

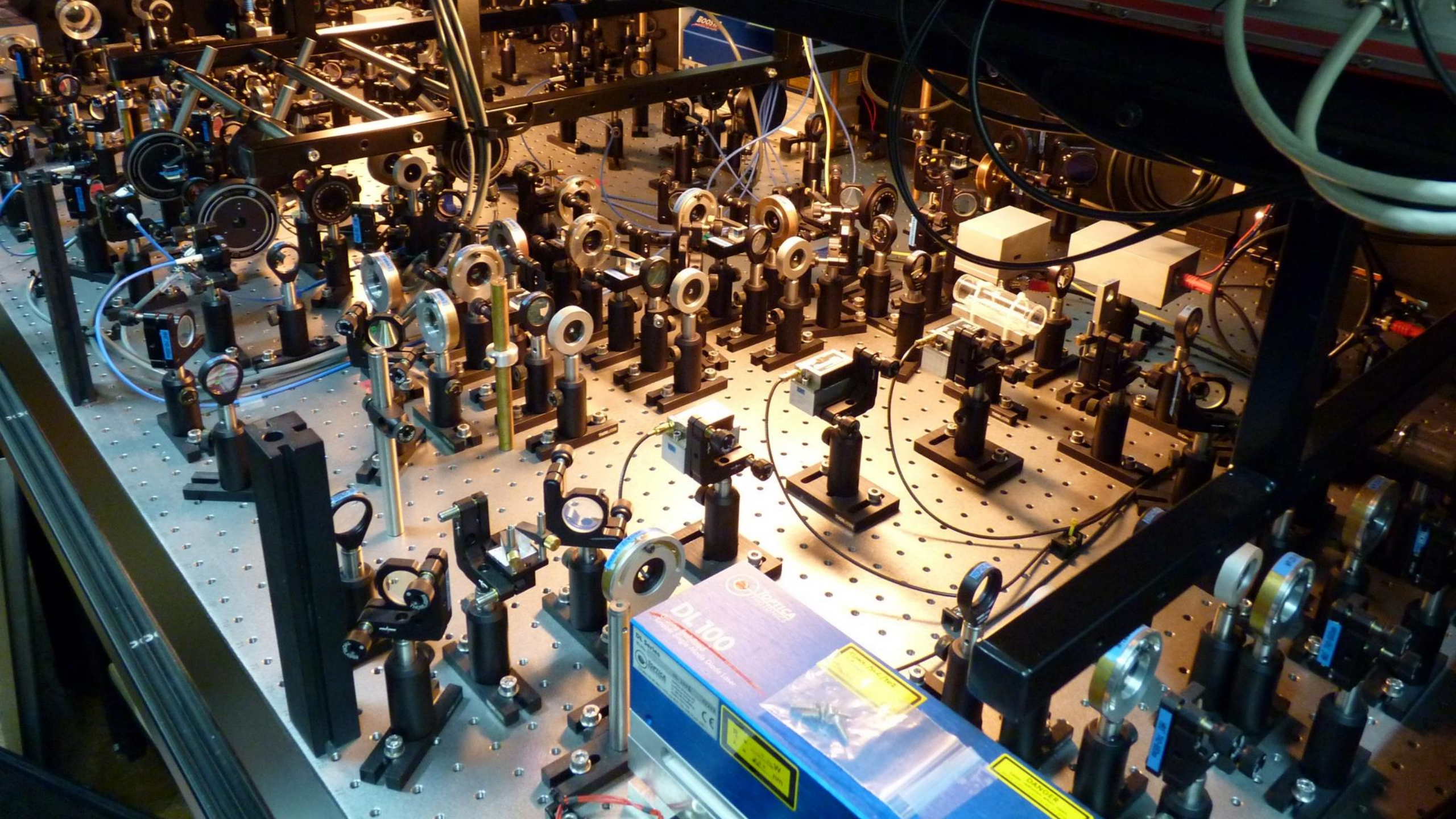
**Automated Testing of Sensors 5000
Miles Away Using LabVIEW &
CompactDAQ**
Dr Tim Wiles (Peratech)

Overview

- The background
- The problem
- The solution
- The implementation
- The reality
- The future
- The questions

The background

- Tim Wiles
- PhD in atomic physics from Durham University.





"Spare a dollar for some lab consumables, buddy?"

The background

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- Worked in bespoke software development for IT consultancy firm Waterstons for 2 ½ years.

Build a better business

Through technology, experience, and commitment,
we work with hundreds of clients, big and small, to
improve their business.

We strive to improve businesses through technology,
and we make sure to do it in one (or more) of the
following 5 Ways:



The background

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- Currently working at Peratech, for just over 2 years, as “Signal Processing & Analysis Engineer”.

Peratech shortlisted twice at the British Engineering Excellence Awards

FIND OUT MORE



Can your HMI do this?

Discover how Peratech technologies
revolutionise touch sensing

SEE THE BENEFITS



Endless Possibilities...

Delivering next generation touch
solutions in countless applications

DISCOVER MORE



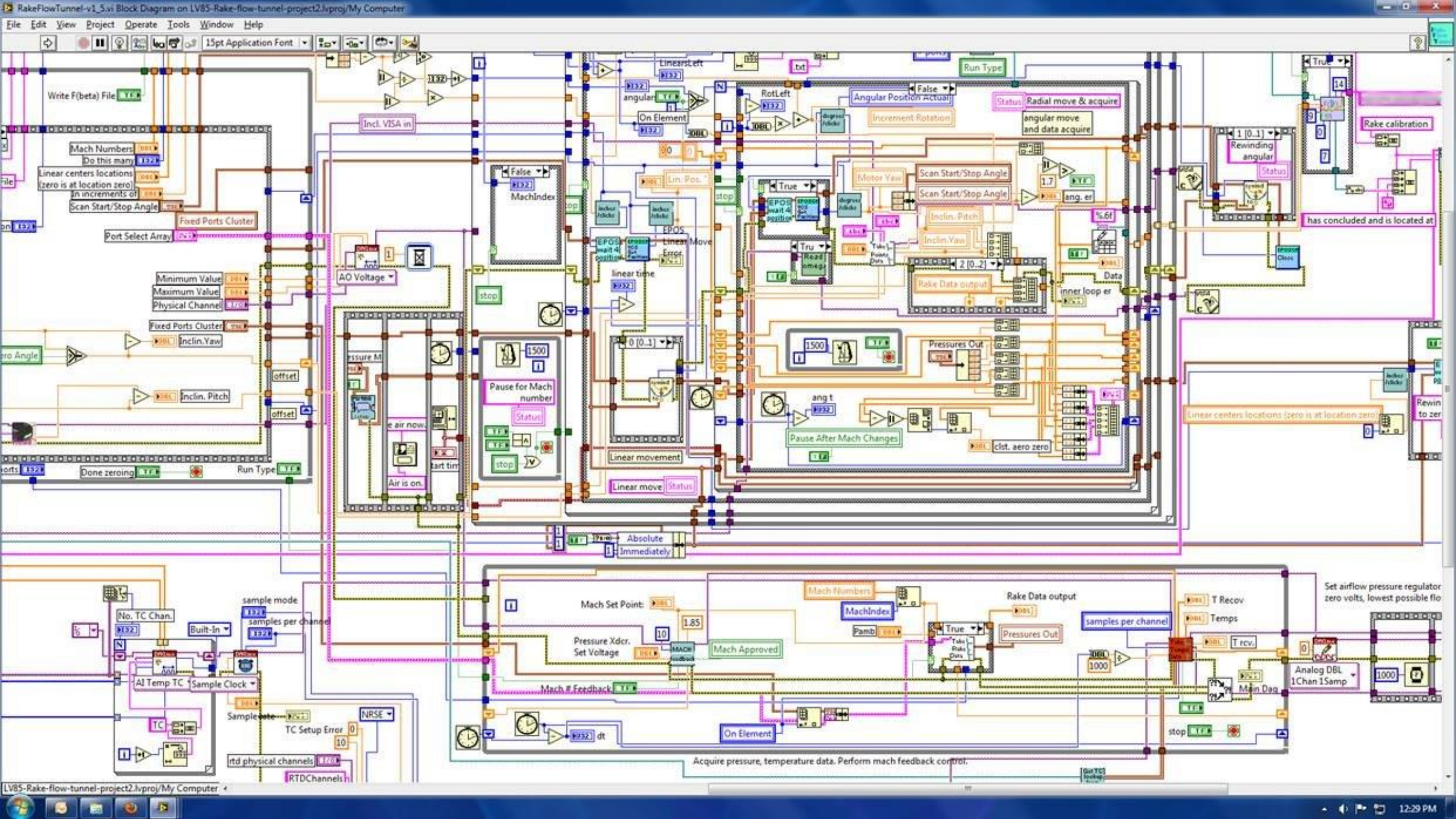
Why Peratech?

