QuantumBasel

FANKHAUSER

uptown Basel

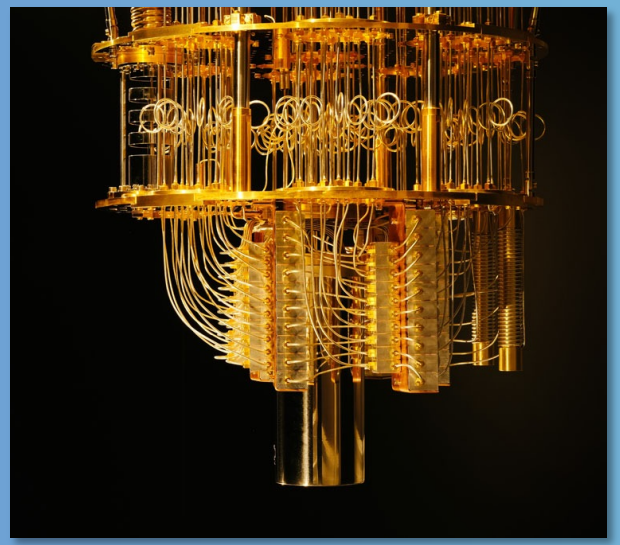
QAIventures

Quantum (KI) – vom Labor zu Industrieanwendungen

4. July 2024

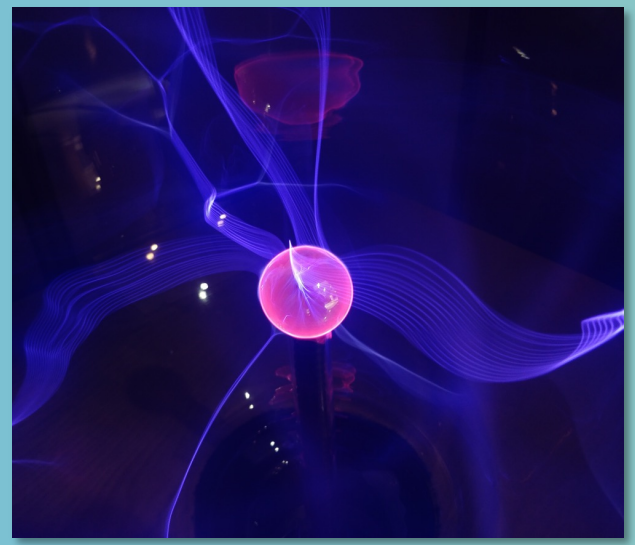
Dr. Frederik F. Flöther, Chief Quantum Officer, QuantumBasel
frederik.floether@quantumbasel.com

What are (new) quantum technologies?



