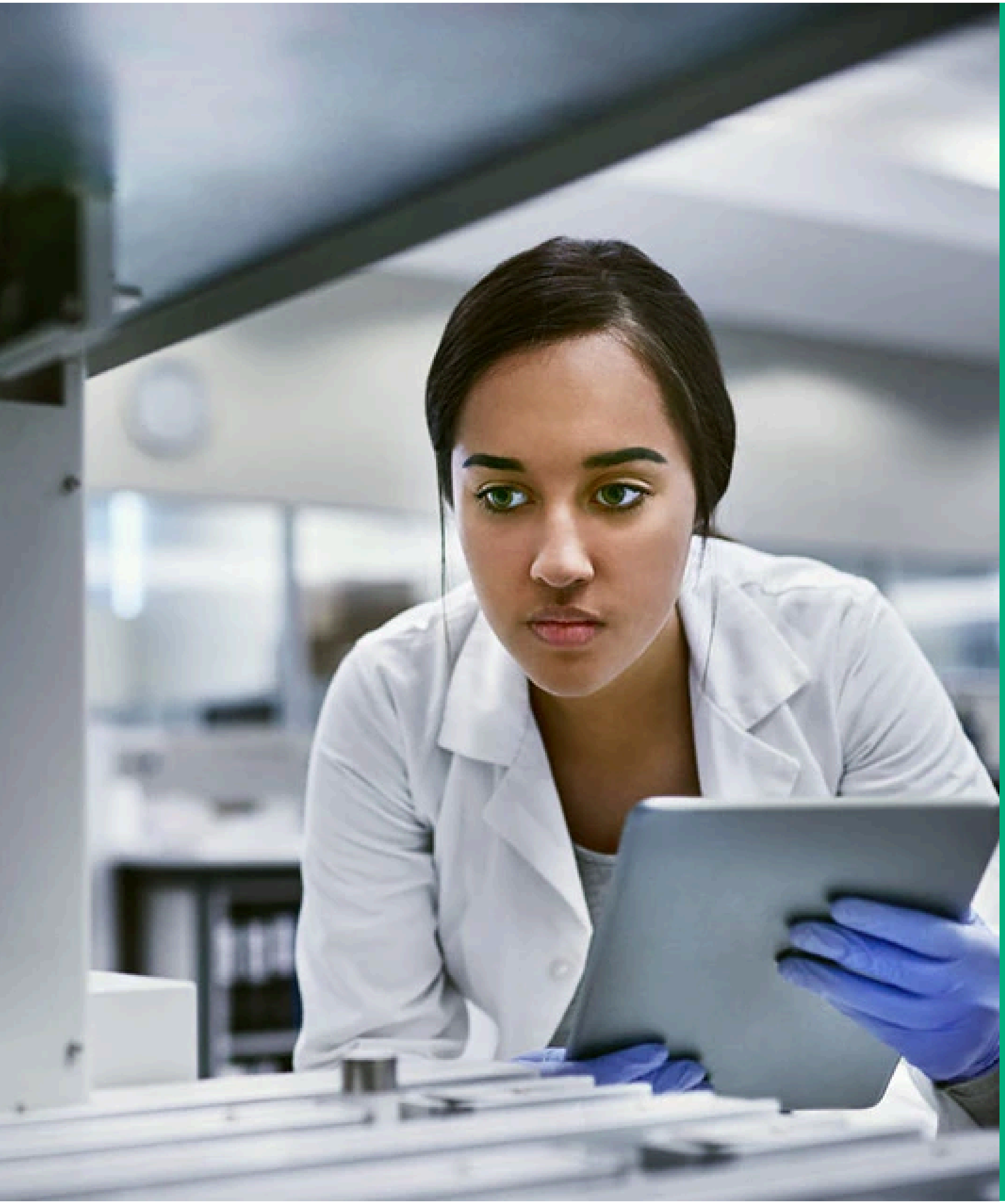

CUSTOMER STORY COLLECTION

MedTech & Life Sciences Customer Stories

1st Edition

> "The move to a COTS approach using PXI and LabVIEW was critical to this production-test success at Philips. The combination of best-in-class modular hardware along with industry-standard software was pivotal to the millions of dollars and hundreds of hours saved in production test engineering."