End-to-end capabilities delivering
solutions on time and budget

FIND OUT MORE

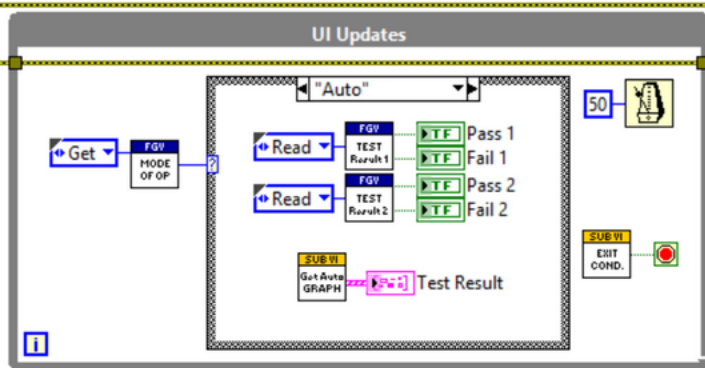
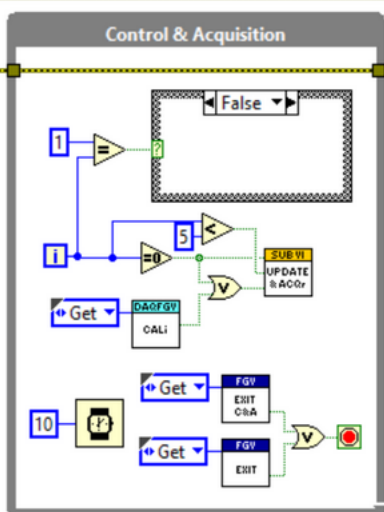
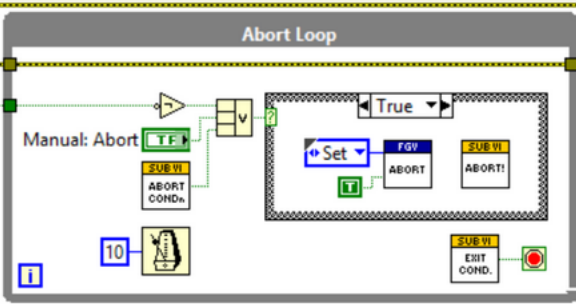
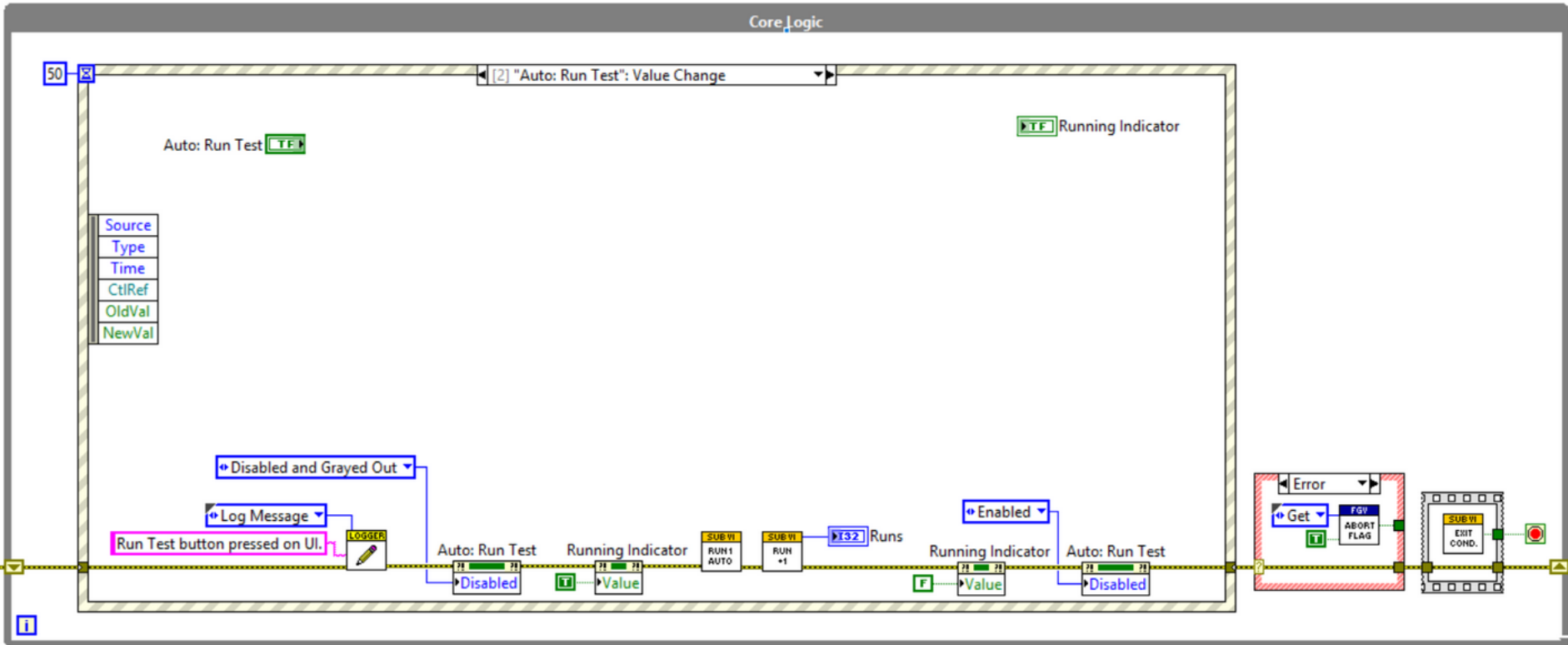
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- 10 years (off and on!) using LabVIEW & NI kit.
- Hated LabVIEW the first time I used it.



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- Now love it!



The background

A caveat

Who we are

509,311,98

492,173,187

451,107,253

367,77,178

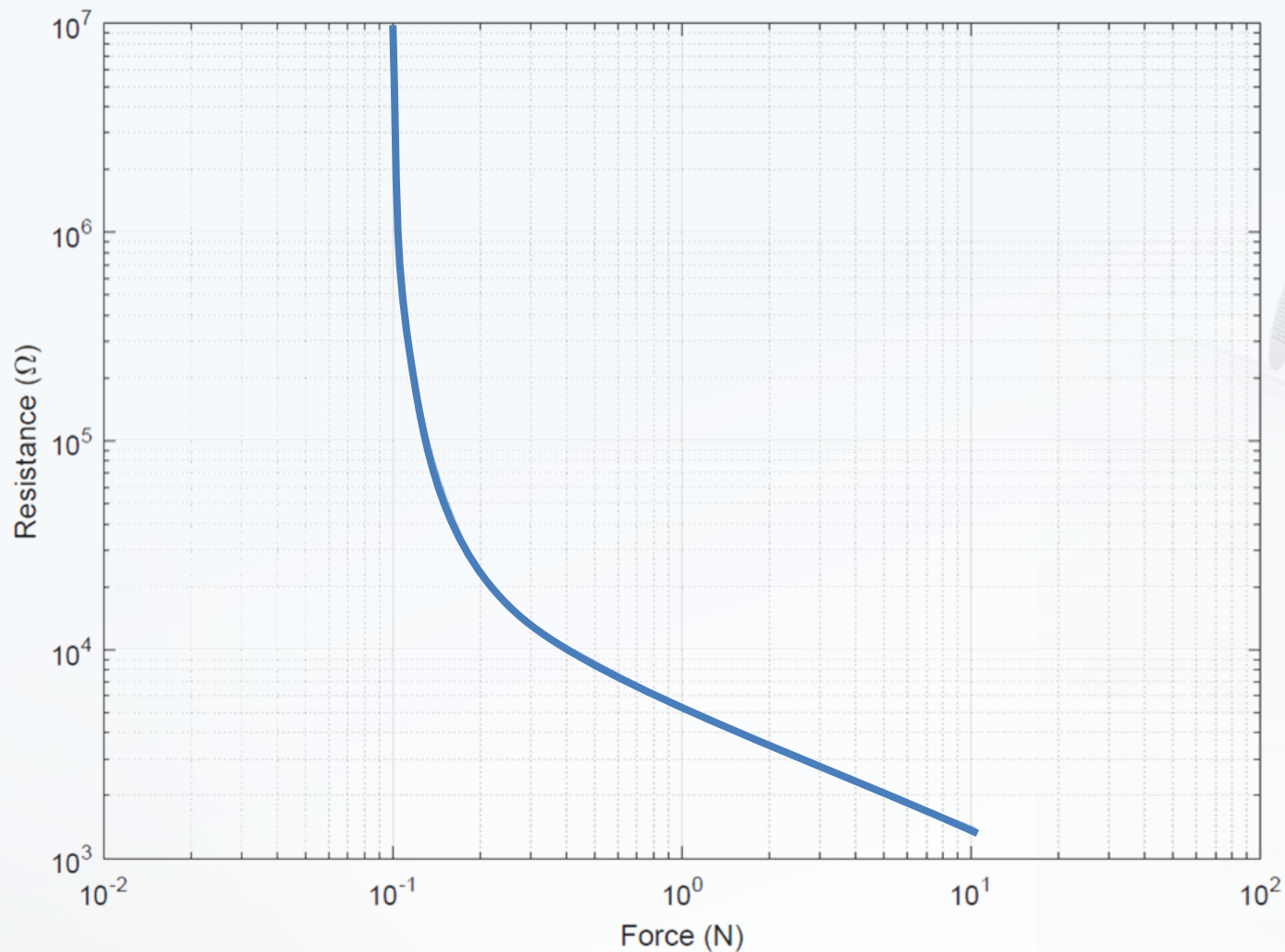
112,200,205



Background

- Peratech
- Originally founded in 1996 around the invention, research, and commercial development of QTC™ material sets.
- Company restarted under new management, investors in 2014.
- International Patent Portfolio protecting core IP.
- Rapid prototyping in house.
- Mass production manufacturing partners in Asia.

