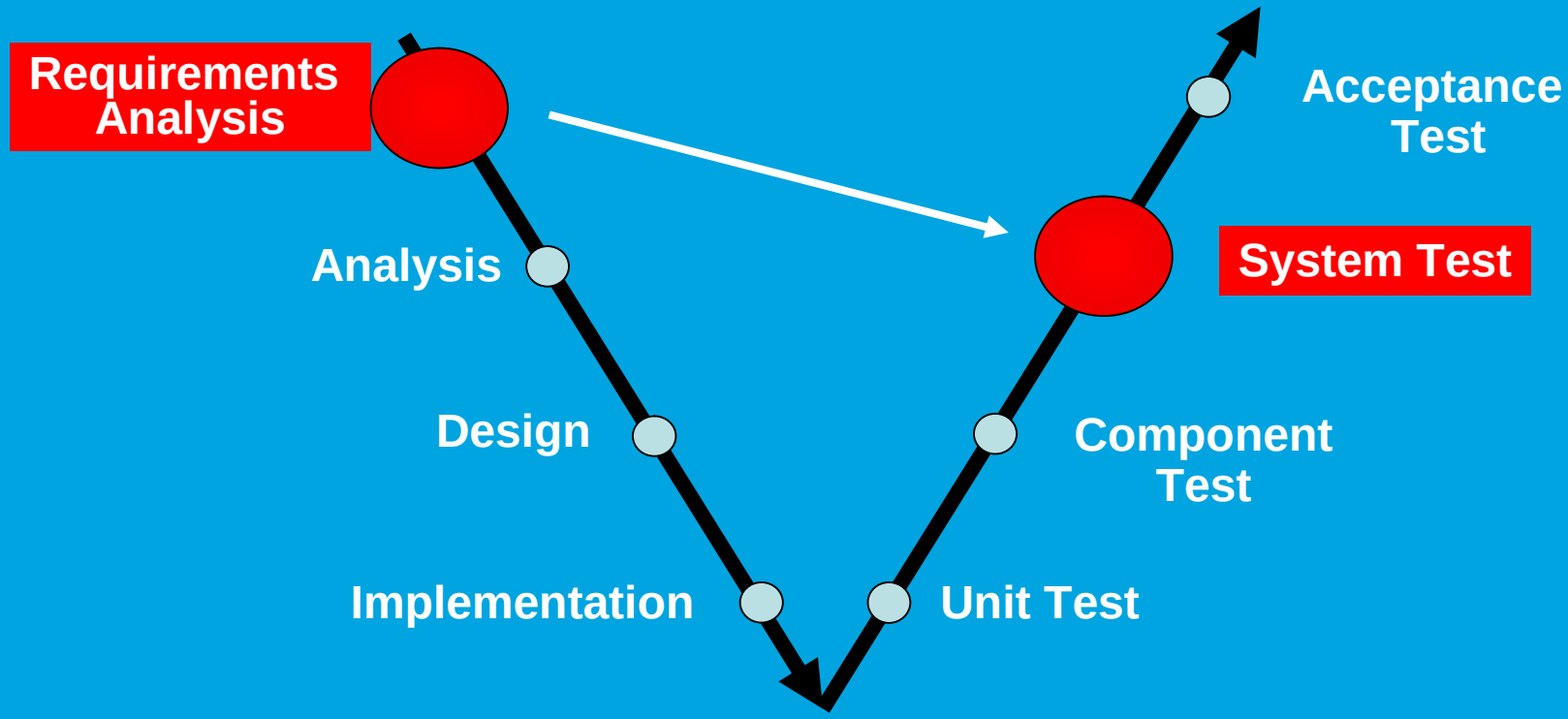


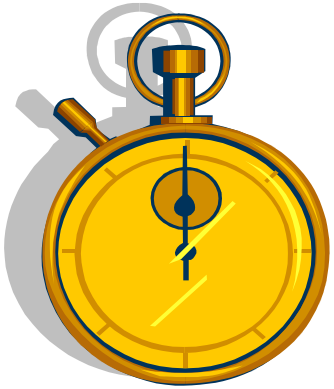
New Ways of Test Automation

MC-ST: Framework for System Test Automation with UML and LabVIEW

MICRO CONSULT

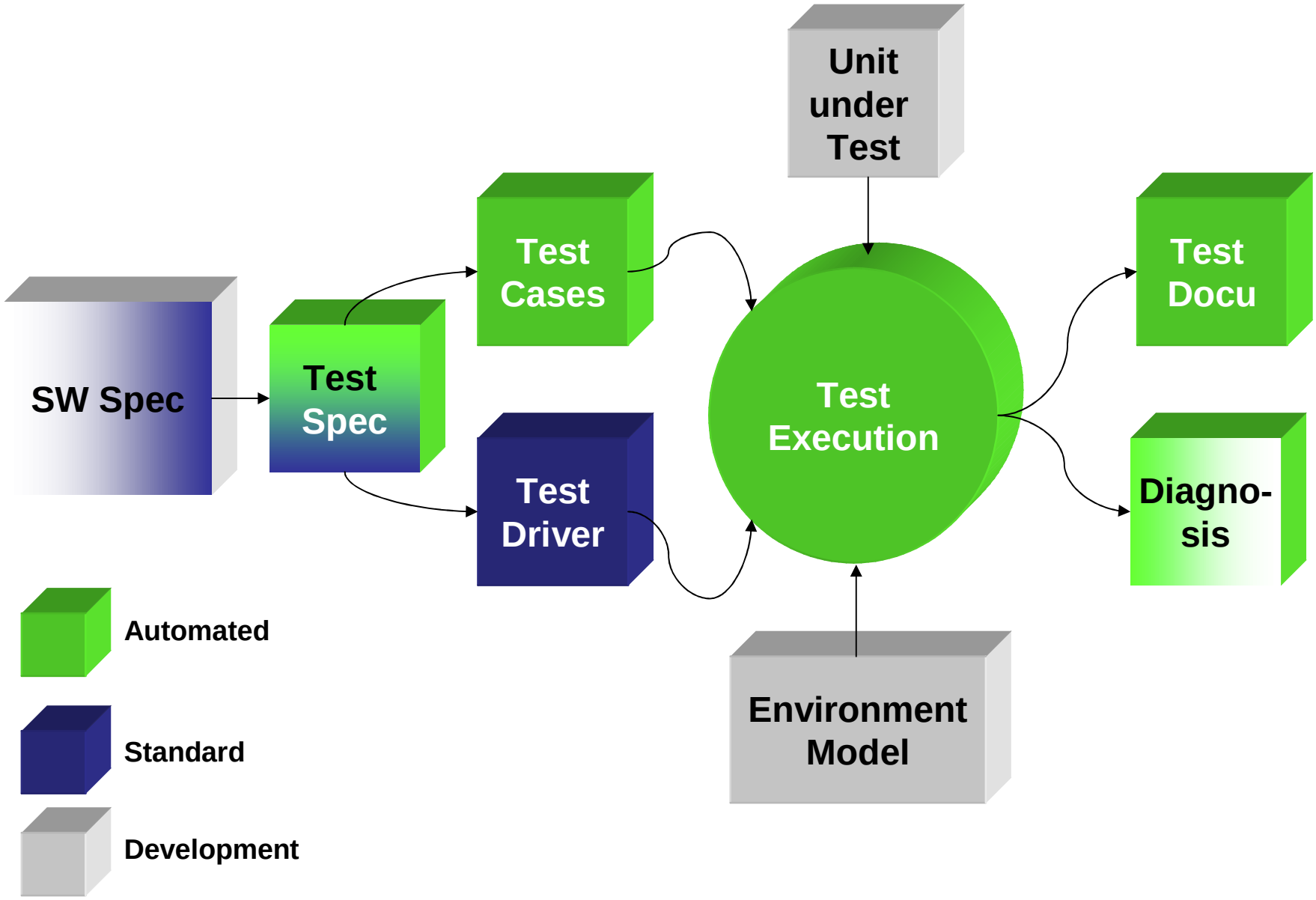
Costs

Time



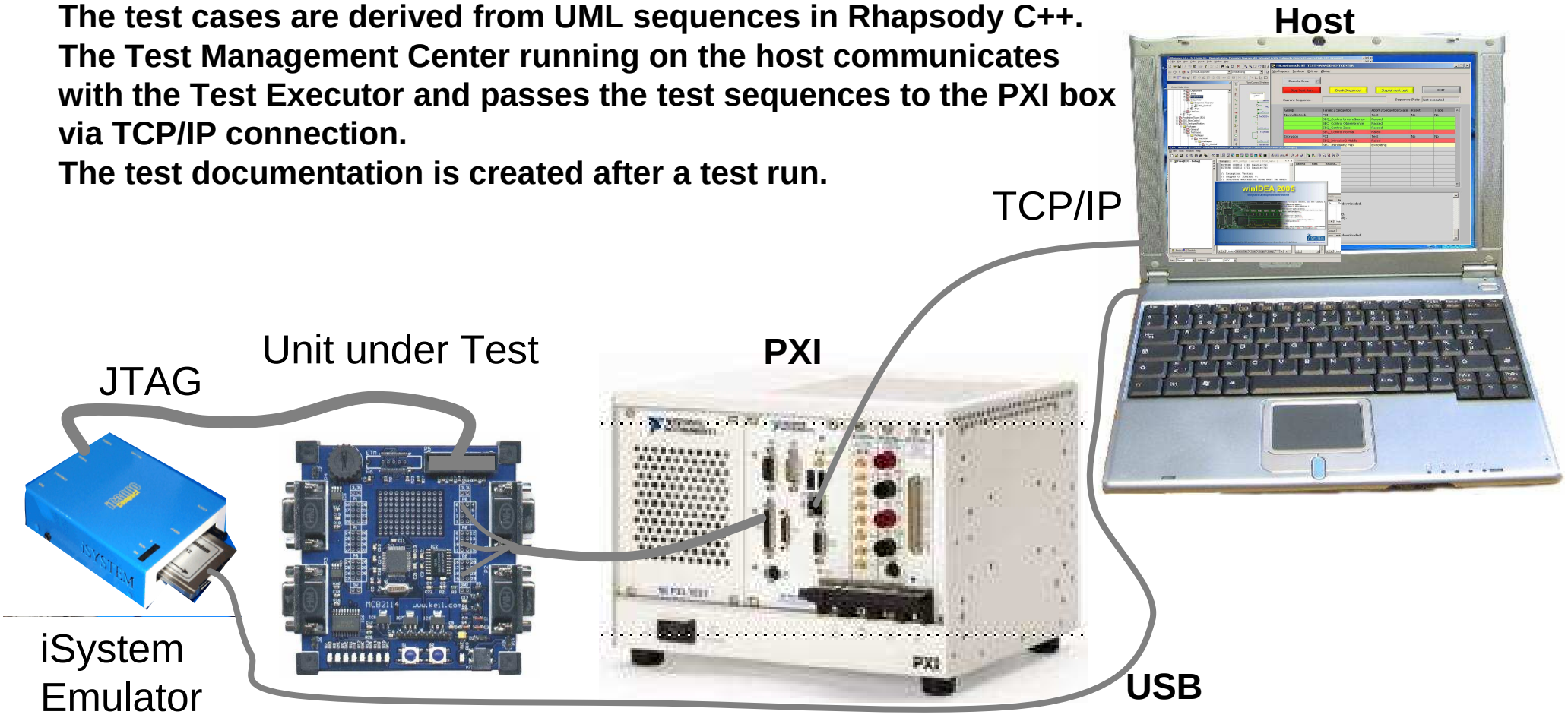
Quality

Q

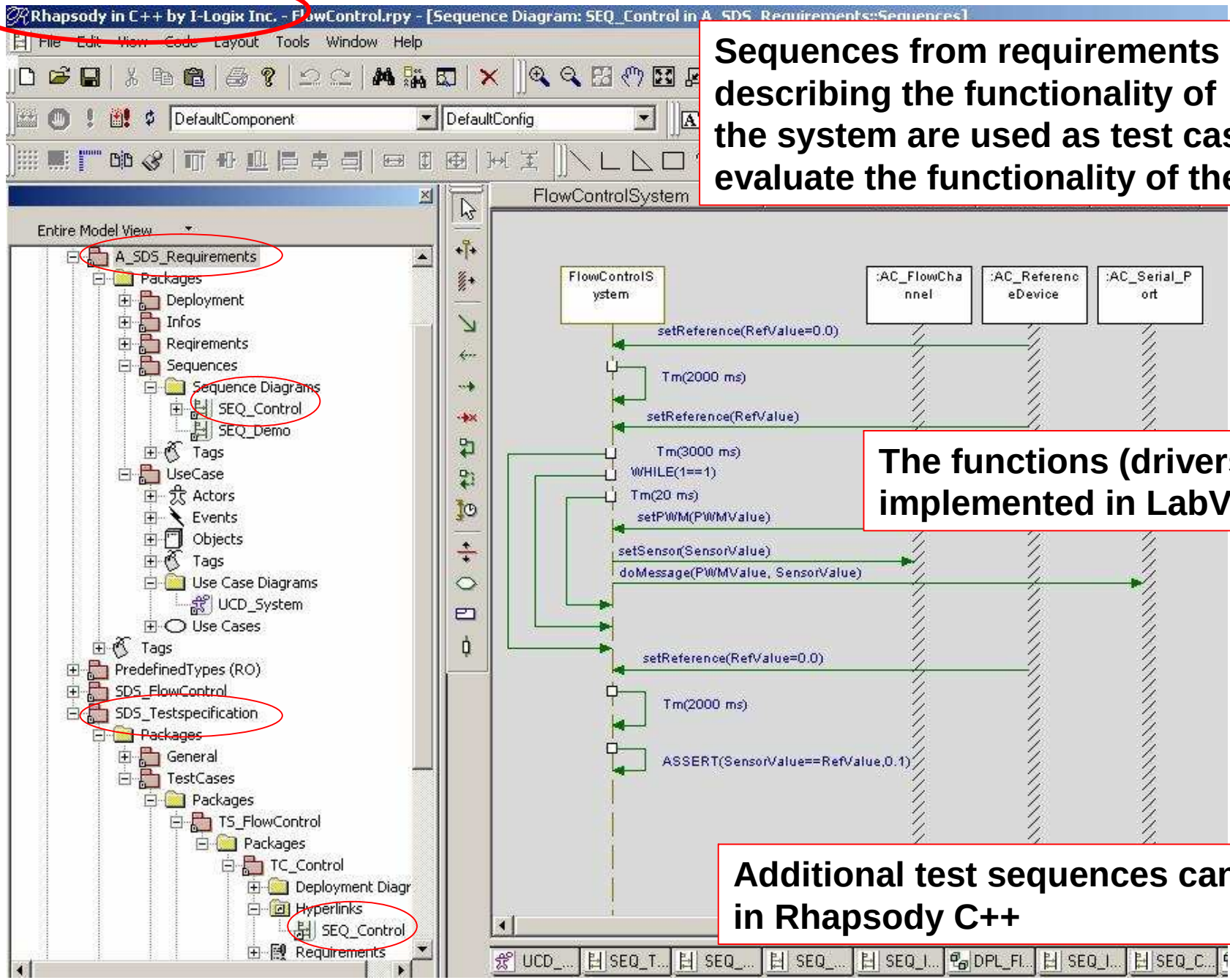


Automated System Tests with MicroConsult System Test, MC-ST

MC-ST is a framework for automated system tests with UML and LabVIEW.
MC-ST consists of the Test Management Center, Test Executor and Test Configurator by MicroConsult.
The Test Executor runs on the PXI Box. It contains the test drivers and executes the test sequences modeled in Rhapsody C++, simulating the environment.
Test cases can be parameterized and composed to test sequences using the Test Configurator.
The test cases are derived from UML sequences in Rhapsody C++.
The Test Management Center running on the host communicates with the Test Executor and passes the test sequences to the PXI box via TCP/IP connection.
The test documentation is created after a test run.



MICRO CONSULT



Sequences from requirements analysis describing the functionality of the system are used as test cases to evaluate the functionality of the system.

The functions (drivers) have to be implemented in LabVIEW.

