

# ThinkQuantum

OPTICAL AND QUANTUM TECHNOLOGIES FOR CYBER SECURITY

Dr. Costantino Agnesi – 24/10/2022

EPIC Online Technology Meeting on Satellite Quantum Communication

# ThinkQuantum

ThinkQuantum Srl, innovative start-up and spin-off of the University of Padua, offers **Optical & Quantum Solutions for Cyber Security and Communication** to ICT, Telecommunication and Space Industries.

ThinkQuantum covers the **Full Value Chain** from development and manufacturing of quantum key distribution and quantum random numbers generation systems to design and commissioning of tailored solutions.

ThinkQuantum, based in Italy with an Italian shareholder structure, offers a **Reliable European supply chain** to those partners active within geopolitical sensitive applications.

# A RELIABLE PARTNER



**Officina Stellare Spa**, as major industrial **partner**, guarantees access to its scientific and opto-mechanical engineering skillset and to its solid international network and reputation in the Space Industry.



ThinkQuantum's recognition as spin-off of **University of Padua** **grants access to resources** such as Labs, relevant IPs, others. Co-founders Professors **Paolo Villoresi (President)** and **Giuseppe Vallone (CTO)** with **twenty years' experience** and prestigious international positions within the scientific community, constitute the scientific pillar of the Company.






# Expertise in Satellite Quantum Communication

As a spin-off of the **University of Padova** ThinkQuantum is backed by over twenty years of pioneering research on the field of satellite quantum communication. Furthermore, thanks to co-founder and industrial investor **Officina Stellare**, premium provider of optical system for ground and space applications, ThinkQuantum offers design capabilities for satellite payloads and ground segment for quantum communication systems.

