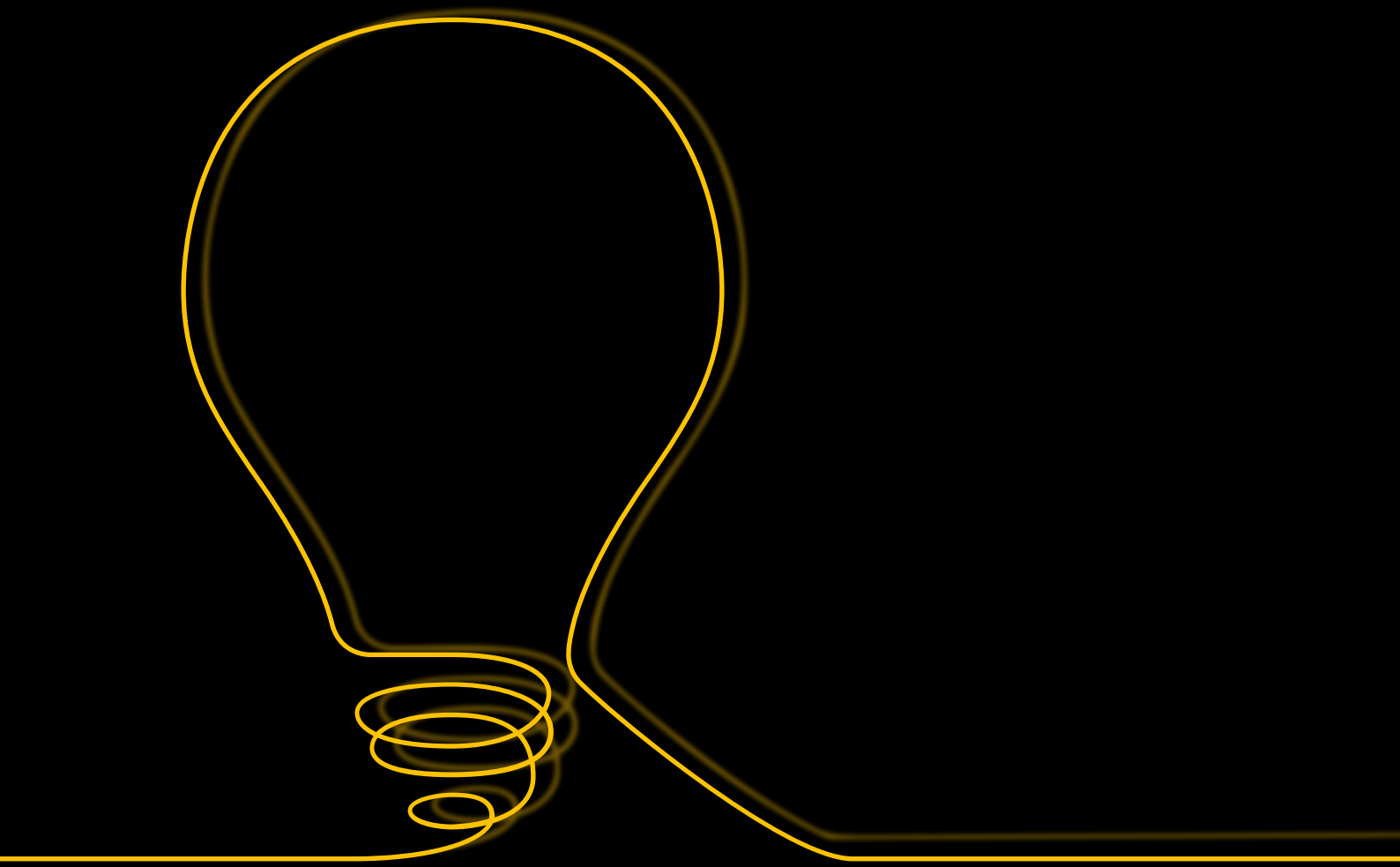


2024

IOP Business Awards

iop.org

IOP Institute of Physics

Professor Sir Keith Burnett
CBE FRS CPhys FInstP FLSW
President of the Institute of Physics

A message from IOP's president

It is a pleasure to congratulate the winners of this year's IOP Business Awards and recognise these impressive businesses that are pushing the boundaries of physics-powered innovation. Physics businesses are developing answers to some of the biggest challenges facing our society, driving economic growth, attracting investment and creating high-value jobs.

I am particularly delighted to celebrate this year's Business Award winners in the year that the IOP has launched its new five-year strategy, Physics for our Future. The winners exemplify the themes at the heart of this strategy: skills, science and society.

They demonstrate the huge impact physics skills have on a thriving economy and society and the need to nurture those skills in future generations. They highlight the importance of both discovery science, where the greatest innovations are born, and the entrepreneurial spirit which brings innovative products to the hands of consumers and societies. And they illustrate physics' enormous potential to benefit society.

Warmest congratulations to all of this year's superb winners.

IOP Business Awards

The Institute of Physics (IOP) is the professional body and learned society for physics in the UK and Ireland. It seeks to raise public awareness and understanding of physics, inspire people to develop their knowledge, understanding and enjoyment of physics and support the development of a diverse and inclusive physics community. As a charity, it has a mission to ensure that physics delivers on its exceptional potential to benefit society.

IOP members come from across the physics community, whether in industry, academia, the classroom, technician roles or in training programmes as an apprentice or a student. However, IOP's reach goes well beyond our membership to all who have an interest in physics and the contribution it makes to our culture, our society and the economy. We are a world-leading science publisher and we are proud to be a trusted and valued voice for the physics community.

The IOP Business Awards recognise the vital role physics and physicists play in our economy, creating jobs and growth by powering innovation to meet the challenges facing us today, ranging from climate change to better healthcare and food production.

Professor Robert Lamb FInstP
IOP Vice-President for Business

Welcome

This year marks a milestone for the IOP Business Awards. Since 2012, the Institute of Physics has celebrated the achievements of 89 individual companies, and this year I am delighted that we will be presenting our 100th award, as the IOP continues to recognise the invaluable contributions that physics-powered businesses make to both the innovation landscape and the UK economy.