Additional test sequences can be modeled in Rhapsody C++

Software Specification -> Test Specification -> Test Cases

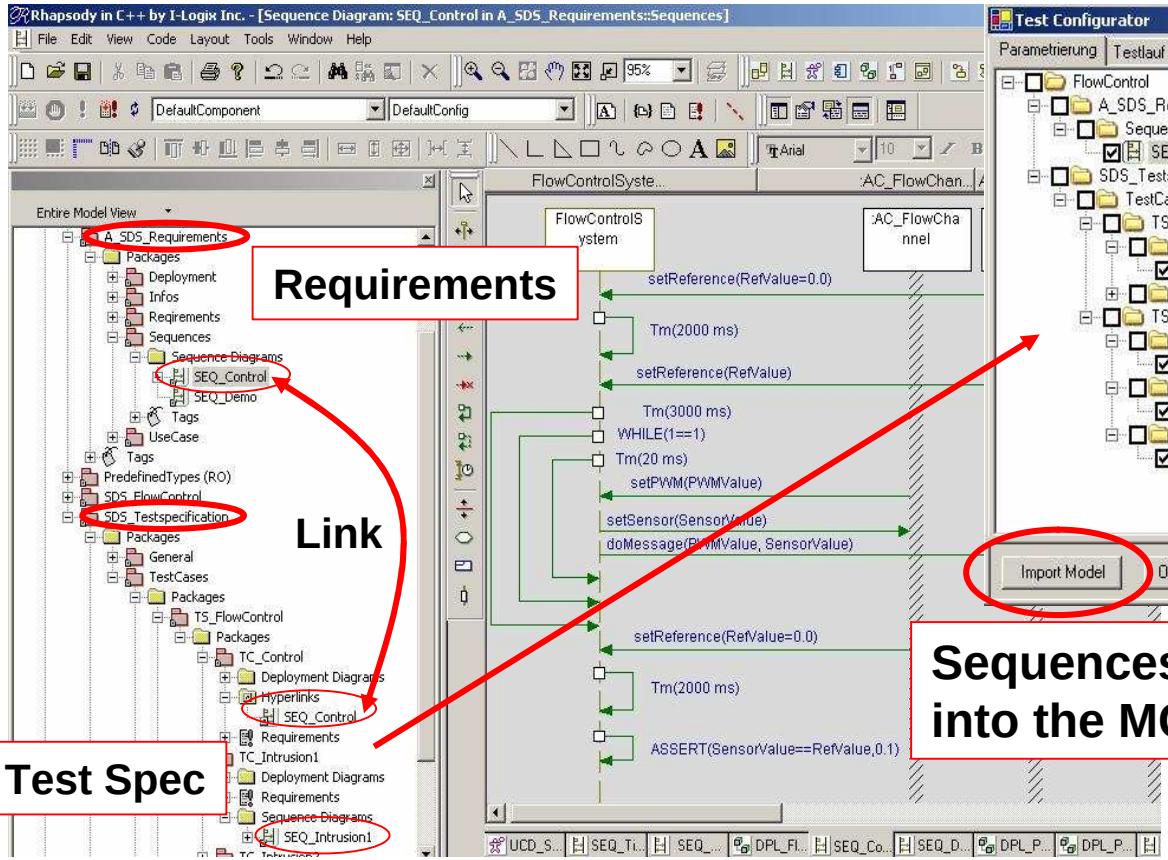
Host

Rhapsody in C++

Test Sequences

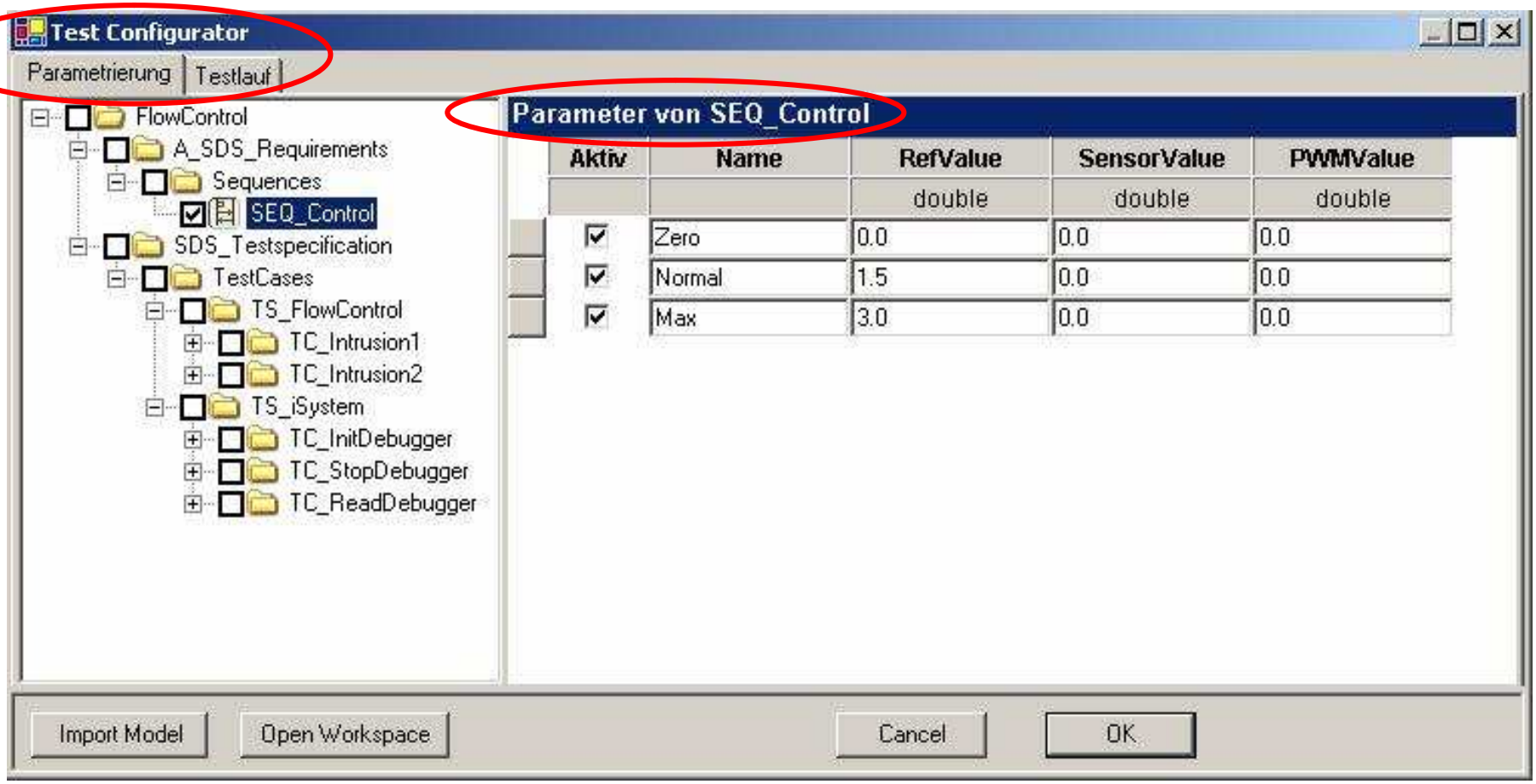
Test Management Center

Protocols



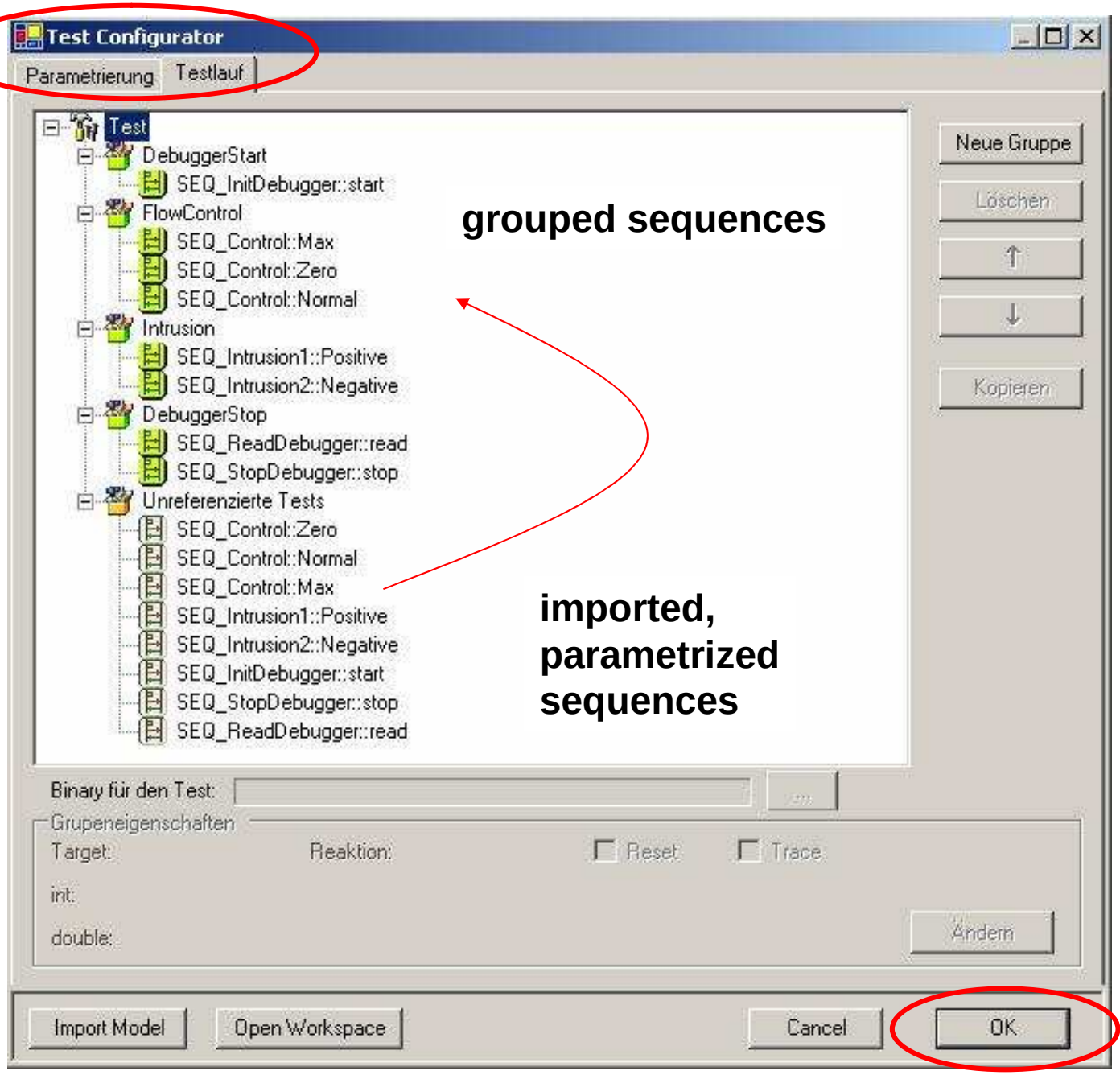
MICRO CONSULT

Parameterization of Test Cases with the Test Configurator