Neil Evans
Senior Manager, Philips

Learn more

Philips Rethinks Functional Test, Shortening Time to Market

Ultrasound products are crucial in a variety of applications, including cardiovascular, obstetrics, gynecology, musculoskeletal, liver, and kidney imaging. To lead medical science in these areas, practitioners require higher-resolution images in more accessible form factors. Recent rapid product innovation to meet these demands has created significant and unprecedented time-to-market pressure, which is compounded by growing product complexity, higher production volumes, global manufacturing distribution, increased regulation, and long station-deployment life cycles.

THE CHALLENGE

Philips required a new production-test approach to reduce development schedules and sustaining effort while maintaining or increasing test coverage and quality.

THE SOLUTION

Standardized platform was implemented where a common set of code modules and COTS instruments could be configured to meet each test station's needs.

RESULTS

- **Complexity**—Test coverage and signal-path improvements meet the needs of a diverse portfolio of state-of-the-art xMatrix ultrasound transducers
- **Quality**—Easy access to test data drives significant yield improvements through structured problem-solving
- **Life Cycle**—
  - Significant ongoing cost savings through **10X reduction in resources required to sustain the systems**
  - Almost no unplanned test downtime exists, thanks to reliable test hardware and verified error-free software
  - Absolutely no platform software changes have been required since deployment in 2018
- **Development Schedule**—We achieved an **80% reduction in NPI test development effort and schedule**
- **Manufacturing Volume**—
  - Product-level **test cycle time reduced by 10X**
  - Wafer test cycle time reduced by 5X
- **Regulation**—**Certification validation reduced by four months**: From between five and six months to two months
- **Data**—One global database system delivers complete test traceability

Figure 1. Philips XL14-3 XMatrix® Transducer.

“Having standardized on the NI hardware platform and LabVIEW, we needed to identify an engineering firm with the technical capability to help us develop our next-generation generic testing platform. We wanted to work with a company that had extensive LabVIEW test system development expertise and a long list of proven applications. Genuen was able to take our test concepts to the next level.”

Todd VanGilder
Genuen

Learn more

Creating a Universal Test System Based on LabVIEW for Stryker Medical Devices

Stryker is one of the world’s leading manufacturers of medical technology. It offers a diverse array of reconstructive, medical, surgical, and neurotechnology and spine products. As part of its research and development efforts, the company uses a series of test systems for life-cycle and durability testing during early product development. However, their existing platform was not architected to accommodate the company’s new goals, and the hardware system design had limited channel count that limited the bandwidth of the test department. Stryker realized it was time to replace these test systems with a next-generation testing platform for both the development and verification phases of new products.

THE CHALLENGE

Creating a flexible and scalable life-cycle and durability tester capable of handling a wide range of new medical products for design development and verification testing.

THE SOLUTION

NI Partner Genuen was contracted to design and build five “Totally Reconfigurable Universal System Tester” (TRUST) machines for Stryker Instruments Division’s Test Lab. With LabVIEW system design software and the NI CompactDAQ modular data acquisition platform, they designed a high-channel-count, universal test-stand platform with a versatile software communications framework that allows additional hardware components to be easily added and controlled by the main operator interface.

RESULTS:

- **50% reduction in test system costs** through scalable architecture and reuse of hardware and software modules
- **20% faster test execution** driven by higher data acquisition rates and an optimized scripting engine
- **2x increase in throughput** by running multiple units under test in parallel from a single system
- **Single, universal test platform** supporting a wide range of Stryker medical devices and test configurations
- **Streamlined user experience** with all teams developing, running, and maintaining tests within LabVIEW
- **Future-ready design** enabling quick integration of new instruments and technologies without re-architecting the system

“We need high accuracy, high precision, and high speed for acquisition. We used NI hardware in the early stage, and thanks to the price, also the price policy of NI, we can keep this card in the final products that we sell. This is a huge advantage to lower the cost of development.”

