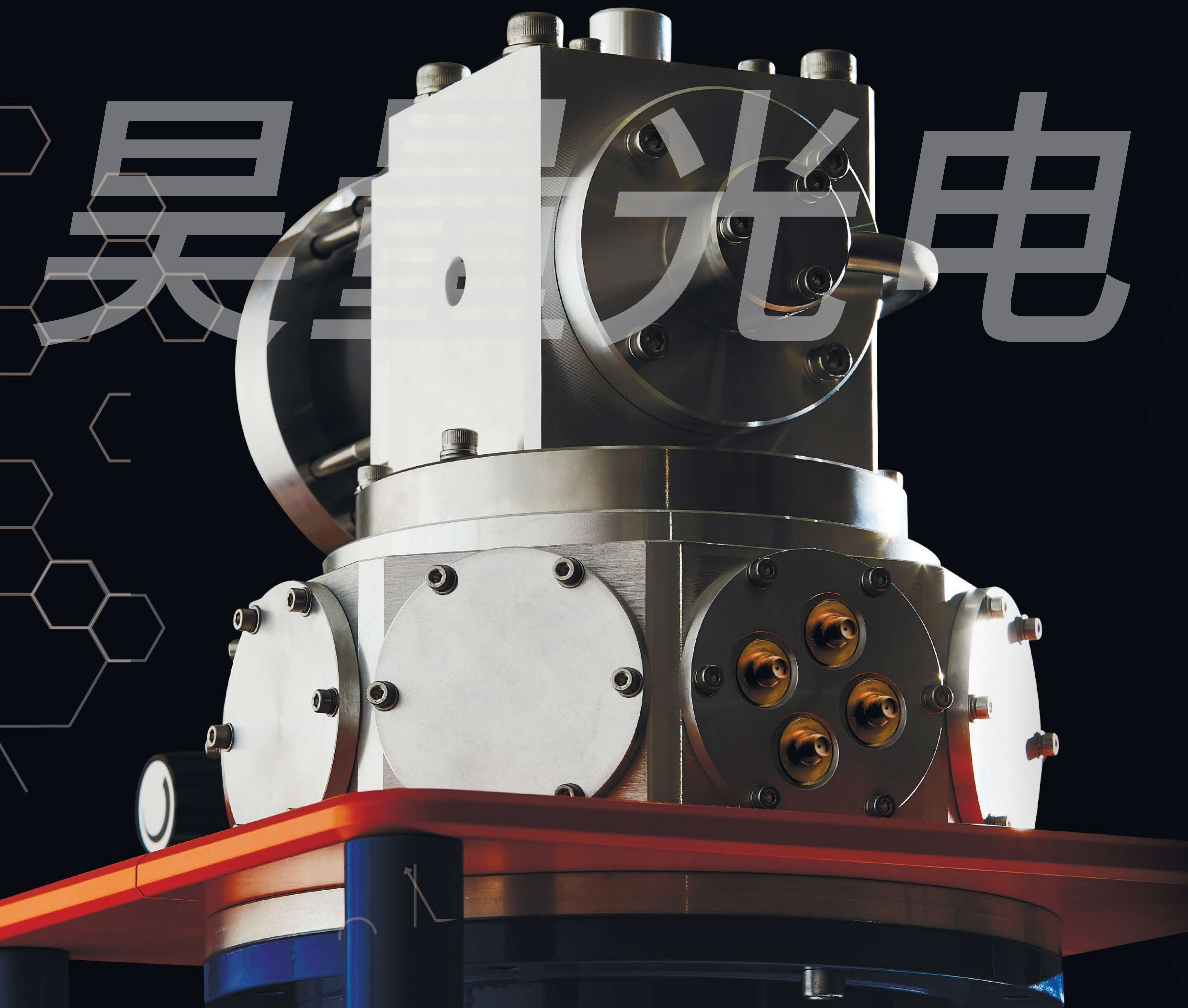




SUPERCONDUCTING NANOTECHNOLOGY

**DETECT EVERYTHING YOU WANT**

ULTRA-SENSITIVE OPTICAL DETECTORS  
**FOR ANY EXPERIMENTAL DEMANDS**





DETECT EVERYTHING YOU WANT

# SUPERCONDUCTING SINGLE-PHOTON DETECTORS

Picosecond time resolution and near-unity efficiency with a single detector

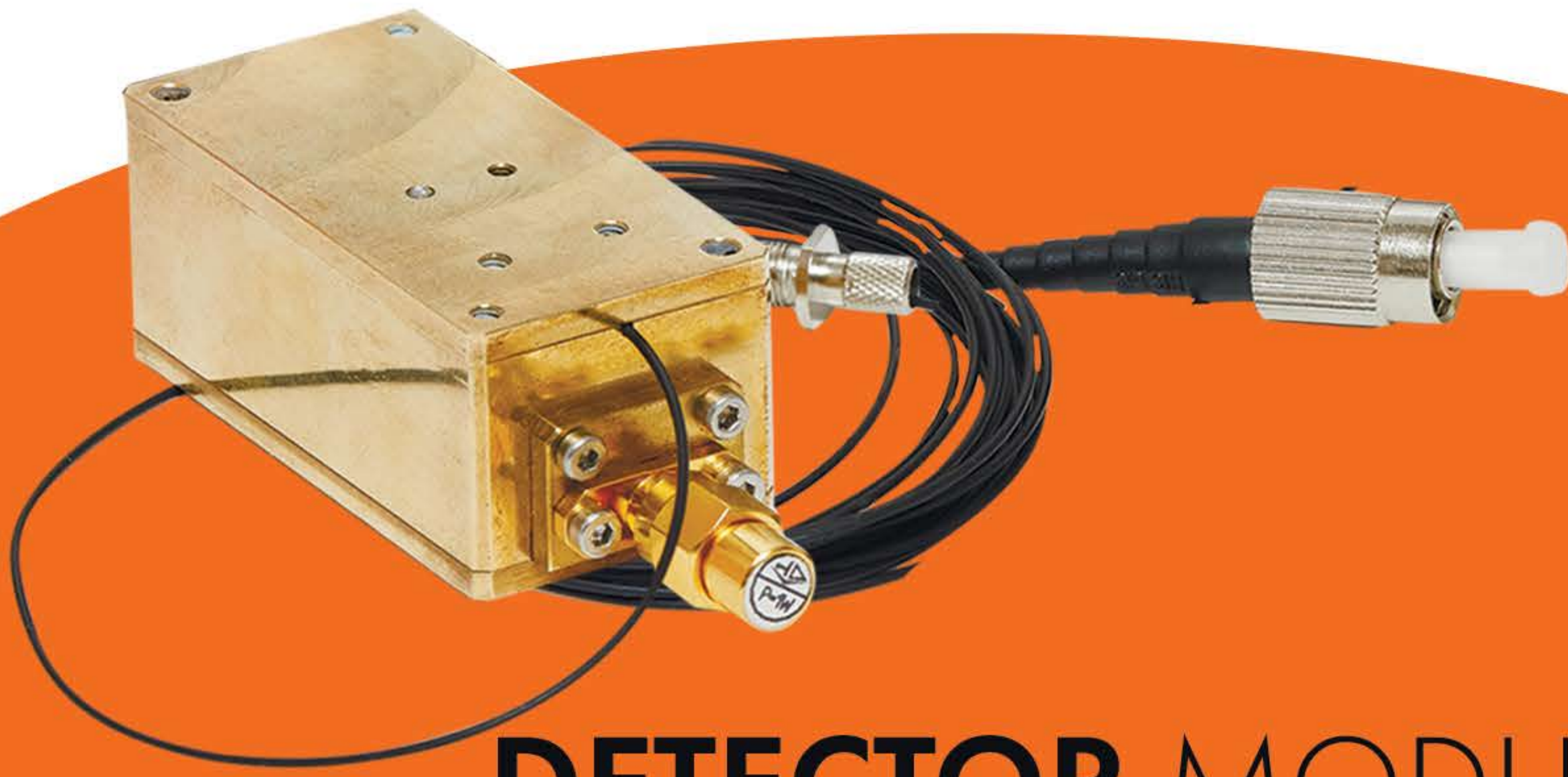
The first demonstration of single-photon detection with an SSPD was made in 2001 in MSPU by future SCONTEL employees. Starting from that moment the performance of the detectors was pushed forward drastically. Nowadays, our detectors make a strong rivalry to established APD and PMT technologies outperforming them in many if not all specifications. The strong side of SSPDs is a remarkably wide spectral range of operation from visible to mid-IR, which is simultaneously obtained with unprecedented speed and efficiency. Our detectors could sustain active operation for more than 4 weeks being resistant to damage by optical and electrical power spikes. Our SSPD detectors come in three different system configurations.