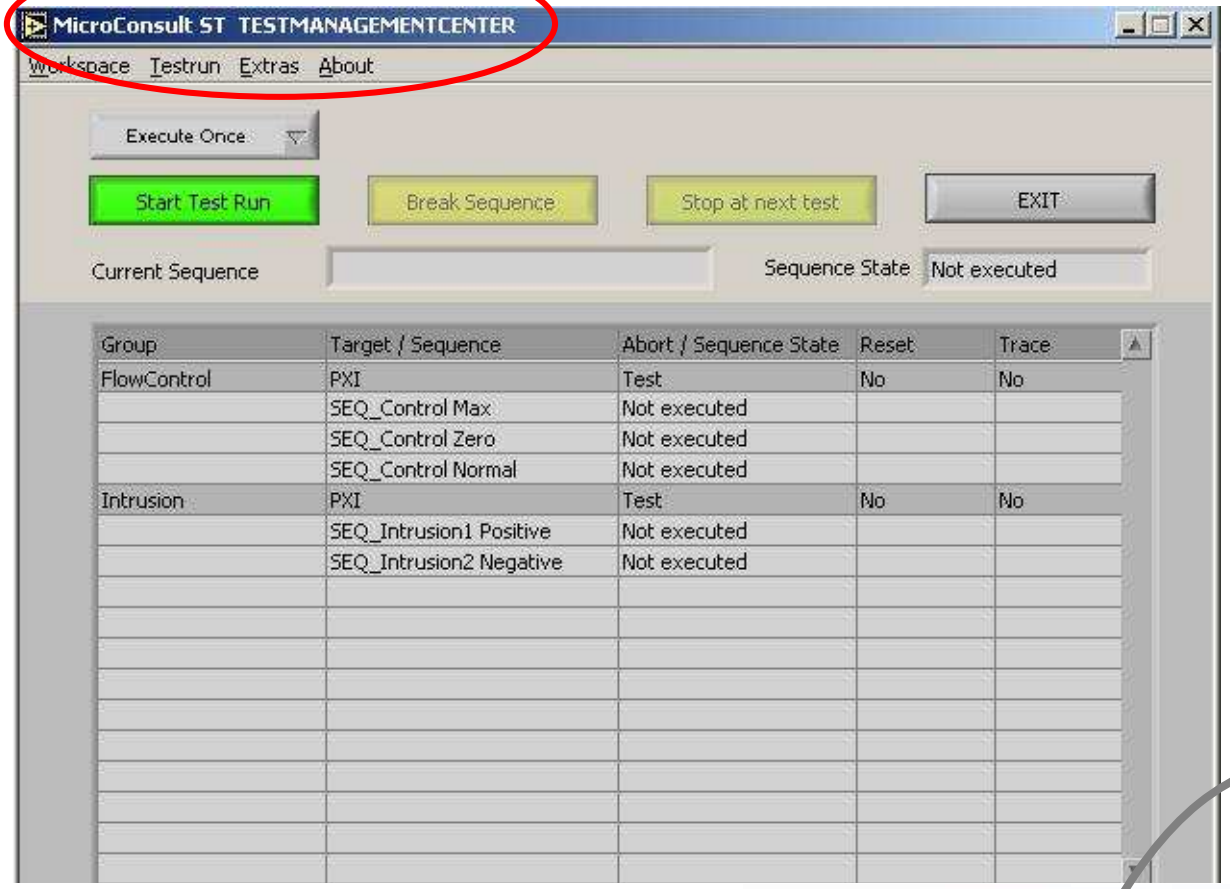


One sequence diagram can be used for several test cases with different parameters.

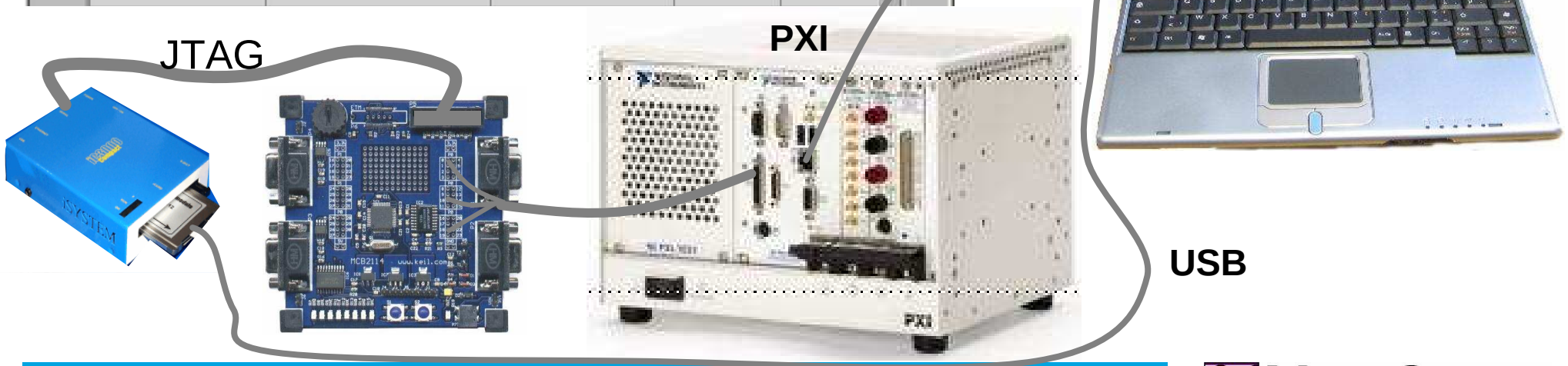
Import of Test Sequences from Rhapsody into the Test Configurator



The test sequences can be grouped and sorted.

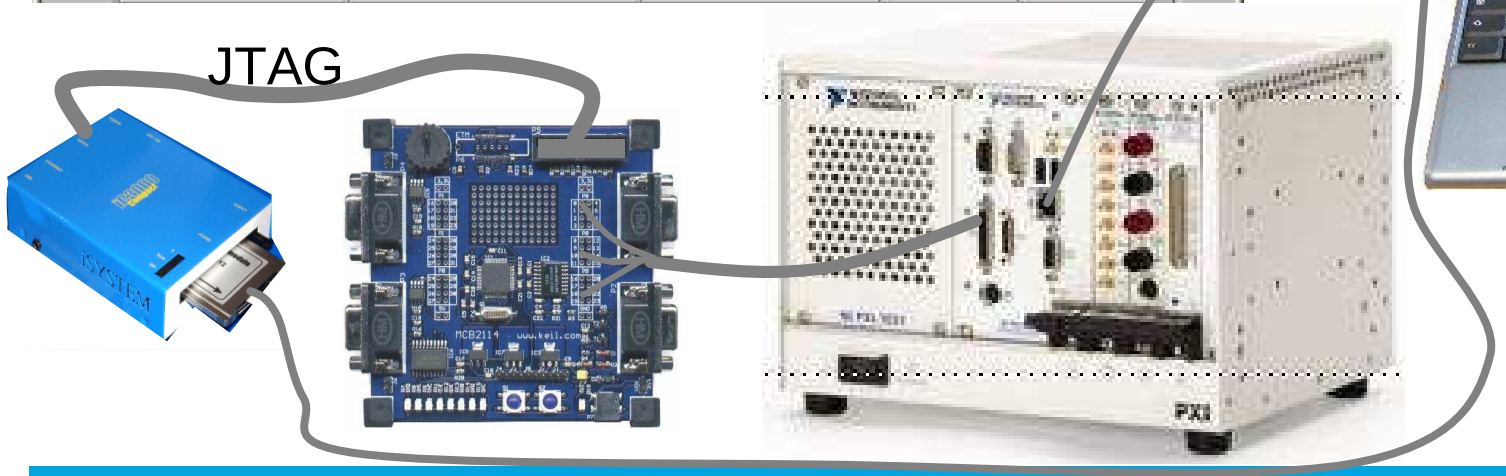


The sorted and parameterized tests are loaded into the Test Management Center.

