ORCA Computing

Scalable quantum computing

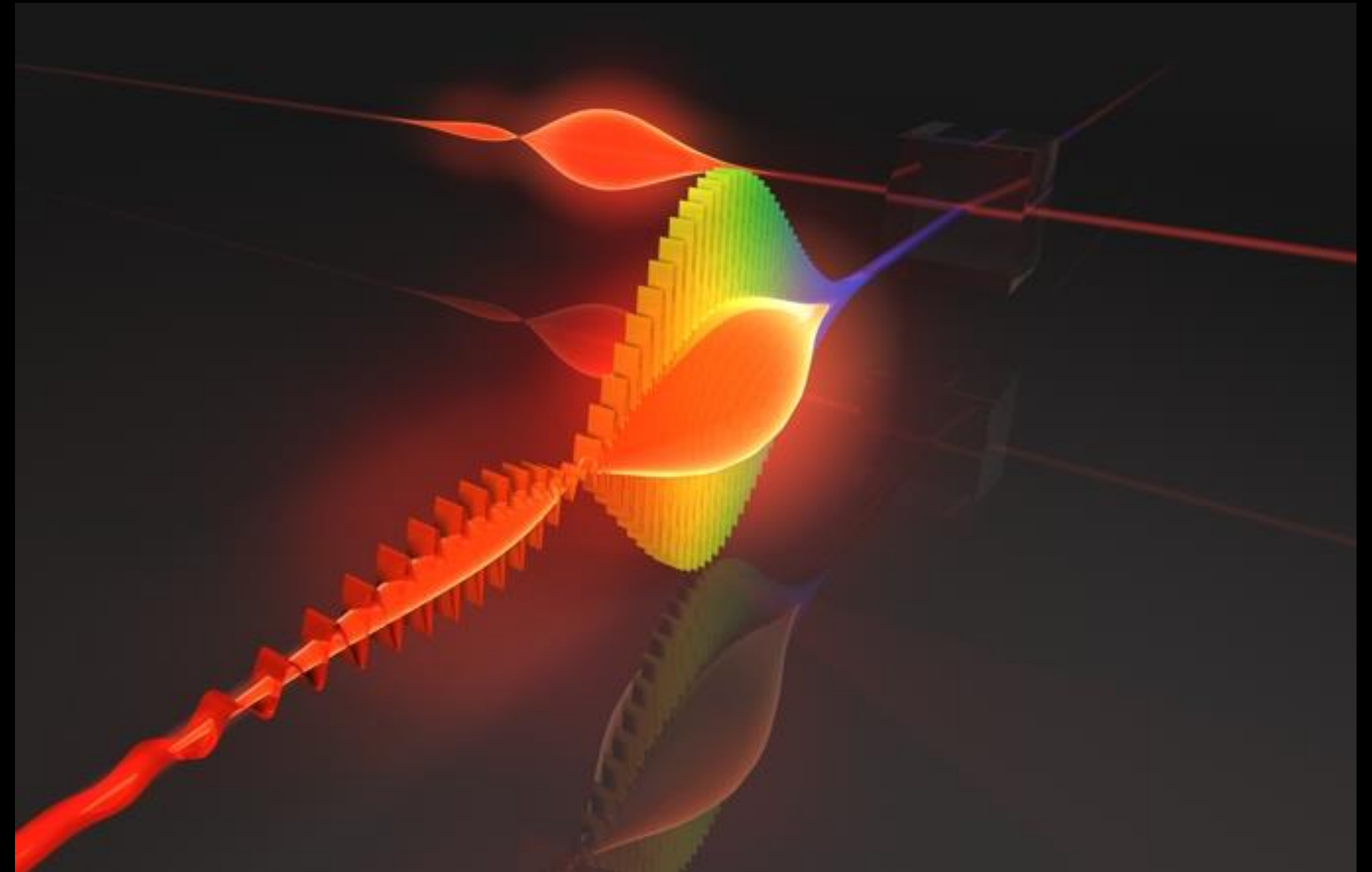*Powered by quantum memories*

DECEMBER 2021

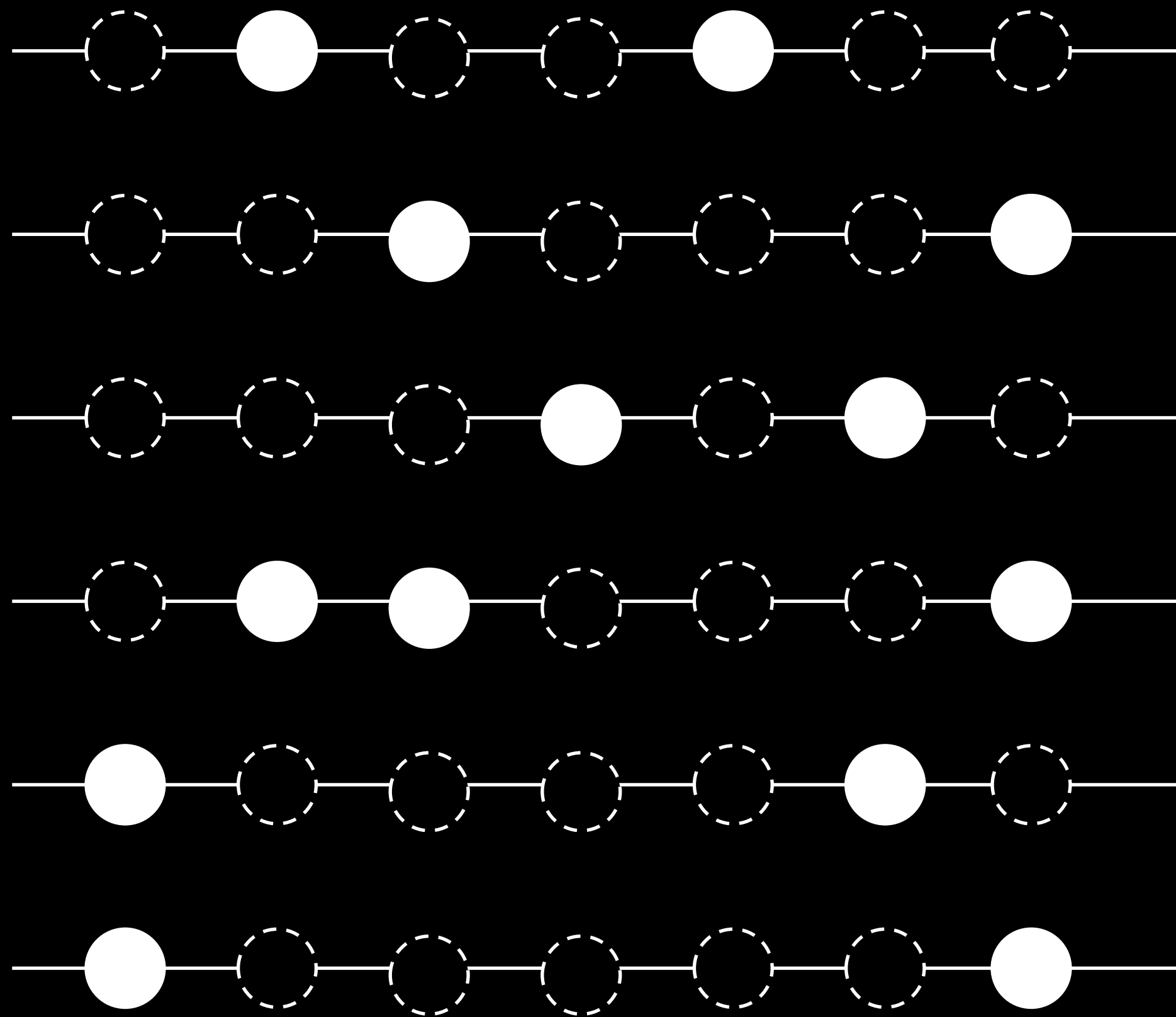# Photonics: the perfect carrier of quantum information

