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Efficient Road Load Data Acquisition

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Need for durability engineering

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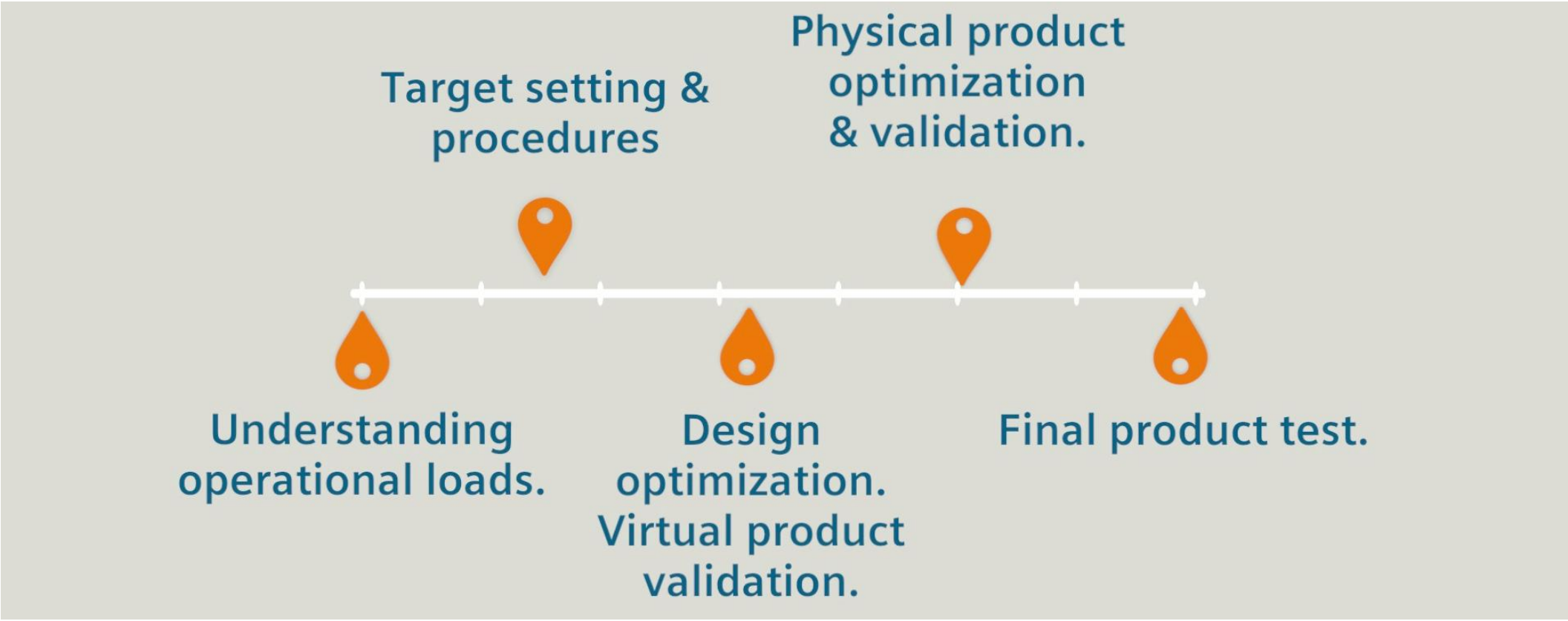

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Need for durability engineering

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Road Load Data Acquisition (RLDA)
Typical steps

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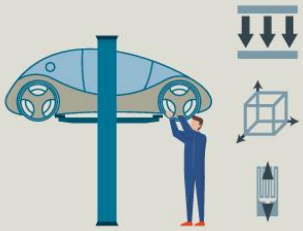
Office
Test preparation

Simulation engineer
Test engineer

Lab
Instrumentation

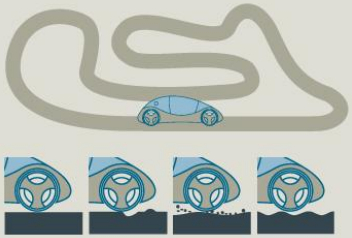


Technician

Channel setup

Test engineer

Proving ground
Measure



Driver

Validate

Test engineer

Office
Data consolidation

Test engineer

Report & share

Test engineer

Office
System-level / component simulation

Simulation engineer

Lab
Rig test validation

Test engineer

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Road Load Data Acquisition (RLDA)
Typical steps

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- Instrumentation
- Channel setup
- Measure & validate
- Data consolidation
- Report & share

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Step 1
Instrumentation

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- **Instrumentation**
- Channel setup
- Measure & validate
- Data consolidation
- Report & share

Challenges

- Acquire & synchronize broad range of different sensor types

- Limited space in vehicle

Universal signal conditioning

- Built-in universal signal conditioning
- Fit for high channel count

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Step 1
Instrumentation

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- **Instrumentation**
- Channel setup
- Measure & validate
- Data consolidation
- Report & share

Challenges (large vehicles)

- Large number of lengthy cables need to be fixed, leading to long instrumentation time and high cable cost
- Reliability acquisition system in extreme testing conditions, like exposure to water and dust, high shocks and vibrations & high/low temperatures

Distributed acquisition setup

- Distributed setup, bringing acquisition units close to sensors
- Designed and certified to work in extreme environments