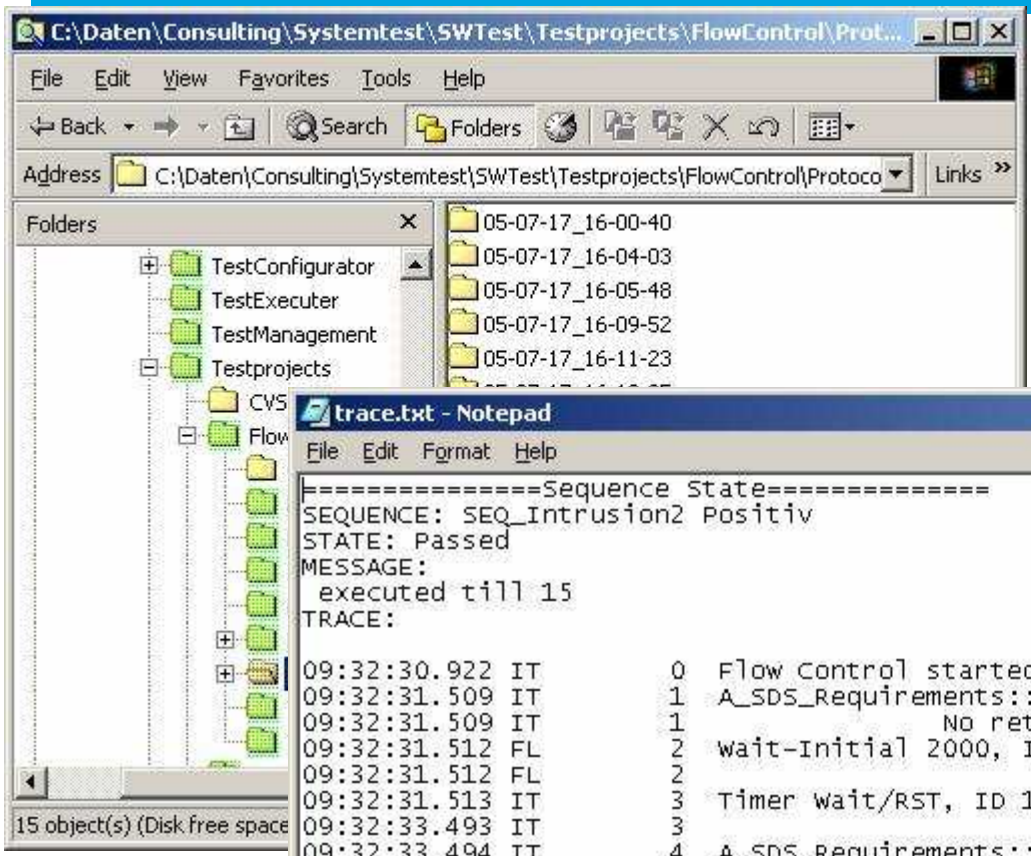


The Test Executor and the drivers are loaded down into to the PXI Box.

The Test Management Center passes the tests on to the Test Executor running on the PXI Box. Tests are executed.



After a test run, protocols are filed in a protocol directory.



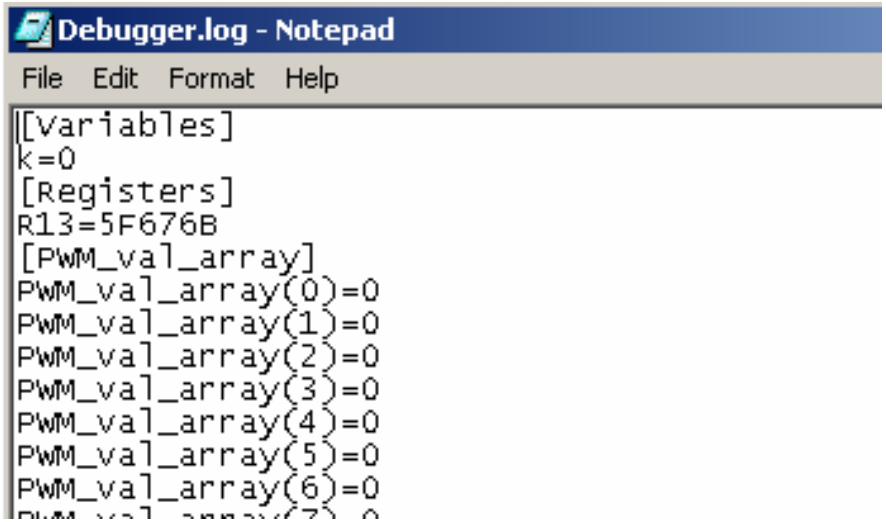
The trace protocol shows each step of the test run.

trace.txt - Notepad

File Edit Format Help

```
==============Sequence State==============
SEQUENCE: SEQ_Intrusion2 Positiv
STATE: Passed
MESSAGE:
 executed till 15
TRACE:

09:32:30.922 IT        0  Flow Control started.
09:32:31.509 IT        1  A_SDS_Requirements::UseCase::FlowControlSystem.FlowControlSystem.setReference
09:32:31.509 IT        1                  No return,0.000000
09:32:31.512 FL        2  Wait-Initial 2000, ID 1
09:32:31.512 FL        2
09:32:31.513 IT        3  Timer Wait/RST, ID 1
09:32:33.493 IT        3
09:32:33.494 IT        4  A_SDS_Requirements::UseCase::FlowControlSystem.FlowControlSystem.setReference
09:32:33.494 IT        4                  No return,1.500000
09:32:33.495 IT        5  Wait-Initial 3000, ID 2
09:32:33.495 IT        5
09:32:33.496 IT        6  Timer Wait/RST, ID 2
09:32:36.467 IT        6
09:32:36.468 FL        7  A_SDS_Requirements::UseCase::AC_FlowChannel.AC_FlowChannel.setIntrusion2
09:32:36.468 FL        7                  No return,0.700000
09:32:36.469 IT        8  Wait-Initial 7000, ID 3
09:32:36.469 IT        8
09:32:36.470 IT        9  Timer Wait/RST, ID 3
09:32:43.407 IT        9
09:32:43.407 FL       10  A_SDS_Requirements::UseCase::AC_FlowChannel.AC_FlowChannel.setSensor
09:32:43.424 IT       10                  No return,1.499108
09:32:43.427 FL       11  A_SDS_Requirements::UseCase::FlowControlSystem.FlowControlSystem.setReference
09:32:43.427 FL       11                  No return,0.000000
09:32:43.427 IT       12  Wait-Initial 2000, ID 4
09:32:43.427 IT       12
```

Testprotokoll		lfd. Nr.:	Default Workspace Name_86
		Datum:	17.07.2005 17:23:13
Projekt:			
Projekt-Nr.:	**Flow Control 001**		
Projektname:	Flow Control Test Project		
Beschreibung:			
Test project for flow control. Test driver with data management.			
vorgelegt von			
Name/Abt.:	Rosenthal	Telefon:	+49(0)89 450617 62
		E-Mail:	[redacted]
Ausgeführte Testfälle:			
Beschreibung der Testfälle	- SEQ_Control: Standard Use Case for controller - Countinous test		
Testfälle Statistik:	Klassifikation:	Absolut	% bezogen auf Anzahl
	Anzahl:	244	100
	Ausgeführt:	243	100
	Passed	243	100
	Failed	0	0
	Execution Error	1	0
Ausführung:			
Testobjekt:	Flow Channel Control		
Testumgebung: (Konfiguration, Test-	HIL, PXI, PXI-6221 MDAQ		



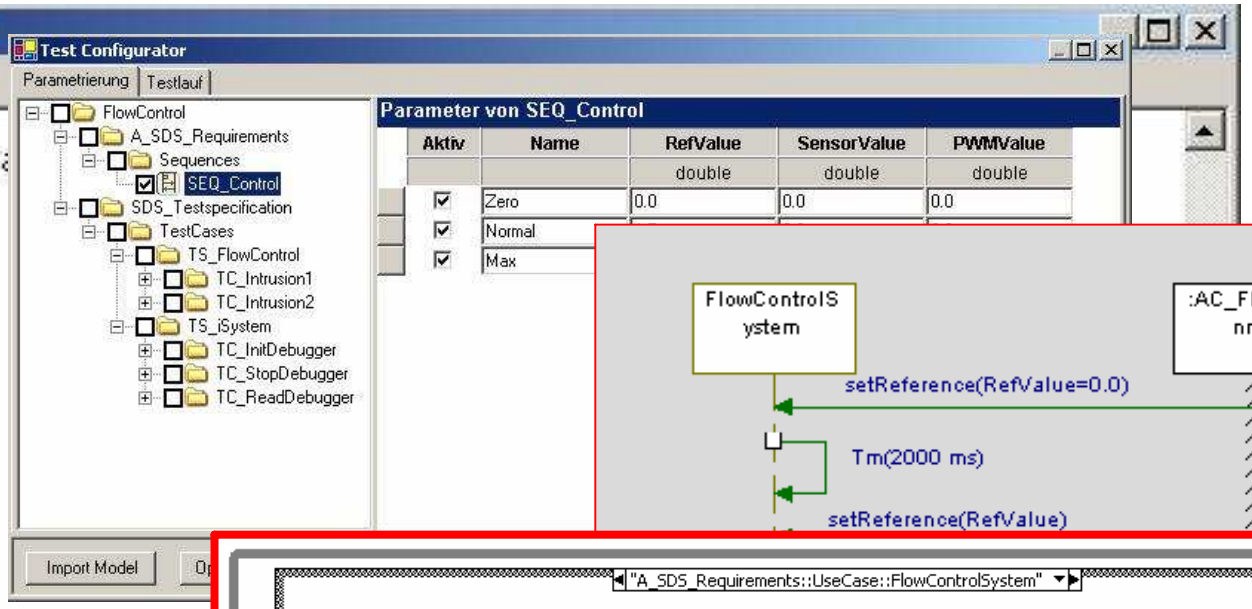
The debugger log file contains the read-out register and variable values. The values are read out using the JTAG emulator.