This year's winners have demonstrated a broad application of physics including quantum sensing, photonics, semiconductors, medical, energy, materials and engineering.

Their achievements include the first generation of flexible colour X-ray cameras, a revolutionary heat engine, quantum computers with electronic qubit control and scalable architecture, patented semiconductor technology for infrared light sensors, mass-produced acoustic metamaterial panels, novel technology that allows non-invasive measurement of intracranial pressure, cosmic ray muon imaging, and the manufacture of periodically poled lithium niobate (PPLN) technologies.

I wish all of this year's winners continued success and congratulate them warmly on their achievements.

2024 Business Innovation Award

Awarded to small, medium and large companies that have excelled in innovation and delivered significant economic and / or societal impact through the application of physics.

Winners

FeTu

Geoptic Infrastructure Investigations

Oxford Ionics

Covesion

2024 Business Start-Up Award

Awarded to young companies with a great business idea founded on a physics invention, with the potential for business growth and significant societal impact.

Winners

Silveray

Metasonixx

Phlux Technology

2024 Lee Lucas Award

The Lee Lucas Award recognises and celebrates very early stage companies taking innovative products into the medical and healthcare sector.

Winners

Crainio

FeTu

“To receive this award is a win for every innovator dedicating their time and efforts to the climate agenda.

FeTu is a beautiful example of British ingenuity redefining what history has taught us, overcoming the impossible to enable access to abundant green energy sources which already exist.

Our ability to generate electricity from heat sources as low as 40°C is a critical development for the UK to recover £4bn in industrial waste heat into free, green electricity, in addition to enabling a new reality for geothermal and Solar.”

Jon Fenton, CEO

Geoptic Infrastructure Investigations

“We’re absolutely both stunned and honoured with our award, partly as it comes from the Institute of Physics. The IOP is a preeminent body for Physicists and a supportive community to develop and grow both businesses and personal careers within. For young companies like Geoptic, the award brings much needed recognition to get the message out and support awareness of Geoptic’s products and services. Geoptic works at the intersection of particle physics and civil engineering and brings its novel 3D imaging technology, based on background radiation measurements, to challenges within structural and UK engineering projects.”

Dr Chris Steer, CEO

Oxford Ionics

“Through novel physics and incredibly precise, scalable engineering, Oxford Ionics is building the world’s most powerful quantum computers. 2024 has been a landmark year for the company: we’ve expanded internationally, rapidly commercialised our technology, and set world records in the three most important metrics for quantum performance. We are honoured to receive this recognition from the Institute of Physics, which validates the power of our innovative approach to making quantum computing a reality.”

Dr Chris Ballance, CEO and co-founder

Covesion

“It is great that Covesion’s periodically poled lithium niobate (PPLN) solutions are being incorporated into breakthrough quantum sensing, communication, and computing products as both components and sub-systems. We are proud that our efforts are technically and commercially successful which has been recognised by the Institute of Physics in this award. We will continue to work hard to find new applications that enable our customers to achieve their goals, delivering cutting edge products on a global scale.”

Mr Mike Day, CEO

Quotes

Silveray

“Our vision is to be a game changer for cancer detection, mammography, and other areas of medical X-ray imaging with our low radiation dose, high res, and cost-effective Digital X-ray Film (DXF).
The field of X-ray imaging hasn’t seen many revolutionary innovations since the advent of digital imaging. Our vision at Silveray is to disrupt this by creating financially sustainable, high quality, physically flexible X-ray detectors. We know there is more to be done but this award from the Institute of Physics is recognition of the valuable potential of our technology for many applications, starting with industrial non-destructive testing (NDT).”

Dan Cathie, CEO

Metasonixx

“At Metasonixx we sell acoustic privacy, in open offices and beyond. Our products are based on acoustic metamaterials: they don’t absorb or reflect noise, but cancel noise, like interferential filters do for light. Like noise-cancelling headphones, but without electronics. Physics is embedded in a modular material, which blocks noise while letting light and/or air through. The perfect solution for heat pumps, which are becoming a need for our country.

We are extremely thrilled by this award, which celebrates 7 years of multi-disciplinary work, first in our parent universities and now in our company. You should have seen the celebrations when we got the news! We feel this IOP award will fuel our rocket with energy, towards greater success.

My thanks go primarily to my passionate team, then to the people who believed in us and invested in the company their time and their money, even when products were still far away. Last but not least, I would like to thank my sons, who keep repeating “daddy is an inventor”. Tonight, I feel they may be right.”

Dr Gianluca Memoli, CEO

Phlux Technology

“Within 4 years of founding Phlux we have managed to not only launch our first product, but also secure our first customer. Winning the IOP Start-Up Award is a tremendous honour and great recognition of our team’s achievements.”

