

FRAUNHOFER INSTITUTE FOR LASER TECHNOLOGY

PHOTONIC SOLUTIONS FOR QUANTUM TECHNOLOGY

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*Low-Noise Frequency Converters for
the First Quantum Internet
Demonstrator – QFC-4-1QID*



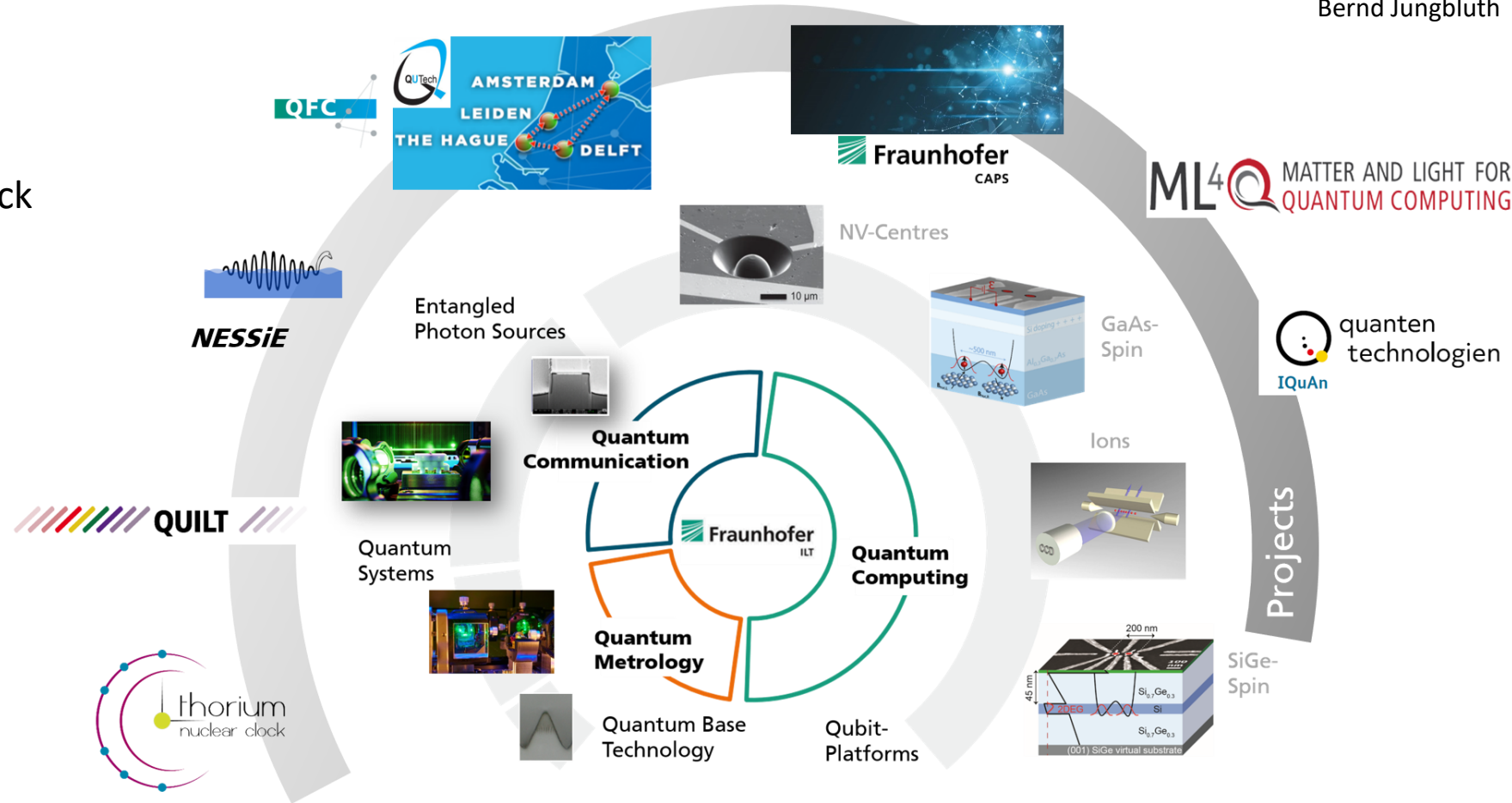
Fraunhofer ILT Collaboratively Develops Technologies for Quantum Computing With Prime International Partners