Robust against noise

Possibility for room temperature

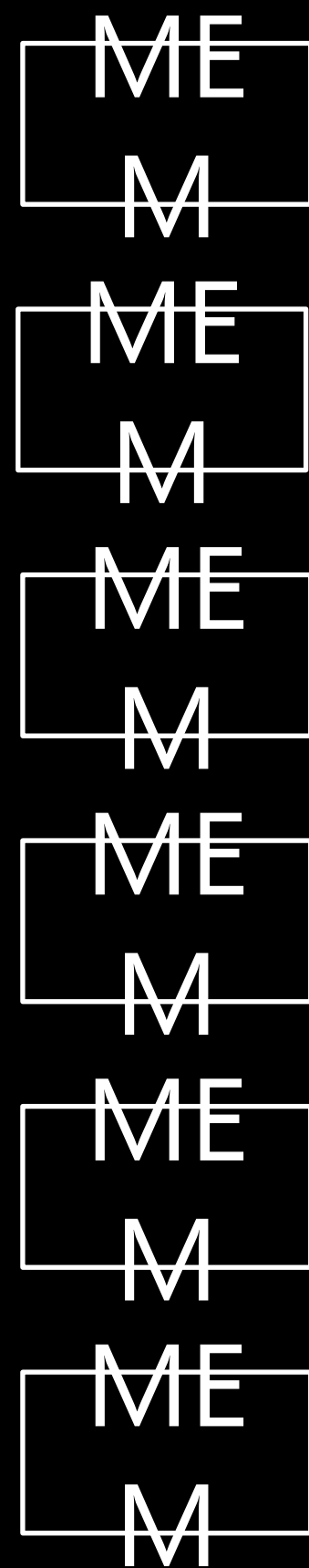Very fast, high connectivity and modularity

Rich connectivity/higher dimensionality coupling leads to possibilities for better error-correction
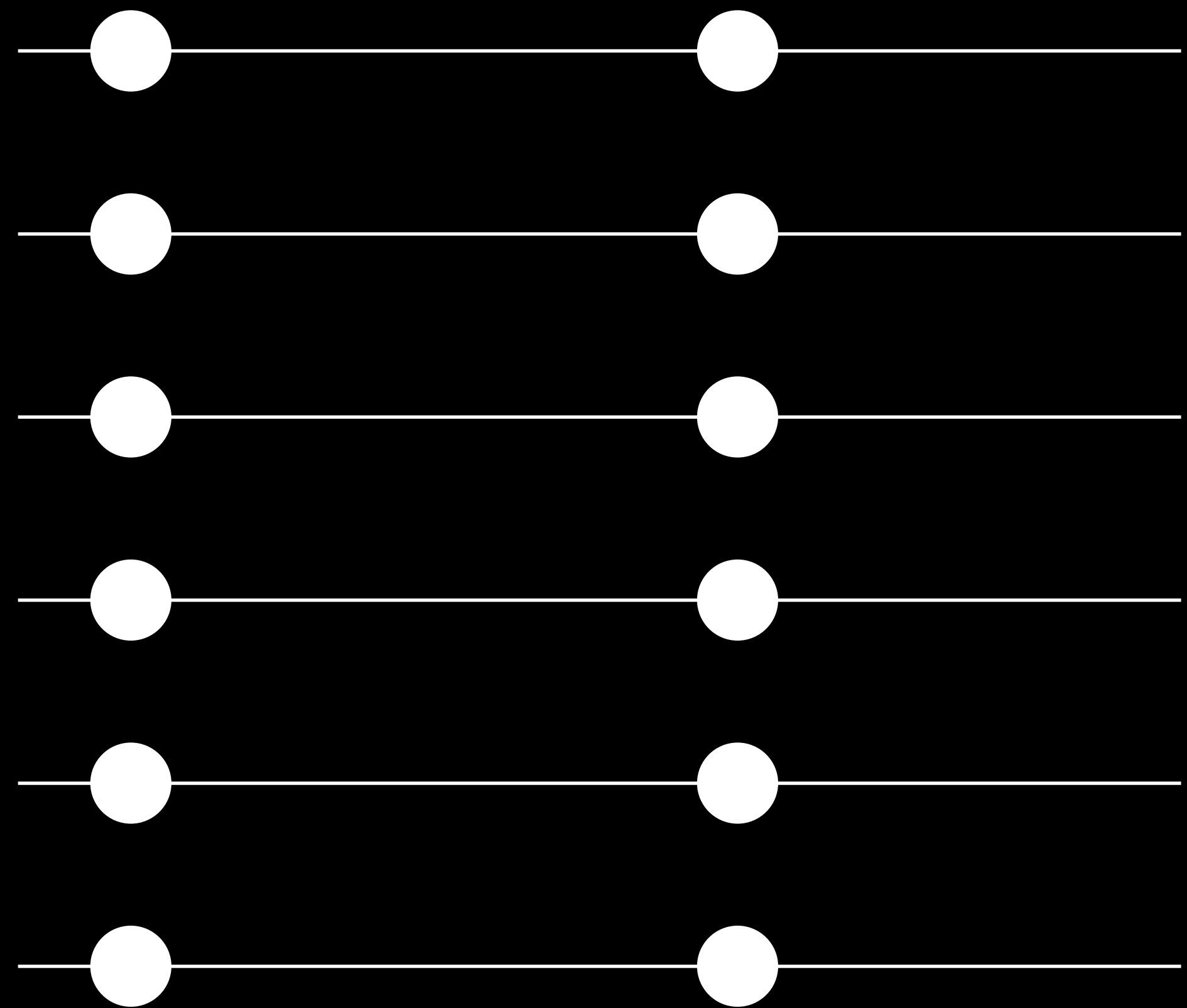
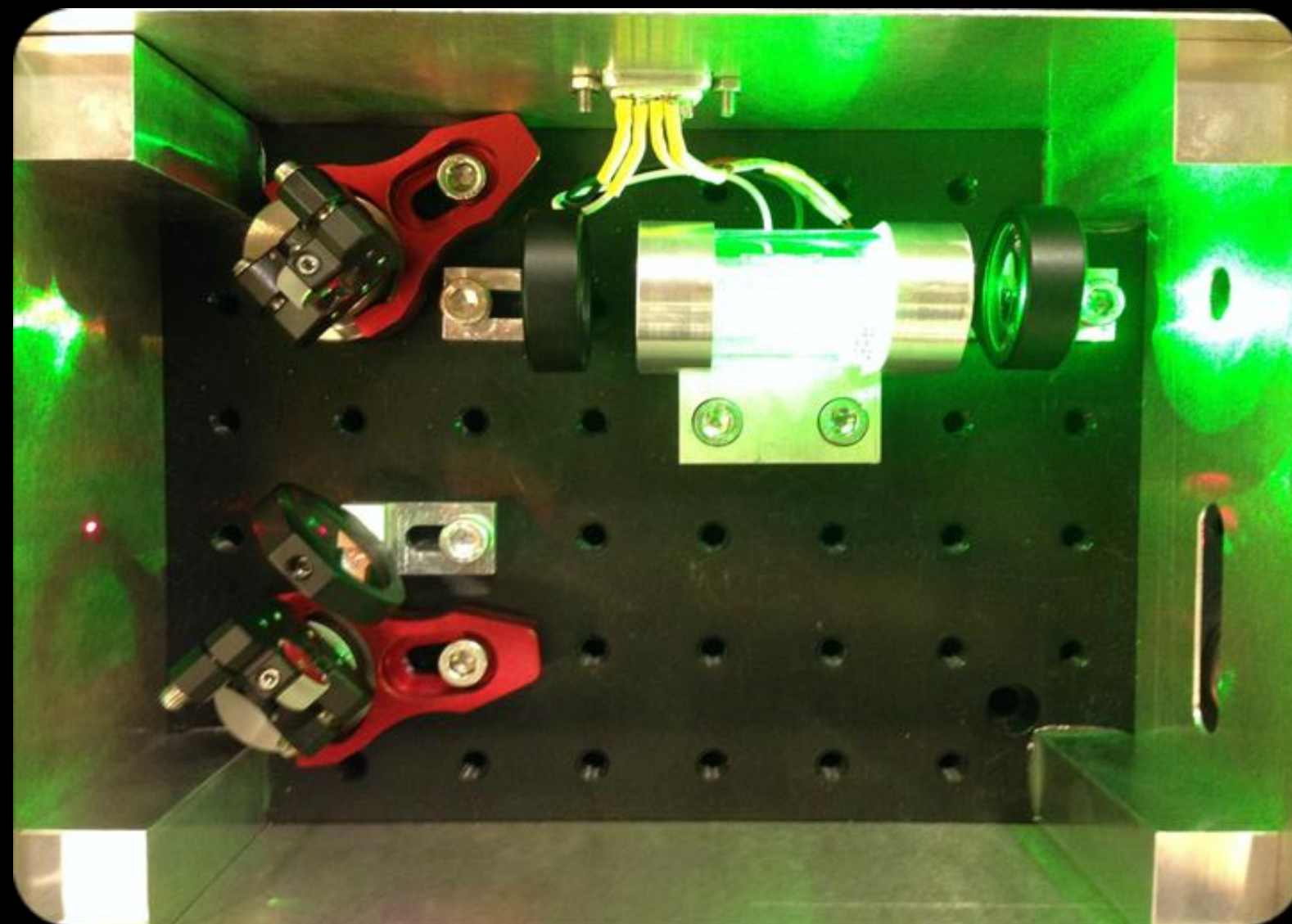# ORCA memory (in 1 slide)

