QUANTUM COMPUTING INC

EPR-XX-YY Series

Entanglement source

User's guide

Headquarters
215 Depot Court, Suite 215
Leesburg, VA 20175, USA
1-703-436-2161

Engineering Labs
5 Marine View Plaza,
Hoboken, NJ 07030, USA
info@quantumcomputinginc.com

EPR-XX-YY Series
Entanglement Source

Key element to practical quantum networking and quantum sensing

Sources for generating entangled photons are critical for quantum computing, provably quantum secure cryptography, and quantum-enhanced metrology. QCI's general purpose source EPR-XX-YY allows users to generate entangled photons for their specific applications. QCI's entanglement source utilizes a fiber coupled periodically poled lithium niobate crystal that produces via Spontaneous Parametric Down-Conversion (SPDC) broadband entangled photons across the entire telecom C-band. QCI's source is highly customizable, robust, compact, and suitable for both academics and industrial applications.

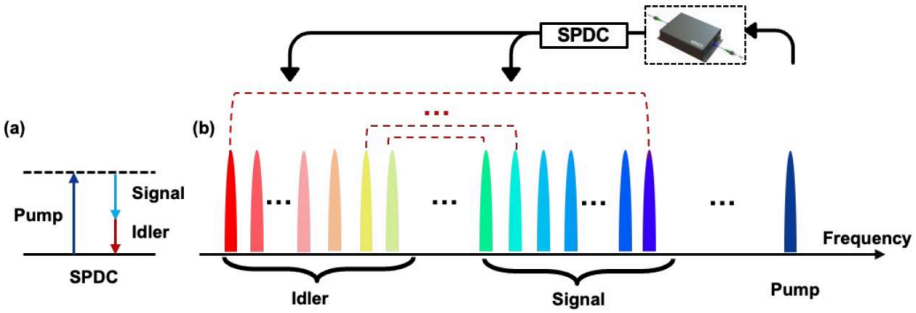


Figure 1 (a) illustrates the SPDC process, a phenomenon in quantum optics where a single photon, known as the 'pump photon', of higher energy, converts into a pair of photons known as signal photon and idler photon. This conversion process obeys the conservation of energy and momentum. Figure 1(b) shows the conceptual diagram of entangled photon pairs (pairs are visualized by red dashed lines) from the SPDC processes. From the incident pump light in the visible band (775.1 nm), photon pairs are simultaneously produced under the quasi-phase matching condition, in which signals and idlers are generated across the entire telecom C-band. Energy conservation requires that for the photons holds

$$\omega_{pump} = \omega_{signal} + \omega_{idler}$$

EPR-XX-YY Series
Entanglement Source

Entangled photon generator for telecom C-band Supports high dimensional encoding plug and play system

Applications

Quantum Key Distribution
Quantum Authentication
Quantum Metrology
Quantum Networking
Time Synchronization System
Fundamental Physics Studies

Advantages

QCI's entangled photon source uses spontaneous parametric down-conversion (SPDC) in a quasi-phase-matched lithium niobate waveguide to create pairs of energy-time entangled photons at telecom wavelengths. It covers the entire telecom C-band thus it supports the existing fiber-optic communication infrastructure. With an integrated 775 nm pump laser, this fiber-coupled source produces >60 million photon pairs per second. Our entangled photon source can achieve a zero-time delay second-order correlation function [$g(2)(\tau = 0)$] value of <0.1 thus producing high-brightness heralded single-photon source ideal for quantum optics applications. The QCI's integrated solution offers the generation of (customizable) transform-limited single photons over the c-band, essential for quantum networks applications in quantum computing, provably secure cryptography, and quantum-enhanced metrology.

Our rackmountable entangled photon source demonstrates remarkable stability over more than 12 hours, enduring prolonged periods of reliable entanglement. Our source's brightness enables its operation in photon starved environments, making it resilient for both fiber and free space transmission across extensive distances. Utilizing either their polarization or time-frequency entanglement, the photon pairs form our source can be used for a myriad of applications

