planqc

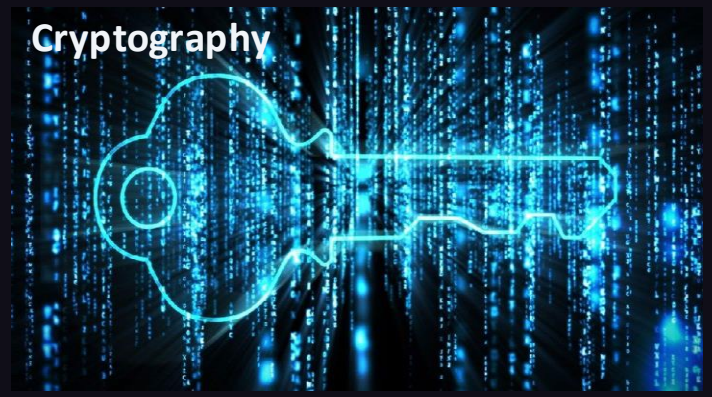
Quantum Computing with Neutral Atoms

Bridging Algorithms and Real-World Applications

Company Presentation

Introduction planqc

Why Quantum Computing? Quantum computers will solve billion-dollar industry problems!



in 10 years

$25 - $50 billion

in 5 years

$2 - $5 billion

Estimated operating income
(cost savings and revenue opportunities)

* Source: BCG Report on Quantum Computing Value Creation

planqc

Our QPU
2040 Tweezers

Lowest cost per qubit

Less than 10 kW energy

Room-temperature operations

Data center compatible

atoms stored in a crystal of light

Our founding team combines decades of research experience on neutral-atom quantum technologies at world-leading institutions

Dr. Alexander Glätzle

Chief Executive Officer

2018-2022: (Senior) Consultant
d-fine GmbH

2016-2018: Senior Researcher
CQT, Singapore

2014-2016: Senior Researcher
Oxford University

Dr. Sebastian Blatt

Chief Technology Officer

2015-today: Group leader
MPI of Quantum Optics

2011-2015: Senior Researcher
Harvard University

2004-2011: Researcher
JILA & University of Colorado

Dr. Johannes Zeiher

Principal Scientist

2020-today: Group leader
MPI of Quantum Optics

2018-2020: Senior Researcher
University of California at Berkeley

2012-2018: Researcher
Ludwig-Maximilians-University

… with strong business expertise, partners and seed & series A investment

Markus Wagner
Founding Investor

Ann-Kristin Achleitner
Founding Investor,
Vice-Chairwoman of the Board

Hermann Hauser
Board Member

Series A (2024 | 50 million euro)

Bayern Kapital
Venture Capital für Bayern

CATRON Holding

DeepTech & Climate Fonds

MAX PLANCK Förderstiftung

Also supported by **UnternehmerTUM**, **TUM Venture Labs**, **Max-Planck-Innovation** and **LMU Research & Technology Transfer**

Seed Round (2022 | 5.6 million euro)

Max-Planck-Innovation

LMU Ludwig-Maximilians-Universität München

UnternehmerTUM

TUM Venture Labs

UVC Partners

Si

APEX Ventures

Amadeus Capital Partners

planqc

planqc builds on world-leading research at the Max-Planck-Institute of Quantum Optics & is the first spin-off from the Munich Quantum Valley

Nobel Prize 2005 & 2023

MAX-PLANCK-INSTITUT FÜR QUANTENOPTIK

The MQV aims to develop and operate competitive quantum computers, bridge academia and industry, facilitate knowledge transfer, provide educational programs, and support a startup ecosystem.

Munich Quantum Valley

70
principal investigators

270
scientists

€600M
total ecosystem funding

planqc was founded 2022 by leading scientists and 100% European investors to commercialize quantum technology “Made in Germany”