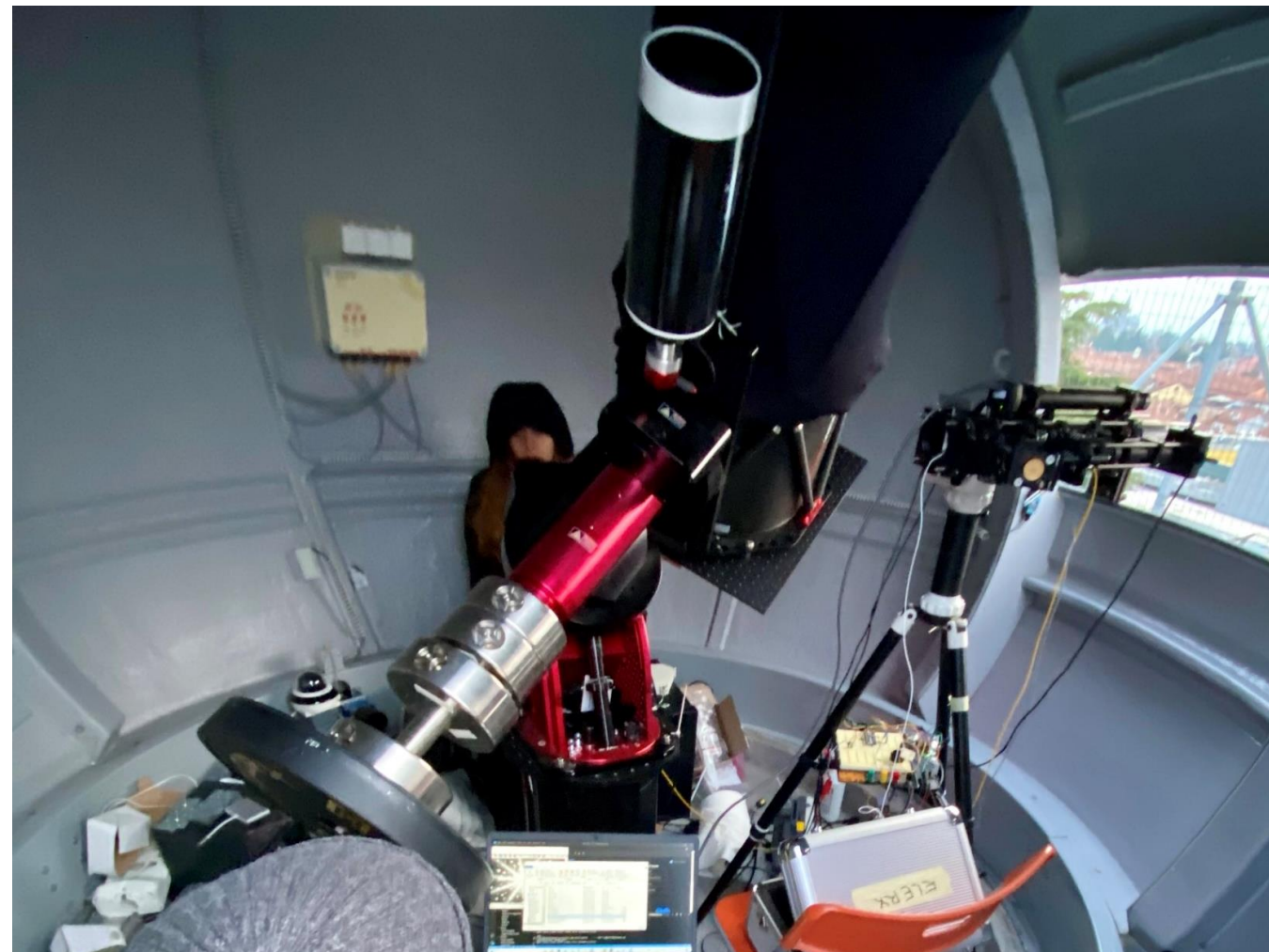
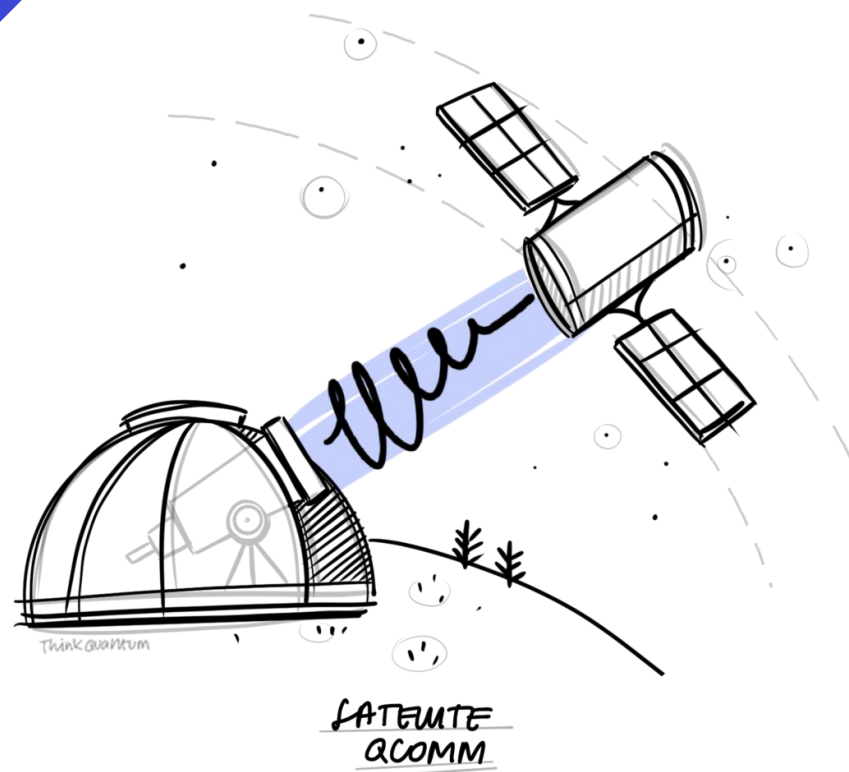


## Our Values and Strengths

	<b>Secure Design</b>	Our patented solutions offer the highest levels of security combined with robustness and reliability.
	<b>Tailored Solution</b>	Flexible design for customized solutions (Wavelength flexibility, customizable system interfaces, adaptable footprint).
	<b>EU27</b>	ThinkQuantum, based in Italy with an Italian shareholder structure, offers a reliable European Supply Chain.

# Optical Ground Station Development

ThinkQuantum offers the development of optical ground stations for the reception and decoding of satellite-transmitted quantum states, with large flexibility in the telescope choice from scientific to commercial. Moreover, the adaption service of existing optical ground stations to quantum communication is provided.





