



NIDays



Keep Your PXI System Busy: Optimize RF Automation with NI-RFmx

George Tsalavoutis
Application Engineering Specialist

Agenda

- Wireless Technology and Automated Test
- PXI Platform
- Introduction to NI-RFmx
- Optimizing for Utilization
- More Speed with the FPGA

The Proliferation of Wireless Is Just Beginning



50 BILLION
DEVICES CONNECTED BY 2020

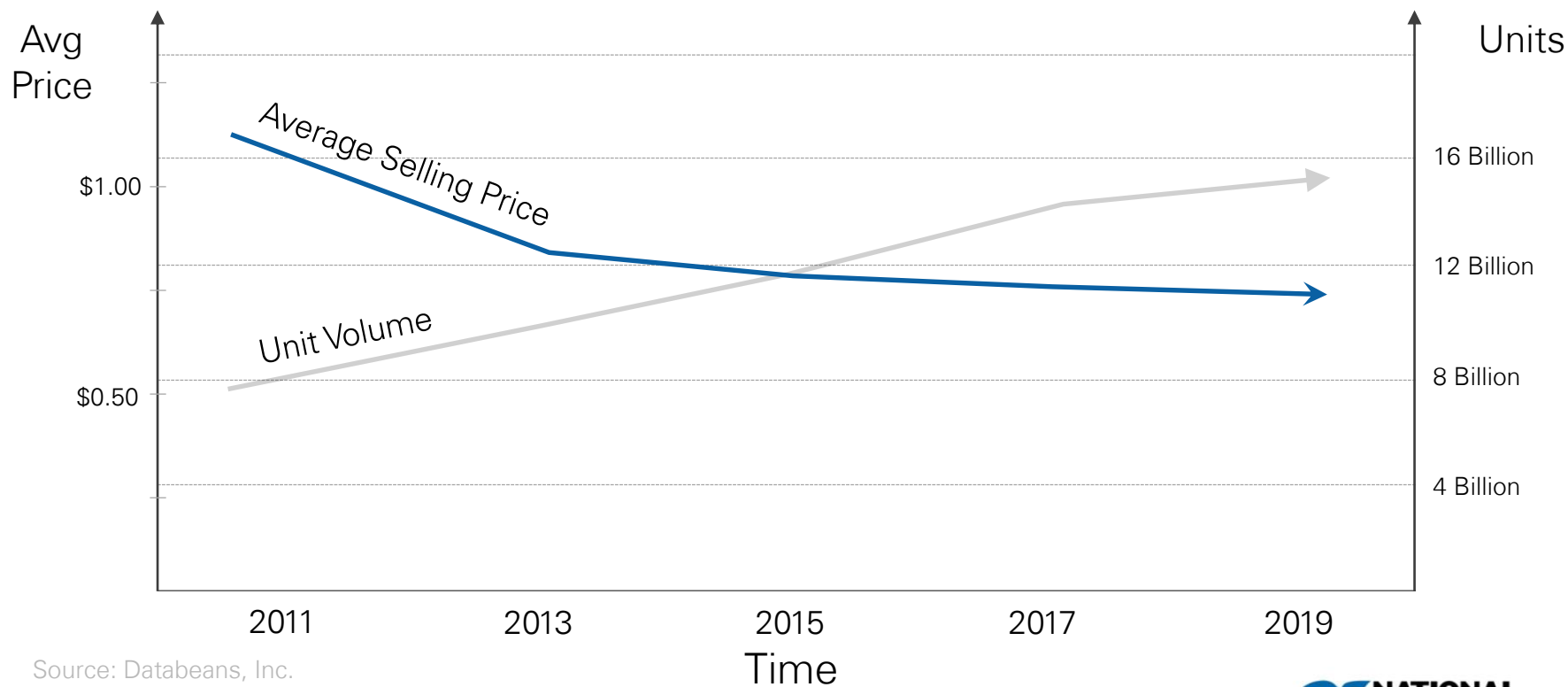


1.9 BILLION
SMART PHONES



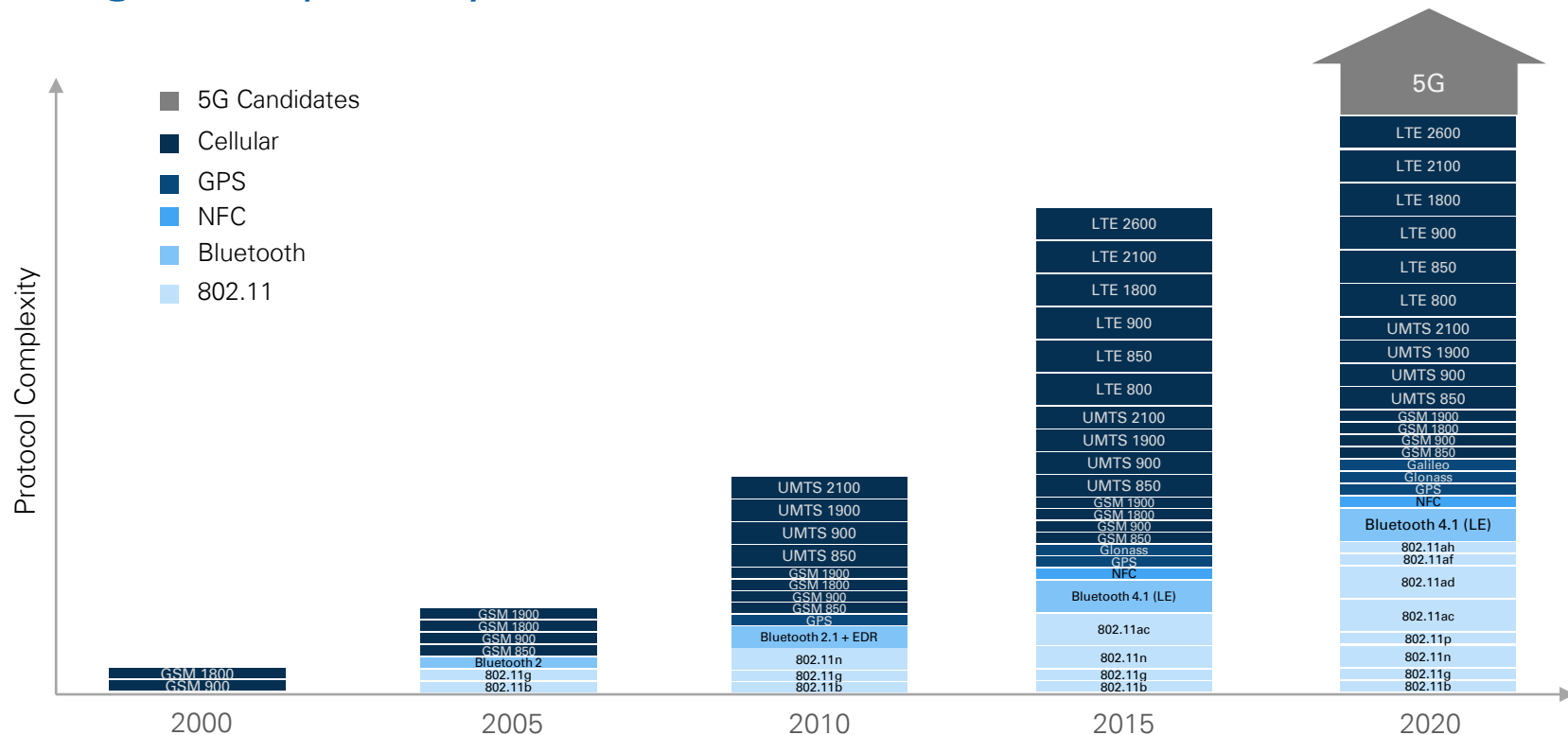
85%
EMBEDDED DEVICES TODAY
ARE UNCONNECTED

The Decreasing Cost of Wireless RFICs



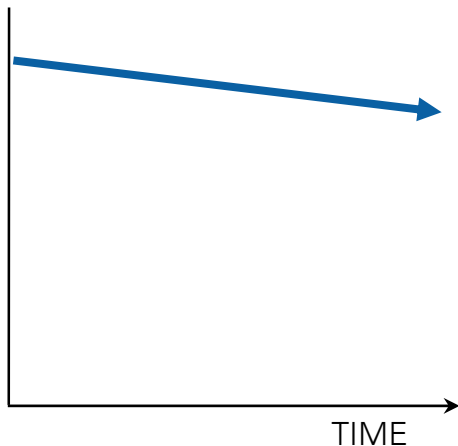
Source: Databeans, Inc.

