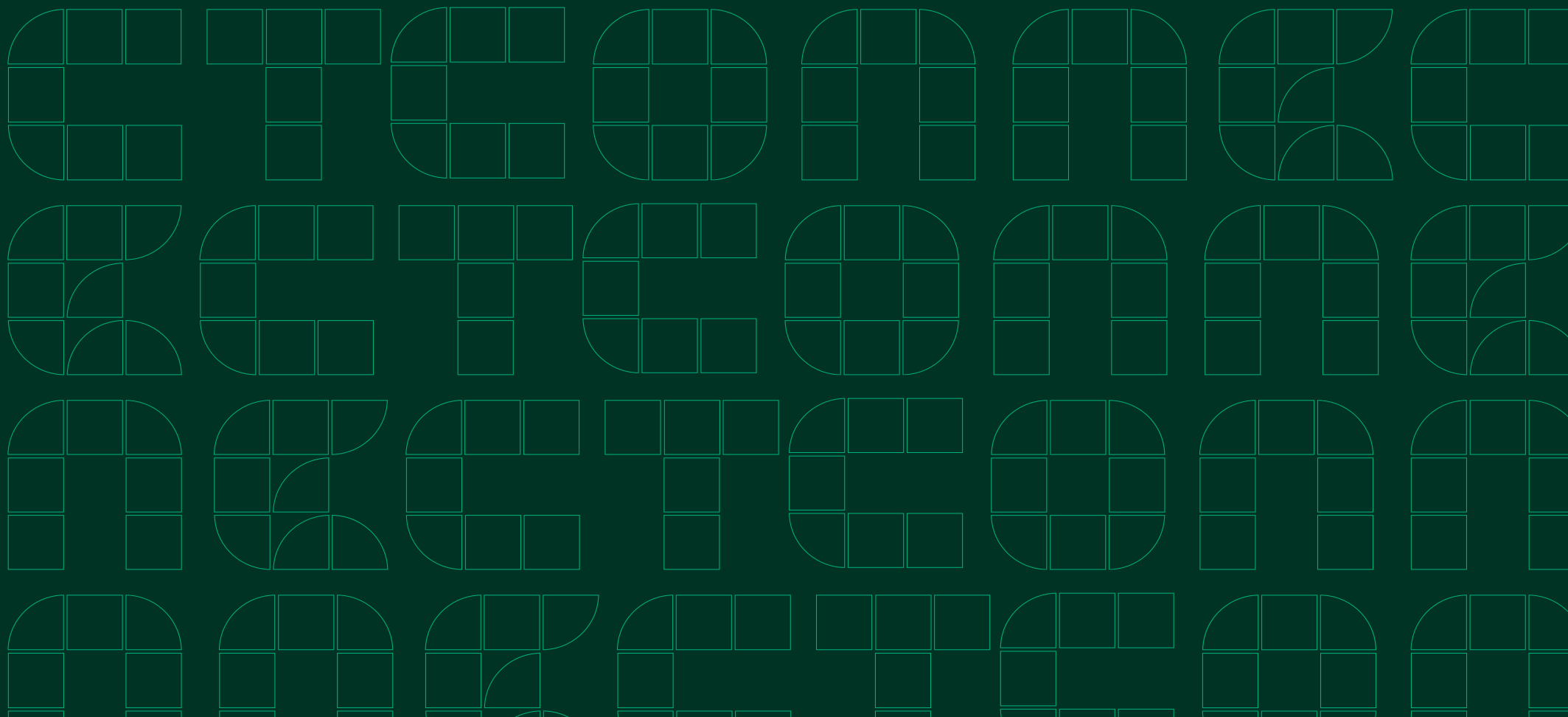


CONNECT



2	0
2	4

EMERSON



ni connect

2024 AUSTIN



Maximizing Semiconductor Validation Outcomes with Connected Workflows

Speaker: Michael Weir

May 21st, 11:30am – 12:30pm

Director – Offering Management

Lab Optimization/Modern Lab

Agenda

Benefits

- Strategically applying software to the lab environment
- Enabling connected workflows across the organization

Reference Architecture

- Lab Reference Architecture
- A software blueprint for validation labs

Realization

- Planning a Journey
- Accelerator Engagement Packages

The Pace of Change Is Faster than Ever

Organizations Must Rethink Product Innovation or Risk Falling Behind



Societal Impact



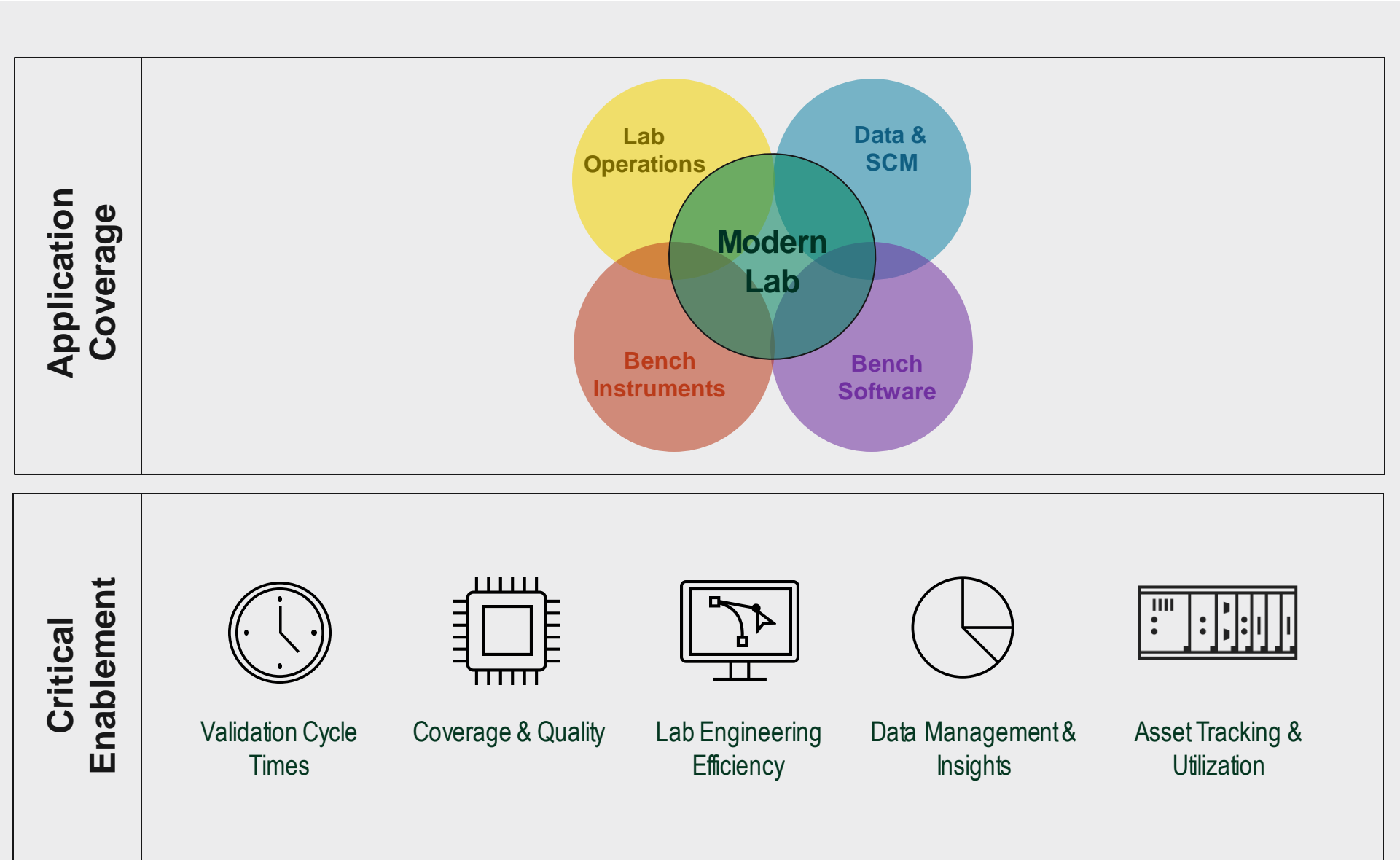
Technological Advancement



Evolving Business Models

Strategic application of software to Lab Workflows

Why Software-Connected Workflow?



