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Test-Focused Facility Monitoring

There are many facility monitoring solutions on the market today designed for the needs of the facility management team. However, these solutions do not address the needs of the test engineering team. A test-focused solution monitors facility assets to gain insights that help the test team make critical test and maintenance decisions.



FIGURE 1
Assets Tracked in Facility Health Monitoring System

These are just a few examples of the assets that can be monitored to collect and analyze the right signals in a test facility and correlate that data with test data to generate facility insights. The power of these insights, especially when combined with machine learning applied to that data, is nearly limitless.

The key to obtaining insights from the facility is to have a powerful data platform that can aggregate multiple types of data, make the data available to flexible data analytics platforms, and share the data insights with the right people in a timely manner.

NI Facility Health Monitoring Solution

NI's solution for facility health monitoring builds on established technologies to provide the tools to acquire data from across a test facility, process that data through leading-edge analytics, and share the results with widely available graphical dashboards.

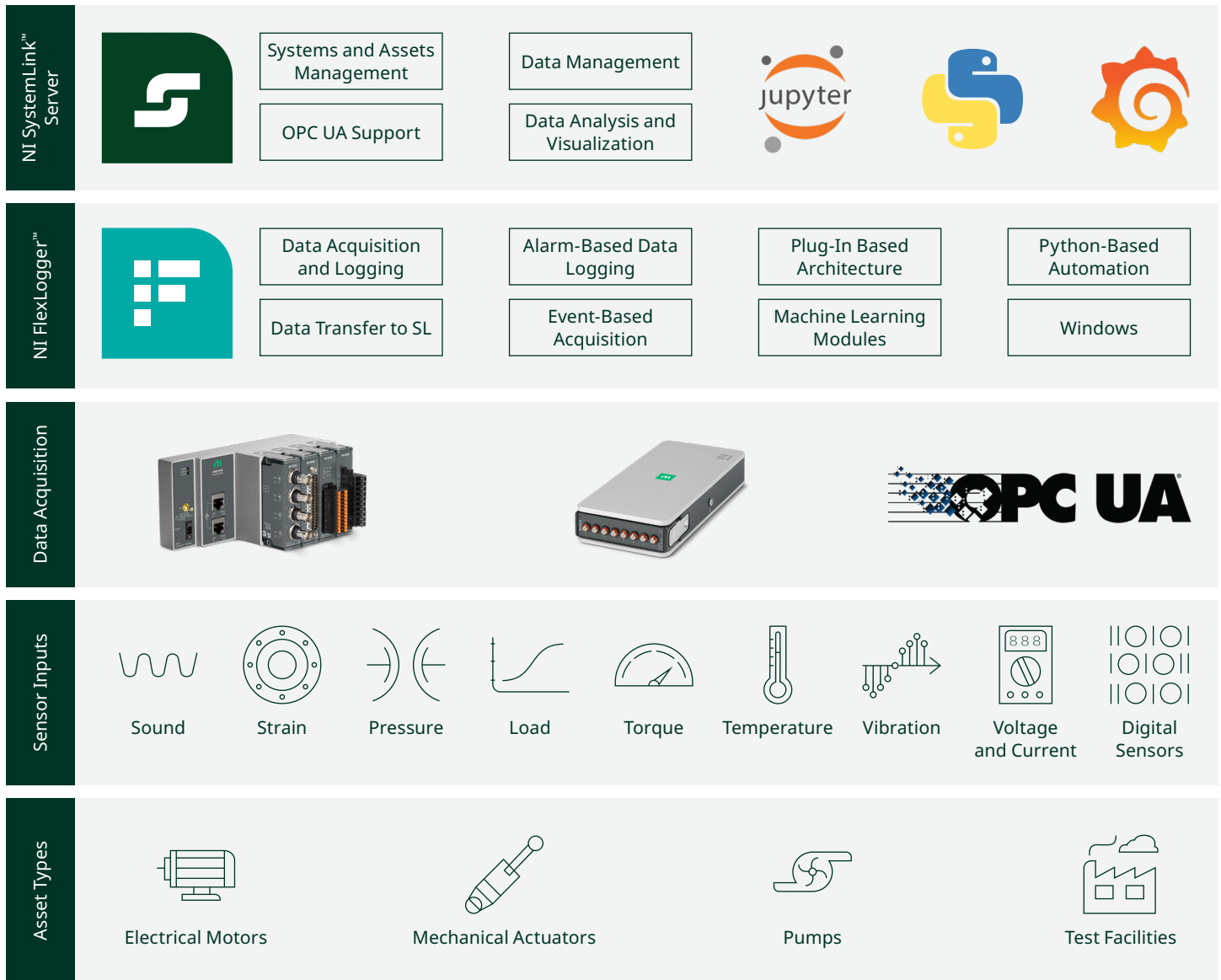


FIGURE 2
NI's Architecture for Facility Health Monitoring

In this architecture, data is aggregated from measurement devices spread throughout the facility and connected by the company network. These devices must be low-cost, distributed, and rugged. NI CompactDAQ is the ideal platform for these devices, with options from single-module sleeves to modular chassis to combine several types of signals into one node.

Sensors collect data from assets throughout the facility. Some of these sensors connect to existing control systems, but some of them require additional measurement devices. All this data, regardless of source, needs to be stored into historical databases. There are many ways to store this data. NI FlexLogger is a simple solution to collect and store data from NI devices and is recommended in this architecture.

Once the data is collected and stored, it needs to be aggregated into a central data platform. This platform needs to pull data from various data sources (files, PLCs, test data) into a common format. The data can then be shared with analysis engines and published to viewable dashboards. NI's SystemLink software platform is ideally suited to this purpose, with the ability to collect data from a wide variety of data sources.

For facility-specific analytics, NI uses custom algorithms running in Jupyter to perform basic analysis, trend analysis, and advanced machine learning analysis. Setting up these algorithms requires experience with the facility assets but opens the analytics development to any Python programmer.

More information about each of these components is available in the [platforms section](#) of this brochure.

Dashboards

Data is conveyed to decision makers through data dashboards. Good dashboards provide a rich view of the insights gathered by the analysis routines and can be easily modified to fit the needs of each facility.

Dashboards are set to display data for an asset, or group of assets, or facilities. This allows operators and managers to view various levels of detail throughout the facility.