2022
founded

100+
employees

€87M
orders & investments

Awards

WINNER 2022
CREATIVE DESTRUCTION LAB

GERMAN STARTUP AWARDS
WINNER 2023

Nominated for
DEUTSCHER ZUKUNFTSPREIS

DEUTSCHER GRÜNDER PREIS
FINALIST 2025

EY Entrepreneur Of The Year

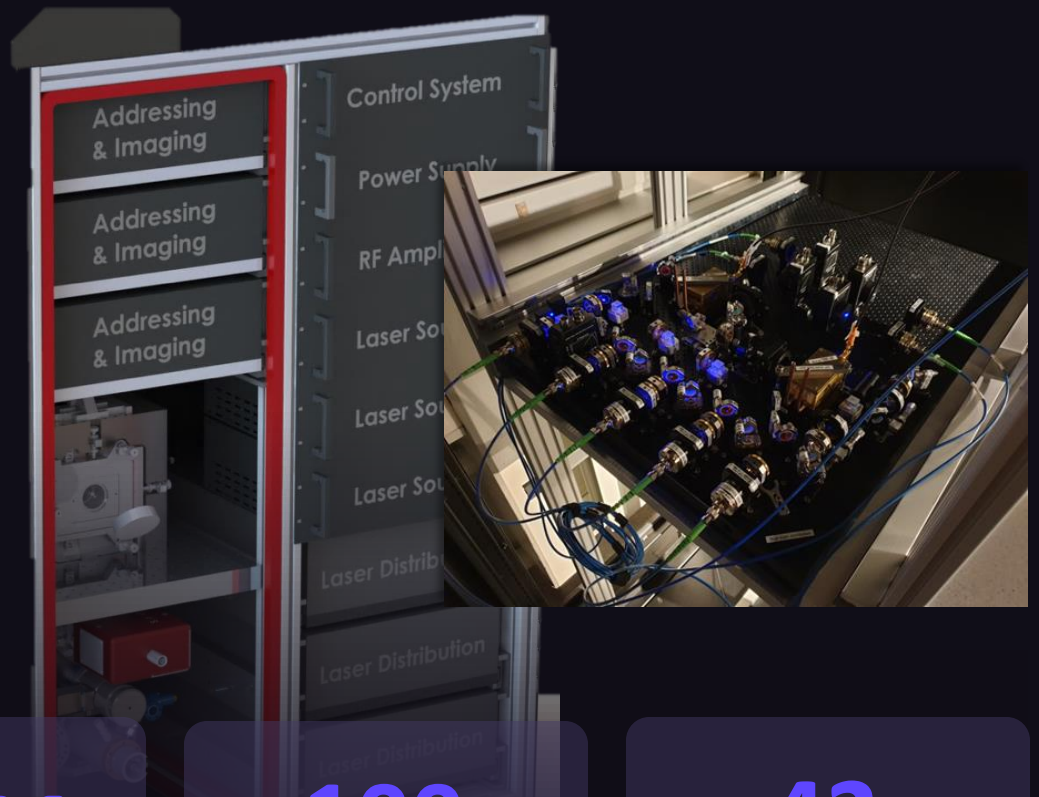
Technology Pioneer 2024
WORLD ECONOMIC FORUM

Capital / TOP 40 UNTER 40

As a full-stack quantum company, we provide quantum computers, QCaaS, and algorithmic engineering consulting for large-scale projects

	Offering	Clients	Live Projects	Partnerts
1	**QCaaS** **Access to compute time** on our managed quantum computer infrastructure	• Industry • Finance • Public sector • Academic research institutes	Go-live in 2026	**Potential distribution partners** aws, Google Cloud, STACKIT, Azure, T Systems
2	**Quantum Computer** Customized neutral atom quantum computer	• HPC Centers • Government agencies	**2 projects, DiNAQC** Europe's first digital Neutral Atom QC **and MAQCS** HPC integrated, 1.000 qubits	DLR Deutsches Zentrum für Luft- und Raumfahrt, QCi, Bundesministerium für Bildung und Forschung, lrz Leibniz-Rechenzentrum der Bayerischen Akademie der Wissenschaften
3	**Algorithms** Algorithm design and consulting	• Industry • Finance • Public sector • Academic research institutes	**15+ projects in** battery simulation, computational fluid dynamics, material simulation, image recognition, quantum error correction	esa, engys, DB, AIRBUS DEFENCE & SPACE, JÜLICH FORSCHUNGSZENTRUM, d-fine, ÖBB, MT AEROSPACE

In 04/2023 planqc wins 30 Million EUR contract to build Europe's first digital quantum computer based on neutral atoms for the DLR



DiNAQC Europe's first digital neutral atom Quantum Computer for the German Aerospace Center

- 100 programmable Qubits
- 2 Logical Qubits (error corrected)
- Testbed for real-world algorithms
- Built on-site at German Aerospace Center in Ulm
- Duration: 09/2023 – 02/2027

€30M
signed contract

100
qubits

42
months project

Cooperation with

DLR QCi MenloSystems

In 11/2023 planqc wins 20 Million EUR project from the German Government to install a 1000 Qubit Quantum Computer at the LRZ

MAQCS is Europe's first HPC integrated digital neutral atom QC

- Multi-Core Architecture
- 10 x 100 programmable qubits
- HPC Integration
- Testbed for real-world algorithms
- Duration: 12/2023 – 12/2027