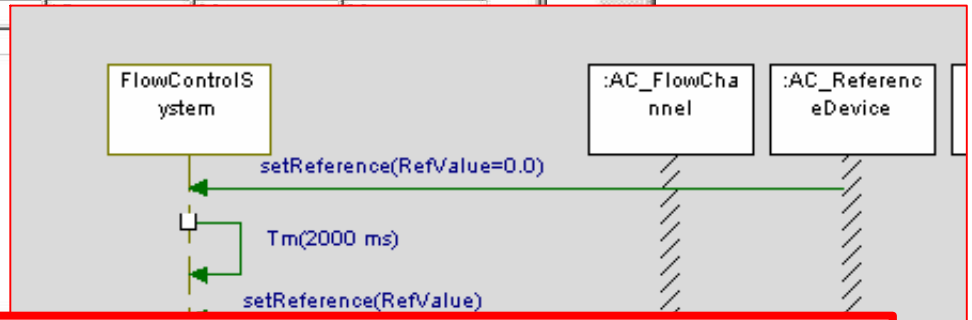
A test protocol according to IEEE 829 is created.

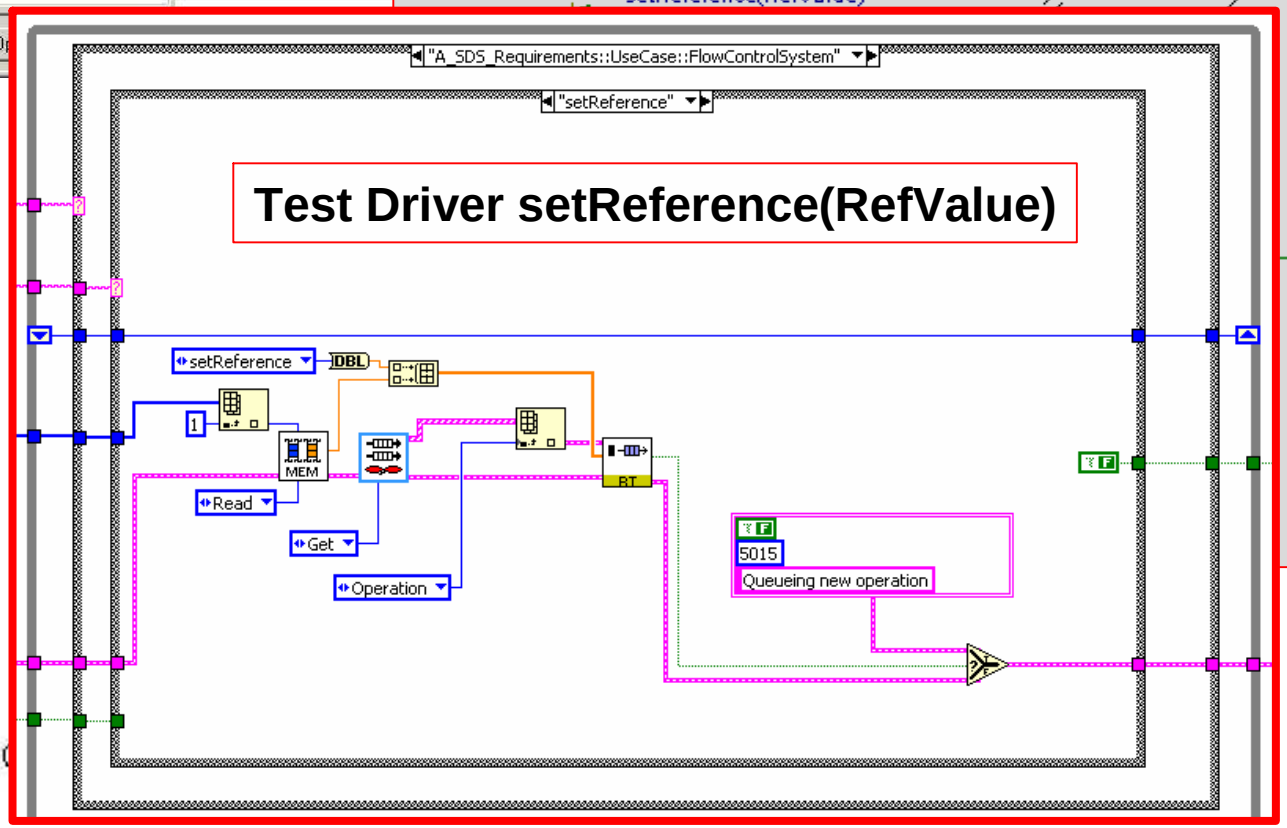
SEQ_Control.tst - Notepad

File Edit Format Help

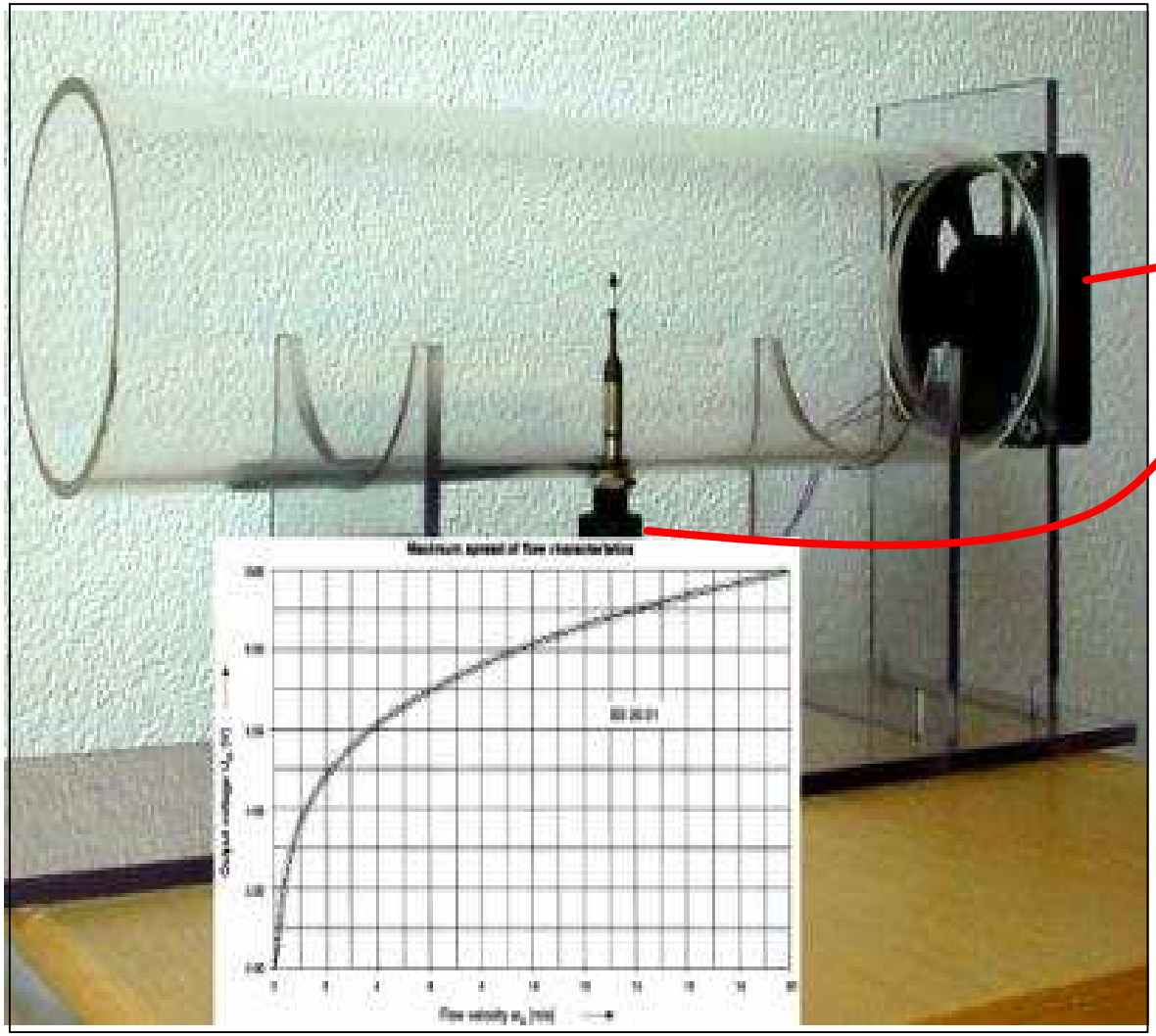
```
[sequence]
Name=SEQ_Control Norma

[parameters_int]
2000 const
20 const
1 const
3000 const

[parameters_double]
1.5 RefValue
0 SensorValue
0 PWMValue
0.0 const
0.1 const

[parameters_string]

[steps]
1 1 2 2 0 40000004
7 0 3 4 1 80000001 3 3
8 0 4 1 1
1 1 5 2 0 40000001
7 0 6 4 3 80000004 3 d
4 0 7 4 80000003 0 80000003 d
7 0 8 4 2 80000002 3 b
1 2 9 2 0 40000003
1 3 a 2 0 40000002
1 4 b 3 0 40000003 40000002
8 0 c 1 2
0 0 6 0
8 0 e 1 3
1 1 f 2 0 40000004
7 0 10 4 4 80000001 3 10
8 0 11 1 4
6 0 12 4 40000002 0 40000001 40(
```