Rising Complexity of Wireless Test

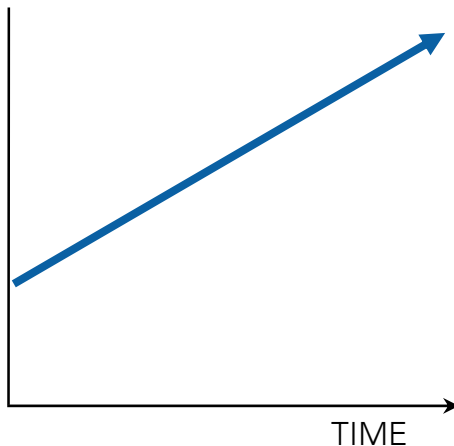


Test Efficiency Is Key to Staying Profitable

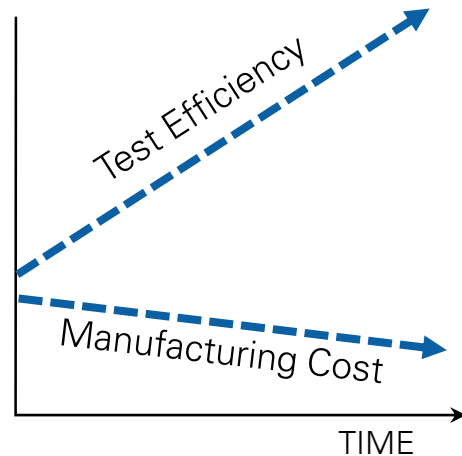
Wireless chipset cost



Wireless complexity



Test implications



"To remain profitable in the future, companies will need to rethink their approach for wireless test and embrace new paradigms." —[Olga Shapiro, Analyst, Frost & Sullivan](#)

Challenges with Traditional RF Instrumentation



Traditional Rack and Stack

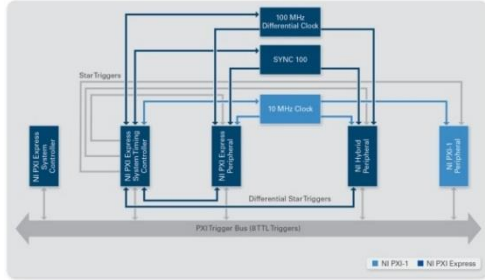
- Expensive
- Slow
- Rigid Vendor Defined
- Not Scalable
- Lack of Integration

Traditional ATE

- Very Expensive
- High Maintenance Cost
- Large Size
- High Power Consumption
- Single Vendor Integration
- Proprietary Interface



PXI System Overview

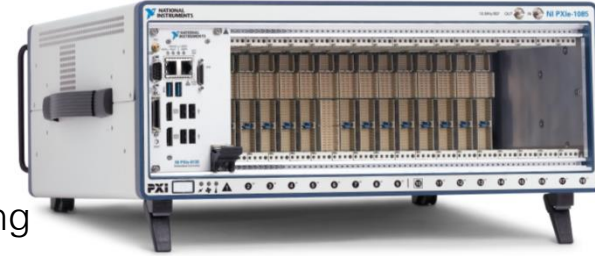


PXI Backplane

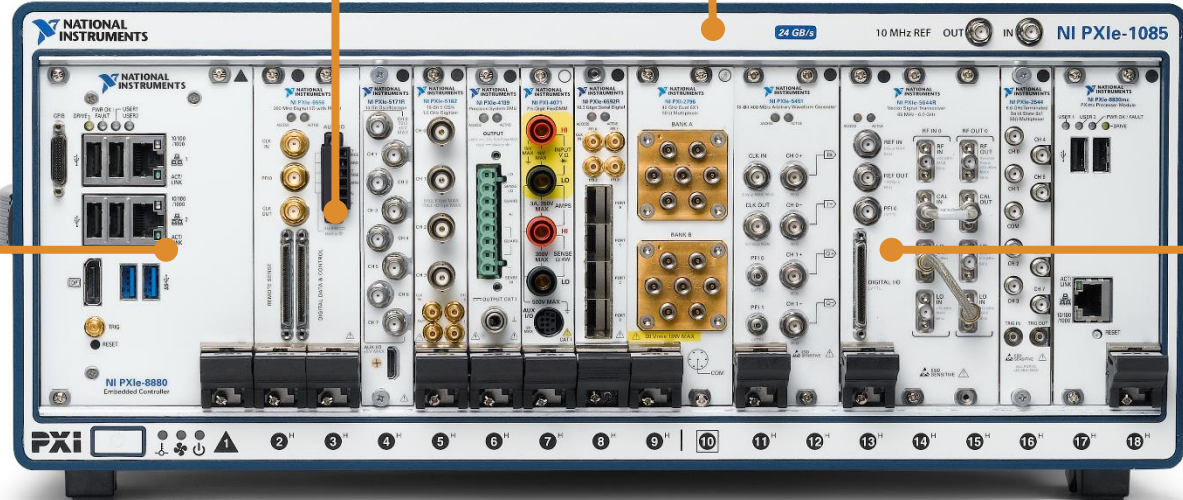
- Data Transfer
- Timing
- Synchronization
- Triggering

PXI Chassis

- Power
- Cooling
- System Monitoring
- Enclosure



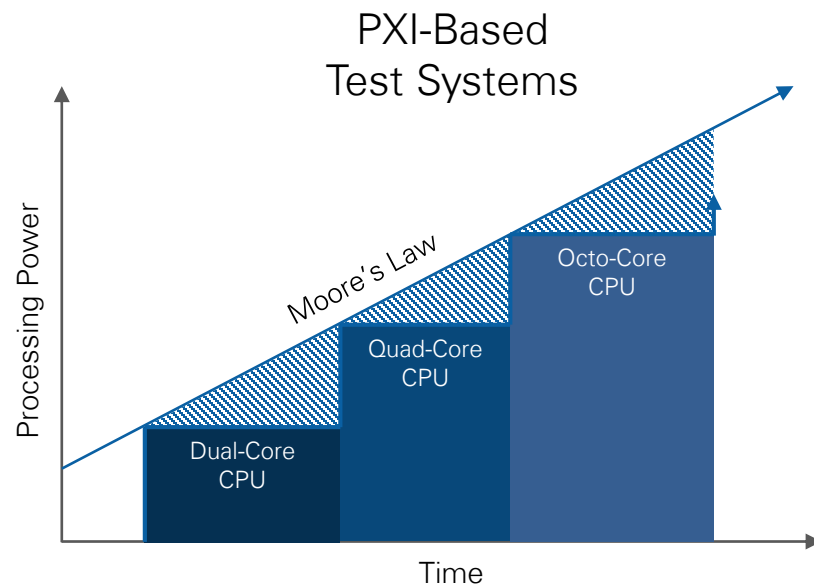
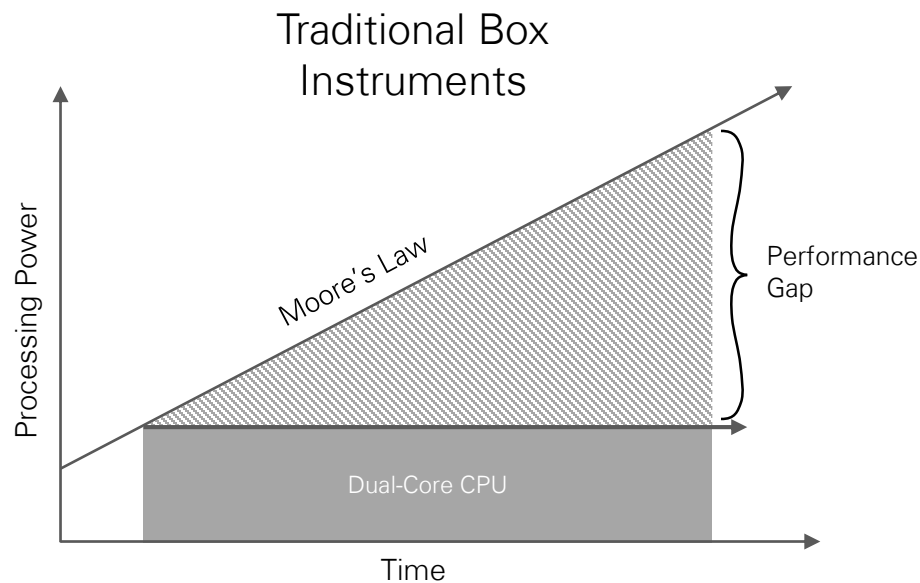
Multicore
Embedded
Controller



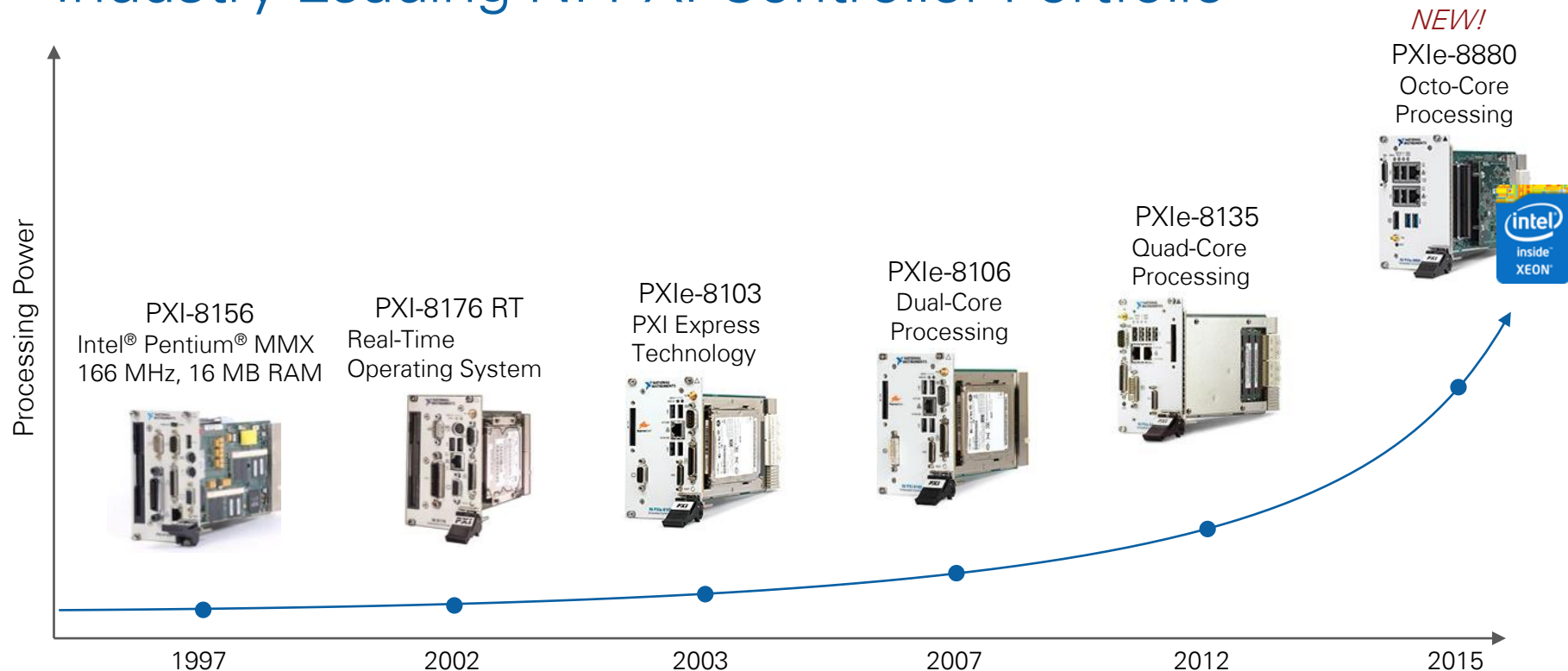
PXI I/O Modules

- Up to 1500
- RF, DC, DIO...