€20M
signed contract

1000
qubits

48
months project

Cooperation with

Bundesministerium für Bildung und Forschung

MAX-PLANCK-INSTITUT FÜR QUANTENOPTIK

lrz Leibniz-Rechenzentrum der Bayerischen Akademie der Wissenschaften

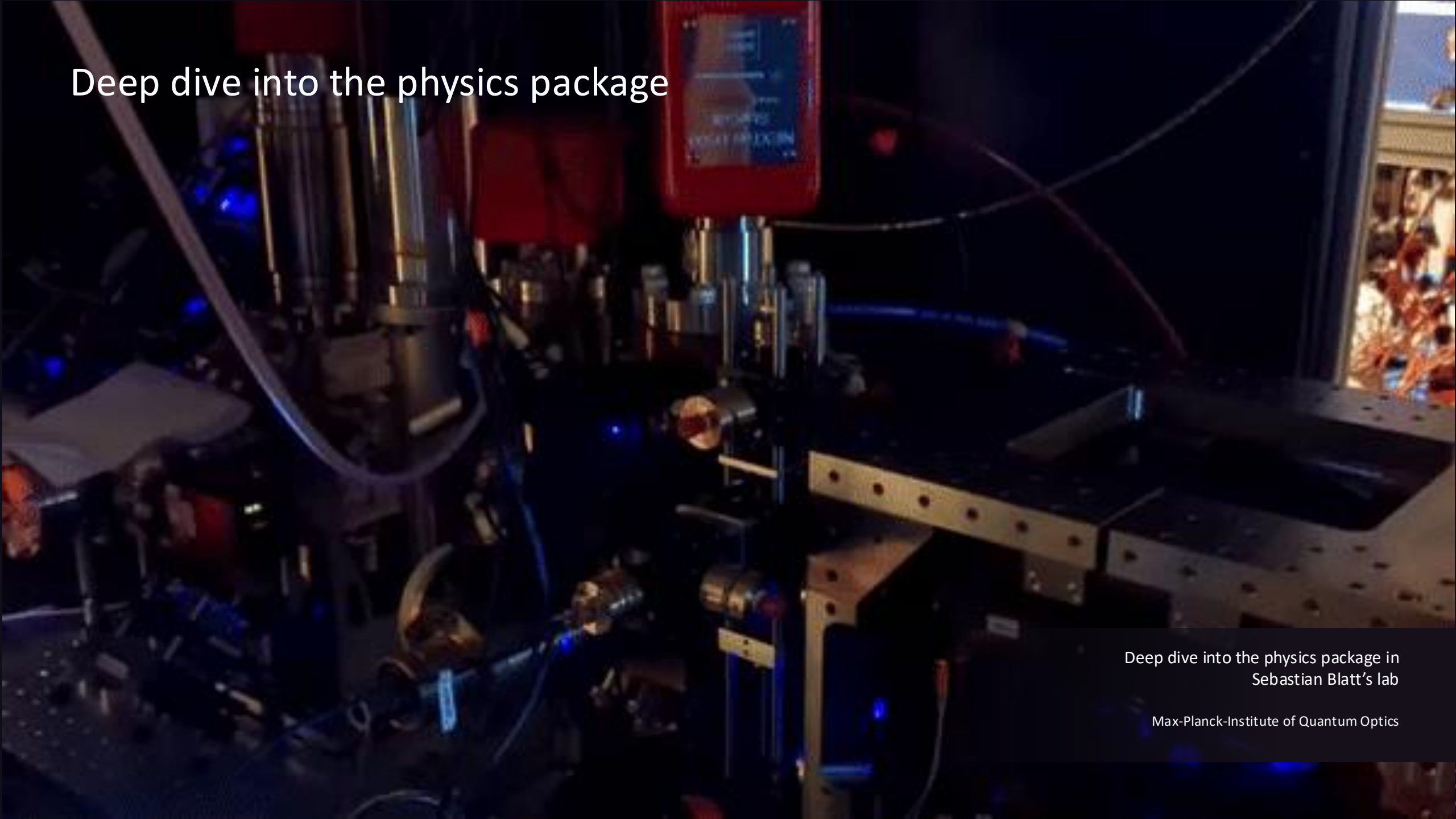
planqc

Company Presentation

Quantum Hardware Technology

What does a planqc quantum computer look like?