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Excellence in Quantum Technology

- ERC Grant Thorium Nuclear Clock
- Fraunhofer Lighthouse QUILT
- Fraunhofer JCAP NESSiE
- Fraunhofer ICON QFC4
- Fraunhofer Cluster of Excellence CAPS
- Cluster of Excellence ML4Q
- BMBF IQuAn
- ET-Pathfinder, E-Test
- ESA GWOL (LISA)



Quantum Internet

Fraunhofer ICON Cooperation QFC4-1QID

Cooperation partner: QuTech in Delft, NL

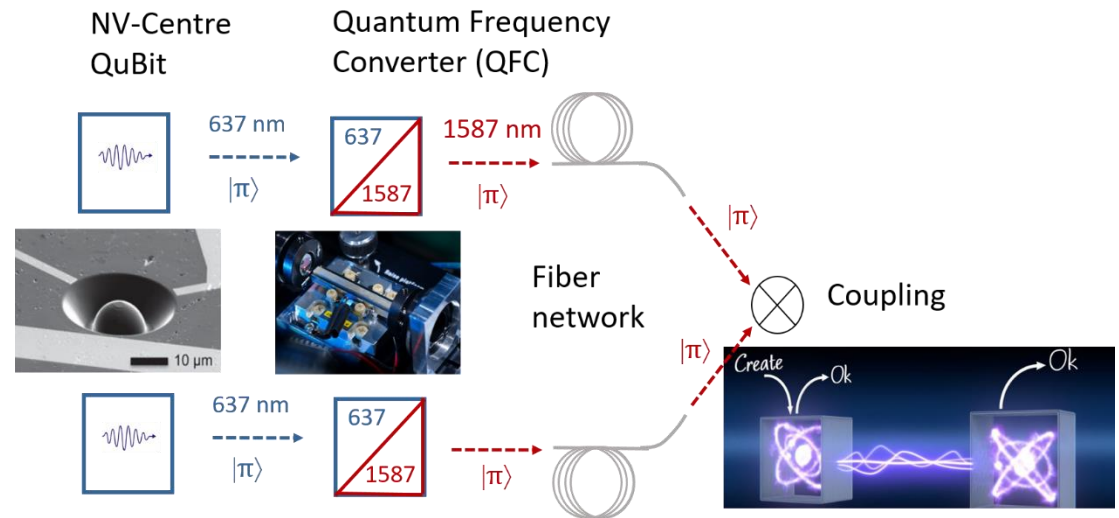
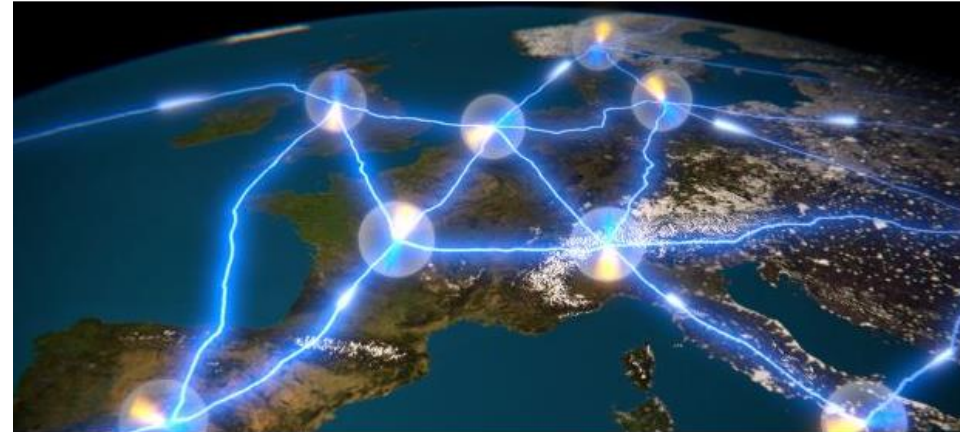
- Leading research organization in the field of quantum information technologies
- Joint venture of TU Delft and TNO
- Goal: Fiber-based quantum internet connecting four cities in the Netherlands
- First demonstration of an entanglement distribution network in 2022