Dr Maël Le Berre
CTO and Cofounder, Elvesys

Learn more

Elvesys Designs the World’s Fastest Pathogen Detection Platform

Today’s pathogen detection methods rely on time-intensive processes and expensive lab equipment to deliver accurate results. But when facing deadly threats like Ebola or anthrax, every minute counts.
That’s why Elvesys developed Fastgene—the world’s fastest technology for detecting any pathogen in a single drop of blood or saliva. Built on Elvesys microfluidic innovations, Fastgene uses lab-on-a-chip technology to rapidly amplify specific DNA sequences, making pathogens easier and faster to detect.

THE CHALLENGE

This microfluidics platform consists of: the microfluidic sample management system, a fluorescent marker detection and measurement system, and a software interface to control the entire process. As the DNA is multiplied, the total quantity of pathogens present in the sample is determined by detecting a fluorescent spot in each DNA duplicate. For success, it is critical that the fluorescent marker detection system keep pace without sacrificing accuracy.

THE SOLUTION

To accomplish this, Elvesys created and commercialized, through the Elveflow brand, a custom fluorescence reader using the NI USB-6003 low-cost multifunction DAQ device. Scaling down a complex laboratory procedure required software-integrated hardware with 100 kHz acquisition speed and the ability to detect small variations in the DNA amidst high background noise, with 16-bit resolution to ensure an accurate count of DNA samples.

RESULTS

- Pathogen detection in 6 minutes for Ebola, 7 minutes for anthrax — respectively 7× and 14× faster than the best existing technologies.
- **High-speed acquisition and high resolution measurement** (e.g., 100 kHz, 16-bit resolution) enabled reliable detection of DNA amplification in a microfluidic context.
- **Development cycle of less than 2 years from design to prototype** for the platform with a small ~20 person team.
- Low-cost instrumentation: the use of NI’s DAQ hardware allowed the custom reader to remain cost-effective enough to include in commercial products.
- Leveraged LabVIEW’s 950+ **built-in analysis functions to reduce development time**, and its built-in User Interface to keep usability in the field simple.

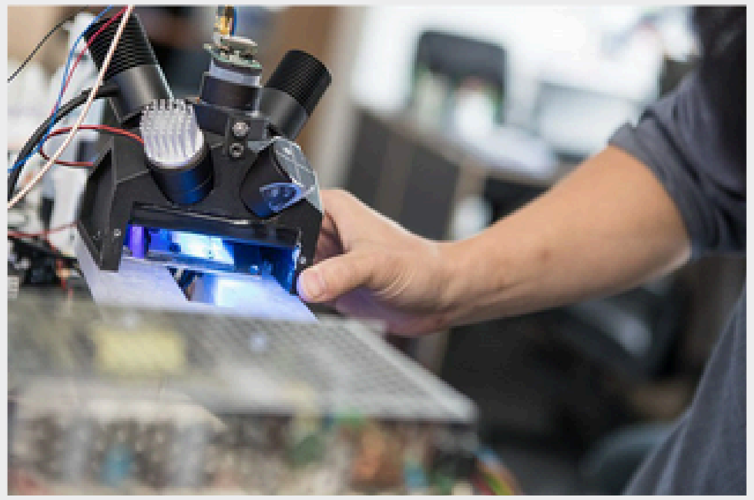

Figure 1. Fastgene Pathogen Detection Technology

“By implementing NI TestStand, we reduced test time by up to 30 percent and, equally important, enhanced knowledge retention through codified and standardized test procedures.”

Dr. Hua Tang
Test Automation Lead, Siemens Healthineers

Learn more

Siemens Healthineers Advances Imaging Component Testing

Siemens Healthineers’ technology center Power & Vacuum Products develops advanced x-ray tubes and generators that are essential components in diagnostic imaging and interventional therapies, including computed tomography (CT), radiography, and angiography. As a market leader in medical imaging components, the company is committed to continuous innovation while maintaining the highest standards of quality and reliability.