Validation Execution

- Faster time to validation complete
- Rapid, low-code development
- Higher levels of reuse

Program Optimization

- Collaboration, less silos
- Cross-discipline collaboration
- Centralized Data and SCM

Lab Optimization

- Asset management & utilization
- Lab station management & configuration

ni A Modern Lab is an Effective Lab

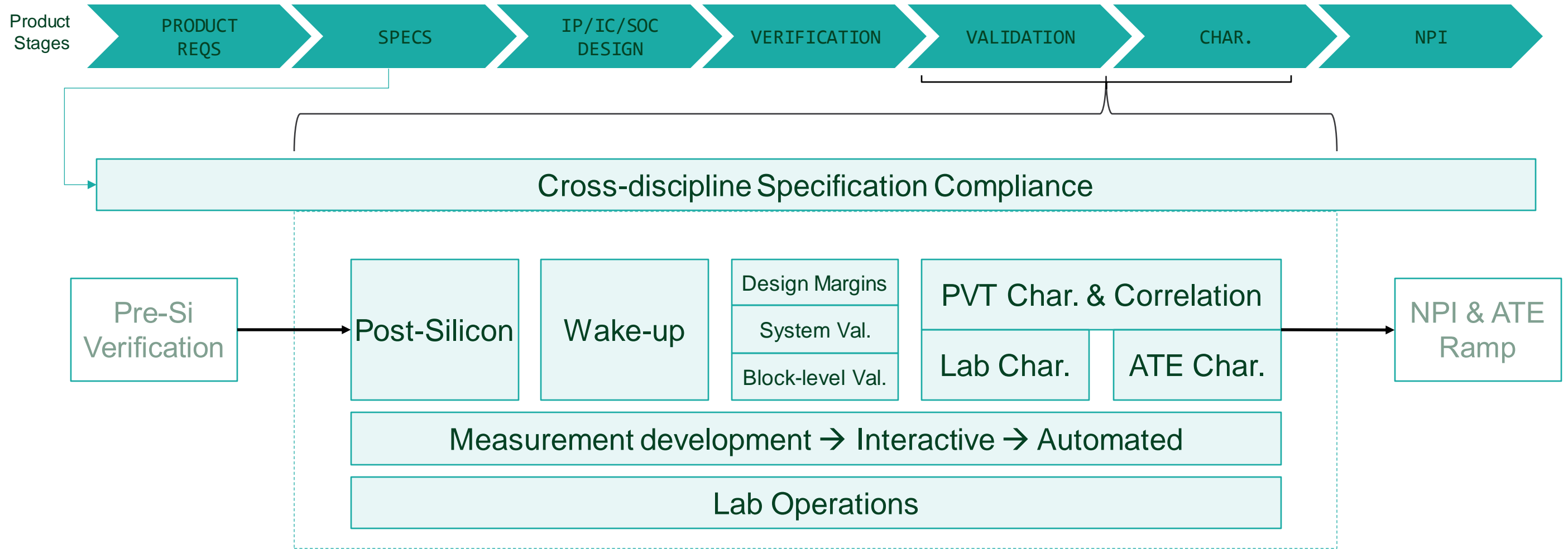
VALIDATION METHODOLOGY THAT USES SOFTWARE TECHNOLOGIES TO MAXIMIZE EFFICIENCY, PRODUCTIVITY, AND PRODUCT OUTCOMES

PROGRAM OPTIMIZATION	LAB OPTIMIZATION	TEST/BENCH OPTIMIZATION
<ul style="list-style-type: none">• Faster & reliable Time-to-NPI• Better integration of customer requirements & features• Connecting bench characteristics	<ul style="list-style-type: none">• Better utilization of lab budgets• Predictable outcomes across all lab footprints• Eliminate reliance on disparate tool chain or tribal knowledge	<ul style="list-style-type: none">• Software development tools and methods for engineers• Faster time to measurements<ul style="list-style-type: none">▶ data ▶ insights ▶ decisions• Connected context across the test workflow
<ul style="list-style-type: none">✓ Reduce characterization by 20%✓ Reduce incorrect PG decisions by 10%	<ul style="list-style-type: none">✓ Reduce CAPEX by >20% by better equipment use & planning✓ Decrease manual tasks by >90% through automation	<ul style="list-style-type: none">✓ Shorten readiness time by a minimum of two weeks✓ Decrease RCA by as much as 70%

Better utilization of staff time, expertise, and resources = improved *Productivity*