Quantum computing

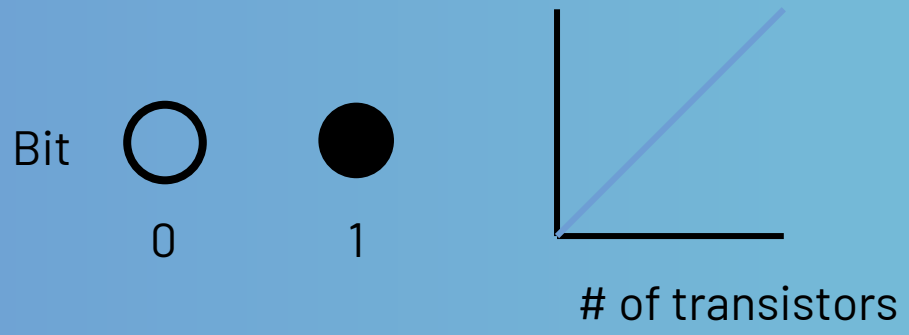
Quantum communication & security



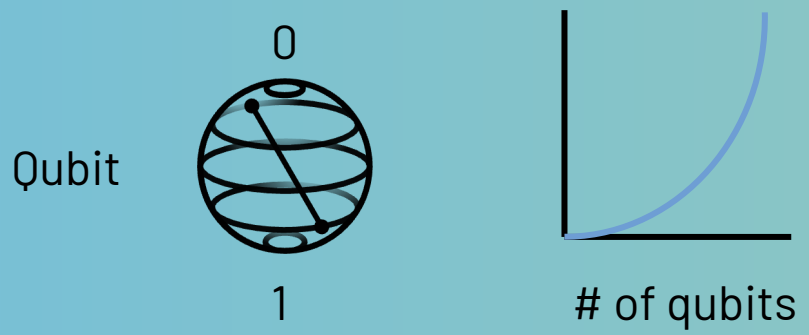
Quantum sensing

Quantum computers are fundamentally different

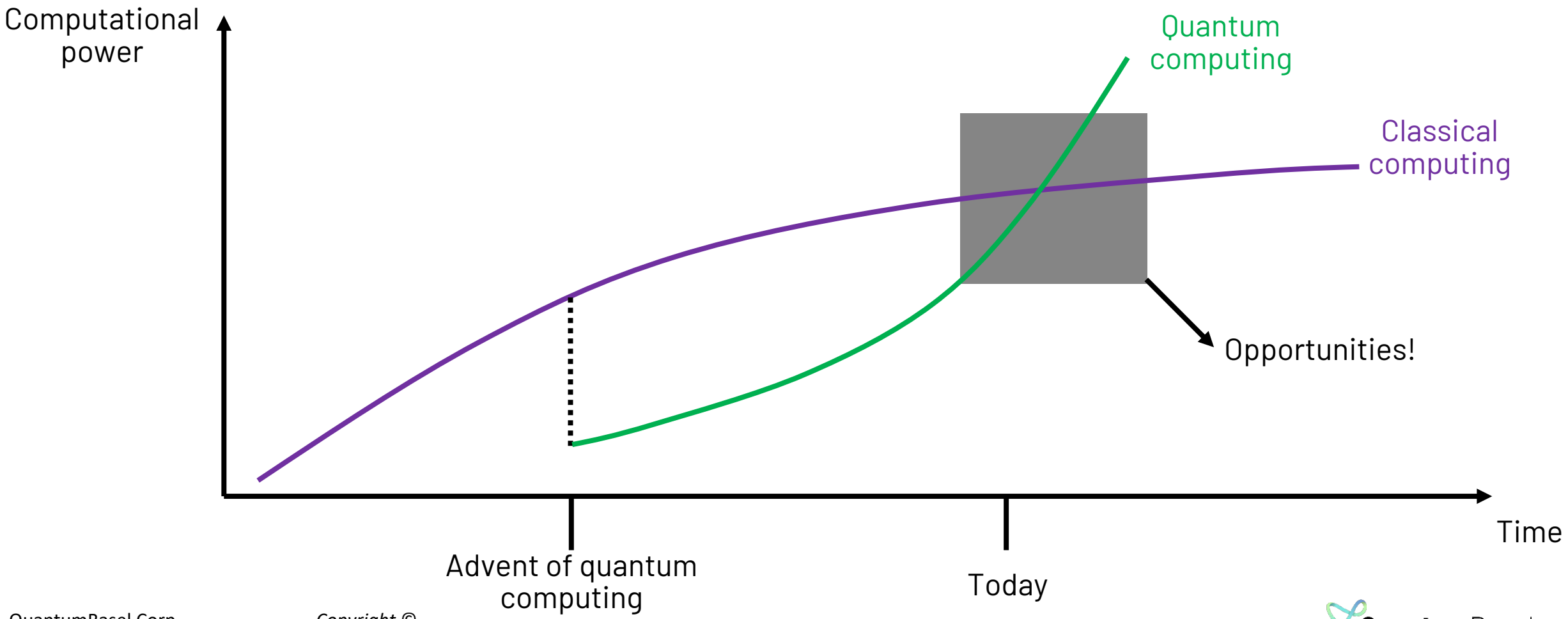
CLASSICAL



QUANTUM



For the first time, computing has bifurcated



Myths about quantum computers

Quantum computers will (soon) **replace** classical ones

Quantum computers will make all calculations **faster**

Quantum computers require a lot of **energy**

Quantum computers are best for **big data** problems

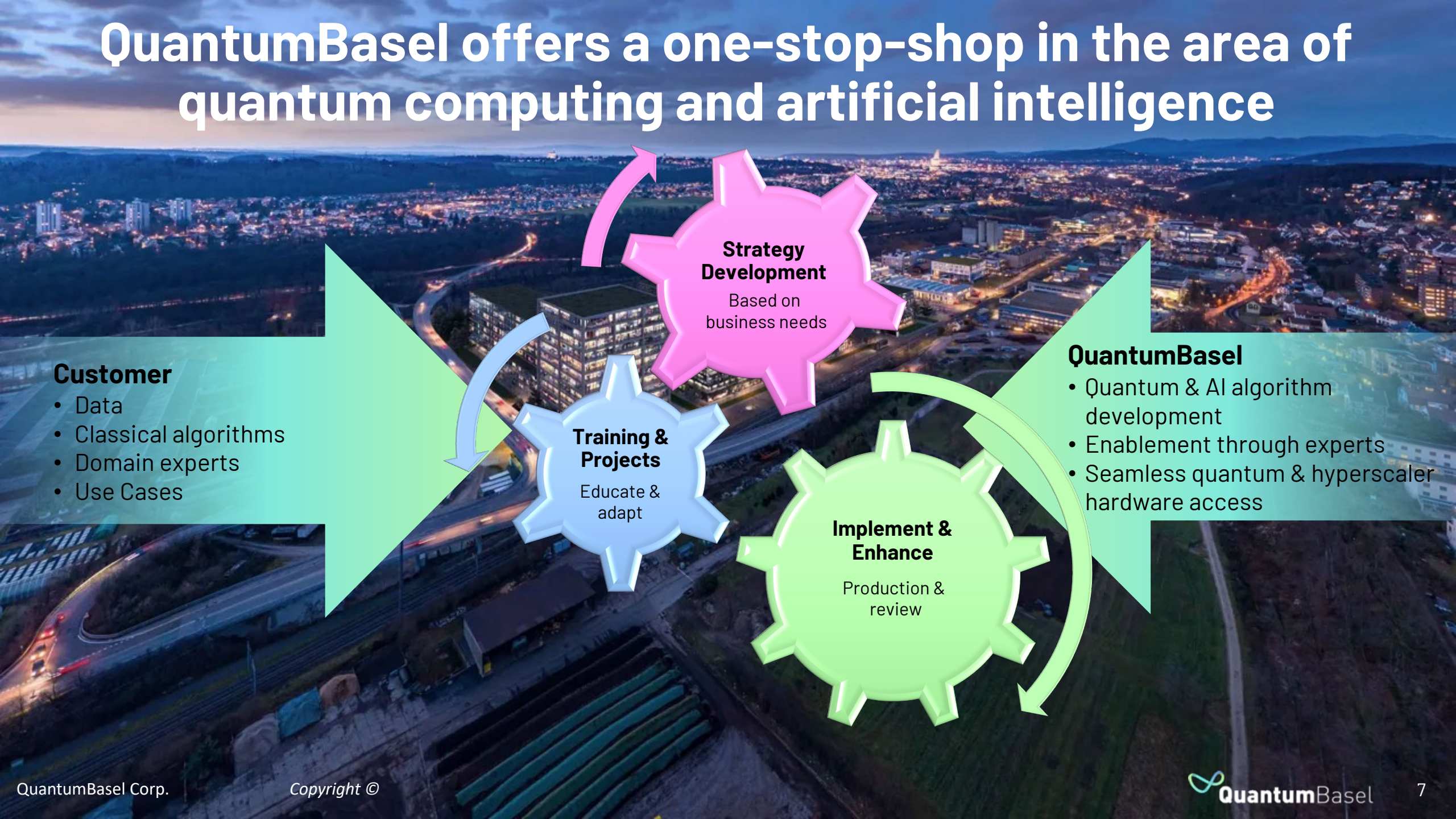
Embedded in **uptownBasel**
The international centre of excellence for Industry 4.0

Vision – Nobel Prize

Mission – Sustainability and Technologies of the Future

Private: Fully privately invested by the family Staehelin

QuantumBasel offers a one-stop-shop in the area of quantum computing and artificial intelligence



Customer

- Data
- Classical algorithms
- Domain experts
- Use Cases

QuantumBasel

- Quantum & AI algorithm development
- Enablement through experts
- Seamless quantum & hyperscaler hardware access

As a privately funded entity, QuantumBasel thrives within its ecosystem of strong and collaborative partners

Technology Partners

IONQ

IBM

D-Wave The Quantum Computing Company™

Phoenix

NVIDIA

Academic Partners

Fachhochschule Nordwestschweiz

Universität Basel

Zürcher Hochschule für Angewandte Wissenschaften

zhaw

Alma Mater Studiorum A.D. 1088

NCCR SPIN

Accelerators & VCs

QAIventures

REDSTONE

PLUG AND PLAY

New Swiss-based AI Cluster

Red Hat OpenShift · IBM · NVIDIA · PHOENIX

750 GPUs H100 Nvidia

IBM AIU AI Chips

WatsonX

SOVEREIGN AI
THE TECHNOLOGY OF OUR TIME

„It was early this year, where I realized that Switzerland needs an independent, flexible, and Sovereign AI for commercial use. This is not a matter of choice, as companies will either use Sovereign AI or be left behind."