## Experimental verification of the feasibility of a quantum channel between space and Earth

**P Villoresi<sup>1,8</sup>, T Jennewein<sup>2</sup>, F Tamburini<sup>3</sup>, M Aspelmeyer<sup>2,4</sup>,  
C Bonato<sup>1</sup>, R Ursin<sup>4</sup>, C Pernechele<sup>5</sup>, V Luceri<sup>6</sup>, G Bianco<sup>7</sup>,  
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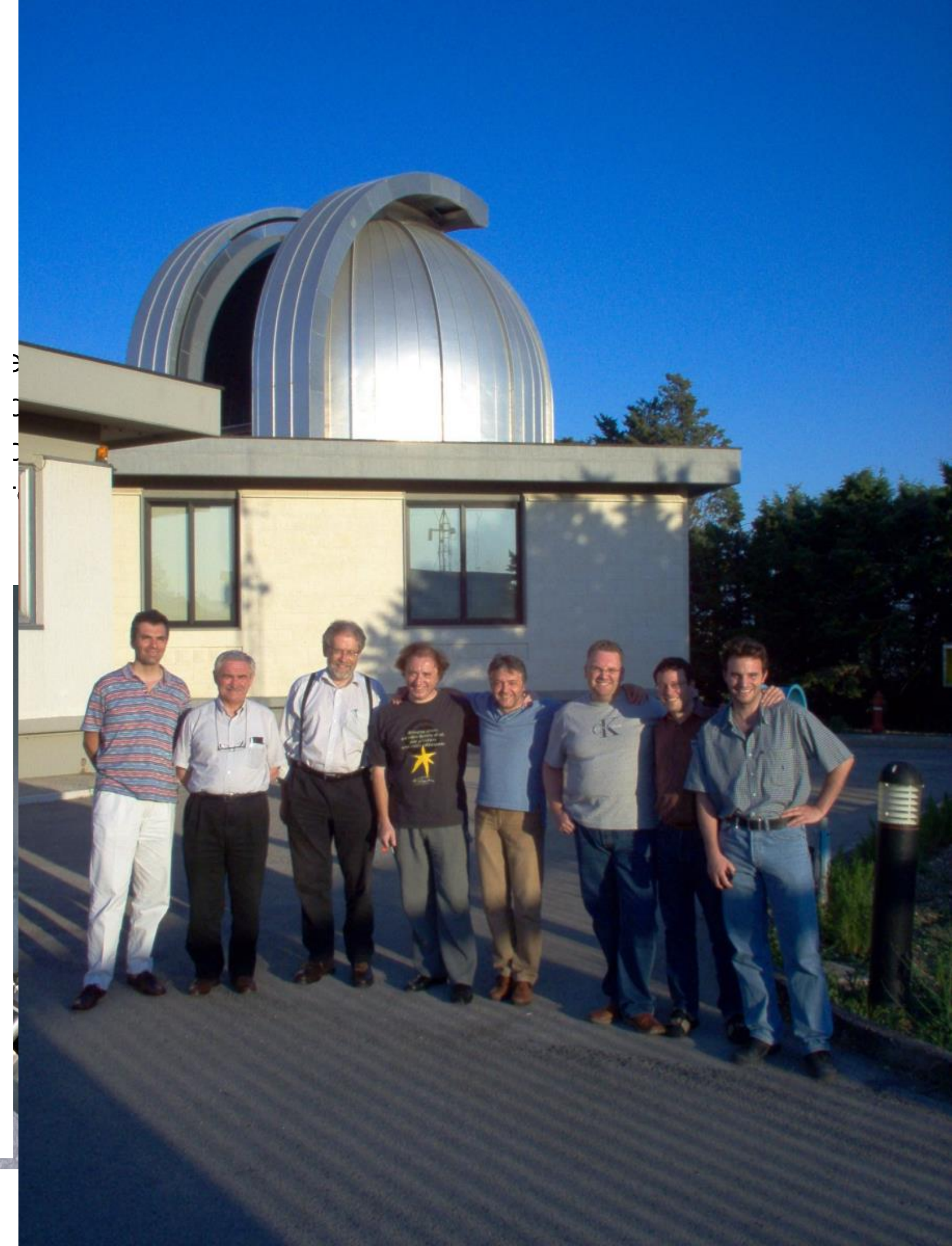
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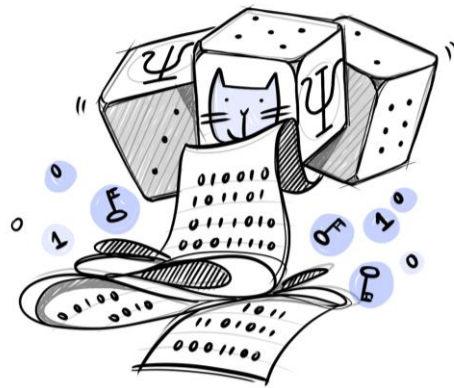
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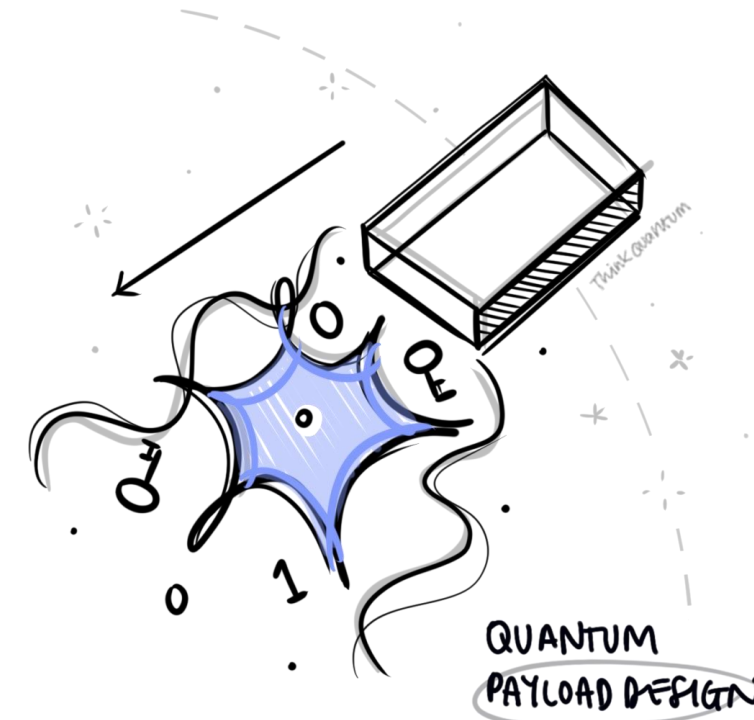
# Satellite Payload Development

