

QSyncNextG – Quantum Synchronisation for Resilient and Secure Next Generation (5G/6G) Campus Networks

The QSyncNextG project aims to achieve time synchronization precision in the network that surpasses the performance of classical (non-quantum) approaches. To this end, it focuses on integrating innovative quantum-technology-based solutions into an end-to-end demonstrator within the 5G/6G Radio Access Network and Mobile Edge Computing environments. In addition, the project seeks to provide advanced network technologies that enhance network security by leveraging quantum technologies to enable secure, resilient, and highly precise network synchronization.

A: Brief Information

Testbed Title	QSyncNextG – Quantum Synchronisation for Resilient and Secure Next Generation (5G/6G) Campus Networks
Start Point	Technische Universität Dresden (TUD), Dresden
End point	Technische Universität Dresden (TUD), Dresden
Institution/Organization	Technische Universität Dresden (TUD), Dresden
Contact	Ashwin Raju: ashwin.raju@tu-dresden.de
	Dr.Ing Muhammad Idham Habibie: muhammad_idham.habibie@tu-dresden.de
Status	Active

B: Technical Information

Type of Transmission	Dark fiber
Length [km]	0,009
Losses [dB]	0.22 dB/km for 1550 nm, 3 dB/km for 850 nm
Supported Wavelengths [nm]	1550 nm and 850 nm
Type of Fiber	Single mode
Type of Deployment	In-house
Polarization Stabilization	No
Quantum Communication Infrastructure	Correlated Photons leveraging SPDC that produces wavelengths 850nm and 1550 nm. The 1550 nm is splitted into two devices, Single-photon sources, single-photon detectors
Available Infrastructure for external Parties	Plan for inauguration in the middle of 2026

C: Additional Information

Linked Projects	<ul style="list-style-type: none">• QuaPhySI: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/quaphysi• QD-CamNetz: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/qd-camnetz• QUIET: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/quiet• 6G-QuaS: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/6g-quas• QUARKS: https://allaboutquarks.de/de/•
Press Release and Publications	<ul style="list-style-type: none">• https://www.linkedin.com/posts/aconnic_6gconferen ce-qsyncnextg-6g-activity-7350422561131741184-EETj/• https://www.aconnic.com/qsyncnextg/• https://www.bsi.bund.de/DE/Themen/Unternehmen-und-Organisationen/Informationen-und-Empfehlungen/5-G/KoPa45/Sicherheit-und-Resilienz-5G-6G/TSP4-QSyncNextG/TSP4-QSyncNextG_node.html
Demonstrated Milestone	<ul style="list-style-type: none">• Participation in IEEE 6G Summit and Berlin 6G Conference in 2025, to showcase the quantum synchronization in the network.• PTP synchronization between two FPGAs is currently operating at the nano-second level and is expected to achieve pico-second level accuracy soon.
Outlook	<ul style="list-style-type: none">• Demonstration of Quantum Synchronization Using Correlated Photon Sources via Type-0 Spontaneous Parametric Down-Conversion (SPDC) with Identical Polarization.• Optimizing the performance of photon detector by reducing the clock drift using FPGA and RC32614A-EVK (leveraging Digitally Controlled Oscillator (DCO)).• Integrating quantum synchronization into 5G infrastructure aims to enhance the timing and precision of the overall network.
Suggested Use Cases	<p>Improving GNSS-based synchronization in 5G networks using 10 MHz ports provided by the time detector aims to reduce phase noise. The use case can be used for remote surgery which requires high-precision synchronization between systems located in different geographical areas. Furthermore, the localization required by the radar or satellite to localize device also requires high-precision synchronization.</p>

Other Comments/ Information	The project is officially complete, though the development and refinement remain in progress. Our aim is to achieve the pico-second level precision and integrate with the 5G networks, which we hope to showcase in future publications.
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Fig 1. The FPGA are used to do post-processing to reduce the clock drifts of the quantum devices.



Fig 2. The Quantum Devices (SPDC, Beam Splitter, Detectors) and Switch are connected and analysed.