Thomas Taroni
Chairman Phoenix Technologies AG

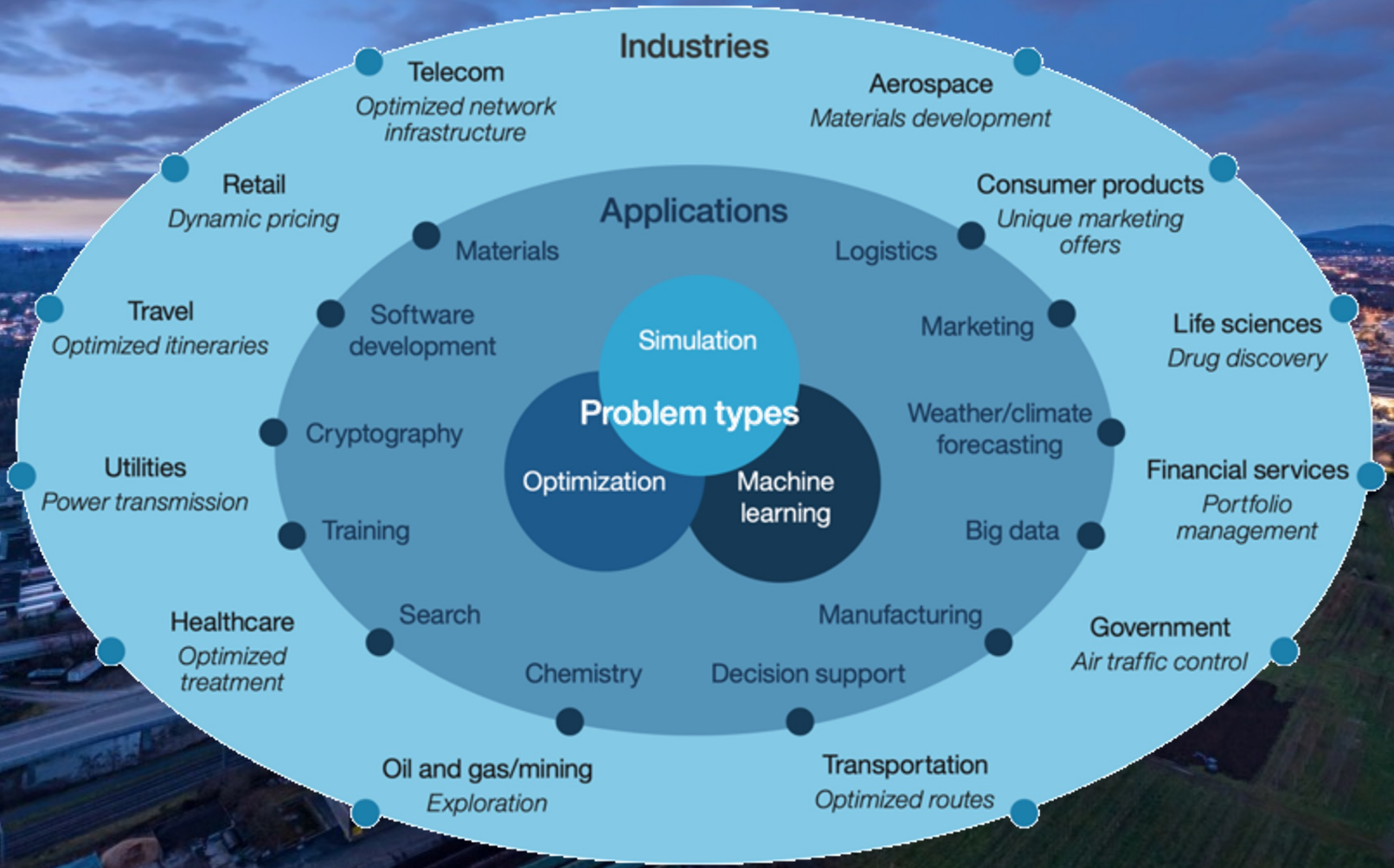
Our task: mapping of quantum algorithms to use cases

Logistics

Industrial Production

Financial Services

Life Science



Source: https://www.ibm.com/downloads/cas/LJBOKBLW

Race is in progress to capture quantum IP

Enabling more precise **customer segmentation**

(CN113688906A, Sichuan Yuanjiang Technology)

1. The customer segmentation method based on the quantum K-means algorithm is characterized by comprising the following steps of: the method comprises the following steps:

determining a subdivision angle, namely the characteristic quantity D, and acquiring a client behavior data set D;

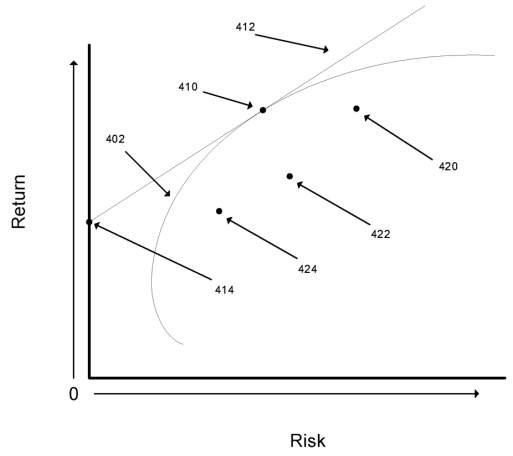
according to the sample x in the customer behavior data set D_mCharacteristic value of (2), sample x_mConversion to quantum state | x_m>Represents; and according to the selected k cluster centers c_iThe characteristic value of (2) converts the clustering center c into a quantum state | c>Represents;

the customer behavior data and the clustering center are subjected to quantum computation, and the similarity between each data and the clustering center is output, namely the quantum state | x is $computed_m$>And | c>The similarity exists in a quantum state | $alpha_m$>Performing the following steps;

looking up quantum state | $alpha_m$>Middle data sample | x_m>And cluster center | c_i>So as to find the minimum value of (c) with sample x_mNearest cluster center c_j。

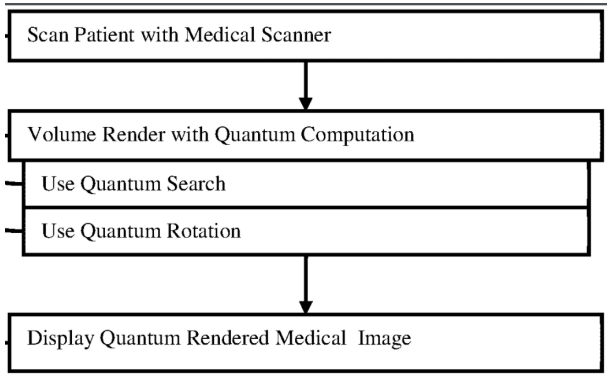
Optimizing **personalized portfolios**

(US20210374585A1, Wells Fargo)



Volume rendering medical imaging data more efficiently to accelerate diagnoses

(US10991133B2, Siemens Healthineers)



Our clients and projects

VINCI ENERGIES

HVAC Quantum Optimization

CGC

LLMs for Genomic Reports

MOONLIGHT AI

QML in Computational Pathology

Hermes

Quantum-Enhanced Delivery Efficiency

Swiss Retail Bank

Quantum Applications in Financial Services

n|w Fachhochschule Nordwestschweiz

Quantum-Enhanced NMR Data analysis For molecular Modelling

Zürcher Hochschule für Angewandte Wissenschaften

zh aw

QML

Medical Technology Company

QML in Tissue Analysis

KIPU Quantum

Hardware-Specific Quantum Algorithms

Quantum Annealing for Optimization Problems

Endress+Hauser

Data Analytics

QUANTUM ANNEALER

VINCI ENERGIES

D-Wave The Quantum Computing Company™

QuantumBasel

How do we achieve efficient network generation while complying with safety and sustainability requirements?

