



X A N A D U

Photonic Quantum Computing

AUGUST 2020

Xanadu Overview



Welcome to Xanadu

CEO



Christian Weedbrook, PhD

HARDWARE



Zachary Vernon, PhD

SOFTWARE



Nathan Killoran, PhD

ARCHITECTURE



Ish Dhand, PhD

CLOUD



Rafal Janik, MSc

Team: 60+ people | 40+ PhDs | 15+ nationalities



Founded in **2016**

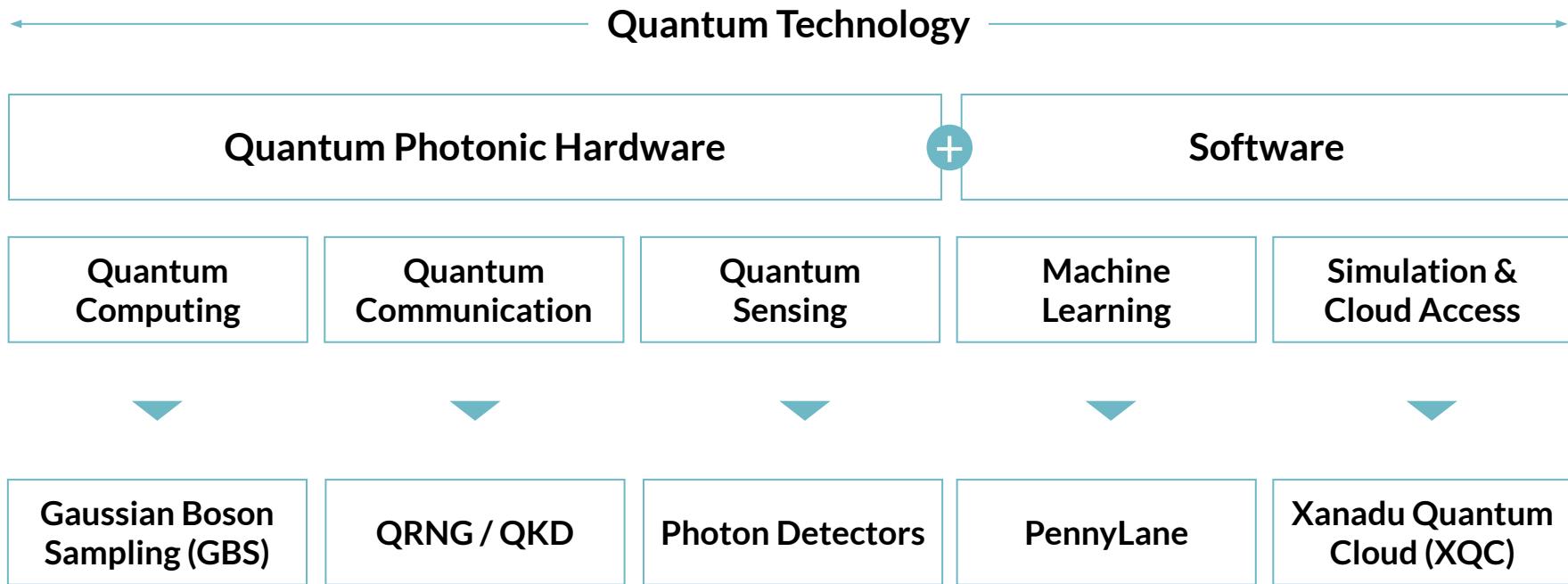
Funding: **\$45M**

Office & Hardware Lab in **Toronto**

Advisors:

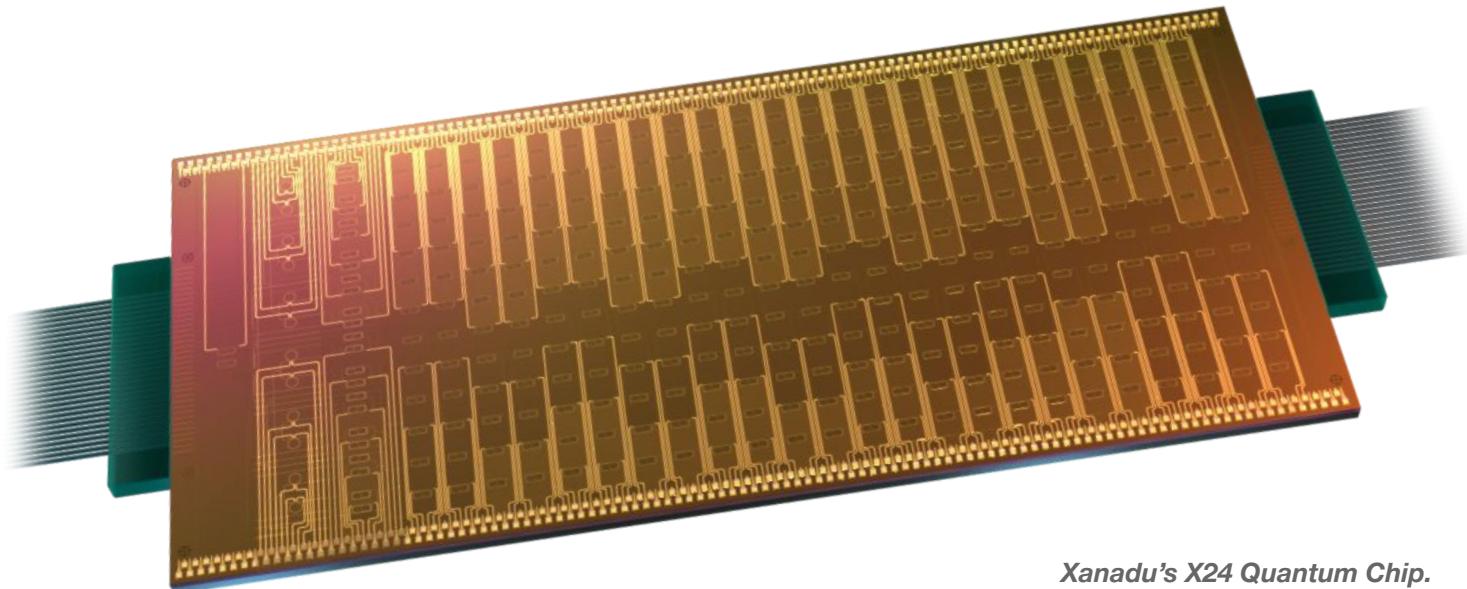


Full-stack quantum technology company



Photonic Quantum Computers

Xanadu designs and develops **integrated quantum photonic chips** that are useful for quantum computing, communication & sensing.



Xanadu's X24 Quantum Chip.

Benefits of Photonics

We are building quantum computers that are **practical & scalable**.

PRACTICAL

NO COOLING

QPU OPERATES AT
ROOM TEMPERATURE

SMALL FORM FACTOR

XANADU'S COMPUTERS
ARE RACK MOUNTABLE

LOWER COST

BUILDING ON TOP OF EXISTING
TELECOM & OPTICS

Room temperature quantum computers are simpler and do not require specialized components, enabling easier mass manufacturing and deployment

SCALABLE

SCALABLE DESIGN

ROADMAP TO
1,000,000+ QUBITS

LOWER CONSUMPTION

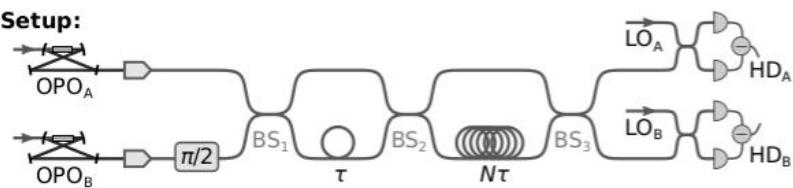
1,000x
LESS POWER

Photonics is the only approach with a clear roadmap to universal quantum computers

Scalability Advantages

Can **multiplex quantum information** in space, frequency, time, etc.