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Distributed setup

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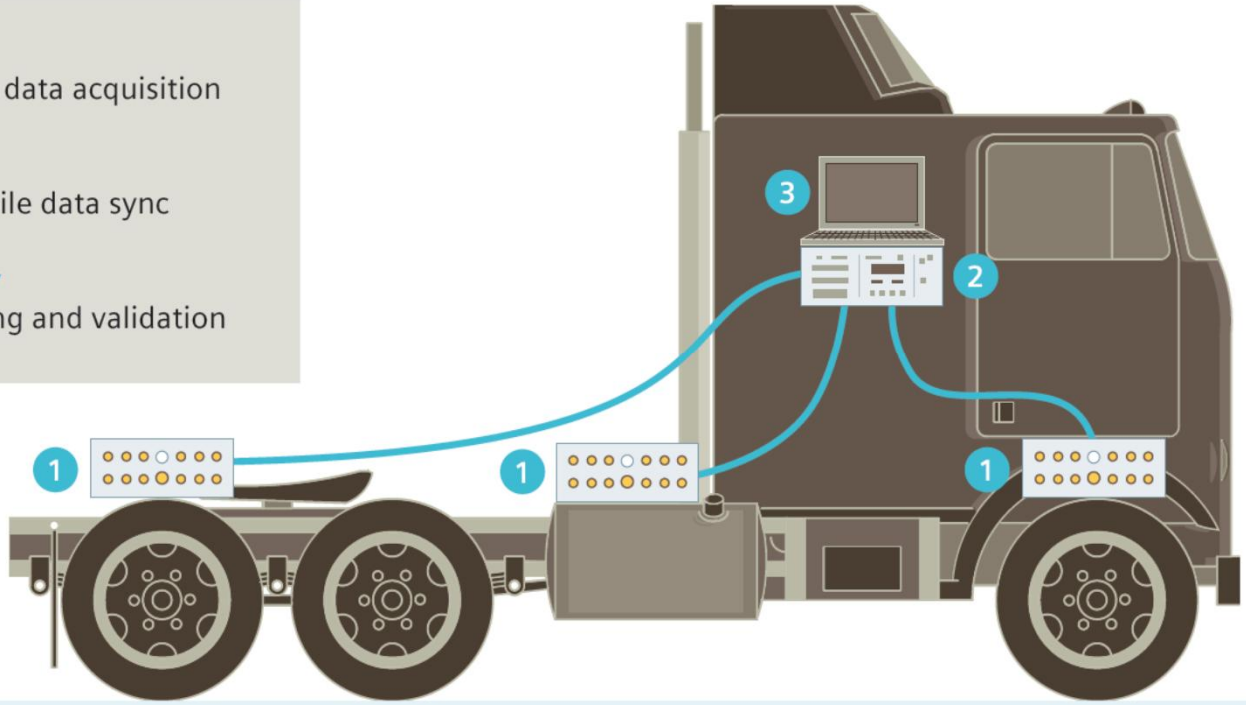
1. **LMS SCADAS Satellite**
   Distributed, digital, local data acquisition
2. **LMS SCADAS Recorder**
   High-channel count mobile data sync
3. **LMS Test.Lab Durability**
   Quick, easy data recording and validation



Typical 200+ channel campaign: strain gages, accelerometers, displacements, wheel-force, temperature, CAN and video

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Distributed setup

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- Distributed setup with acquisition units near sensors

Centralized setup	Distributed setup
60 (long) cables	5 (green) cables

- One single (green) cable carrying data and power for 12 channels simplifies instrumentation and repair

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Certified equipment

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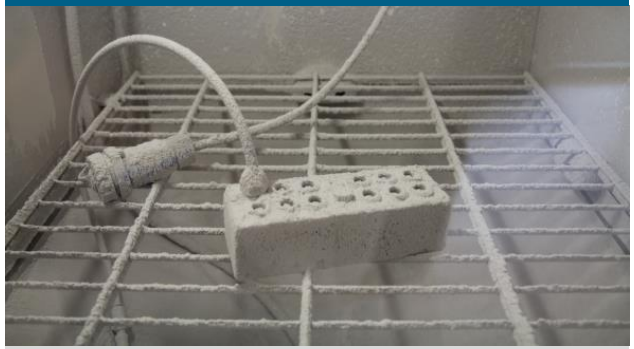
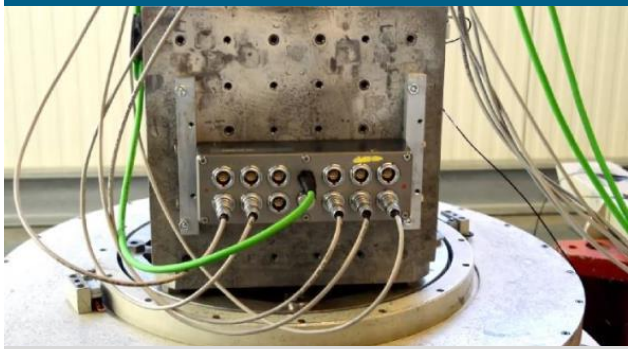
Water and dust



IEC 60529: IP66 and IP67

- Dust-tight (IP6x)
- Power water jet (IPx6)
- Immersion up to 1m (IPx7)

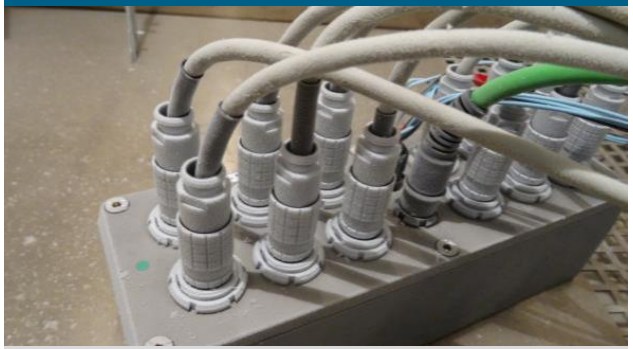
Shock and vibration



MIL-STD-810F

- Vibration: 7.7grms
- Shock: 100g shock

Temperature



Wide range

- -40 ºC up to 85 ºC
  -40 ºF up to 185 ºF

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Step 1
Instrumentation

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Instrumentation

Channel setup

Measure & validate

Data consolidation

Report & share

Simplify hardware setup by embedding different signal conditioners
Reduce costs & increase uptime with certified distributed setup