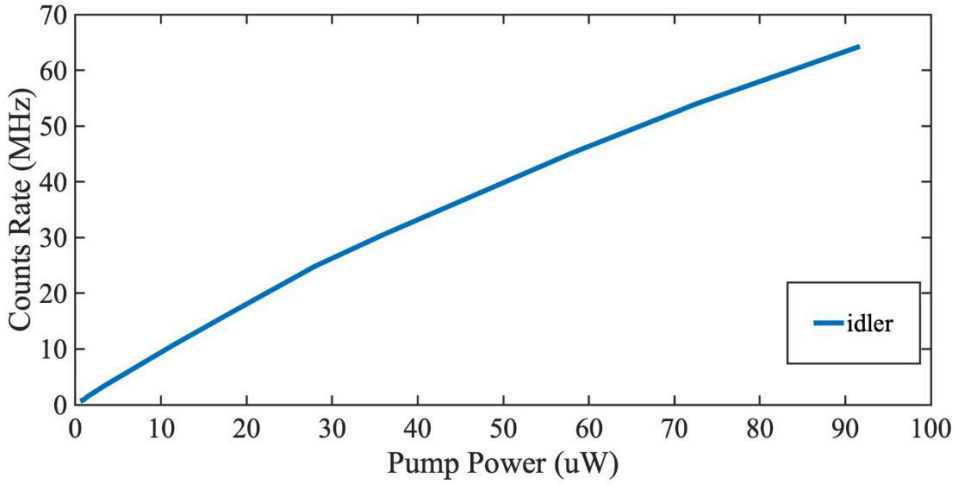
EPR-XX-YY Series
Entanglement Source

Specifications

Generation rate (pairs/power/unit time)	5 million pairs/1uW/s
Coincidence-to-accidental count (CAR)	~180
Wavelength ranges	1534.3 nm ~ 1566.4 nm
Operating temperature	15 C to 55 C
Laser pump source	775 nm

Characterization

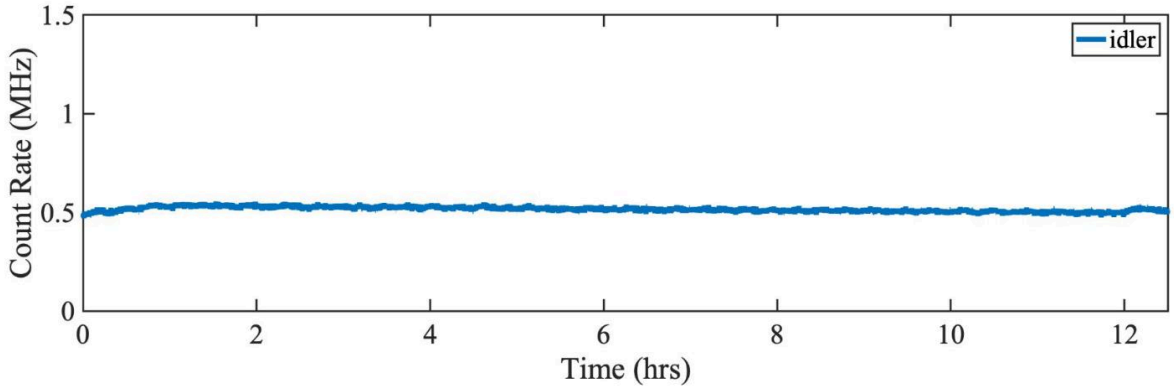
1. Laser power vs intrinsic count rate (16 pairs)



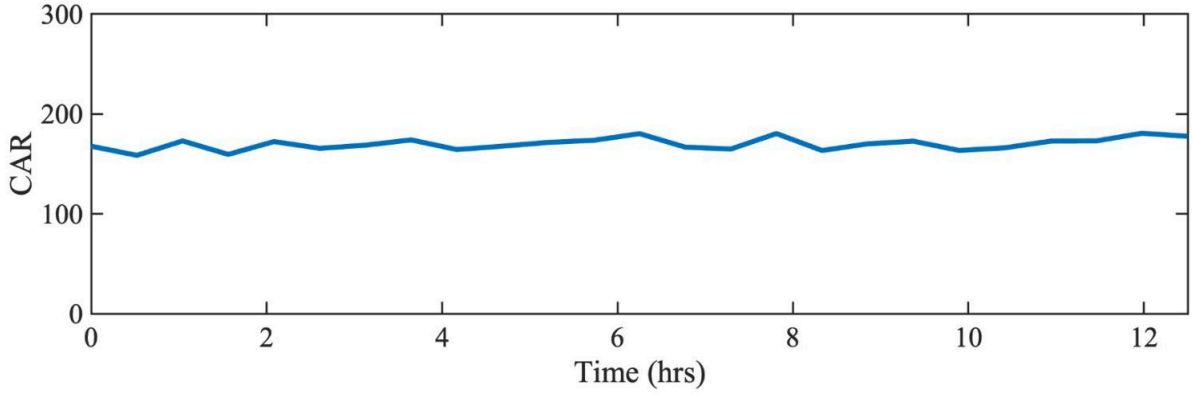
The above figure shows the pump laser power vs the idler intrinsic counts rate, in which the count rate is integrated among all 16 entanglement pairs.

