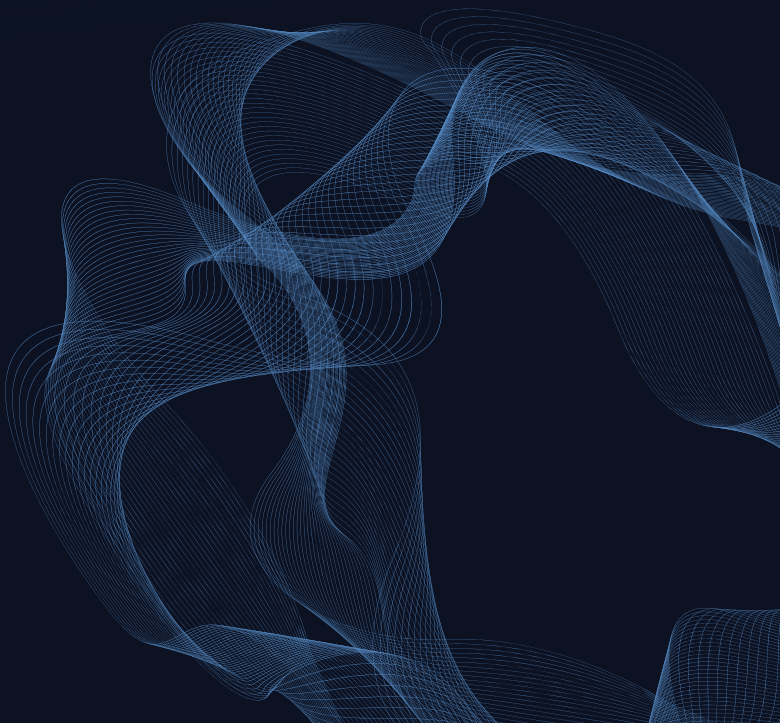
Glentanglement®

Scotland's Quantum Valley



Explore Scotland's Quantum Valley

Scotland is home to a world leading cluster in the development and application of quantum technologies – welcome to Glentanglement®!

Glentanglement® represents Scotland's collective strength in quantum technologies, leveraging our rich heritage in photonics and our capabilities in adjacent critical technologies including semiconductors, connectivity and sensing.

In future the cluster will take a central role in the development and advancement of quantum technologies, integrating these technologies into viable, efficient and commercially attractive products.

Glentanglement®

Internationally recognised research base with multiple academic centres of excellence.

Vibrant industry cluster, leveraging our strengths across the critical technologies.

Coordination and cluster management through Technology Scotland.

World leading capabilities in quantum component/device development and manufacture.

Strengths in key commercial markets for quantum technologies e.g. space & defence, life sciences, and financial services.

Network of supporting assets to accelerate innovation and drive collaboration between industry and academia.

About Technology Scotland

Technology Scotland is the industry representative body for Scotland's Critical Technologies sector.

We help to empower our members with opportunities for growth, collaboration, and influence. By connecting industrial and academic leaders, Technology Scotland supports our members to make cutting-edge advancements in their fields, bolstering Scotland's position as a leader in numerous competitive global markets.

We deliver substantial business value to our members through a variety of activities such as networking, advocacy, and thought leadership, supported by Scottish Enterprise and our Corporate Sponsor, Scintilla IP

Glentanglement® was created and registered by Fraunhofer UK Research Ltd. for use by the Scottish quantum community, and is managed by Technology Scotland under the Photonics Scotland network.

Photonics Scotland is the vibrant community for all photonics and photonics-enabled organisations in Scotland.

We are dedicated to boosting the profile of the Scottish photonics and quantum sector, empowering our members to accelerate innovation, and driving growth across the sector.

We represent an industry generating an output of £1.3bn and supporting more than 7,200 jobs. Our network facilitates collaboration between industry and academic institutions to drive innovation in areas like quantum communications and sensing.

Find out more about our work in quantum and read our vision for Scotland's quantum sector.

Alter Technology UK

Alter Technology UK are a microelectronic and photonic design, assembly, and test company with a specialism in packaging quantum devices. In addition to customisable TO, butterfly and TOSA-style packages for photodiodes, SPADs, VCSELs and laser diodes we provide a standard PIC packaging platform with an ADK, and produce frequency-stabilised lasers (Flame) with integrated Rb gas reference cell, 780nm external-cavity and our 780nm tapered amplifier. We have expertise in packaging challenges surrounding quantum applications such as non-magnetic materials, cryogenic temperatures, low loss coupling, mK temperature control and supply chain to accommodate prototype batches through to volume manufacturing.