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Step 2
Channel setup

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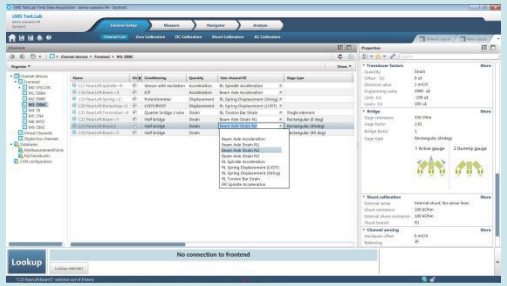
- Instrumentation
- **Channel setup**
- Measure & validate
- Data consolidation
- Report & share

Challenges

- Manual channel parametrization takes time and is error-prone
- No link to in-house sensor database

Sensor database

- One-button click to upload sensor information from database or TEDS
- Microsoft® Office Excel alike channel grid



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Road Load Data Acquisition
Automatic channel setup with lookup from ODBC database

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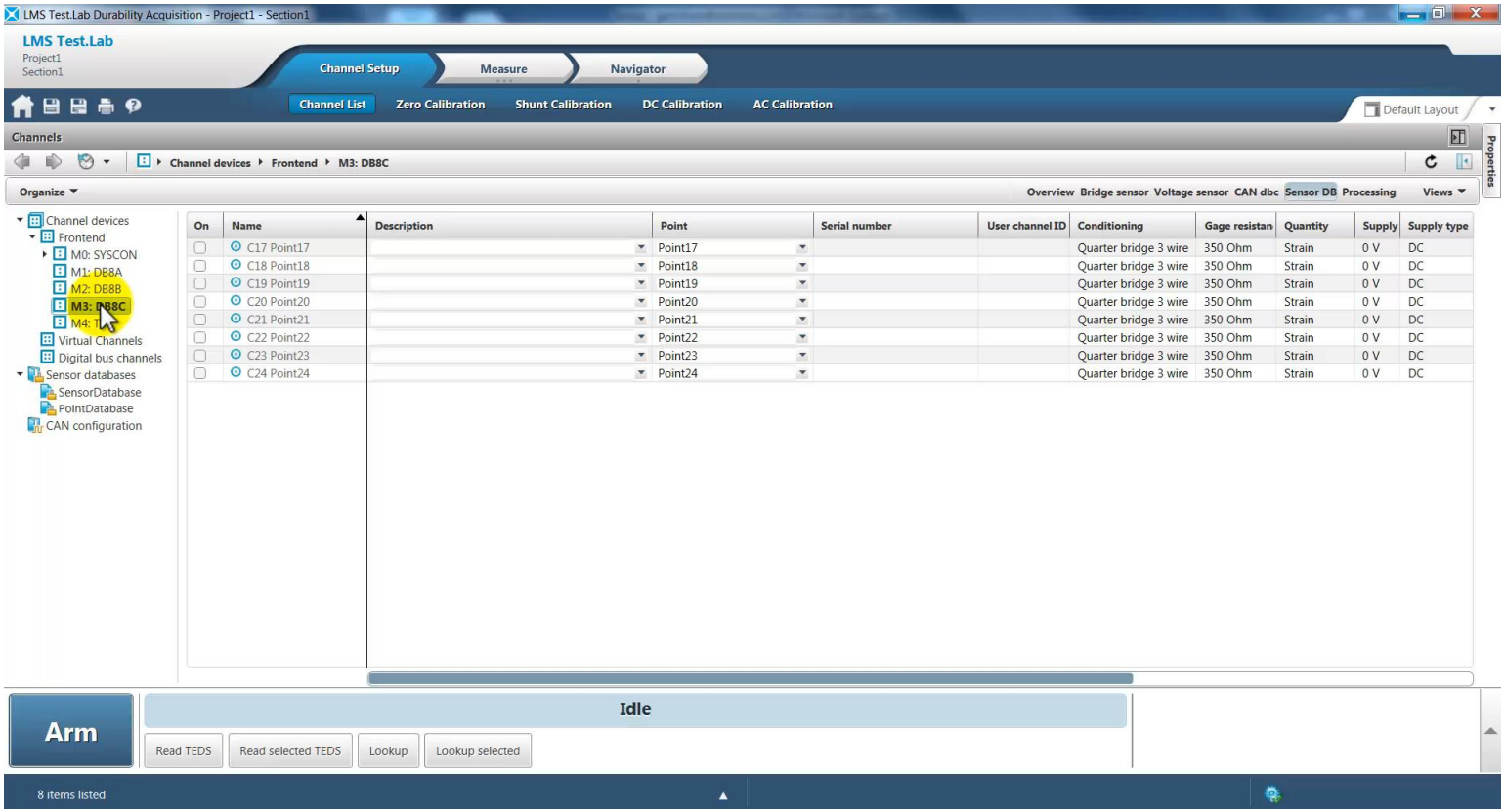

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Step 2
Channel setup

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- Instrumentation
- **Channel setup**
- Measure & validate
- Data consolidation
- Report & share

Simplify hardware setup by embedding different signal conditioners
Reduce costs & increase uptime with certified distributed setup