Deep dive into the physics package

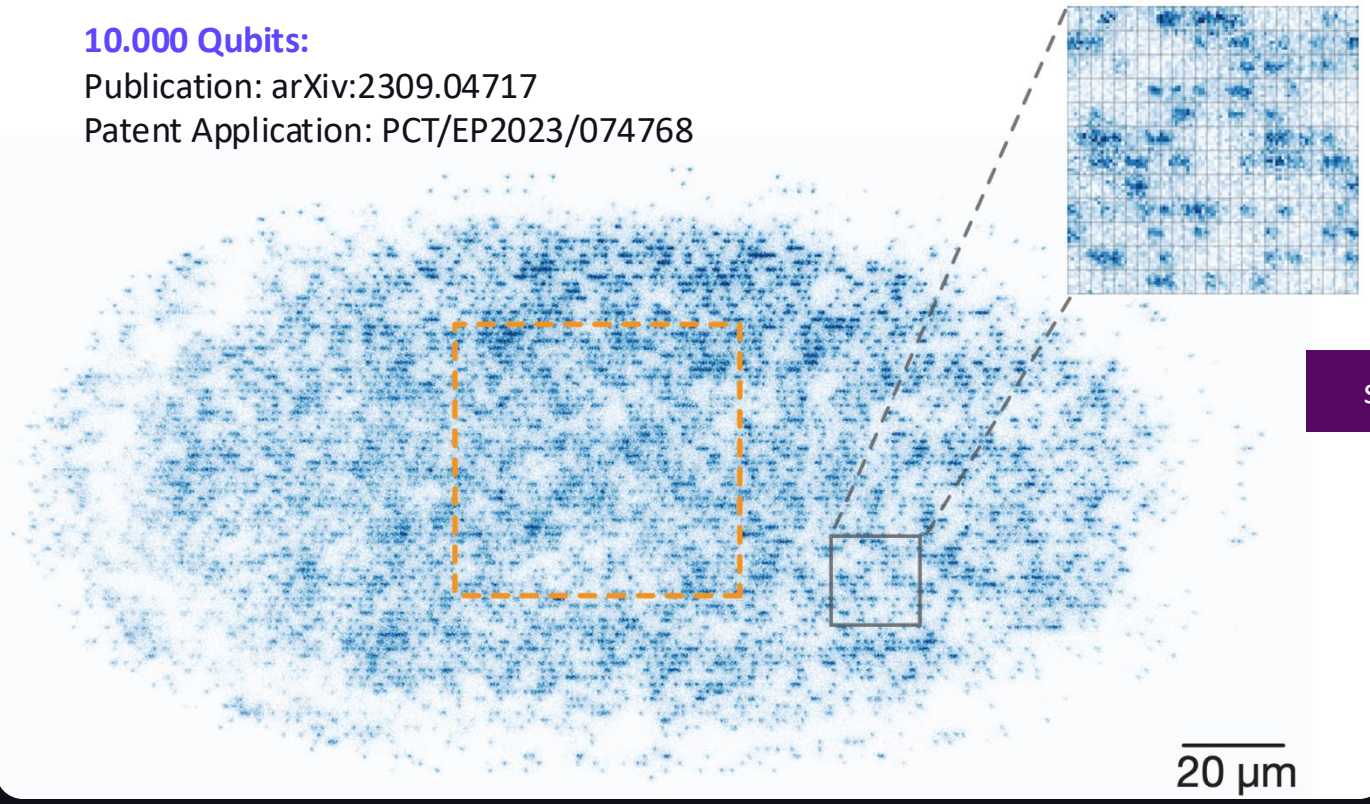


Deep dive into the physics package in Sebastian Blatt's lab

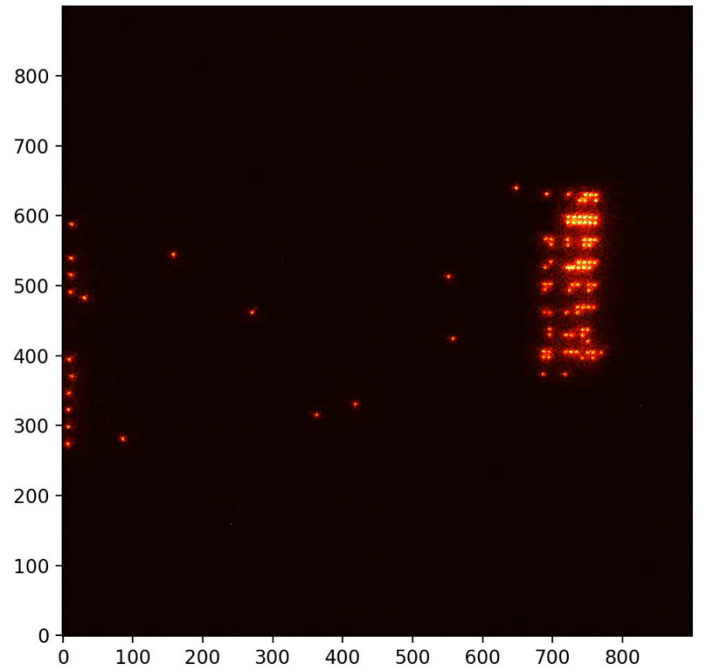
Max-Planck-Institute of Quantum Optics

planqc uses optical lattices – a record breaking technology to scale our quantum computer to thousands of qubits today

10.000 Qubits:
Publication: arXiv:2309.04717
Patent Application: PCT/EP2023/074768



sorting



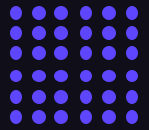
Single-shot image of more than 10.000 qubits directly loaded into the lattice from the magneto-optical trap.

planqc's roadmap focusses on developing logical quantum processors with value creation at every development stage

Analog

- Special-purpose optimization
- Maximum independent set

2023

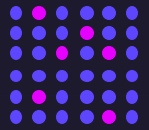


All qubits addressed simultaneously

Digital

- Reach beyond classical computability
- Universal Quantum Computing possible but limited by physical qubit gate quality

2025

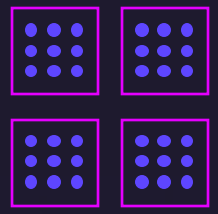


Individual qubits addressable

Fault-resistant

- General-purpose computation
- Small-scale applications demonstrated

2028

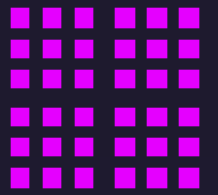


Logical qubits available

Fault-tolerant

- Universal Quantum Computing with logical qubits
- All applications

2035



Logical qubits at scale

planqc

Company Presentation

Quantum Algorithms

Our algorithm team combines decades of research excellence, guided by world-class scientific advisors

Martin Kiffner

Head of Algorithms & Use Cases

UNIVERSITY OF OXFORD

Dieter Jaksch

Scientific Advisor

UNIVERSITY OF OXFORD

Ignacio Cirac

Scientific Advisor

MAX-PLANCK-INSTITUT FÜR QUANTENOPTIK

18
External projects

19
Team members

Google

UCL

Aalto University

Alumni of

SISSA Scuola Internazionale Superiore di Studi Avanzati

TUM

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

UH Universität Hamburg

MAX-PLANCK-INSTITUT FÜR PHYSIK KOMPLEXER SYSTEME

MAX-PLANCK-INSTITUT FÜR QUANTENOPTIK

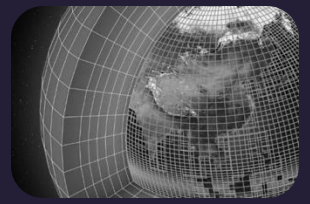
universität innsbruck

planqc

planqc develops a wide range of quantum use cases with customers and partners, many leveraging tensor-networks

Our Portfolio of Quantum Use Cases

Quantum Machine Learning

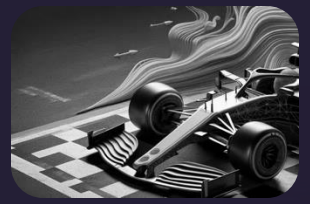


Using QML we reduce climate forecast uncertainties to improve reliable global policy actions.

