



QuantumBasel's Offering and Services

QuantumBasel

Switzerland's Center of Competence for Quantum Computing & AI
We democratize the Power of Quantum Computing

Quantum and Real-World Problems

Today's Biggest Concerns

- Poor Data Quality & Reliability
- AI Limitations
- Highly Complex Processes
- Sustainability Goals
- Data Security
- Operational Overhead
- Slow Innovation & Discovery

Meet Quantum

Quantum Computing and AI can help solve problems in three key areas



Optimization



Machine Learning



Simulating Nature



Logistics



Manufacturing

Optimization – Simulation – Machine Learning



Financial
Services



Life Science

uptownBasel

The international centre of excellence for Industry 4.0



uptown
Basel

Vision - Nobel Prize

Mission - Sustainability and Technologies of the Future

Private: Fully privately invested

Vision – Democratizing the power of quantum computing & AI



Hub Building



**Education &
Training**

Our **Quantum & AI** Service Portfolio



Projects



**Technology
Access**

Mission – Collaboration & seamless access to the world's best quantum computers

Quantum & AI Hardware Access

On-Premise:



IonQ
Trapped Ions



AI Cluster
750+ GPUs



Cloud Access:



IBM
Superconducting



IonQ
Trapped Ions



D-Wave
Annealing

Personalized Training Programs on Quantum Computing and AI



- Adaptable for different skill levels – from business leaders to technical professionals
- From half-day sessions up to multiple day training programs

AI

Understanding AI

How to use AI in Business

Prompt Engineering and Techniques

Use Cases and Applications

Quantum

Quantum 101

Quantum Trends

Industry Application

Quantum Program Demos

Quantum Safe Encryption

Data

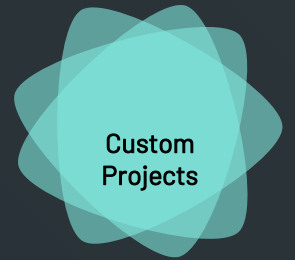
Principles of Data Management

Data Governance

Data Security

Best Practices

Some of our Client Projects



HVAC Quantum optimization



Quantum-enhanced delivery efficiency



QML in computational pathology



Fine-tuned LLMs for emergency wards



Quantum applications in Financial services



Optimization applications in pharma

Zürcher Hochschule für Angewandte Wissenschaften



Quantum machine learning (QML)



LLMs for genomic reports



Quantum Annealing for optimization problems



Quantum-Enhanced NMR data analysis for molecular modelling



QML in nanotechnology



LLMs on Quantum Computers

OPTIMIZATION



BUSINESS CHALLENGE

HOW DO WE ACHIEVE
EFFICIENT NETWORK
GENERATION WHILE
COMPLYING WITH SAFETY
AND SUSTAINABILITY
REQUIREMENTS?



40 %
OF TOTAL ENERGY
CONSUMPTION COMES
FROM HVACS

IMPROVE DESIGN AND REDUCE COSTS

HVAC OPTIMIZATION



- Maximize user comfort and efficiency
- Minimize environmental burden, fuel consumption, delivery times, and costs

Results: 27% reduction in duct length and major efficiency gains when compared with the existing ML-based approach