Faster setup
by linking available sensor data to measurement software

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Step 3
Measure & validate

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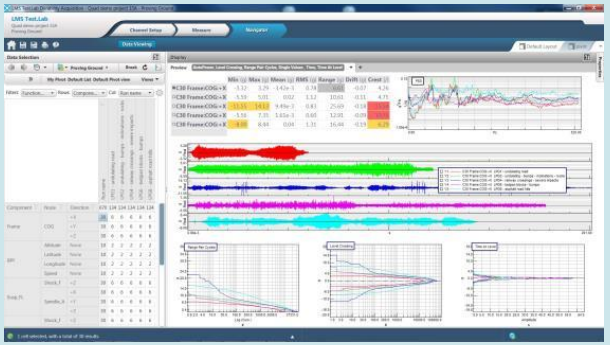
- Instrumentation
- Channel setup
- **Measure & validate**
- Data consolidation
- Report & share

Challenges (PC connected)

- Compare large amount of acquired data
- Be able to make quick but efficient data validation

Instant data visualization

- Tailored user experience for organizing multiple measurements and channels, thanks to PivotTable
- Preview pictures automatically display any combination of test data and insights



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Measure and validate in real time
Online displays while measuring

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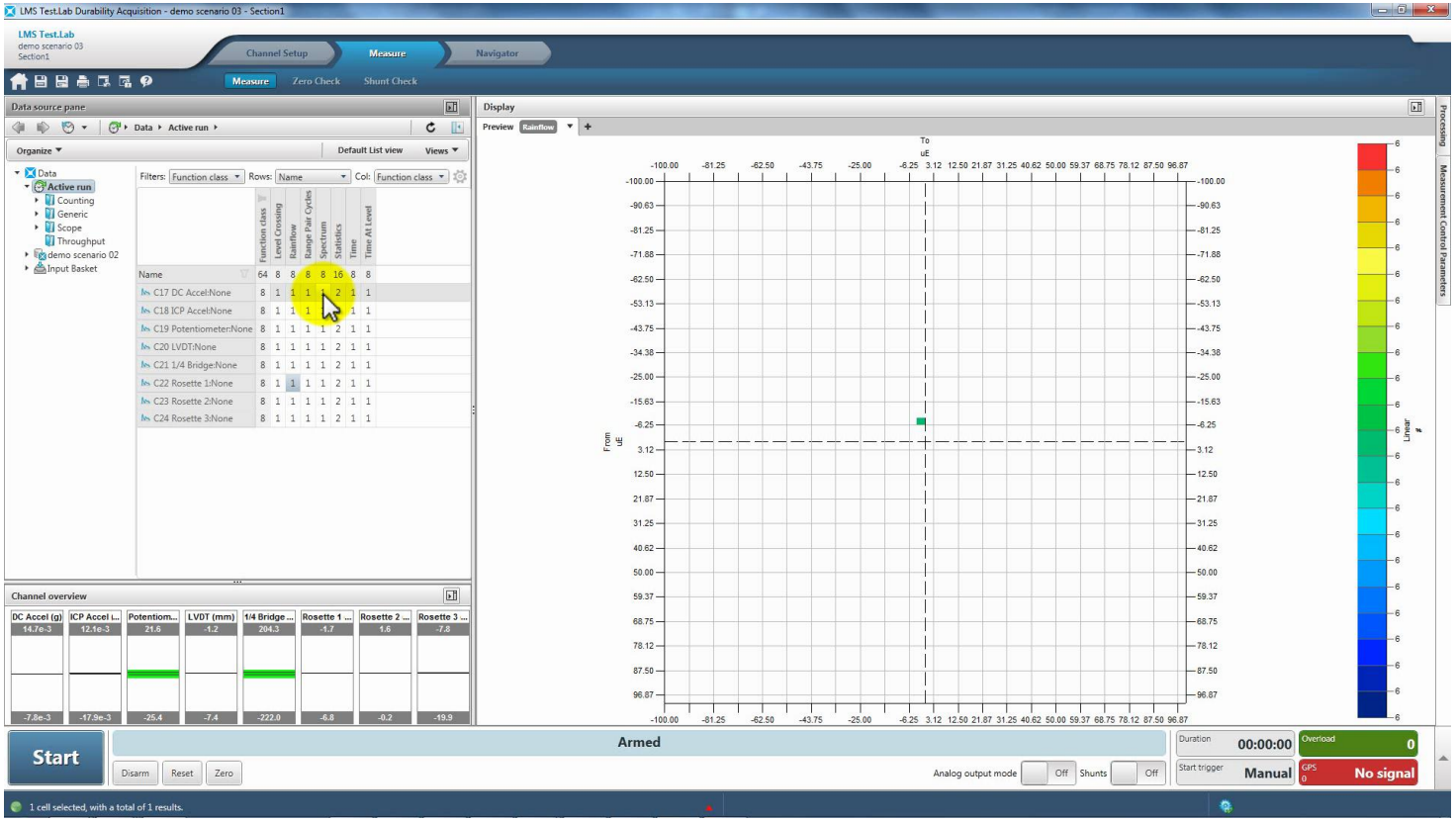


Step 3
Measure & validate

SIEMENS
Ingenuity for life

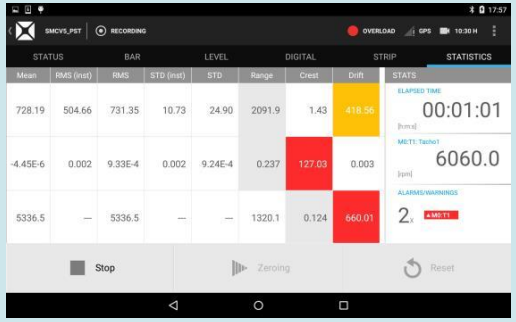
- Instrumentation
- Channel setup
- **Measure & validate**
- Data consolidation
- Report & share

Challenges (no PC connected)

- Costly test re-runs in case of erroneous channel acquisition
- No immediate feedback on test procedure quality during measurement

Trackside validation of test quality

- Detect and highlight signal anomalies through statistics monitoring during test
- Verify test procedure quality immediately after each measurement