Logistics Optimization

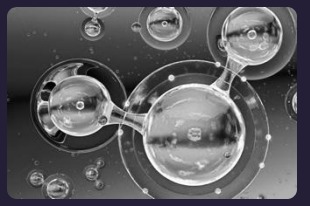
Developing quantum algorithms for solving large-scale optimization problems.

Computational Fluid Dynamics



Developing quantum software to revolutionize fluid dynamics and improve electric vehicles.

Material Simulations

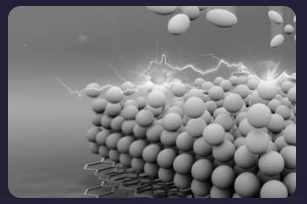


Developing quantum-optimized algorithms for strongly correlated materials.

Finance

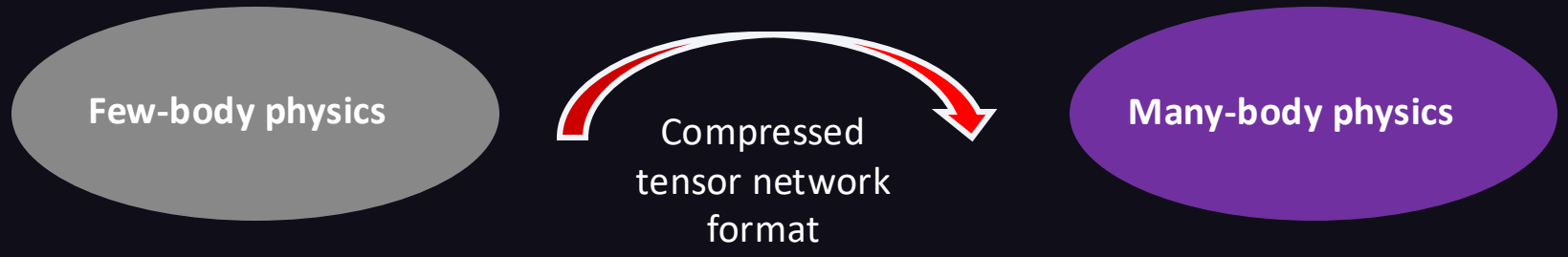
Developing quantum algorithms for solving computationally hard financial use cases.

Battery Simulations



Developing quantum algorithms to improve accuracy of battery charge transport models.

Quantum inspired tensor networks



Quantum inspired tensor network use cases at planqc

Few-body physics

Compressed tensor network format

Many-body physics

Computational Fluid Dynamics

engys

Logistics Optimization

TriCon Container-Terminal Nürnberg GmbH, duisport, kombi verkehr, rnv, DB Regio Bus