**LHe** DIPSTICK

A convenient option if you work with liquid helium. Dipsticks allow continuous operation which is only limited by the LHe residue. The dipstick can cool down 4 (max.) SSPD channels of the required types.





## DETECTOR MODULE

This is the most compact and portable option which however shall be installed into your cryostat or cooled down below 5 K by any other means. Detector module is equipped with SMA RF readout and detector-coupled single-mode fiber. Achievement of the declared characteristics is highly dependent on the operating temperature of the module.



## CLOSED CYCLE



LHe-free systems based on the Gifford-McMahon cycle. A simple and stable long-term operation for 1-16 SSPD channels. The types of channels could be customized.



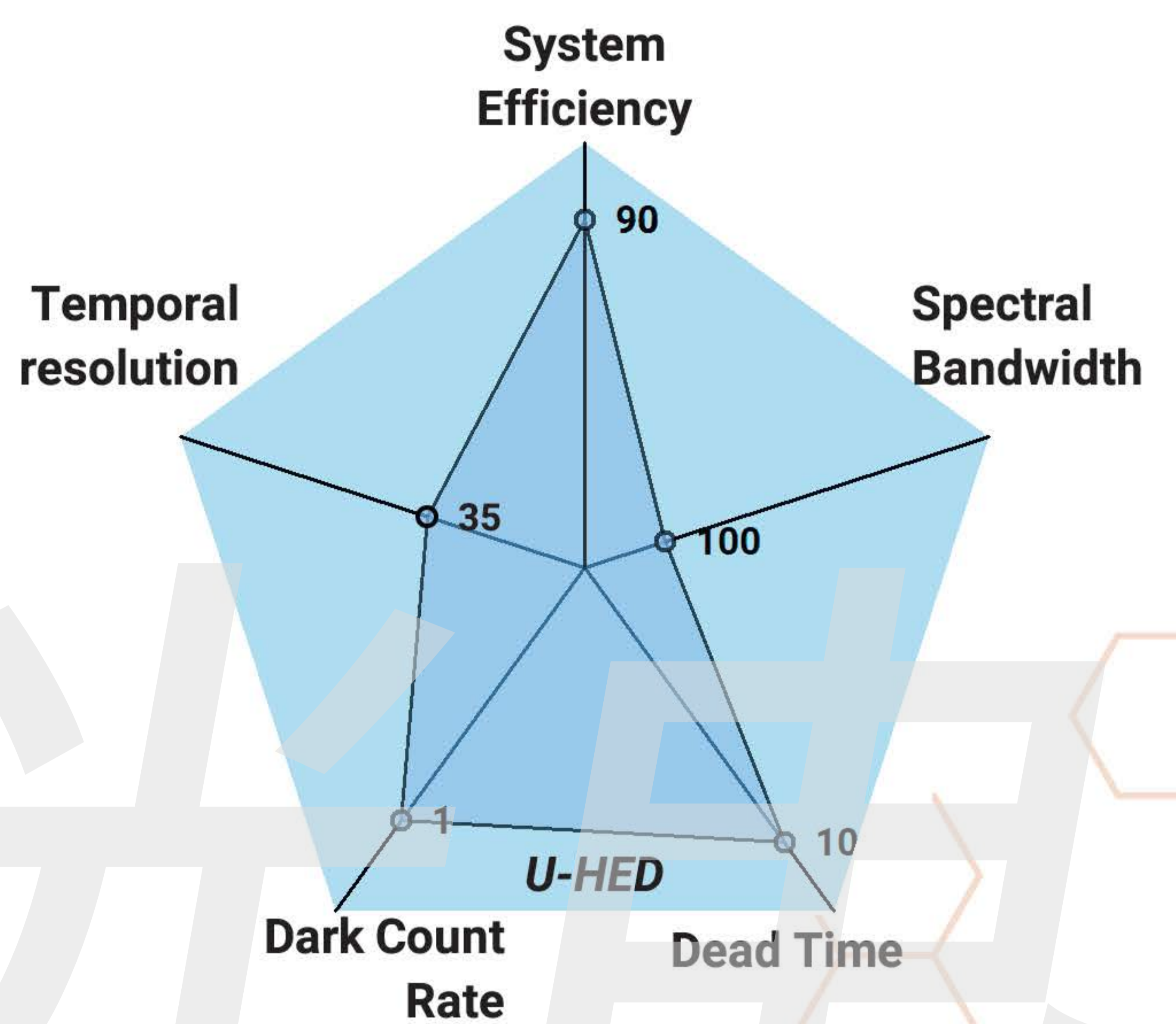
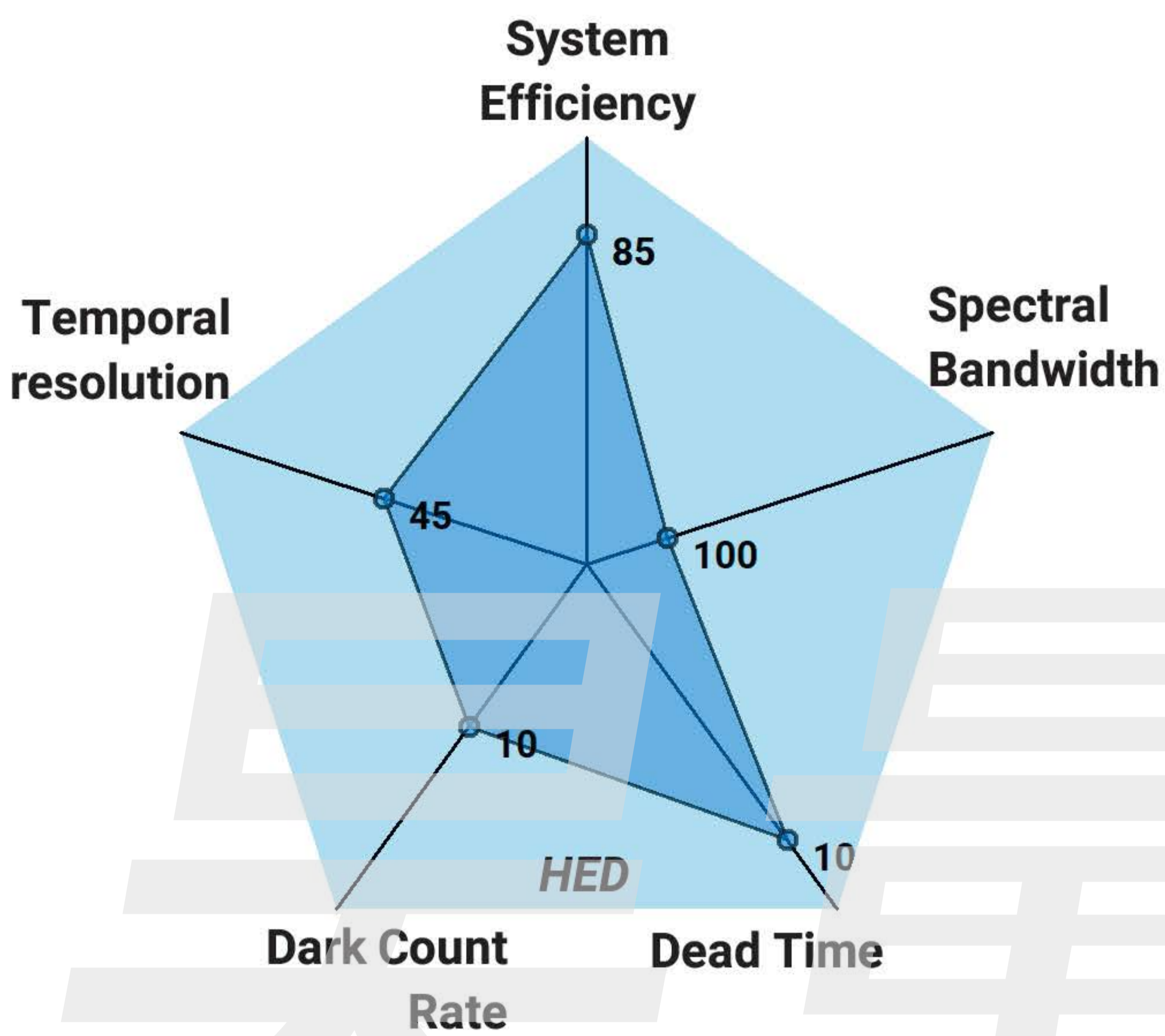
## SSPD CONFIGURATIONS