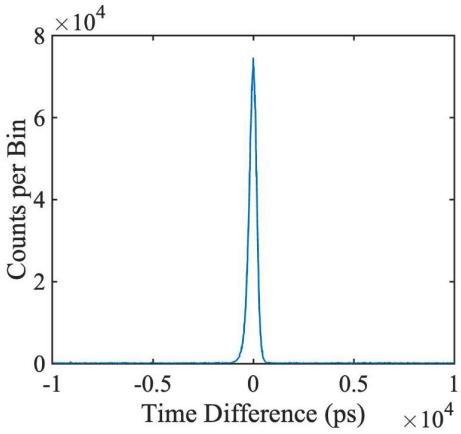
EPR-XX-YY Series
Entanglement Source

2. Counts rate (one idler) stability over time with the pump power at 12 uW.



3. CAR stability over time (1 pair)



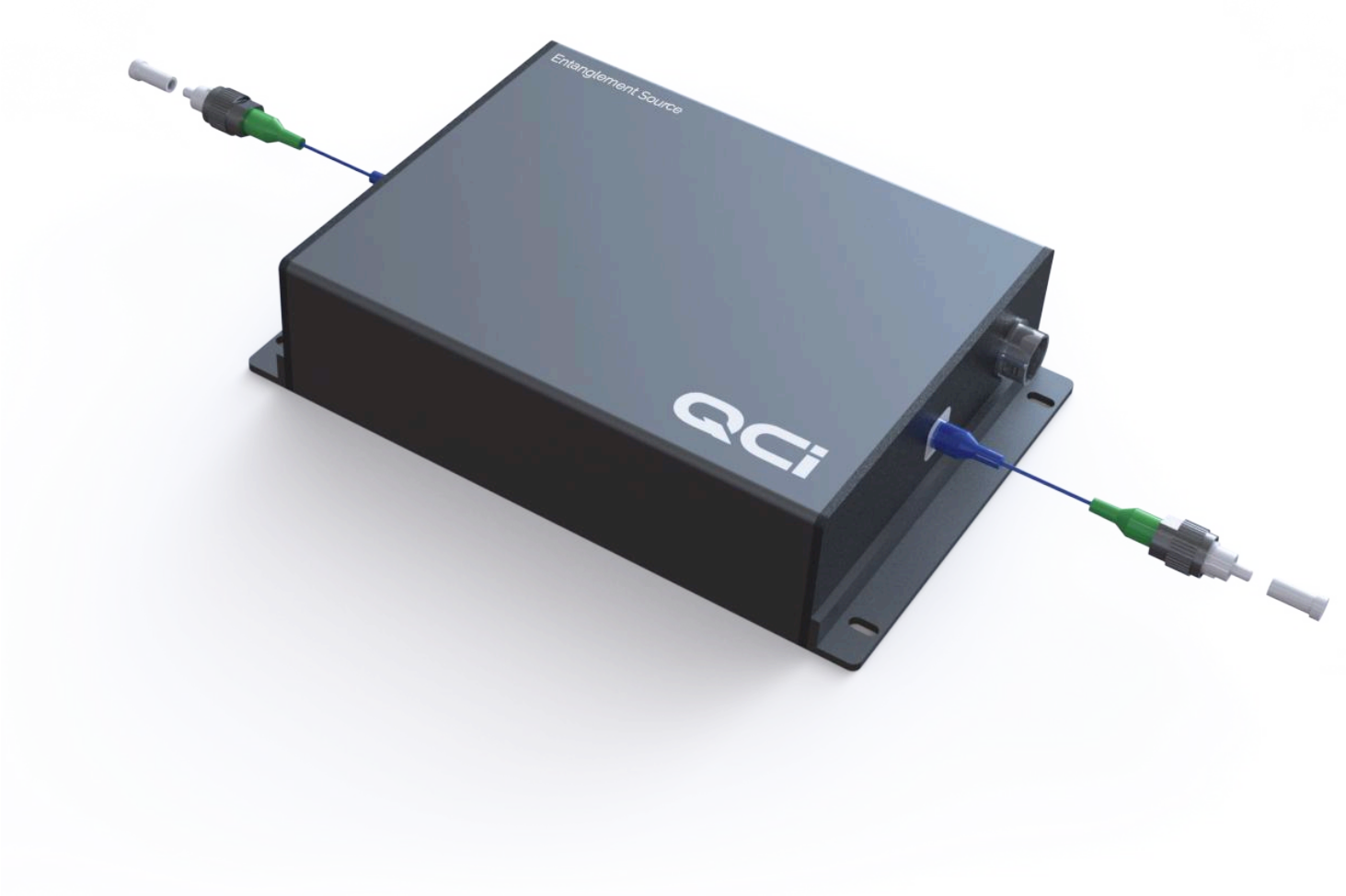


Bin width: 10 ps
Acquisition time: 0.5 hr

EPR-XX-YY Series
Entanglement Source

EPR-XX-YY

XX	IT: integrated module ST: standalone module
YY	No number for standalone Number of channels, from 2 to 48



EPR-XX-YY Series
Entanglement Source

Mechanical