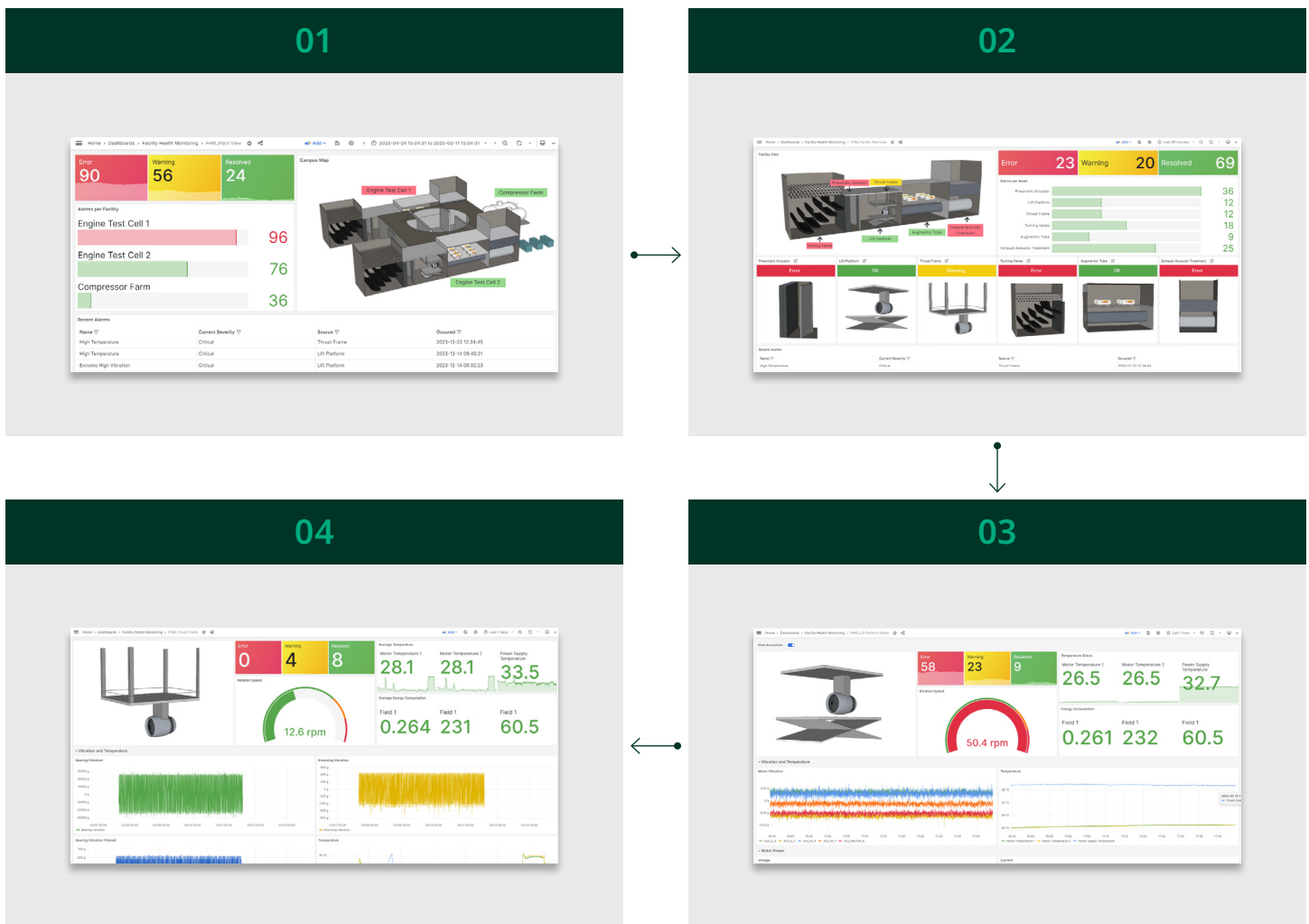


FIGURE 3

Dashboards are built with Grafana to provide an open-source, intuitive platform for creating additional dashboards for each facility.

Facility Monitoring Deployment Process

The process to identify, purchase, deploy, and monitor a facility health monitoring system can be overwhelming to a test engineering group. NI's test-focused approach and deployment resources simplify the process to install and manage a monitoring system.

01

Identify risk and impact

The first step in the process is to narrow the focus of a monitoring effort by identifying the test and facility equipment most likely to fail, and where failures have the largest impact. This helps focus efforts to collect data from assets that matter most.

02

Plan measurements

With the list of most critical assets, the next step is identifying the right measurements to collect from those assets. This is where experience with equipment monitoring matters. NI engineers work with test engineers to select the sensors that will provide the most information. Additionally, teams should look at existing data sources that may provide additional insight—PLCs, test systems, and existing facility controllers.

03

Deploy sensors

With a measurement plan, test teams can now purchase and install sensors and measurement devices. The installation should be optimized to minimize cabling distance from the sensors to the measurement devices, thereby reducing noise and cable costs. This must be balanced with centrally locating devices between equipment that is being monitored. These devices then need to be connected by Ethernet cable back to the server location.

04

Deploy servers

Ideally, there are three types of servers in a facility monitoring system. The data acquisition server runs the storage software (such as FlexLogger) and connects to the measurement devices. The database server collects data from multiple data acquisition servers to

