going into receiver to avoid receiver compressing, causing measurement errors (nonlinearity of receiver instead of device under test)

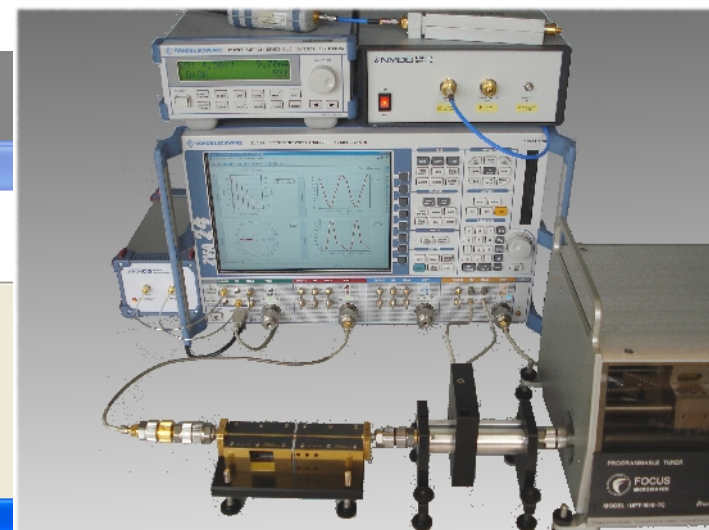


Automatic adaptation of error coefficients

ICE supports and configures different power test - sets

- External test-sets are required when power exceeds the damage level of the standard network analyzer
- ICE allows to configure your own network analyzer, combining a receiver, possibly part of a standard network analyzer, with an external test-set

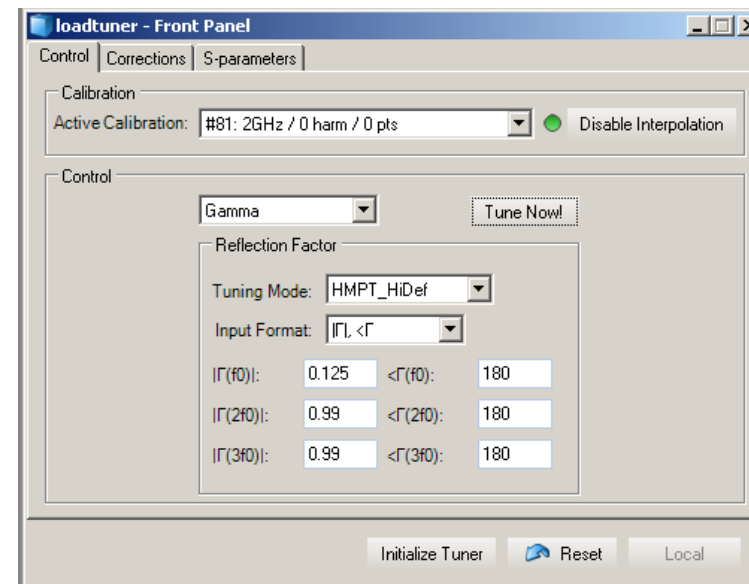
The screenshot displays the ICE software interface for configuring a network analyzer. The main window is titled "Define Network Analyser" and shows a "50 dBm Network Analyzer" configuration. A "Signal Separation" dialog box is open, and a "Define Test Set" dialog box is also visible. A "Define Input Couplers" dialog box is open, showing the configuration for "Input 50 dBm Couplers" with a characteristic impedance of 50.0 Ohms and coupling factors of 50 dB for both channels. A "Define Two-Channel Reflectometer" dialog box is also present, showing a "Two-Channel Reflectometer > Coupler Based" configuration. The interface includes various input fields, buttons, and a "Plugins..." button.