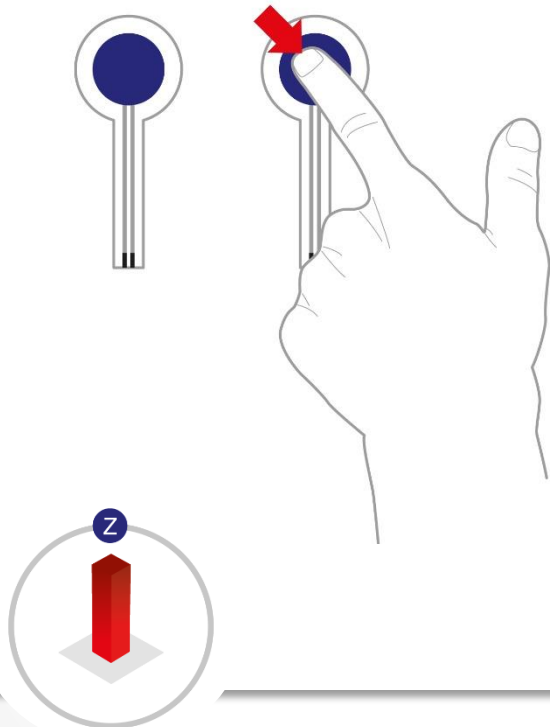
Peratech QTC[®] based force-touch sensors provide high-dynamic range and first-touch sensitivity



The Background

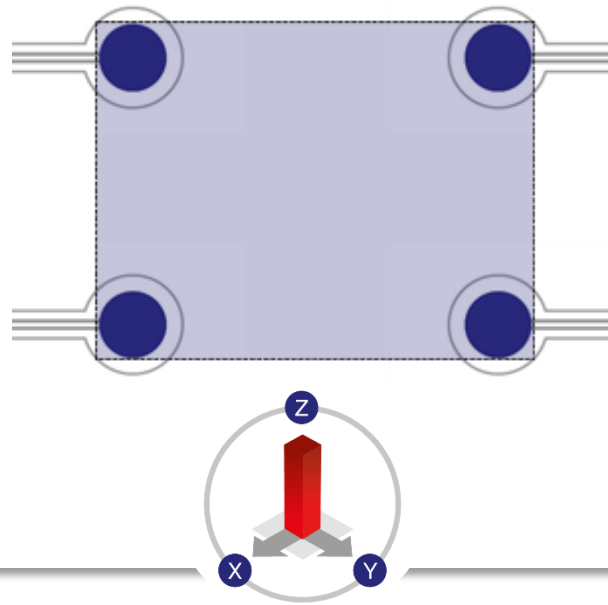
SINGLE POINT

Measures changes in one axis (z) pressure from any object.



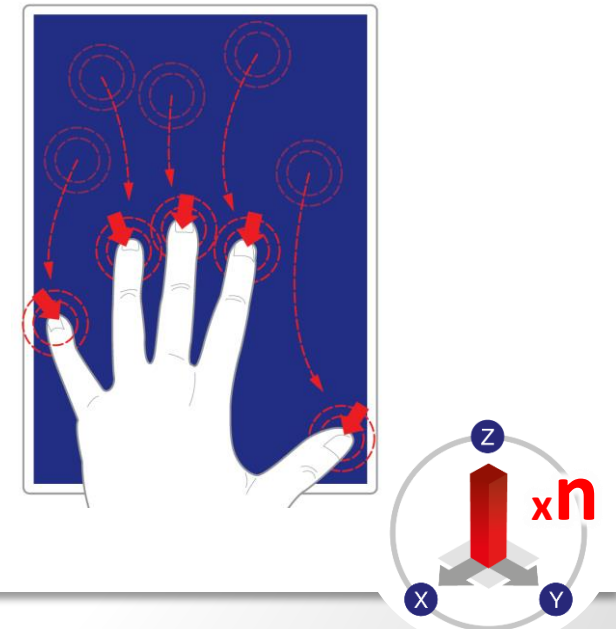
SINGLE TOUCH, SINGLE-TOUCH ARRAY

Combined with a capacitive-sensing surface, the use of 1-8 sensors measures changes in z-axis under a rigid surface or display



MULTI TOUCH, MATRIX

Measures multiple points of pressure from any object in all 3 axes simultaneously either under or on top of a surface.



The Background



GAMING CATEGORY



COMPUTER ACCESSORIES



COMPUTER HARDWARE



Swiftpoint Z Mouse

\$229.00

Introducing the "Best Gaming Innovation of 2017" the high-performance gaming mouse brings you the world first pivot, tilt and roll functionality.

THE PACKAGE INCLUDES: a Swiftpoint Z mouse in a travel case with long and short fingertip caps x2 and trigger caps x2. FlightStick Extender, adjustable tilt base x2, lock out base x2 and user documentation.

1

Add to cart

[Add to Wishlist](#)

[SKU: SM700](#)

[Category: Z Mouse](#)

Description

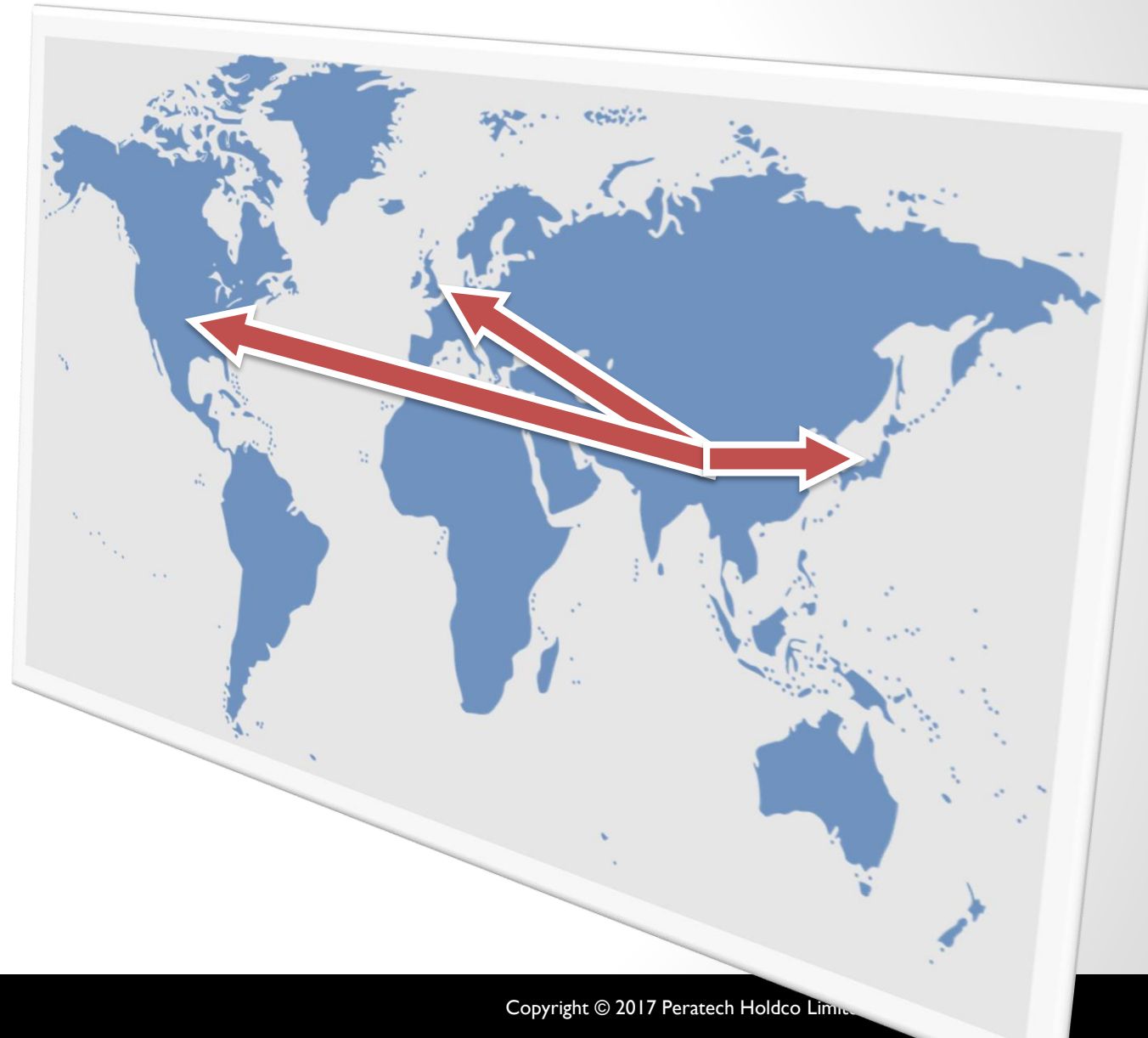
After more than three years of development, we have just launched the Swiftpoint Z.

It's the world's first mouse to **pivot, tilt and roll**, with a brand new way of clicking buttons – meaning you can access dozens of different button actions while barely moving your fingers.

The Swiftpoint Z also senses how hard you click, giving variable speed/force control, and provides tactile feedback, so you know when you've made a 'deeper click'. We built in an **Accelerometer, Gyroscope, Force Sensor & Tactile Feedback** to unleash a faster, more precise and highly intuitive mouse.

The problem

‘We need to be able mass produce single point sensors in Asia and be able to track product quality, as it comes off the production line, from anywhere in the world.’



The problem: Expanded

- Four broad areas to problem solve:
 - Mechanical
 - Electronic
 - Software
 - Infrastructure

The problem: Expanded

- Four broad areas to problem solve:
 - Mechanical
 - Electronic
 - Software
 - Infrastructure

The problem: Expanded

- The mechanical side:
 - We need mechanical apparatus that can apply force up to at least 12 N.
 - Must be robust and reliable.
 - Must be modular in design.
 - Must be quick to prototype design improvements.