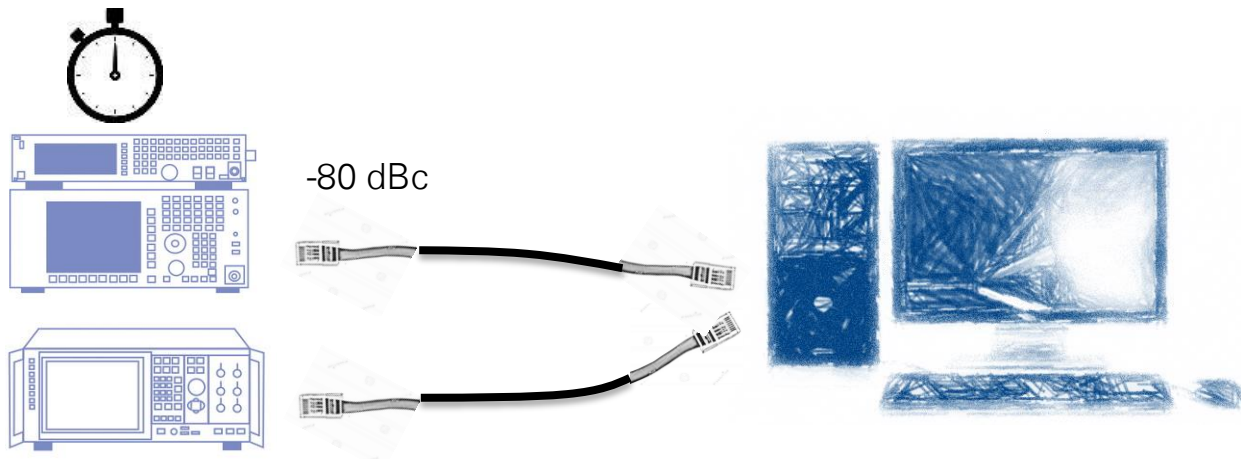
Reducing Test Times with The Latest CPUs and FPGAs



Industry-Leading NI PXI Controller Portfolio



Traditional Method of Programming



Why are we still programming this way?

- Takes too long
- Instrument returns data only after processing is done
- Parallel processing
- Processor technology ?

Programming
Environment

Read: ACP
Measurement

NI-RFmx

Making Complex RF Measurements Simple

Measurement-Focused API

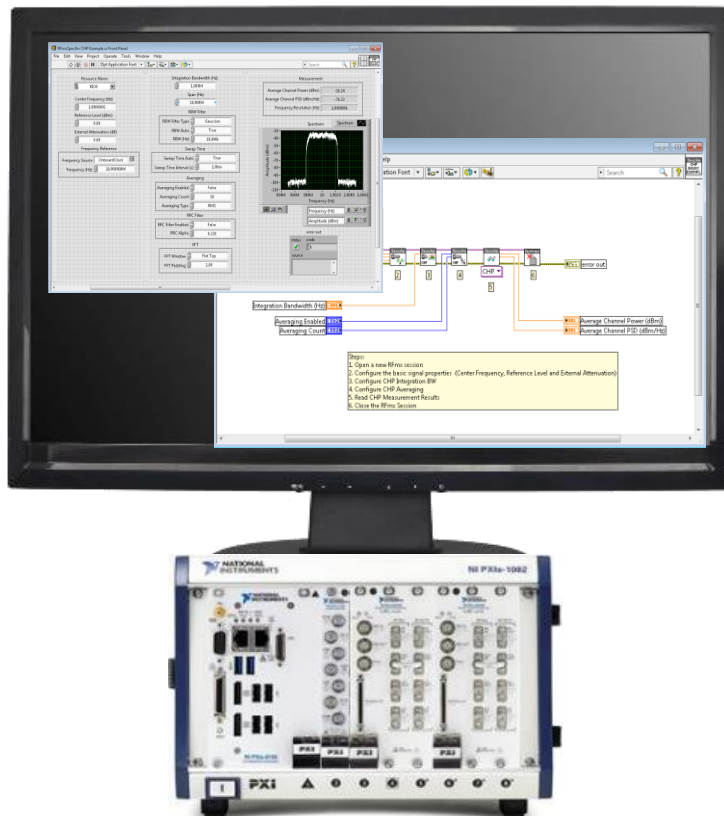
Measurement focused API that speeds up software Development times

Fast

Industry-leading measurement speeds for characterization and production environments

Guiding Documentation

Measurement focused documentation that helps test engineers solve RF test applications



Intuitive Example Programs

Shipping LabVIEW, .NET, LabWindows™/CVI, and C examples for all supported measurements and capabilities

Highly Parallel

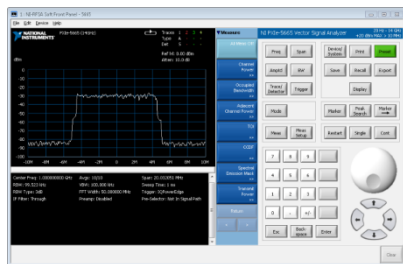
Easy-to-program parallel measurements for multi-DUT testing

High Performance

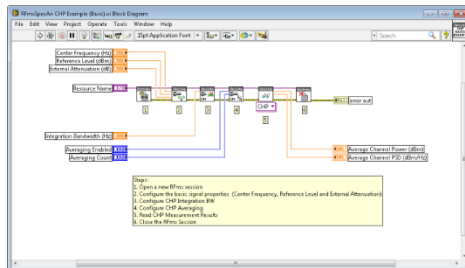
Use instrument features for best-in-class dynamic range and EVM measurements