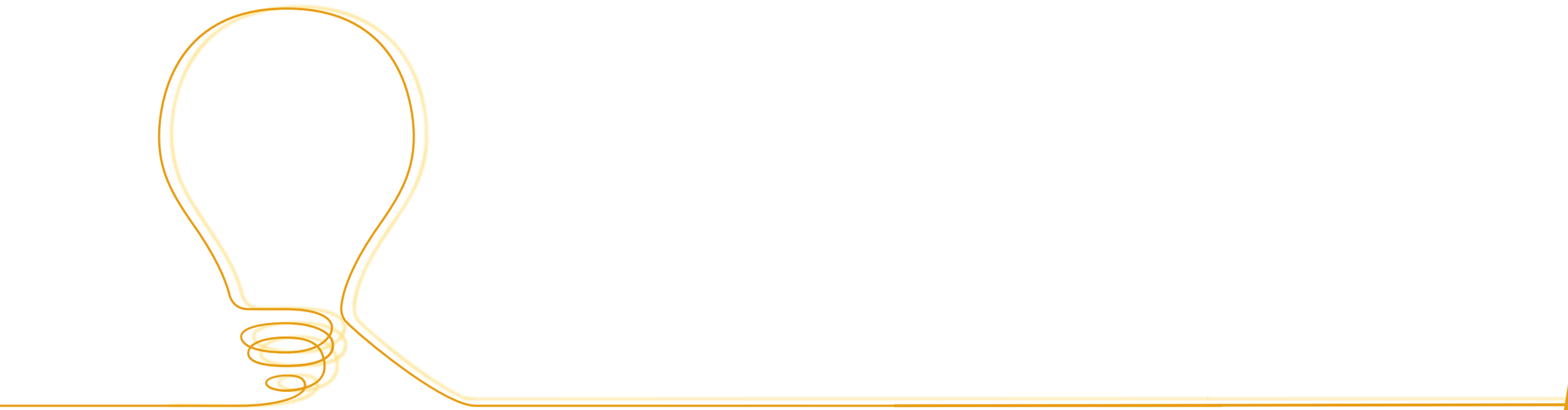
Dr Benjamin White, CEO

Crainio

“Crainio’s non-invasive intracranial pressure measurement technology promises to revolutionise the treatment of people who suffer traumatic brain injury, the biggest killer of males under 40. We are thrilled to have the innovation, quality, and robustness of the underlying physics of the invention recognised through the award of the Lee Lucas prize.”

Dr Jeremy Holland, CEO

Business Innovation Award



Business Innovation Award

FeTu

The Company

A West Yorkshire-based innovation-driven enterprise has created a groundbreaking ‘energy motor’ that has evidenced its ability to outperform compressors, Organic Rankine Cycles (ORC) heat engines, and pumps. A disruptive enabling technology targeting mass-sector decarbonisation across various markets and sectors.

A single architecture, which is a blueprint technology for many fluid power applications, the Fenton Turbine, or FeTu, is both the technology and the company.

The unique architecture of this simple fluid energy motor employs a novel quad-acting principle, seamlessly converting energy between volumetric and rotational sources at its most basic, fundamental level.

FeTu has established new performance norms in low-temperature power generation, enabling commercially compelling arguments for sustainable power from formerly unexploitable sources, such as geothermal and ultra-low-temperature industrial waste heat. With UK Government support, FeTu is developing the same architecture as an enabling high-temperature heat pump, targeting profound new efficiency levels.

The hybrid FeTu architecture combines the most desirable characteristics of radial, axial and reciprocating compression technologies within a single platform, creating a ruthlessly effective and efficient fluid energy machine, which has often been described as resembling a heart.

This multifaceted machine also enables the replacement of volatile high-global warming potential (GWP) refrigerant fluids with a patented zero-GWP refrigeration and heating cycle using nothing more than air. There seem to be few practical limits on how this technology can play a critical and impactful role in the race to net zero.

The action of its unique four-chamber spherical design is elegant and mesmerising to behold, boasting a 100% evacuated volume and only two moving parts. It is lightweight, compact, scalable, low-friction, positive displacement, and continuous flow, manufactured from abundant and recyclable materials. Due to its spherical design, it is an ideal pressure vessel and scales up inordinately well from tens of kilowatts to several megawatts.

FeTu’s groundbreaking design provides countless advantages to industrial manufacturers in addressing a comprehensive end-user need to reduce costs and improve their environmental impact by using less and producing more sustainable energy. It sets a new standard for performance and sustainability, unlocking new potential in recovering ultra-low-grade waste heat and beyond.

Generating electricity from ultra-low grade heat (40°C) with efficiencies that are commercially attractive to end users.

For the development of a revolutionary heat engine, generating electrical power from waste heat and geothermal sources as low as 40°C.

Business Innovation Award

Geoptic

Geoptic Infrastructure Investigations

The Company

Geoptic is a spin-out from three collaborating physics groups of the Universities of Durham, Sheffield and St Mary's Twickenham.
The company applies cosmic ray muon radiography and tomography for engineering insights into large structures.

Geoptic's tunnel muon survey service provides railway asset engineers the ability to look through and X-ray the overburden from tunnel roof to the surface. Given that the average age of the UK's railway tunnels is around 170 years old, old concealed construction shafts pose a significant hazard to the tunnel's integrity, especially if the shaft's location is not known and with increasing amounts of rain due to climate changes. Over the last two years, Geoptic has worked with Tier 1 suppliers to Network Rail to survey over 10km of tunnels on the network, leading to a number of identified concealed shafts, some dating to Brunel's time building the network. The historic construction shafts were manually excavated in order to speed up a tunnel's completion. Just before the tunnel was completed, some of the construction shafts along the tunnel would be sealed at the surface and the tunnel. If you are standing inside the tunnel, or on the surface, there is typically no sign that the shaft is close by.

On the UK's railway network, either the shaft's location was not initially recorded, or the records have been misplaced or destroyed since the tunnel's construction, leading to a significant information gap. When concealed construction shafts are not properly maintained, accidents such as the Clifton Hall tunnel collapse, that destroyed three houses and killed five people, may occur. Geoptic's imaging solution allows tunnel asset engineers to locate and characterise shafts and voids above the tunnel.
Geoptic uses part of Earth's natural radiation, a highly penetrating source of muons, to image through the tunnel's roof in an analogous manner to medical X-ray imaging. By taking muon images at steps along the tunnel, the team has pioneered and delivered 3D tomographic data to the asset engineers, providing a clear structural view of the hazards above railway tunnels.

Helping to improve the safety of the UK's railway network with muon imaging.

For establishing cosmic ray muon imaging as a primary technique in assuring the safety of the UK's railway tunnels from concealed shafts, effectively solving Network Rail's hidden shaft location challenges.

Business Innovation Award

Oxford Ionics

The Company

Oxford Ionics is creating the world's first useful quantum computers. They are innovating with scale in mind, building ultra-high performance quantum processors in standard semiconductor foundries alongside chips for laptops and cellphones, and are focused on facing challenges head-on to unlock the potential of quantum computing.