QuantumBasel Corp.

Improve design and reduce costs

HVAC Optimization

Maximize user comfort and efficiency

Minimize environmental burden, fuel consumption, emissions, delivery times, and costs

Results: Efficiency gains and reduction in length of HVAC design when compared to existing classical methods

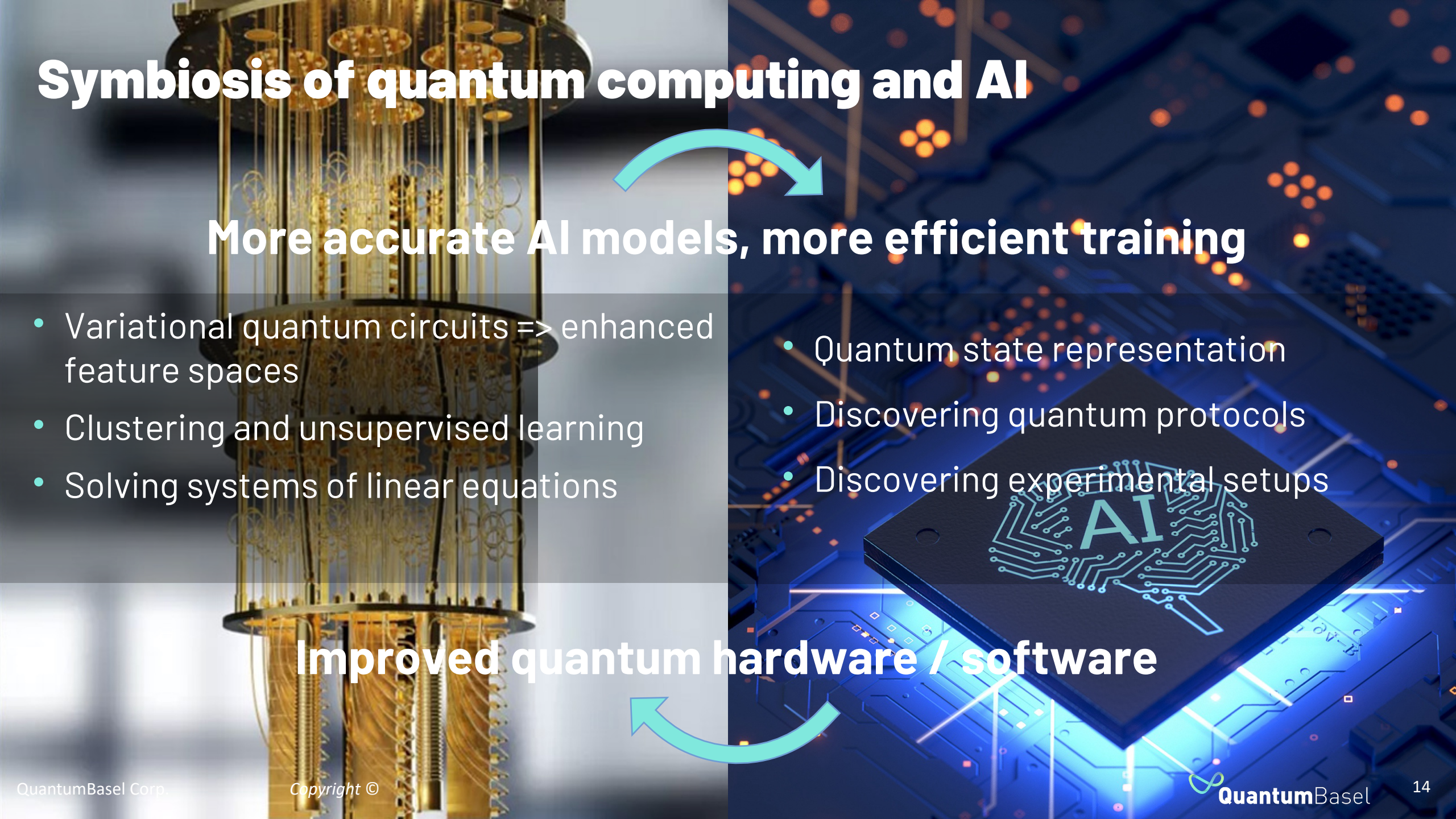
QuantumBasel

Symbiosis of quantum computing and AI

More accurate AI models, more efficient training

- Variational quantum circuits => enhanced feature spaces
- Clustering and unsupervised learning
- Solving systems of linear equations

- Quantum state representation
- Discovering quantum protocols
- Discovering experimental setups