NI-RFmx Architecture

Soft Front Panel



NI-RFmx Measurement API



Software

Hardware

NI-RFmx

NI-RFSA

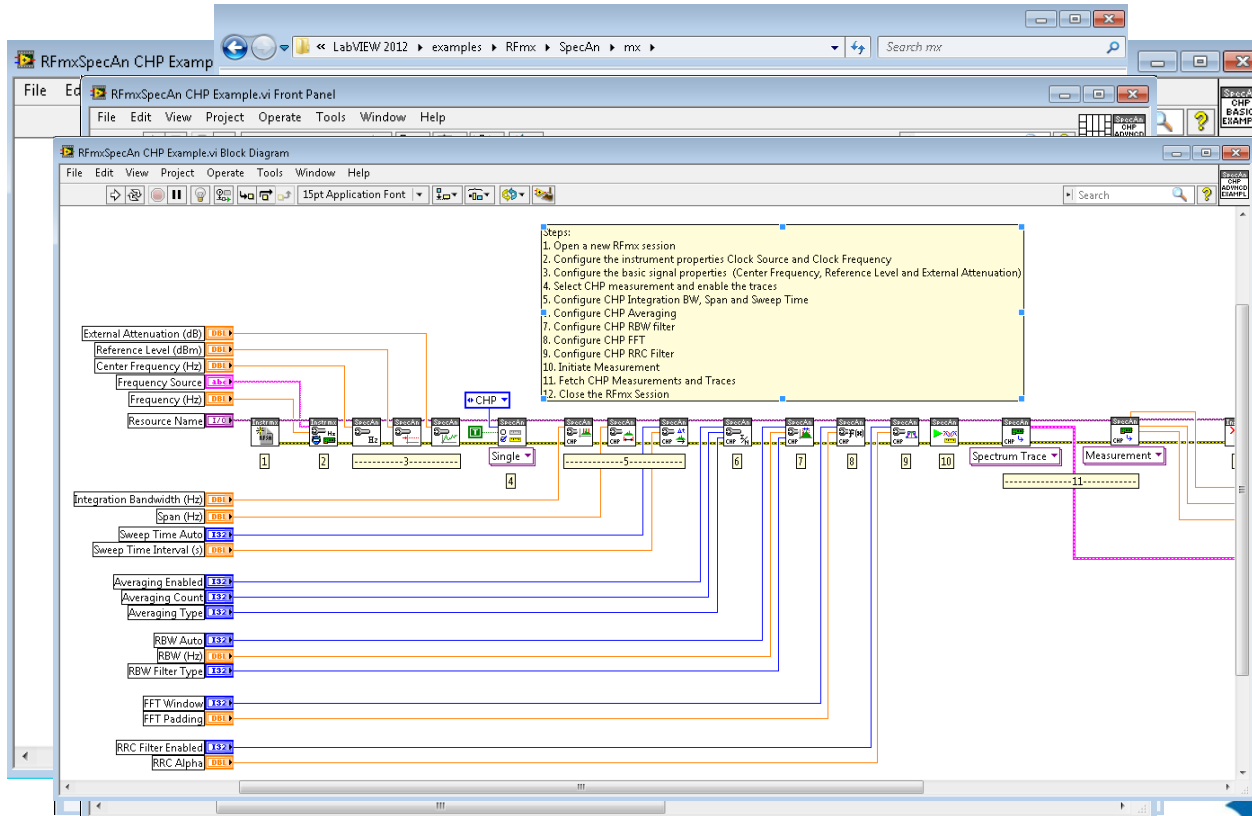
PXI Platform

PXI RF Instrument

LabVIEW FPGA



Using NI-RFmx Example Programs



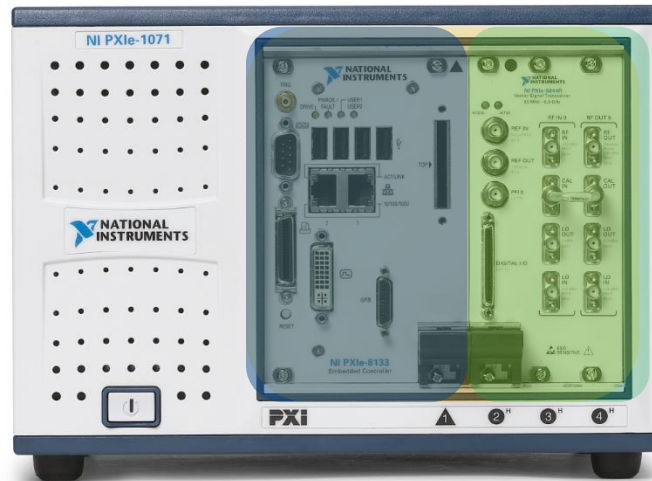
Fundamental Operations in a Measurement

Configure Measurement
Parameters

Acquire Measurement
Data

Analyze Measurement Data

Fetch Measurement Results



RF measurement – Serial Measurement

Serial /
Single Thread



Time →

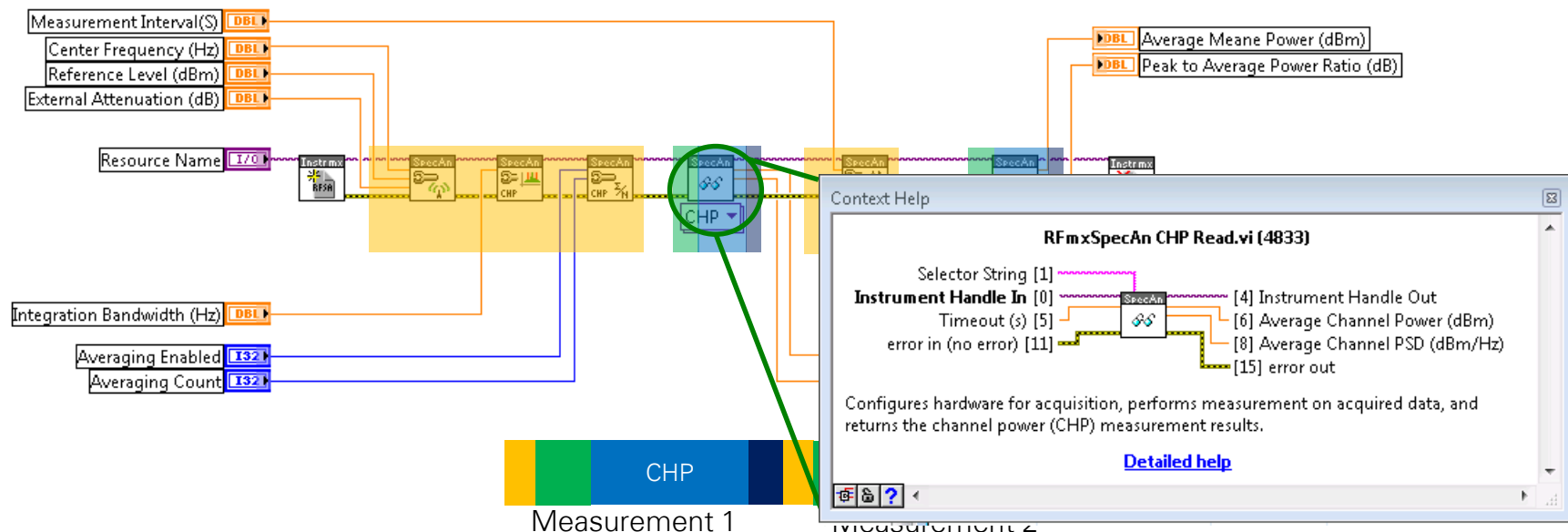
Configure

Acquire

Analyze

Fetch

Simple Serial Measurements



Time →

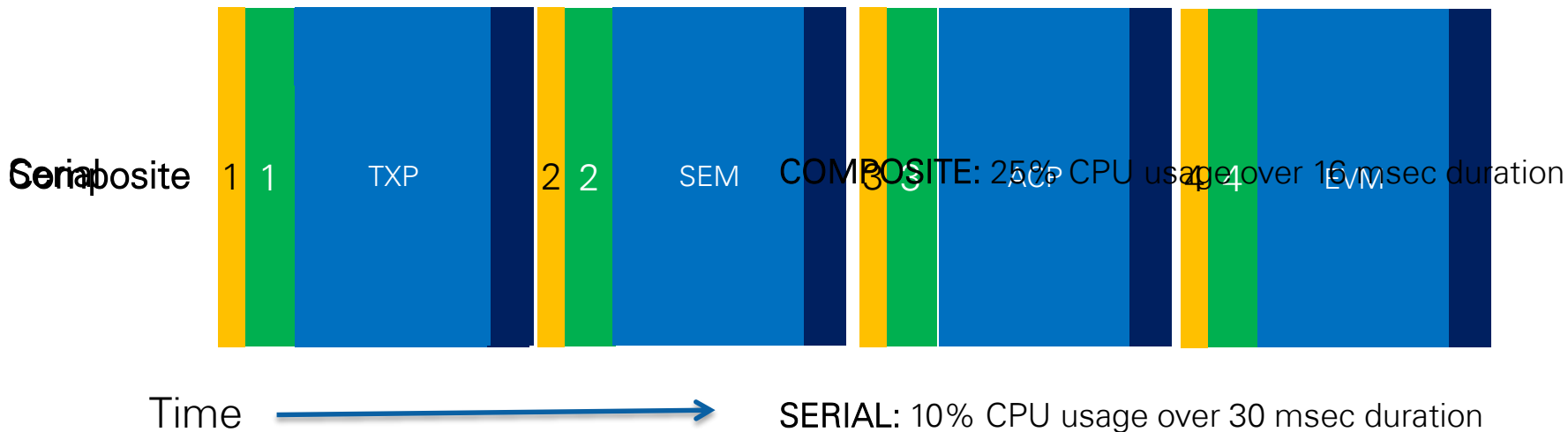
Configure

Acquire

Analyze

Fetch

RF measurement – Composite Measurement



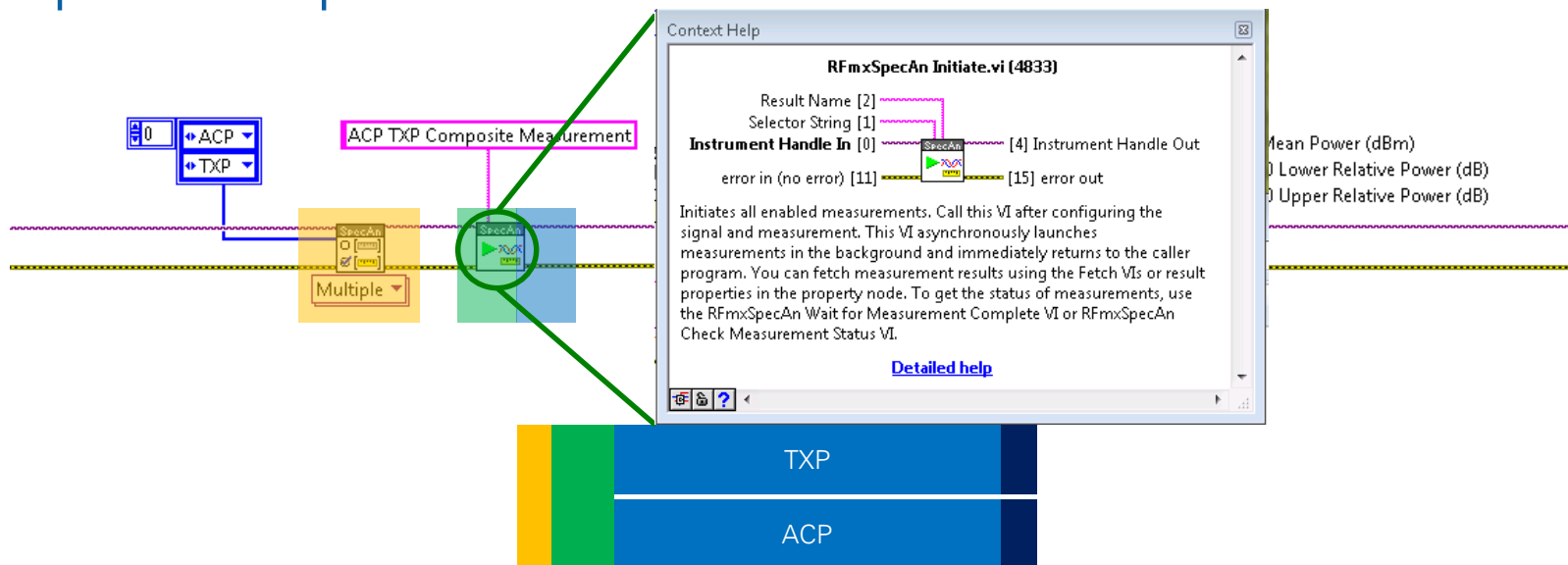
Configure

Acquire

Analyze

Fetch

Simple Composite Measurements



Time →

Configure

Acquire

Analyze

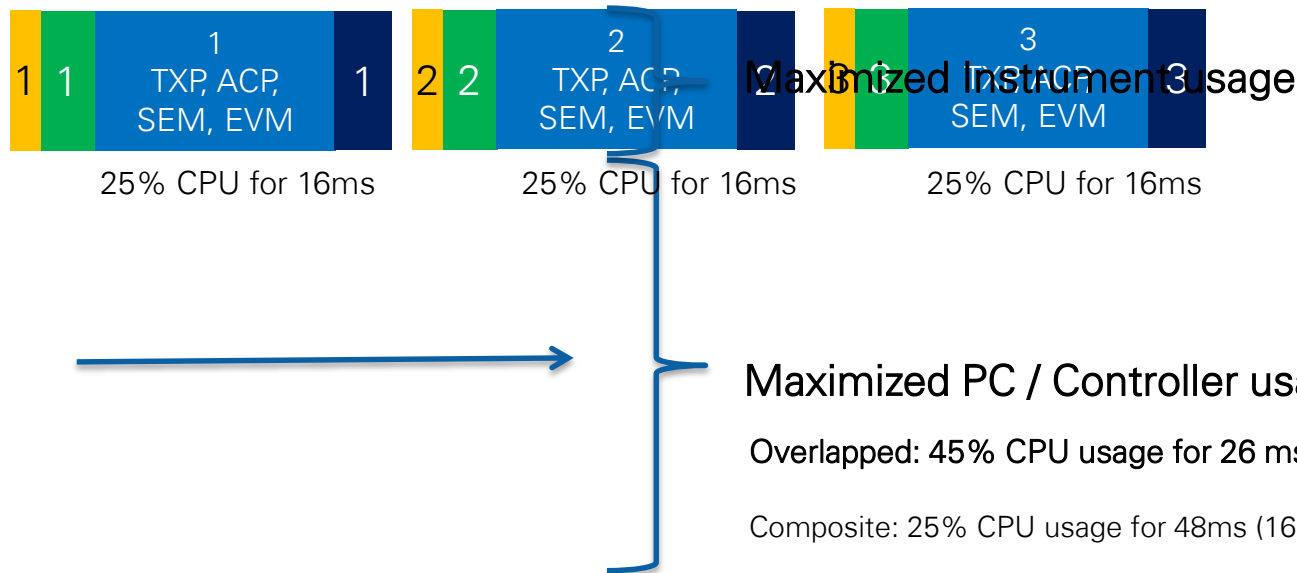
Fetch

RF measurement – Overlapped Measurements

Instrument

PC /
Controller

Time



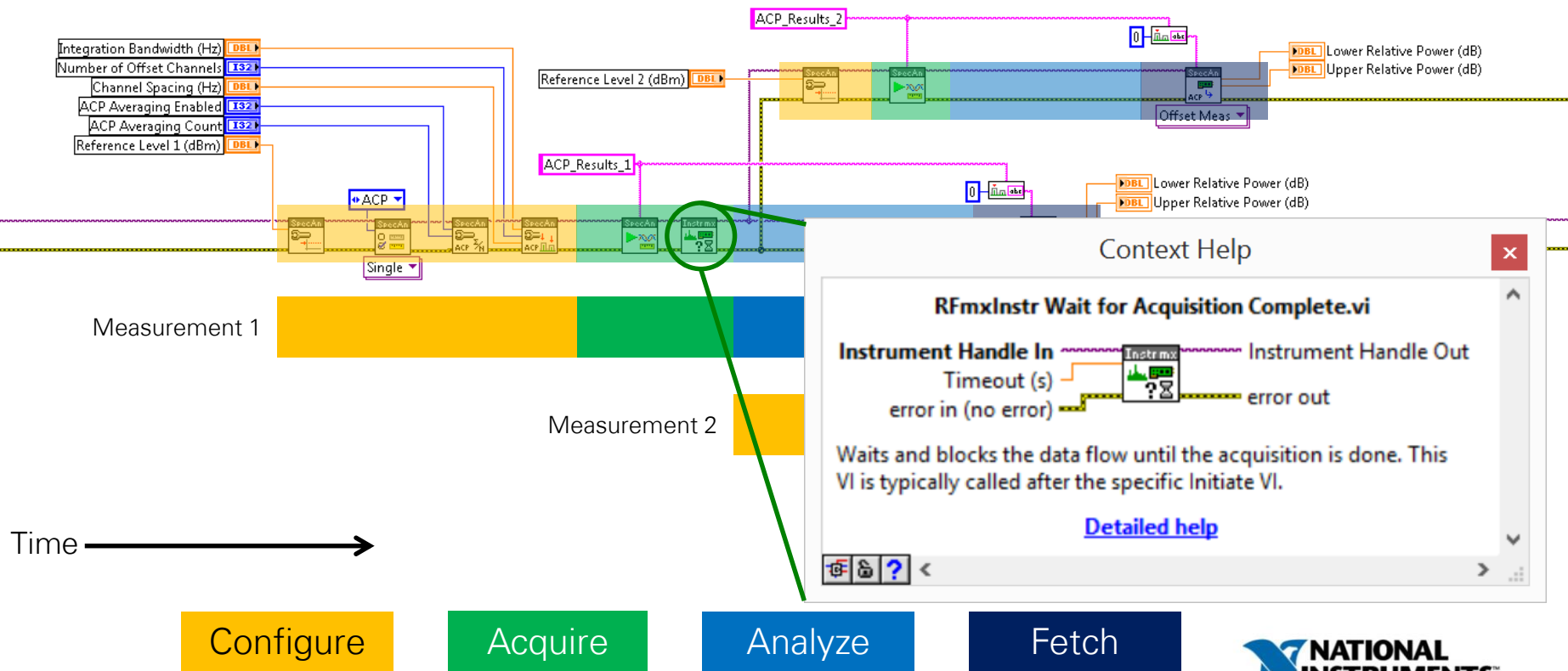
Configure

Acquire

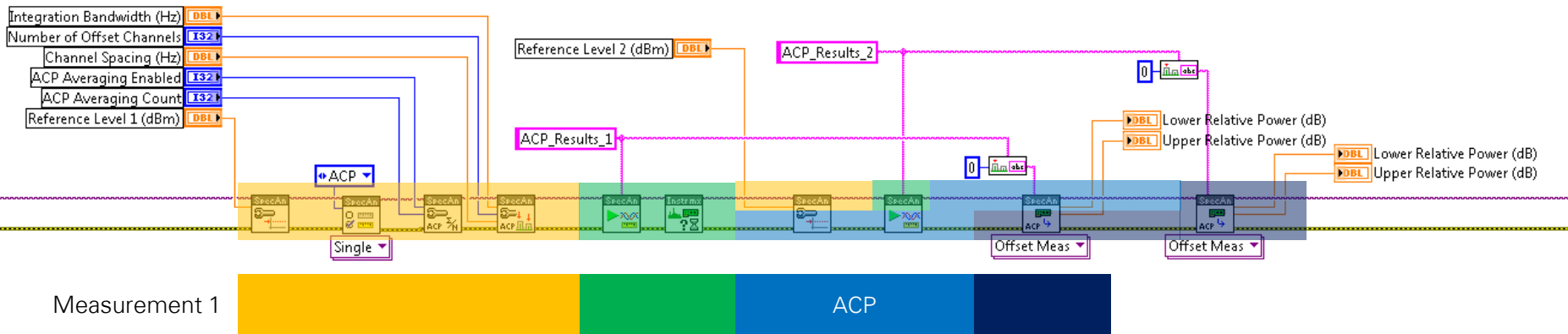
Analyze

Fetch

Overlapped Measurements



NI-RFmx Results Naming



Time \longrightarrow

Configure

Acquire

Analyze

Fetch

Overlapping In TestStand

Alliance Day 2015.seq		
Steps: MainSequence		
Step	Description	Settings
[-] Setup (4)		