ThinkQuantum is your perfect partner for developing QKD solution for the space segment from the design, customized for different missions, system interfaces and mechanical footprints, to the qualification process tailored to comply with the project and customer requirements.



**Quantum Random Number Generator**, provides the most secure random numbers, based on the Heisenberg's uncertainty principle.

**Quantum State Generator**, based on patented technology, offers high quality in terms of robustness, reliability and compatibility with the BB84 QKD and other quantum protocols.

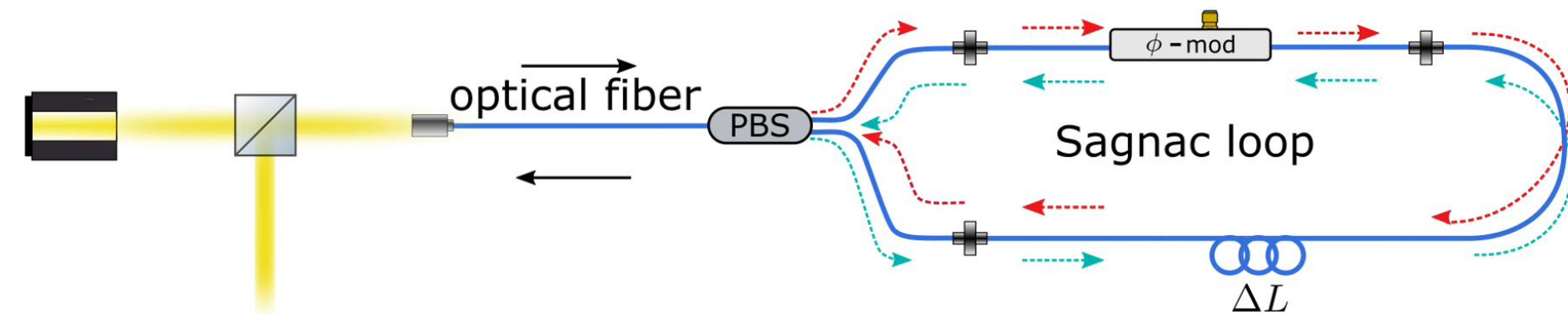


# IPOGNAC Polarization Decoder

$$|H\rangle + e^{i\phi}|V\rangle$$

## Key Features:

- Secure against side-channel attacks
- Self-compensating design: immune to temperature and DC drifts
- No re-calibration needed
- Low-intrinsic QBER ( < 0.1%)
- Stable and well-defined output states
- Space-qualified version under development



