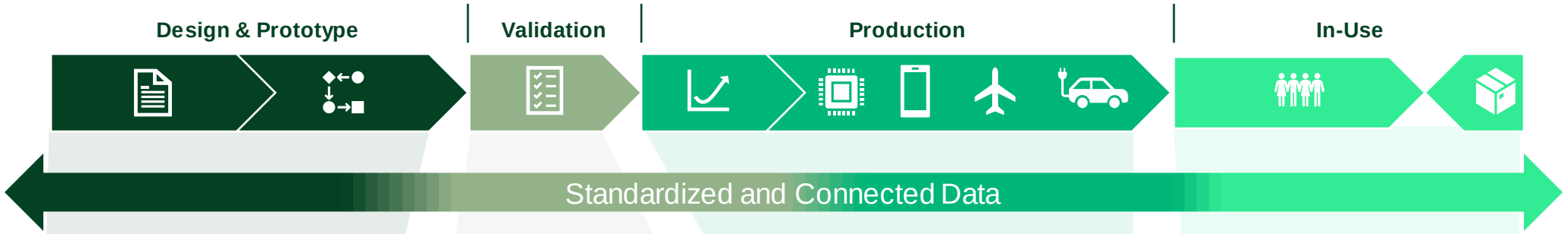
CONNECT 2022

NI in Action:

The Key to Achieving Your KPIs

Ron Chaffee

NI Lifecycle Solutions



Orchestrating, connecting, and analyzing data to solve problems within and across product lifecycle stages

Design & Prototype

Spec management and test-data alignment

Validation

Test system orchestration and data reporting

Production

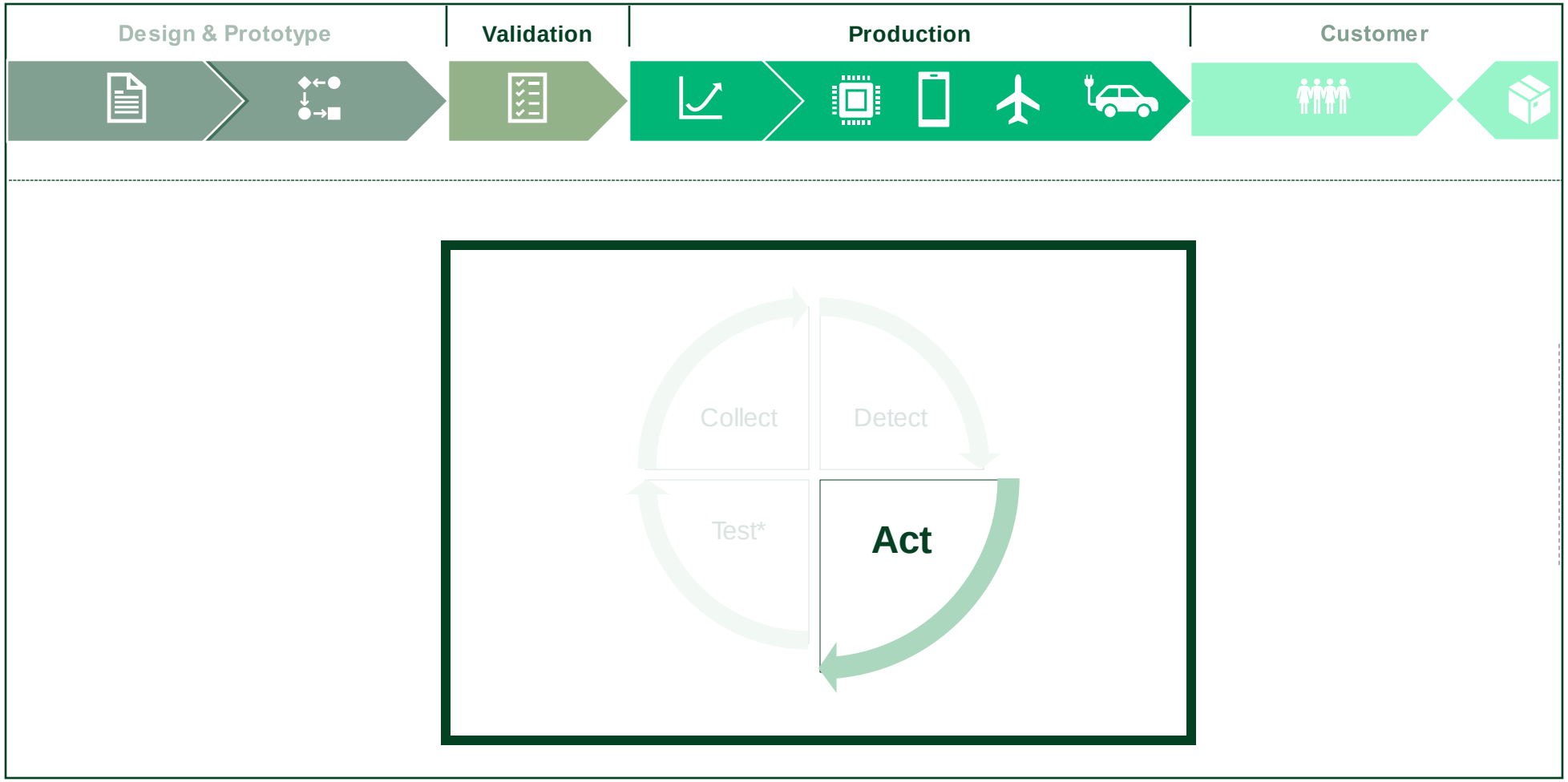
Product-centric analytics to drive improvement

In-Use

Train analytics models with in-field data to improve design & mfg.