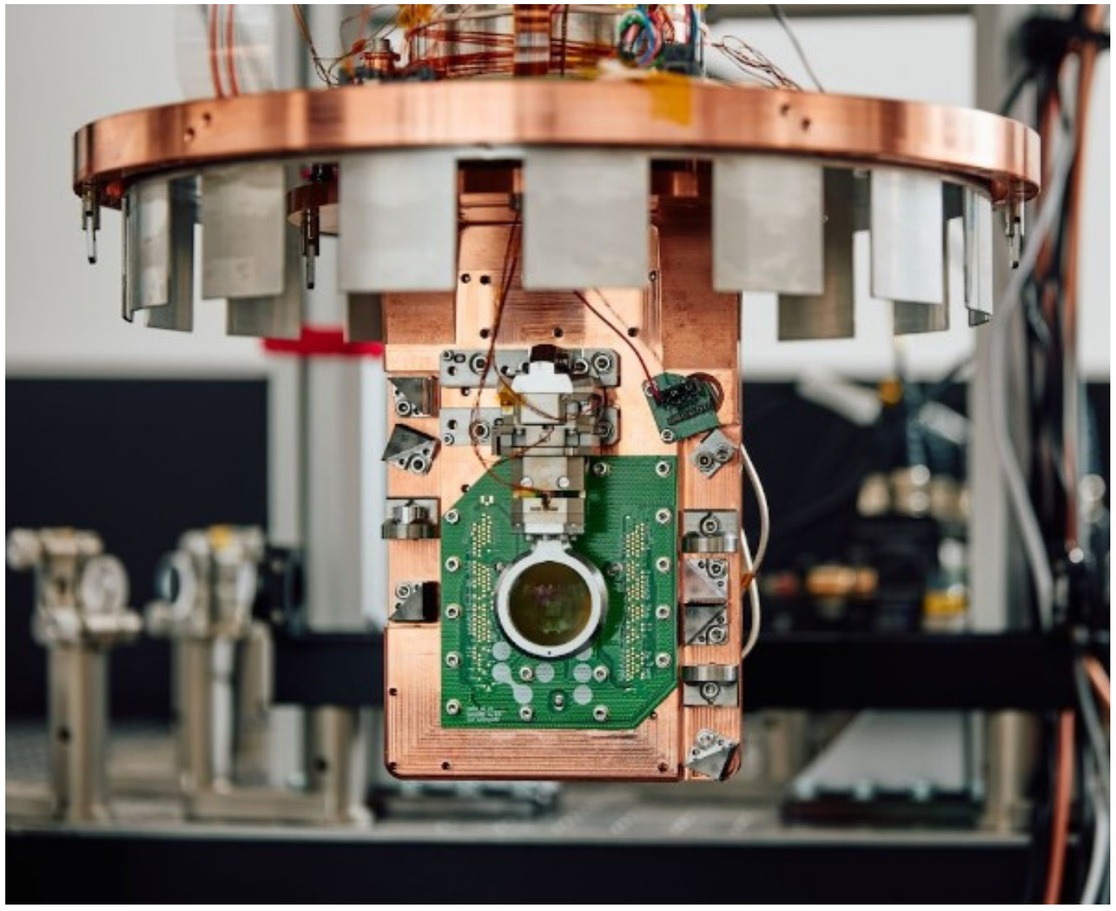
Designing architectures for quantum computing is hard because three things must be achieved:

- Extremely low gate error rates that stay low as the number of qubits increases.
- Parallel qubit control - the ability to perform different operations on all of the qubits at the same time.
- The exclusive use of technologies that can be built at scale and integrated into a single device.

There are many architectures which solve one or two of these challenges but none has yet achieved all three simultaneously. Oxford Ionics has demonstrated a way of controlling qubits that can.

The best error rates have been demonstrated with trapped ion qubits, but these typically require lasers to drive the quantum operations, which are challenging to integrate. Oxford Ionics' unique electronic qubit control system allows them to trap and control ions above the surface of the chip and build out large scale chips. They have achieved record-setting qubit control fidelities while maintaining the scalability of the architecture of their systems which can be built in the same semiconductor foundries as chips for laptops and data centres. To date, they have established key partnerships in the industry in order to tackle real-world challenges in various fields, such as catalytic science.

Revolutionising computation in catalytic science, materials development and quantum chemistry.



For the development of quantum computers with electronic qubit control and scalable architecture that enables world-leading performance with chips that can be manufactured at scale on standard semiconductor production lines.

Business Innovation Award

Covesion

The Company

Covesion is a world leading designer, innovator & manufacturer of PPLN technologies for highly-efficient, non-linear, frequency conversion. Established in 2009, as a spin out of the University of Southampton, they are at the forefront of enabling QuantumTechnology by creating stable narrow linewidth light used in Quantum Sensing, Communication and Computing.

Covesion is a world leader in the research, development and manufacture of magnesium doped, periodically poled, lithium niobate (MgO:PPLN) crystals and waveguides for highly efficient, non-linear frequency conversion. Since being established in 2009, they have been supporting the photonics industry by offering insight and guidance on the design of laser systems for generating visible and infrared (IR) light.