$$\{|L\rangle, |R\rangle\} \quad |D\rangle$$



# IPOG

## Key

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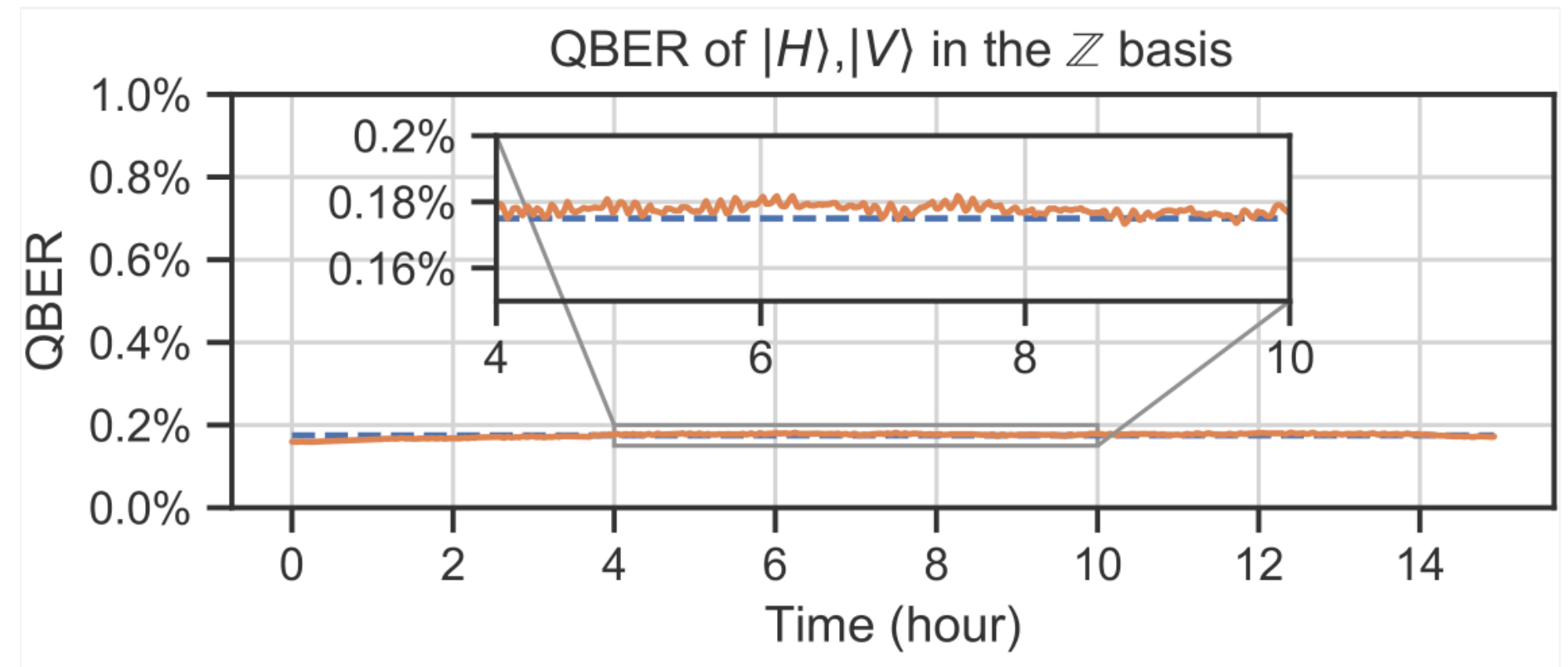
Motivation: Due to the great importance of quantum cryptography in the future scenario, the robustness of the proposed approach and the degree of advancement of the project are emphasized. The degree of maturity of the solution and the clear vision of the concrete potential in the short and medium term represent the prerequisite for the future success of this promising innovation”



# IPOGNAC Trails

## Tested in:

- Free-space links: Opt. Lett. **45**, 4706-4709 (2020)