a centralized database. The processing server then runs the data platform software (SystemLink), the analytics software (Jupyter), and serves the data dashboards (Grafana). These can all be located on-premises, or may be located in the cloud, depending on concerns with cost, security, and connectivity.

05

Design dashboards

With the server in place, the team can design dashboards to define the desired analysis outcome. NI engineers deploy a set of pre-built dashboards and work with engineering teams to adjust these to meet their needs. Additionally, NI engineers design custom dashboards and train teams to create their own dashboards in the future.

06

Collect data/trend analysis

Finally, the analytics can be set up to pull data from the servers and provide the insights called for by the data dashboards. Initially, these will focus on basic analytics and trend analysis, with alarms set up to notify teams of variance from historical performance.

07

Set up machine learning

Machine learning requires a lot of data, including failures. This data is used to train the algorithms. Over time, NI engineers review the trend analysis data to apply advanced analytics to calculate remaining useful life and other predictive analytics results. Depending on the amount of data and failures produced, this process can take several months or even years.

System Deployment and Analytics Services

NI's Product Analytics team provides consulting services to guide your team through the full design and deployment process to ensure the success of your facility health monitoring system. Our experienced engineers will create a measurement plan with your team, deploy the measurement systems and servers, program the data analytics platforms, and set up data dashboards.

Once the system is deployed, NI engineers provide technical support to ensure that your system continues to provide useful insights, including tuning algorithms to ensure correct and relevant results.