Probability and uncertainty

ORCA Memory

Stability and determinism

The solution: ORCA Quantum Memory

Allows 'temporal multiplexing'- a buffering operation which selects successful events in time

Memory features:

High bandwidth / on demand storage and retrieval of single photons
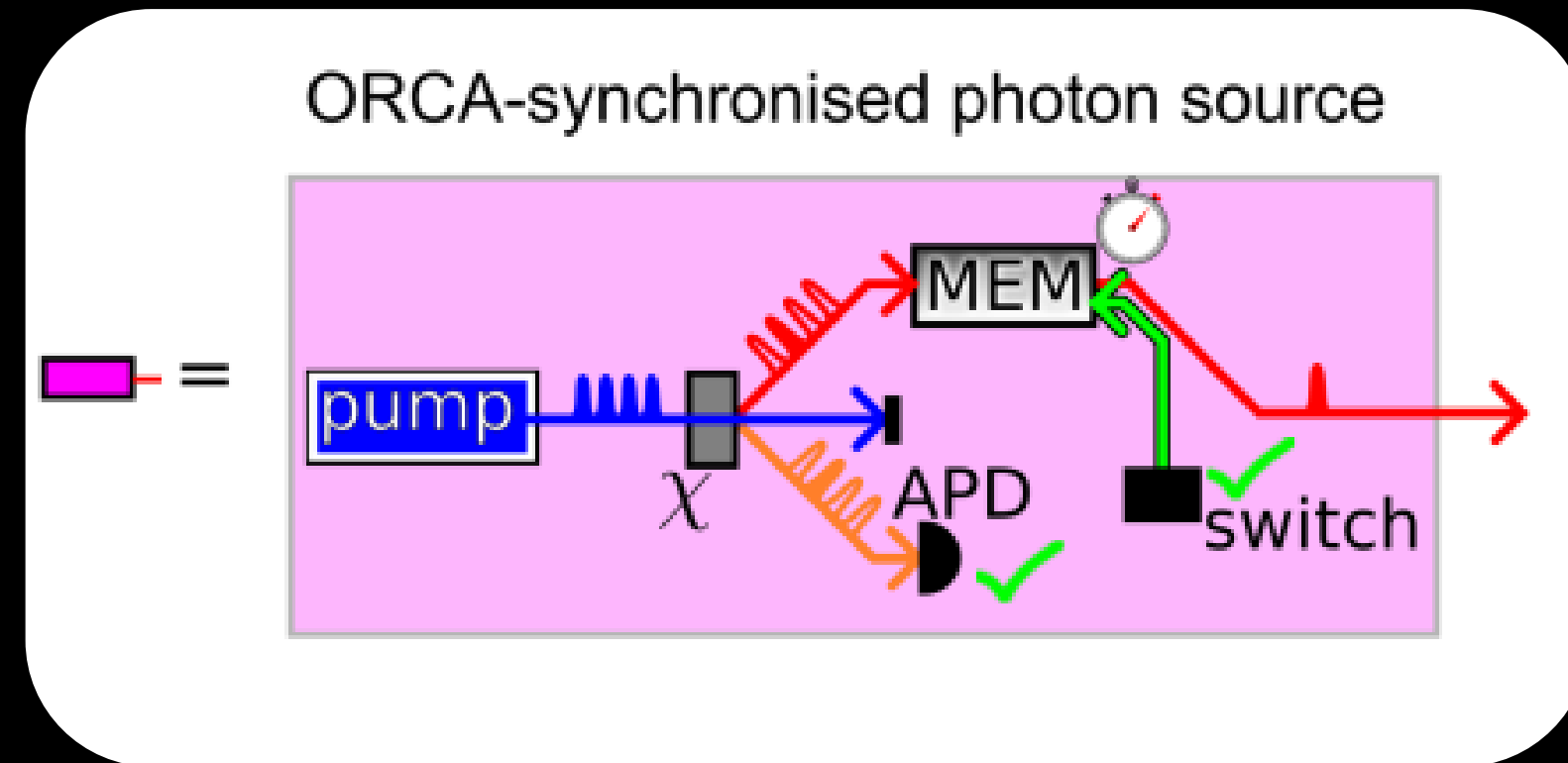
Synchronization and buffering of quantum operations

