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BENCHTOP POLARIZATION-ENTANGLED PHOTON SOURCES: RUBY & EMERALD

PRELIMINARY

Features:

- High-quality turn-key polarization entanglement
- Custom wavelength offerings
- Rugged, room temperature operation
- Two (Signal / Idler) outputs or single output

Applications:

- Quantum Information Science
- Quantum metrology
- Quantum key distribution
- Quantum computing and information processing

Product Description:

Ruby and Emerald are crystal based polarization entangled photon sources which integrate the crystals responsible for spontaneous parametric down-conversion into photon pairs inside a self-balanced interferometer engine to generate the wavelength/polarization entanglement in a robust benchtop turn-key device. Each source comes equipped with a wavelength stabilized pump laser, a variable optical attenuator, and a temperature controller to fine tune phase matching parameters to realize optimal efficiency. The components are packaged inside a rugged aluminum housing with an on/off power switch and keyed laser control. Signal and Idler photons are available with the pump wavelength removed at separate output ports on the front panel.

Ruby entangled photon sources make use of Type 0 down-conversion to generate a broadband biphoton spectrum, with a bandwidth of several tens of nanometers. Emerald entangled photon sources make use of Type 2 down-conversion to generate a narrow bandwidth biphoton spectrum, with a bandwidth of a few nanometers. In both cases the interferometer engine ensures photon entanglement regardless of the down-conversion type. OZ Optics can assist in selecting the preferred version (Ruby or Emerald) depending on your target wavelength and application.

Benchtop Polarization-Entangled Photon Source: Ruby

Benchtop Polarization-Entangled Photon Source: Emerald

Performance Specifications[1]

Parameter		Max.	Typical	Min.	Unit
Signal / Idler degeneracy wavelength		1560	Custom	810	nm
Signal / Idler degeneracy wavelength accuracy		–	±2	–	nm
Biphoton bandwidth (3 dB)		Phase matching dependent			nm
Pair-generation rate		4x10^6	Custom	1x10^5	Pairs/second
Coincidence-to-accidental ratio[2,4]		–	1000	100	
Fidelity[5] to $\|\Psi\rangle=(\|HV\rangle+\|VH\rangle)/\sqrt{2}$		99%	98%	95%	
Two-photon interference visibility[3]		99%	98%	95%	
Physical dimensions	Width x depth x height (cm)	35 x 16.5 x 12.5			
	Weight (kg)	~6			
Power requirements	Ruby	5 V, 8 A			
	Emerald	12 V, 6 A			

Note:
1 Under continuous-wave (CW) operation.
2 Coincidence counts are measured on signal/idler FWHM bandwidth of 16 nm each, over 0.65 ns window, with free-run SPAD detectors having dark counts of ~5 kHz.
3 Measured for both HV basis and AD basis. Without subtracting accidentals.
4 Pump power dependent that can be controlled using the built-in attenuator.
5 Limited by detector dark counts.

Optical Specifications:

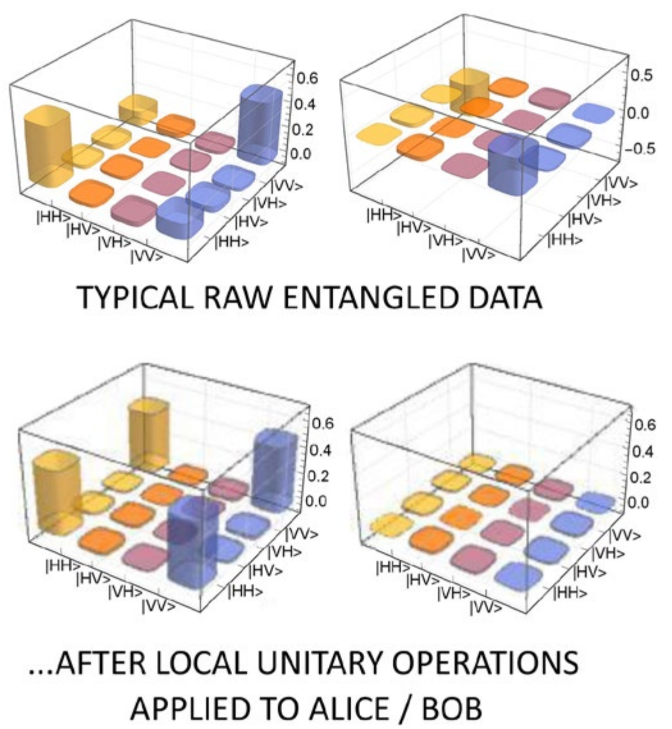

Figure 1. Example results from Ruby 775nm/1550nm

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

Link To White Paper:

1. Auto-balancing and robust interferometer designs for polarization entangled photon sources, *Optics Express*, Vol.27, Issue 12, pp.17369-17376; https://doi.org/10.1364/OE.27.017369

Description: Benchtop Polarization-Entangled Photon Sources: Ruby & Emerald

Part Number: **EPG-N-*XY*-*W*-*a/b***

N = 1000 = Ruby, broadband biphoton bandwidth
2000 = Emerald, narrow biphoton bandwidth

a/b = Core/Cladding of signal, idler

W = Central Wavelength of signal photons

X,Y = Output Connector Codes
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT- FC/PC
SC = SC
SCA = Angled SC
8 = AT&T-ST
MU = MU type connector
LC = LC type connector