LTE10M - Configure Measurement - Composite #1	Semiconductor Multi Test, niRFSTS SA SPECAN Configure.vi, Numbe...	
LTE10M - Configure Measurement - Composite #2	Semiconductor Multi Test, niRFSTS SA SPECAN Configure.vi, Numbe...	
LTE10M - Configure Measurement - Composite #3	Semiconductor Multi Test, niRFSTS SA SPECAN Configure.vi, Numbe...	
LTE10M - Configure Measurement - Composite #4	Semiconductor Multi Test, niRFSTS SA SPECAN Configure.vi, Numbe...	
<End Group>		
[-] Main (4)		
LTE10M - Measurement - Composite #1	Semiconductor Multi Test, niRFSTS SA SPECAN Measure.vi, Number...	
LTE10M - Measurement - Composite #2	Semiconductor Multi Test, niRFSTS SA SPECAN Measure.vi, Number...	
LTE10M - Measurement - Composite #3	Semiconductor Multi Test, niRFSTS SA SPECAN Measure.vi, Number...	
LTE10M - Measurement - Composite #4	Semiconductor Multi Test, niRFSTS SA SPECAN Measure.vi, Number...	
<End Group>		
[-] Cleanup (4)		
LTE10M - Fetch Result - Composite #1	Semiconductor Multi Test, niRFSTS SA SPECAN Fetch RF and DC P...	
LTE10M - Fetch Result - Composite #2	Semiconductor Multi Test, niRFSTS SA SPECAN Fetch RF and DC P...	
LTE10M - Fetch Result - Composite #3	Semiconductor Multi Test, niRFSTS SA SPECAN Fetch RF and DC P...	
LTE10M - Fetch Result - Composite #4	Semiconductor Multi Test, niRFSTS SA SPECAN Fetch RF and DC P...	
<End Group>		
Steps: MainSequence Variables		