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Instant graphical and tabular feedback per channel

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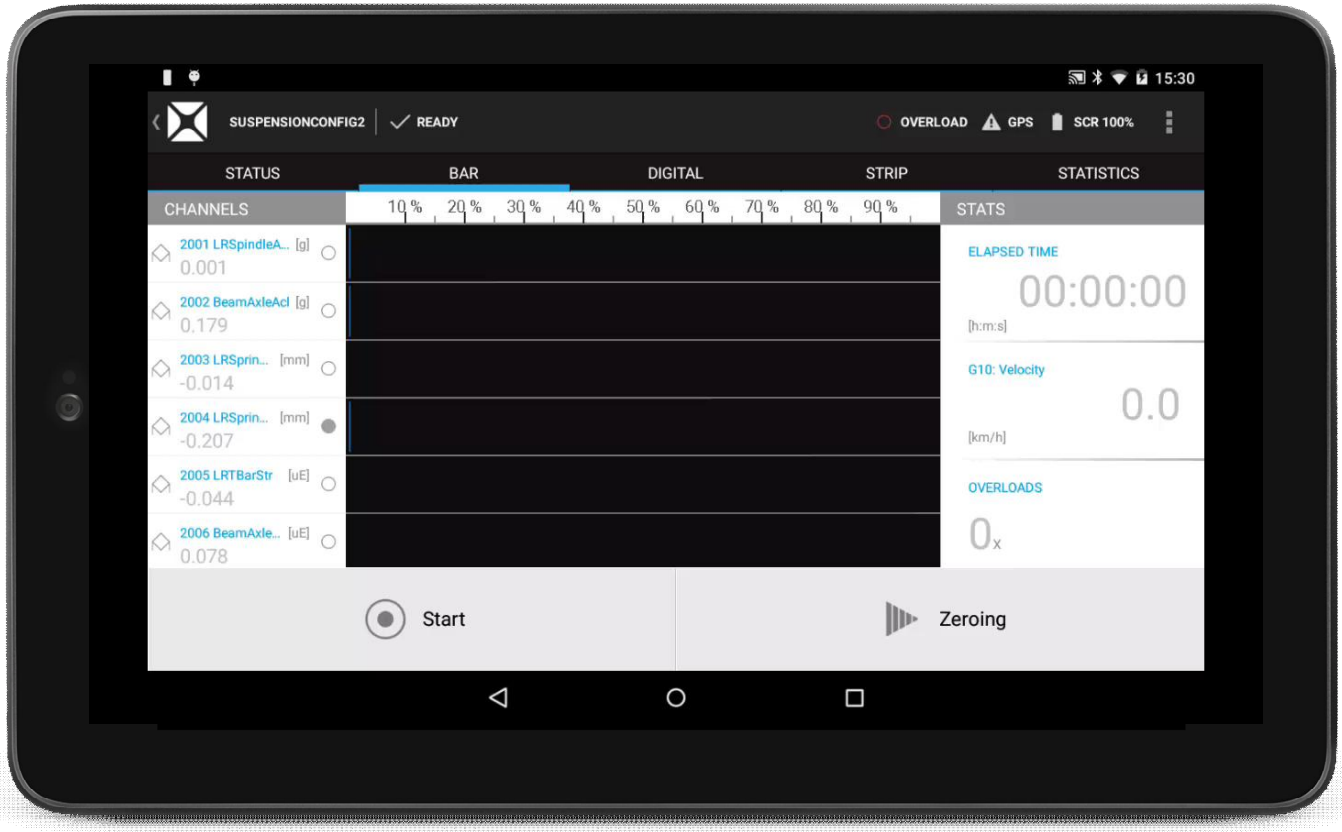

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Step 3
Measure & validate

SIEMENS
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- Instrumentation
- Channel setup
- **Measure & validate**
- Data consolidation
- Report & share

Simplify hardware setup by embedding different signal conditioners
Reduce costs & increase uptime with certified distributed setup

Faster setup
by linking available sensor data to measurement software

Right-first-time tests
by on-the-spot validation of data & test quality

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Step 4
Data consolidation

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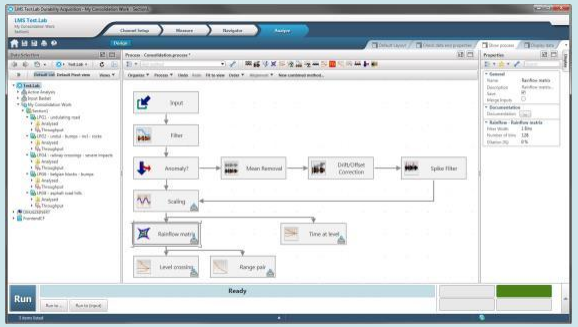
- Instrumentation
- Channel setup
- Measure & validate
- **Data consolidation**
- Report & share

Challenges

- Need to upload (and convert) data into processing tool
- Manual data clean-up is time-consuming and sensitive to human interpretation & errors

Automate repetitive tasks

- Dedicated interactive environment designed for non-experts to define analysis tasks
- Automated execution of an unlimited number of analysis tasks with LMS Test.Lab ProcessDesigner