THE CHALLENGE

Siemens Healthineers’ technology center Power & Vacuum Products handles retest and regression testing of core components across a broad product portfolio in diagnostic imaging and advanced therapies. Committed to an end-to-end digitization and automation strategy, the team sought to eliminate the common inefficiencies associated with traditional V&V labs.

THE SOLUTION

By adopting NI TestStand and NI hardware, Siemens Healthineers built a scalable and automated test framework that streamlined execution, standardized reporting, and enhanced traceability through the product lifecycle.

RESULTS: Time Savings, Standardization, and Future Readiness

- Significant reduction in test time for angiography products
- Standardized workflow for test documentation
- Increased repeatability of test processes
- Enhanced traceability through automated logging of test steps, standardized reporting, and version control of both test procedures and function code.
- Reusable test architecture that supports future scalability
- Improved knowledge retention through codified test procedures

Figure 1. Verification and validation (V&V) lab at Siemens Healthineer’s technology center, Power & Vaccuum Products.

“The flexibility of the PXI architecture coupled with the capabilities of LabVIEW and the fantastic performance of NI RIO solutions helped us control an advanced deep cancer treatment facility based on hadrotherapy.”

Luigi Tremolada
SIDeA

Learn more

Revolutionary Cancer Treatment Minimizes Damage to Healthy Tissue

SIDeA collaborated with the Italian National Center for Oncological Hadrontherapy (CNAO) to build a highly precise control system for hadron therapy (protons and carbon ions). Using NI PXI, CompactRIO, and LabVIEW (Real-Time + FPGA), they developed a synchronized, real-time control architecture to direct powerful particle beams at tumors while minimizing harm to surrounding healthy tissue.

THE CHALLENGE

Delivering therapeutic particle beams deep into the body requires extreme precision: the system must tightly control beam timing, intensity, and position to maximize tumor damage and spare healthy cells. With nearly 300 networked devices and strict safety interlocks, the engineering demands for synchronization and real-time control are immense.

THE SOLUTION

SIDeA implemented a distributed control and measurement system packed with National Instruments technologies: NI PXI chassis, CompactRIO, and LabVIEW (Real-Time and FPGA). They built an Ethernet-based messaging protocol for 100 µs resolution synchronization, and a fiber-optic network for 50 ns timing — all controlled within a unified LabVIEW environment. Beam intensity was measured every microsecond, and position every 100 µs, with spatial accuracy down to ~100–200 µm.

RESULTS:

- Achieved **real-time, microsecond-scale** feedback on beam intensity, enabling safer and more effective treatment.
- Measured beam position **every 100 µs with 100–200 µm accuracy**, allowing precise targeting of tumors.
- Built a **modular, open architecture** using COTS NI hardware (PXI, CompactRIO) that supports flexibility and reliability.
- Delivered a system that enabled **patient treatment to begin** at CNAO, advancing hadron therapy as a viable clinical option.

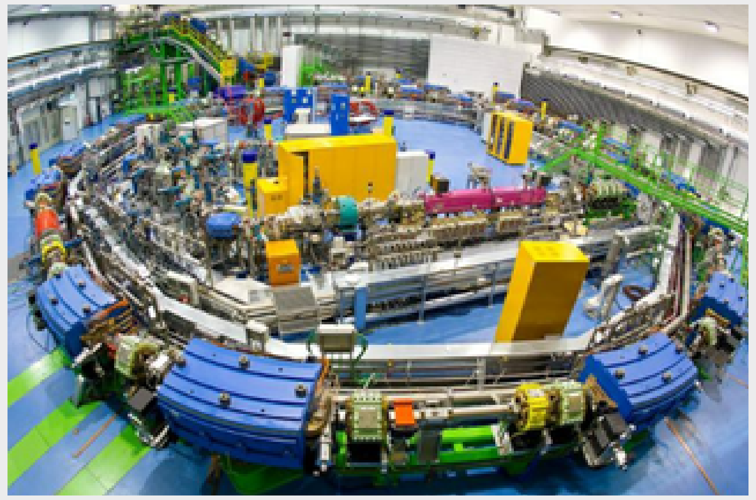

Figure 1. Overview of the Synchrotron

Improving Ultrasonic Tumour Therapy With Passive Acoustic Detection

Researchers at the Institute of Biomedical Engineering, University of Oxford, developed a real-time monitoring system for high-intensity focused ultrasound (HIFU) cancer therapy. They used a custom 32-channel hydrophone array together with NI PXI Express hardware and LabVIEW FPGA to passively map acoustic emissions during therapy, giving clinicians insight into cavitation activity as treatment is applied.