AI and Image Recognition

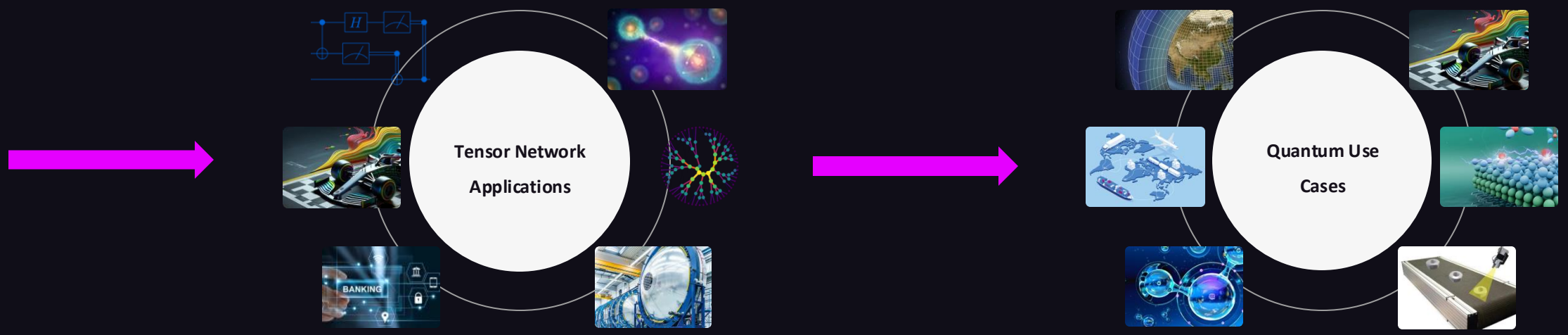
esa

Finance

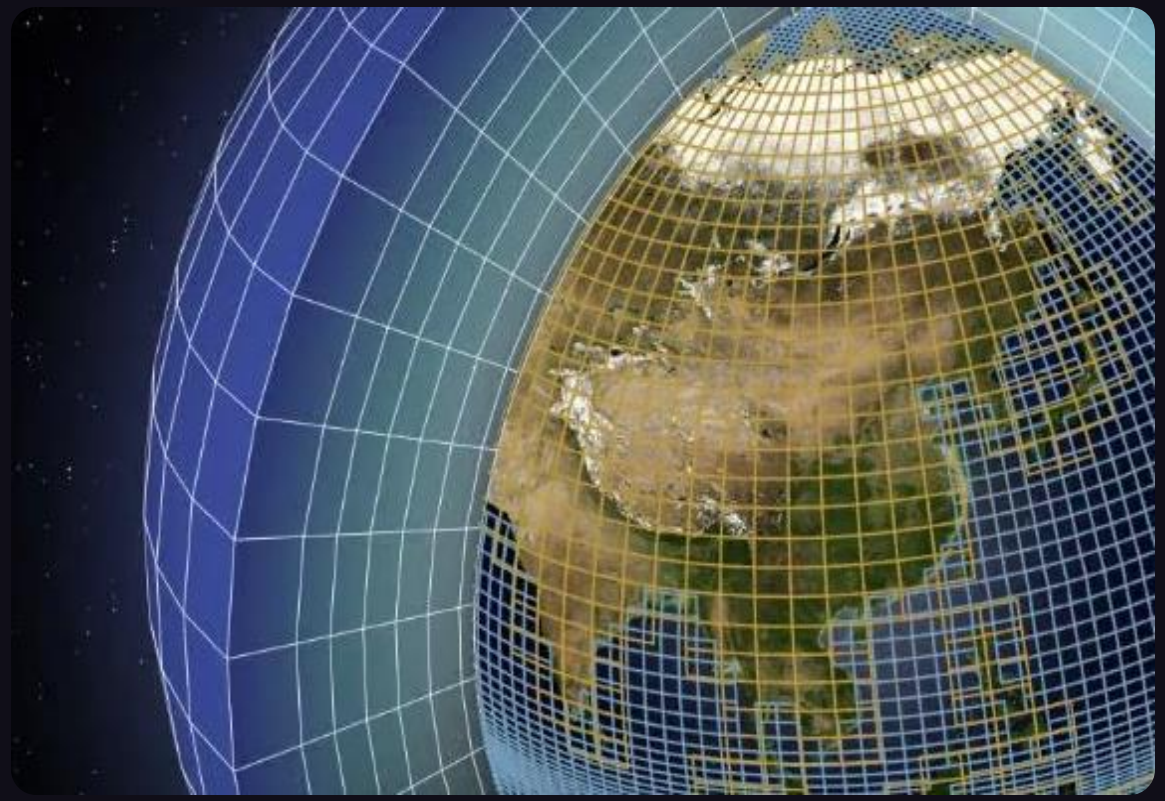
d-fine

Tensor Network Approach

Tensor Networks are a Programming Paradigm for Quantum Algorithms



Quantum inspired algorithms applied to Image Recogniation



Our partners

Deutsches Zentrum für Luft- und Raumfahrt (DLR)

d-fine

planqc

Motivation

Climate change is one of the most pressing challenges facing humanity. The required rapid and coordinated global action needs accurate climate predictions as a basis for decision taking, which are beyond processing power of classical computers. Quantum computing promises to overcome these limitations in current climate models and produce more accurate climate predictions.

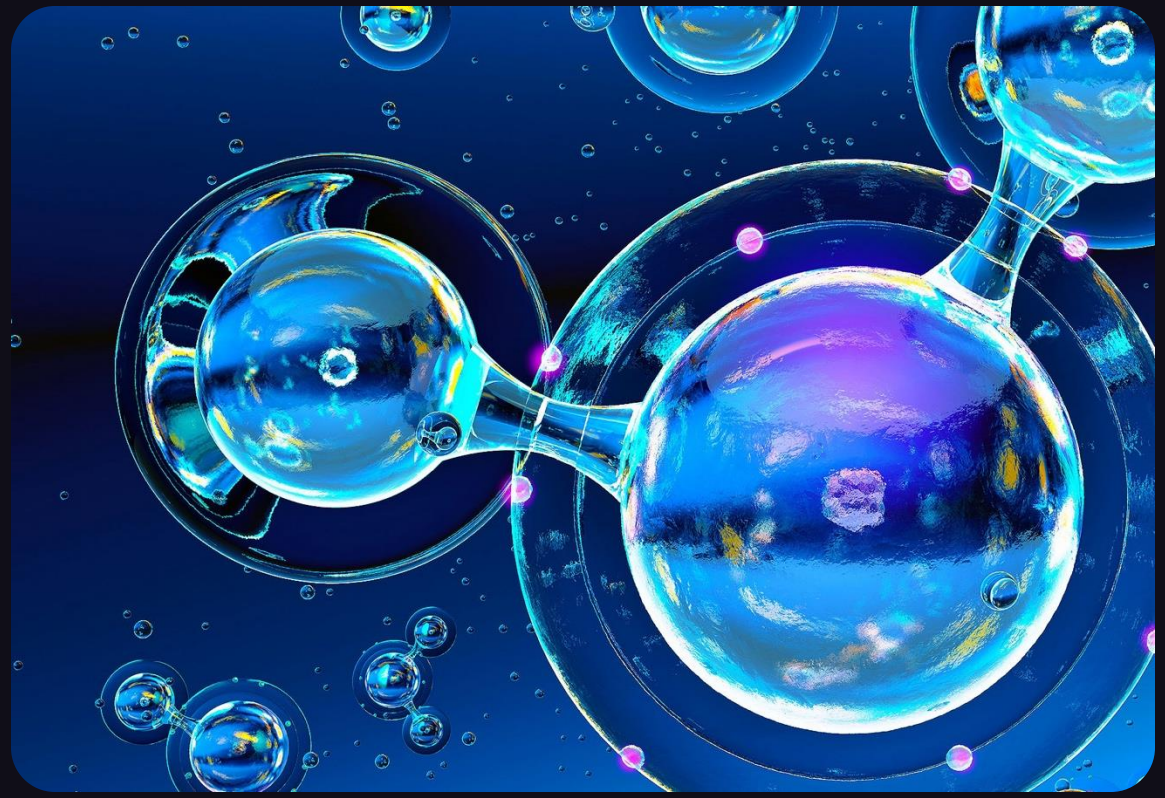
"We are happy to team up with the DLR and d-fine enabling more precise climate predictions and robust strategies for mitigating the effects of climate change."