<2ns control demonstrated with~100ns memory lifetime makes this a highly unique, ultra high-speed switch

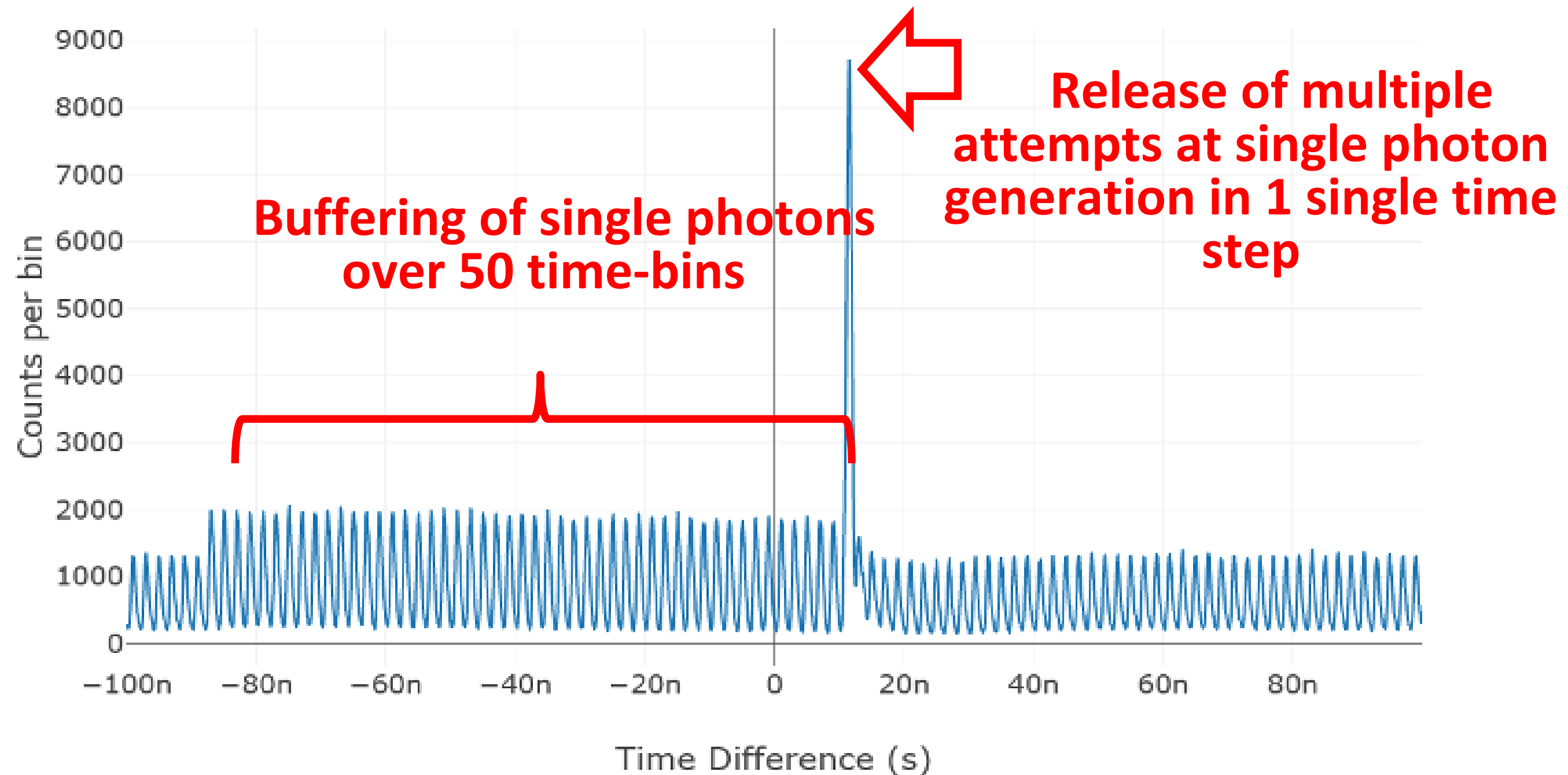Already exhibiting 50%+ efficiencies, with further gains to be had in the next 12 months
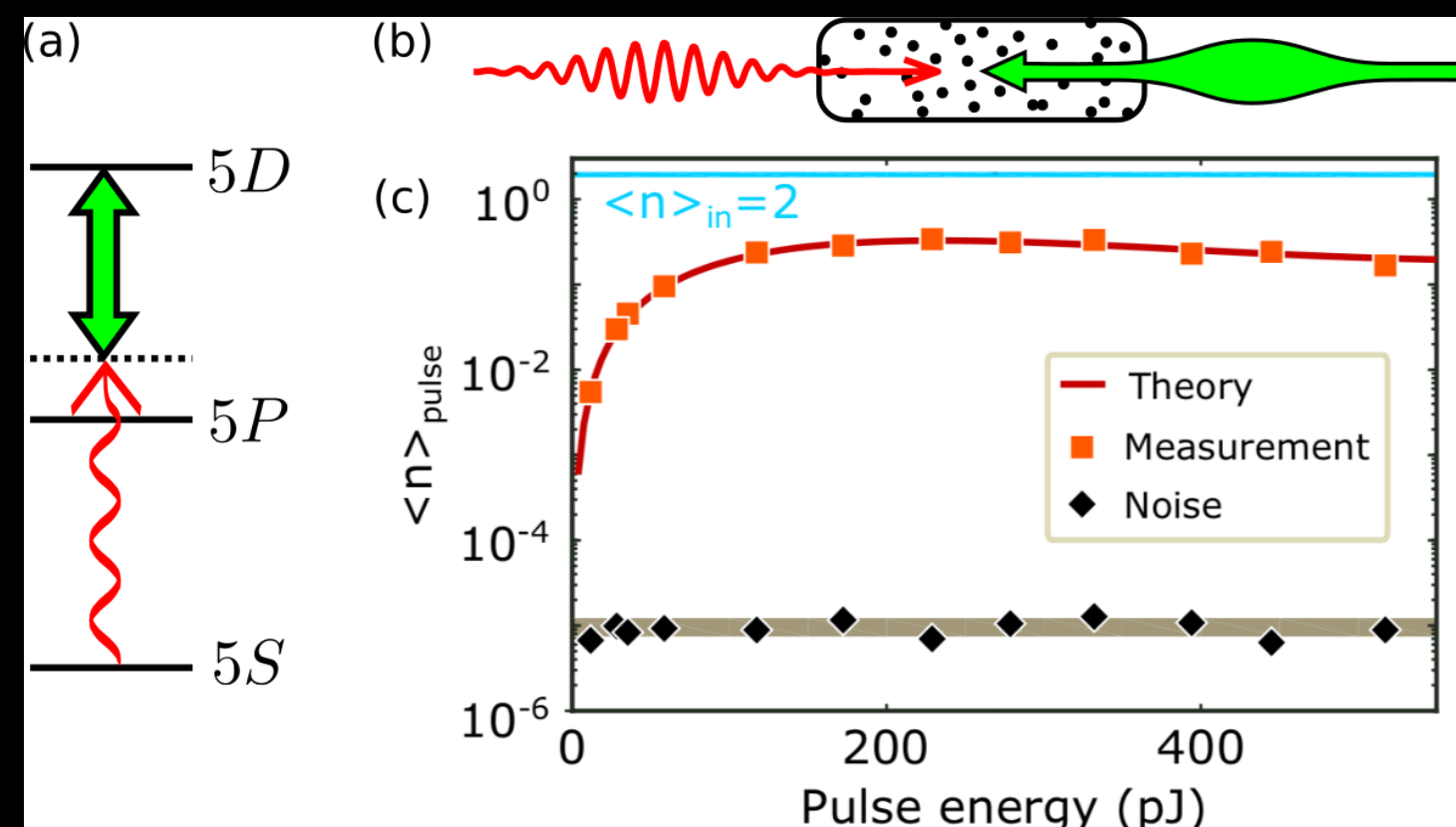
Allows the benefits of photonics to be realized with low-loss, optical fiber-based architectures