“National Instruments provided a refreshing alternative route that allowed for rapid development of a monitoring application using NI LabVIEW FPGA plus complete control and access to acquired data.”

Christian Coviello
Institute of Biomedical Engineering, University of Oxford

THE CHALLENGE

HIFU offers a non-invasive way to treat tumors, but one of its major drawbacks is the lack of real-time feedback: clinicians don’t reliably know whether they are over- or under-treating because there’s no inexpensive, effective way to monitor treatment in situ.

THE SOLUTION

Oxford’s team implemented a passive acoustic mapping (PAM) system by embedding a 32-element, flexible hydrophone array around the HIFU transducer. They digitized signals at 50 MS/s using NI FlexRIO (PXI Express + FPGA) and processed them in LabVIEW to spatially map cavitation activity in real time.

RESULTS:

- Enabled **real-time passive acoustic mapping** of cavitation activity during HIFU therapy, giving clinicians immediate visibility into treatment dynamics.
- **High-speed acquisition (50 MS/s) across 32 channels** preserved the full time-domain signal, allowing detailed analysis of bubble behavior.
- A modular system architecture that supports **future expansion** (e.g., up to 64-element arrays) without redesign.
- Lower-cost monitoring compared to MRI, offering an **economical way to improve safety** and efficacy for HIFU therapy.
- Appealing possibility of on-board pre-processing written in LabVIEW and embedded onto the FPGA on the FlexRIO, as a move is made to more computationally complex methods for improved imaging in the future.

Learn more

Figure 1. Multi-element passive cavitation detector

Using NI FlexRIO to Control Ultrasonic Arrays for Sonotweezing

"The complete dexterous manipulation system was a fraction of the cost of a traditional multichannel controller and the LabVIEW integration greatly increased its versatility and the future possibilities for the hardware."

D Lines
Diagnostic Sonar Ltd, Livingston, UK

Diagnostic Sonar Ltd (DSL), together with the Institute for Medical Science and Technology (IMSaT) at the University of Dundee, developed a compact, high-performance multichannel ultrasound controller using NI FlexRIO and LabVIEW. The system drives a 16-element ultrasonic array to trap and manipulate 10 µm particles in real time by controlling each channel's phase and waveform.

THE CHALLENGE

The engineering challenge was to generate continuous-wave (CW) multichannel excitation with independent phase control for each element of an ultrasonic array, enabling real-time manipulation of microscopic particles (as small as 10 µm). Traditional controllers are expensive, bulky, or not suited for continuous operation at mid-level voltages.

THE SOLUTION

DSL used NI FlexRIO hardware to produce repeating digital waveforms and control each transducer channel's phase individually. The team drove a 16-transducer array at 2.45 MHz using 10 V square waves (with PWM) via LabVIEW FPGA, enabling the creation of standing-wave acoustic fields for particle trapping and precise positional control.

RESULTS:

- Successfully trapped agglomerates of **10 µm** particles and moved them by more than 1 mm in real time.
- Observed smooth changes in the ultrasonic pressure field when shifting the focus, with stable trapping up to about 1.3 mm from the center.
- Achieved a full pressure-field visualization via Schlieren imaging, confirming coherent phase control across the array.
- Built a dexterous manipulation system at a **fraction of the cost** of traditional multichannel controllers.
- Leveraged LabVIEW for control and waveform calculation, giving the system **high versatility and future extensibility**