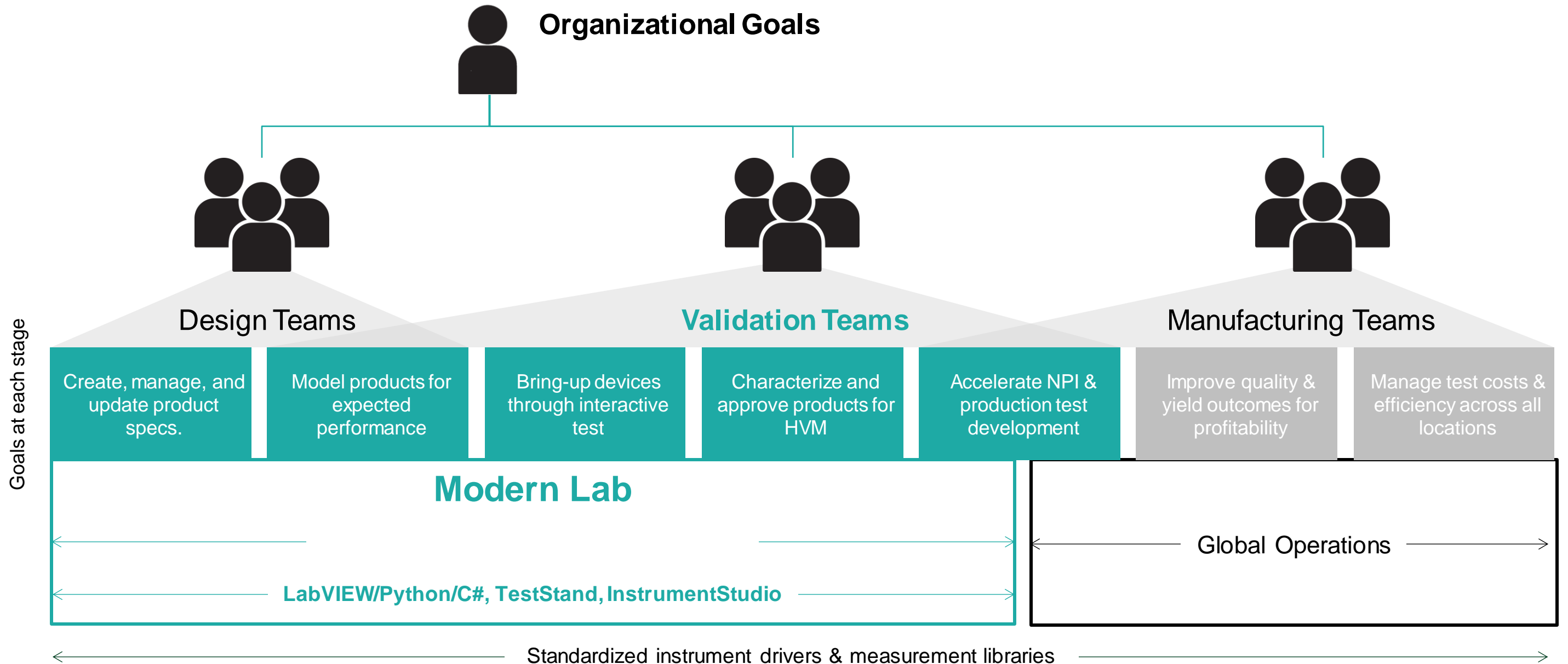
Considering the Development Workflow



More Features = More Specs = More Tests = More Data = More Risk = More Stress

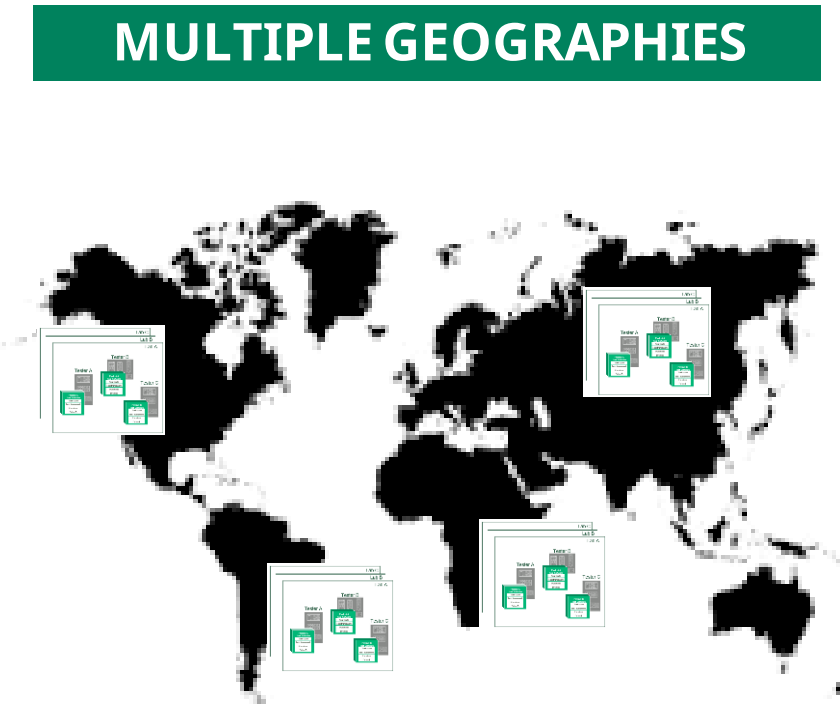
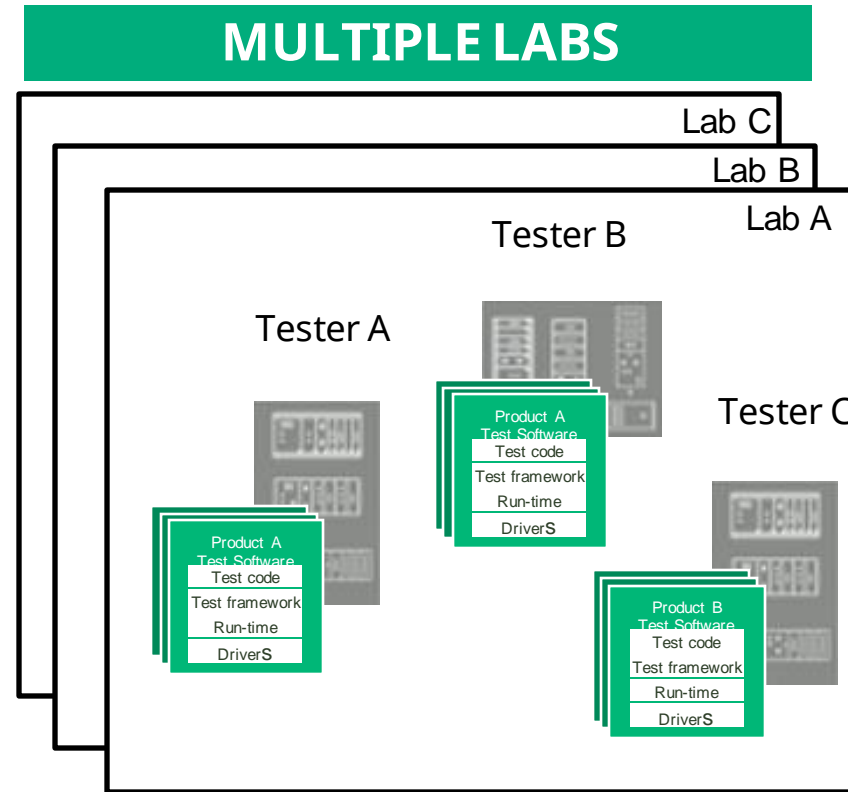
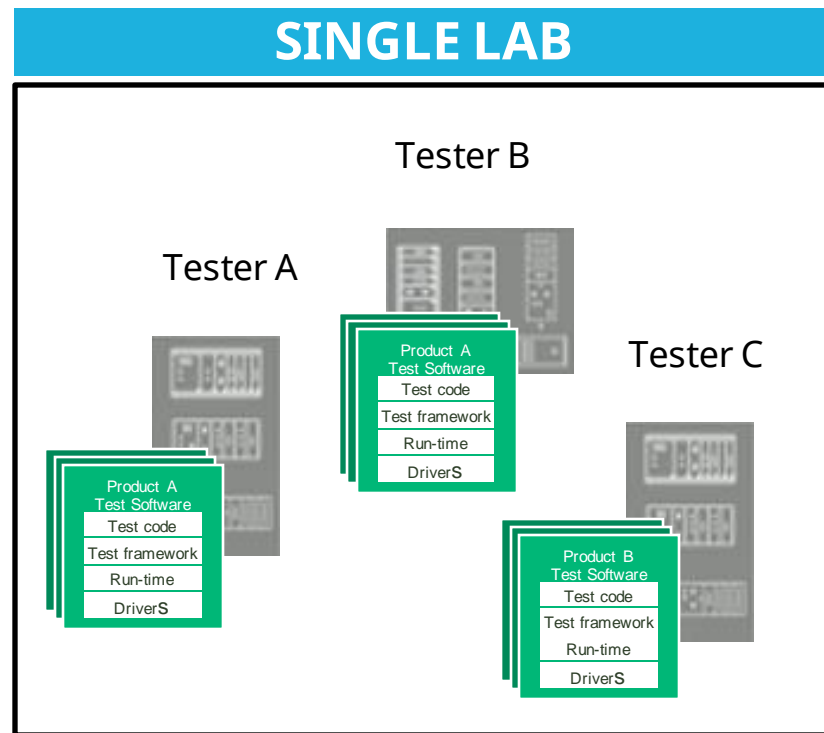
ni Labs Supports the Entire Validation Scope ni.com

INCLUDING INTERACTIONS WITH OTHER TEAMS





Lab Today's Labs Scale From a Single Lab to Global Enterprises



- Standardize Across Locations
- Reliable and Repeatable
- Flexible and Open

- IT Enabled
- Local-to-Global Visibility
- On-prem or Private Cloud

Performance, service, and scale for an entire validation organization.

ni Leading to Expensive, Ineffective DIY Approaches

Validation Teams are Responsible for:

- Implementing Test Plans
- Automating Test
- Executing Test
- Collecting Test Results
- Scaling Test And Measurement
- Purchasing and Integrating HW
- Managing HW Compliance & Uptime
- Reporting Data to Other Teams
- Continuously Improving
- Onboarding new employees

Translating to DIY System Requirements:

- Support Various Coding Standards
- Enable Interactive Measurement
- Provide Test Automation Frameworks
- Handle HW from Multiple Vendors
- Check and Verify System SW/Drivers
- Collect & Manage Test Data
- Analyze and Report Results
- Connect to Relevant Apps (APIs)
- Support Users Daily
- Be Continuously Maintained & Upgraded

The True Costs to Organizations

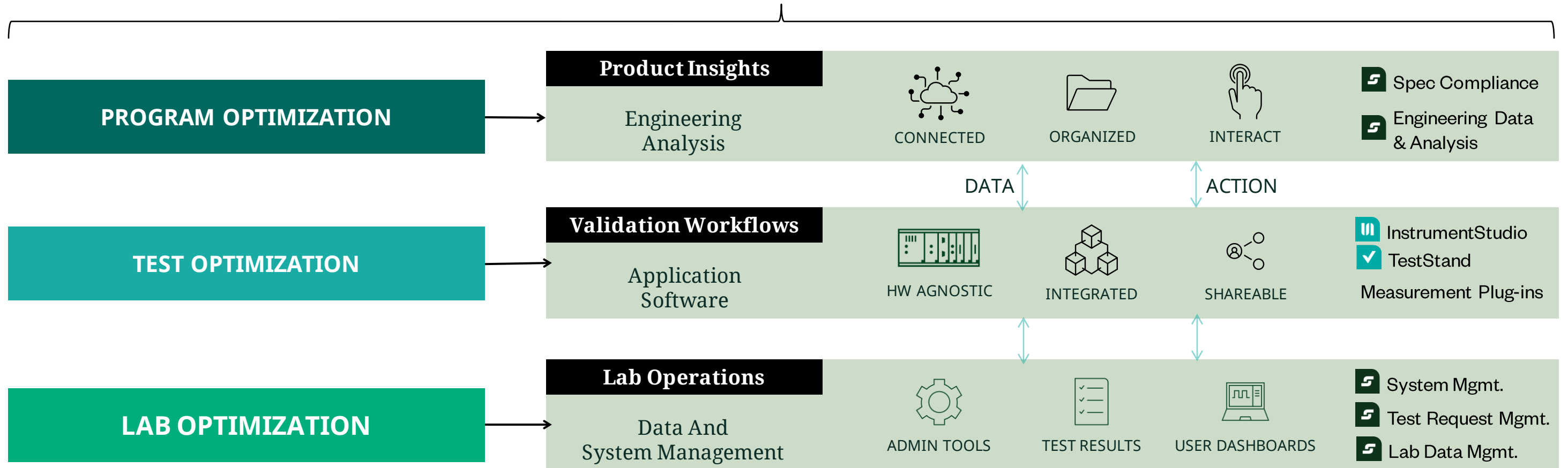
Typical Test Team (Engineers)	10
Org Size (Product Lines)	5
Time Spent on DIY Infrastructure, Tools, and Maintenance	15 %
Total Opportunity Cost of DIY Approach	$10 \times 5 \times 15\% = 7.5$ Engineers
Cost to Org of DIY Approach (@\$120k/yr)	\$900k