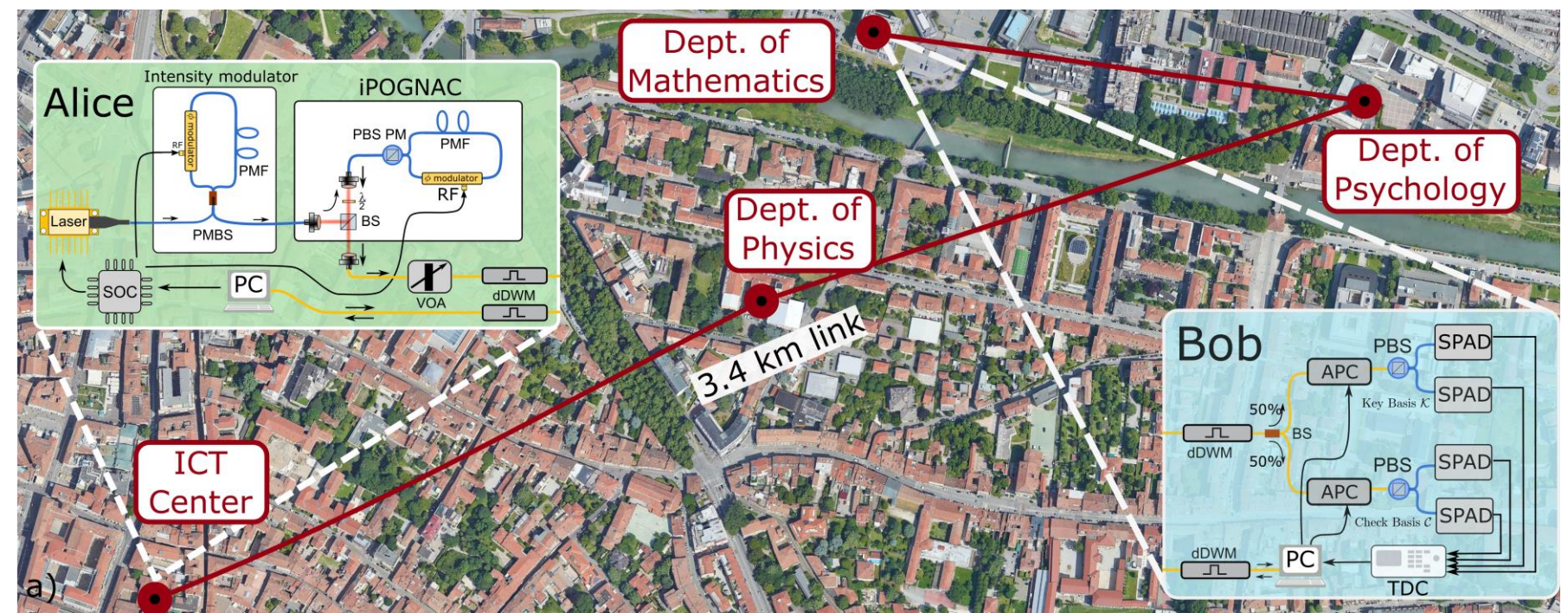
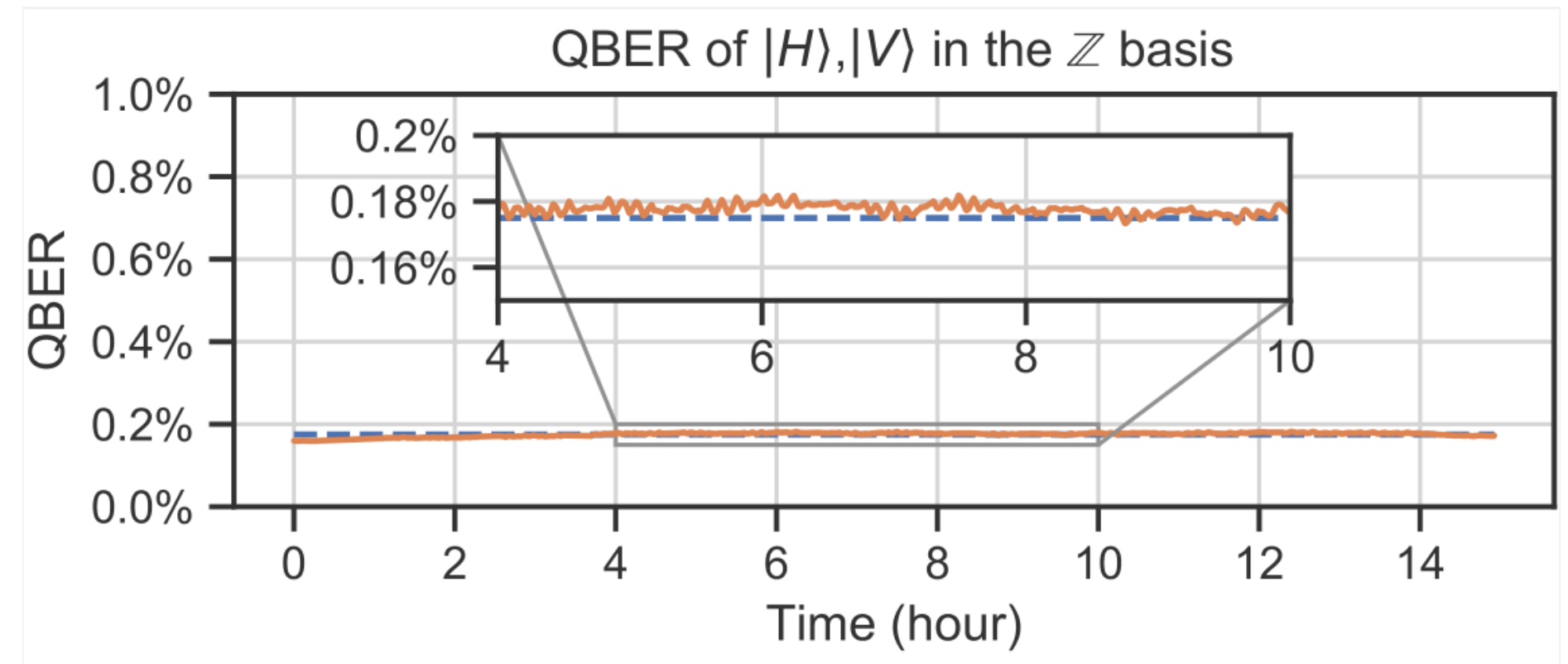