NI's data science team also provides machine learning services, working with your team and your data to find opportunities to deploy machine learning for predictive maintenance.

To get started with your facility health monitoring solution, contact your NI account manager.



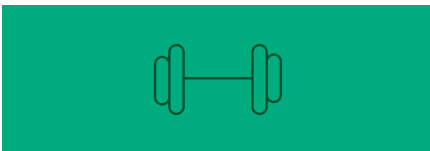
NI Facility Health Monitoring Platforms



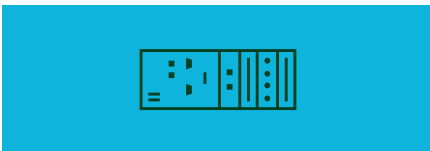
FIGURE 4
CompactDAQ Measurement Platform

NI CompactDAQ

CompactDAQ systems collect and provide the rugged, distributed measurement system needed for a large facility monitoring system. These Ethernet-connected systems are available in 1-, 4-, and 8-slot options to provide flexibility to balance the need for short sensor cable lengths with the need for mixed signal and shared measurement topologies.



CompactDAQ chassis and modules are designed to meet the rigorous requirements of test facilities and withstand operating temperatures from -40 °C to 70 °C and up to 50 g of shock.



With the modularity of CompactDAQ, test teams can create distributed monitoring systems of up to thousands of channels with exactly the mix of sensor support types needed to get the right insights into facility equipment.



The NI cDAQ-9189 and NI cDAQ-9185 chassis comply with IEEE 802.1 Time-Sensitive Networking (TSN) synchronization standards that enable the tight alignment of measurements taken from distributed instruments. These chassis also support IEEE 1588 precision time protocol to sync clocks to a local network source.



CompactDAQ offers best-in-class strain measurement performance at the best price point along with accurate thermocouple and voltage measurements, resulting in a highly reliable and repeatable measurement system.

NI FlexLogger Application Software

FlexLogger is a configuration-based data recording tool that test teams use to configure hardware, label channels, implement rules or channel math, adjust instrument settings, perform calibration, and log data. It works seamlessly with CompactDAQ input modules, making it fast and easy to select sensors and properly document measurement channels in software when installing and commissioning facility monitoring systems.

In a facility health monitoring system, FlexLogger acquires data from hundreds of sensors across the facility. Data is stored in .TDMS files for efficient data storage that can be easily collected by SystemLink for additional analysis.