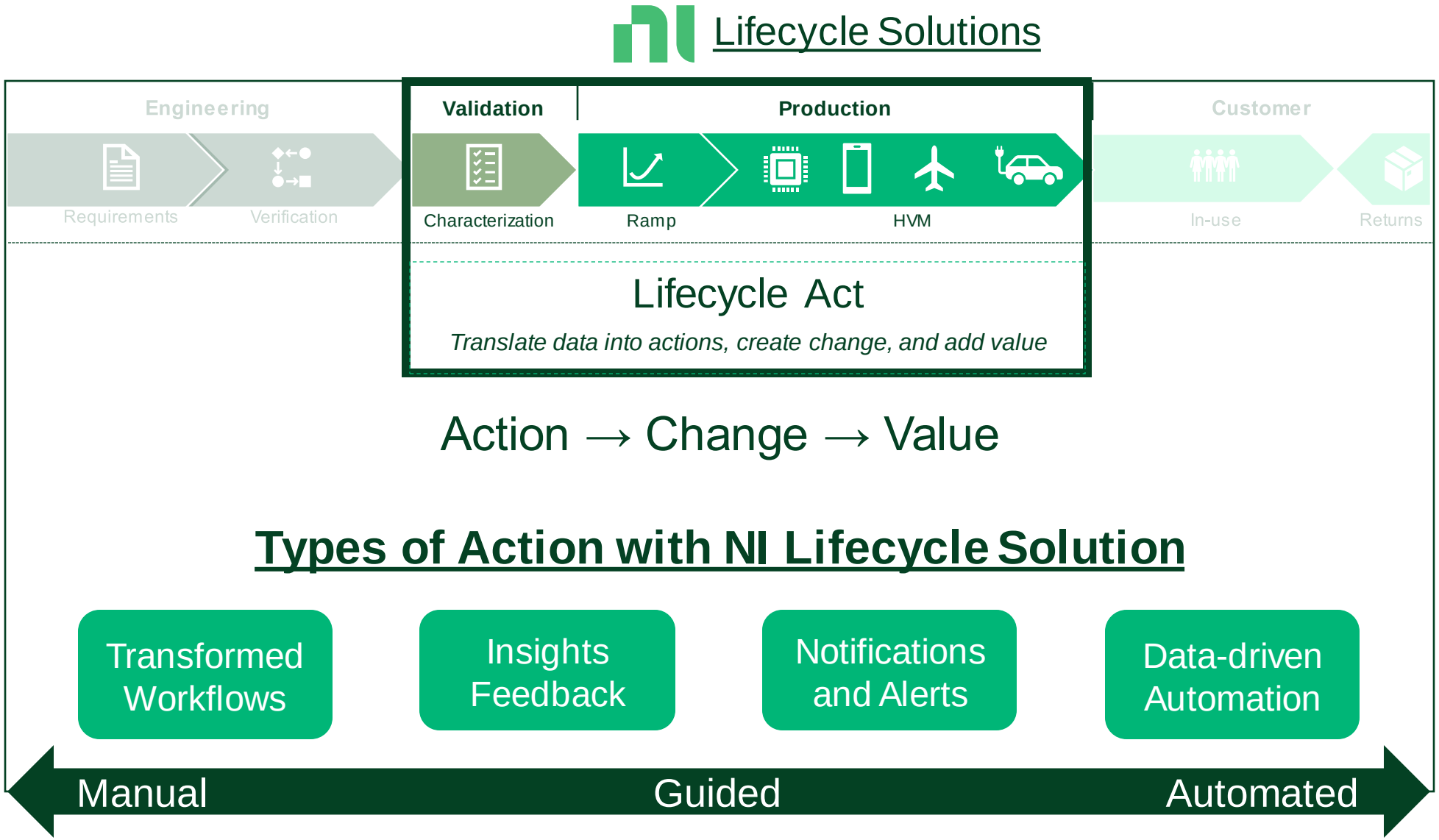
Act with NI Lifecycle Solutions

Lifecycle Solutions

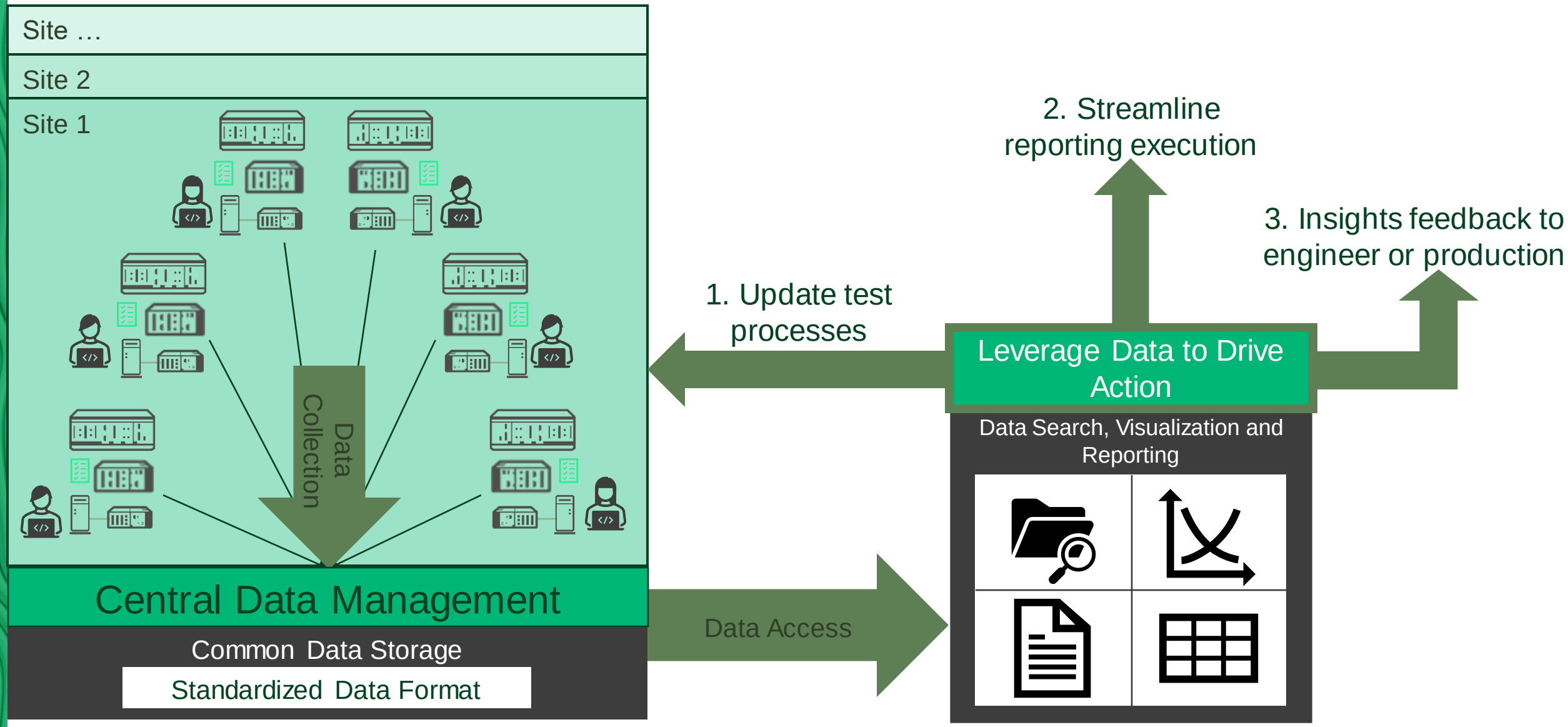


*Compatible with Test HW and Systems from **any Vendor**

Act with NI Lifecycle Solutions



Workflow for Manual Action



Transformed Workflows

Update Test Processes

Identify: Compare trends to limits, isolate outliers and find problem

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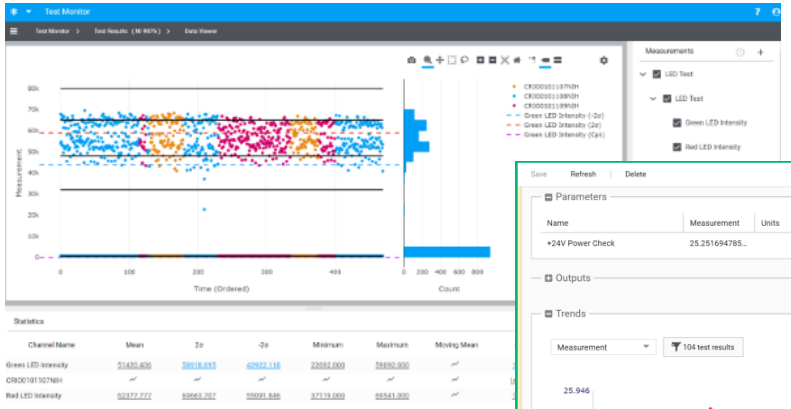
Investigate: Select test values to access detailed test results