Strategic cooperation in the ICON project

- Photonic components for the first quantum internet
- Phase1: Low-noise quantum frequency converters



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Low-Noise Quantum Frequency Conversion (QFC) to the Telecomb band



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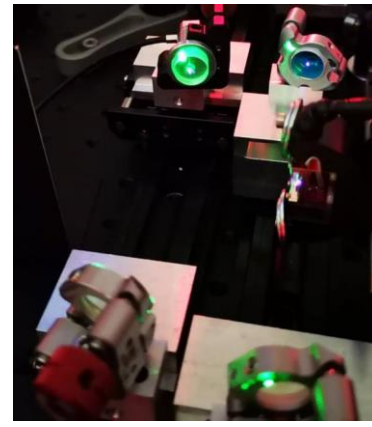
Development and comparison of two different QFC designs

(Baseline) QFC at QuTech

- Moderate laser power, PPLN, waveguide.
- Proven performance: 17% (in-out), SNR 7.
- Current work horse for the quantum node development in Delft.

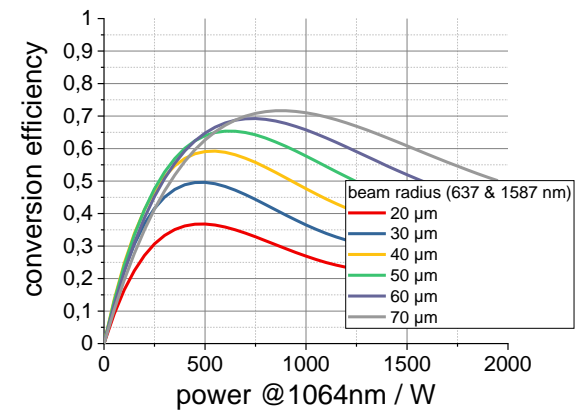
QFC at ILT (NORA)

- Higher laser power, KTA, enhancement-cavity:
 - ✗ More complex !
 - ✗ Less rugged ?
 - ✓ As efficient ?
 - ✓ Less noisy !?

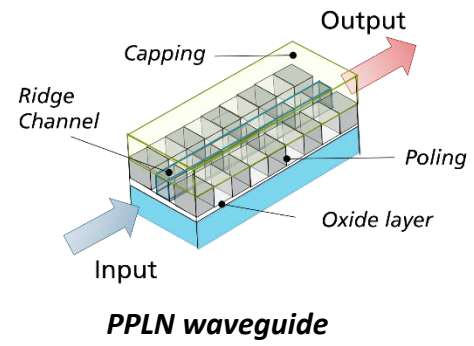


d) NORA lab setup

e) NORA expected performance

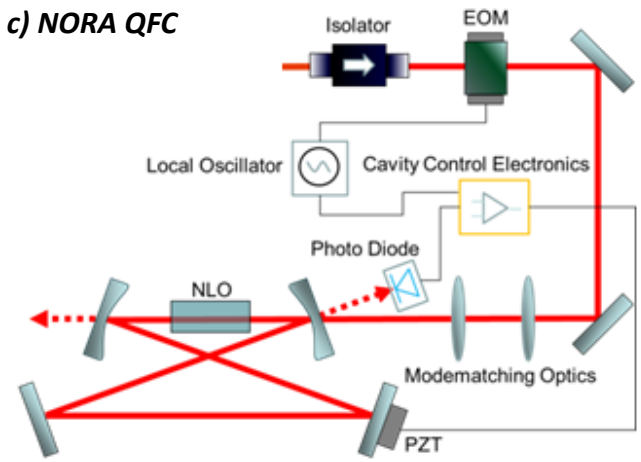


b) Baseline QFC



PPLN waveguide

c) NORA QFC





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