

I. TECHNICAL SPECIFICATION OF A SINGLE PHOTON DETECTION SYSTEM

Scotel offers superconducting single photon detectors (SSPD) and ultra-low noise single-photon registration systems for the visible and near infrared range. All systems operate in a continuous mode (no gating).

The system is based on fiber-coupled NbN superconducting single photon detectors and can have several independent channels (up to 8). For operation superconducting detectors need cryogenic temperatures, and Scotel offers a complete cooling system:

1) Cryogenic-free system

The closed-cycle refrigerator is a cryogenic-free cooling system which does not use liquid helium (the operating temperature is 2.2K). This type of detection system would be ideal for those who want to avoid handling with liquid helium. A particular advantage is that closed-cycle refrigerators can operate continuously for months from just an electrical power source. This makes long-term experiments possible. There are detection systems available for three spectral ranges:

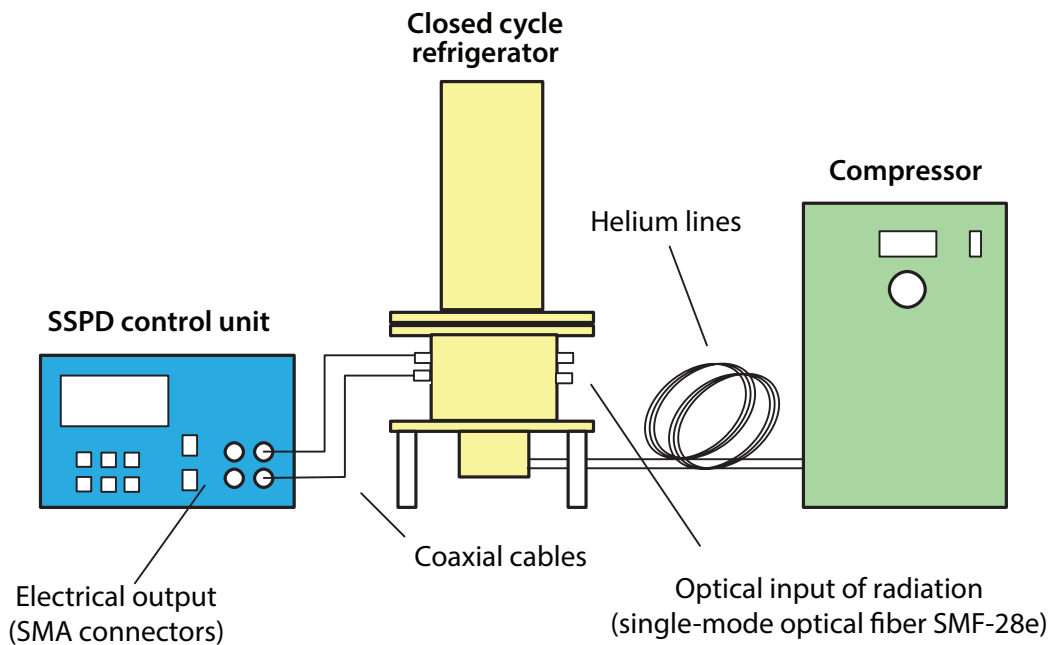
Spectral range	Quantum efficiency (referred to optical input)
0.7 – 1.3 μm	90 %
1.3 – 1.6 μm	85 %
1.6 – 2.3 μm	50 %

** These values available for both types of cooling systems.*

Parameters of the Cryogenic-Free System:

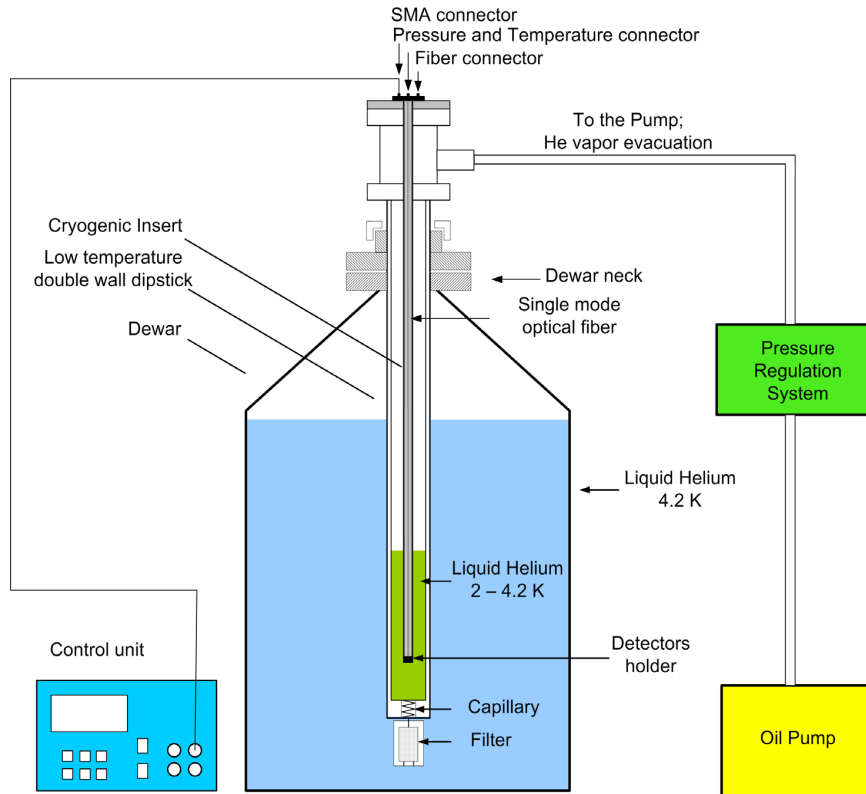
Element/Parameter	Closed-cycle refrigerator	Compressor	Control unit
Weight, kg	25	75	1
Length x width x height	240x240 x580 mm	450 x 320 x 560 mm	240 x 260 x 140 mm
Preparation time	150 min	-	-
Maintenance, hours	10,000	30,000	-
Power consumption	1.5 kW*		30 W*