A Modern Lab Creates the Future of Validation

AN OPEN, CONNECTED, SOFTWARE ENABLED APPROACH TO ALL LAB RESPONSIBILITIES

Supporting the entire design cycle to **launch better products, faster.**



A Modern Lab Reference Architecture

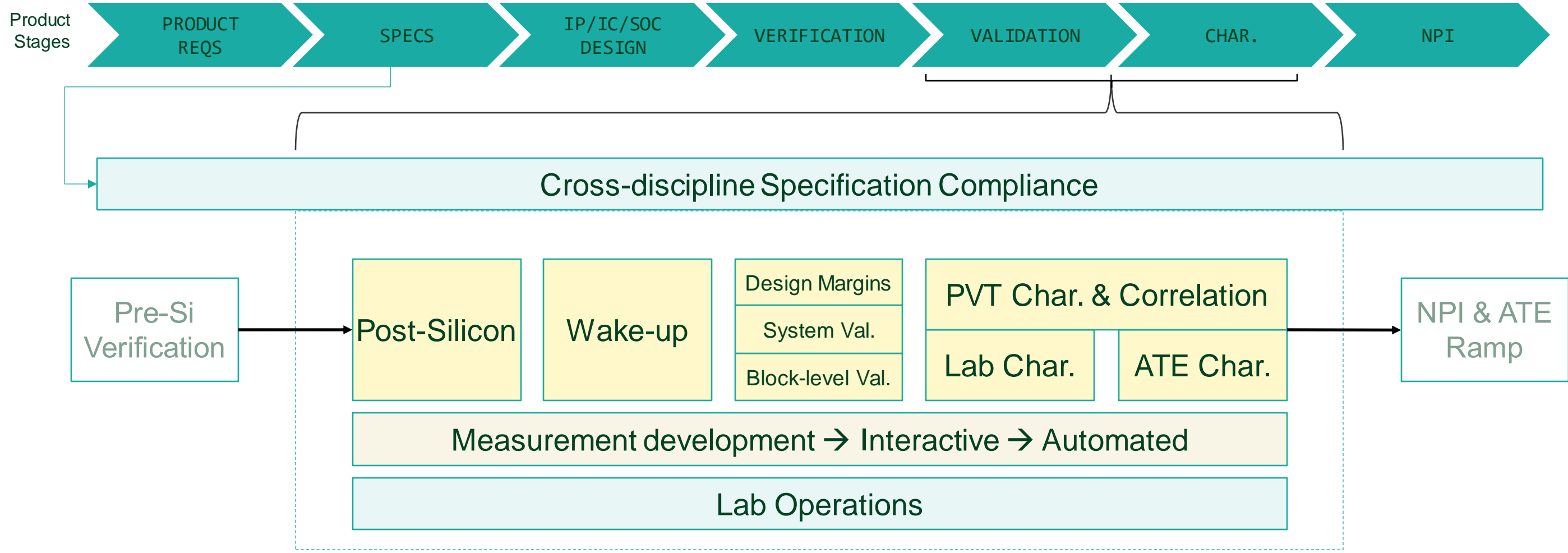
A software blueprint for validation labs



Considering the Development Workflow

ETW Tools

PA Tools



More Features = More Specs = More Tests = More Data = More Risk = More Stress



Reference Architecture – Modern Lab

ETW Tools

Ent Tools

Best Practices

Product Stages



System Link – SCM Module, Engineering Data Manager

Pre-Si Verification

Instrument Studio

Semi Device Control (GUI)

IP Library/HW
Measurement Plug-ins
Pin Maps

Char Workflow - TestStand
Bench States
Correlation Tools - ATE

NPI & ATE Ramp – O+

Measurement Library

Instrument Studio – LabVIEW - TestStand

System Link Assets, Software, Workflow Mgmt

Source Code

More Reuse & Frameworks = More Multiple teams = More Onboarding = More Align Dev languages = More Standardization = More Stress

Example Workflows Addressed by Modern Lab RA

1. End to End Full connected Lab Data Workflow – Close the Loop
2. Spec Definition to val source code development
3. Publishing and retrieving Reusable Measurements
4. Organization Asset Management
 1. View Available Assets from all station
 2. Understand utilization and financial impact
5. System Management
 1. Monitor Resource usages and connected assets
 2. Software Deployment Tracking and auditing
6. Device Debug to data collection
 1. Bring up a device while collecting and publishing relevant data
7. Program Data Review for Device Decisions
8. Device Debug to active Validation automation
9. Active Validation to data collection
10. Data Management and Analytics
11. Migration of existing code to Instrument Studio Pro Plug-ins
12. Acceleration Utilities
 1. Advanced UI Building
 2. Python Interoperability
 3. Existing Measurement Migration Utilities



Visit the Demo Floor

NI Software Promise: A Comprehensive, Connected Approach



JOE & LUIS
LabVIEW Developers,
EI Electronics, Ireland.

1. **Develop more quickly** in an environment tailored to the specific workflow of the test engineer
2. **Spend time where it matters most** with higher level starting points for most measurement tasks
3. **Get unbound flexibility** to meet new and evolving requirements with an ecosystem open to any HW & SW
4. **Share and reuse IP** with a connected suite of software that spans the product development lifecycle
5. **Deliver insight across the organization** with trusted data sharing and visualization.

Reference Architecture RoadMap



Modern Lab

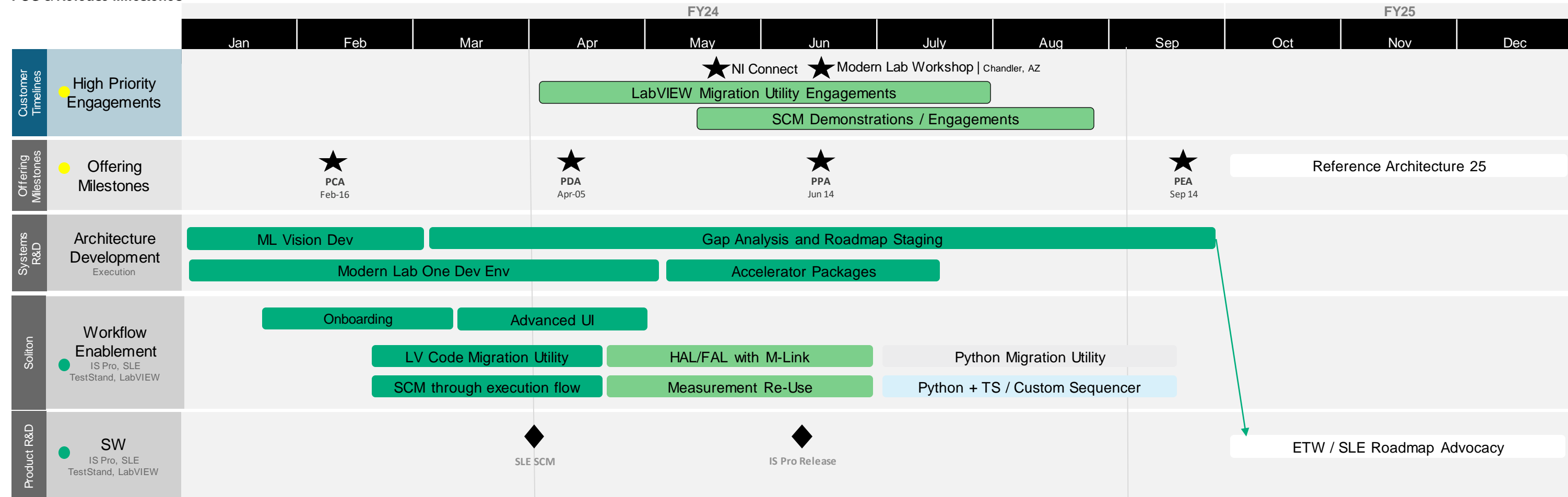
Reference Architecture, Workflow Enablement, ML1 Dev Environment

Deliver
Execution
Planning
Definition
Pre-Concept, Concept

- Offering PSG Phase: Planning
- Offering Manager: Mike Weir
- Offering Program Manager: Jay Ripley



PSG & Release Milestones



Status Update

Features:

- Conceptual Architecture:
 - Vision → Gap Analysis → Product Roadmap Advocacy
- Workflow enablement, utilities, examples:
 - LV/Py Migration Utility
 - End-to-End SCM Workflow Demonstration
- Modern Lab 1
 - Physical instantiation of reference architecture
 - To be available for NI Connect
 - Vehicle for V&V of workflows and assumptions