– Martin Kiffner, Head of Algorithms, planqc

Goal

This work intends to reduce climate forecast uncertainties such that recommended actions for combating the global climate crisis via policy changes in aviation, space travel, transport and energy become more reliable.

Quantum algorithms applied to Chemistry



Our partners

Deutsches Zentrum für Luft- und Raumfahrt (DLR)

d-fine

MQS Molecular Quantum Solutions

planqc

Motivation

The development of new materials or drugs is dependent on our ability to model the complex interplay of its components. Quantum algorithms are deployed to simulate and investigate structure, dynamics and other properties. In this project, water is used to test the capabilities and limitations of materials simulations.

"Water and hydrogen are important for industrial processes and the starting point for even more complex calculations in the future"

– Prof. Dr. Matthias Sperl, DLR

Goal

Our objective is to develop advanced algorithms for atomistic simulations of water and hydrogen, optimized for quantum hardware. These are aimed at addressing challenges in material simulations to leverage quantum computational advantages.

Quantum algorithms applied to Material Science

Motivation

The development of new materials or drugs is dependent on our ability to model the complex interplay of its components. Quantum algorithms are deployed to simulate and investigate structure, dynamics and other properties. In this project, quantum computers are integrated in the classical workflow for calculating properties of strongly correlated materials.

"Whether for energy storage, aerospace, or high-performance materials, the accelerated development of new materials using quantum computers will drive numerous innovations that contribute to sustainability and growth"

– Dr. Alexander Glätzle, CEO, planqc

Goal

Our objective is to develop advanced algorithms for calculating electronic structure properties of strongly correlated materials, optimized for quantum hardware. These are aimed at leveraging quantum computational advantages in simulating the time evolution of impurity models.

Our partners

DLR Deutsches Zentrum für Luft- und Raumfahrt

d-fine

exomatter

AIRBUS

planqc

Quantum inspired algorithms applied to Image Recogniation

Motivation

In the mobility sector, potential run-time advantages of quantum computers are extremely relevant both for time-critical problems and for problems where high levels of complexity must be taken into account. A typical feature of these types of problems is that even small improvements over state-of-the-art solutions result in substantially increased profits.

Goal

The goal of this project is to optimize workflows in the mobility sector. With our partners we cover a broad range of use cases including lock management in the maritime sector, as well as road traffic, rail and intermodal transport.

In collaboration with our partners, we map industrial use cases to models like quadratic unconstrained binary optimization (QUBO) problems that can be solved with state-of-the-art quantum and quantum-inspired methods.

Our partners

Fraunhofer IML
kombi verkehr
Fraunhofer CML
DB Regio Bus
TriCon Container-Terminal Nürnberg GmbH
duisport
UIRR International Union for Road-Rail Combined Transport
rnv GmbH

planqc

Quantum algorithms applied to Fluid- and Aerodynamics

Motivation

To allow objects in motion, for example cars or ships, to move as quickly and efficiently as possible, one must understand how air or water flows around them. Simulating those dynamics is extremely challenging even on the world's largest supercomputers. Quantum methods promise to enable more robust and scalable solutions beyond the state-of-the-art.

"We will tackle this challenge by developing a quantum software framework for solving a wide range of industrially relevant computational fluid dynamics problems."

– Prof. Dieter Jaksch

Goal

We are developing a cutting-edge quantum software to transform fluid dynamics analysis, starting with improving battery-electric vehicles. Our approach will integrate with industry-standard tools to maximize impact and extend to various fluid flow challenges.