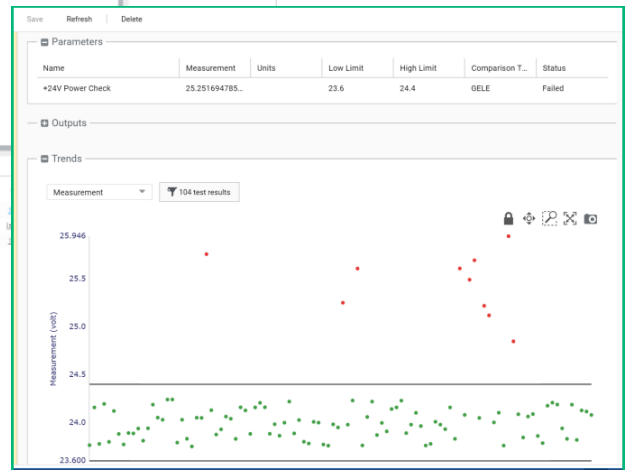
↓

Filter: Group-by and color-code test results by system, operator, etc.

↓

Fix: Implement corrective actions to address issue





Streamline Reporting Execution

Create: Define report data sources, processes, and visualizations

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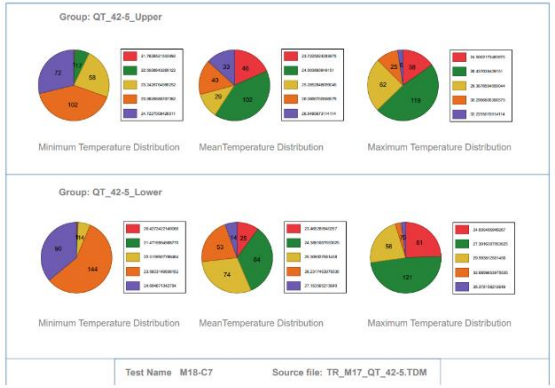
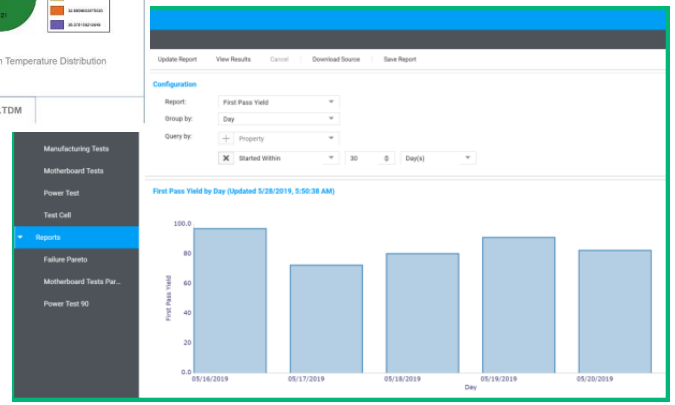
Automate: Easily replicate report as new data becomes available

↓

Deliver: Send Report PDF to stakeholders for easy distribution





Insights Feedback

Use data to drive engineering and innovation decisions

NI Battery Data and Analytics Workflow

SystemLink™

Situational Awareness

- BATTERY ANALYTICS
- USER DASHBOARDS
- CONFIGURABLE REPORTS
- ADMIN TOOLS

Systems Connectivity

- DEVICE DISCOVERY
- REMOTE EXECUTION
- MONITORING AND TAGS

Data Gateway

- FILE INGESTION
- TEST RESULTS

Battery Validation Labs

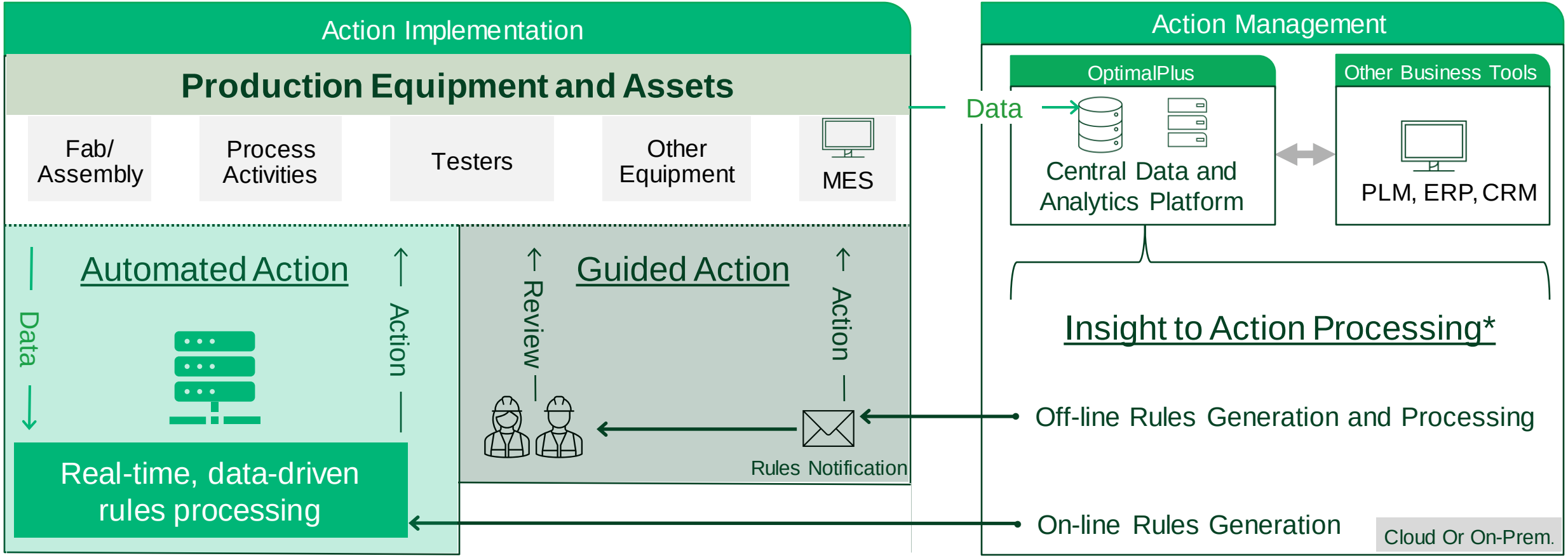
- Desktop PC/Servers
- NI Battery Test System
- Other Test System
- Data Generating Assets