Characteristics	Short-Wave (0.7-1.3 um)	Telecom-Wave (1.3-1.6 um)	Long-Wave (1.6-2.3 um)	Detector type
System efficiency (%)	85	85	50	<b>HED</b> High-efficiency detector
Spectral width (nm)	100	100	100	
Dead time (ns)	10	15	25	
Dark count rate (cps)	10	100	500	
Minimal jitter (ps)	45	50	70	
System type	Closed cycle; LHe dipstick		CC	
System efficiency (%)	90	90	70	<b>U-HED</b> Ultra-high-efficiency detector
Spectral width (nm)	100	100	100	
Dead time (ns)	10	20	25	
Dark count rate (cps)	1	100	500	
Minimal jitter (ps)	35	40	70	
System type	Closed cycle			
System efficiency (%)	60	60	15	<b>Broadband</b>
Spectral width (nm)	300	400	500	
Dead time (ns)	10	15	25	
Dark count rate (cps)	10	10	500	
Minimal jitter (ps)	45	50	70	
System type	Closed cycle; LHe dipstick		CC	
System efficiency (%)	85*	75*	-	<b>Low-noise</b>
Spectral width (nm)	50	20		
Dead time (ns)	10	15		
Dark count rate (cps)	0.5*	1*		
Minimal jitter (ps)	50	60		
System type	Closed cycle; LHe dipstick			
System efficiency (%)	85*	75*	-	<b>Low-jitter</b>
Spectral width (nm)	100	100		
Dead time (ns)	10	15		
Dark count rate (cps)	10	100		
Minimal jitter (ps)	25*	35*		
System type	Closed cycle; LHe dipstick			