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ALTER

Caledonian Photonics

Caledonian Photonics Limited is a micro-SME in the field of robust, miniaturised solid-state lasers. We have expertise in design for manufacture, reliability and environmental insensitivity, with experience of the academic, scientific and defence markets. Caledonian has taken part in 3 successfully completed Innovate Quantum Technologies projects, with a further project ongoing. These have involved developing size, weight, power and cost-reduced laser systems suitable for operating robustly outside of the laboratory environment. Highlights include a high-power low-noise diode-pumped Ti:Sapphire laser for atom trapping, and a miniaturised sub-ns pulsed UV laser for SPAD-assisted standoff Raman sensing of Hydrogen.

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CALEDONIAN PHOTONICS

CENSIS

CENSIS, established in 2013, is a research technology organization focused on developing and deploying advanced enabling technologies. It specializes in fast-tracking new products and services for global markets, helping companies adopt digitalization to enhance quality, efficiency, and performance. Supporting various end markets, CENSIS operates across the technology stack, from device to system level. Over the years, it has assisted hundreds of organizations in innovating by bridging the gap between technology concepts and practical applications. The team of 20 comprises experienced engineers and experts in business development and project management, dedicated to driving impactful innovation.

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Chromacity

Chromacity is a world leader in the design and development of advanced ultrafast pulsed fibre lasers. Based in Edinburgh, UK, the company specialises in fixed wavelength femtosecond and picosecond optical parametric oscillator (OPO) based tuneable laser systems.

The fixed wavelength fibre lasers work at 1040nm and 920nm, and the tuneable OPO lasers work across the near infra-red and mid infra-red wavelengths from 1.4um to 12um.

The lasers are used for materials analysis, biological imaging and a broad variety of quantum applications including characterising the performance of superconducting nanowire single-photon detectors, quantum imaging with mid-IR undetected photons, and infra-red photon entanglement.

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Coherent

Coherent Corp is a leading global provider of lasers and photonics technology, offering solutions that drive innovation across markets such as communications, electronics, life science and scientific instrumentation and industrial manufacturing. In the field of quantum technologies, Coherent Corp specializes in high-performance ultra narrow linewidth lasers for cold atom based research, ultrashort-pulsed lasers for entangled photon generation as well as optics, and photonic components critical for quantum computing, quantum sensing, and secure quantum communications.

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COHERENT

Craft Prospect

Craft Prospect is a space engineering practice based in Glasgow, Scotland, developing enabling technologies for small satellite missions. With an agile, experienced team, we deliver smarter and more secure technologies, making full use of the limited resources available in CubeSats.

The Quantum Technologies team develops cutting-edge hardware and software to leverage the principles of quantum mechanics. Currently focused on quantum key distribution (QKD), we provide cryptography solutions that offer forward secrecy to protect against advancing quantum computing capabilities. Our product portfolio includes BB84 QKD transmitters, polarisation-preserving beamsteering units and telescopes for CubeSats, and QKD receivers for Optical Ground Stations.

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CRAFT PROSPECT

CTA

The Critical Technologies Accelerator was funded specifically to support industrial activity in the high growth Semiconductor, Photonics and Quantum markets. This 2-year pilot programme was designed to explore how a shared resource of highly skilled engineers could accelerate the development of five nascent technologies identified by industry with risk profiles and technical challenges that typically lie beyond the scope of individual companies. Our Work packages include the exploration and development of Laser Technology for Quantum Communications, Laser Sources for Quantum Security Systems and Superconducting Quantum Circuits.

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Fraunhofer CAP

Fraunhofer Centre for Applied Photonics, provides professional, applied R&D services for industry in all areas of photonics in Quantum Technologies.

We successfully demonstrated quantum sensing, and quantum communications in real world settings: from measuring hydrogen gas remotely at Sellafield, proving QKD communications links across the rooftops of Glasgow, and flying cold atoms around Cornwall. We have also developed single photon and entangled photon sources, and a wide range of compact, precision laser systems for controlling atoms and ions.

Fraunhofer CAP has successfully worked with more companies, in more projects, in the UK's Industrial Strategy Challenge Fund than any other organisation.