Configure

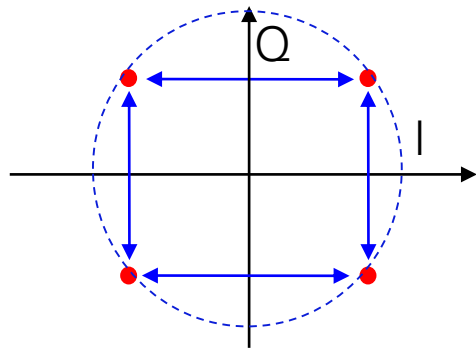
Acquire

Analyze

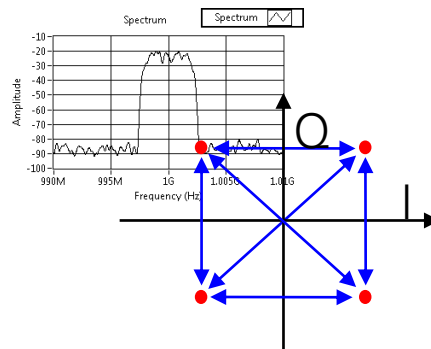
Fetch

Signal Naming

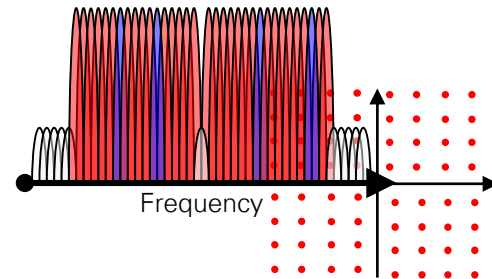
GMSK: 2G



WCDMA: 3G



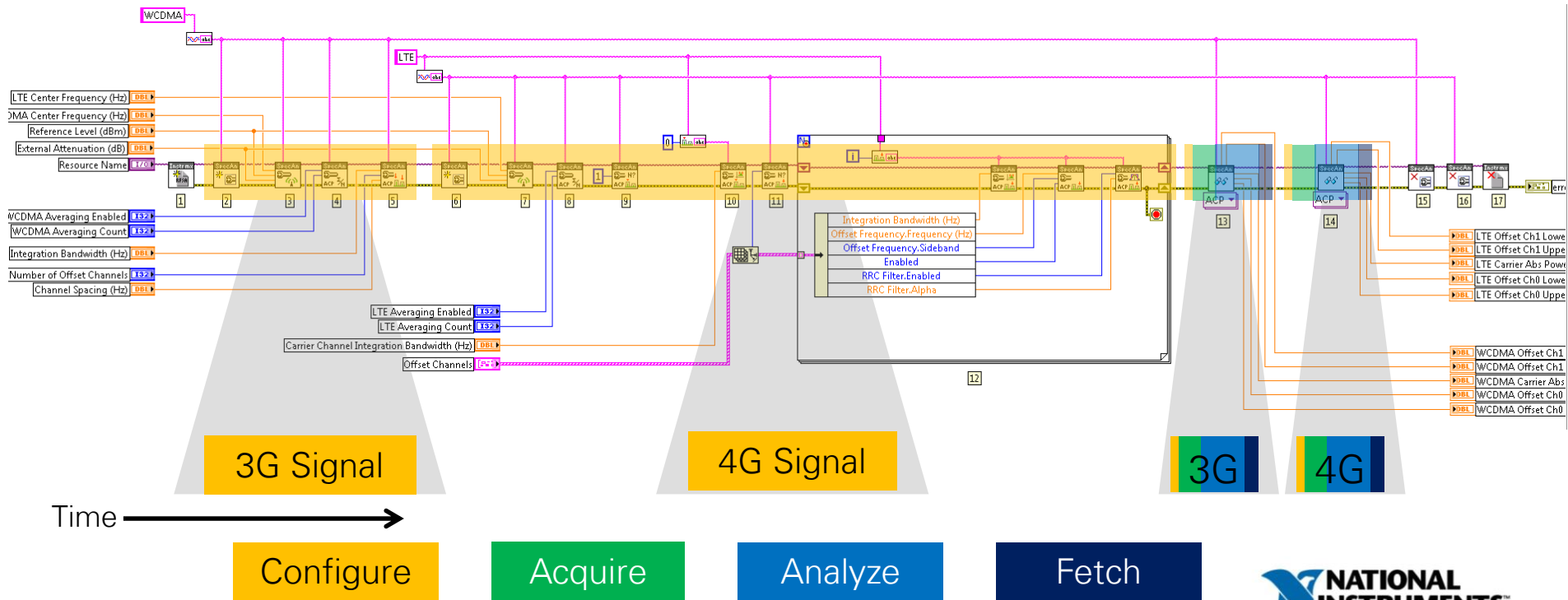
LTE / LTE-A: 4G



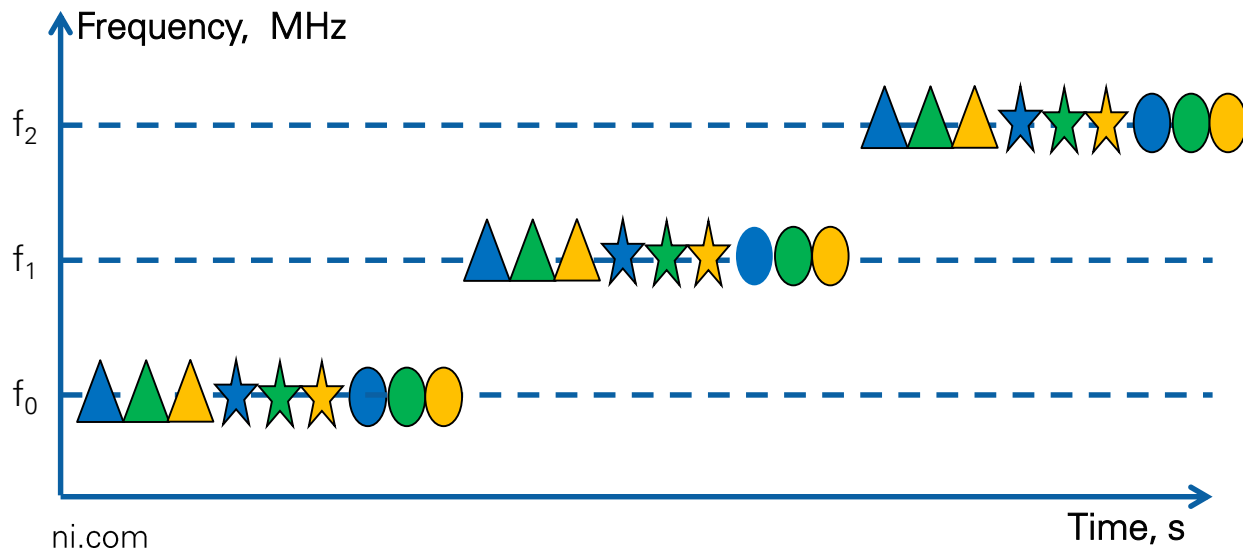
Signal Attributes

	2G	3G	4G
Bandwidth	200 KHz	3.84 MHz	1.4 MHz – 20 MHz+
PAPR	0 dB	4 dB+	8 dB+
Demodulation	Simple	Several Options	Many Options