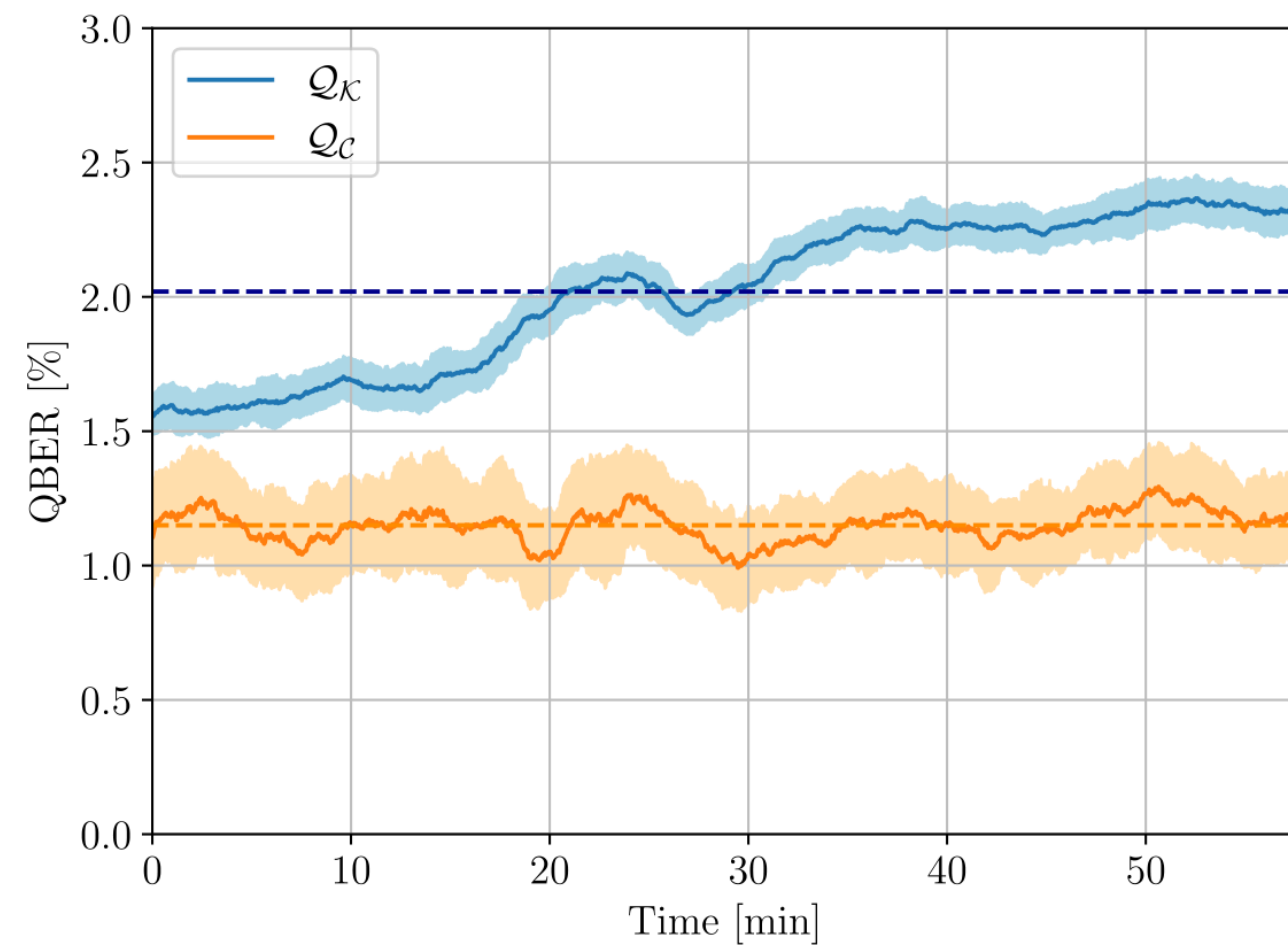