Benefits

- REDUCED COST OF BATTERY DEVELOPMENT
- 100% REQUIREMENT COMPLIANCE
- ACCELERATE PRODUCTIVITY AND TIME TO INSIGHTS
- OPEN AND INTEROPERABLE FOR FLEXIBILITY AND SCALE

Workflow for Guided & Automated Action

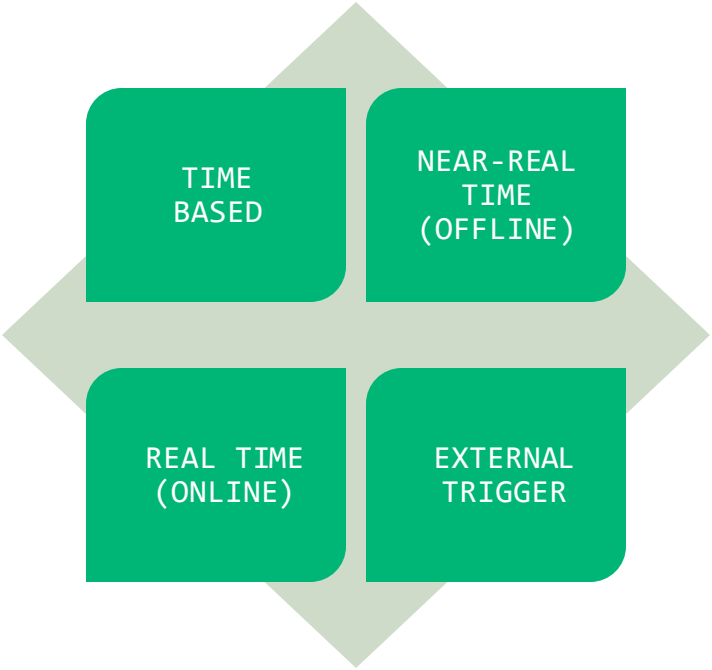
O+ Action Workflow is Adaptable to Various Industries/Environments



*Off-line vs on-line action availability is infrastructure dependent

The Power of ‘Rules’

Use Data-driven Rules to identify scenarios and predefined trigger responses



Canned Rules By Mode Of Operation

Time Based

- Sequoia Rule*
- Cross Rule*

External Trigger

- Crack Detection Rule*
- Trigger by MES

'End of Wafer' (Offline)

GO

- E-Test Inking
- Fail Test Limit
- Fail Test Within Limits Result
- Freeze
- Generic Rule
- Parametric Process Capability
- Parametric Trend Aggregated
- Parametric Trend by Test
- Probe Mark Count
- S2S Bin Deviation
- S2S Fail Test Deviation
- S2S Statistical Deviation
- S2S Yield Deviation
- S2Sx Rule
- SBL
- TTR Monitor
- Yield Monitor

Escape Prevention (EP)

- Good Die With Failing Tests
- Pass with Results out of Limits*
- PRR Number of Tests Validation*
- Test Program Checksum
- Test List Comparison between TP Revs
- Test Cell Validation
- ULT Validation

Outlier Detection (OD)

- Virtual Operation Rule*

'Device Analytics' (Online)

- Adaptive Parametric TTR*
- Bin Monitor
- CBL
- Freeze
- Parametric Process Capability
- Parametric Trend Aggregated
- Parametric Trend by Test
- S2S Bin Deviation
- S2S Fail Test Deviation
- S2S Statistical Deviation
- S2S Yield Deviation*
- Tester Settings Validation
- TP Checksum Validation
- Yield Monitor

Flexible Sequoia Rules

Custom Sequoia Rules

Custom script to query, process, and analyze data to identify a scenario and act accordingly