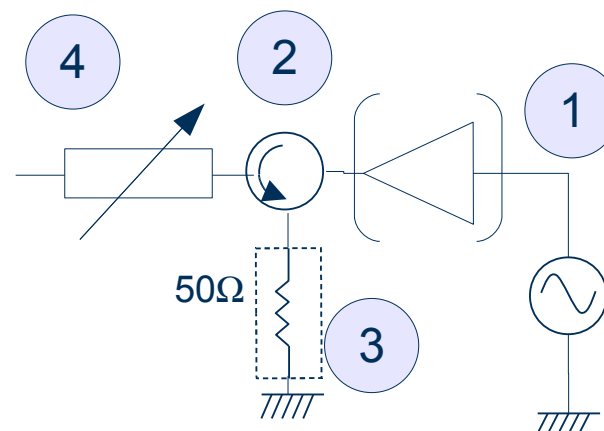
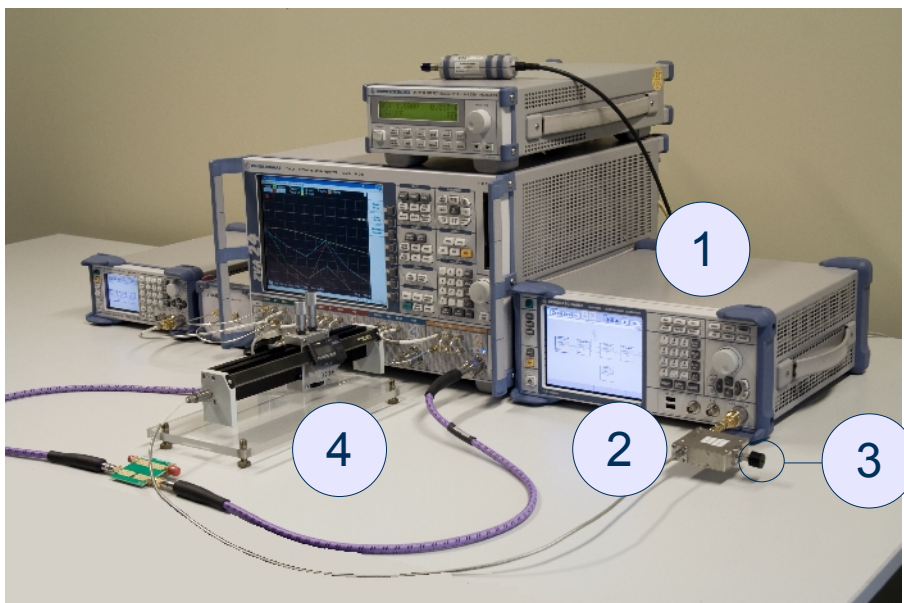
Focus MPT with Focus VI Probe as couplers at output [low insertion loss - high power]

ICE supports different tuners

- Focus Microwaves - CCMT and MPT



- Active tuning



ICE allows recording and replay of measurements

Measure continuously

For example, tune bias

After recording

Recording continuously

#	Label	Signal	Correction	Timestamp
18		Fund Freq: 2GHz / #Harmonics: 5	<input checked="" type="checkbox"/>	16:54, 25 Apr
19		Fund Freq: 2GHz / #Harmonics: 5	<input checked="" type="checkbox"/>	16:54, 25 Apr
20		Fund Freq: 2GHz / #Harmonics: 5	<input checked="" type="checkbox"/>	16:54, 25 Apr
21		Fund Freq: 2GHz / #Harmonics: 5	<input checked="" type="checkbox"/>	16:54, 25 Apr
22		Fund Freq: 2GHz / #Harmonics: 5	<input checked="" type="checkbox"/>	16:54, 25 Apr