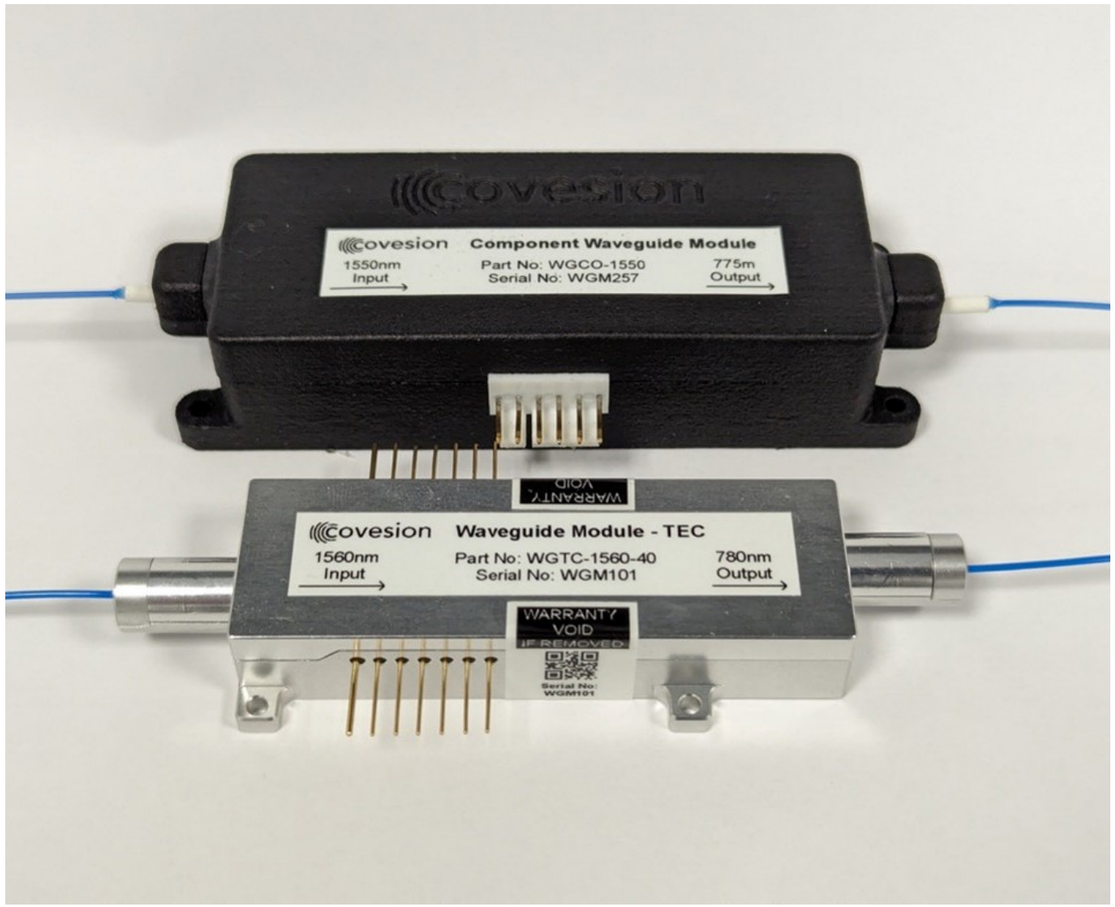
From their manufacturing base in Southampton, United Kingdom, their optoelectronic engineers, product development specialists and research scientists are committed to ongoing innovation in the field of photonics. The team, chosen from academia and industry, works in close collaboration with customers and industry partners to ensure that they continually design and manufacture world leading PPLN technologies for a broad range of cutting-edge, scientific applications including:

- space and defence quantum technology
- spectroscopy
- environmental science
- research and development

MgO:PPLN supports a wide range of applications such as: quantum computing, communication, sensing and timing applications; frequency doubling of femtosecond lasers; mid-infrared generation; atom cooling; terahertz generation and biomedical imaging. Recently launched into their extensive portfolio of waveguides, Covesion's fibre-coupled (input and output) component waveguide for second harmonic generation (SHG) of C-band frequencies is designed for both OEMs and researchers. The novel waveguide provides reliable output power from a few milliwatts up to one watt in a compact package with external fibre coupling.

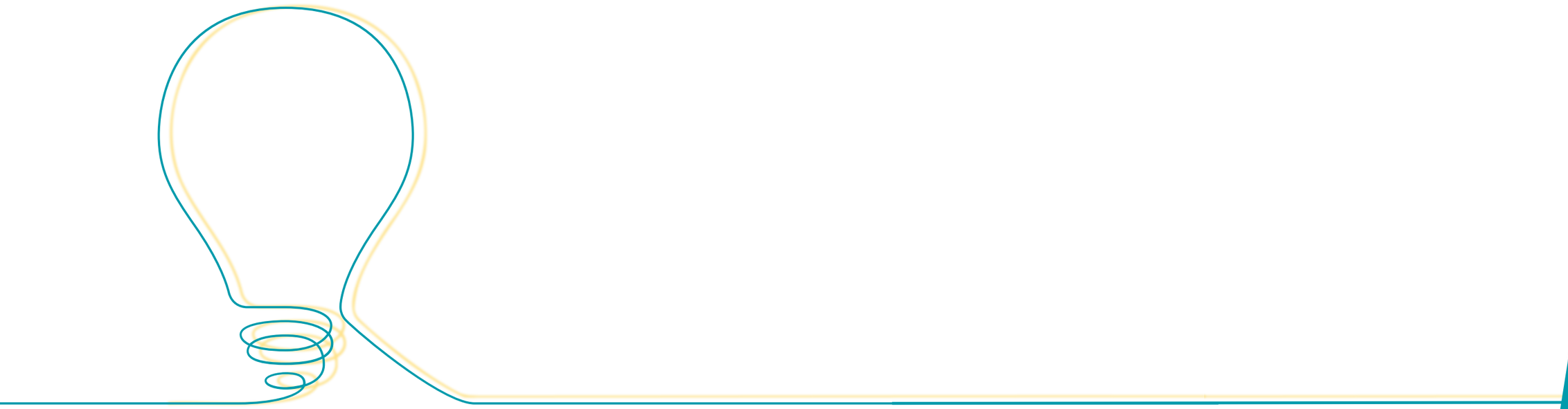
Covesion has developed the world's first ruggedized, frequency doubling module for 1560 to 780nm conversion, generating over 1W output power, to drive Rb-based quantum technologies and demonstrated operation of the module within a Rb-MOT for quantum applications. Waveguide packaging has been tested under 'harsh' environmental conditions, including temperature, shock, vibration and radiation. The test results show that Covesion has a route to offer a space-qualified waveguide, which has wider use in applications requiring remote, autonomous operation in harsh environments, like mobile earth-based sensing drone operation.

Enabling Quantum Technology emerge from the Laboratory to real applications



For the research, development and manufacture of PPLN technologies, facilitating highly efficient frequency conversion, providing access to wavelengths that are presently unavailable from commercial laser sources.