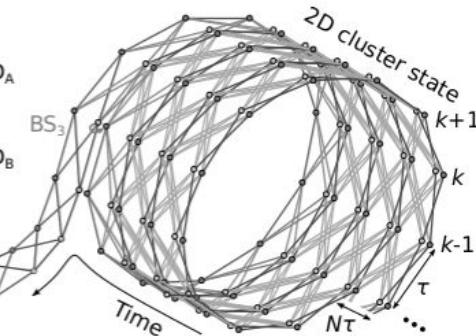
Setup:



Resulting graph:

-1 —
-1/2 — 1/2 —
-1/4 — 1/4 —

Squeezed states EPR states 1D cluster state
A ° ° ° °
B ° ° ° °
BS₁ BS₂



Source: "Deterministic generation of a two-dimensional cluster state", M.V. Larsen et al., Science 366, 369 (2019)

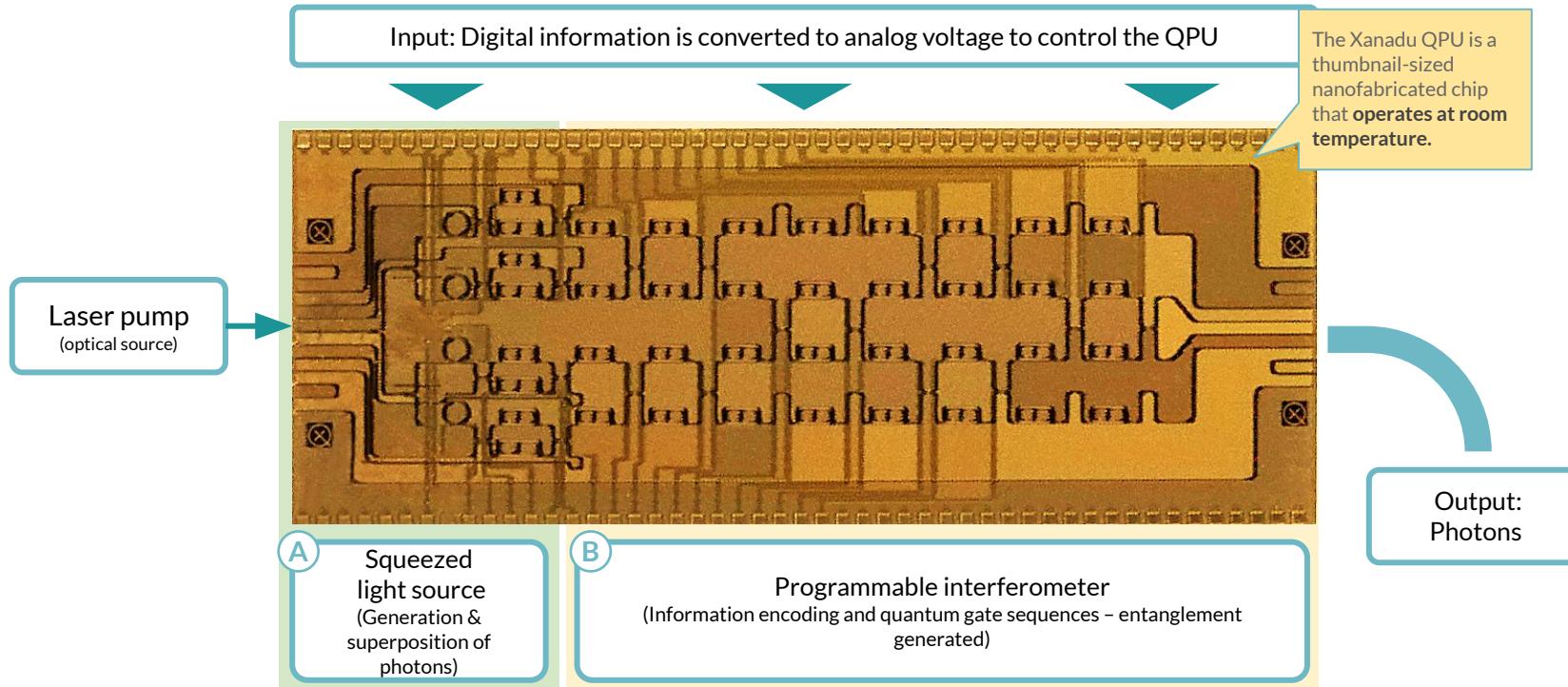


Can also **easily network photonic quantum computers**: optical telecom and fiber optics
(also a major enabler for rapid advancement of quantum photonics: can borrow a lot from existing telecom tools)

Architecture Overview



Integrated Quantum Photonics - How it Works



Xanadu's NISQ roadmap (12-18 months)