Stop Record Now! Save Export Record overranged data

Measure: Hold Single Continuous

ICE supports pseudo real-time displays

OBSERVE

Configurable Pseudo Real-Time Displays

TUNE

Source Tuner

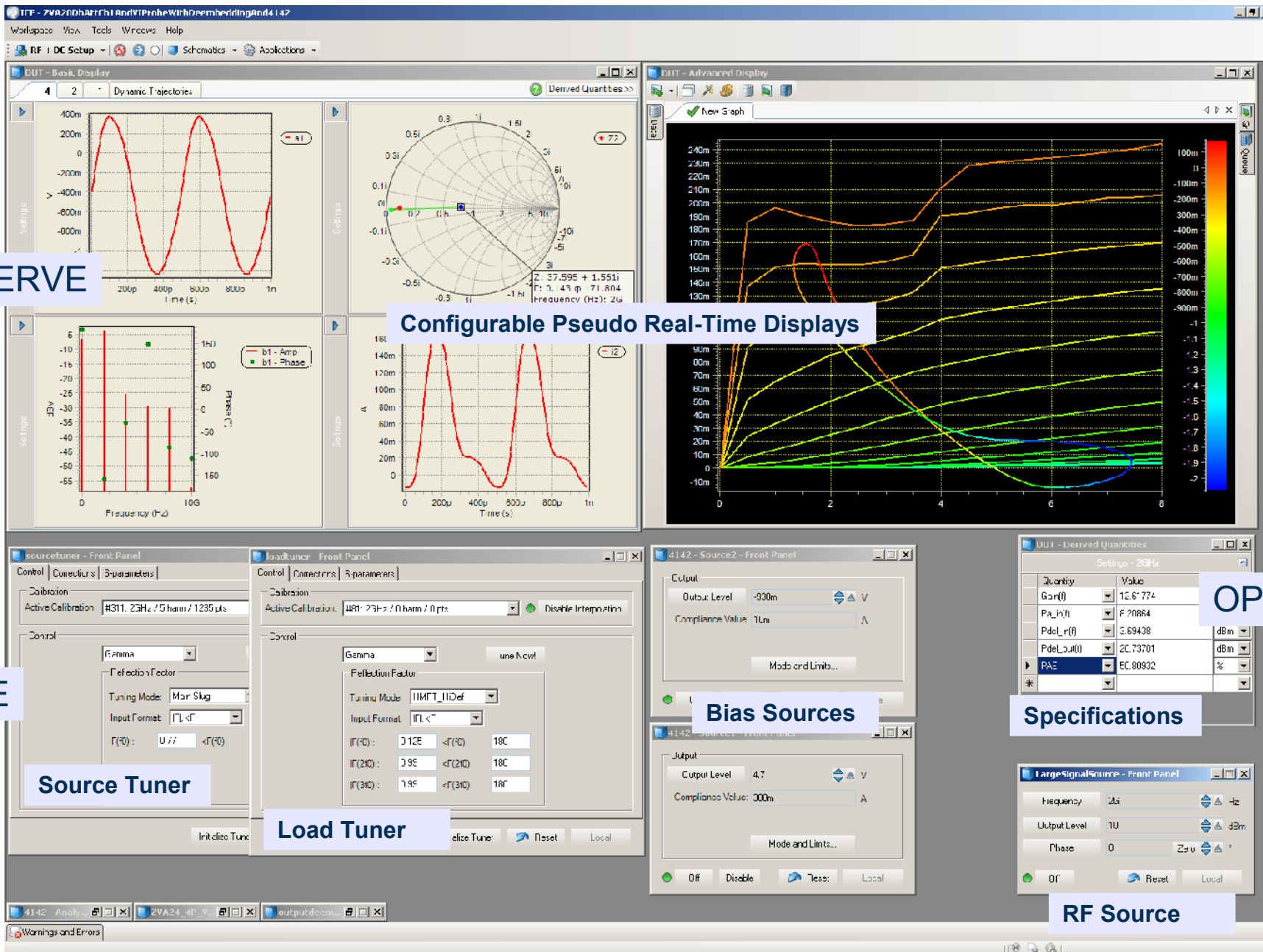
Load Tuner

Bias Sources

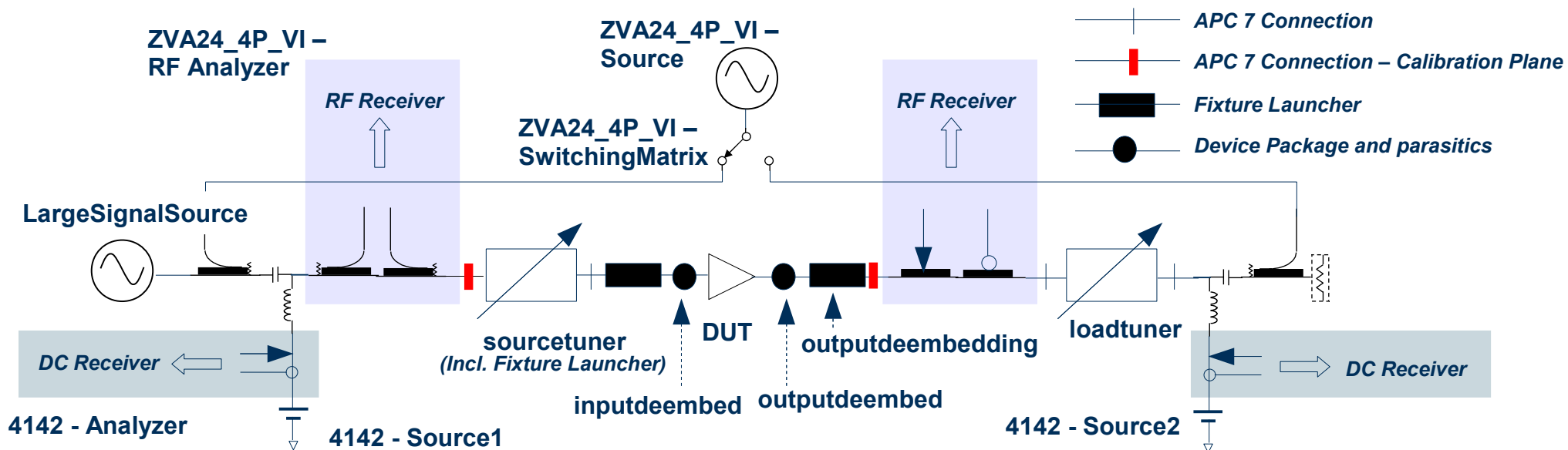
Specifications

RF Source

OPTIMIZE



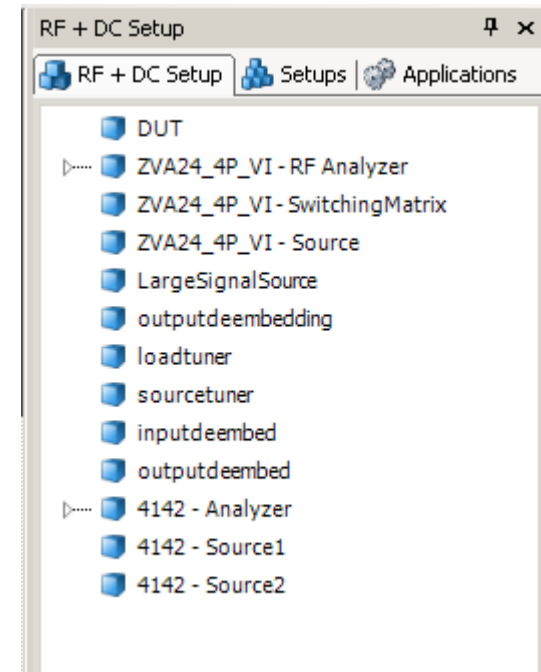
Build your own measurement setup with ICE



Connection Scheme

Connections			
Wires			
Source Schematic	Source Port	Sink Schematic	Sink Port
outputdeembed	Port 2	DUT	Test Port 2
ZVA24_4P_VI - RF Analyzer	Port 1	sourcetuner	Port 1
ZVA24_4P_VI - RF Analyzer	Port 2	outputdeembedding	Port 2
inputdeembed	Port 2	DUT	Test Port 1
sourcetuner	Port 2	inputdeembed	Port 1
outputdeembedding	Port 1	outputdeembed	Port 1

Cal Planes	
Schematic	Measurement Plane
ZVA24_4P_VI - RF Analyzer	Meas Plane 1
4142 - Analyzer	Meas Plane 2



ICE integrates smoothly with your test-environment

Test Environments:

Matlab
LabView
Mathematica

...

Example: Setting deembedding matrix (Mathematica)

```
Untitled-1 *
Making connection with ICE via IPC
iceURL = "ipc://icelink/ICE.rem";
iceServer =
  CastNETObject[ClientServices`OpenConnection[iceURL],
  "RMDG.ICE.RemoteLibrary.IRemoteServer"];

Getting access to the "outputdeembed" object
myoutputdeembed =
  iceServer@GetActiveSchematic["outputdeembed"];

Setting S-par as function of frequency
s11 = . . . , s12 = . . . . , etc
deembed = Transpose[{{s11, s12}, {s21, s22}}, {2, 3, 1}];

Creating a .NET matrix
deembeddotNET2 = MakeNETObject[deembed,
  "Extreme.Mathematics.DoubleComplex[,]"]

Setting the "outputdeembed" object
myoutputdeembed@SetDeembeddingABCDMatrix[freqList,
  deembeddotNET2, Zc dot NET]
```