Atomic quantum memories

ORCA-synchronised photon source

ORCA memory provides efficient light-matter coupling allows *multiplexing* (world first)

Buffering of single photons over 50 time-bins

Release of multiple attempts at single photon generation in 1 single time step

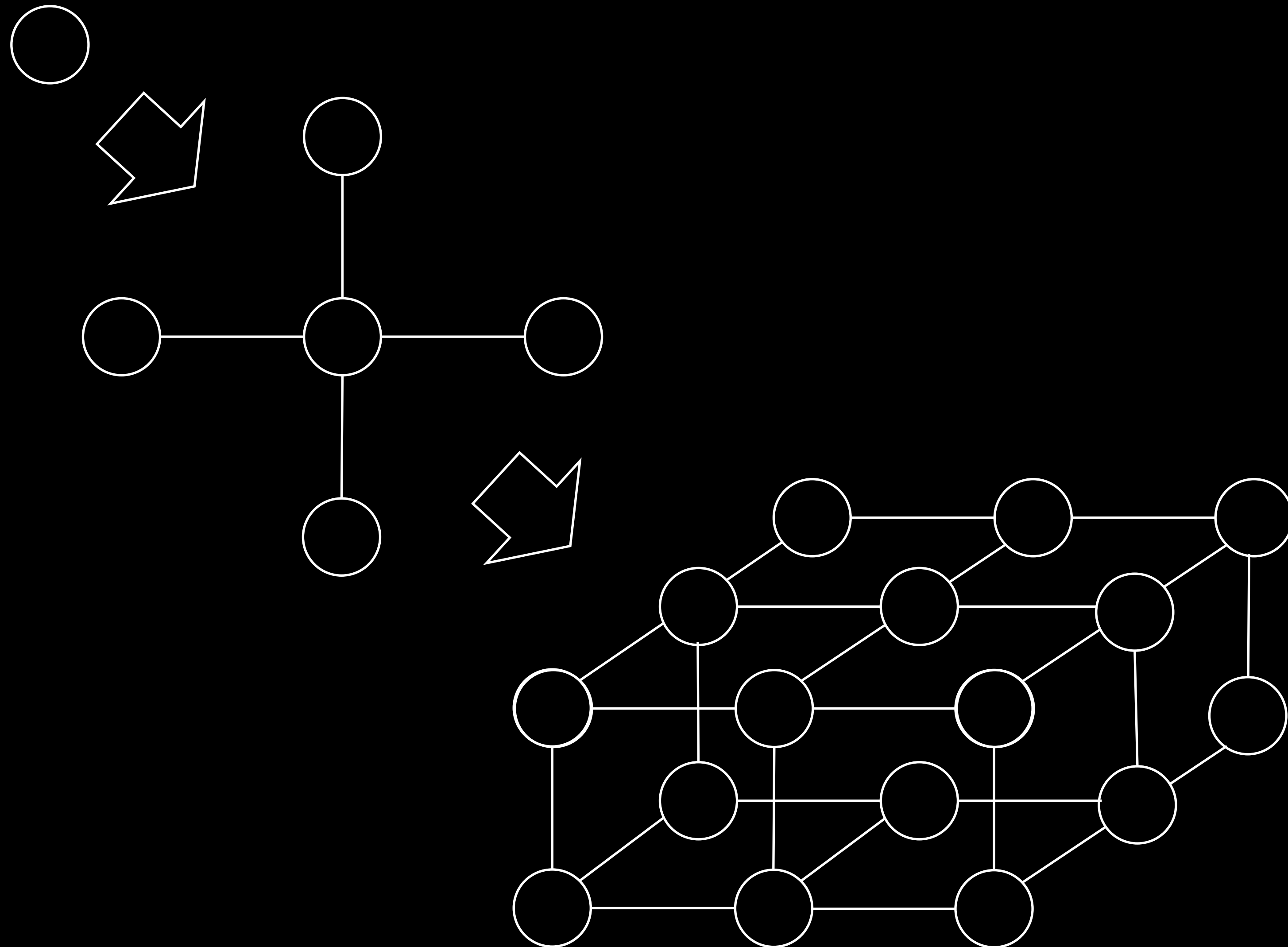# Repurposing standard telecoms components, rather than reinventing the wheel