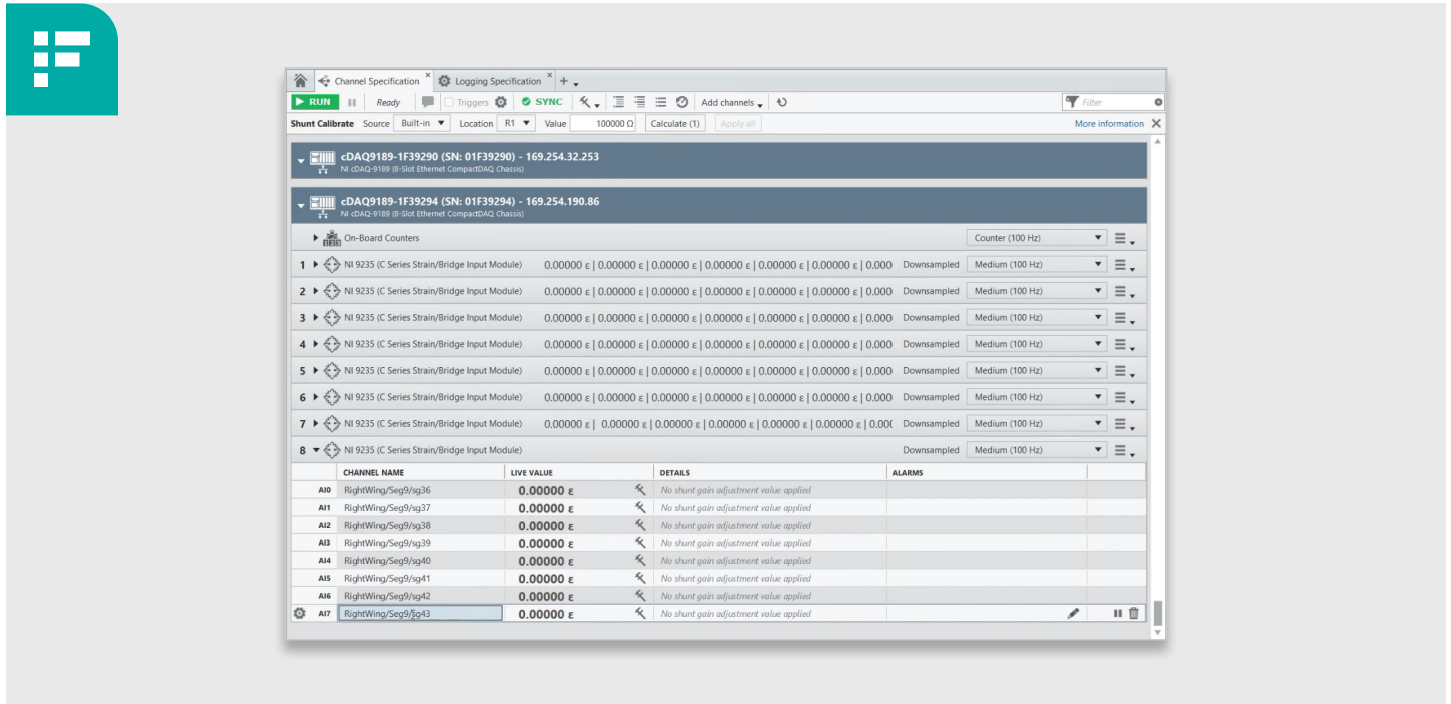


FIGURE 5
FlexLogger Configuration Screen

NI SystemLink Application Software

SystemLink software provides a data aggregation platform to help enterprises analyze facility and test data to remove operational inefficiencies, uncover actionable insights, and improve overall performance across their test workflows. This network-based test system and test data management tool can operate on a dedicated or enterprise network, in the cloud or on-premises.

SystemLink is used in facility health monitoring to:

- Centrally manage all data from data sources including FlexLogger, PLCs, test systems, and test results files
- Organize data into a central database for analytics and historical trending
- Make facility data available to advanced analytics packages
- Serve data dashboards to decision makers to provide real-time situational awareness of the facility