Learn more

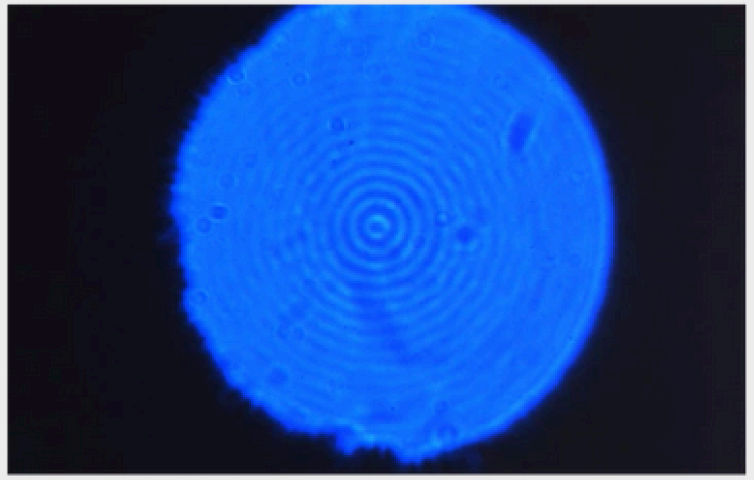

Figure 1. Schlieren image through the centre of the 10 mm diameter ring of 16 transducers.

"[NI CompactRIO technology] enabled faster software development so our team could focus on our core value proposition instead of infrastructure work."

Paulo Carvalho
Worcester Polytechnic Institute

Learn more

Enhanced Cancer Interventions With Modular Control of MRI Robots

WPI’s AIM Lab developed a modular, MRI-compatible robotic control system for surgical robots to enable image-guided interventions inside an MRI scanner. The system uses an NI CompactRIO as the core controller, paired with a custom backplane and up to 10 actuator-specific daughtercards, allowing piezo-electric motion control suitable for MRI environments. This architecture supports different MRI-safe robots — for example, a neuro-intervention robot for deep-brain therapy and a prostate biopsy robot — under a unified control platform.

THE CHALLENGE

Combining robotics with MRI-guided interventions presents a difficult engineering challenge: MRI scanners are extremely sensitive to electromagnetic interference (EMI), and many conventional actuators or control electronics cannot safely operate within the MRI bore. In addition, surgical robots inside MRI require coordinated, real-time control of multiple axes, and the system must remain modular to support different types of robot end-effectors without redesigning the whole control architecture.

THE SOLUTION

WPI built a custom multiaxis motion-control system: a CompactRIO at the core interfacing via a backplane to up to 10 daughtercards, each handling a robot axis through FPGA-based multichannel SPI. Communication between the control system and external interfaces is done over fiber-optic Gigabit Ethernet to avoid EMI. The architecture supports modular replacement of daughtercards to adapt to different robot designs, and the control software runs on a real-time OS with a web-server based UI.

RESULTS:

- **Modular control system** compatible with MRI environments — enabling MRI-guided surgical robots that can operate inside the MRI bore.
- **Unified control platform** for different robots: the same control architecture supports both a neuro-robot (for brain interventions) and a prostate-biopsy robot simply by swapping daughtercards.
- **Real-time, multiaxis motion control** with piezoelectric actuators, allowing precise instrument delivery under MRI imaging without generating harmful interference.
- Use of commercial off-the-shelf (COTS) hardware (CompactRIO + daughtercards) and a standardized development environment (LabVIEW/FPGA) **accelerated development and reduces effort required for validation and scale-up**.