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Automate repetitive tasks

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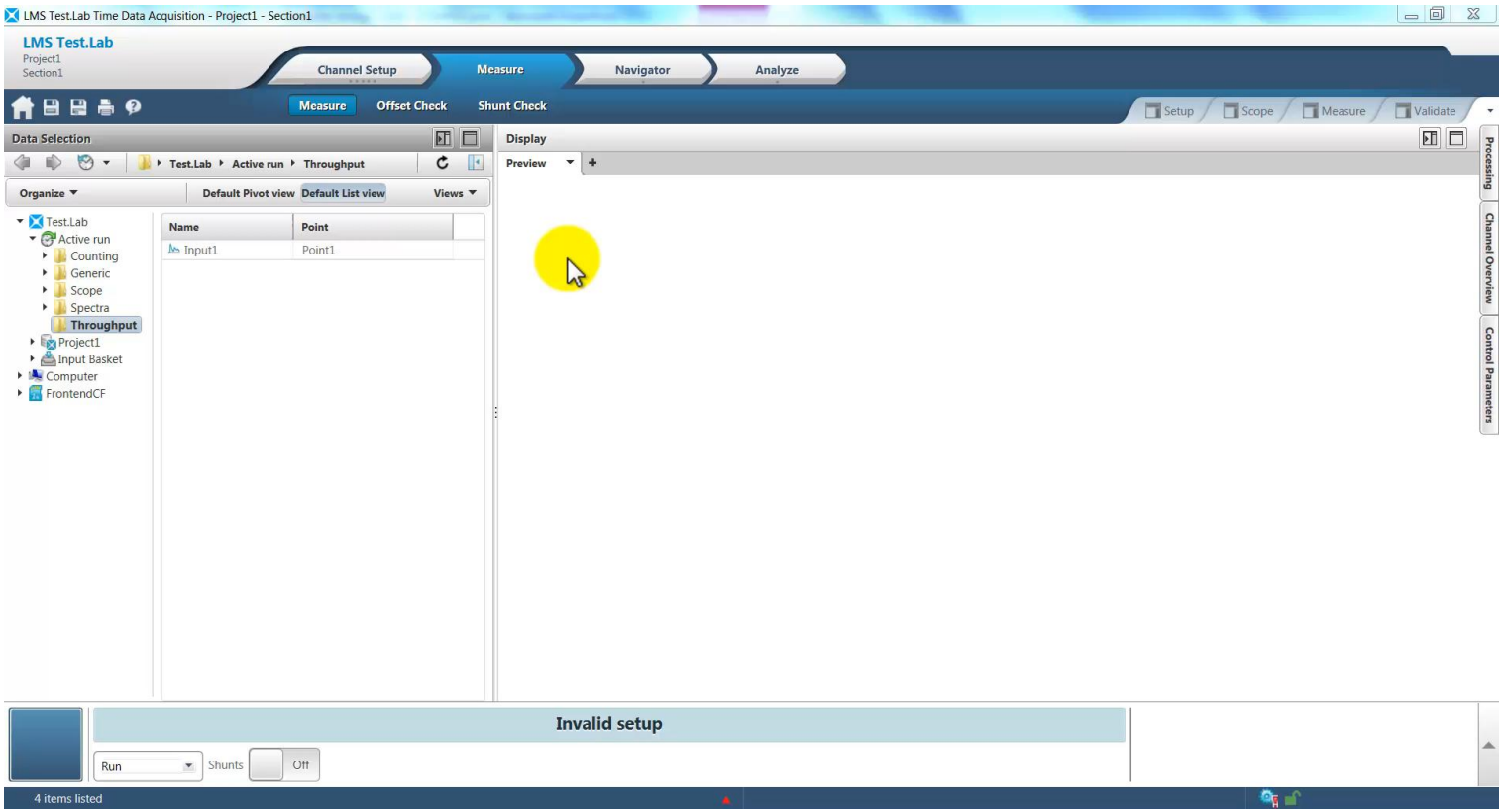

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Step 4
Data consolidation

SIEMENS
Ingenuity for life

- Instrumentation
- Channel setup
- Measure & validate
- **Data consolidation**
- Report & share

Simplify hardware setup by embedding different signal conditioners
Reduce costs & increase uptime with certified distributed setup

Faster setup
by linking available sensor data to measurement software

Right-first-time tests
by on-the-spot validation of data & test quality

Work smarter
by automating repetitive tasks

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Step 5
Report & share

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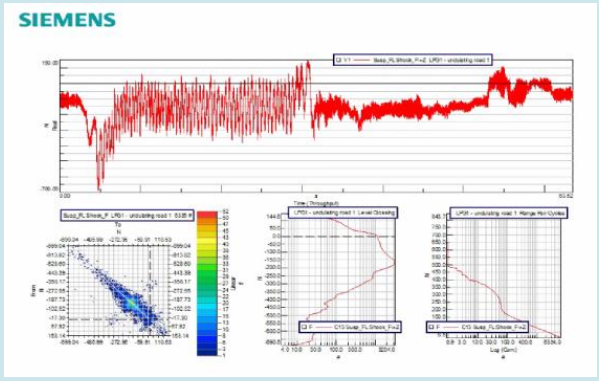
- Instrumentation
- Channel setup
- Measure & validate
- Data consolidation
- **Report & share**

Challenges

- Static screenshots with limited information
- (Non-value added) reporting time ≠ (value added) measuring time

Actionable reports

- Template-based batch reporting to Microsoft® Office
- Sharing data and insights as interactive representations with Active Pictures