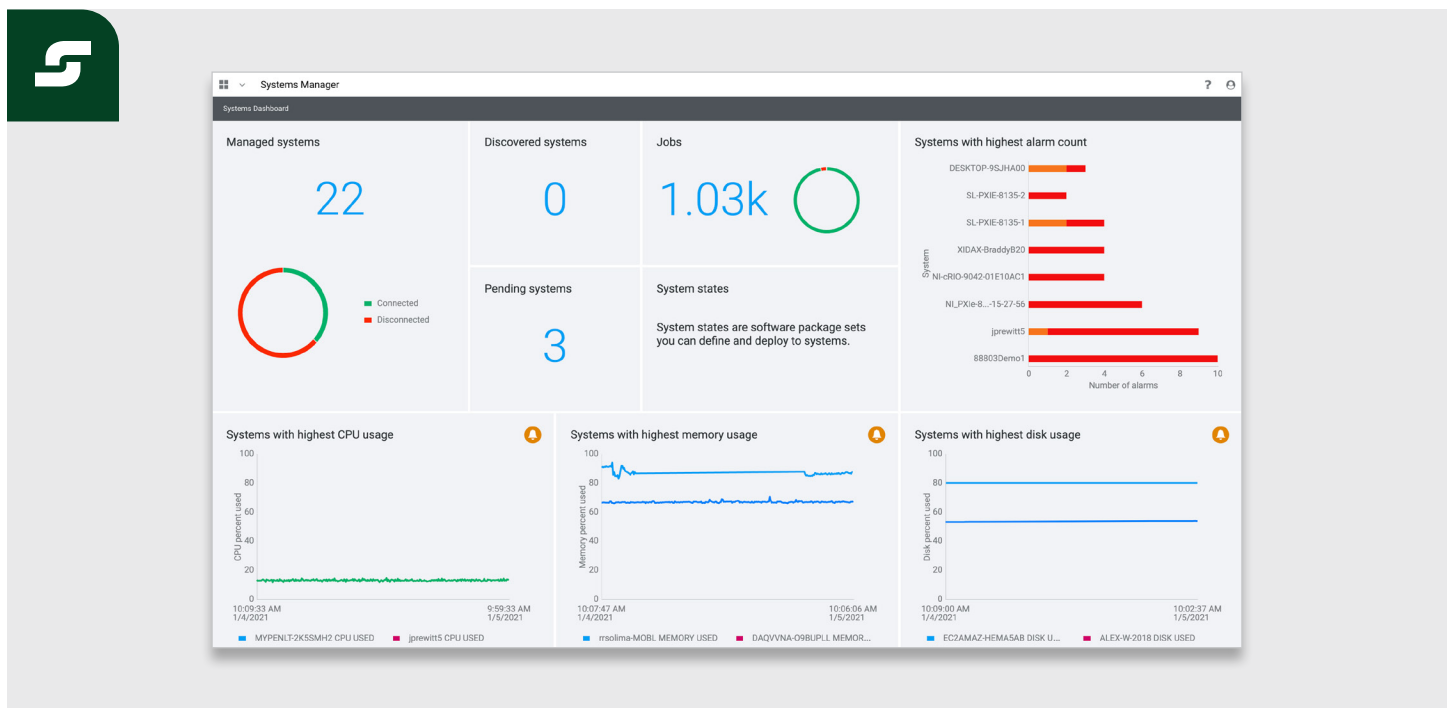
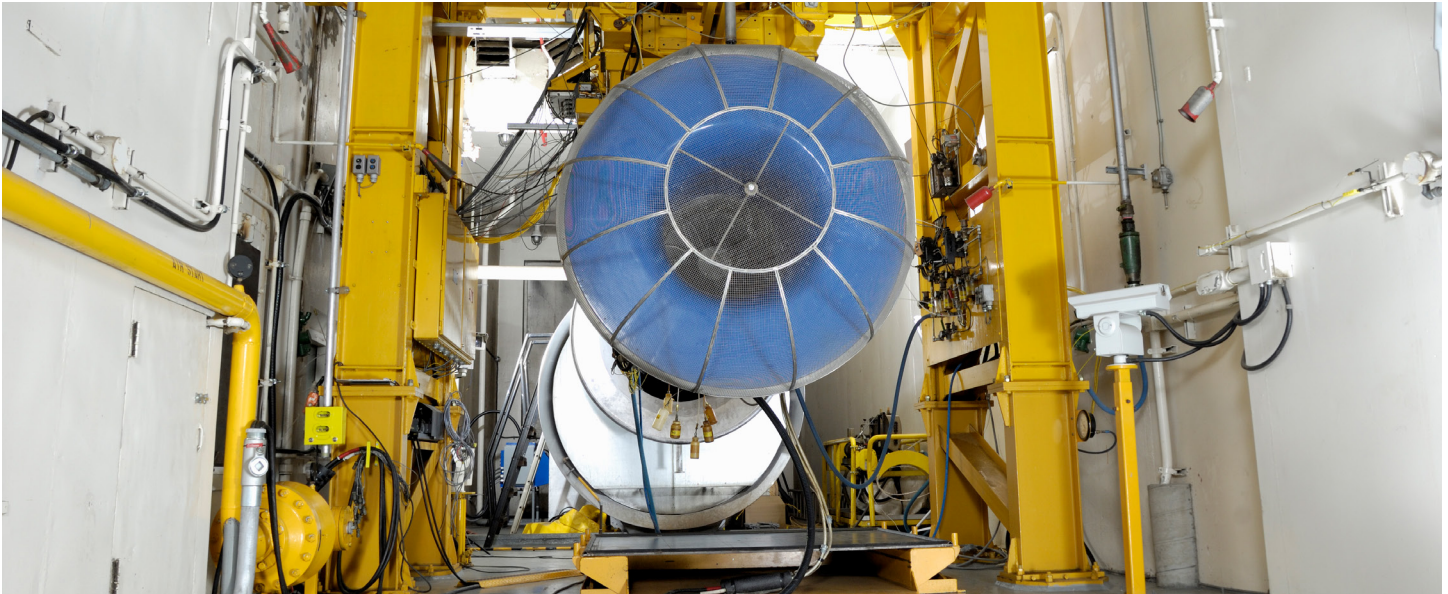


FIGURE 6
SystemLink Data Dashboard



System Integration on Your Terms

NI offers a variety of solution integration options customized to your application-specific requirements. You can use your own internal integration teams for full system control or leverage the expertise of our worldwide network of NI Partners to obtain a turnkey system.

Contact your account manager or call or email us to learn more about how NI can help you increase product quality and accelerate test timelines at (888) 280-7645 or info@ni.com.

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