ORCA's platform combines mature optical-fiber and telecoms technology
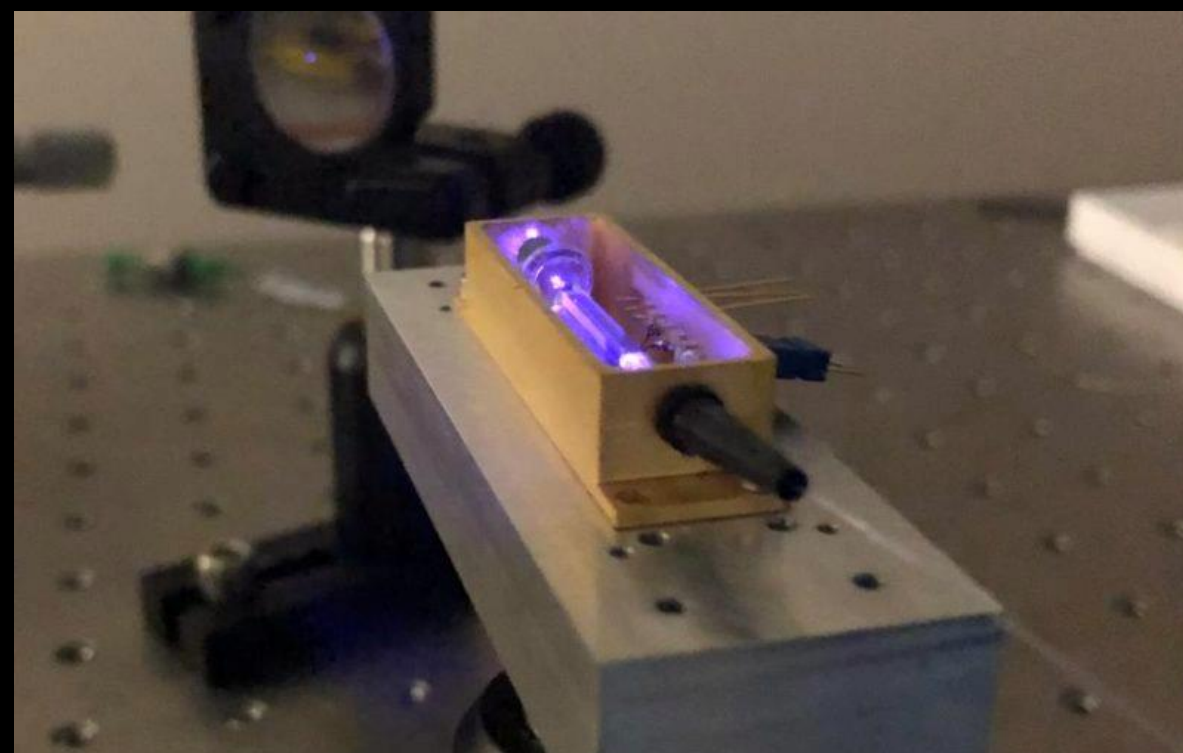
with off-the-shelf quantum optics tools

Spatially-encoded QC

Memory-synchronized photonic operations for fault tolerance and error correction

ORCA's modular components are repurposed for larger-scale, fault tolerant quantum computing

The ORCA quantum memory is used throughout architecture to buffer/synchronize operation
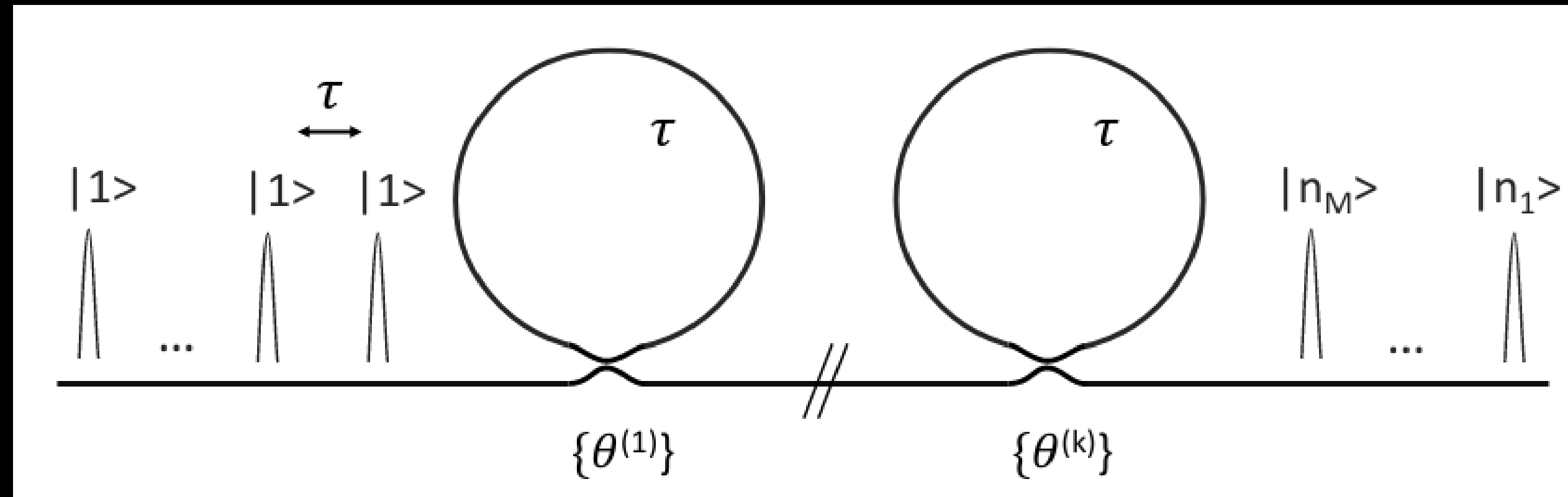
Photonic resource states are used for measurement-based quantum computing
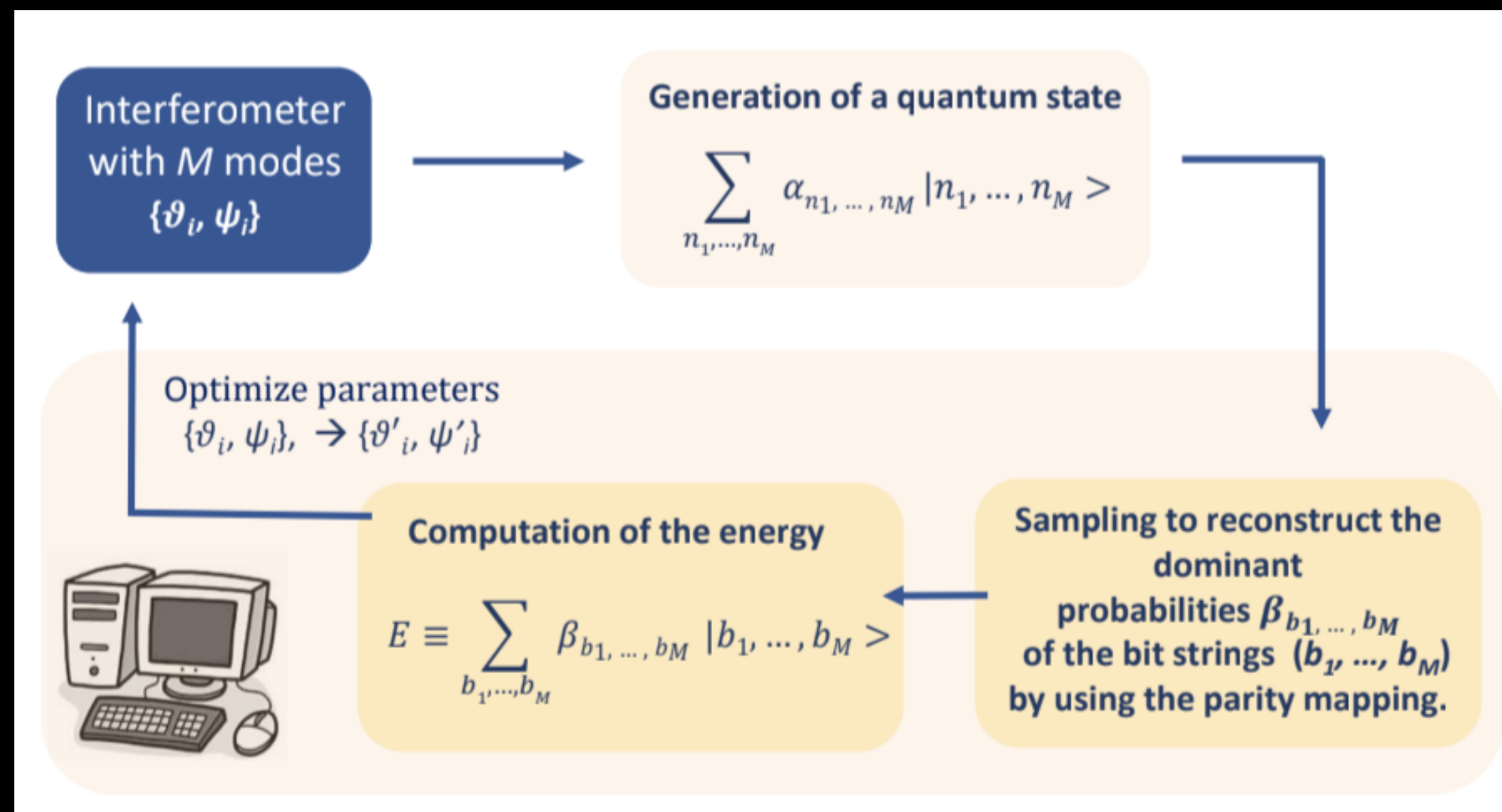
Time-encoded QC

