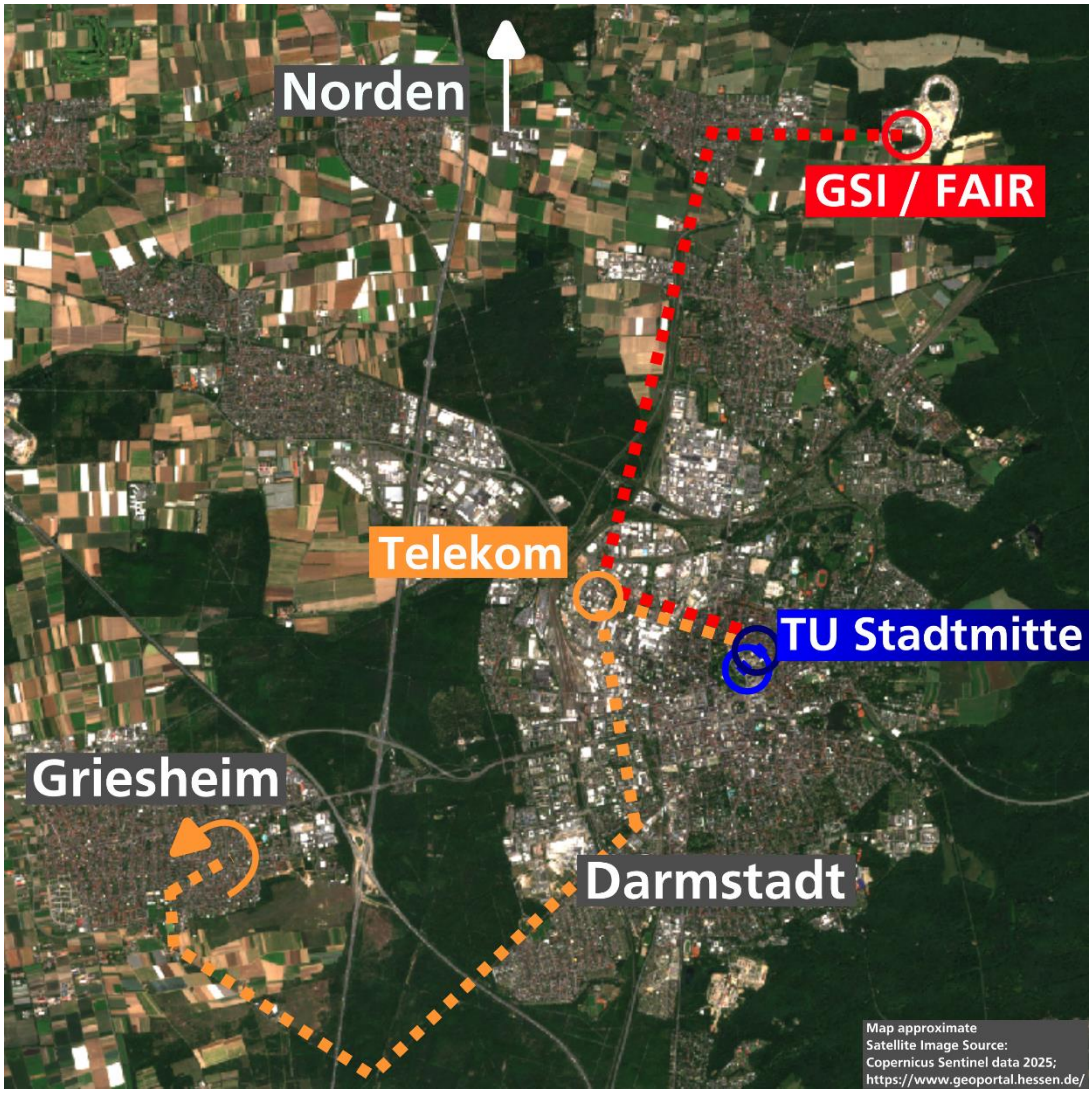
Darmstadt Quantum Local Area Network (DaQLAN)

The DaQLAN testbed enables city-wide QKD via fiber links. It features a central photon pair source to enable multiple users (receivers) to connect at once. Thus, multi-user QKD based on simultaneous pairwise connections is investigated in a star-shaped network topology. As the source acts as hub for the photon pairs and is untrusted, the network can be considered free of trusted-intermediate-nodes. Currently, there exist one photon pair source and four receivers which are tested as demonstrators.