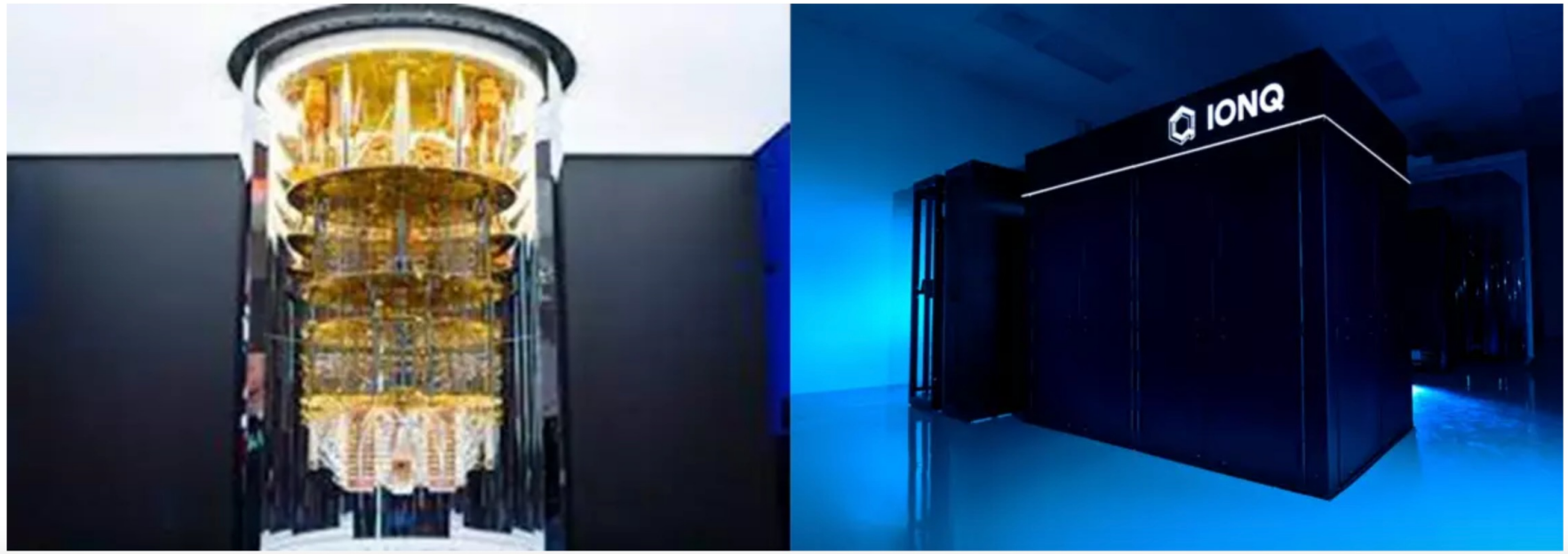


Improved quantum hardware / software

QuantumBasel and ZHAW School of Engineering join Forces for Quantum Machine Learning Research

QuantumBasel, the centre of competence for quantum computing and artificial intelligence, and the ZHAW School of Engineering are entering into a research partnership. The strategic collaboration focuses on cutting-edge research projects in the dynamic field of quantum machine learning.

Tuesday, 16 January 2024



Data augmentation experiments with style-based quantum generative adversarial networks on trapped-ion and superconducting-qubit technologies

Julien Baglio

QuantumBasel, Schorenweg 44B, CH-4144 Arlesheim, Switzerland.

E-mail: julien.baglio@quantumbasel.com

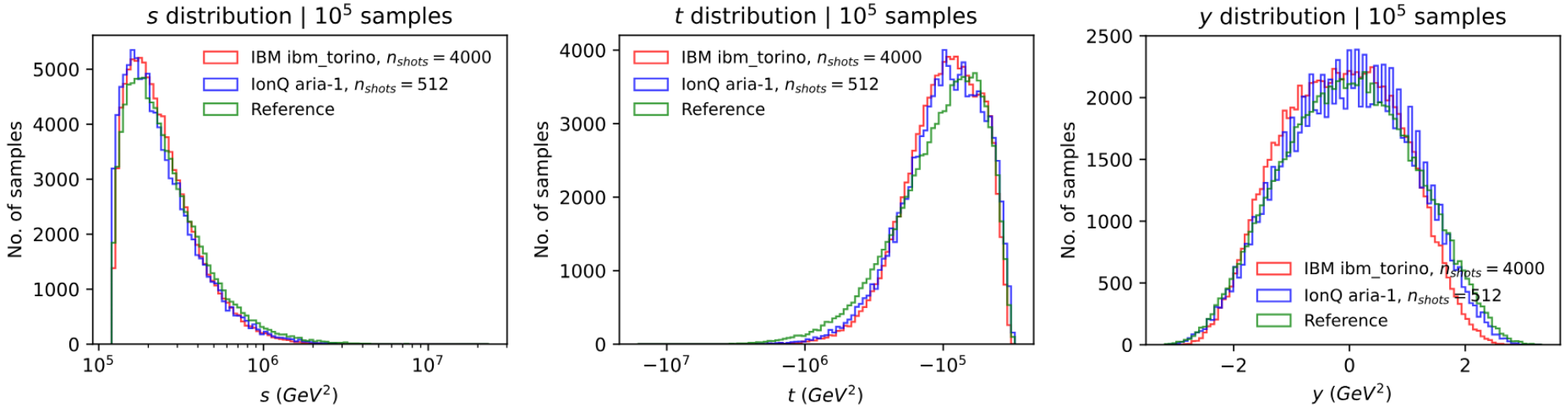


Figure 7. Comparison of the data augmentation on IBM `ibm_torino` (red lines) and on IonQ `aria-1` (blue lines) with the reference sample distribution (green lines) for the marginal samples distributions s, t, and y.

Cancer Genomics Analysis

Cancer Diagnosis

Cancer Report

ORDERED TEST # [redacted]

GENOMIC FINDINGS

observed here, are predicted to be oncogenic[95-116].

GENE
PTEN

ALTERATION
T319fs*6

HGVS VARIANT
NM_000314.4:c.955dup (p.T319Nfs*6)

VARIANT CHROMOSOMAL POSITION
chr10:89720803

POTENTIAL TREATMENT STRATEGIES

— Targeted Therapies —

PTEN loss or mutation leads to activation of the PI3K-AKT-mTOR pathway and may predict sensitivity to inhibitors of this pathway[48,117-119]. A Phase 1 expansion study of the AKT inhibitor capivasertib combined with fulvestrant for patients with PTEN-mutated disease who were hormone-receptor-positive (HR+) reported an ORR of 21% (for those exposed to fulvestrant) and 8% (for those who were fulvestrant-naive)[52]. Clinical studies in breast cancer have not observed an association between PTEN deficiency and response to the mTOR inhibitors everolimus or temsirolimus[7,120-124], although exploratory analysis of Phase 3 studies suggests that patients with HER2+ metastatic breast cancer and PTEN loss derived significant benefit from everolimus added to trastuzumab plus chemotherapy[125]. One PR was observed for a patient with breast cancer harboring PTEN and STK11 alterations following treatment with the mTOR1/2 inhibitor sapanisertib combined with metformin[126]. Preclinical data indicate that PTEN loss or inactivation may predict sensitivity to PARP inhibitors[127-131], and clinical benefit has been observed for patients with PTEN-altered breast cancer including triple negative breast cancer[132], ovarian cancer[133], uterine leiomyosarcoma[134], and endometrial cancer[131] treated with PARP inhibitors. However, some studies have reported a lack of association between PTEN mutation and PARP inhibitor sensitivity[135-136]. A Phase 2 trial of the AKT inhibitor capivasertib with paclitaxel versus paclitaxel alone showed a median OS benefit for the overall population (19.1 vs. 12.6 months; HR=0.61), for patients with AKT1-, PTEN-, or PIK3CA-mutated triple-negative breast cancer (TNBC) (not reached vs. 10.4 months; HR=0.37), and for patients with TNBC without PI3K-pathway mutations (16.6 vs. 13.2 months; HR=0.84)[61]. In a Phase 2 trial, the addition of capivasertib to fulvestrant improved median PFS (mPFS) relative to fulvestrant plus placebo alone for patients with PIK3CA-, AKT1-, and/or PTEN-altered hormone-receptor-positive (HR+), HER2- metastatic breast cancer (12.8 vs. 4.6 months, HR=0.44)[62-63], although the Phase 3 CAPItello study of capivasertib with fulvestrant for patients with HR+, HER2- metastatic breast cancer reported improved median PFS (mPFS) relative to fulvestrant plus placebo for patients with and without alterations in the AKT pathway (7.3 vs 3.1 months, HR=0.50 and 7.2 vs 3.7 months, HR=0.70, respectively)[64]. In a Phase 2 basket trial of capivasertib monotherapy in AKT1-mutated cancers, 33% (2/6) of patients with HR+, HER2- or TNBC experienced PRs, and 2 other PRs were unconfirmed[65]. Despite promising initial results in earlier trials[66-67], the Phase 3 IPATunity130 trial failed to show improved PFS for first-line ipatasertib in combination with paclitaxel relative to paclitaxel alone for patients with AKT1-, PTEN-, or PIK3CA-mutated TNBC (7.4 vs. 6.1 months)[64] or HR+, HER2- breast cancer[68].

