Q.ANT


# Q.ANT NPS

## The Photonic AI Accelerator

Photonic Processor for energy-efficient High-Performance Computing and Real-Time AI Applications available in a 19″ Rack-mountable Server

# Defining the Future of AI Processing

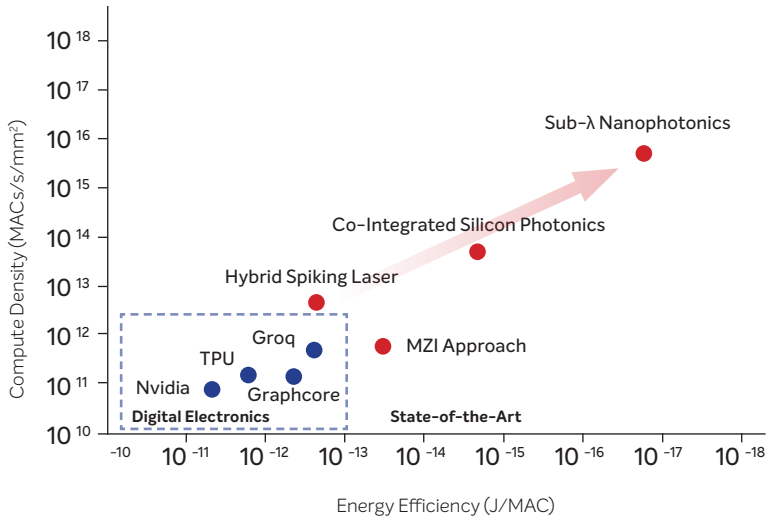
Join a transformative leap in technology – where light meets algorithms to redefine AI processing. Seize the exclusive opportunity to experience Q.ANT's first commercial Photonic AI Accelerator. Based on the innovative Light Empowered Native Arithmetic LENA architecture, this technology will go beyond traditional computing, promising to deliver up to 30 times the energy efficiency of conventional technologies – and thus reducing operational costs and environmental impact of data centers significantly.

The future is built on Q.ANT's Native Processing Server NPS, the first photonic 19" Rack-mountable server with a Photonic AI Accelerator as a PCIe card designed specifically for AI inference and advanced data processing. Plug & play ready to be integrated in datacenters and HPCs for immediate access to photonic computing. Upgradable with additional PCIe cards for even more processing power in the future. The gateway to a new era of computing with the power of light at ease.

Experience the platform where complex, non-linear mathematical models for AI, machine learning, physics simulations, time-series analysis, and graph problems can be executed with unparalleled performance, powered by the pure energy of light and based on the Q.ANT proprietary material Thin Film Lithium Niobate on Insulator. Don't just adapt to the next generation of computing – define it with Q.ANT.


**Leverage Q.ANT technology for harnessing the extraordinary potential of photonic AI acceleration.** Test, innovate, and get hands-on with a technology that promises a sustainable and powerful future. Redefine the possibilities of AI processing – where cutting-edge efficiency will meet the brilliance of light.

# The Potential of Photonic Computing




Source: Nahmias, et al, IEEE J. Sel. Top. Quantum Electron, 26, no. 1 (2019), 1–18.

**High performance:** Photonics can run at few tens of GHz bandwidth compared to few GHz in digital electronics, giving more operations performed per second.

**Inherent parallelism:** Using multiple wavelengths of light to run calculations on the same chip at the same time drastically increases compute density.

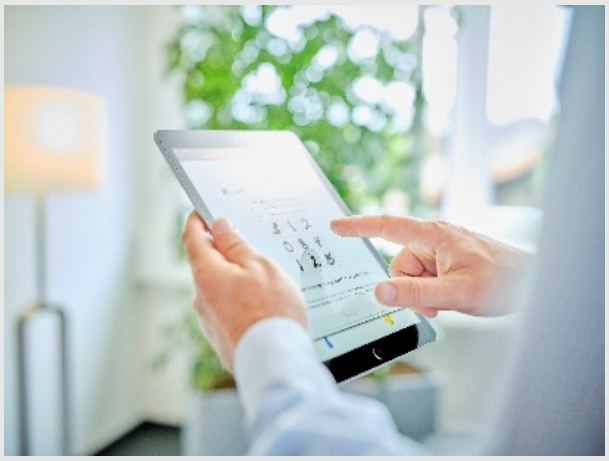
**Better energy efficiency:** Since only light, and no current, is flowing through the circuit, photonic chips have lower cooling requirements. Combining this with higher performance and compute density leads to energy savings.

# The Software Development Kit to use the NPS
## The Q.ANT Toolkit

- The Q.ANT Native Processing Server features an interface known as Q.ANT Toolkit. This interface enables users to operate directly at the multiplication level or to leverage optimized neural network operations, such as fully connected layers or convolutional layers.
- The Toolkit offers a comprehensive collection of example applications that illustrate how AI applications can be enhanced.
- These examples can be used directly or as a foundation for creating own implementations.

| Name | Description | Programming Language |
|---|---|---|
| Digit Recognition | Determination of the number shown in a picture (based on the MNIST data set) | Python (Jupyter) |
| Matrix Multiplication | Multiplication of a matrix and a vector | Python / C++ |
| Speech Recognition | Recognition of spoken English words (based on LibriSpeech data set) | Python (Jupyter) |
| Semantic Segmentation | Segmentation of an image (based on the KITTI data set) | Python (Jupyter) |

# Test Q.ANT's functional cloud application
## Handwriting Recognition



Users can experience the Photonic AI Accelerator by cloud through an exemplary AI showcase: the recognition of handwriting. Users select an image of a handwritten number from the MNIST database. Using a trained neural network, the NPS predicts the number (0–9) and efficiently performs matrix-vector multiplication on the photonic chip. With a recognition accuracy of 95%, this demonstration proves that Q.ANT's NPS can perform complex AI tasks at a reduced power consumption.

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# Technical specifications for NPS

| System / Subsystem | Feature |
|---|---|
| System node | X86 based 19” 4U commercially available rack system |
| Operating System | Linux Debian/Ubuntu with kernel version 5 |
| Network interface | Ethernet with up to 10 Gbit speed |
| Software interface | Python library functions; upgradable to HPC job submission |
| API to subsystem | Linux device driver |
| Photonic AI accelerator | • Full length PCIe card with 3 slot height<br>• PCIe Gen3 x8 interface, shared memory & I/O windows<br>• Upgradable with enhanced photonic integrated circuits<br>• Upgradable with enhanced logic functions for performance |
| Power consumption of photonic AI accelerator | 30 W |
| Photonic integrated circuit (PIC) | Ultrafast photonic core based on z-cut Lithium Niobate on Insulator (LNoI) |
| Throughput of photonic AI accelerator | 100 MOps |
| Cooling of photonic AI accelerator | Passive |
| Operating temperature range | 15 to 35°C |

All specifications may be subject to change without advanced notice.

# Photonic Integrated Circuit PIC at the heart of NPS

At the heart of this innovation is Q.ANT’s proprietary Thin Film Lithium Niobate on Insulator PIC, which offers precise light control at the chip level.
Q.ANT controls the entire value chain from raw materials to fully functional systems to make these processors achieve superior mathematical and algorithmic performance.

www.qant.com/photonic-computing

**Q.ANT GmbH | Handwerkstraße 29 | 70565 Stuttgart, Germany**
**+49 711 25245-0 | info@qant.de | www.qant.com**