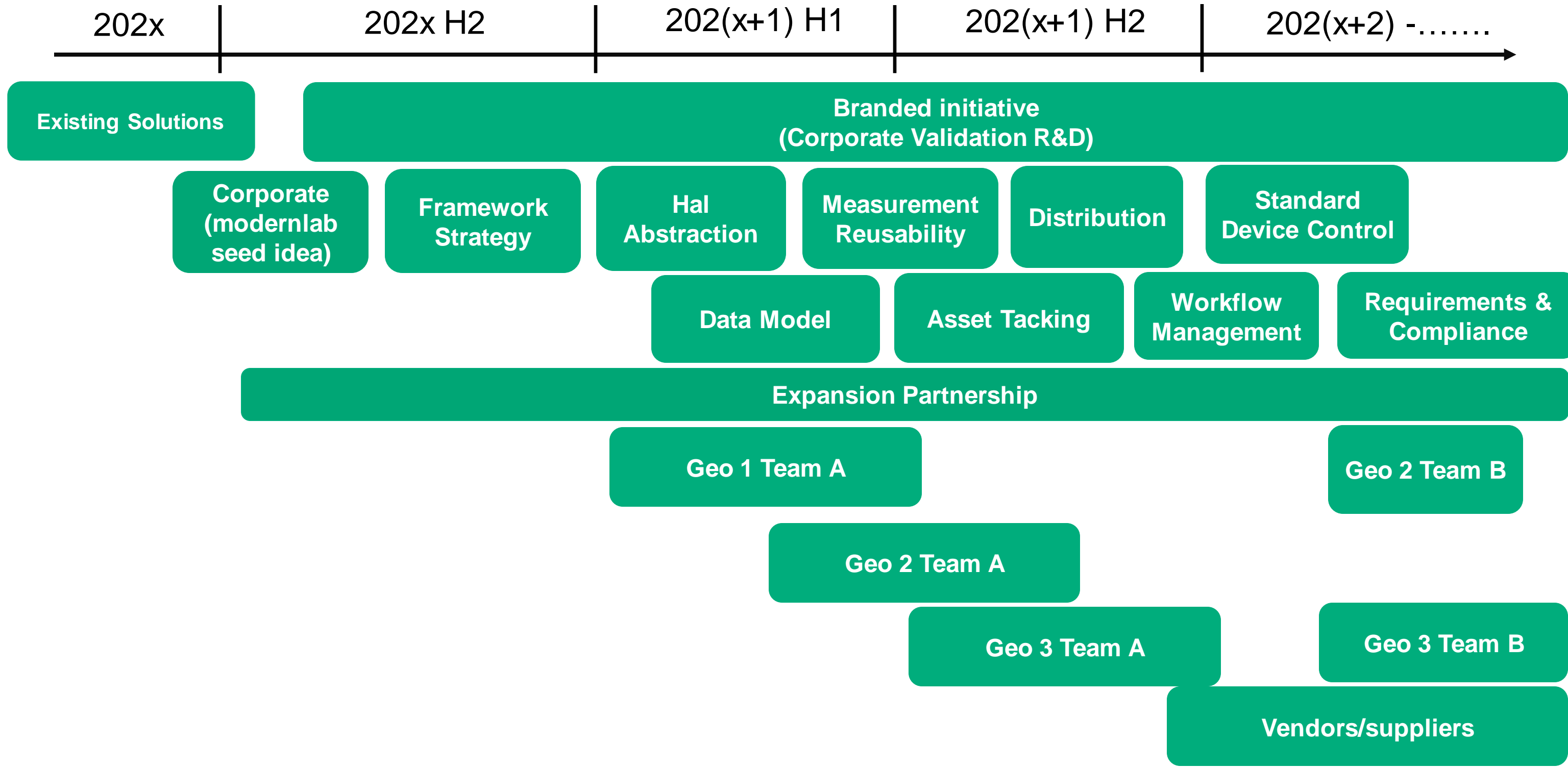
Status, Key Issues and Decisions

- Conceptual Architecture
 - Internal and customer-facing RA complete
 - Gap analysis ongoing with PA, PR&D
 - No roadmap changes planned for FY24
 - Development resources embedded in IS team
- Deliverables
 - LV migration tool, Advanced UI developed and in-use for customer engagements
 - End-to-End SCM workflow demo created and implemented
 - HAL/FAL implementation development ongoing
 - Measurement re-use architecture underway



Realization

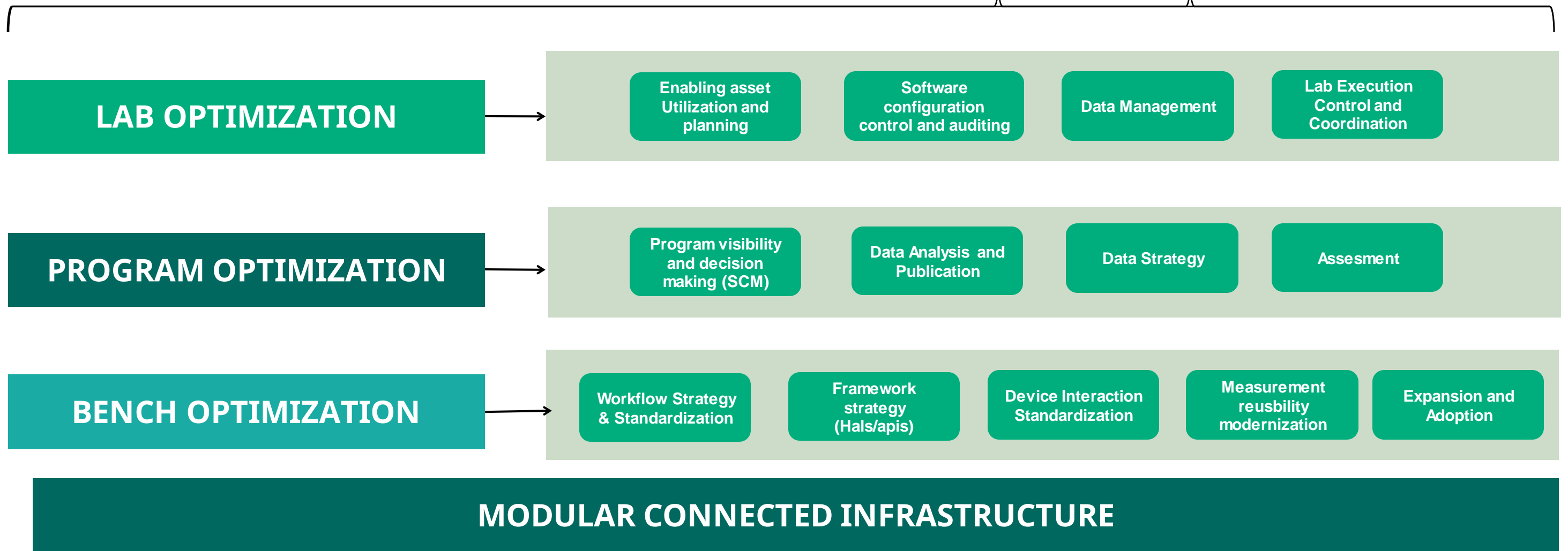
Create a vision and Execute an Iterative Plan



ni ~~Modern Lab Accelerator Packages - Actionable~~ Areas to Focus in the Lab Software Environment

A Leap Forward

A focused, collaborative NI and customer activity to implement and validate a component of the modern lab journey in an accelerated period of time through technical expertise and delivery



Accelerator Packages

		Packages			
		Tool Focused - Free	One Lab Optimization	Lab Optimization Enterprise	Custom – Expansion and Adoption
	NI Tasks				
	Kick Off Meeting, planning, execution & closure		✓	✓	✓
	NI Technical Guidance & Resourcing		✓	✓	✓
	Multi phase goal definitions			✓	✓+
	License Availability	Trial	Configurable	Configurable	Custom
	Accelerator Package Focus Areas		Single Lab (1 Topic)	5 topics	Lab Expansion
Bench	Framework Strategy - Standardization				✓+
	Reusable Measurements		✓		✓+
	Device Communication Standardization			✓	✓+
	APIS and software abstraction (Hals, Mals)			✓	✓+
Program	Data Analysis and Publication			✓	✓+
	Program Visibility and Decision Making - Life Cycle Data Management –			✓	✓+
Lab	Enabling Asset Utilization and Planning				✓+
	Software configuration Control and Auditing				✓+
	Focused Technical Support and training	General	✓	✓	✓+
	Optional				
	Custom Topics/Onsite Travel		Optional	Optional	✓+

Engage with Us

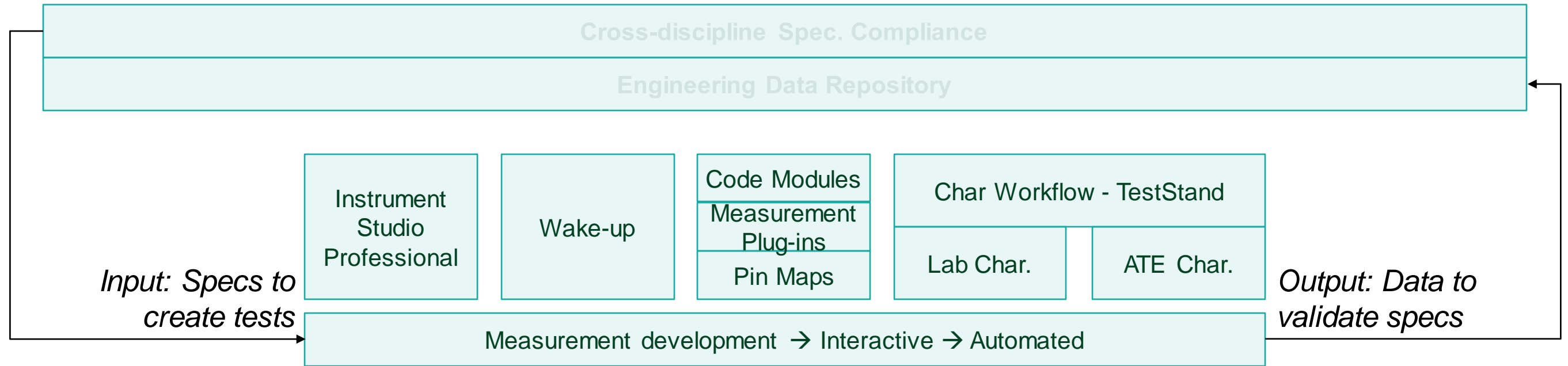
Thank you!
Michael Weir

Bench



Supercharge Validation Workflows with SW Connectivity

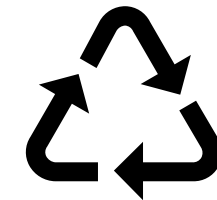
ACCELERATING THE WORKFLOW, ENHANCING PRODUCTIVITY



Faster Time-to-Measurement.
Accessible IP



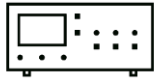
Debug to Automation
Reliable timelines.