OPTIMIZATION

MANUFACTURING CLIENT



BUSINESS CHALLENGE

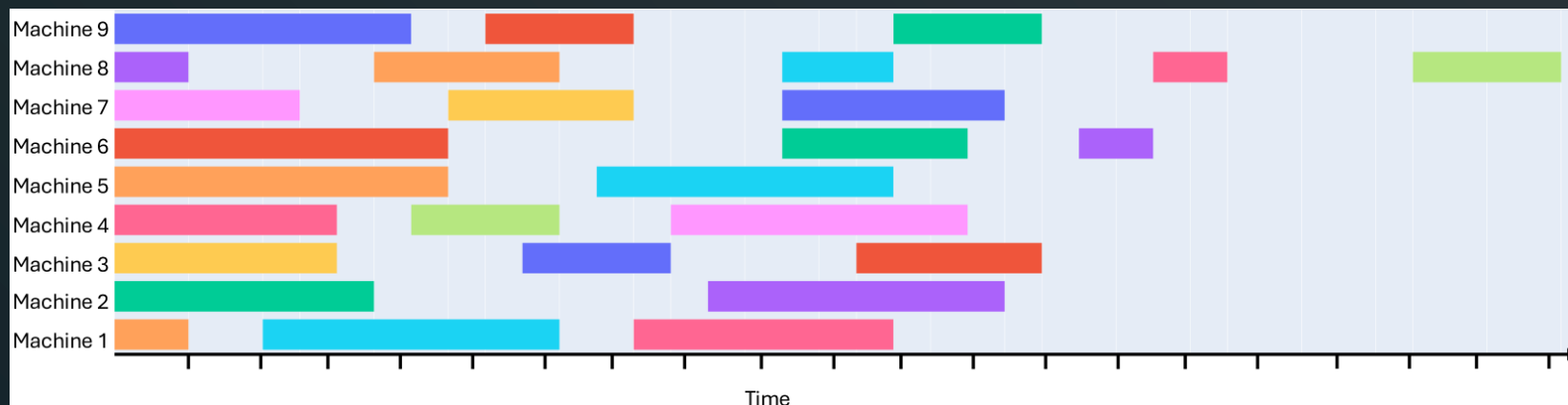
HOW CAN WE REDUCE
PRODUCT MAKESPAN,
IMPROVE MACHINE
UTILIZATION, AND ELIMINATE
EXPENSIVE OVERTIME
SHIFTS?



20'000+ JOBS

ENHANCE JOB SHOP SCHEDULING

PRODUCTION PLANNING



Results of initial Proof of Technology:

- **61% improvement in makespan**
- Eliminate costly weekend shifts
- Reduce number of late jobs by 27%
- Potential to increase capacity with additional makespan

MACHINE LEARNING

MOON
LIGHT_{AI}



RESEARCH CHALLENGE

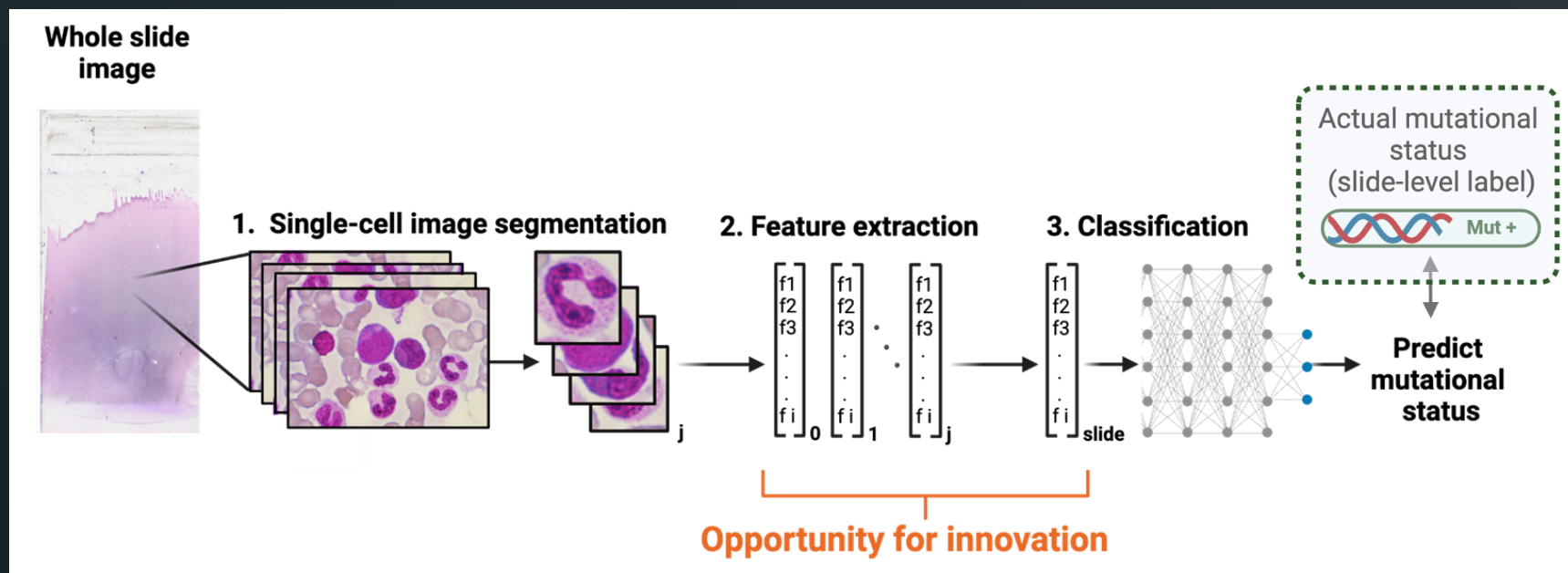
CAN QUANTUM ALGORITHMS
IMPROVE THE PREDICTION OF
NMR SIGNALS?