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Helia Photonics

Helia Photonics has provided thin film coating and back-end semiconductor processing services for over 22 years at its Central Scotland site. With a wide range of PVD deposition technologies and coating materials we design, fabricate and characterise AR, mirror and filter coatings for laser facets and optics in a wide range of industries including aerospace, telecommunications, defence/security, automotive and instrumentation. Support services include automated visual inspection and handling systems, polishing/sawing and electro-optic test.

Quantum Technology development includes the fabrication of short-wavelength gallium nitride (GaN) laser sources for atomic clock applications and ultra-high efficiency mirrors for low cost/high performance quantum cavities.

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HELIA PHOTONICS

III-VEpi

III-V Epi, the compound semiconductor wafer foundry, manufactures MBE and MOCVD, epitaxial structures. III-V Epi produces low to medium volumes with a fast turnaround; ideal for quantum applications and customers seeking to expedite manufacture and bring new compound semiconductor products to market, as quickly as possible.

III-V Epi already produces quantum devices for many industrial and academic customers and is a well-established supplier in the commercial, quantum technologies supply chain. Our customers also benefit from our specialist, wafer design, product development and process optimisation capabilities, along with a complete range of test, metrology and characterisation services.

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III-V Epi

Institute of Photonics

The Institute of Photonics (IoP) focuses on applications-driven photonics research with significant UK and international impact. With over 70 staff and students, the IoP pioneers advancements in areas such as Advanced Lasers, Photonic Materials, Neuro-photonics, and Optical Wireless Communications. Its innovations serve various fields, including Quantum Technology, Sensing, Neural Processing, and AI. The IoP also fosters industrial impact through spinout companies, collaborative R&D projects, and intel-lectual property licensing. It played a key role in establishing the Fraunhofer Centre for Applied Photonics and developed a Scottish Enterprise-funded foundry for compound semiconductors, leading to the creation of CST Global Ltd and other ventures.

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IQN Hub

The Integrated Quantum Networks (IQN) Hub is an EPSRC Quantum Technology Hub led by Heriot-Watt University, and includes a host of collaborating Universities and institutions. The central vision of the IQN Hub is to establish quantum networks at all distance scales, from local networking of quantum processors to national scale entanglement networks for quantum-safe communication, distributed computing and sensing, all the way to intercontinental networking via low-earth orbit satellites.

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Kelvin Nanotechnology

KNT are a supplier of miniaturised quantum devices and components to support quantum systems for sensors, computing, chip scale cold atoms, and high precision timing and navigation. KNT was one of the first miniaturised quantum component suppliers in the market; as the manufacturer of the successfully demonstrated MOT gratings for the original high-profile paper in Nature Nanotechnology, we now sell the MOT gratings as a product to a global customer base. In addition to our device portfolio, we provide a superconducting cryogenic measurement service with our partners at the University of Glasgow.

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KELVIN NANOTECHNOLOGY

Leonardo

Leonardo is the largest manufacturer of airborne radars, electro-optic sensors, laser designators and rangefinders, high resolution thermal imaging, electronic warfare and multi-domain communications in the UK and Europe. We pioneer advanced technology development across broad defence requirements where quantum technology underpins the highest operational performance. We have long-established expertise in single photon lidar that underpins integrated secure optical communications with QKD, atomic clock development for synchronisation of sensor/comms networks, Rydberg atom development for advanced waveform generation and SWIR detectors for 3D lidar. We are now developing quantum information processing algorithms for advanced command and control of cognitive intelligent sensor networks.

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LEONARDO

M Squared Lasers

M Squared Lasers M Squared is a leading developer of photonic and quantum technologies, developing advanced laser systems for quantum sensors, timing, and computing. They have pioneered technologies like the UK's first commercial quantum gravimeter and accelerometer. Their work includes creating precision quantum clocks and quantum computers based on neutral atoms and ions. M Squared integrates its innovative laser technology into various applications, enhancing research capabilities in quantum mechanics and supporting developments in satellite-free navigation and high-accuracy measurements.

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NPL

The National Physical Laboratory's world-leading expertise and cutting-edge facilities are critical to ensuring end-users, system integrators and investors can have confidence in new products and services based on quantum technologies. Through our work we can support development and validate progress in new product development, as well as helping companies focus on the most productive avenues for R&D. This has real world impact, helping companies secure funding, move quickly through Technology Readiness Levels, protect IP, and reach markets earlier.