Data Connectivity to Reqs & Compliance

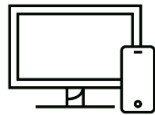


Provides an integrated approach to interactive measurements with the ability to monitor and debug test systems, and more.



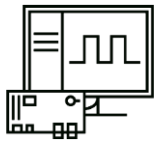
Visualize and Control Measurements

Interface interactively with your instruments and measurement IP with customizable front panels.



Share Projects with Colleagues and Systems

Store your layout and instrument configuration as a project for instant repeatability.



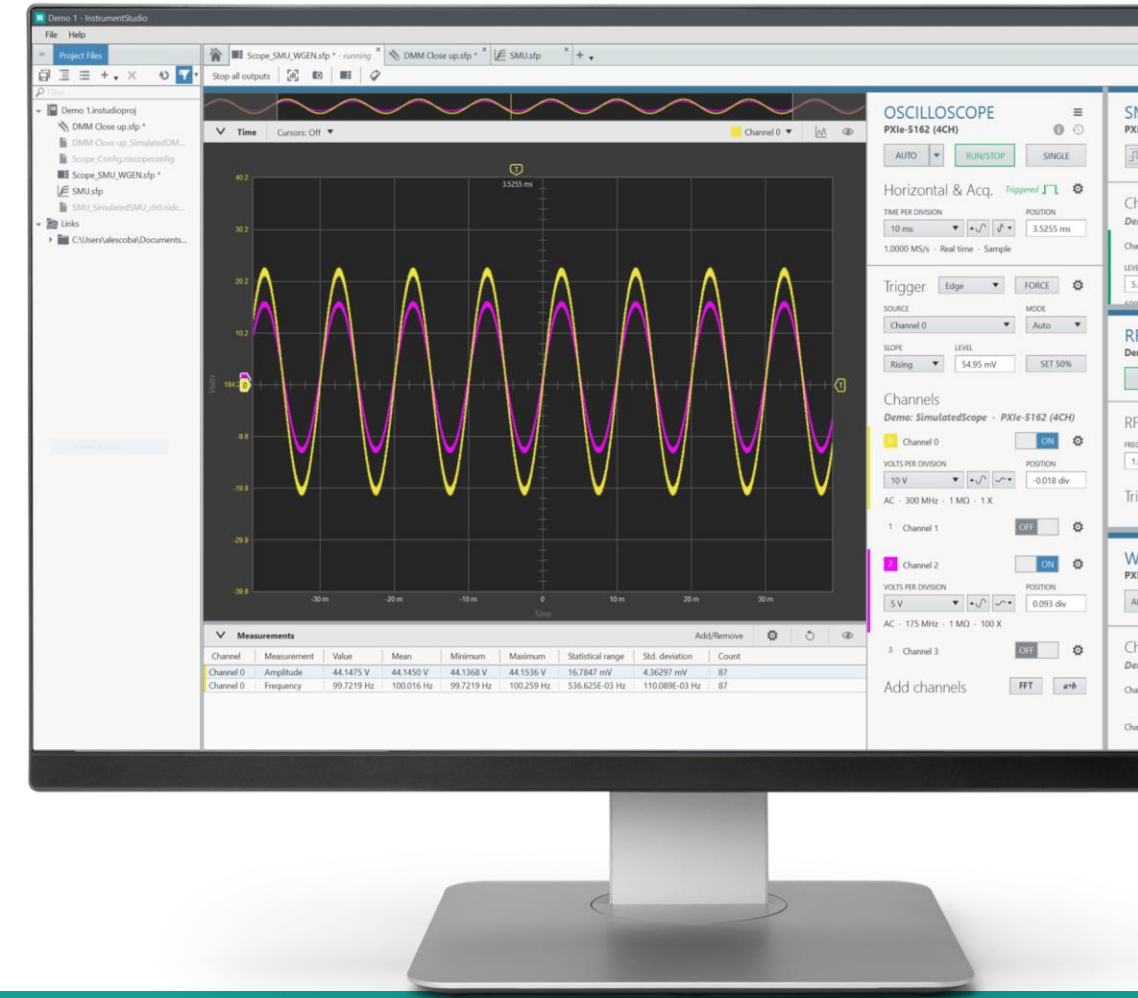
Monitor and Debug Applications

Monitor measurements in LabVIEW, Python, TestStand, and others for run-time debugging.



Automate Interactive Operations

Sequence over interactive steps, automate parametric sweeps and produce reports.



Connect InstrumentStudio



With **LabVIEW** to build and share reusable interactive measurement panels



With **TestStand** to quickly build complex test sequences and generate reports



With **your test infrastructure and IP** to lower costs and improve workflows

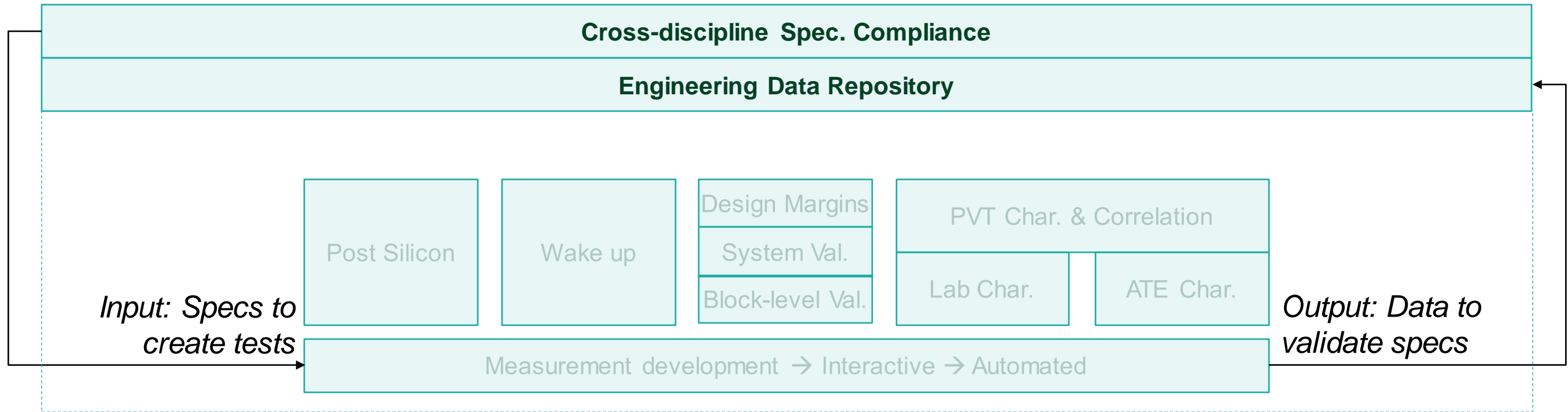


Program



Upgrade Product Programs with Data Connectivity

IMPROVING PROGRAM EFFECTIVENESS WITH BETTER COLLABORATION



Faster Time-to-NPI.
More reliable timelines.



Better product results
through collaboration.