WORKFLOW REDUCED
FROM OVER 10 DAYS TO
HOURS

MEDICAL DIAGNOSTICS

COMP. PATHOLOGY WITH QUANTUM MULTIPLE-INSTANCE LEARNING (MIL)



- Detection/classification of cell morphologies is conducted using image recognition and MIL AI tools
- Feature aggregation is a computationally intensive step for such a use case
- Quantum algorithms may allow better slide-level representations to help build improved detection models

SIMULATING NATURE



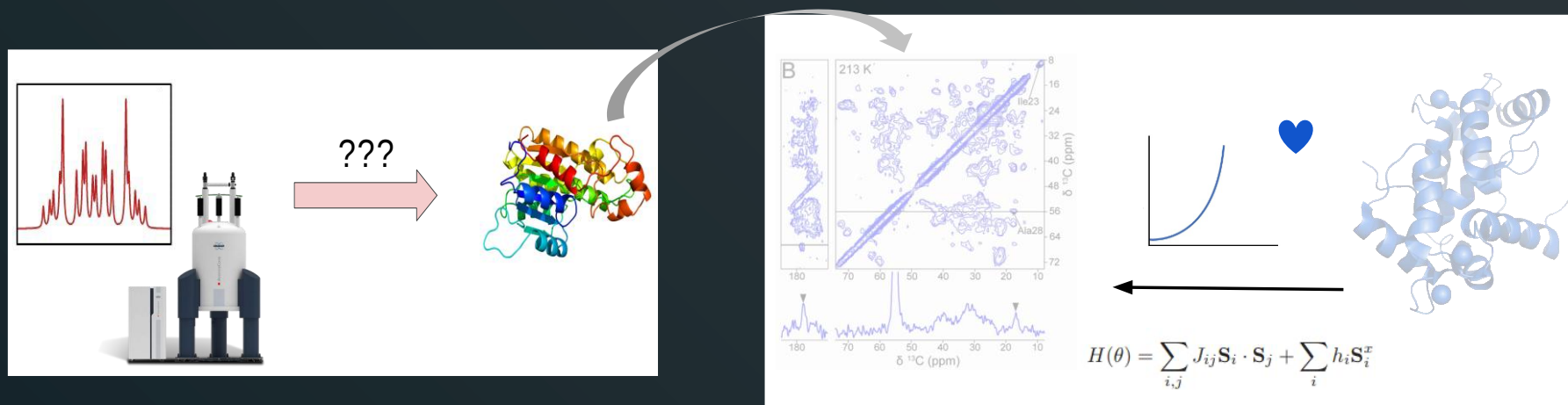
RESEARCH CHALLENGE

CAN QUANTUM ALGORITHMS
IMPROVE THE PREDICTION OF
NMR SIGNALS?