Note: The start point of a link is always at the photon source. The QKD key will, however, always be exchanged between two arbitrary end points (e.g. GSI + DT Technik). So, basically two fiber links are involved at a time for one QKD link. The photon source (start point) does not yield information on the key.

A: Brief Information

Testbed Title	Darmstadt Quantum Local Area Network (DaQLAN)
Institution/Organization	TU Darmstadt with Deutsche Telekom Technik GmbH
Contact	Prof. Thomas Walther: thomas.walther@physik.tu-darmstadt.de
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Status	active

B: Technical Information

Start Point	**End Point**	**Length [km]**	**Losses [dB]**
TU Darmstadt Institut für Angewandte Physik (IAP)	GSI Helmholtzzentrum für Schwerionenforschung (GSI)	25.15	13.45
TU Darmstadt Institut für Angewandte Physik (IAP)	Deutsche Telekom Technik GmbH via Griesheim	37.06	13.56
TU Darmstadt Institut für Angewandte Physik (IAP)	TU Darmstadt Cybersecurity (CYSEC)	0.27	1.88
TU Darmstadt Institut für Angewandte Physik (IAP)	TU Darmstadt Institut für Angewandte Physik (IAP)	25.13	7.63
Type of Transmission	fiber		
Supported Wavelengths [nm]	C-band (around 1550 nm)		
Type of Fiber	single mode		
Type of Deployment	underground		
Quantum Communication Infrastructure	entangled photon source @ C-band around 1550 nm (width > 6 THz); single photon detectors @ 1550 nm; fiber spools additional to field-deployed fiber		
Available Infrastructure for external Parties	access upon request and agreement; available infrastructure: access to entangled photon source, single photon detectors, fiber spools and links		

C: Additional Information

Linked projects	• SFB 1119 CROSSING: https://www.crossing.tu-darmstadt.de/crc_1119/index.en.jsp • QuNET+ProQuake: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/qunet-proquake

Press Release and Publications	• *Darmstadt quantum local area network (DaQLAN)*, 03.2025 • *Implementing post-processing algorithms for a star-shaped quantum key hub*, 03.2025 • *A quantum key distribution network with a multi-user phase- time coding quantum key hub for city-wide deployment*, 03.2024 • *Scalable Network for Simultaneous Pairwise Quantum Key Distribution via Entanglement-Based Time-Bin Coding*, 05.2022 • *Secure communication with light particles - Researchers at TU Darmstadt develop anti-eavesdropping quantum network*, 05.2022
Demonstrated Milestone	• simultaneous, pairwise QKD of multiple users (Polarization-insensitive BBM92). • reconfiguration of user pairs to enable any link. • operation of the full key post-processing in live operation
Outlook	• demonstration of polarization-insensitive QKD operation and network scalability • optimizing the setup and key-rates including post-processing performance • Test of network applications for QKD • Possible extension to new network endpoints throughout Darmstadt
Suggested Use Cases	• application-agnostic testbed for QKD, therefore applicable to arbitrary use cases
Other Comments/ Information	• The start point of a link is always at the photon source. The QKD key will always be exchanged between two arbitrary end points (e.g. GSI + DT Technik). So, basically two fiber links are involved at a time for one QKD link. The photon source (start point) does not yield information on the key. • The fiber connection is not direct (from the IAP but instead there is a loop via Griesheim.

Receiver