&

Virtual Operation Rules

A simple composite of multiple rules to identify and act on a given scenario

Input

- Define data source to query

Process

- Canned modules
- R/Python Scripts
- ML Capable

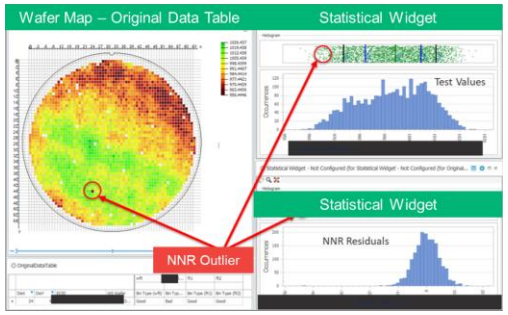
Output

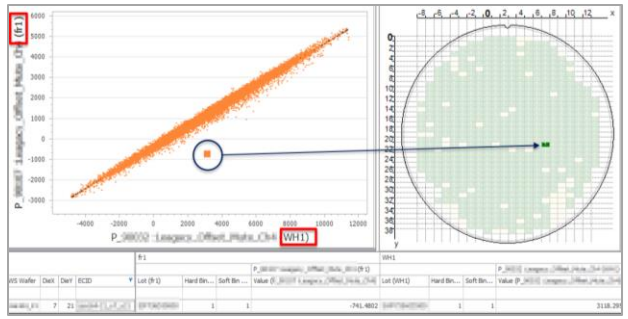
- Load to O+ DB or external system

Act

- Send defined alerts
- Trigger corrective action

NNR

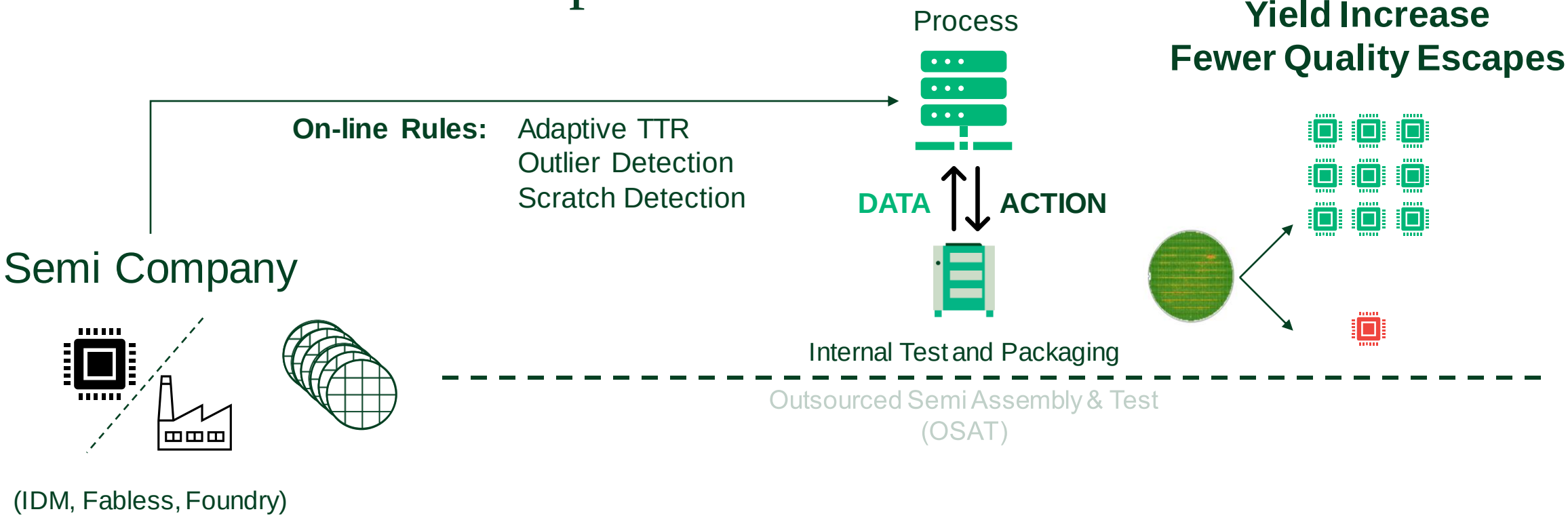




Bivariate correlation

On-line Rules Example

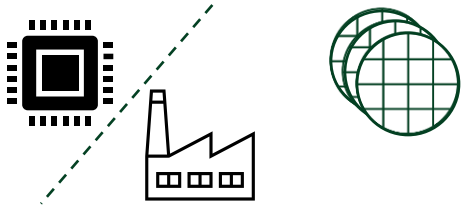
Test Efficiency
Yield Increase
Fewer Quality Escapes