Our partners

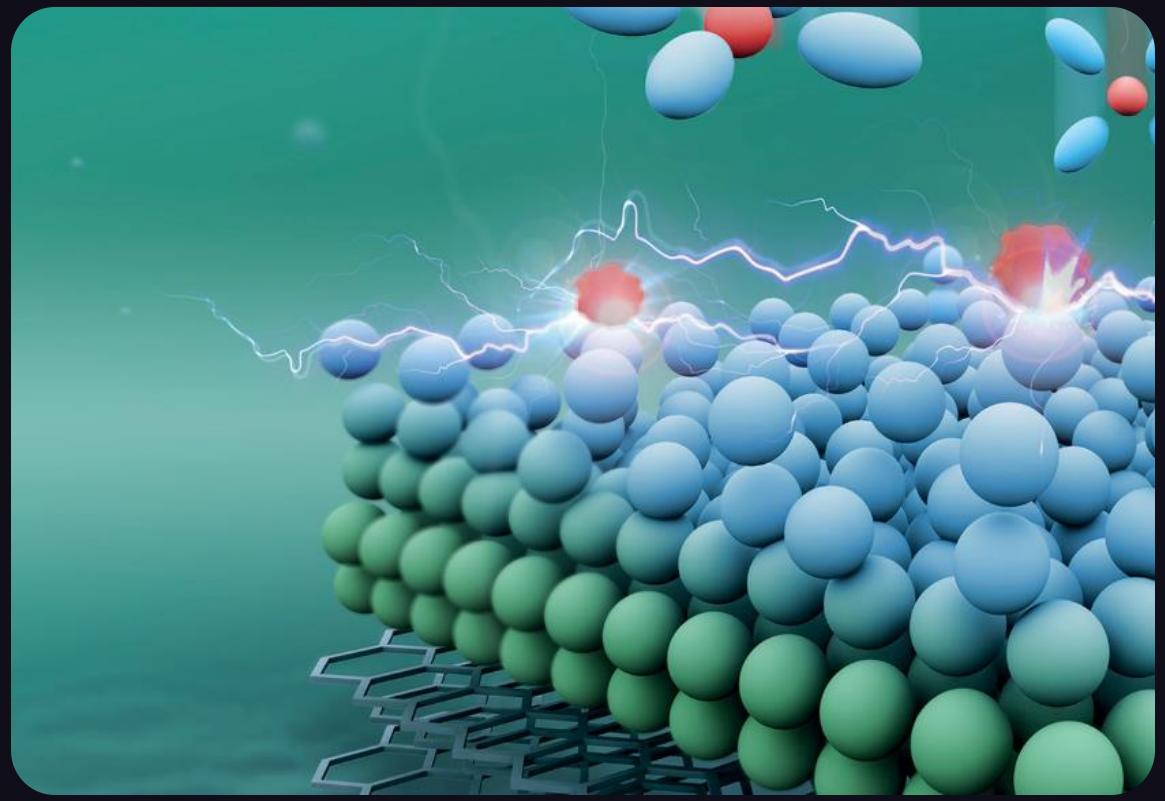
UH

JÜLICH FORSCHUNGSZENTRUM

engys

planqc

Quantum algorithms applied to Battery Materials Simulations



Our partners

Deutsches Zentrum für Luft- und Raumfahrt (DLR)

d-fine

planqc

Motivation

Our ability to store energy in a more efficient, cost-effective and durable way will be a determining factor on our path towards a more sustainable future. Quantum computing has the potential of describing the highly complex interplay of battery materials far beyond current computing capacity and promises to revolutionize battery technology.

"With the insights from the BASIQ partnership, we will advance the industry in such a relevant field as battery material development."

– Birgit Schuster-Pascher, Projekt Manager DLR QCI

Goal

Develop quantum algorithms for capturing the multi-scale problem of charge carrier transport, thus enabling more accurate battery models and enhanced predictive value of these models.

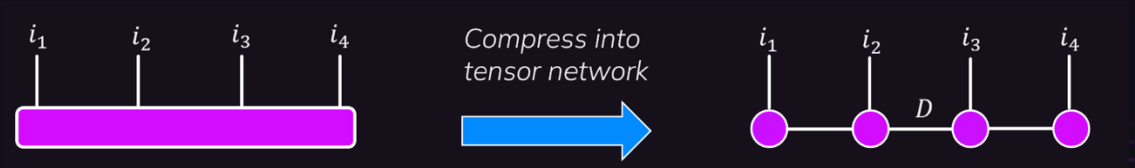
Quantum inspired algorithms applied to Image Recogniation

Motivation

Quantum and quantum-inspired techniques can offer exponential performance benefits in storing image data without loss of accuracy. Quantum-inspired tensor network methods can leverage this exponential advantage on classical hardware while additionally offering energy efficient training protocols for supervised learning tasks. The proposed solution can be readily integrated into conventional machine learning workflows and is designed to scale very well to large problems.

Goal

We use quantum-inspired tensor network methods for recognizing defects in two-dimensional images of dome segments for rocket tanks formed by shot peening. This task can be achieved with a fraction of the energy required by conventional approaches due to the compressed format of the training images. The runtime performance of tensor network methods can be enhanced by specialized classical hardware such as GPUs and TPUs, while quantum hardware offers additional performance enhancements.



Our partners

esa

planqc

Thank you for your time

Dr. Martin Kiffner
Head of Algorithms
Mobile +49 173 7095825
E-Mail martin@planqc.eu

Dr. Marcus Hennig
Head of Business & Projects
Mobile +49 162 4996394
E-Mail marcus@planqc.eu

www.planqc.eu

planqc