

Your partner for quantum tech innovation



Embrace the Quantum Era

We stand on the verge of a technological revolution. The advent of quantum technology will change the way we work, communicate, interact and more. Ready to take your quantum ambitions to the next level? TNO can support you and co-develop solutions.

A name you can trust

Since 1932, TNO has been the independent link between academic investigation and real-world application. Our work focuses exclusively on developing the technologies, systems and applications that demonstrate a direct benefit to company competitiveness and to society as a whole.

Our unique position as a Research and Technology Organisation (RTO) enables us to work at the cutting edge of the most revolutionary technologies, while remaining focused on their practical application and direct value-add for citizens and communities.

The digital society

As part of our strategic efforts to contribute to the digital society, we began exploring the potential of quantum technology as early as 2014. From the beginning of our investigation, the vast potential of the technology became abundantly clear.

By 2018, our knowledge and experience had grown, and we began co-developing the earliest technologies. Quantum Technology became its own TNO department. With 50 colleagues working full-time on the technology, we began – and continue – to make significant strides. In 2022, the Applied Cryptography and Quantum Applications team was formed. There, 40 experts work on quantum algorithms and post-quantum cryptography.

Today, TNO is considered a leading player in quantum tech, and is part of both national and international consortia, working groups, networking and validation collaborations and more. For example, we contributed to the development of the National Agenda Quantum Technology, and are taking the lead in Qu-Test, an international collaboration made possible by the EC's Quantum Flagship initiative. Our renowned facilities are part of Europe's most advanced and effective testing and validation sites in all of Europe.

Co-founder of QuTech

As part of our leading role in this emerging technology, we are the proud co-founders of QuTech, now a world-renowned centre of excellence for the development of quantum technologies and for collaboration amongst international partners with complementary goals. Together with our co-founder, the Delft University of Technology, we offer partners around the globe the opportunity to work on prototype quantum computers and quantum internet solutions, in order to drive the entire industry towards higher levels of maturity.

Harnessing quantum computing power

Developing and fully exploiting the power of quantum computing requires many fields of expertise and dedicated, trained personnel. You need a partner with the experience, network and know-how to ensure that your efforts lead to optimal results and new insights. TNO is that partner.

Quantum Application Lab

The Quantum Application Lab (QAL) is one of the few places in the world where quantum hardware, software and application development combine seamlessly. Business leadership, R&D departments and heads of technology come to QAL to explore the benefits of quantum computing. Whether for de-risked investment decisions, pre-competitive R&D collaborations or fit-for-purpose technology and application development.

At QAL, quantum computing specialists co-develop with end-users. QAL provides a realistic view of the capabilities and limitations of quantum computing technologies for optimisation, simulation, machine learning and more.

This open innovation ecosystem bridges the gap between academic research and practical application for industries ranging from healthcare to logistics, from manufacturing to aviation, from finance to telecommunications and beyond. TNO developed QAL with the University of Amsterdam, CWI, SURF, Delft University of Technology, and Netherlands eScience Center.

Contact

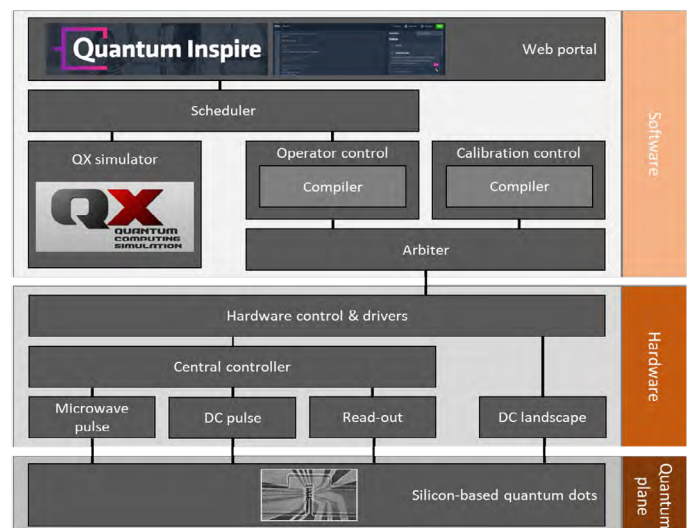
✉ mark.buningh@tno.nl

Quantum computing

Quantum computing will revolutionise communication, simulation, AI applications, materials science and much more. TNO is active in answering the key questions that will harness the incredible power that quantum computing may offer. From optimising the quality, parallelisation and integration of qubits, to developing quantum algorithms for anomaly detection and route optimisation, we are eager to both share and develop our knowledge in how to bring quantum computing to its full maturity.