ORCA's PT-Series

- Boson sampling model of quantum computing, with programmable interference

- Photons spread over temporal modes (time-bins)

- Can be integrated in a classical optimisation loop for quantum variational algorithms
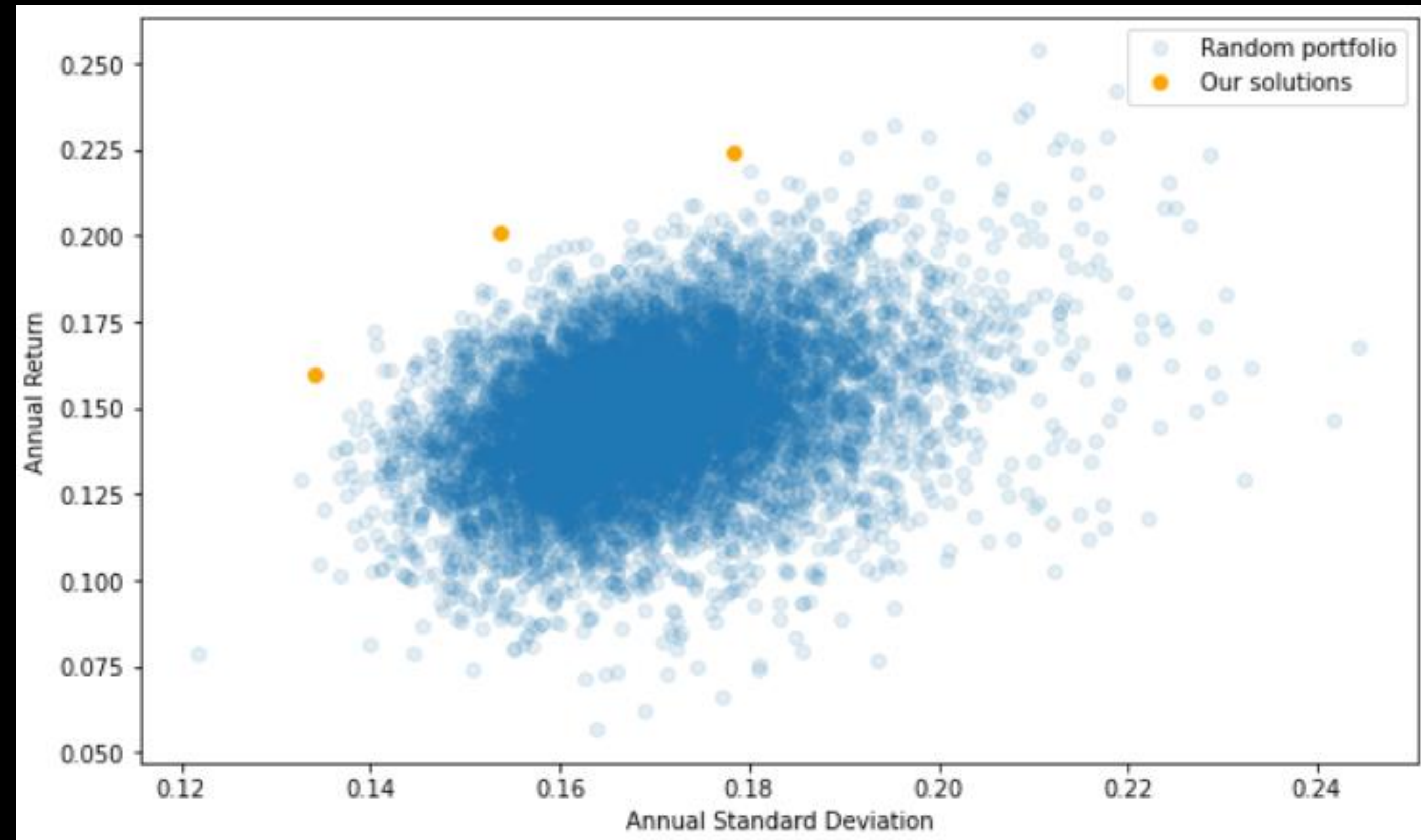
Application to QUBO

- Variational optimisation of the cost function

- The PT-Series generates a broad class of candidate solutions containing a good solution