	1st Gen	2nd Gen	3rd Gen
X Series	The 1st Integrated photonic chip demonstrating the power of quantum photonics and is limited by restrictions.	XD Series 2nd generation chips will shift to degenerate squeezing , improving connectivity and unlocking additional computational tasks.	XT Series 3rd generation chips will incorporate state-of-the-art time domain multiplexing capabilities , unlocking massive increase in performance.
Modes	4-100	4-50	1,000+
Connectivity	>50%	100%	3D connectivity
Access	Available on XQC: X8, X12, X24	XD4 starting in Q4 2020	XT alpha release Q1 2021
Objective	Quantum Algorithm Prototyping & Research	Demonstration of Quantum Advantage	Demonstration of Scalability: 100K+ Quantum Systems

Note: NISQ is Noisy Intermediate-Scale Quantum

Benefits of Continuous Variable Encoding

Continuous variable = Encoding information in an infinite-level quantum system

Increased dimensionality

Increased information capacity

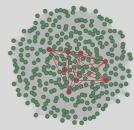
More powerful NISQ-era quantum computers

Unique NISQ-era applications

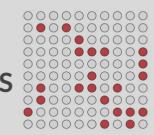
DENSE SUBGRAPH



MAXIMUM CLIQUE



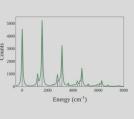
POINT PROCESSES



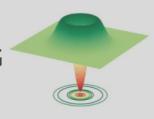
GRAPH SIMILARITY



VIBRONIC SPECTRA



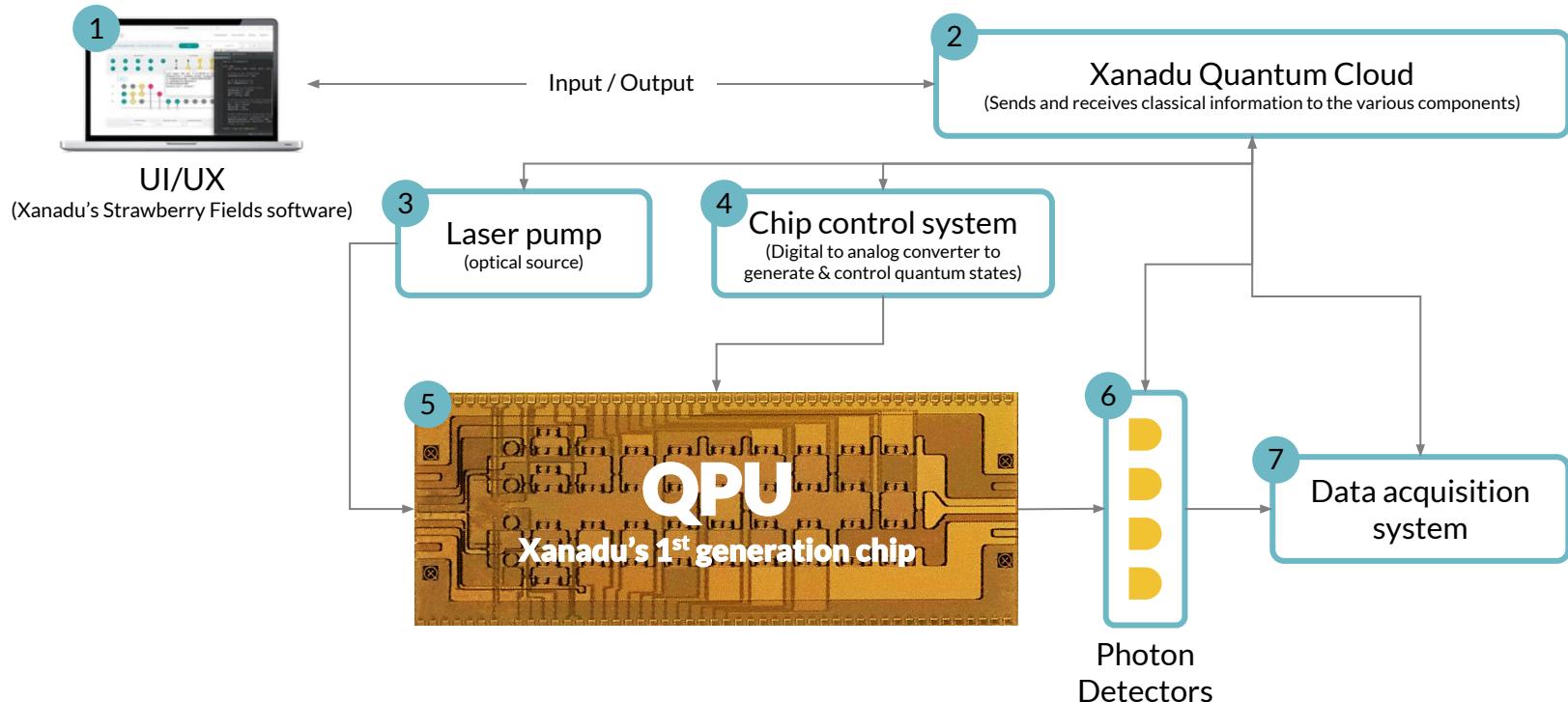
SAMPLING



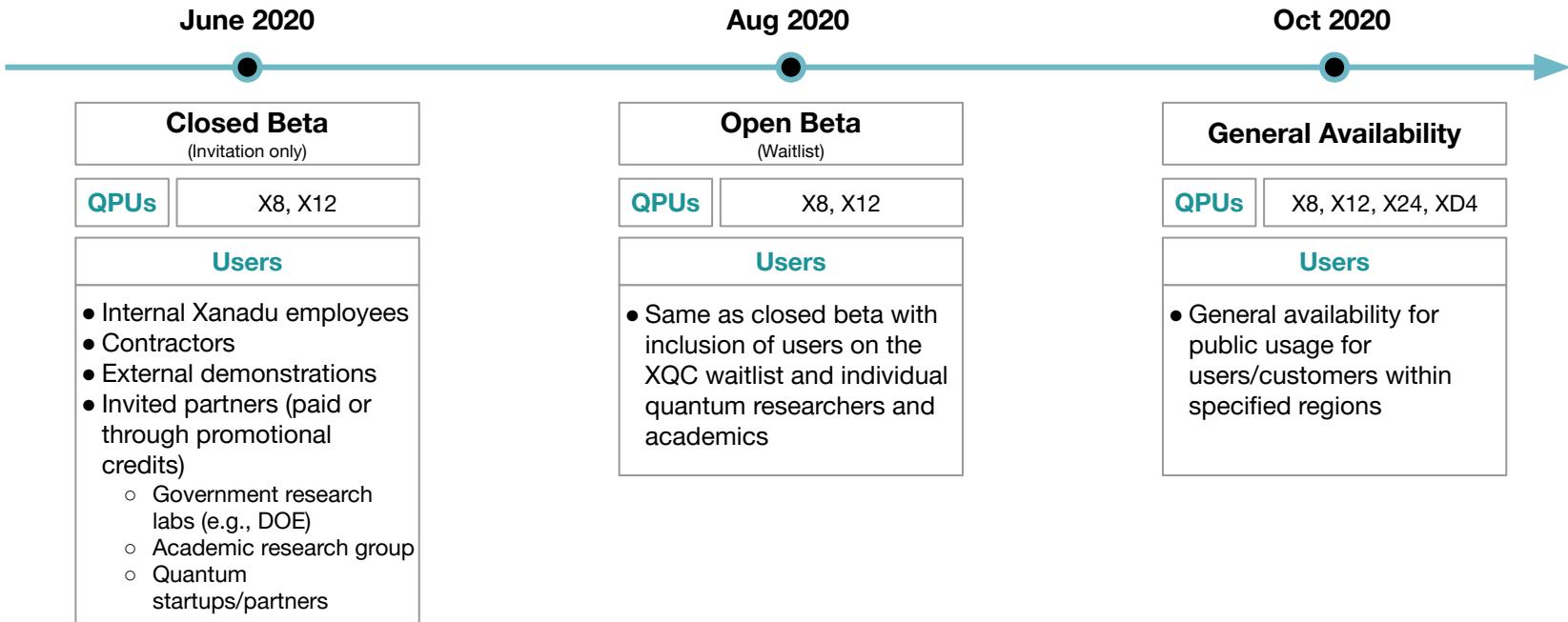
Cloud Access



Xanadu Quantum Cloud (XQC)



XQC - 2020 Roadmap





XANADU

Thank you.