Through key partnerships and collaborative relationships like QuTech, Quantum Inspire and QLSI (Quantum Large-Scale Integration with Silicon), TNO partners with leading institutions to co-develop solutions and explore the possibilities of this emerging technology.

By sharing our knowledge, our experience and our facilities and working within our extensive network, we contribute every day to the understanding – and application – of this remarkable technology. From support in the nanomanufacturing of Si/Ge Spin Qubits to access to the experts and equipment at our Quantum Information Technology Test (QITT) facility. We are also active in hardware development initiatives and the testing and characterisation of QPUs. TNO offers all of our experience and facilities for the advancement of the technology and the benefit of society and industry.



Quantum Inspire's full stack cloud quantum computing system (system architecture).

Contact

✉ wilbert.staring@tno.nl

Applying Quantum Tech

TNO is also active in a variety of other crucial developments for quantum technology – both to ensure security in the new quantum era and to revolutionise industries. We are ready to offer our experience, know-how, facilities and network to enable everyone to take part in the quantum world.

Quantum communication

A mature, secure and accessible quantum computing network requires the technology that makes quantum internet connectivity possible. TNO is actively working on a variety of aspects of the quantum internet future, from developing the nodes and other hardware and software components ourselves to testing and validating other organisations' components. In the shorter term, quantum technology can be used to execute Quantum Key Distribution (QKD) protocols and quantum entangled communication.

In our QKD Validation Test Lab, industry players can validate optical subsystems for free space QKD and demonstrate end-to-end QKD optical communications. In addition, we offer our knowledge, experience and equipment to partners who want to co-develop systems and gain hands-on experience in the QKD domain. We are currently engaged in a number of projects that will, amongst other things, enable both fibre and free space links for the secure exchange of data, as well as demonstrate the feasibility of entanglement-based QKD from a satellite in geostationary orbit.

Industry contact

✉ theo.lodewijkx@tno.nl

Space contact

✉ charlotte.postma@tno.nl

Quantum Safe

Quantum computers will render most current cryptographic security systems obsolete. In order to protect data and keep digital communication secure, the industry must develop implementations and strategies that will mitigate those risks.

At TNO, a unique, multidisciplinary team of mathematicians and computer scientists are creating the migration strategies and tooling for the current digital infrastructure that can – and must – accompany our quantum future. The Applied Cryptography and Quantum Algorithms (ACQuA) team is dedicated to exploring and developing safe networks and Post-Quantum Cryptography, among other developments.

TNO is uniquely positioned to offer you independent exploration of the latest developments in applied cryptography and quantum algorithms, from initial exploration to hands-on application. In this way, ACQuA is directly contributing to the quantum-safe future today.

Contact

✉ danielle.keus@tno.nl

Quantum sensing

TNO is working actively with university and industry partners to explore the potential of quantum technology to develop the most sensitive and accurate sensors imaginable. At our Quantum Sensing Lab, partners and organisations can explore the potential of sensors based on the NV centres in diamond. Applications have already been identified for NV-based sensors for the semiconductor and connected transport industries. But we envision a much broader scope and scale for their use in measuring magnetic fields, electrical currents, temperature, positioning or pressure.

The Quantum Sensing Lab gives our partners access to the unique and specific knowledge, experience, equipment and facilities needed to make significant progress in quantum sensor development. Instruments are available to test sensor components, complete sensors, or specific sensor applications for accuracy, reliability and efficacy.

Industry contact

✉ gabriele.bulgarini@tno.nl

Defence contact

✉ johan.bogerd@tno.nl

TNO: your partner in co-development of the quantum future

Whether you are merely curious about how quantum technologies can impact your business, or are actively developing components, instruments or applications for quantum technology, TNO is the partner you need to take your ambitions to the next level. Contact us today to find out how.



Quantum Information Technology Test facility (QITT) at TNO

Your innovation partner

TNO is eager to contribute to the development of quantum technology in as many ways as possible. From our participation in a variety of quantum technology consortia, to our pre-competitive, explorative public/private partnerships to targeted contract research to testing and validation, we are truly a one-stop shop for all your quantum tech questions.

Contact us today to find out more about how we can put our knowledge, experience and facilities to work to solve your quantum technology challenges and ensure that the software, hardware, systems and services you are designing can reach their full potential.

White paper - Synergy between quantum computing and semiconductor technology:

General Quantum Tech Questions

Wilbert Staring

✉ wilbert.staring@tno.nl

☎ +31 888 66 3330

TNO innovation
for life