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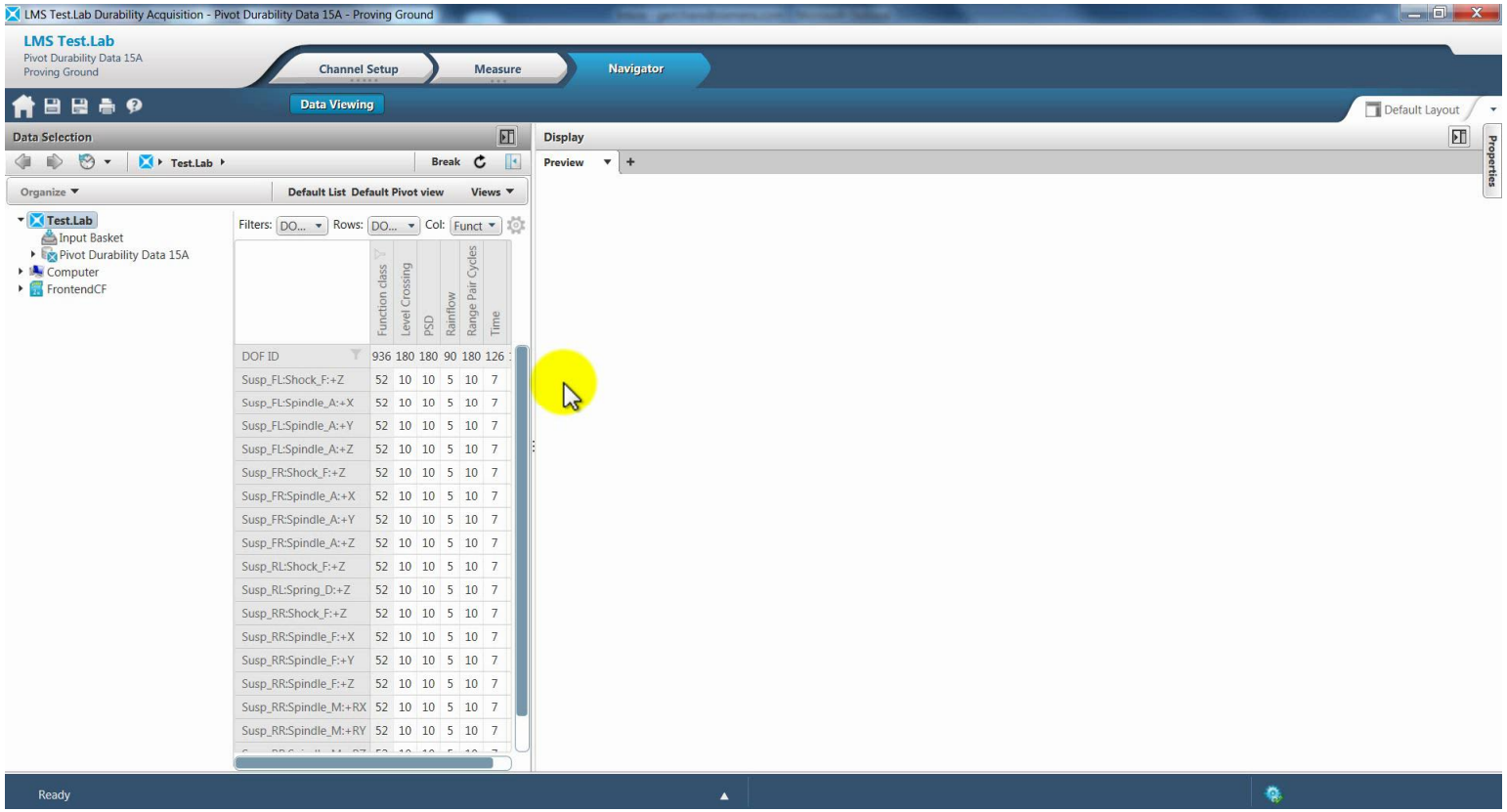
Active reports for easy results sharing



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Step 5
Report & share

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Instrumentation	**Simplify hardware setup** by embedding different signal conditioners **Reduce costs & increase uptime** with certified distributed setup
Channel setup	**Faster setup** by linking available sensor data to measurement software
Measure & validate	**Right-first-time tests** by on-the-spot validation of data & test quality
Data consolidation	**Work smarter** by automating repetitive tasks
Report & share	**Quicker delivery** by embedding complete test data in actionable reports

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Summary

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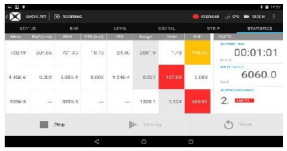
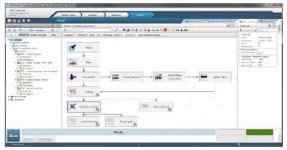
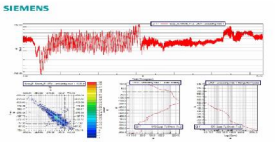
Instrumentation	**Simplify hardware setup** by embedding different signal conditioners **Reduce costs & increase uptime** with certified distributed setup
Channel setup	**Faster setup** by linking available sensor data to measurement software
Measure & validate	**Right-first-time tests** by on-the-spot validation of data & test quality
Data consolidation	**Work smarter** by automating repetitive tasks
Report & share	**Quicker delivery** by embedding complete test data in actionable reports







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Applications

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General Motors

Using LMS SCADAS and LMS Test.Lab for road load data acquisition

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- **Plug-and-go data acquisition**
- **Efficient hardware, easy-to-use software**
- **Dedicated technical support team**
- **Innovative tools for better brand confidence**

End-to-end solution for road load data acquisition

Developing world-class GM vehicles

Road data gathering in tough terrain

- Despite growing use of simulation, ever-growing and challenging volume of testing
- Simcenter™ end-to-end solution lets engineers have complete control of the RLDA process

"Since the LMS SCADAS data acquisition system is streamlined for efficiency, it lets engineering teams get their jobs done much more quickly and easily."

John Davis, lead measurement engineer, General Motors (GM) Proving Grounds, Milford, Michigan

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Daimler Trucks
Enhancing durability testing with the help of Siemens PLM Software

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- **Enhanced durability testing**
- **Improved measurement instrumentation and the execution of the data collection**
- **Generated high-quality results on the test track**

Boosting measurement instrumentation and data collection

Forging a strong collaboration

Understanding specific market requirements

- Implement full integration of test and simulation procedures
- Leverage data generated on the proving grounds

"We very much appreciate the collaboration with Siemens PLM Software, especially the fully integrated service offered. It is not only about evaluating data; when needed, Siemens PLM Software can provide us with the full line of services."