Business Start-Up Award



Business Start-Up Award

Metasonixx

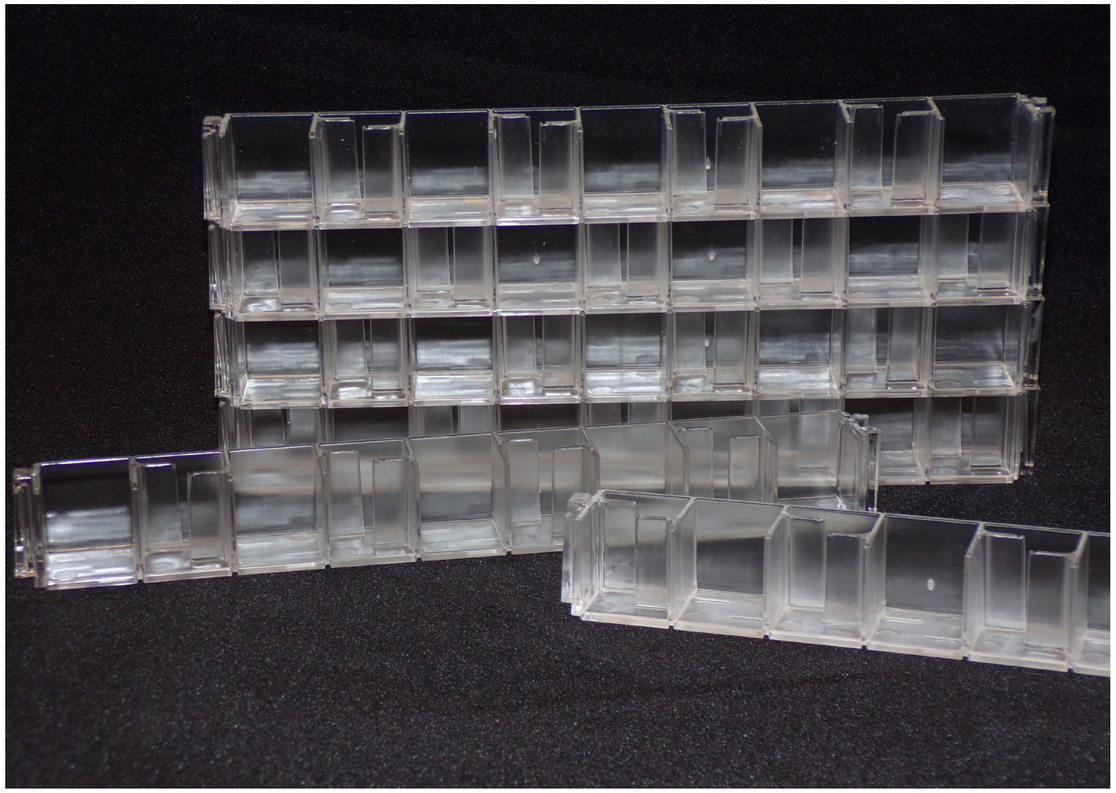
The Company

Metasonixx use acoustic metamaterials to transfer Nobel-winning technologies from optics to acoustics. They sell modular, super-light, eco-friendly and see-through noise-cancellation panels (interferometric filters) to improve productivity in noise-polluted open offices to give respite to patients in hospitals/ motorways, and allowing airflow to facilitate net zero targets without noise pollution.

Metasonixx is a spin-off from Sussex and Bristol universities, incorporated in 2019. They specialise in engineering advanced materials for sound and noise management. The company builds on its patented IP, proving that sound can be shaped using only a set of 16 pre-defined, sub-wavelength, quantized shapes, reassembled into different configurations. This discovery has allowed thems to bridge centuries of development gap between sound and light. Their mission against unwanted sounds started during the 2020 lockdown, when team Metasonixx received a UK Research and Innovation (UKRI) grant to find solutions to reduce noise in hospitals: a known problem, with no practical solution at the time, affecting the recovery of patients and staff wellbeing.

They were awarded the Armourers and Brasiers Venture Prize in 2021 for their successes in COVID wards.

At the end of the project in2021, Metasonixx had plans to mass-produce panels that weigh at least one third of traditional solutions (for the same performance), use one twelfth of the space, are greener, are modular and allow air and light through. From the physics point of view, these are interferential filters, but working over four doublings of frequency (i.e. ”octaves”). With manufacturing and first sales in 2023, their desk separators are now being tested in noisy offices worldwide. They see their products that allow airflow (SonoBlind Air and SonoFlow) as a crucial facilitator for net-zero industrial ventilators and heat pumps.



For the development of mass-produced acoustic metamaterial panels that allow airflow, enabling improvements to noise management and ventilation, and facilitating net zero industrial ventilators and heat pumps.

Business Start-Up Award

Silveray

The Company

Silveray, a University of Surrey spin-out, is revolutionising X-ray imaging by bringing “colour” to X-rays. Adding hyperspectral information to previously monotonic data is transforming industrial Non-Destructive Testing, with extensions in future medical imaging. This transformation results from a new fundamental understanding of the physics for nanoparticle scattering within semiconductor polymers.

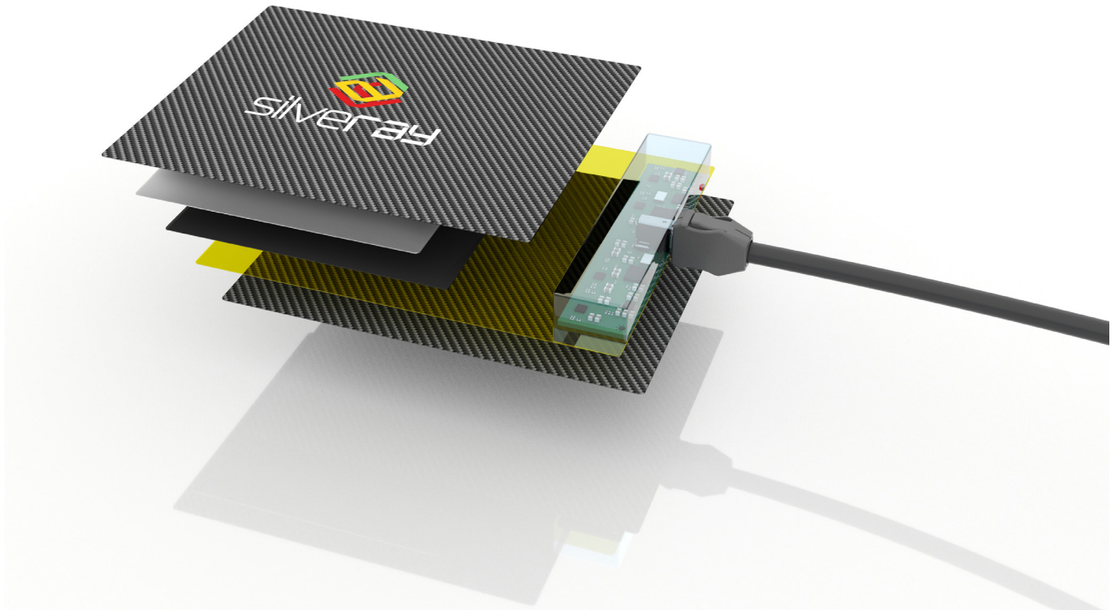
Silveray is revolutionising X-ray imaging across industrial markets, into healthcare, and beyond. Since 1895, X-rays have transformed modern medicine and industrial testing. However, one fundamental element has not changed: X-rays have been black and white. Inspired by the use of X-radiation in the analysis of star-forming galaxies by astronomers, pioneering research into X-ray absorption of nanoparticles at the University of Surrey laid the foundation for the novel X-ray detector technology being pioneered at Silveray. Based on that early work, they have discovered and patented an innovative X-ray sensor material – NPX. NPX is a semiconductor nanoparticle ink which is highly sensitive to X-rays. It can be coated on any surface to create curved or flexible X-ray detectors. It retains spectral information, paving the way for colour X-rays.