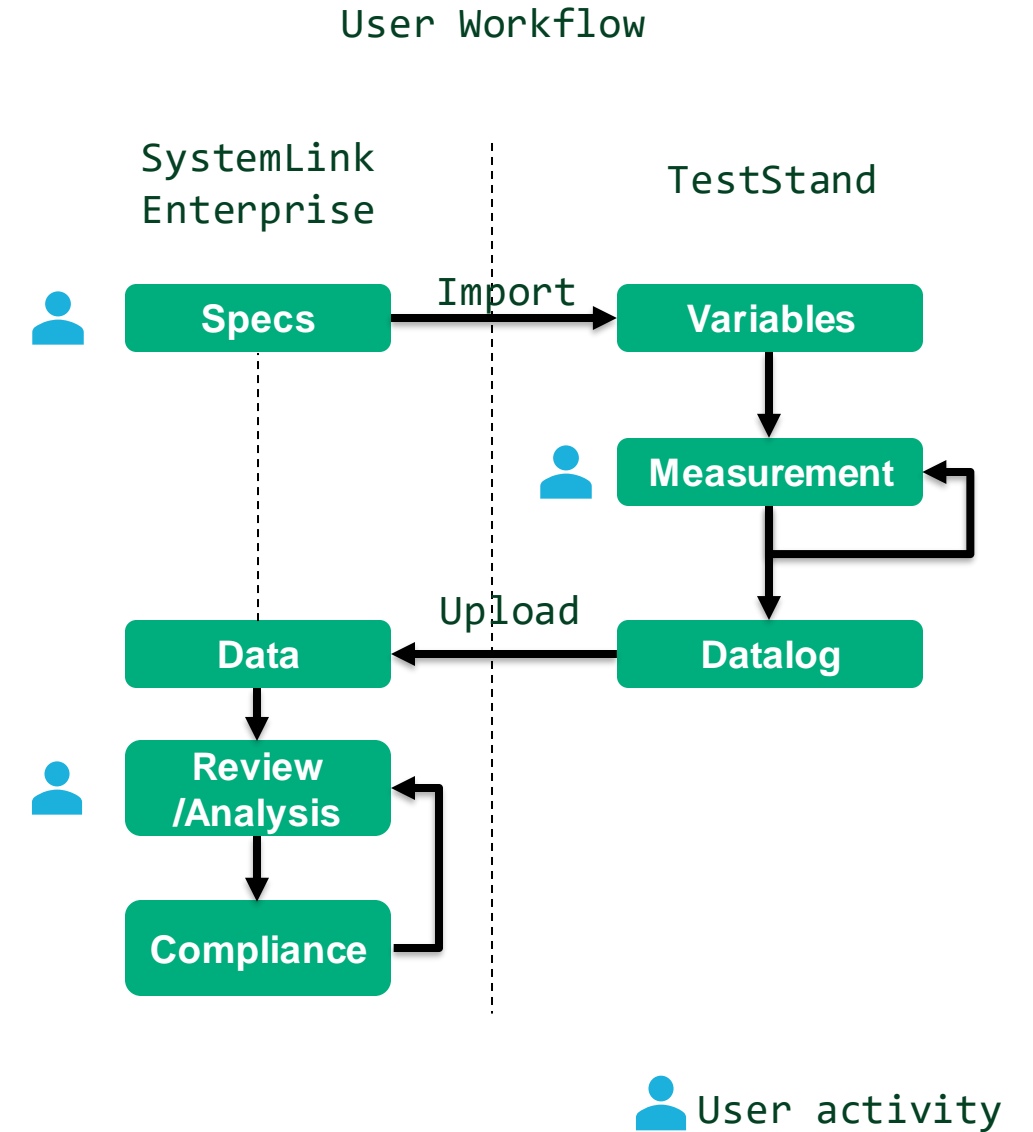
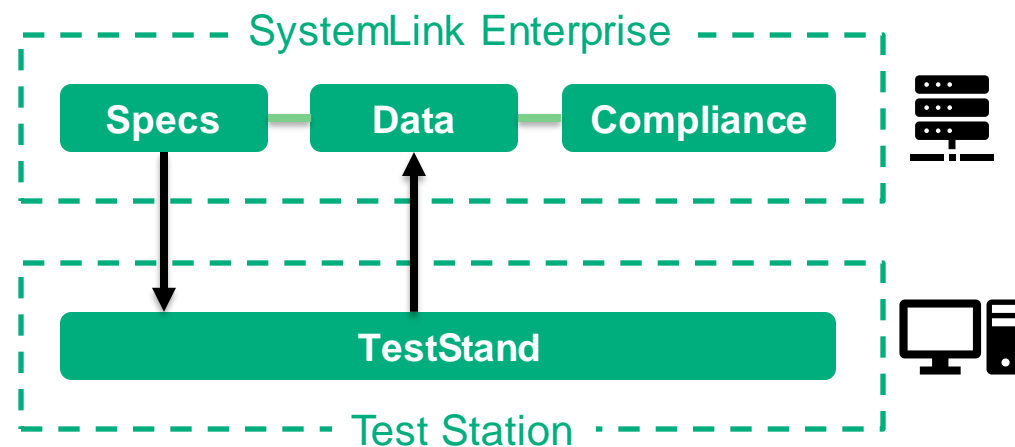


Better relationships
between teams.

End to End SCM Workflow

What is covered

- Device Specifications → Measurement Data → Specification Compliance → Data Analysis
- Connected Specification Compliance cycle through TestStand and SystemLink
- Intuitive workflow to standardize specification management and measurement data management for ADV



E2E SCM Workflow | Sample

Products / Voltage Regulator (7805)

Name	Family	Part number	Updated
Voltage Regulator	DataStudio Customer Success	7805	May 10, 2024, 8:28:11 AM

Results Files **Specs** Test Plans DUTs

SPEC ID	SYMBOL	NAME	MIN	TYPICAL	MAX
Group1 (7)					
7805_Spec_001	VO	Output Voltage	4.75	5	5.25
7805_Spec_002	Regline	Line Regulation		5	100
7805_Spec_003	Regload	Load Regulation		1.3	100
7805_Spec_004	IB	Quiescent current		3.2	8
7805_Spec_005	ΔIB	Quiescent current change			0.5
7805_Spec_006	RR	Ripple Rejection		68	
7805_Spec_007	VI - VO	Dropout voltage		2	
NameYourGroup (1)					
JustAnotherGroup (1)					

Specifications on SLE

Sequence File 1 x

Steps: MainSequence

Manage Specifications

Select product and categories.

Product
7805

Categories
Group1, JustAnotherGroup, NameYourGroup

(Select All)

Group1
 JustAnotherGroup
 NameYourGroup

Help OK Cancel

Import Specifications into TS

Variables

Filter by name

NAME	VALUE	TYPE
SCM_Specifications		Container
123 Vin__V_	0	Number
123 TJ__C_	0	Number
123 IO__A_	0	Number
123 Ripple__Hz_	0	Number
123 CondA__V_	0	Number
A Mode	""	String
_7805_Spec_001		Container
A Id	"7805_Spec_001"	String
A Name	"Output Voltage"	String
123 MeasurementValue	0	Number
123 Min	4.75	Number
123 Typical	5	Number
123 Max	5.25	Number
A Unit	"V"	String
Vin		Container
TJ		Container
IO		Container
<Right click to insert Field>		
_7805_Spec_002		Container

Specification in TS Variables

E2E SCM Workflow | Sample

Steps: MainSequence

STEP	DESCRIPTION	SETTINGS
+ Setup (0)		
- Main (3)		
⚙ Sweep Vin Tj lo	3 Sweep Parameter(s)	
📏 Your measurement		
⏹ End		
<End Group>		

Step Settings for Sweep Vin Tj lo

Sweep Parameters | Input | Output | Loop Information

	PARAMETER NAME	TYPE	PARAMETER
<input checked="" type="checkbox"/>	0 Vin	123	FileGlobal
<input checked="" type="checkbox"/>	1 Tj	123	FileGlobal
<input checked="" type="checkbox"/>	2 lo	123	FileGlobal

Use Spec conditions with Measurements

Products / Voltage Regulator (7805)

Name: Voltage Regulator | Family: DataStudio Customer Success | Part number: 7805

Updated: May 10, 2024, 8:28:11 AM

Results | Files | Specs | Test Plans | DUTs

Refresh: Manual

Showing 12 of 12 test results. Sorted by most recent start time

Test program	Part number	Serial number	Elas
STI-HPLT-710_Demo2.seq_2024-0...	7805		0 s
VoltageRegulator_Simple_v1	7805	C8759	0 s
VoltageRegulator_Simple_v1	7805	C8759	0 s
VoltageRegulator_Simple_v1	7805	C8759	0 s
VoltageRegulator_Simple_v1	7805	C8759	0 s
VoltageRegulator_Simple_v1	7805	E5914	0 s
VoltageRegulator_Simple_v1	7805	D8721	0 s

Measurement Data on SLE

Products / Voltage Regulator (7805)

Name: Voltage Regulator | Family: DataStudio Customer Success | Part number: 7805 | Updated: May 13, 2024, 5:29:08 PM

Results | Files | Specs | Test Plans | DUTs

*Compliance

SPEC ID	SYMBOL	NAME	UNIT	COMPLIANCE_HE...	COMPLIANCE_MIN	COMPLIANCE_MEAN	COMPLIANCE_MA
Group1 (7)							
7805_Spec_001	VO	Output Voltage	V	Pass	4.82077800000647	4.946729662145...	5.085282428631...
7805_Spec_002	Regline	Line Regulation	mV	Pass	14.83104560347	45.65463098180...	77.36908371965...
7805_Spec_003	Regload	Load Regulation	mV	Pass	31.3724292479035	41.72956342003...	56.33508834937...
7805_Spec_004	IB	Quiescent current	mA	Pass	2.9463161315715	5.421617191209...	6.005970464210...
7805_Spec_005	ΔIB	Quiescent curren...	mA	Not Available	Not Available	nan	Not Available
7805_Spec_006	RR	Ripple Rejection	dB	Not Available	Not Available	nan	Not Available
7805_Spec_007	VI - VO	Dropout voltage	V	Pass	1.97803315900877	2.007820735528...	2.036885959214...
NameYourGroup (1)							
Sample P Spec ID		Some Parametri...	Santhosh	Not Available	Not Available	Not Available	Not Available