Signal Naming



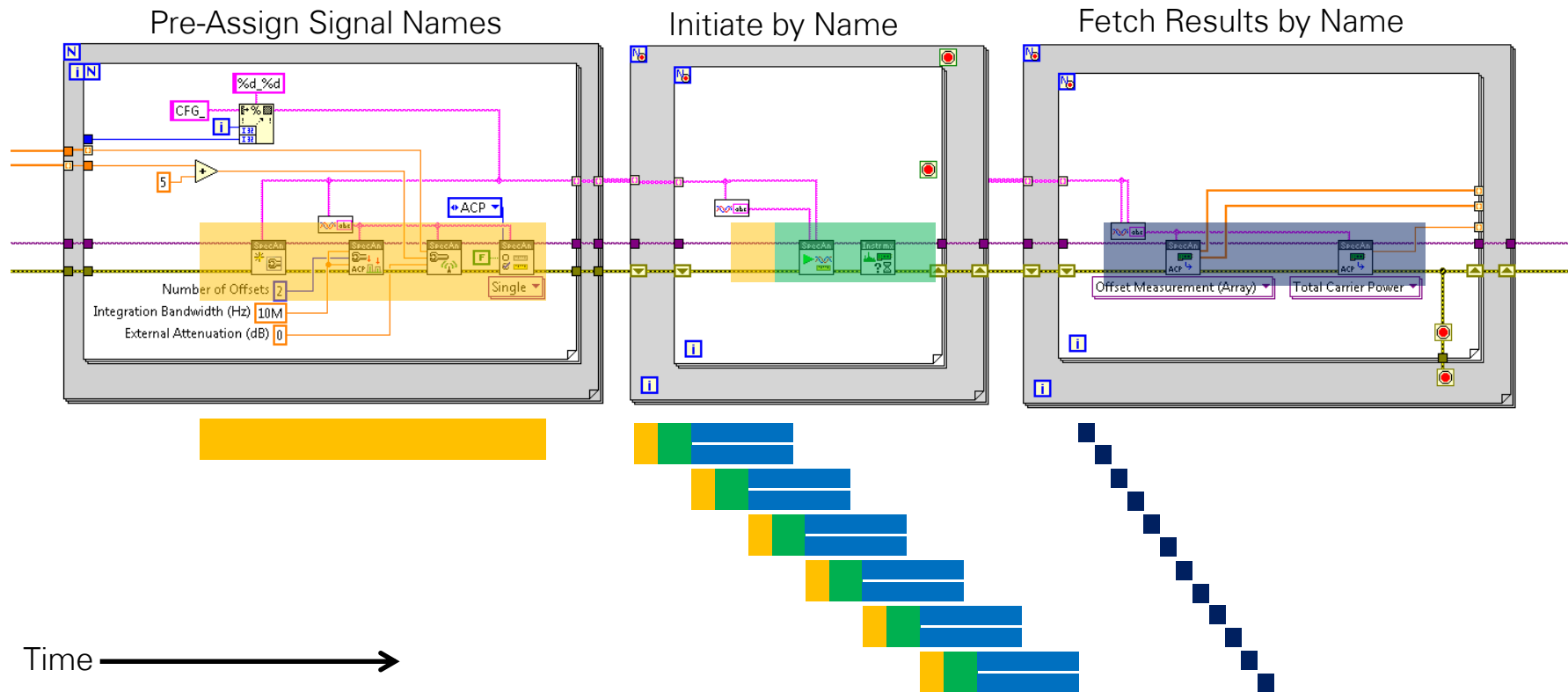
Signal Configurations in Automation



Measurement List

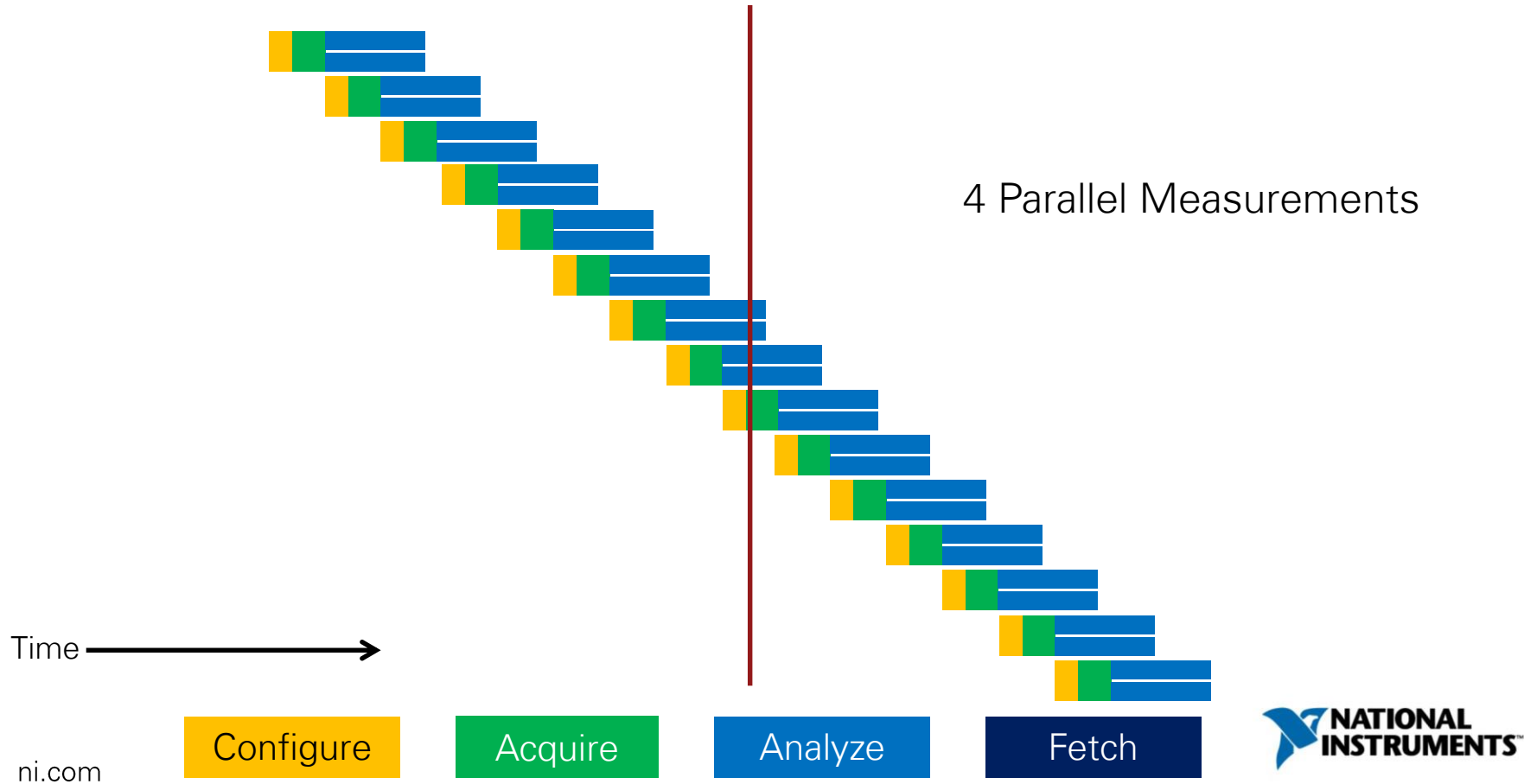
Signal Name	Result Name
"2G"	"2G F0 LP"
"2G"	"2G F0 MP"
"2G"	"2G F0 HP"
"3G"	"3G F0 LP"
"3G"	"3G F0 MP"
"3G"	"3G F0 HP"
"4G"	"4G F0 LP"
"4G"	"4G F0 MP"
"4G"	"4G F0 HP"
"2G"	"2G F1 LP"
Etc..	Etc...