NPX is solution-processed at low cost, delivers clear X-ray images at low doses, and can be produced in large areas on flexible plastics

Silveray’s ambition is to bring colour X-ray imaging to hospitals worldwide and help doctors save more lives with dramatically enhanced diagnostic detail. It will allow X-ray imaging to be available in regional hospitals in the poorest of nations, providing affordable healthcare worldwide.

Silveray has started product development with industrial NDT, with lower regulatory requirements compared to medical. They are partnering with lead customers to replace radiographic film for the inspection of critical welds. Their solution dramatically improves productivity for disaster avoidance, keeping people safe. Silveray is the first to market with digital X-ray film, offering dramatic efficiency improvements for traditional radiographic film users.

With an X-ray detector market of $5 billion, their technology introduces a disruptive potential unparalleled in the industry.



For the development of the first generation of flexible colour X-ray cameras based on proprietary semiconductor materials, bringing new analytical capabilities in industrial markets, and transforming the future of medical diagnostics.

Business Start-Up Award

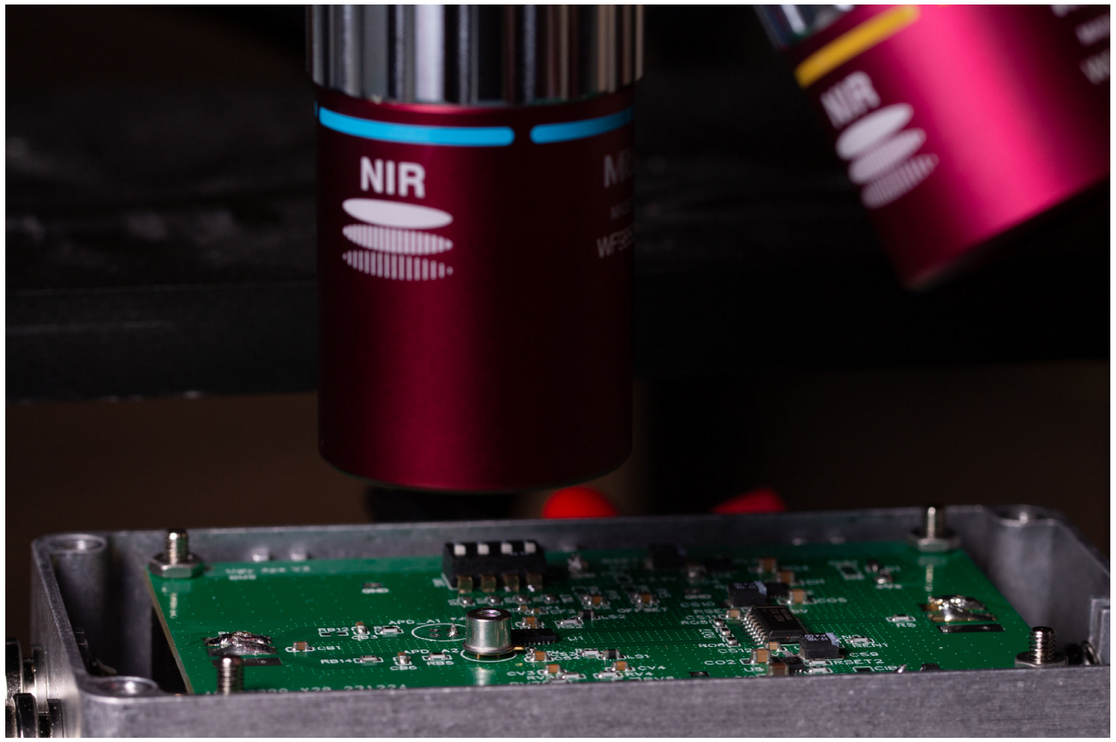
Phlux Technology

The Company

Phlux is a technology company that produces infrared detectors with 12X more sensitivity than alternatives. Our sensors are used in optical instruments and communications systems to enable up to 50% greater range, 12X higher imaging resolution and lower-cost systems.

Phlux has developed patented semiconductor technology for infrared light sensors with 12X higher sensitivity than existing state-of-the-art devices. This has a profound, positive impact on applications including light detection and ranging (LIDAR), laser range finders, optical fibre test instruments, optical communications networks, greenhouse gas detection and monitoring, and quantum communications.

In these and other applications, Phlux sensors increase the operating range of instruments and systems by up to 50%, enable systems to operate in a wider range of environments, and reduce systems costs and size by 40% and 30% respectively by enabling lower power, simpler infrared transmitters to be used. In LIDAR applications, which create visual maps of the environment, the sensors enable up to 12 times greater image resolution for a given transmitter power. In automotive LIDAR, Phlux sensors make vehicles much safer by enabling higher-resolution images to be created over longer distances, enabling safety systems to be more effective. In early 2024, the company started shipping its sensors in production quantities and has received substantial export business from North America. One of the great benefits of Phlux sensors is that they have been designed as drop-in replacements for existing devices, so customers can achieve instant performance improvements for their products simply by changing one component.