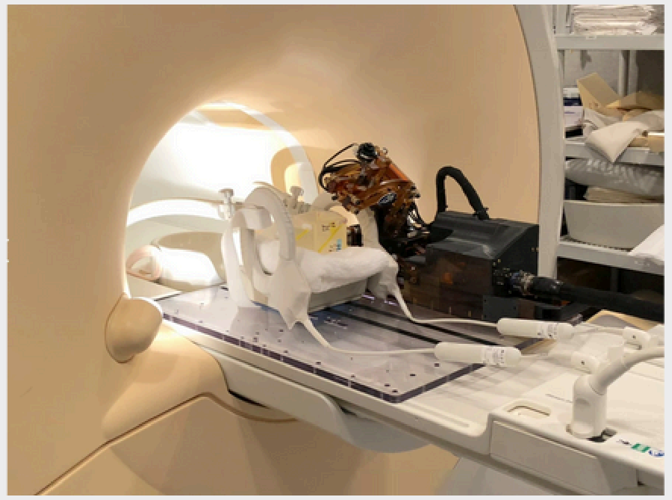

Figure 1. NeuroRobot Inside the MRI Bore With Validation Phantom and Flex Coils

College of Engineering, NIHON UNIVERSITY
日本大学工学部

EMERSON

"We succeeded in developing this system thanks to the multilevel measurement system using the NI PXI platform and LabVIEW system design software. There was no other way of making that happen."

Yoshinobu Murayama PhD
Department of Electrical and Electronic Engineering, College of Engineering
Nihon University

Learn more

Enhancing Endoscopic Surgery With an Improved Ultrasonically Activated Scalpel

Researchers at Nihon University — together with partner companies — developed a new, ultrasmall-diameter ultrasonically activated scalpel (UAS) for endoscopic surgery. The project aimed to support next-generation minimally invasive procedures (e.g., single-hole laparoscopic surgery, natural orifice transluminal endoscopic surgery) by creating a high-precision, flexible, and approval-ready instrumentation and control system.

THE CHALLENGE

They faced three main engineering challenges: first, building a measurement and control system flexible enough for R&D (since ultrasonic scalpel behavior under different loads and resonator conditions is nonlinear and unpredictable); second, handling a wide dynamic range of signals — from small sensing voltages up to drive voltages of 200 Vpp; and third, collecting reliable, high-quality data that meet regulatory standards for approval by the Japanese regulatory agency (PMDA).

THE SOLUTION

The team standardized on the NI platform — using PXI Express controllers and LabVIEW — and developed three variants of the system (stand-alone, PXI-based, and FPGA-based) to cover the full development lifecycle. This approach allowed them to measure and control ultrasonic drive parameters, vibration behavior, and resonator loads; gather optical and vibration data (e.g., via a laser Doppler vibration meter and microscope); and consistently migrate from R&D to regulatory-compliant data logging — all using the same software/hardware base.

RESULTS:

- The full toolchain (stand-alone → PXI → FPGA) was built using the same NI platform and all programmed in LabVIEW, ensuring **consistency across R&D and production-ready systems.**
- **Development time was drastically reduced:** the system was built within about a week, representing ~ **80% reduction in development time** compared with prior approaches.
- **Required lab space decreased by two-thirds**, and the system became portable — greatly improving flexibility for development and testing.
- The system enabled characterization and control of the ultrasonic scalpel over a **wide dynamic range (including drive voltages up to 200 Vpp)**, capturing all relevant signal and vibration data — a requirement for **safe, reliable, and regulatory-compliant development.**

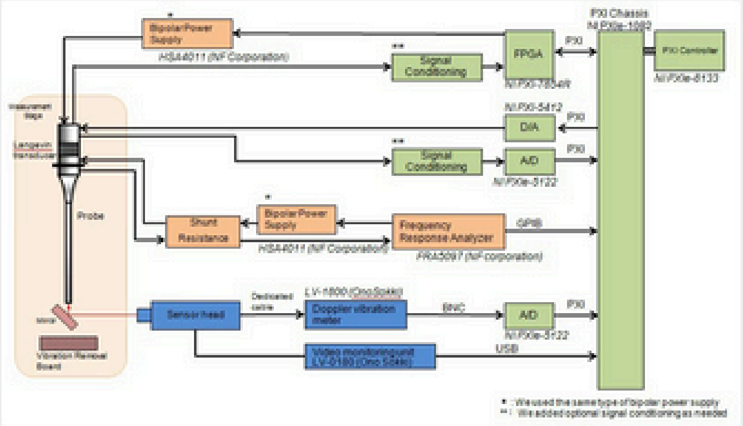

Figure 1. Block Diagram of a Piezoelectric Ultrasonic Vibration Measurement and Control System