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BROADBAND POLARIZATION-ENTANGLED PHOTON SOURCE

PRELIMINARY

Features

- High-quality polarization and frequency entanglement
- Broad bandwidth covering C- and L- bands
- High fidelity and excellent stability
- Turn-key and room-temperature operation
- Low power consumption
- Compact and light weight platform
- Rugged, alignment free, all fiber design

Entangled Photon Source

Applications

- Quantum imaging
- Quantum metrology
- Quantum key distribution networks
- Quantum computing and information processing

Product description

This fiber-based device is a compact, robust, and alignment-free source of broadband polarization-entangled photon pairs. Based on periodically-poled silica fiber (PPSF) technology, it features turn-key, room-temperature operation, and needs little maintenance. The all-fiber design makes it environmentally stable for challenging applications such as space-based instruments. It generates high-quality polarization-entangled photon pairs at telecom wavelengths with more than 80 nm of bandwidth. This ideal entanglement source has myriad applications in quantum information processing, quantum sensing, and WDM-based quantum key distribution networks.

Performance specifications[1]

Part number: EPS-1000-3A-1564-9/125-S					
Parameter		**Max**	**Typical**	**Min**	**Unit**
Signal/Idler degeneracy wavelength[2]		1580	1564	1530	nm
Signal/Idler degeneracy wavelength accuracy		±2.0	±1.0	–	nm
Biphoton bandwidth (3dB)[3]		>120	80	60	nm
Signal/Idler sum frequency bandwidth (3dB)		0.4	0.2	0.1	nm
Pair-generation rate		4×10^6	2×10^6	1×10^6	Pairs/second
Coincidence-to-accidental ratio[4]		–	300	100	
Fidelity[5] to $\|\Psi\rangle=(\|HV\rangle+\|VH\rangle)/\sqrt{2}$		99.5%[6]	98%	97%	
Two-photon interference visibility[7]		99.5%[6]	98%	97%	
Physical dimensions	Width x depth x height	26 x 26 x 9 cm (9 cm height can be reduced to 4.5 cm)			
	Weight	<2 kg			

Note:
1 Under continuous-wave (CW) operation.
2 The degeneracy wavelength is usually conveniently set at the boundary of C- and L-bands. Customized degeneracy wavelength in the indicated range is possible.
3 Before signal and idler is separated by the wavelength splitter.
4 Coincidence counts are measured on signal/idler FWHM bandwidth of 16nm each, over 0.65ns window, with free-run SPAD detectors having dark counts of ~5kHz.
5 Measured on conjugated signal/idler pairs of 1nm FWHM bandwidth over 80nm centered at degeneracy. Without subtracting accidentals.
6 Limited by detector dark counts.
7 Measured for both HV basis and AD basis. Without subtracting accidentals.

Optical specifications

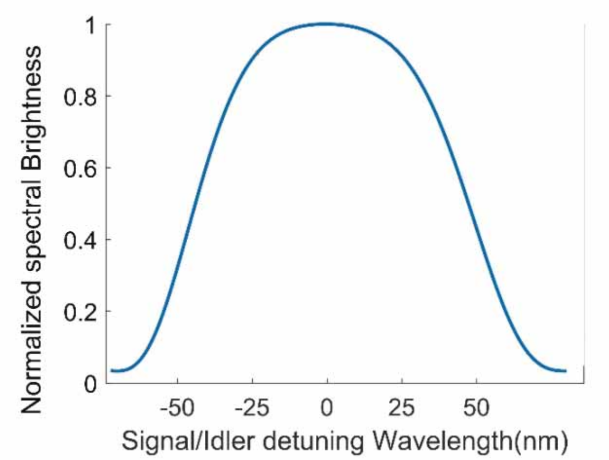

Figure 1. Typical biphoton spectrum.

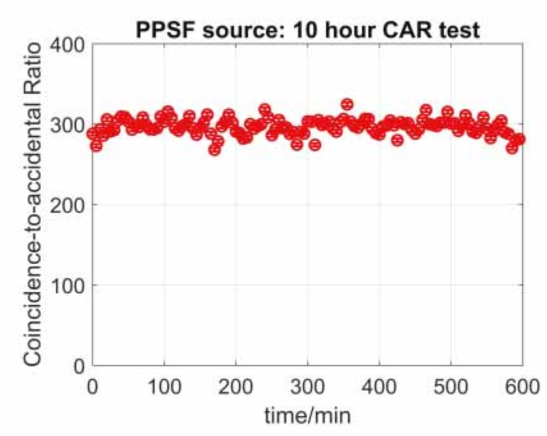

Figure 2. Typical Coincidence-to-Accidental Ratio (CAR) over 10 hours of continuous operation.

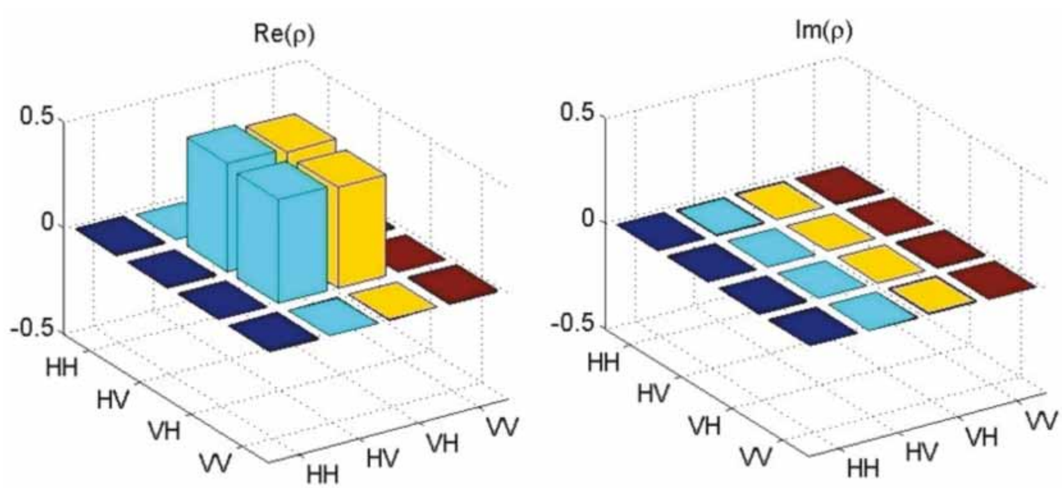

Figure 3. Typical polarization density matrix.

Operating and storage conditions

Parameter	Min	Max
Operating temperature	15°C	25°C
Operating relative humidity (% RH)	5	60
Storage temperature	-40°C	40°C
Storage relative humidity (% RH)	0	90

Links to white paper

1. Changjia Chen, Eric Y. Zhu, Arash Riazi, Alexey V. Gladyshev, Costantino Corbari, Morten Ibsen, Peter G. Kazansky, and Li Qian, “Compensation-free broadband entangled photon pair sources,” *Opt. Express* 25, 22667–22678 (2017). https://www.osapublishing.org/oe/abstract.cfm?uri=oe-25-19-22667
2. Zhu, E. Y., et al. “Multi-party agile quantum key distribution network with a broadband fiber-based entangled source,” arXiv preprint arXiv:1506.03896 (2015).
3. Changjia Chen, Arash Riazi, Eric Y. Zhu, Alexey V. Gladyshev, Mili Ng, Peter G. Kazansky, and Li Qian. “A Compact All-fiber Polarization Entangled Photon Source Pumped by a Laser Diode,” Conference on Lasers and Electro-Optics, 2018, San Jose, CA, USA. https://arxiv.org/abs/1506.03896