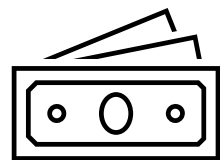
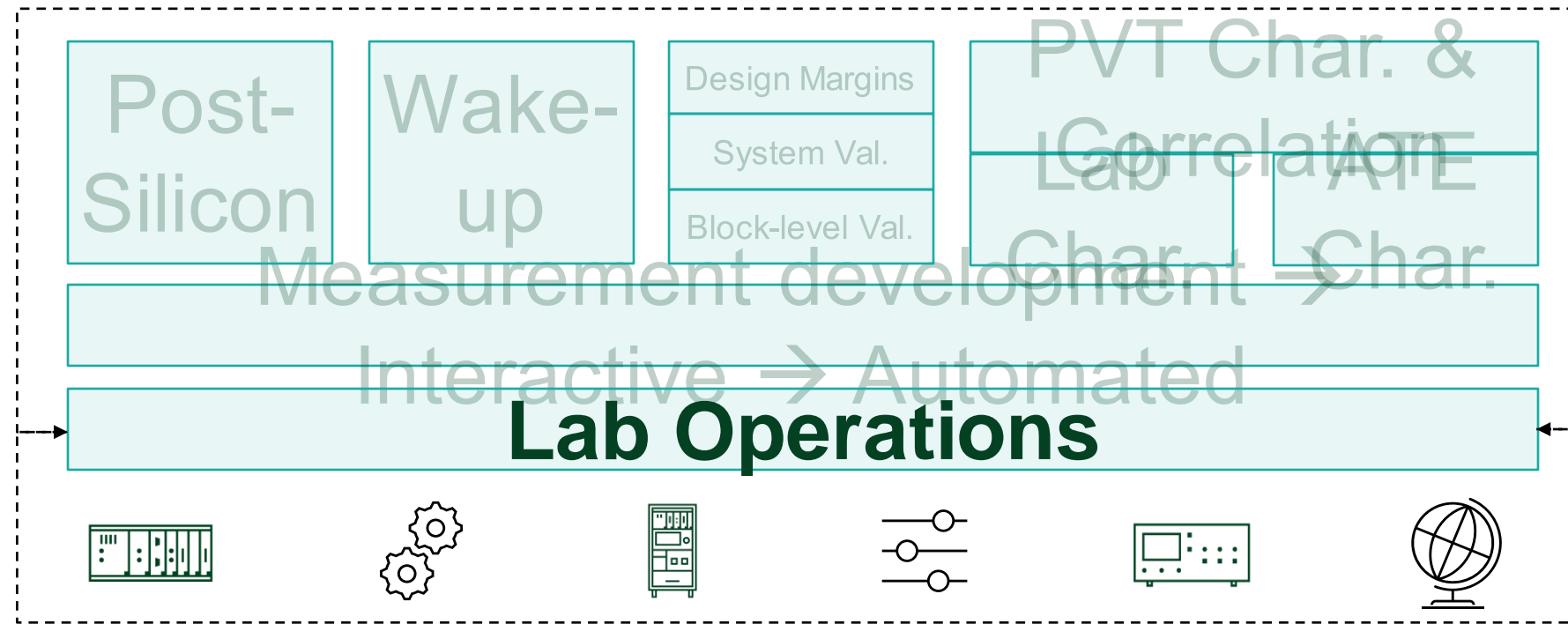
Spec Compliance on SLE

Lab



Focus More on the Product, Less on Managing Labs

EASILY ORCHESTRATING LAB ACTIVITIES FROM A CENTRAL SYSTEM

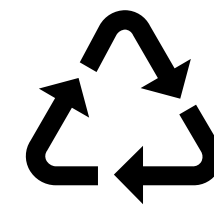


Better utilization of lab budgets.
Lower Cost-of-Test.



Fewer errors.

Better product results.



Fewer resources spent on non-test activities.

Work Orders / Check WO

Name: Check WO

Status: New

Assigned to: Nandhini Vijayakumar

Earliest start date: Aug 7, 2023

Due date: Aug 8, 2023

Type: Test request

Workspace: Default

Requested by: Nandhini Vijayakumar

Updated: Aug 8, 2023, 4:39:34 AM

Test plans | Files | Results

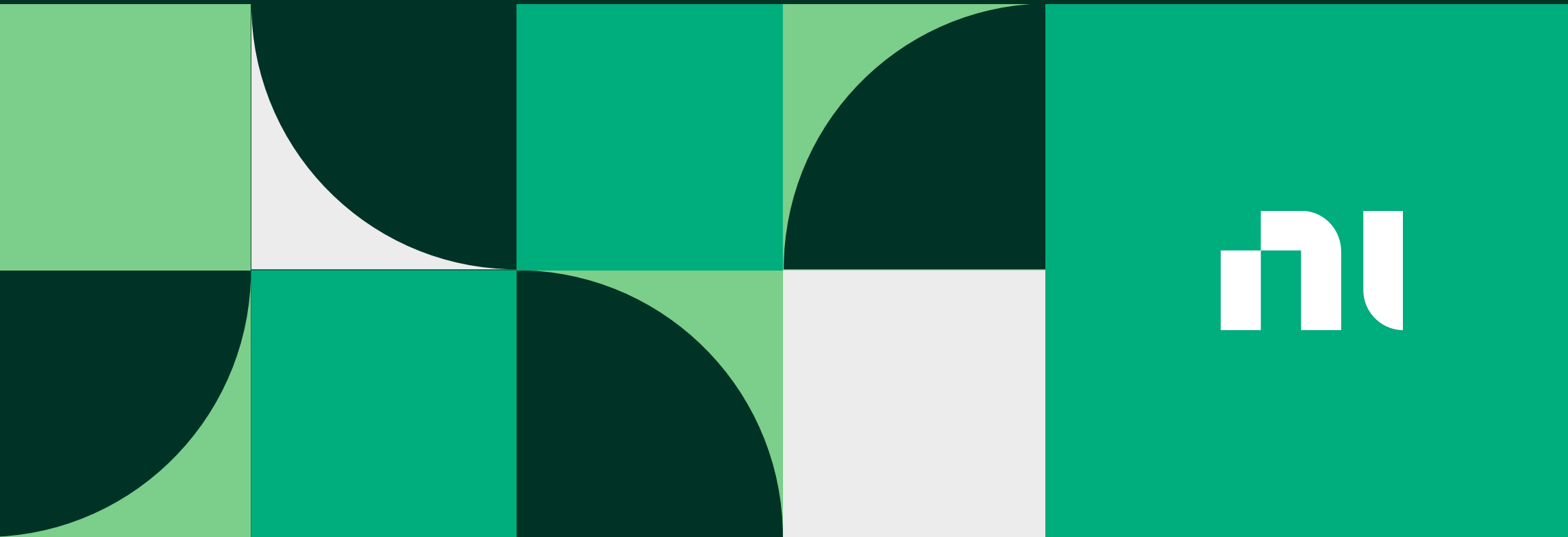
Create test plan

<input type="checkbox"/>	Name	Status	Assigned to	Work order
	test name	New	Nandhini Vijayakumar	Check WO
	Check TP 6	New	Nandhini Vijayakumar	Check WO
	Check TP 5	New	--	Check WO
	Check TP 4	New	--	Check WO
	Check TP 3	New	--	Check WO
	Check TP 2	New	--	Check WO
	Check TP 1	New	--	Check WO



Test Plan Management

- Define, manage, schedule, deploy, start, and monitor tests
 - Notify requestor when results are available
 - Comment on test plans and results to help clarify requirements and improve collaboration with others
- Leverage test plan templates to streamline test planning and scheduling
- Schedule systems, assets, and DUTs to be used for test plan execution
- Ability to remotely deploy and start tests remotely
- Monitor test execution in real-time as well as critical resources and get immediate updates as test result data is available



NI is now part of Emerson.

Workflows

Example Workflows Addressed by Modern Lab

1. End to End Full connected Lab Data Workflow – Close the Loop (1) – spec -> bench -> measurement -> data -> compliance
2. Spec Definition to val source code development
3. Organization Asset Management (2)
 1. View Available Assets from all station
 2. Understand utilization and financial impact
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 1. Advanced UI Building
 2. Python Interoperability
 3. Existing Measurement Migration Utilities
11. [Reference Architecture_Modern Lab_Workflows.docx](#)

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