# IPOGNAC Trails

## Tested in:

- Free-space links: Opt. Lett. **45**, 4706-4709 (2020)
- Buried fiber links: Opt. Lett. **46**, 2848-2851 (2021)



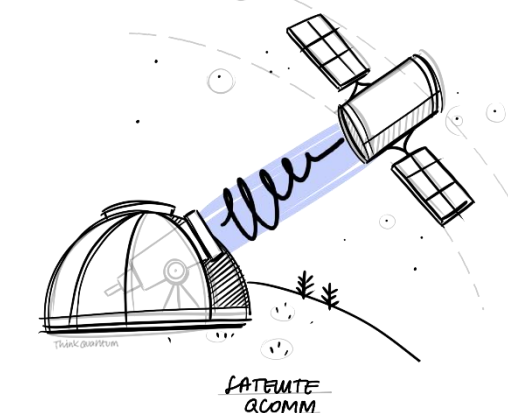
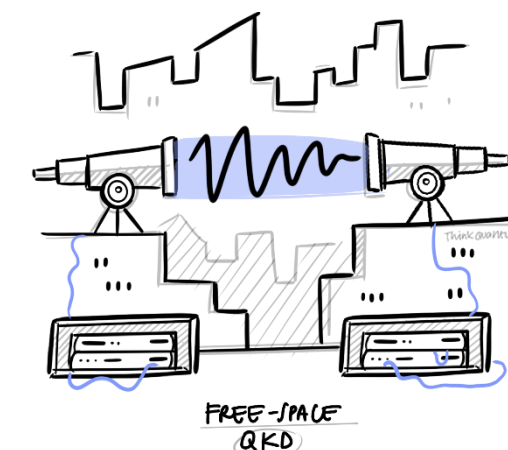
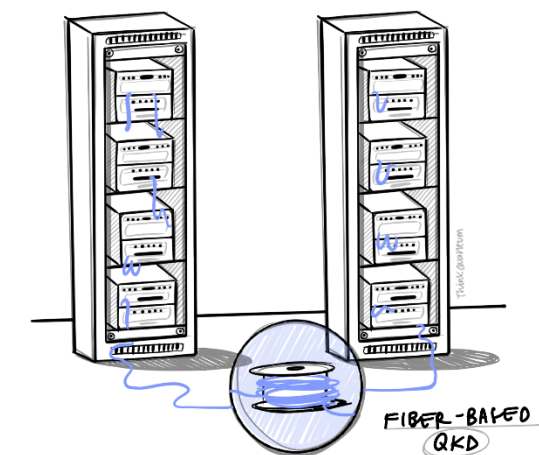
# ThinkQuantum OFFER as turn-key solutions

**QKD & QRNG Systems**  
commercially available:

- ThiKe
- QuKy



**Solutions** for integrated infrastructures deployed through the integration of fiber connections, free-space optical link and satellite communications





# ThinkQuantum Contacts



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