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Photon Force

Photon Force specializes in designing and manufacturing single-photon sensitive cameras, modules, and sensors for various applications, focusing on time-resolved single-photon imaging. With support from Innovate UK, the company is involved in several quantum technology projects, including the development of novel time-resolved SWIR detectors (QuEOD), next-generation quantum-enhanced detectors (QT Assemble), and quantum gas sensors for the hydrogen economy (HYDRI). Additionally, they are working on quantum-safe encryption for satellite communications (TQEC) and an underwater imaging system to create high-resolution 3D maps of the seafloor.

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PHOTON FORCE

PQA

In 2024, the Photonics and Quantum Accelerator (PQA) was established to unite research capabilities from the Universities of Strathclyde, Glasgow, Heriot-Watt, and St Andrews, along with local authorities and industry bodies, to enhance Scotland's photonics sector. The PQA aims to leverage academic excellence in photonics and quantum technologies for economic and societal benefits in the Central Belt. Plans include supporting entrepreneurship and company creation, expanding the skills base in photonics technologies, and increasing public awareness of the photonics sector, particularly highlighting the leading role of Scottish photonics industries in driving growth and attracting investment to the region.

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PHOTONICS & Quantum Accelerator

QCA

Quantum Computing Applications (QCA) Cluster is an academic partnership between the Universities of Glasgow, Strathclyde, Edinburgh, and EPCC; combining strengths in quantum hardware, software, algorithms, and applications, with classical high-performance computing expertise and access to Archer2, the national supercomputer.

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QUANTUM COMPUTING APPLICATION CLUSTER

QEPNT

The UK Hub for Quantum Enabled Position, Navigation & Timing (QEPNT) has the vision to deliver the technology and build a UK community for atomic clocks, quantum inertial sensors, magnetometers, lidar & quantum-classical hybrid sensors that can be developed into practical systems for future resilient position, navigation & timing applications.

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UK HUB FOR QUANTUM ENABLED POSITION, NAVIGATION & TIMING

QuantIC

QuantIC is the UK Quantum Technology Hub in Quantum Enhanced Imaging. We bring together industry and academia in a collaborative project to revolutionise imaging across industrial, scientific and consumer markets.

Established in 2014, we are one of four Hubs that are part of the Government's £1b National Quantum Technology Programme set up to exploit the potential of quantum science and develop a range of emerging technologies.

QuantIC's investigating team and their groups represent over 120 full-time researchers in quantum technology across eight partner institutions.

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QUANTIC
The UK Quantum Technology Hub in Quantum Enhanced Imaging

Quantum Software Lab

The Quantum Software Lab (QSL) is hosted at the School of Informatics at the University of Edinburgh, ranked 1st for research power in Computer Science in REF2021. QSL, in collaboration with the National Quantum Computing Center, identifies, develops and validates real-world use cases for quantum computing. QSL's 50+ researchers partner with industry professionals and NQCC's applications engineers to transform existing computational challenges into research problems that can be tackled using quantum technology.

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Quantum Software Lab

QURECA

QURECA is a pioneering company dedicated to advancing the quantum industry through innovative workforce development, training, and consulting solutions. Founded to bridge the gap between quantum technology and real-world applications, QURECA supports individuals, businesses, and governments in understanding and harnessing the potential of quantum technologies. By offering specialised courses, recruitment services, and strategic business consulting, QURECA enables organisations to stay ahead in the rapidly evolving quantum landscape. Committed to empowering a global quantum workforce, QURECA plays a vital role in helping industries prepare for a quantum-powered future and leverage new technological and economic growth opportunities.

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QURECA
WE SPEAK QUANTUM

Singular Photonics

Singular Photonics is a fabless image sensor company spun out of the University of Edinburgh CMOS and Sensors Systems Group. We have a portfolio of sensors based on single photon avalanche diodes detectors (SPADs) technology. These sensors can detect and time single photons (light quanta) enabling simultaneous capture of depth and temporal dimensions generating next generation 4D images. They have seen their transformation from a research curiosity to a mainstream semiconductor technology with billions of SPAD devices in consumer use in mobile phones for depth sensing, autofocus-assist and more recently into LiDAR. In the near future, next generation SPAD-based detectors can be expected to play a major societal role, from wearable health, microplastic detection to hydrogen sensing and even adding further dimensions to the phone camera in your pocket.