- Excellent empirical results with a simulated PT-Series up to 100 nodes

QUBO for portfolio optimisation
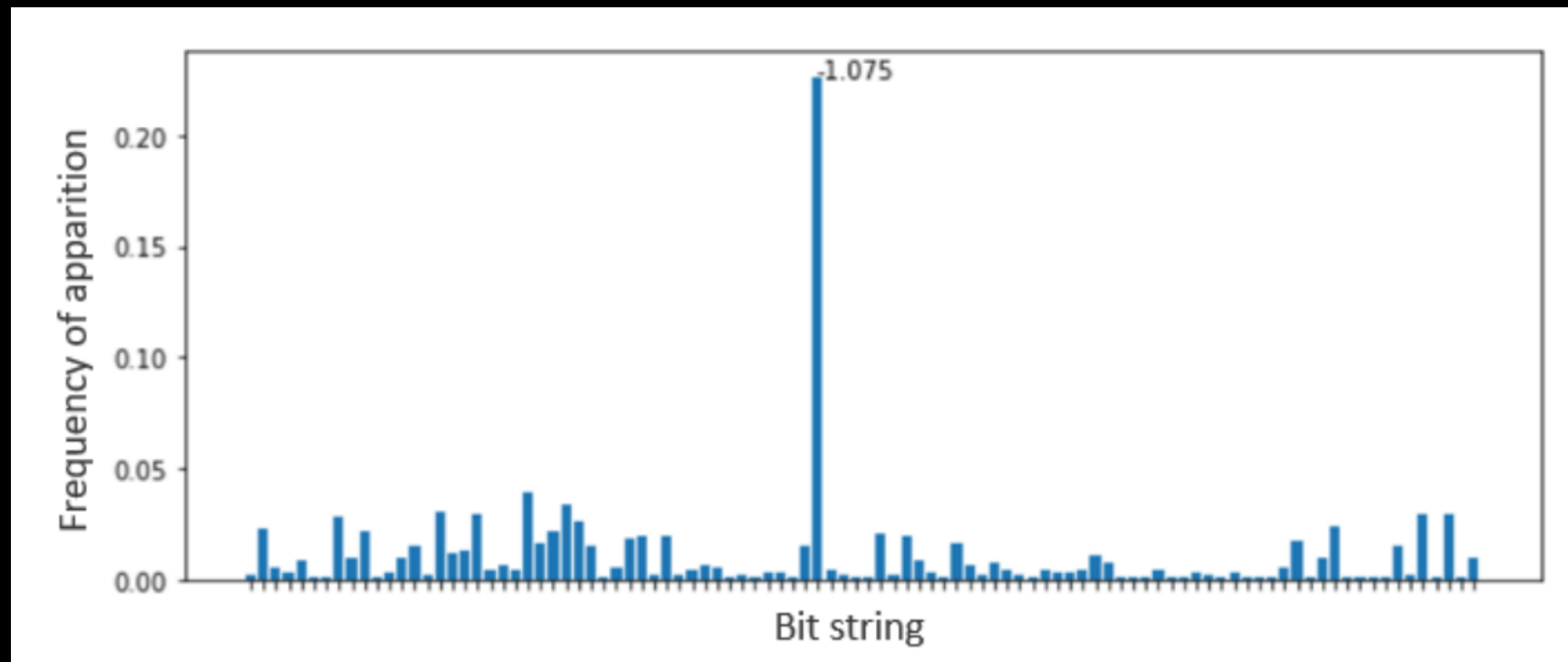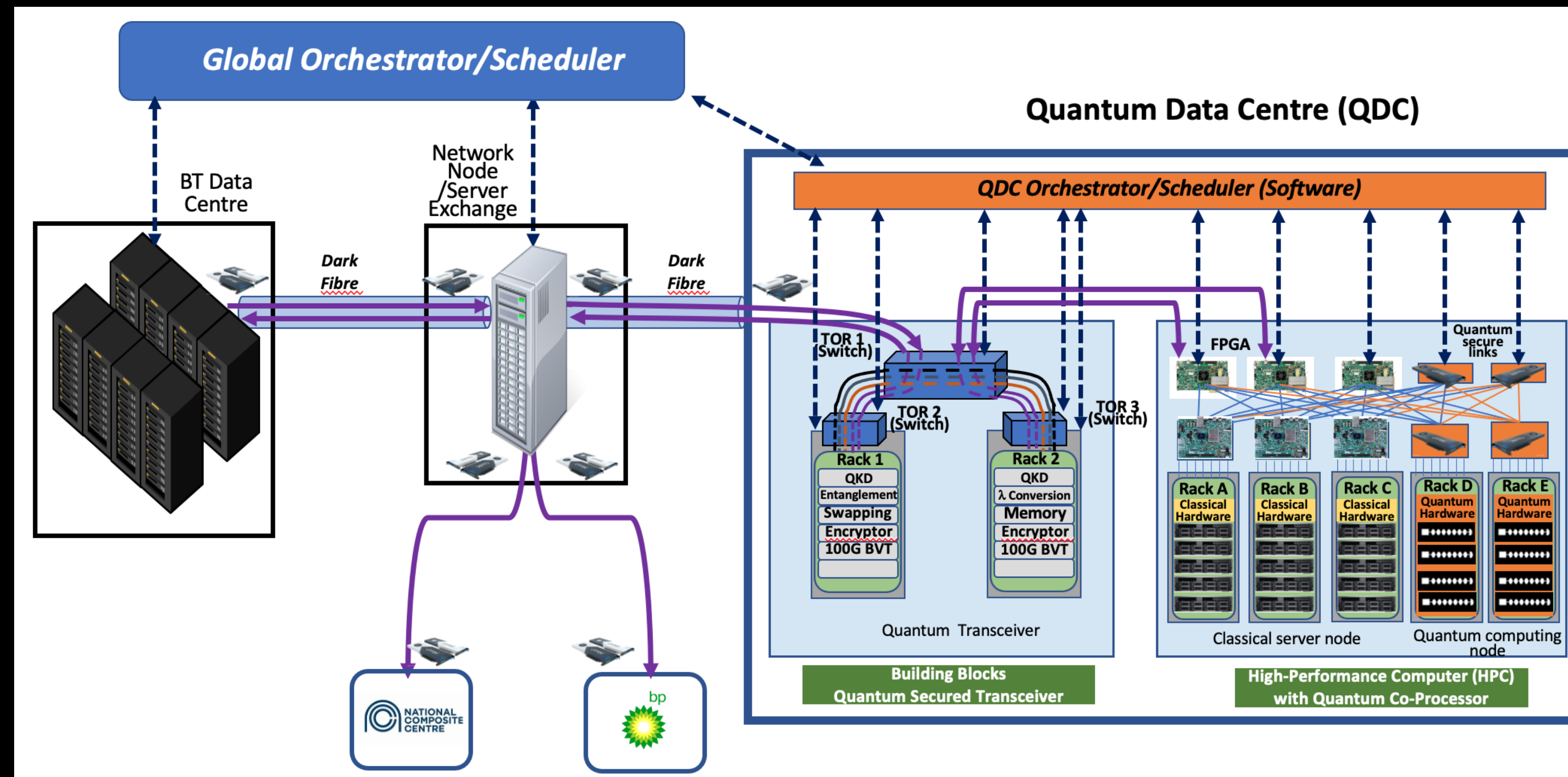

Identified optimum solution

Portfolio of 20 stocks

The future: Integrated QC hardware

ORCA's technology naturally adept at networking with:

- existing high-performance computing & data centres

- quantum networks

- other QC platforms

Partnering with: UKRI Innovate UK · University of BRISTOL · UCL · BT · ZAPATA

Leadership Team

Business and technical experience

Entrepreneur and technology consultant

Previously Innovate UK and EU quantum flagship

PhD Quantum Physics

CEO
Richard Murray

Provost Imperial College

Leading academic in quantum optics

Inventor of the SPIDER laser tool

Previous president of the OSA

CHAIRMAN
Ian Walmsley

CHIEF SCIENTIST

Josh Nunn

ORCA Memory inventor

ARCHITECTURE LEAD

Kamil Bradler

Previous Xanadu
architecture lead

CORPORATE STRATEGY

Michael Piraino

Previous Cray senior executive

PRODUCT LEAD

Kris Kaczmarek

ORCA memory Inventor

HARDWARE LEAD

Jamie Francis-Jones

Single photon expert

ML LEAD

William Clements

QML expert/ previous
consultant

ORCA
Computing

A new approach towards **photonic quantum computing**

Using proprietary **ORCA quantum memory technology**

Leveraging industry standard **optical fiber infrastructure**

With a **world class team**

And a **capital efficient** business model

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