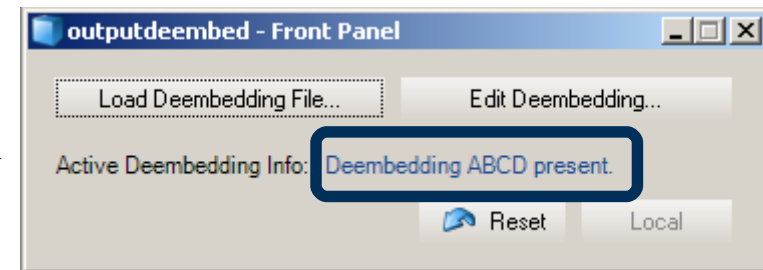
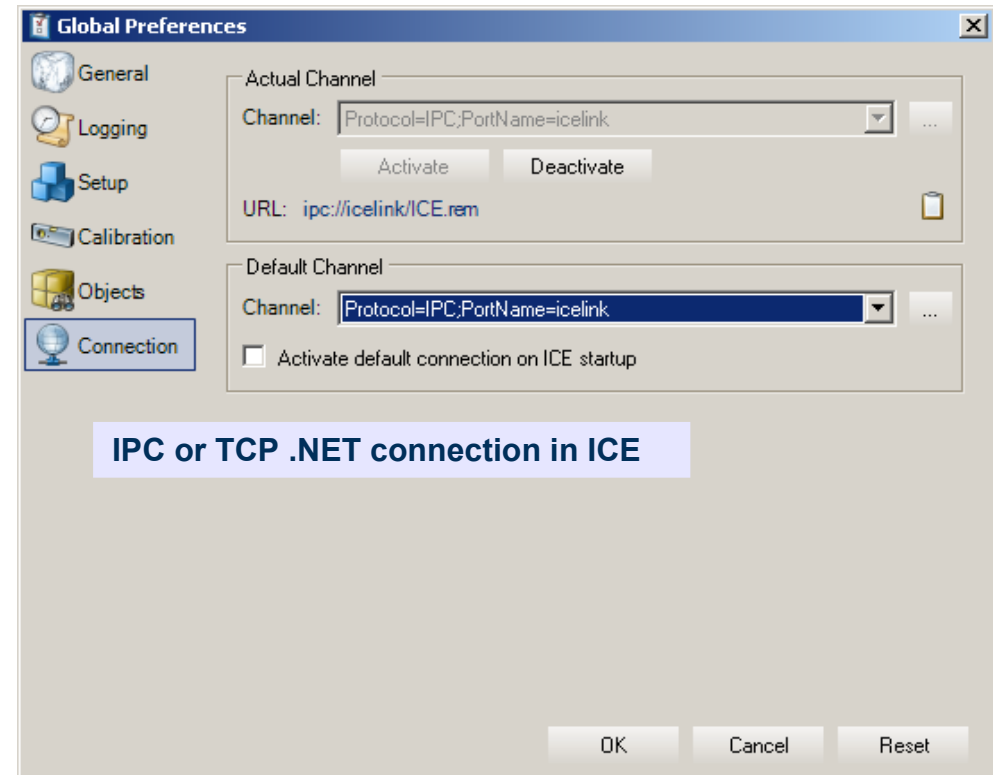
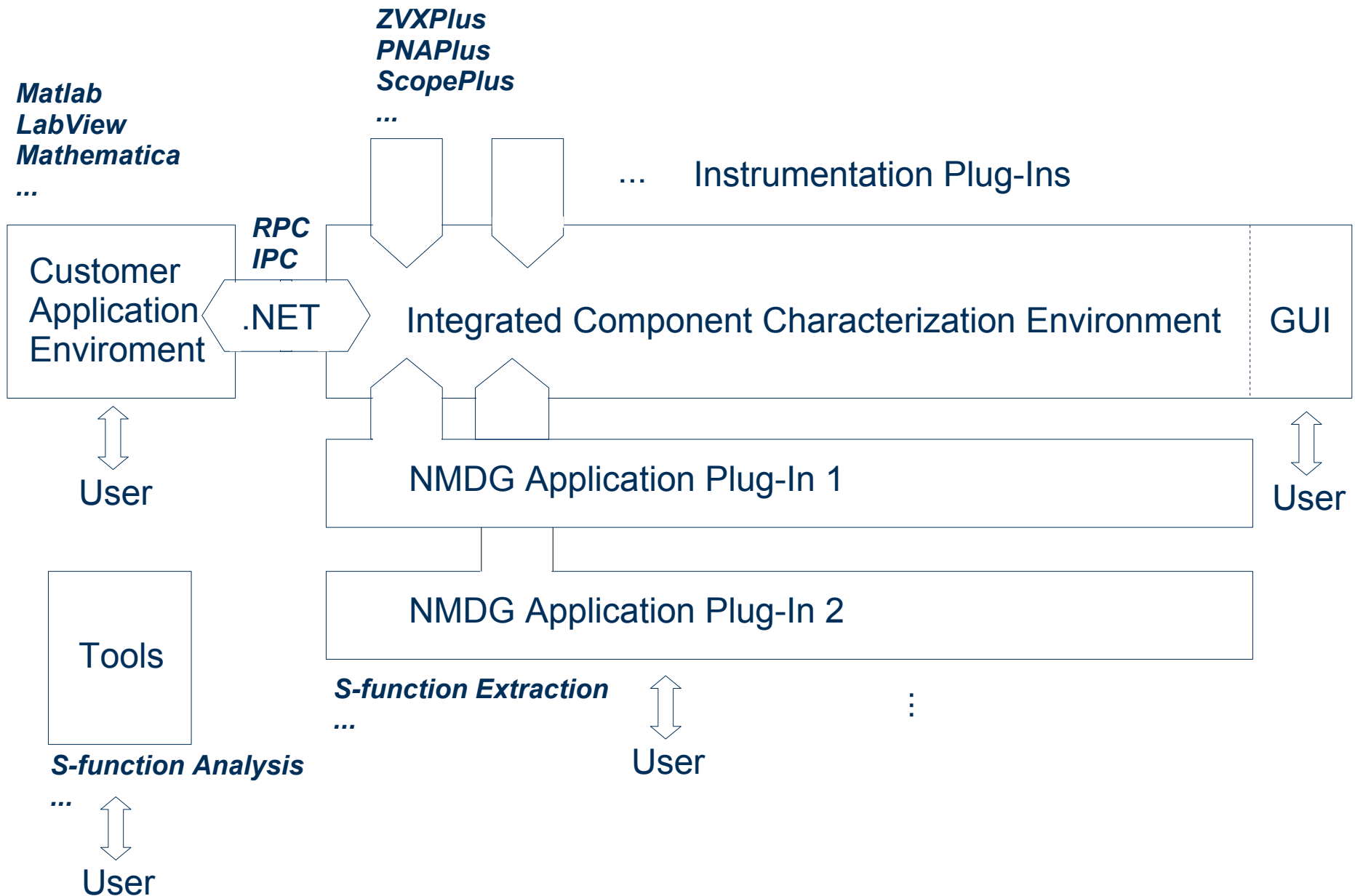