Dr. Christof Weber, Daimler Durability and Bench Testing Competence Center

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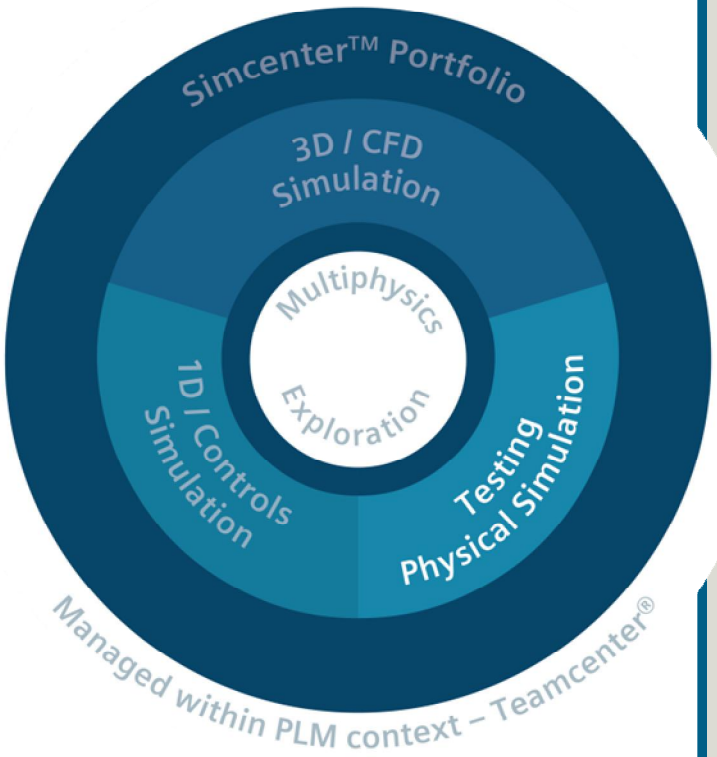
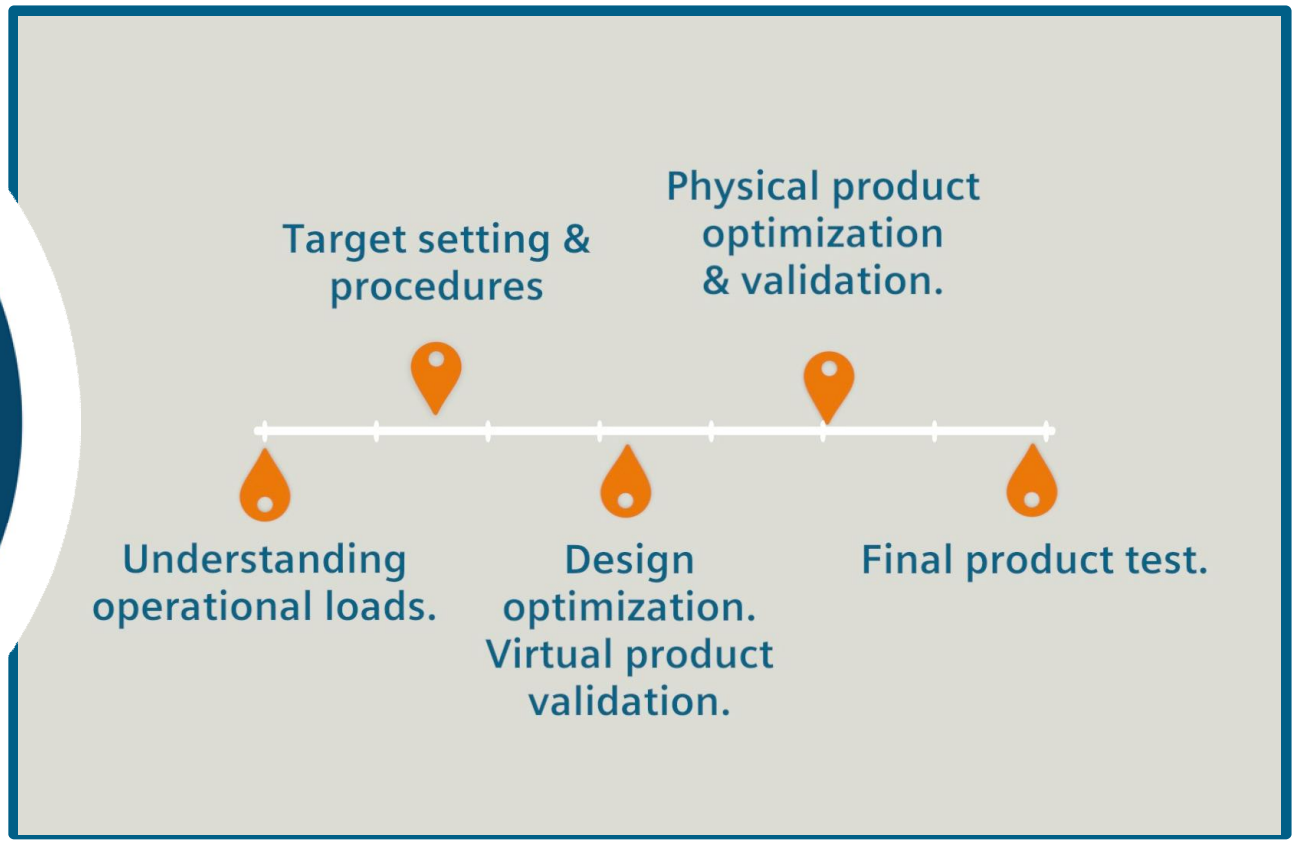
Simcenter durability solutions throughout the development process





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