



Free-Space Link Jena

Fraunhofer IOF operates two terrestrial free-space optical (FSO) links in Jena, both aligned approximately north–south. Link 1 connects the Fraunhofer IOF at the Beutenberg Campus to the rooftop of a Jenaer Stadtwerke building (line-of-sight distance ≈ 1.7 km). Link 2 connects the IOF site to the village of Schiebelau (line-of-sight distance ≈ 7.0 km). Both links can be accessed from either the laboratory in the IOF building or the QuBUS lab container at the IOF site, as well as from lab containers at the remote terminals (Stadtwerke or Schiebelau). Interchangeable transmit/receive telescopes with clear apertures from 20 mm to 200 mm support operation across 700–1600 nm. Active beam stabilization (tip–tilt) and adaptive optics are available to enhance pointing stability and maximize single-mode fiber coupling efficiency.

A: Brief Information

Testbed Title	Free-Space Links Jena	
	Link 1	Link 2
Start Point	Rooftop Jenaer Stadtwerke 	Schiebelau (field) 
End point	Fraunhofer IOF	Fraunhofer IOF
Institution/Organization	Fraunhofer IOF	
Contact	Dr. Matthias Goy, Matthias.Goy@iof.fraunhofer.de Prof. Dr. Fabian Steinlechner, Fabian.Steinlechner@iof.fraunhofer.de	
Status	active	

B: Technical Information

Type of Transmission	free space link
Length [km]	Link 1: 1.7, Link 2: 7.0
Losses [dB]	strongly dependent on transmitting and receiving optics
Supported Wavelengths [nm]	500 nm bis 2 μ m (810 nm, 1550 nm etc.)
Type of Fiber	coupling to SM and MM
Type of Deployment	combined
Polarization Stabilization	Yes
Free Aperture	200 mm for QuBUS, 200mm for Lab access, both obscuration-free telescopes
Adaptive Optics	AO available for SM & MM
Quantum Communication Infrastructure	Sources and detectors are present. Availability to external users might be possible.
Available Infrastructure for external Parties	QuBUS platform and Lab at IOF are accessible. External Partners are invited to test their own terminal optics, as well.

C: Additional Information

Linked Projects	<ul style="list-style-type: none">• QuNET: https://qunet-initiative.de• QuNET+RECONNAITRE: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/qunet-reconnaitre• QuNET+MOBIXHAP: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/qunet-mobixhap
Press Release and Publications	<ul style="list-style-type: none">• QuNET initiative: One step closer to highly secure quantum communication, 06.2023• High performance optical free-space links for quantum communications, 06.2021
Demonstrated Milestone	<ul style="list-style-type: none">• QKD at daytime demonstrated
Outlook	<ul style="list-style-type: none">• key experiment 1 in QuNET• many individual experiments ongoing
Suggested Use Cases	<ul style="list-style-type: none">• FSO testbed for classical laser and quantum communication• AO pre-compensation
Other Comments/ Information	



Container Stadtwerke



Container Schiebelau