Simplified Automation with Signal Naming

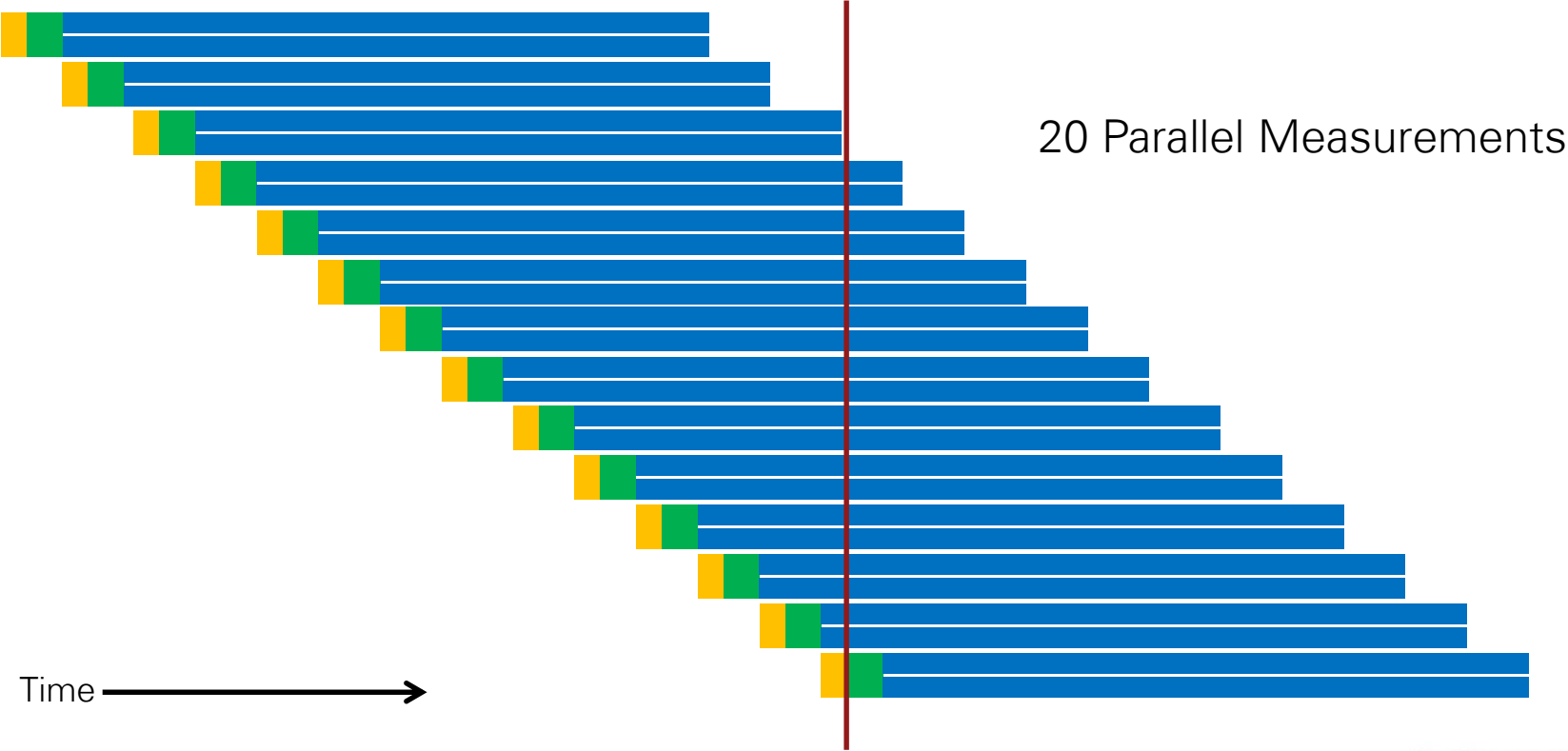


Time →

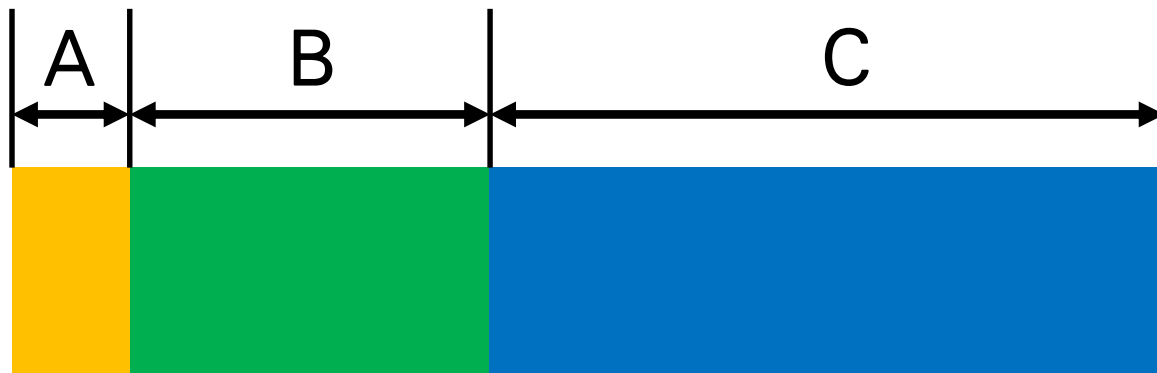
Keeping the System Busy



Keeping the System Busy



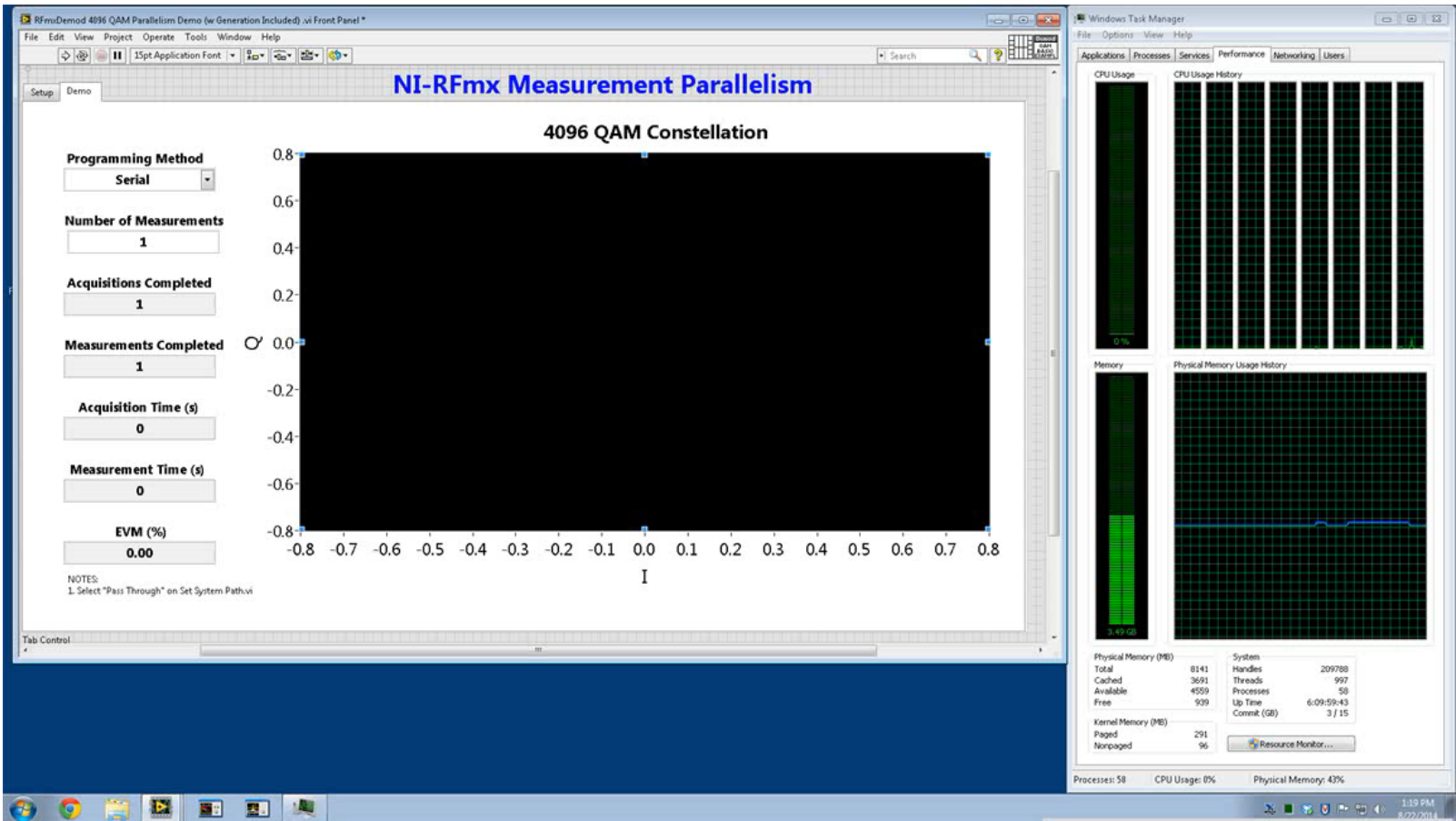
Keeping the System Busy



$$\frac{C}{A+B} = \text{Number of Parallel Measurements}$$

Time →

NI-RFmx Measurement Parallelism Demo



Where Else Can We Get Faster ?

Faster Servo

- FPGA
- DUT-Specific-Algorithm

Faster Analysis

- Coprocessor (PXImc or FPGA)



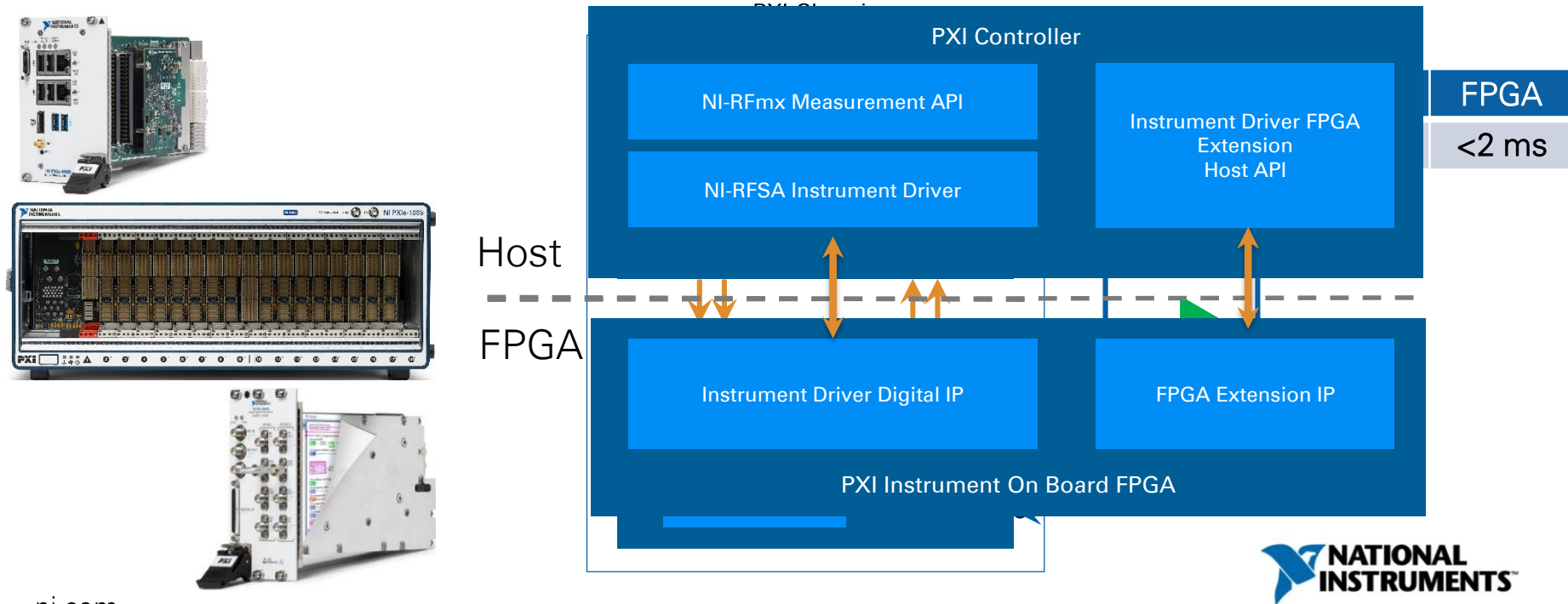
Shorter Acquisition

- Stimulus-Response-Triggering
- Low-Noise-DUT

Time →

Instrument Driver FPGA Extensions

- NI-RFmx Preserves usage of Instrument Drive FPGA Extensions



More Resources

Download NI-RFmx

- ni.com/rf
- Click “Test Application Software”
- NI-RFmx SpecAn, Demod...

NI RF LabVIEW RIO Instruments

- ni.com/vst/getting-started
- Instrument Driver FPGA Extension IP
 - Servo, Triggering, I2C, RFFE, RTSA, Etc...

The screenshot displays the National Instruments website's 'NI RF and Wireless Products and Solutions' page. The top navigation bar includes links for Products, Industries & Applications, Support & Services, Community, Academic, and Events & Training. The main content area features a video player titled 'NI RF and Microwave Introduction Video' with a LabVIEW logo overlay. To the right of the video, a text block describes the range of NI RF products and solutions, from design to test, and mentions the benefits of PXI instrumentation and NI AVR software. Below the video, a 'Shop by Product' section lists various products: Vector Signal Transceiver, Vector Signal Analyzer, Signal Generator, Vector Network Analyzer, Software Defined Radio, EDA Tools, Custom, FPGA-Based Modules, RF Switches, RF Power Meters, Microwave Components/Assemblies/Synthesizers, Test Application Software, and Soft Front Panels. The left sidebar contains filters for 'Learn' (NI RF and Wireless, Product Lines, Application Areas, Why Choose NI RF, Services and Support) and 'Shop By' (Device/Module, Narrow by Product Line, Product Family, Form Factor).

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