— Potential Resistance —

In the context of breast cancer, clinical and preclinical[81] evidence suggests that PTEN loss or mutation may predict resistance to PI3K inhibitors alone[43,82] or in combination with aromatase inhibitors[83] or fulvestrant[79], as well as cross-resistance to CDK4/6 inhibitors such as palbociclib, ribociclib, and abemaciclib in combination with antiestrogen therapy[83-85]. Based on limited clinical evidence, loss of function PTEN alterations may be associated with resistance to alpelisib plus fulvestrant or aromatase inhibitors in the context of HR+, HER2- breast cancer with PIK3CA alterations[78-80] and have been detected as emergent alterations for patients with progressive disease[80].

FREQUENCY & PROGNOSIS

PTEN mutations have been reported in up to 6.4% of breast invasive carcinomas, including invasive ductal and invasive lobular carcinomas[86-87,137]. Loss or reduction of PTEN expression has been observed in 28% of invasive ductal breast carcinomas and has been correlated with metastasis and poor patient prognosis, including decreased 2-year disease-free survival[138-141].

FINDING SUMMARY

PTEN encodes an inositol phosphatase that functions as a tumor suppressor by negatively regulating the PI3K-AKT-mTOR pathway; loss of PTEN can lead to uncontrolled cell growth and suppression of apoptosis[118]. Alterations such as seen here may disrupt PTEN function or expression[142-183].

POTENTIAL GERMLINE IMPLICATIONS

One or more of the PTEN variants observed here has been described in the ClinVar database as a likely pathogenic or pathogenic germline mutation (by an expert panel or multiple submitters) associated with hamartoma tumor syndrome (ClinVar, Apr 2023)[184]. Follow-up germline testing would be needed to distinguish whether the finding in this patient is somatic or germline. PTEN mutations underlie several inherited disorders, collectively termed PTEN hamartoma tumor syndrome (PHTS), which include Cowden syndrome (CS) and its variant Lhermitte-Duclos disease (LD), Bannayan-Riley-Ruvalcaba syndrome (BRRS), PTEN-related Proteus syndrome (PS), and Proteus-like syndrome[185-186]. The mutation rate for PTEN in these disorders ranges from 20 to 85% of patients[185,187]. The estimated incidence of Cowden syndrome is 1/200,000, which may be an underestimate due to the high variability of this disorder[188]. Given the association between PTEN and these inherited syndromes, in the appropriate clinical context, germline testing for mutations affecting PTEN is recommended.

Many cancer genomics reports are too complex for >80% of oncologists

Results

Is the current treatment effective?

Based on the information provided, it is not explicitly stated what the current treatment for the patient is. Therefore, I cannot accurately determine if the current treatment is effective. However, the context does mention that the patient is currently receiving cancer therapy and provides a list of treatments that the patient should be sensitive to and some that the patient should not be sensitive to. These include:

Potentially effective:
1. Topoisomerase I and II inhibitors
2. Platinum salt-based chemotherapies
3. Binimetinib (BRAF and MEK inhibitors)
4. Vemurafenib (BRAF inhibitors)
5. Vemurafenib and cobimetinib (BRAF and M

Ineffective:
1. Dacarbazine (alkylating agents)
2. PD-1/PD-L1, NTRKx, and RET inhibitors

Please provide the current treatment for the

James Creeden — Gestern, 11:29

This is actually a really good answer, it seems to have understood from the text which would NOT be effective.

Antworten | Löschen

James Creeden PhD
Genome Expert 20 years of experience

[1]First performance indication

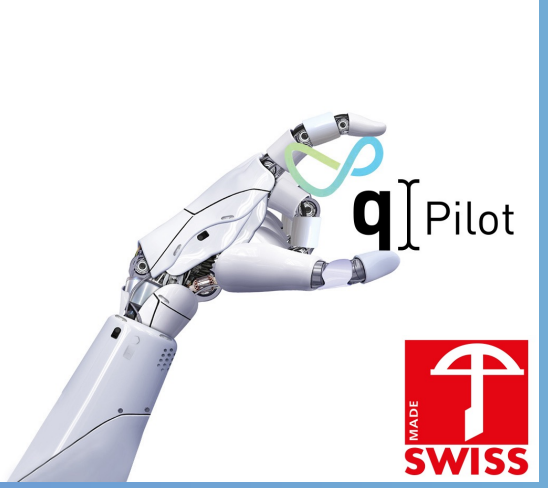
90%[1] Reduction of text reading and analysis work

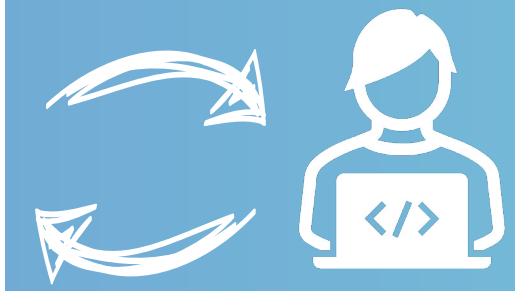
24% more hardware efficient (inference)