The problem: Expanded

- The electronic side:
 - Should be as close to plug-and-play as possible.
 - Must be robust and reliable.
 - Must be able to measure forces that vary over 3-4 orders of magnitude and resistances over 4-5 orders of magnitude.
 - Must be able to handle voltages > 24 V.
 - Must have high bit depth.
 - Must not waste time reinventing the wheel.

The problem: Expanded

- The software side:
 - Must be quick to initially develop.
 - Must be quick to prototype new test methods.
 - Must be quick to bug fix.
 - Must not waste time reinventing the wheel.
 - Must integrate well with test components.

The problem: Expanded

- The infrastructure side:
 - Must allow relevant people to observe test results rapidly.
 - Upload of data must be robust to internet connection outages.
 - Must be flexible enough to allow automated reporting.
 - Must store data in a flexible format which could be modified at a later date.
 - The data store must secure and accessible from anywhere in the world.

The solution

- Electronic and software:
 - NI CompactDAQ + LabVIEW.
 - cDAQ-9174: 4-slot CompactDAQ Chassis.
 - NI-9218: C Series Universal Analog Input Module.
 - NI-9229: C Series Voltage Input Module.
 - NI-9263: C Series Voltage Output Module.
 - NI-9403: C Series Digital Module.

The solution

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The solution

LabVIEW

NI 9403



Switches &
Indicators



NI 9263



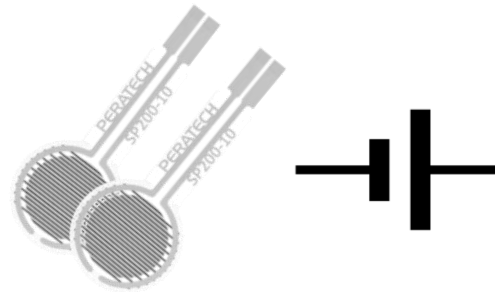
Stepper Motor
(Voltage)



NI 9229



SP Sensors & V_{DC}
(Voltage/Resistance)



NI 9218



Load Cells
(Force)

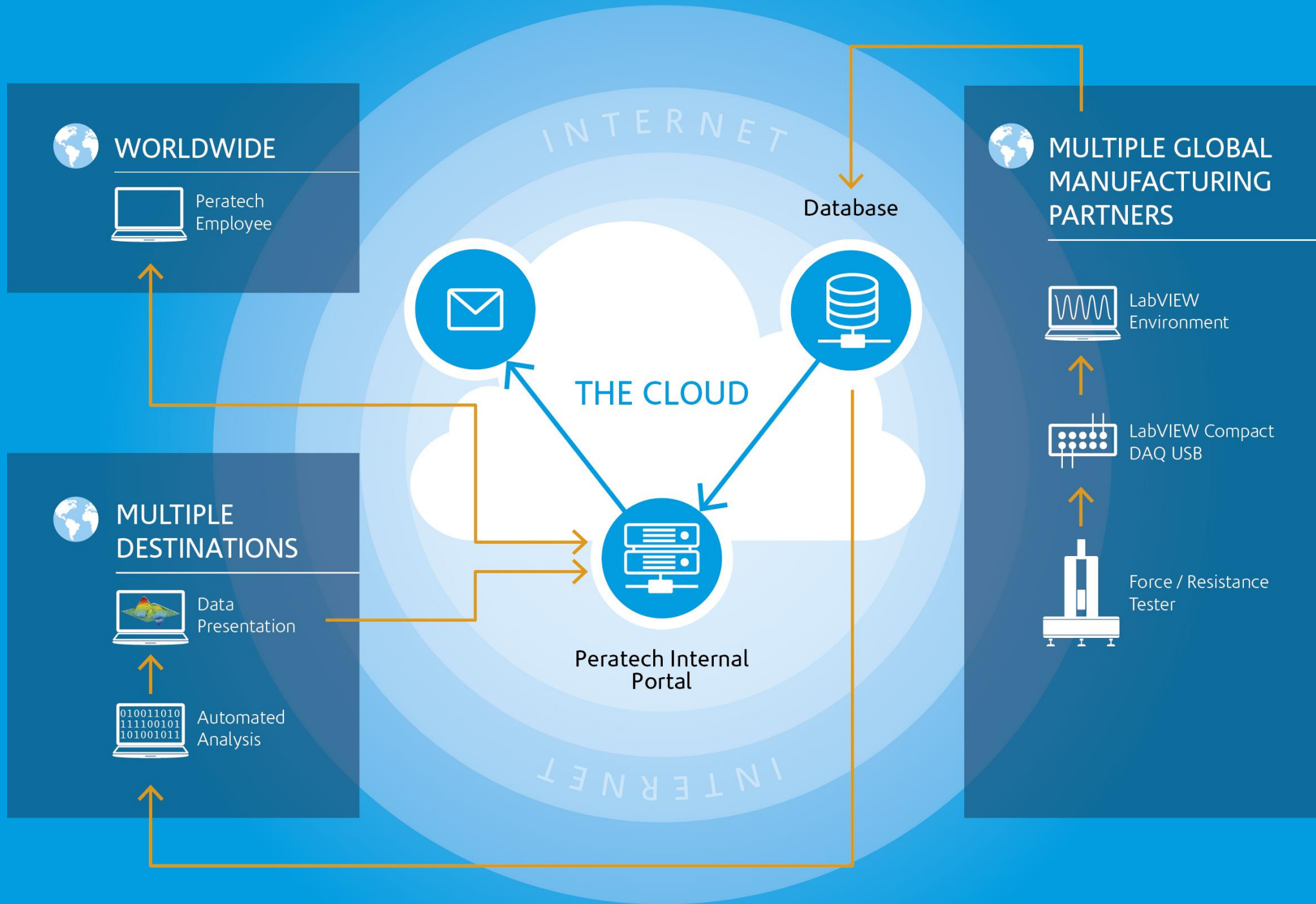


The solution

- Infrastructure:
 - Microsoft stack: C#, .NET framework, Microsoft SQL Server.
 - Storage handled by Microsoft's cloud-based service, Azure.

The solution

- The infrastructure side:
 - Must allow relevant people to observe test results rapidly.
 - Upload of data must be robust to internet connection outages.
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The implementation

- Implementation almost universally brings reality crashing down on you, when you thought you had it sussed:
 - Where exactly in resistance is my noise floor?
 - How about in force?
 - What will be the true effect of software timing?
 - How exactly will high frequency noise affect the combined force-resistance data?
 - What external elements come into play that weren't clear initially?
 - We'll revisit some of the things that tripped me up later...