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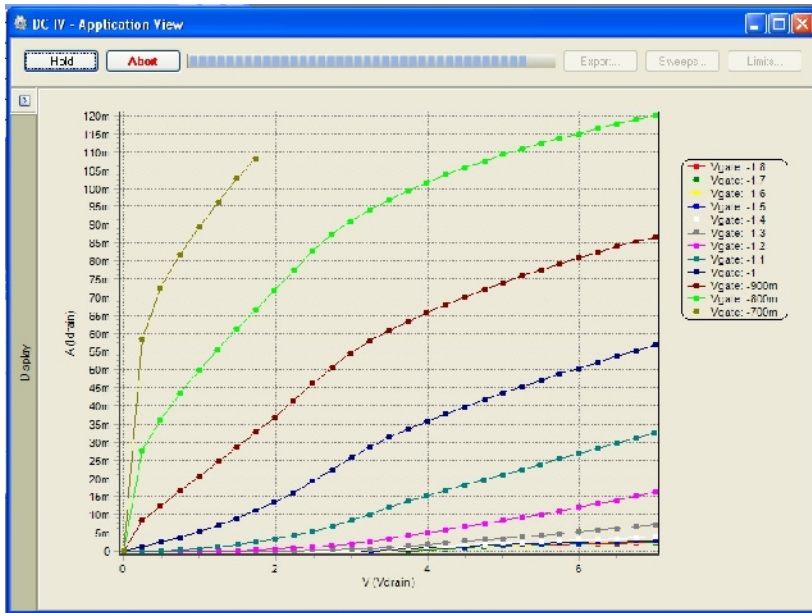
ICE Architecture