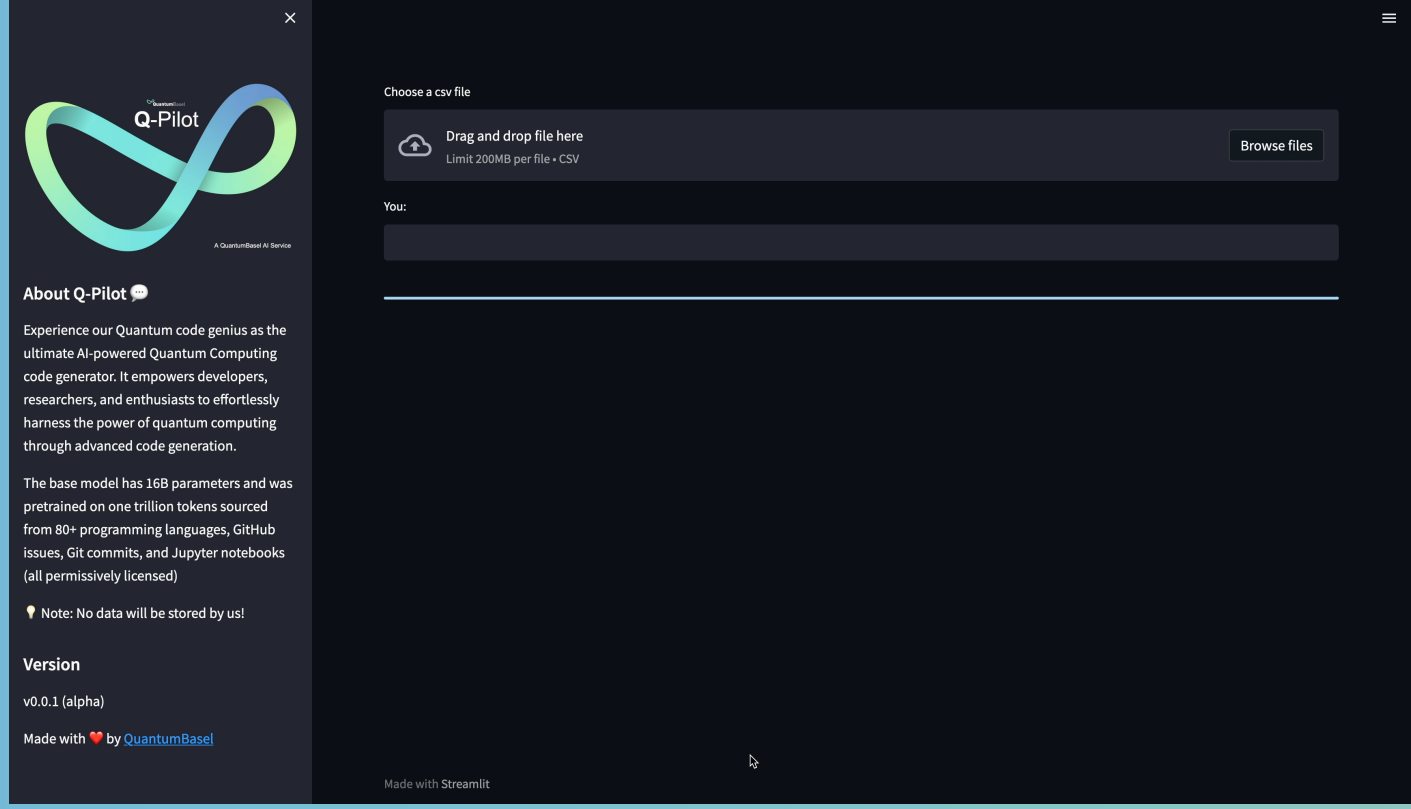
x^2 Speedup in training the AI [Outlook]

qPilot

MADE SWISS







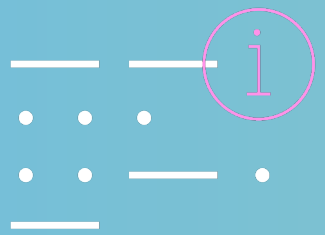
AI-based Quantum Computing Code Generation

Quantum Developers are

55%* faster in writing

Quantum Code

Use Case 1:
Code Assistant



Use Case 2:
Code Translator

D-Wave The Quantum Computing Company™

IONQ

IBM

* Kennzahl auf Basis vergleichbarer KI-Codegenerierungsverfahren

National and Global Acknowledgement

Forbes

Strategic Partnership Between Io And QuantumBasel Could Transform Switzerland Into A European Quantum Powerhouse

Paul Smith-Goodson Contributor
Moor Insights and Strategy Contributor Group

Bloomberg

Business

VINCI Energies and QuantumBasel Launch a Pilot Project with D-Wave's Quantum Technology

18 July 2023 at 15:00 CEST

VINCI Energies and QuantumBasel Launch a Pilot Project with D-Wave's Quantum Technology

Business Wire

BURNABY, British Columbia & PALO ALTO, Calif. -- July 18, 2023

QuantumBasel, Switzerland's first quantum hub for commercial use embedded in the uptownBasel innovation campus, launches a quantum pilot project with VINCI Energies, an accelerator of environmental and digital transition. With D-Wave as its technology partner, QuantumBasel and VINCI Energies will work on the research and development of a series of quantum-hybrid applications. The collaboration will use D-Wave's annealing quantum computers and quantum hybrid solvers through the Leap™ quantum cloud service to provide VINCI Energies with real-time access to quantum solutions

VINCI Energies' Use Case

One of the many challenges you face when constructing a building is the design of the heating, ventilation, and air conditioning (HVAC) system. The design of the HVAC system involves several steps to maximize user comfort, minimize environmental burden and reduce cost of materials. One of the last steps in the HVAC design process is called "network generation" . This step ensures that all HVAC elements are correctly connected while complying with safety and sustainability requirements. While this step is of crucial importance it is also a step that is computationally very expensive or even prohibitive.

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BreakingNews

Erstaunliche Entdeckungen — Ist AccuTox® die Silberkugel in der Krebsbekämp

D-Wave and QuantumBasel Extend Agreement to Accelerate Commercial Adoption and Production Use of Quantum Technology in Europe

Nachrichtenquelle: Business Wire (engl.) | 26.10.2023, 13:00 | 177 | 0 | 0

D-Wave Quantum Inc. (NYSE: QBTS), a leader in quantum computing systems, software, and services and the world's first commercial supplier of quantum computers, and QuantumBasel, Switzerland's first quantum hub for commercial use embedded in the uptownBasel innovation campus, today announced a two-year extension to the companies' strategic relationship to further accelerate quantum and quantum-hybrid application development in Europe. As part of the agreement, D-Wave will open a European office on the QuantumBasel campus, establishing an onsite presence in support of the companies' joint efforts to fast-track the commercialization of quantum computing in the region.

The opening of D-Wave's European office reflects growing regional customer interest in and usage of D-Wave's annealing quantum computing solutions, which include the Advantage system, a fifth-generation annealing quantum system that features 5,000+ qubits and 15-way connectivity. In addition to QuantumBasel, D-Wave's European customers include Koç Holding, Satispay, Poznan Superconducting and Network Center, Cineca, as well as several other Forbes Global 2000 companies.