Off-line Rules Example

Test Efficiency
Yield Increase
Fewer Quality Escapes

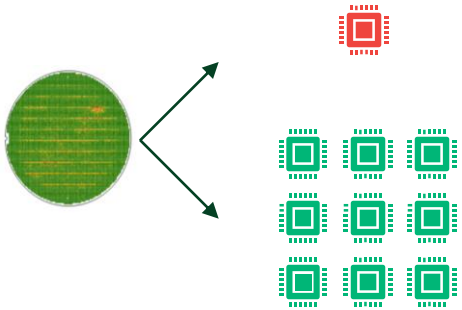
Semi Company



(IDM, Fabless, Foundry)

Internal Test and Packaging

Outsourced Semi Assembly & Test
(OSAT)

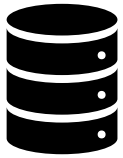


Off-line Rules:
Test Limit
Yield Deviation

ALERTS

DATA

Process

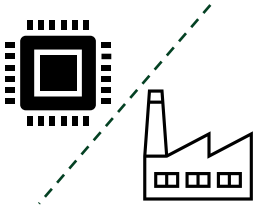


Transparency
Trust
Oversite

Rules Impact

Test Efficiency
Yield Increase
Fewer Quality Escapes

Semi Company



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Internal Test and Packaging

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Transparency
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EV Power PCBA Mfg Cost Reduction w/ Deep Learning Image Algorithms

The Challenge

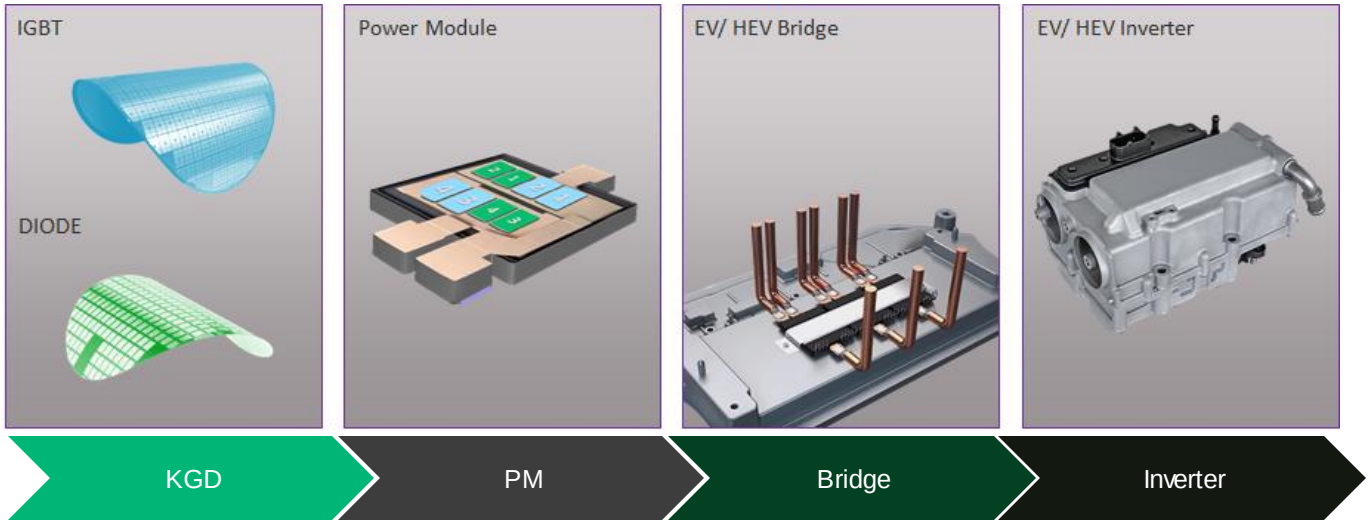
- Sensitive product steps difficult to maintain and require significant quality control

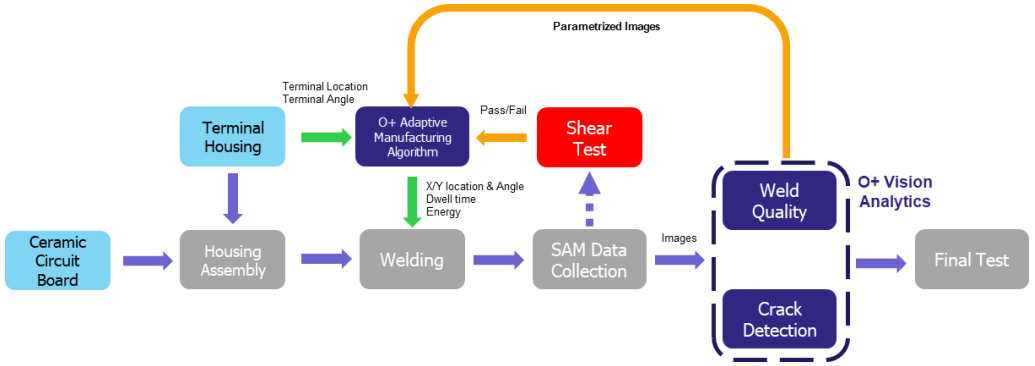
Deployment Summary

- Implemented in-line edge Deep Learning vision algorithms to improve test time and accuracy
- Increased product reliability and quality
- Improved value of RMA analyses