*Voltage of control unit and compressor: 100-240 V/ 50-60 Hz (can be adapted to any other standard networks)



2) Liquid Helium (LHe) based system

The system is designed as a cryogenic insert placed inside a standard LHe Dewar. That allows the use of the superconducting detectors without the need for expensive special cryogenic equipment. The LHe storage Dewar, filled with 100 liters of helium, allows up to 2 months of uninterrupted operation of the system. The main advantage of the system is higher quantum efficiency and lower price if we compare with Closed-cycle system.



Cryogenic insert placed inside the standard liquid helium Dewar

Parameters of the Liquid Helium (LHe) based system:

Element/Parameter	Liquid Helium insert	Pump	Control unit
Weight, kg	4	17	1
Length x width	1100x30 mm	300 x 220 x 160 mm	240 x 260 x 140 mm
Preparation time	120 min	-	-
Maintenance, hours	10,000	5000	-
Power consumption	0.6 kW*		30 W*

* Voltage of control unit and compressor: 100-240 V / 50-60 Hz (can be adapted to any other standard networks)

System specifications:

- Detection efficiency: **90 %**
- Timing jitter: ≤ 45 ps (20 ps on request)
- Dark counts rate: ≤ 10 cps (0.01 cps on request)
- Spectral range: **0.6 ÷ 2.3 μ m**
- No afterpulsing
- Operation in a continuous mode (no gating)

General parameters

- Number of channels: 1-8
- Fiber: SMF 28e*
- Output voltage: 150 mV
- Types of output voltage: TTL, ECL, LVDS
- Electrical connection: SMA
- Driver interface: USB, LabVIEW

III. CONFIGURATION OF THE DETECTION SYSTEM

Each system includes all the components necessary for operation. Some of the components may be excluded at the customer's request.

TYPE OF SYSTEM	THE SYSTEM COMPONENTS
Cryogen-free System	<ul style="list-style-type: none"> • Closed cycle refrigerator (SUMITOMO, series SRDK 101 or other): <ul style="list-style-type: none"> – One / Two / Four hermetical FC/PC-FC/PC adapters; – One / Two / Four CuNi coaxial cables with SMA connectors; – One / Two / Four hermetical SMA female – SMA female adaptors; – Temperature sensor (1.4-300 K); – One / Two / Four fiber coupled superconducting detectors in holders with single mode optical fibers. • Control Unit: <ul style="list-style-type: none"> – One / Two / Four -channel precision DC-bias source for superconducting detectors; – One / Two / Four Bias-T adapters; – One / Two / Four amplifying chains; – Set of connecting cables and SMA connectors; – Power supply. • Temperature monitor. • Compressor. • Operation manual.
TYPE OF SYSTEM	THE SYSTEM COMPONENTS
LHe System	<ul style="list-style-type: none"> • Low temperature double wall dipstick with Cryogenic Insert: <ul style="list-style-type: none"> – One / Two / Four single mode optical fibers (SMF 28e) with FC connectors; – One / Two / Four coaxial cables with SMA connectors; – Pressure transducer and temperature sensor; – One / Two / Four fiber coupled superconducting detectors. • Control Unit: <ul style="list-style-type: none"> – One / Two / Four -channel precision DC-bias source for superconducting detectors; – Temperature and pressure measuring unit; – One / Two / Four Bias-T adapters; – One / Two / Four amplifying chains; – Set of connecting cables and SMA connectors; – Power supply. • Vacuum system: <ul style="list-style-type: none"> – Oil pump; – Pressure regulating system; – Set of vacuum hoses and clamps. • Adapter for Helium Dewar (DN-50 or other); • Operation manual.

IV. DELIVERY TERMS OF SINGLE PHOTON DETECTION SYSTEM

Delivery Time:

LHe System: 12-16 weeks after receipt of Purchase Order; Cryo-

genic-free System: 25-30 weeks after receipt of Purchase Order.

Delivery Terms: DAP Buyer's city (Incoterms 2010)

Payment Terms: Payment only after 30 days of successful testing.

All bank charges are at the Seller's cost