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Singular Photonics

Skylark

Skylark Lasers is a Scottish laser manufacturer, that specialises in the development of continuous wave single-frequency compact diode-pumped solid-state (C-DPSS) lasers. Skylark Lasers has a strong quantum focus and produces both a modular laser system tied to atomic resonances which are absolutely referenced, and an innovative multi-channel quantum photonic subsystem called the NEST-Q. Skylark Lasers works collaboratively with customers and research partners to understand their needs and tailor our lasers to their application - helping them reveal the unseen, detect the imperceptible, and measure the unknown.

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Skylark Lasers

Sivers Photonics

Sivers Photonics, a subsidiary of Sivers Semiconductors (NASDAQ:SIVE), are recognised as a world-class supplier of bespoke lasers for advanced applications and next generation products in the Communications, Sensing, and Quantum sectors. For over twenty years Sivers have been designing and manufacturing custom photonic chips for a variety of ground-breaking projects in the quantum space, collaborating with academia, industry, and government organisations to enable critical real-world applications.

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sivers PHOTONICS

SRPe

The Scottish Research Partnership in Engineering (SRPe) is the pan-Scotland strategic partnership of 10 universities working in collaboration with industry and government, to future-proof Scotland's position as a world-class centre of research excellence and a globally competitive driving force in engineering. SRPe focuses on collaboration which aligns innovative academic research with industry/public sector challenges and opportunities, providing the depth and breadth of specialist and cross-disciplinary expertise to tackle complex technological and societal challenges. SRPe Partnership Universities are involved in all 5 of the UK Quantum Hubs, either as lead organisation or as a partner, as well as other collaborations and individual quantum research.

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SRPe
Scottish Research Partnership in Engineering

TopGaN Quantum Technologies

TopGaN Quantum Technologies (TGQT) is an R&D design house based in Edinburgh focused on developing UV & visible GaN laser diode technology for quantum technologies, including quantum timing, quantum sensing, quantum communications & quantum computing, and also next generation telecommunication systems.

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TGQT

University of St Andrews

The University of St Andrews leads quantum technology research in areas including quantum sensing, information and materials, manipulating quantum states for technological advances in secure communication, precision measurements and biological sensing. The Centre for Designer Quantum Materials develops quantum-enhanced 2D-materials and topological insulators. Theory research includes methods to simulate quantum devices, accounting for realistic environmental interactions. Recent highlights include realisations of superabsorption and quantum batteries, deterministic photon sources, and proposals for quantum associative memory. Strong collaborations with industry, and international partners including the Max Planck Institute, are integral to advancing our fundamental understanding of quantum phenomena for future quantum technologies.

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University of St Andrews

University of Strathclyde

The University of Strathclyde undertakes internationally leading research across the quantum technologies sector, demonstrating broad impact and outputs. With a strategic technology focus underpinning an institutional cluster of activity, the university has participated extensively across all three phases of the UK's quantum hub programme and demonstrated strong industrial and user engagement across the sector.

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University of Strathclyde Glasgow

Vector Photonics

Vector Photonics produces PCSEL-based, III-V semiconductor lasers – the most significant innovation in laser design and manufacture for 30 years. PCSELs (Photonic Crystal Surface-Emitting Lasers) are low cost, robust, have a broad wavelength range and high power. This unique combination of key characteristics makes them ideally suited to many different, quantum applications.

PCSELs are produced using established supply chains and, by emitting light from their top surface, are simple to package and incorporate into PCBs and electronic assemblies.

Vector Photonics is a spin-out from the University of Glasgow, set up to commercialise PCSELs, with over £9.8m of equity and government funding.

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VECTOR® PHOTONICS

Wideblue

Wideblue is a full-service product design and development company based in Glasgow, UK. We operate across various industries, specializing in innovative medical, optical, and quantum products to bridge the gap between scientific innovation and real-world applications. Our strong focus on translating novel technologies into commercially viable products has gained us international recognition. We have a dynamic and diverse team of skilled product designers, mechanical engineers, electronics engineers, software engineers, and physicists, all with extensive experience. Our passion and creativity enable us to engineer complex, innovative solutions, particularly in quantum technology, where we deliver compact beam combiners and optical ground station sub-assemblies for QKD.

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wideblue
making technology happen
A PIVOT INTERNATIONAL COMPANY

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Read our vision for Scotland's quantum sector

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