PERATECH
FORCE RESISTANCE ANALYSER

PERATECH
FORCE RESISTANCE ANALYSER

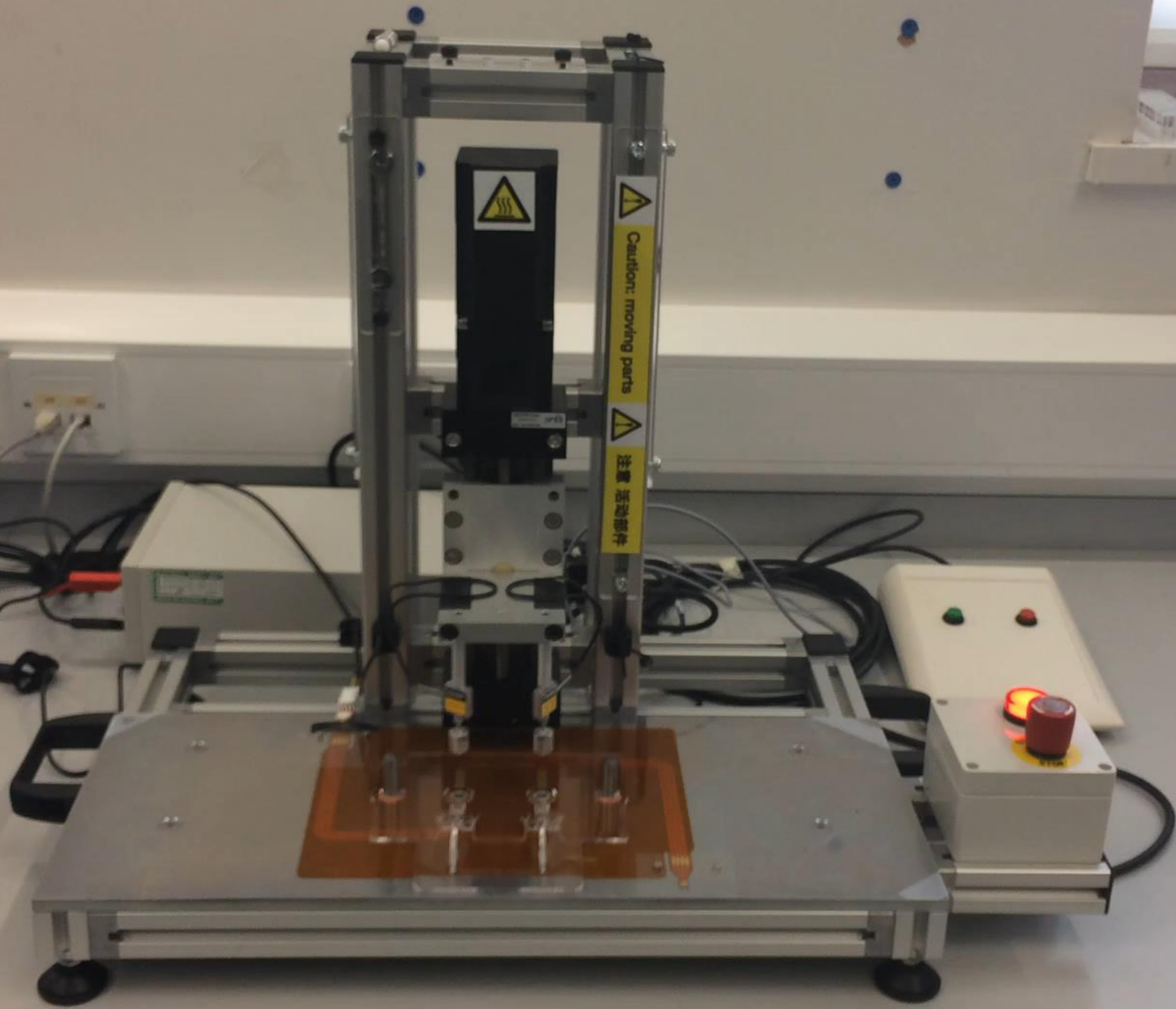
PERATECH
FORCE RESISTANCE ANALYSER

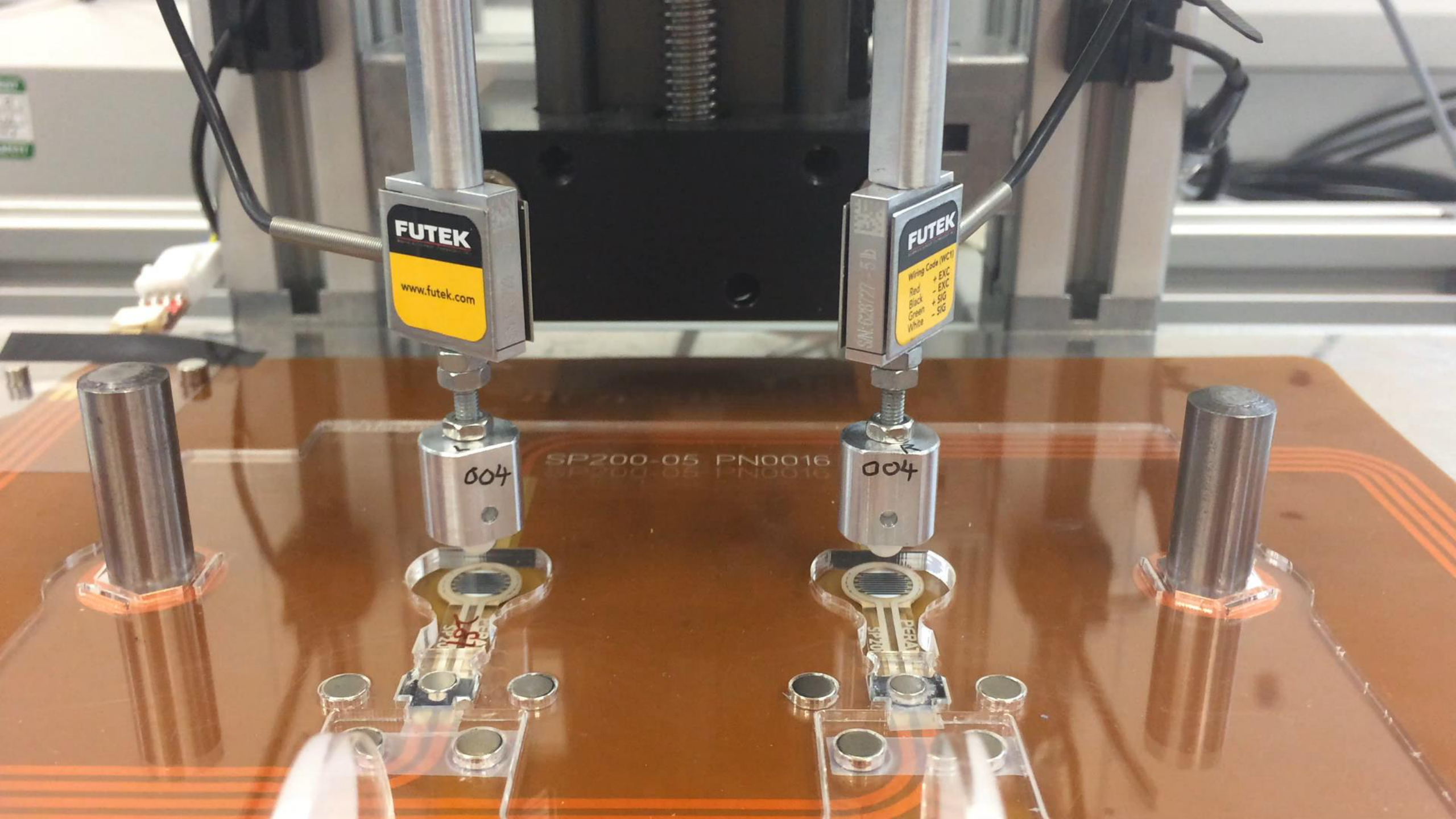


No expense spared...