CHEMICAL ANALYSIS, MATERIAL SCIENCES & DRUG DISCOVERY

SIMULATING NMR SIGNALS FOR DESIGNING NEW MATERIALS AND DRUGS



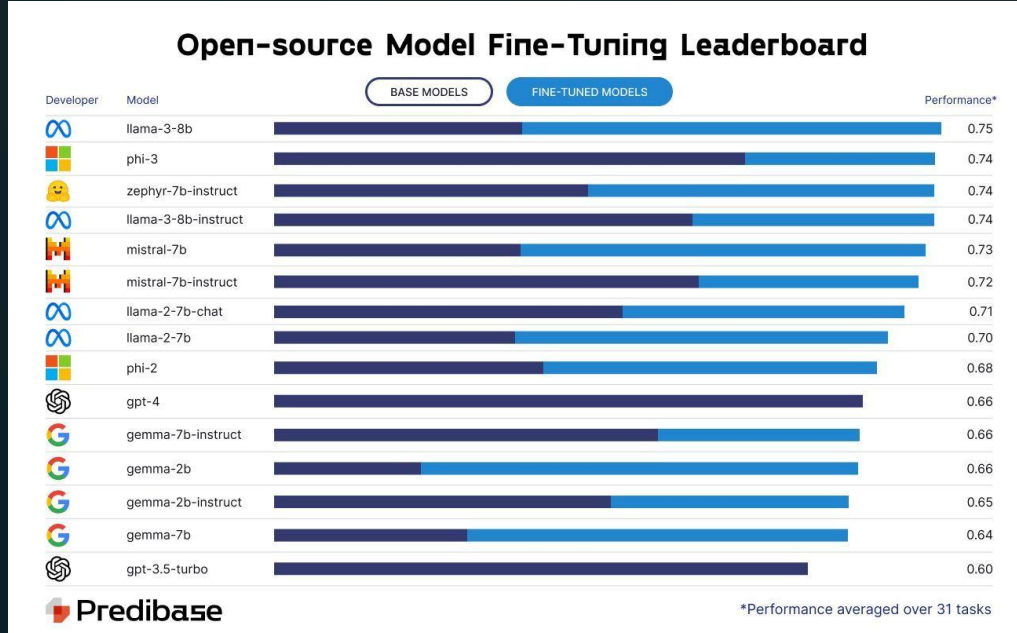
Nuclear magnetic resonance (NMR) is very powerful to get insights into molecular structure.

BUT! It is hard to interpret NMR spectroscopy signals...

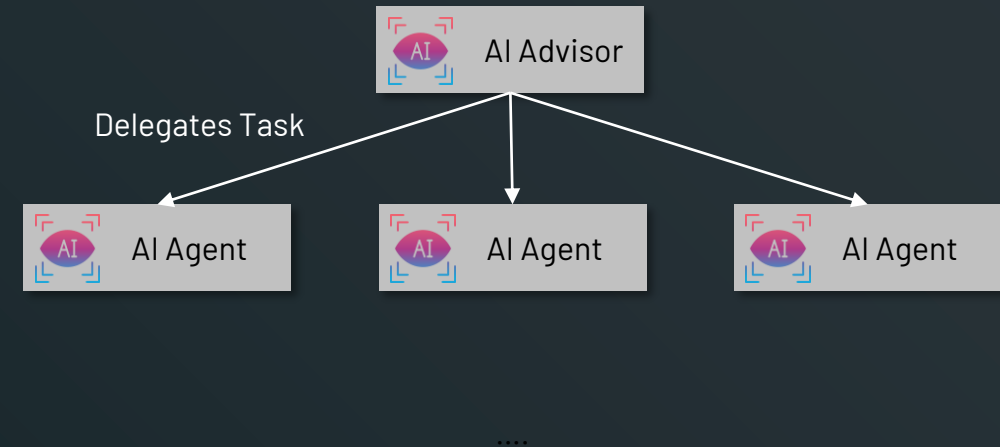
- No fast and automated solution to interpret NMR spectroscopy signals: still being done manually
- We need to precisely understand how a (complex) molecule's structure affects its NMR signal
- Quantum algorithms may allow prediction of NMR signals with an accuracy beyond the reach of classical simulations

QuantumBasel focuses its AI efforts on fine-tuning of LLMs & AI Agent Workflows

LLM Fine-Tuning



AI Agent Workflows



Generative AI fine-tuning for rare cancer case recommendations

Genomics Report Analysis

Genomics Report

Reports

Example Results

Query: "What are the recommendations for clinical trials?"