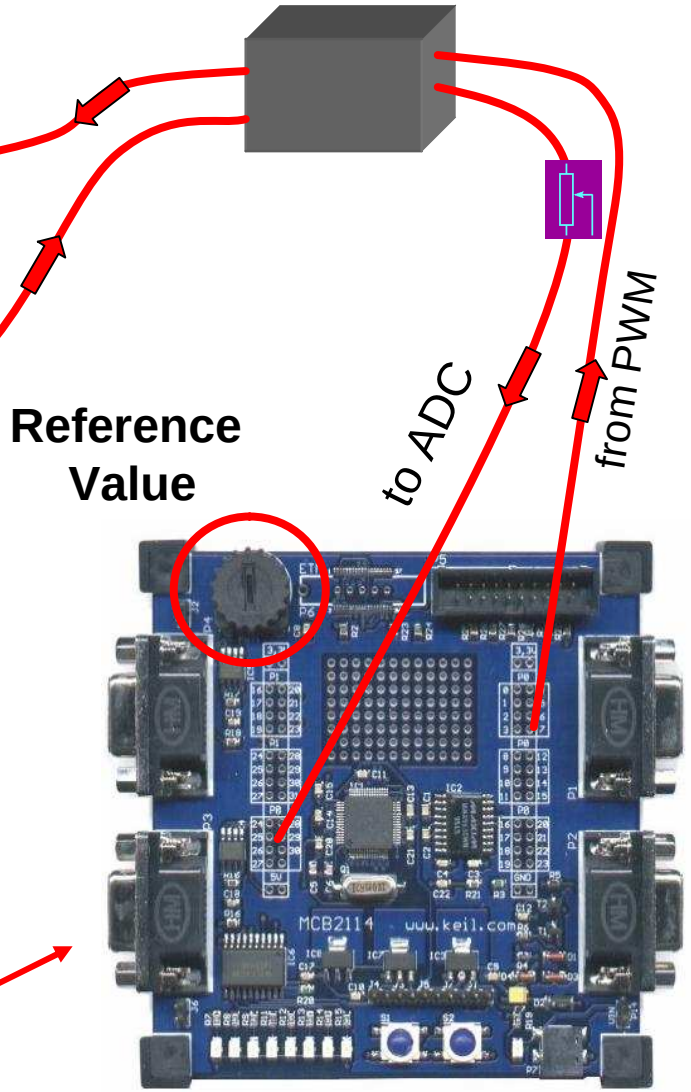






Constant air flow in the flow channel

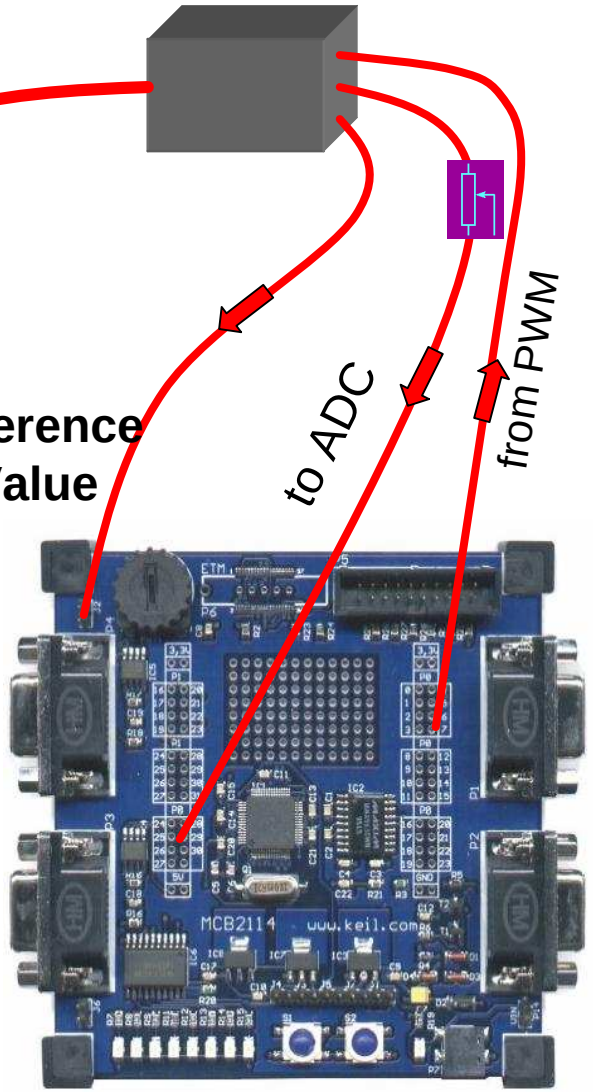




Constant air flow in the flow channel

PXI

Environment Model



Control Device

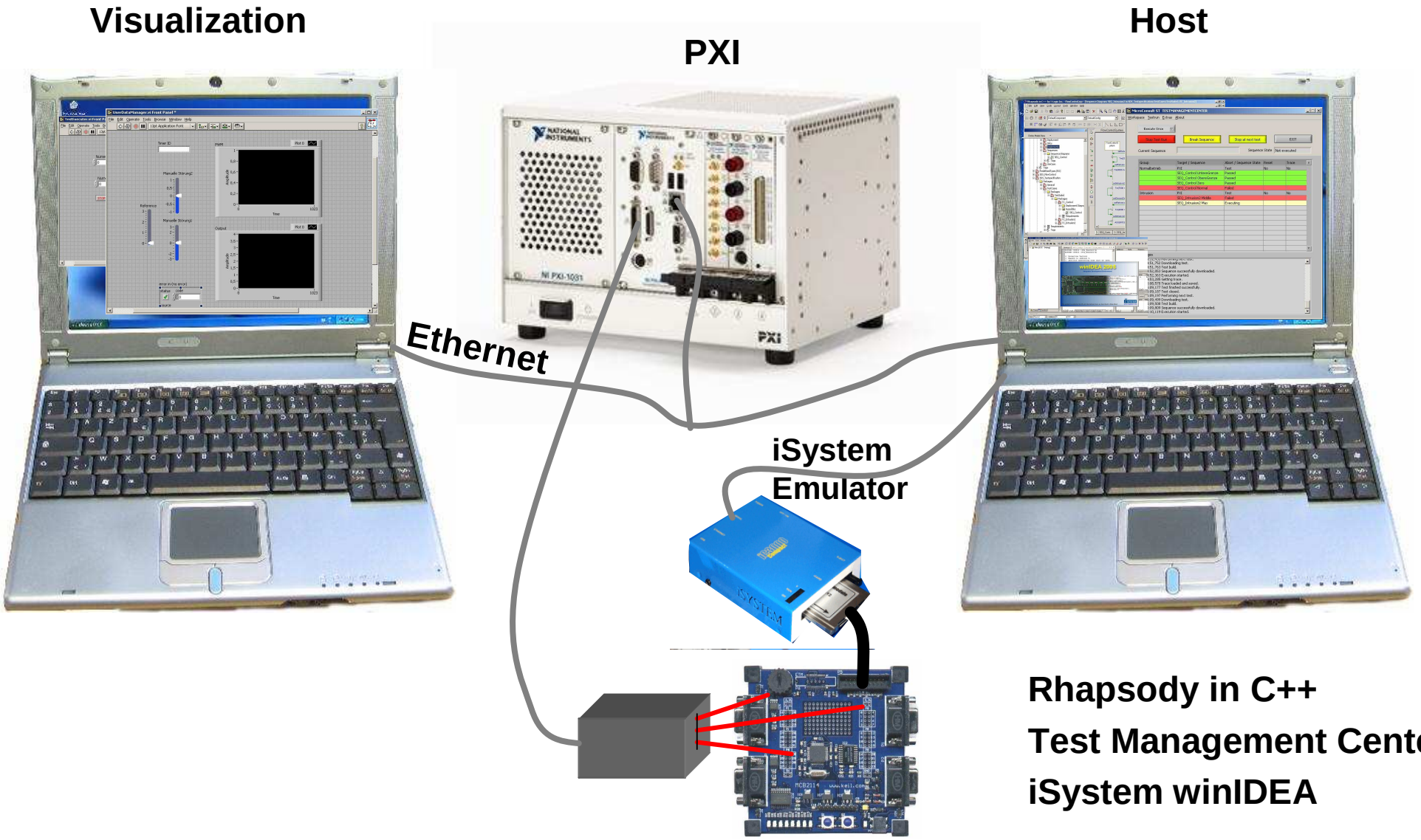
Constant air flow in the flow channel

PXI

Environment Model

PXI

Control Device



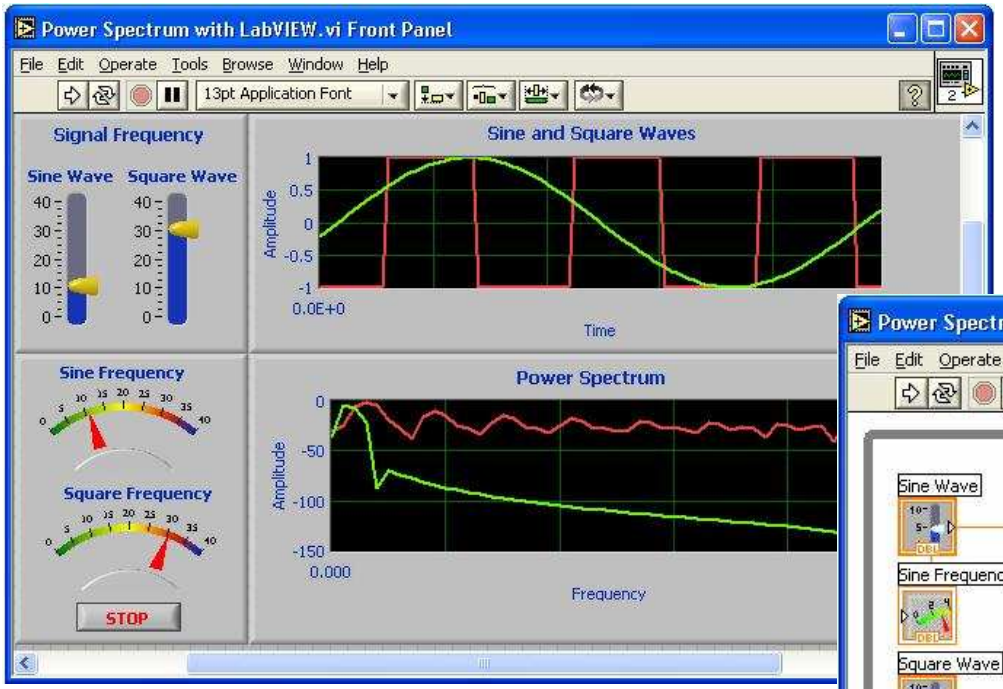
Rhapsody in C++

Test Management Center

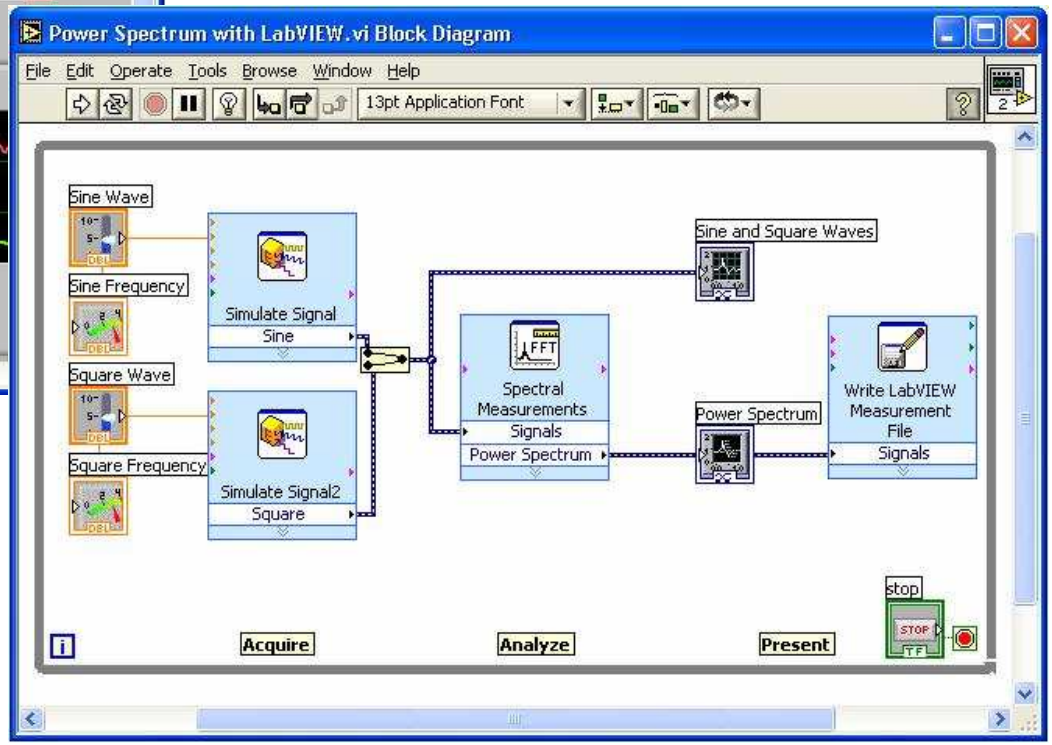
iSystem winIDEA

PXI offers a standardized, open hardware platform
for generating, measuring and displaying signals