For the development of patented semiconductor technology for infrared light sensors with 12X higher sensitivity than existing state-of-the-art devices, delivering unprecedented levels of speed and sensitivity for 3D imaging.

Lee Lucas
Award

Lee Lucas Award

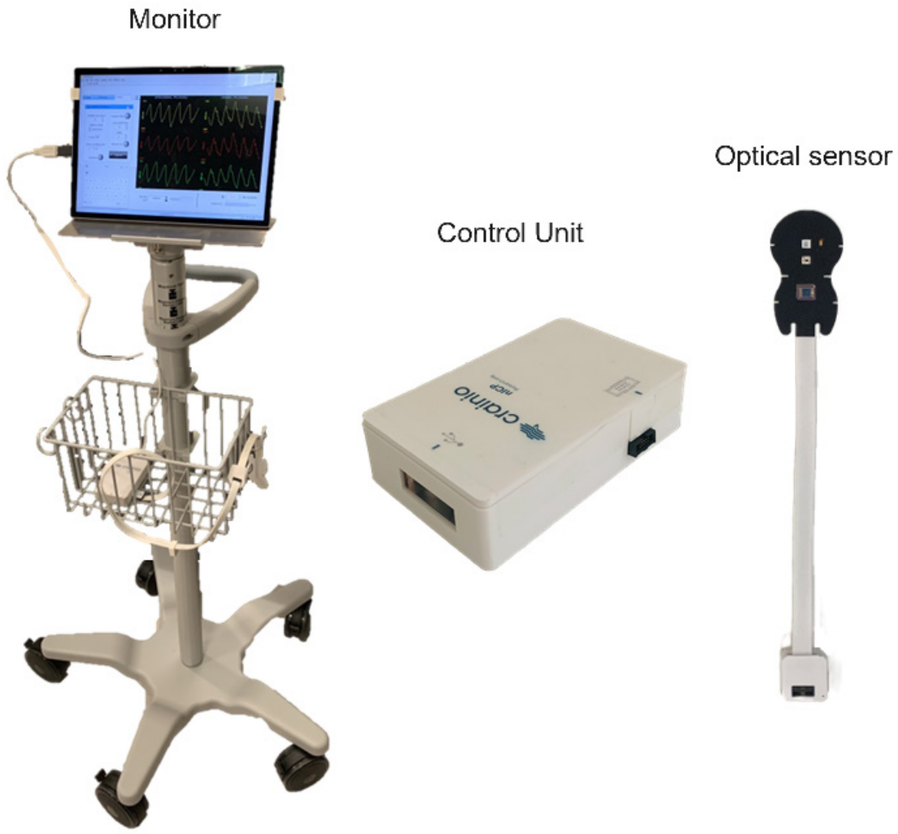
Crainio

The Company

Crainio is a spinout company from City, University of London. Their technology allows the simple, affordable, risk-free and non-invasive measurement of intracranial pressure, a vital indicator of brain health after a head injury.

Crainio is a medical technology (medtech) company spun out to commercialise research at City, University of London. Crainio enables the simple, affordable, risk-free and non-invasive measurement of intracranial pressure (ICP). ICP is a vital indicator of brain health after a head injury, the leading cause of death among adults under 40. Currently, the only way to directly measure ICP is for a neurosurgeon to drill a burr hole in the patient's skull and place an expensive probe in the brain. This highly invasive procedure is slow to access taking place outside the 'golden hours' immediately after an accident. It is expensive, requiring access to scarce neurosurgery resources, and carries risks of infection, bleeding, and other complications. Crainio's technology eliminates these risks, enabling direct measurement of ICP through a simple non-invasive probe applied to the forehead.

The technology, using infrared photoplethysmography (PPG) combined with machine learning, is based on years of research and development work conducted by Professor Panicos Kyriacou and his team at the Biomedical Engineering Research Centre at City, University of London. Good levels of accuracy have been demonstrated in clinical studies conducted at the Royal London Hospital. Crainio's initial market is as a triaging tool to be used in the neurotrauma ward but will be rapidly moving to markets earlier on in the care pathway to be nearer the scene of the accident. To this end, they will be providing their technology to accident and emergency units and first responders such as ambulances and air ambulances.



For the development of a novel technology that allows the simple, affordable, risk-free and non-invasive measurement of intracranial pressure, a vital indicator of brain health after a head injury.

Thirteen years of Business Award winners

Active Needle Technology
Advanced Hall Sensors
AegiQ
Aeristech
Airbus Defence and Space
Aqua Cooling Solutions
ArtioSense
Aurox
CanSense
Causeway Sensors
Cellular Highways
Cerca Magnetics
Ceryx Medical
Coherent Scotland
Covesion
Crainio
Creavo Medical Technologies
Digistain
Displaydata
Dyneval
Elekta
Endomag
FeTu
FFEI
Focal Point Positioning
Gas Sensing Solutions
Geoptic Infrastructure Investigations
Gooch & Housego
Hallmarq Veterinary Imaging
Hirst Magnetic Instruments
Horiba
ICEoxford
Ikon Science
Innovative Physics
Jaguar Land Rover
Keit Industrial Analytics
Kromek
Leonardo
Lightpoint Medical
Lynkeos
M Squared
Magnox
Matoha Instrumentation
MBDA
Metasonixx
Metrasens
MR Solutions
Naneum
Nebu~Flow
Novosound
Occuity
Opsydia
ORCA Computing
Ossila
Oxford HighQ
Oxford Ionics
Oxford NI
Oxford Space Systems
OxMet Technologies
PepsiCo
Phlux Technology
Photon Force
Plastipack
Porotech
Promethean Particles
pureLiFi
QLM Technology
Quantum Dice
Reaction Engines
Rolls-Royce
Siloton
Silixa
Silveray
Simpleware
Sonobex
Stream Bio
Teledyne e2v
Tesla Engineering
The Technology Partnership
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Tracerco
turboTEM
Ultra Electronics
Universal Quantum
VeriVin
York Instruments
Zephir
Zilico

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