No expense

Spared





Auto

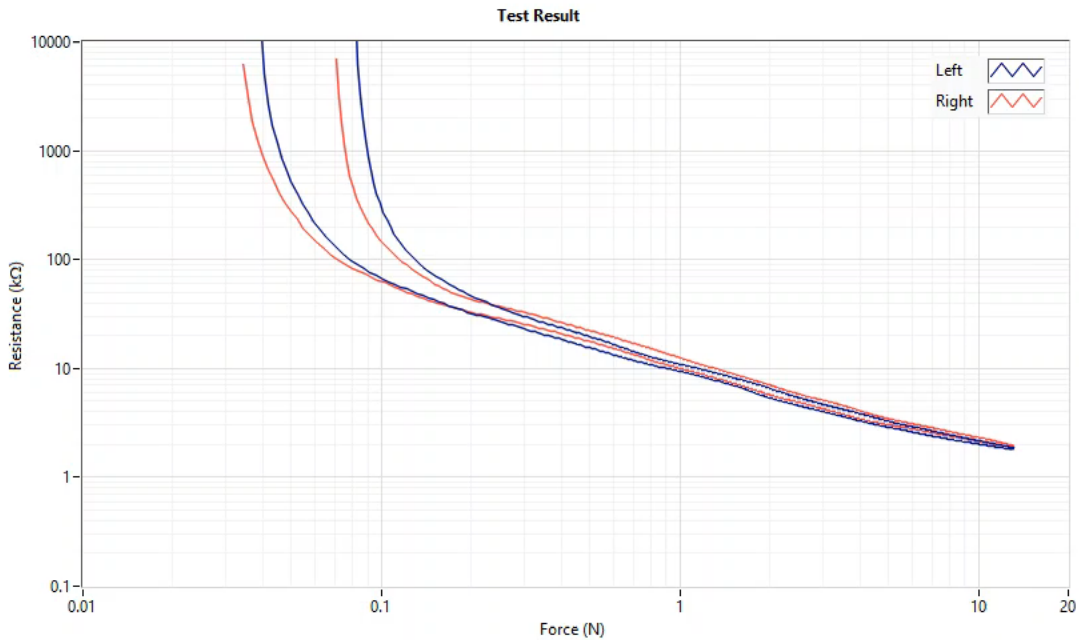
Manual

Configuration

Sensor Type
SP200-10

Type of Test
Standard

Number of Repeats
1



Runs

24993

Current Cycle

1

Left



Right

20171002 Video Test

Sensor Reference

Sensor Position



Calibrate



Diagnostic Mode OFF

Sensor Reference 20171002 Video Test

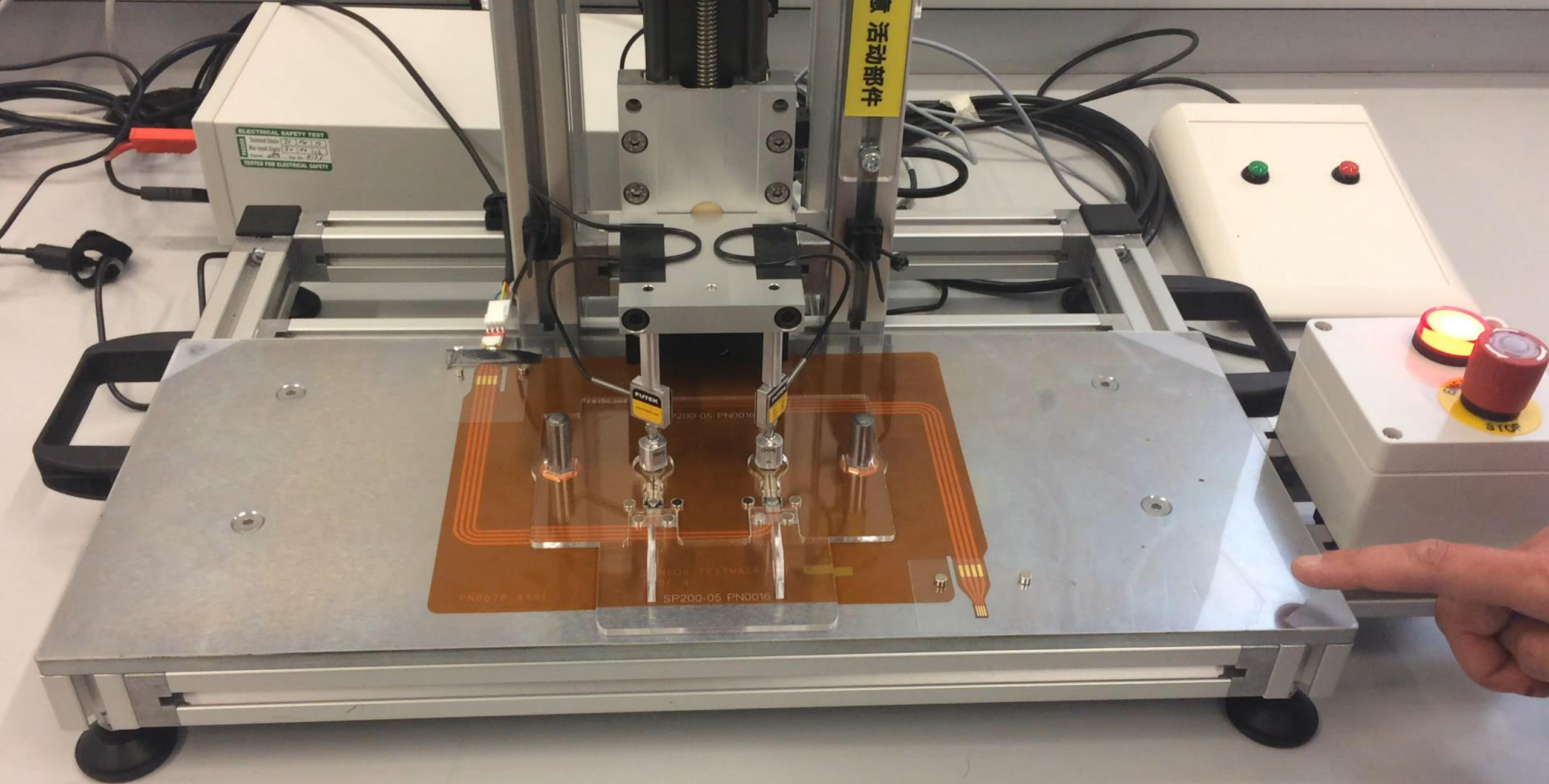
Sensor Position



Log Off



Exit





1



1

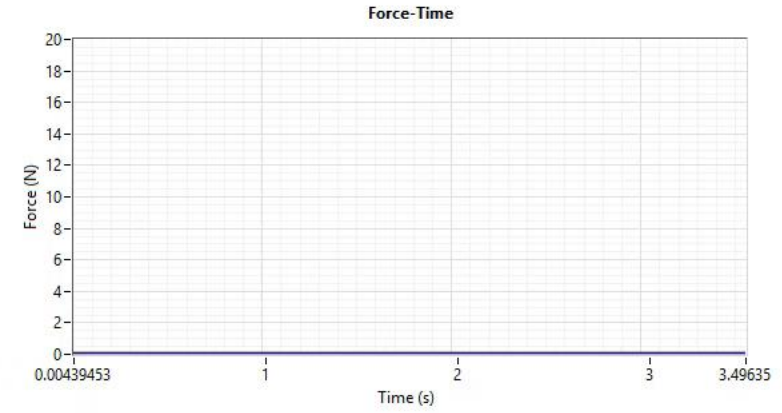


Move to Force (N)

1

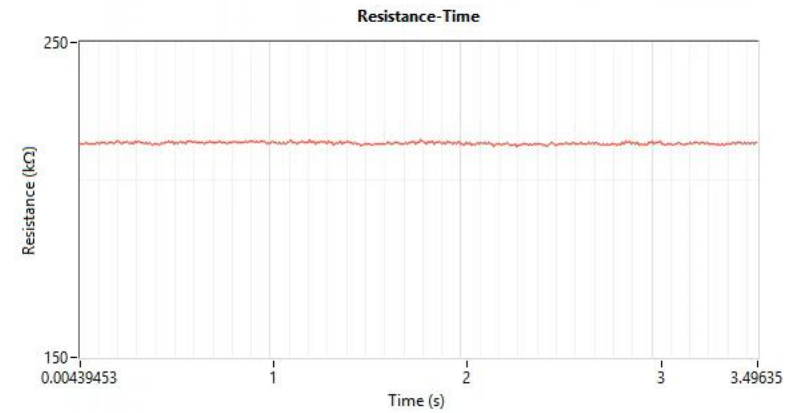
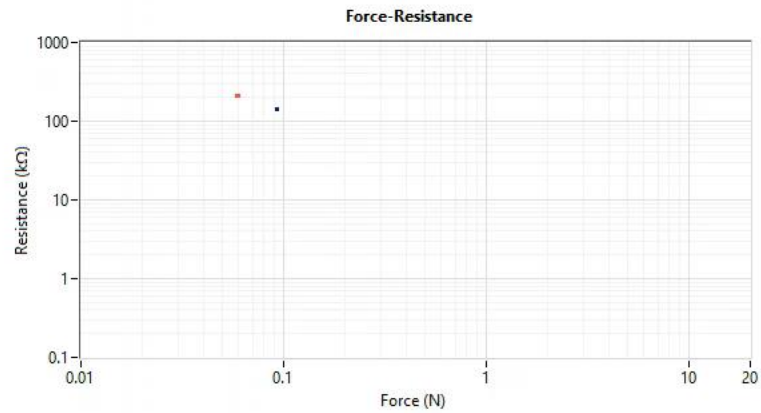


Left Sensor 
Right Sensor 



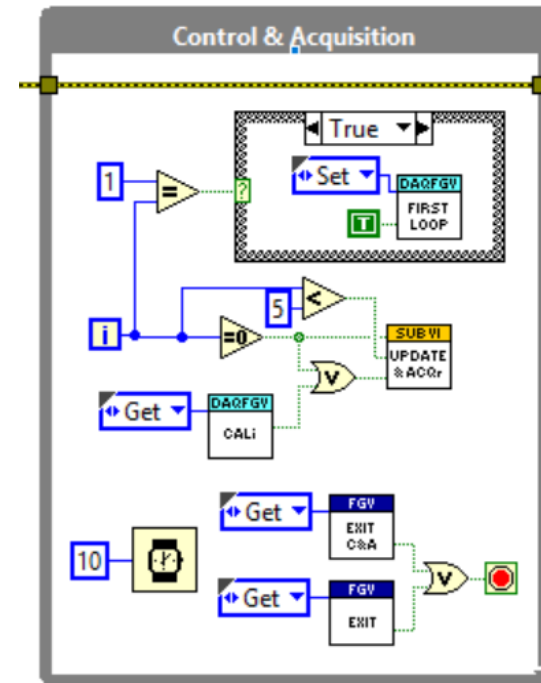
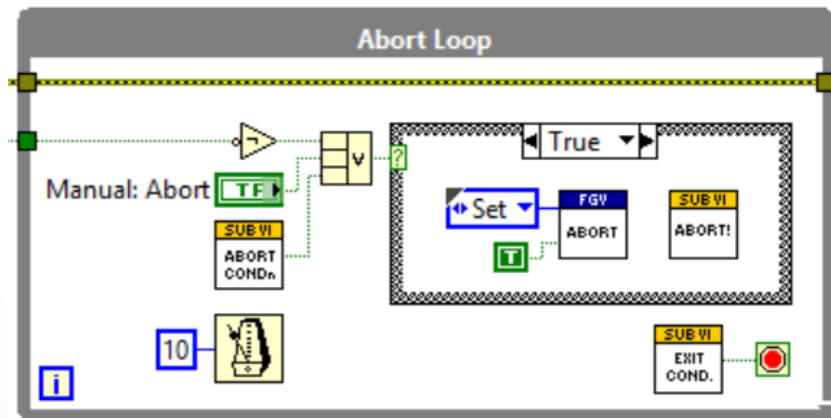
Left Force (N) 0.09161
Left Resistance (Ohm) 1.431E+5

Right Force (N) 0.06002
Right Resistance (Ohm) 2.126E+5



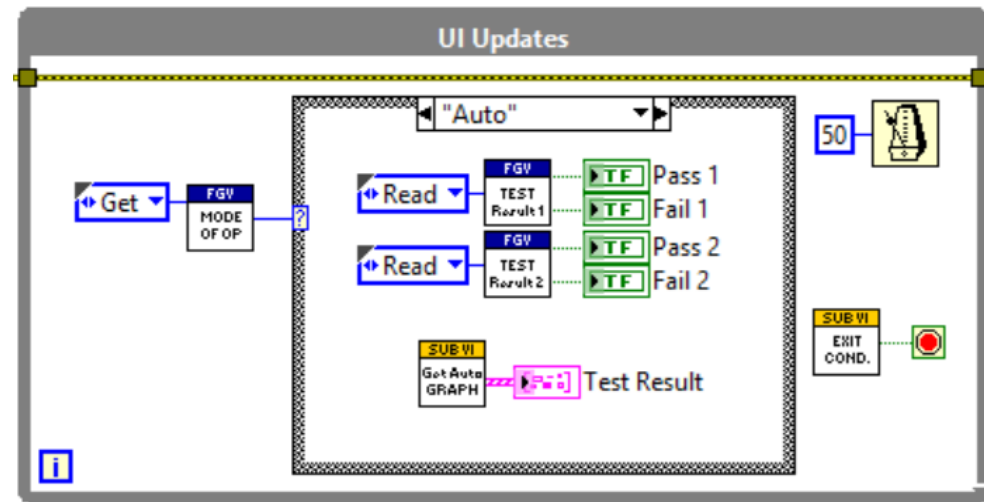
The implementation

- Under the hood:



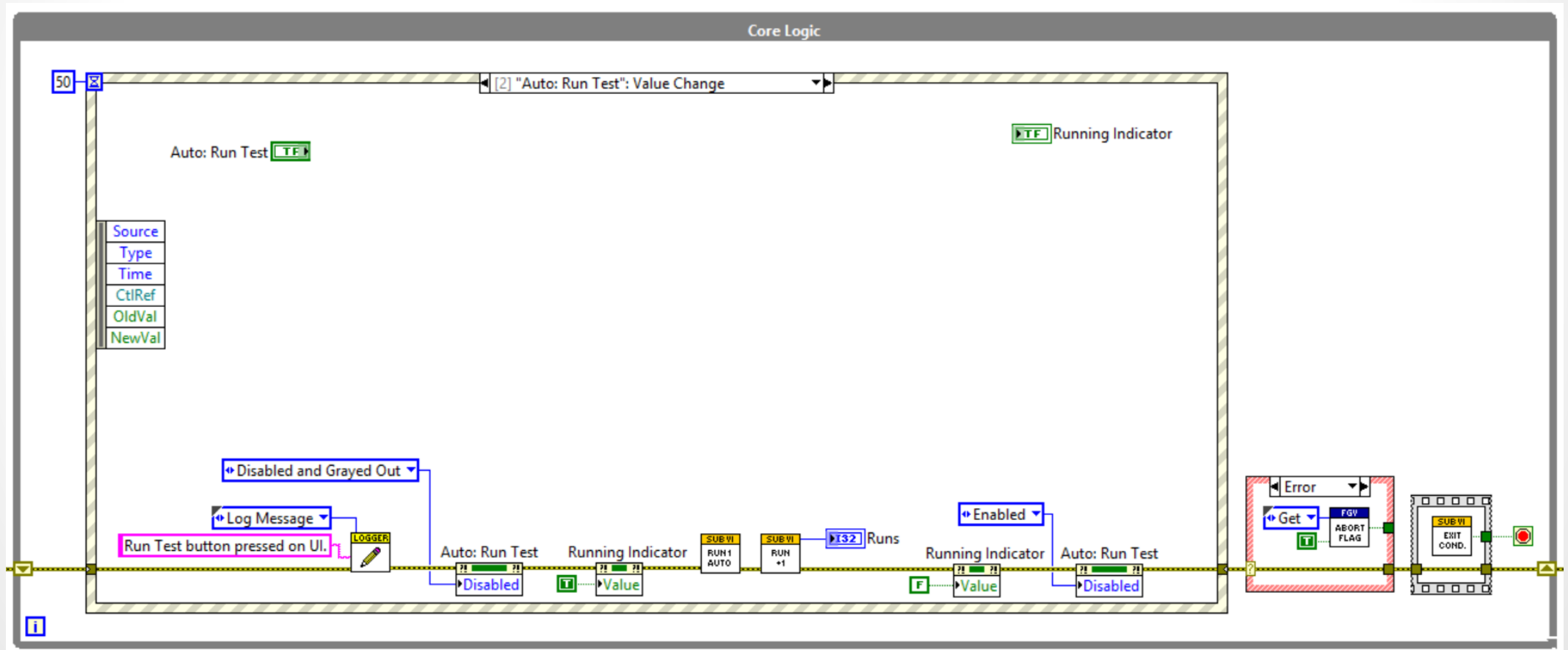
The implementation

- Under the hood:



The implementation

- Under the hood:

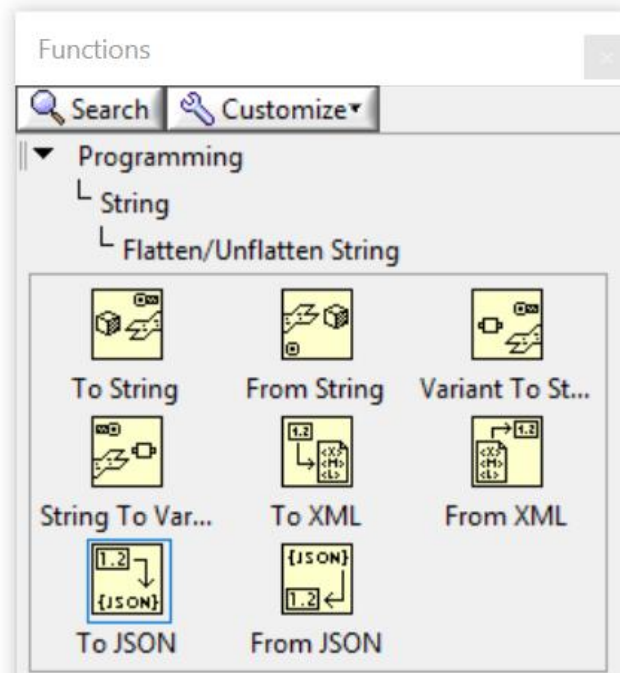


The implementation

- The novelty is in integration, to create a coherent system.
- How do we get LabVIEW to talk to C# in a robust, but loose enough fashion?
- Why loose?
- We don't want LabVIEW to know the C# portion of the system exists.
 - Prevents this external factor from breaking the tester.
 - Keeps the system modular.
 - Easier to bug fix.
 - Easier to upgrade.

The implementation

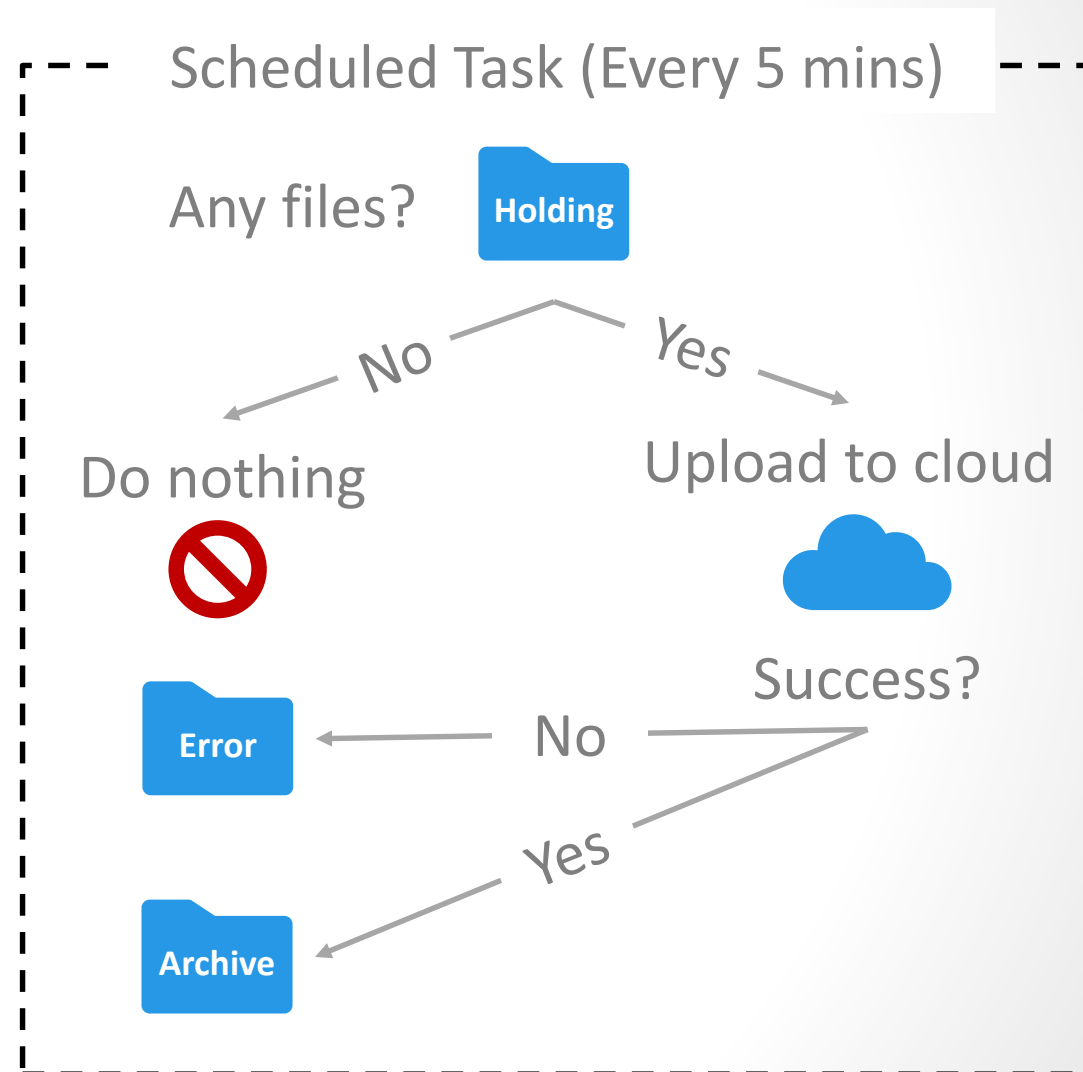
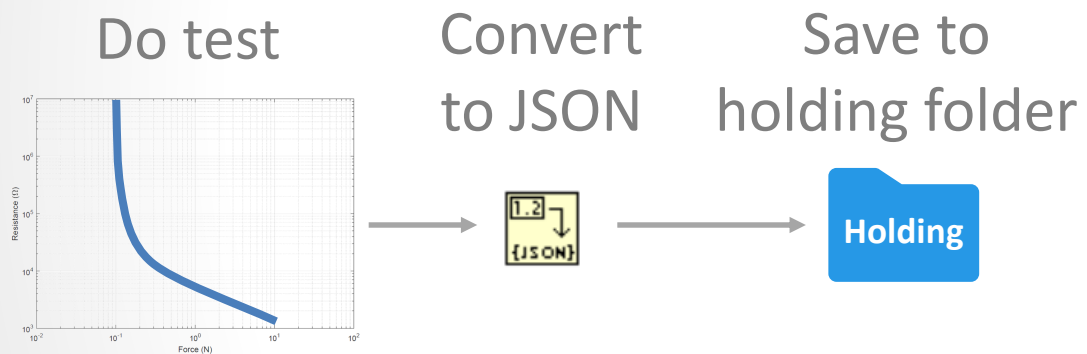
- Solution?
- Generate JSON (JavaScript Object Notation) files:

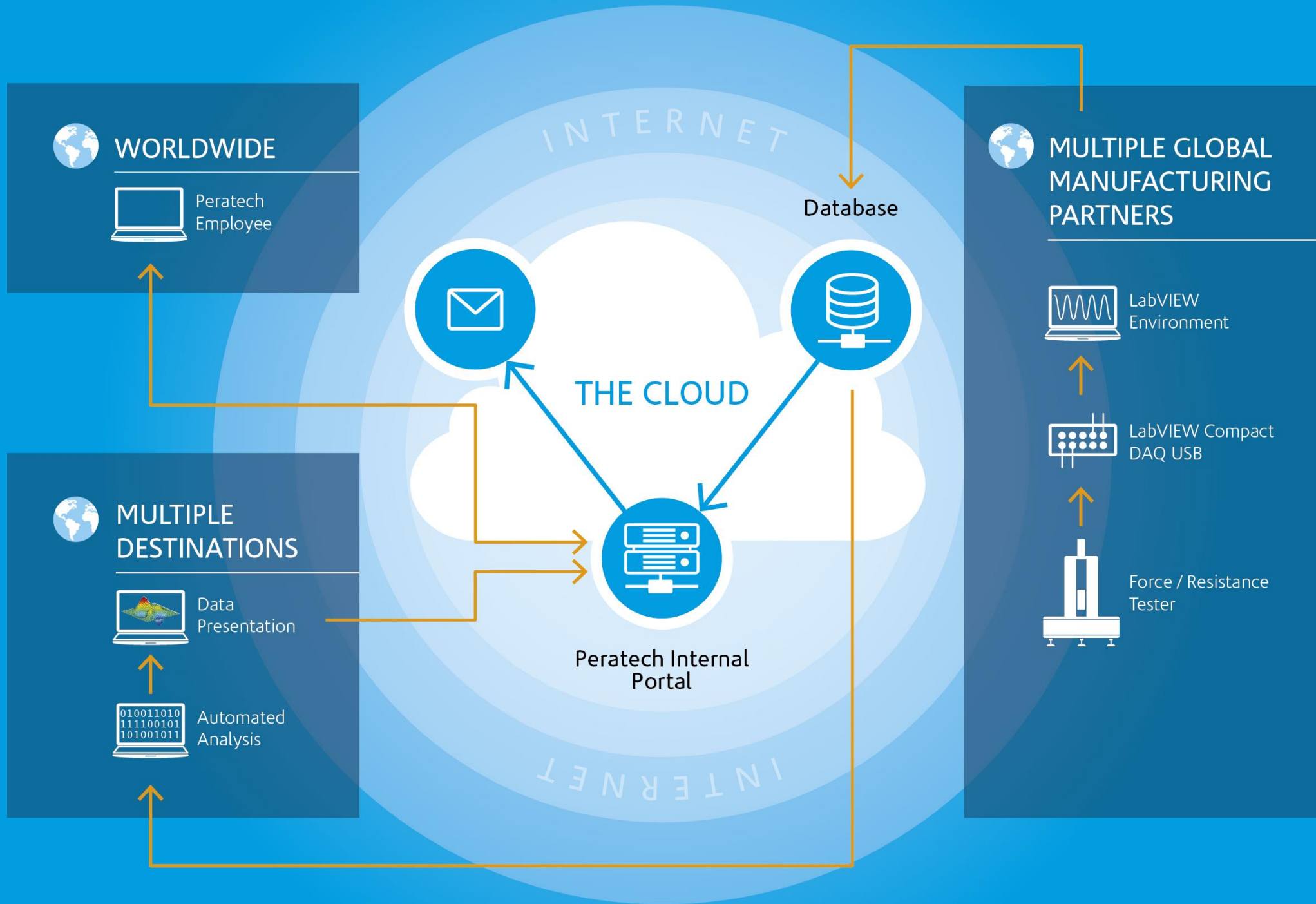


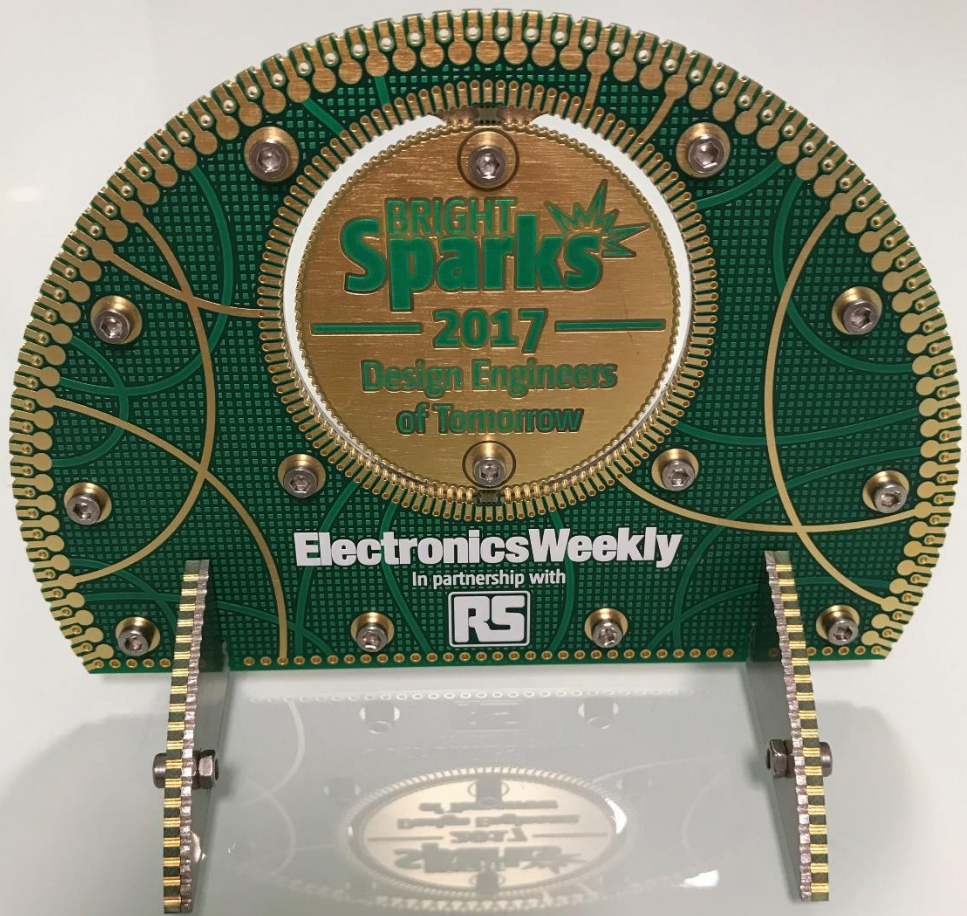
```
{
  "Company":{
    "Employees":[
      {
        "Name":"Tim Wiles",
        "Department":"Engineering",
        "Email":"tim.wiles@peratech.com"
      },
      {
        "Name":"Amy Davies",
        "Department":"Lab Ops",
        "Email":"amy.davies@peratech.com"
      }
    ],
    "Offices":[
      {
        "City":"Richmond",
        "Country":"UK"
      },
      {
        "City":"Shanghai",
        "Country":"China"
      }
    ]
  }
}
```

The implementation

- The process:









Electronics Weekly has teamed up with RS Components to highlight the brightest and most talented young electronic engineers in the UK today.

RECOMMENDED ARTICLES



EW BrightSparks
2017 profile: Andrew
Cowan, Cobham
Antenna Systems



EW BrightSparks
2017 profile: Calum
Finn, Nestle



EW BrightSparks
2017 profile: James
Hayman, Ametek



In the latest of our series on the [EW BrightSparks of 2017](#) we highlight Tim Wiles, a Signal Processing and Analysis Engineer at Peratech, who previously gained an MSc in Physics and a PhD in Atomic Physics, both from Durham University.

Tim Wiles | EW BrightSparks | Electronics ...



Quantum Tunnelling

When Tim first joined the company he started investigating the signal coming from its Quantum Tunnelling Composite sensors.

TechUK urges post-Brexit investments

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next year



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Search for best component deals

Tim Wiles | EW BrightSparks | Electronics ... 



The reality

- The perils of Microsoft Office.
- Windows doesn't always do what you want it to do. But it's not as unreliable as you might think.
- Timing is not great, but there are ways to handle this.
- The Great Firewall of China.
- Constantly acquiring data has its downsides. Keep an eye on the buffers.
- When the tester is measuring something odd, almost all of the time the tester is really seeing what it is reporting.
- Two stations can give subtle errors that result from swapping of cables.

The future

- Automation, automation, automation:
 - Fully automated reporting.
 - Automated remote warning messages.
 - Automated testing of a greater number of sensors.
 - Reducing human interaction with sensors in test.
- Performance improvements:
 - Faster test cycle.
 - Parallelisation.
 - Move to real time system.

The questions

Any questions?