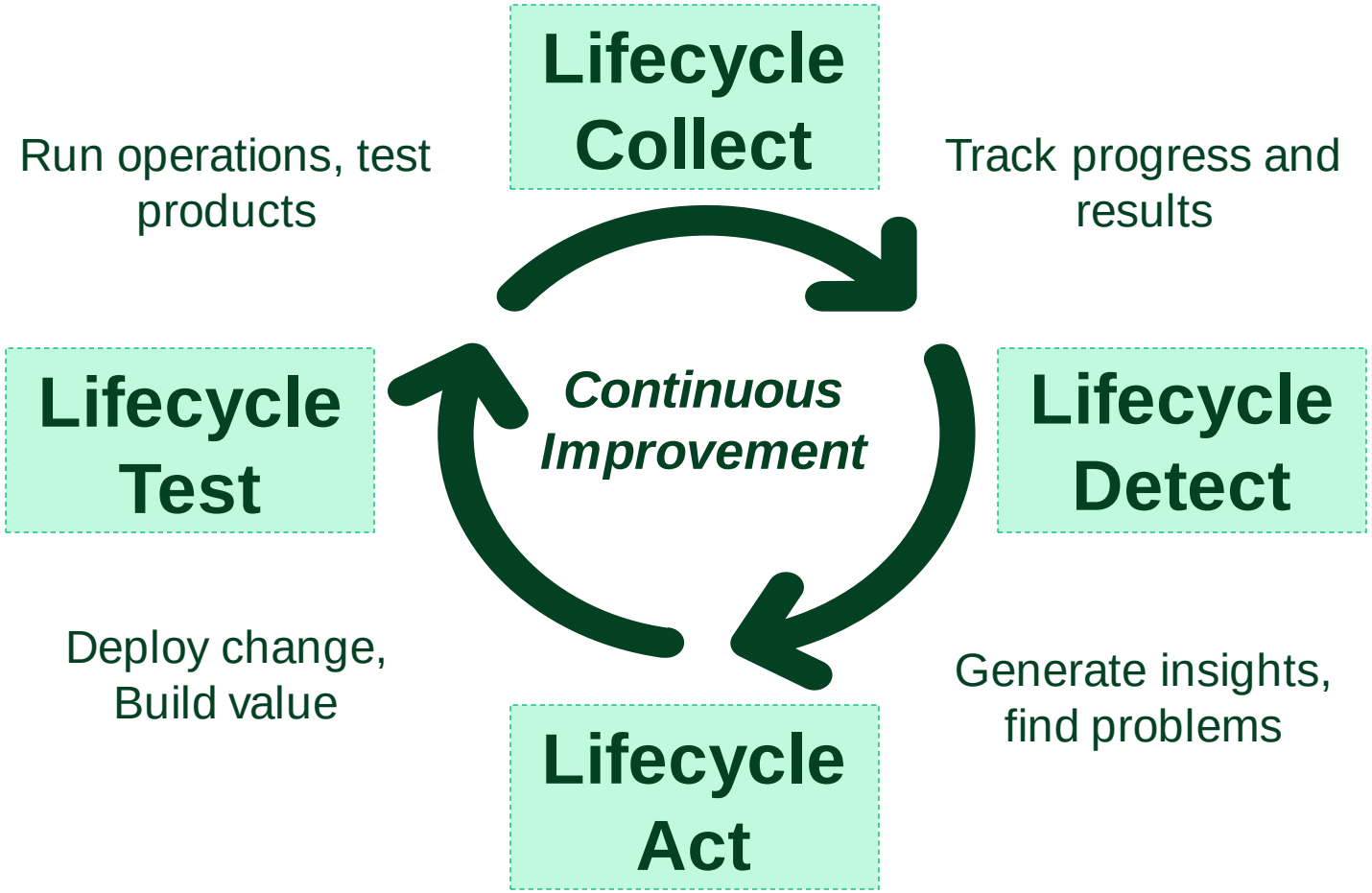
Realized Benefits

- **>80% reduction** in manual inspection
- **40% improvement** in scrap reduction YoY
- **Quantified claim/warranty exposure**





The Data to Action Cycle



The NI Manufacturing Journey

An inside story of NI Lifecycle Solutions

Session 6: Bringing it All Together with NI Manufacturing

NI Journey: 4-Steps to Becoming Data-Centric

1. Identify

- What problem needs to be solved
- What data is needed to solve those problems

2. Collect

Lifecycle Test

Lifecycle Collect

- Identify data sources to connect and centralize
- Set up a data pipeline with flexibility for future changes

3. Analyze

Lifecycle Detect

- Create dashboards and reporting for visibility of data
- Train teams to use dashboards for low-effort analysis

4. Act

Lifecycle Act

- Integrate data-driven workflow into decision making processes
- Implement process changes to achieve desired results

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is now NI.