FINANCIAL TIMES

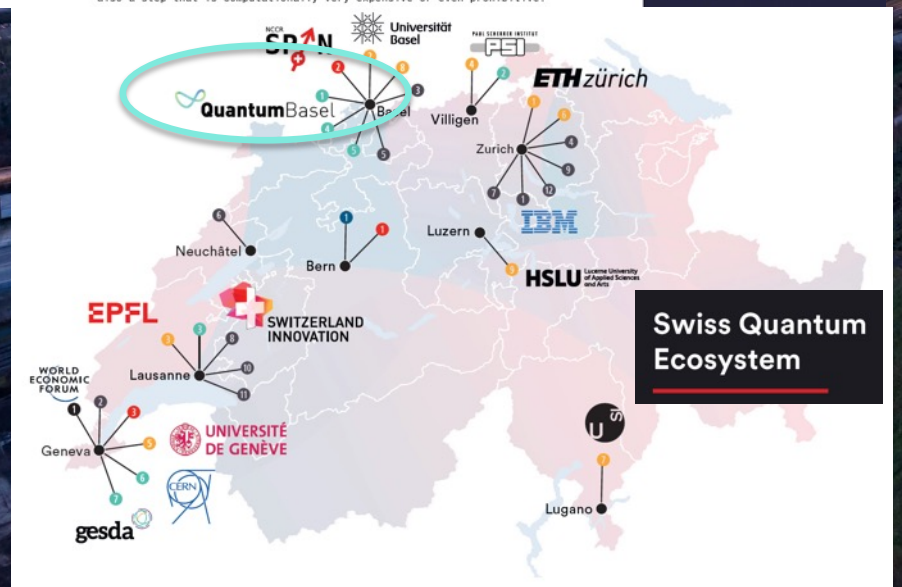
Company Announcements

D-Wave Quantum Inc

D-Wave and QuantumBasel Extend Agreement to Accelerate Commercial Adoption and Production Use of Quantum Technology in Europe

D-Wave to open European office on uptownBasel campus, facilitating increased development of near-term quantum applications for businesses, governments, and researchers

PALO ALTO, Calif. & BURNABY, British Columbia & BASEL, Switzerland--(BUSINESS WIRE)--Oct. 26, 2023-- D-Wave Quantum Inc. (NYSE: QBTS), a leader in quantum computing systems, software, and services and the world's first commercial supplier of quantum computers, and QuantumBasel, Switzerland's first quantum hub for commercial use embedded in the uptownBasel innovation campus, today announced a two-year extension to the companies' strategic relationship to further accelerate quantum and quantum-hybrid application development in Europe. As part of the agreement, D-Wave will open a European office on the QuantumBasel campus, establishing an onsite presence in support of the companies' joint efforts to fast-track the commercialization of quantum computing in the region.



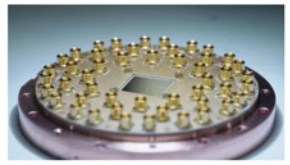
Swiss Quantum Ecosystem

SRF Schweizer Radio und Fernsehen

NZZ Format

Startseite > Video

Neue Zürcher Zeitung



07.09.2023, 23.05 Uhr SRF1

Von Katzen- und Quantensprüngen

Ein neuer Supercomputer soll in Zukunft Tierversuche unnötig machen und Krebs heilen. «NZZ Format» wirft einen Blick in den Quantencomputer und zeigt, dass Potenzial und Gefahren nahe beieinanderliegen.

Recent QuantumBasel Publications

Release Note – VBFNLO 3.0

Julien Baglio[1], Francisco Campanario[2], Heiko Dietrich-Siebert[4], Terrance Figy[3], Matthias Kerner[4], Michael Duc Ninh Le[6], Maximilian Löschner[7], Simon Plätzer[8,9], Michael Rauch[4], Ivan Rosario[2], Robin Roth[4], Di

9 Quantencomputing in der Medizin – neue Möglichkeiten für komplexe Herausforderungen im digitalen Krankenhaus von morgen?

Frederik F. Flöther und Christian Elsner

ıtífico, C/Catedrático José Beltrán, 2, E-46980
e University, 1845 Fairmount
y (KIT), 76128 Karlsruhe, G
Aachen University, D52056 A
ı 12116, Vietnam
nburg, Germany
olatz 5, A-8010 Graz, Austria
anngasse 5, 1090 Wien, Austr

Research D
Quantum T

www.cambri

Data augmentation experiments with style-based quantum generative adversarial networks on trapped-ion and superconducting-qubit technologies

Julien Baglio

QuantumBasel, Schorenweg 44B, CH-4144 Arlesheim, Switzerland.

Research Directions: Quantum Technologies

www.cambridge.org/qut

How can quantum technologies be applied in healthcare, medicine and the life sciences?

Frederik F. Flöther[1,2] and Paul F. Griffin[3]

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icine. *

Quantum Computing in Precision Medicine

Frederik F. Flöther

Eur. Phys. J. C (2023) 83:826
https://doi.org/10.1140/epjc/s10052-023-11957-2

THE EUROPEAN PHYSICAL JOURNAL C

A Quantum State of Mind

Regular Article - Theoretical Physics

Why Business Adoption of Quantum and

AI Technology Must Be Ethical

Full NLO QCD predictions for Higg
2-Higgs-doublet model

J. Baglio[1,2,a], F. Campanario[3,b], S. Glaus[4,5], M. Müh

Christian Hugo Hoffmann

House of Lab Science AG, Garstligweg 8, 8634 Hombrechtiko

Technopark Zurich, Technoparkstrasse 1, 8005 Zurich, Sv

Centre for Ethics of the University of Zurich, Zollikerstrasse 117, 800

Frederik F. Flöther

QuantumBasel, Schorenweg 44b, 4144 Arlesheim, Swi

Artificial intelligence (AI) recently had its "iPhone moment" and adoption has drastically

computing is one of the most recent arrivals in medicine's toolbox although
heory and medicine have arguably been entangled ever since Schrödinger's cat[1].
computing may turn out to be one of the toolbox's most powerful instruments
s in the footsteps of the information processing revolution, which transformed
and medicine with it. This includes computational breakthroughs over the last

Towards quantum-enabled cell-centric therapeutics

Saugata Basu[1], Jannis Born[2], Aritra Bose[3], Sara Capponi[4,5], Dimitra Chalkia[6], Timothy A Chan[7,8], Hakan Doga[9], Frederik F. Flöther[10], Gad Getz[11,12,13,14], Mark Goldsmith[15], Tanvi Gujarati[9], Aldo Guzmán-Sáenz[3], Dimitrios Iliopoulos[6], Gavin O. Jones[9], Stefan Knecht[15], Dhiraj Madan[16], Sabrina Maniscalco[15], Nicola Mariella[17], Joseph A. Morrone[3], Khadijeh Najafi[18], Pushpak Pati[2], Daniel Platt[3], Maria Anna Rapsomaniki[2], Anupama Ray[16], Kahn Rhrissorrakrai[3], Omar Shehab[18], Ivano Tavernelli[19], Meltem Tolunay[9], Filippo Utro[3], Stefan Woerner[19], Sergiy Zhuk[17], Jeannette M. Garcia †‡9, and Laxmi Parida†‡3

https://doi.org/10.1017/qut.2023.1
https://doi.org/10.1017/qut.2023.4
https://arxiv.org/abs/2403.02733
https://arxiv.org/abs/2307.05734
https://arxiv.org/abs/2312.10081
https://link.springer.com/article/10.1140/epjc/s10052-023-11957-2
https://arxiv.org/abs/2405.04401
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ThanQ

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