Baseline:

... Based on the provided context, the recommendation for clinical trials is related to the PIK3CA gene with the H1047R alteration. It is suggested to consider clinical trials involving a PD-L1 inhibitor alone or in combination with a CTLA-4 inhibitor, especially in cases where the tumor mutational burden (TMB) is 228 Muts/Mb or approximately equivalently 14 Muts/Mb as measured by the assay. **This recommendation is based on a Phase 2 study in colorectal cancer ...**

Retrained:

1. NCT05306340 - **A Phase 3 study** evaluating the Efficacy and Safety of Giredestrant Plus Everolimus Compared With Exemestane Plus Everolimus in Participants With Estrogen Receptor-Positive, HER2-Negative, Locally Advanced or Metastatic Breast Cancer (evERA Breast Cancer). This trial targets ER, mTOR, Aromatase.
2. NCT05501886 - **A Phase 3 study** evaluating Gedatolisib Plus Fulvestrant With or Without Palbociclib vs Standard-of-Care for the Treatment of Patients With Advanced or Metastatic HR+/HER2-Breast Cancer (VIKTORIA-1). This trial targets CDK6, ER, CDK4, PI3K-alpha, PI3K- gamma, mTORC1, mTORC2

90%
Reduction of text
reading and analysis
work

24%
more energy efficient

ORIGINAL TEXT		GENOMIC FINDINGS
observed here, are predicted to be oncogenic ^{95,96} .		
GENE PTEN		
ALTERATION T1047C		
HGV variant NM_000314.4:c.955dup (p.T1047R)		
VARIANT CHROMOSOMAL POSITION chr10:89720833		
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 ^{90,91,92} . 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+) HER2- metastatic breast cancer (12.8 vs. 4.6 months, HR=0.44) ⁹³ , respectively ⁹⁴ . 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 ⁹⁵ . Despite promising initial results in earlier trials ^{94,95} , the Phase 3 IMbunit330 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) ⁹⁶ or HR+ HER2- breast cancer ⁹⁷ .		
— Potential Resistance —		
In the context of breast cancer, clinical and preclinical evidence suggests that PTEN loss or mutation may predict resistance to PI3K inhibitors alone ^{43,92} or in combination with aromatase inhibitors ⁹⁸ or fulvestrant ⁹⁹ , as well as cross-resistance to CDK4/6 inhibitors such as palbociclib, ribociclib, and abemaciclib in combination with endocrine therapy ¹⁰⁰ . 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 ^{101,102} and have been detected as emergent alterations for patients with progressive disease ¹⁰³ .		
FREQUENCY & PROGNOSIS		
PTEN mutations have been reported in up to 6.4% of breast invasive carcinomas, including invasive ductal and invasive lobular carcinomas ^{94,102} . Loss or reduction of PTEN expression has been observed in 38% of invasive ductal breast carcinomas and has been correlated with metastasis and poor patient prognosis, including decreased 2-year disease-free survival ^{104,105} .		
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 ⁹⁴ . Alterations such as seen here may disrupt PTEN function or expression ^{104,105} .		
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) ¹⁰⁶ . 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-Ravichs syndrome (BRRS), PTEN-related Proteus syndrome (PS), and Proteus-like syndrome ^{95,107} . The mutation rate for PTEN in these disorders ranges from 20 to 95% of patients ^{95,107} . The estimated incidence of Cowden syndrome is 1/200,000 which may be an underestimate due to the high variability of this disorder ⁹⁶ . Given the association between PTEN and these inherited syndromes, in the appropriate clinical context, germline testing for mutations affecting PTEN is recommended.		

Our Ecosystem to accelerate your Innovation



The international Center of Competence for Industry 4.0



Technology & Innovation
Sustainability | CO2-free
site by 2028



New Work



The Center of Competence for Quantum Computing & AI.

The **first commercial quantum hub** in Switzerland.



Expert Knowledge
Professional Enablement
Project Delivery
Technology Access



Access to
Quantum Computing



Access to **AI**
infrastructure



Access to
Startups



Academia



Partners



Get in Touch with our Team



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