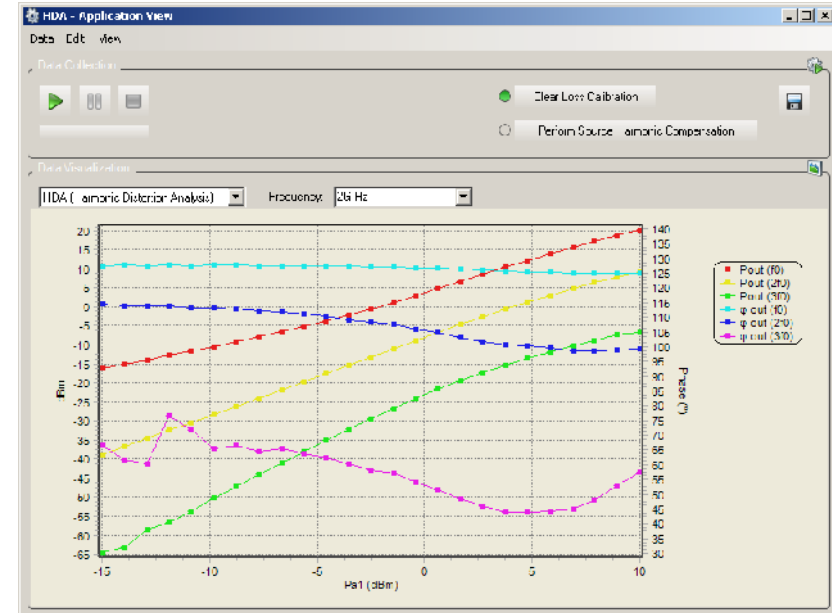
Driver support

- DC Sources
 - R&S, Agilent, ...
 - DC Voltmeters, Currentmeters
 - Agilent, ...
 - DC Force / Sense
 - Keithley, ...
 - RF Source CW and Modulation
 - R&S, Agilent, Anritsu, ...
 - RF Power Meters
 - R&S, Agilent, Anritsu, ...
 - Tuners
 - Focus Microwaves, Maury Microwave
 - Receivers
 - R&S, Agilent, Tektronix, ...
-
- Drivers for different instruments are developed on customer demand

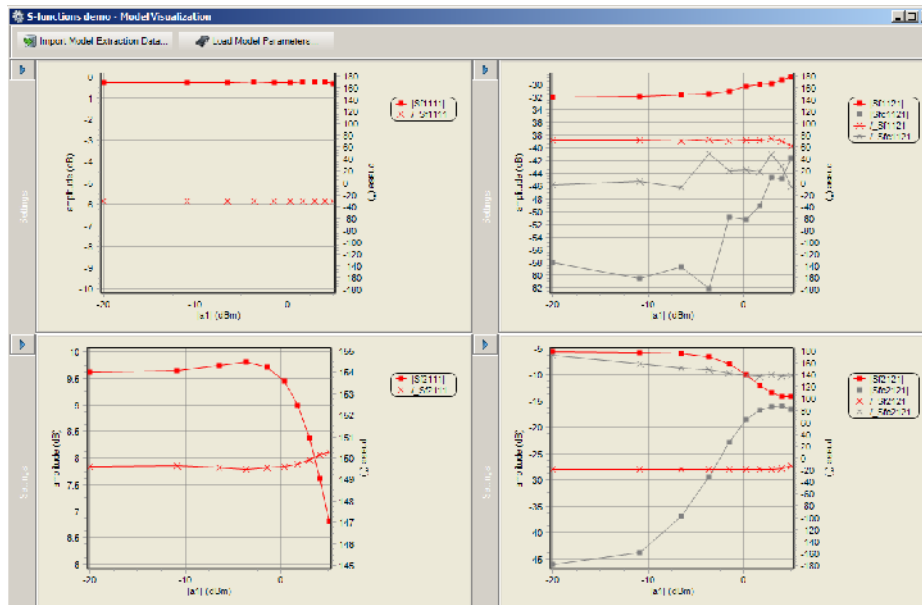
Application Plug-ins



DC IV Characterization



Harmonic Distortion Analysis



S-functions

More to come ...

Conclusion

- ICE is your “real-life simulator”
 - Tune your different stimuli
 - Observe in pseudo real-time
 - Gain insight in the behaviour of your active RF components
 - Optimize the specifications with strong guidance
- ICE is the base platform for applications, solving customer problems
- ICE is made to incorporate the latest advancements in HF measurement science
- ICE is based on the latest software technologies to realize a fast development cycle focusing on the measurement problems

For more information

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www.nmdg.be

Want to try?

Request a Free Trial ICE copy here:

http://www.nmdg.be/register_freeICEsoftware.php