with more then 1000 I/O-cards from many different manufacturers.

With LabVIEW, you can program a test environment for generating, measuring and displaying signals graphically.



User Interface



LabVIEW controls Debugger

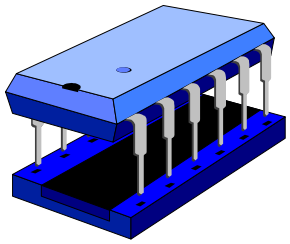
- Download
- Flash programming
- Program start/stop
- Variable read/write
- Register read/write
- Profiling

PC Sequencer as SIL

- no real-time

PXI System as HIL

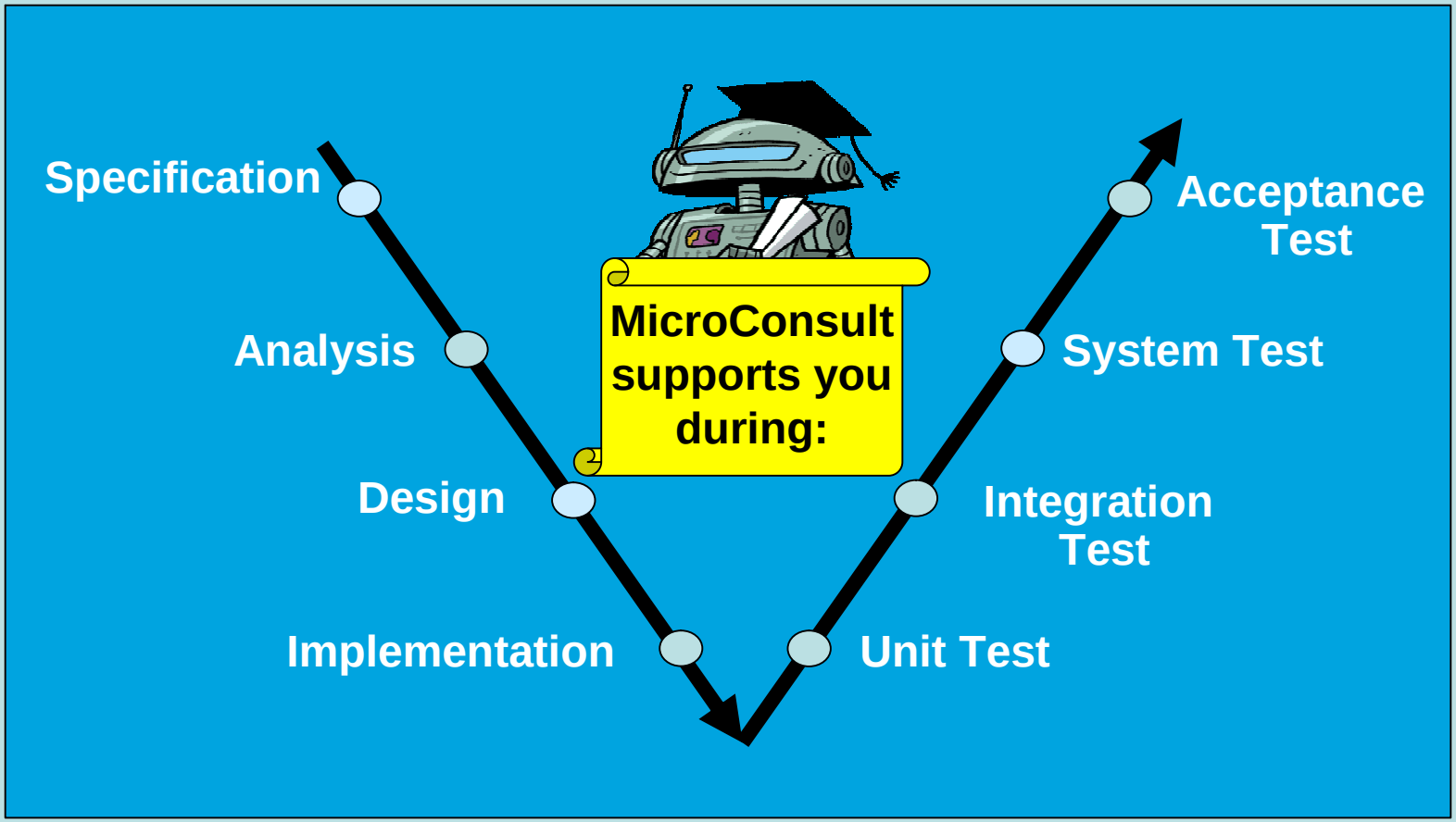
- >= 1 ms



FPGA as HIL

- >= 25 ns

Consulting, Training, Workshops, Coaching, Engineering



HW /SW Technologies, Tools, Methods, Process, Team