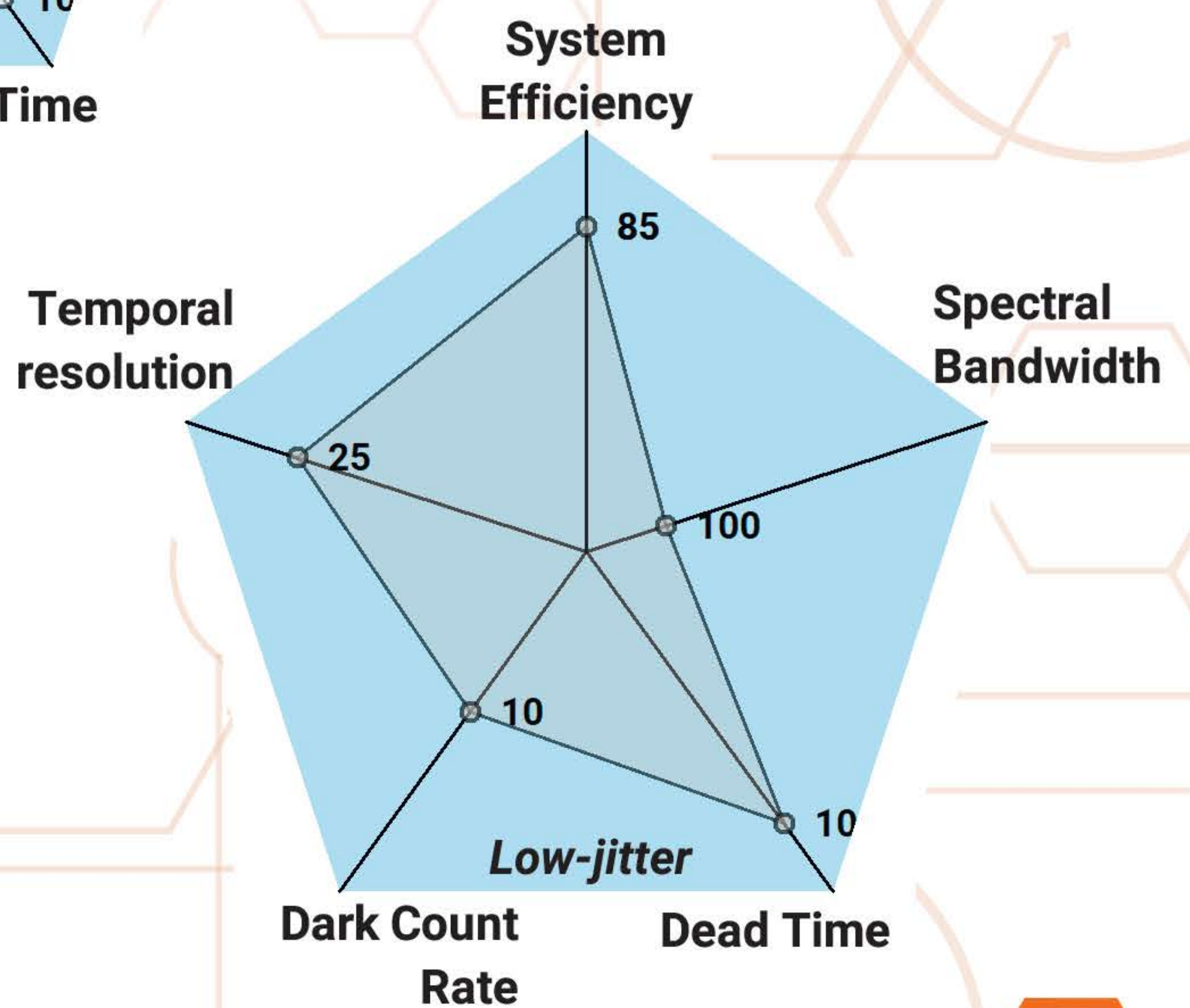
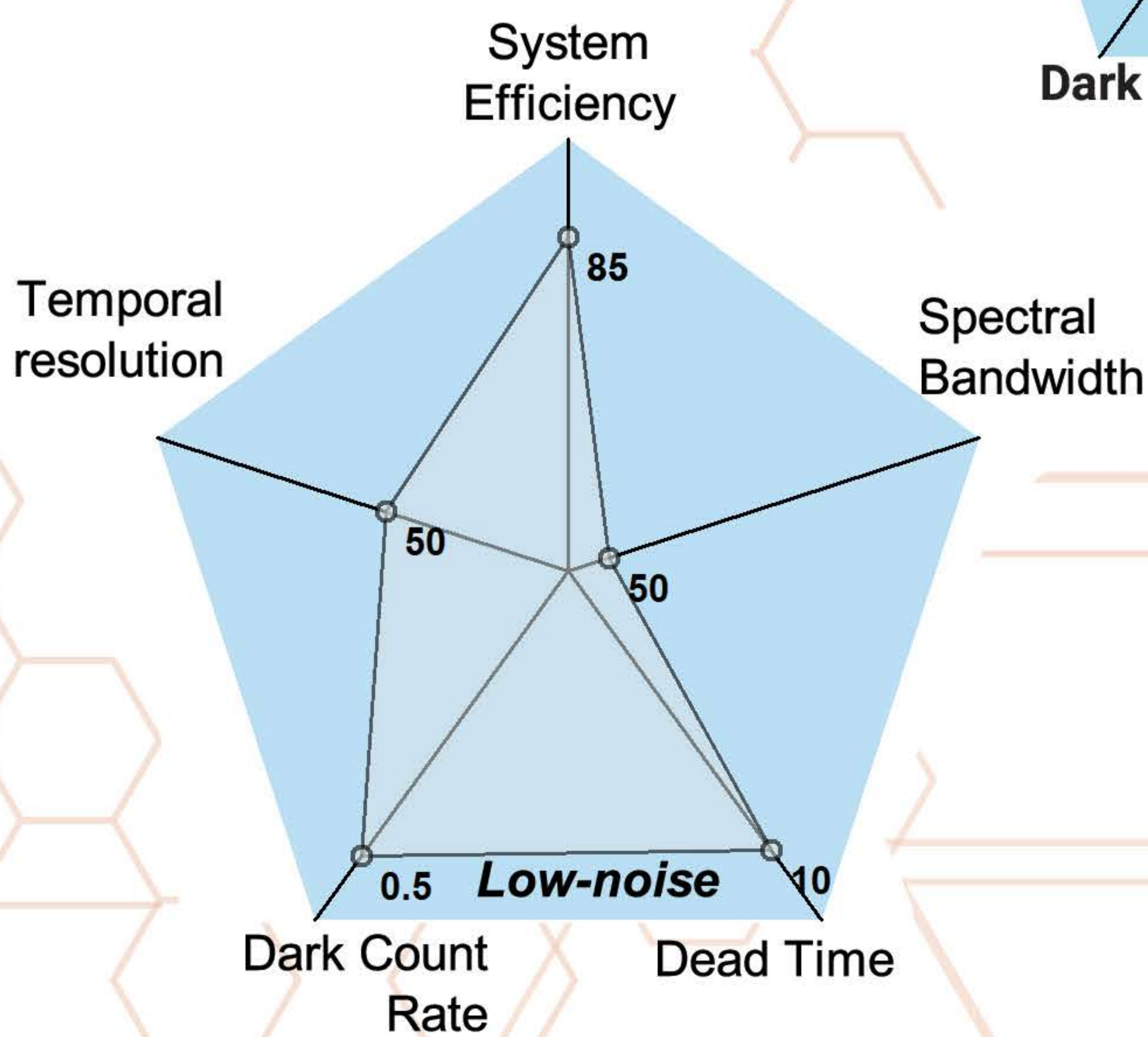
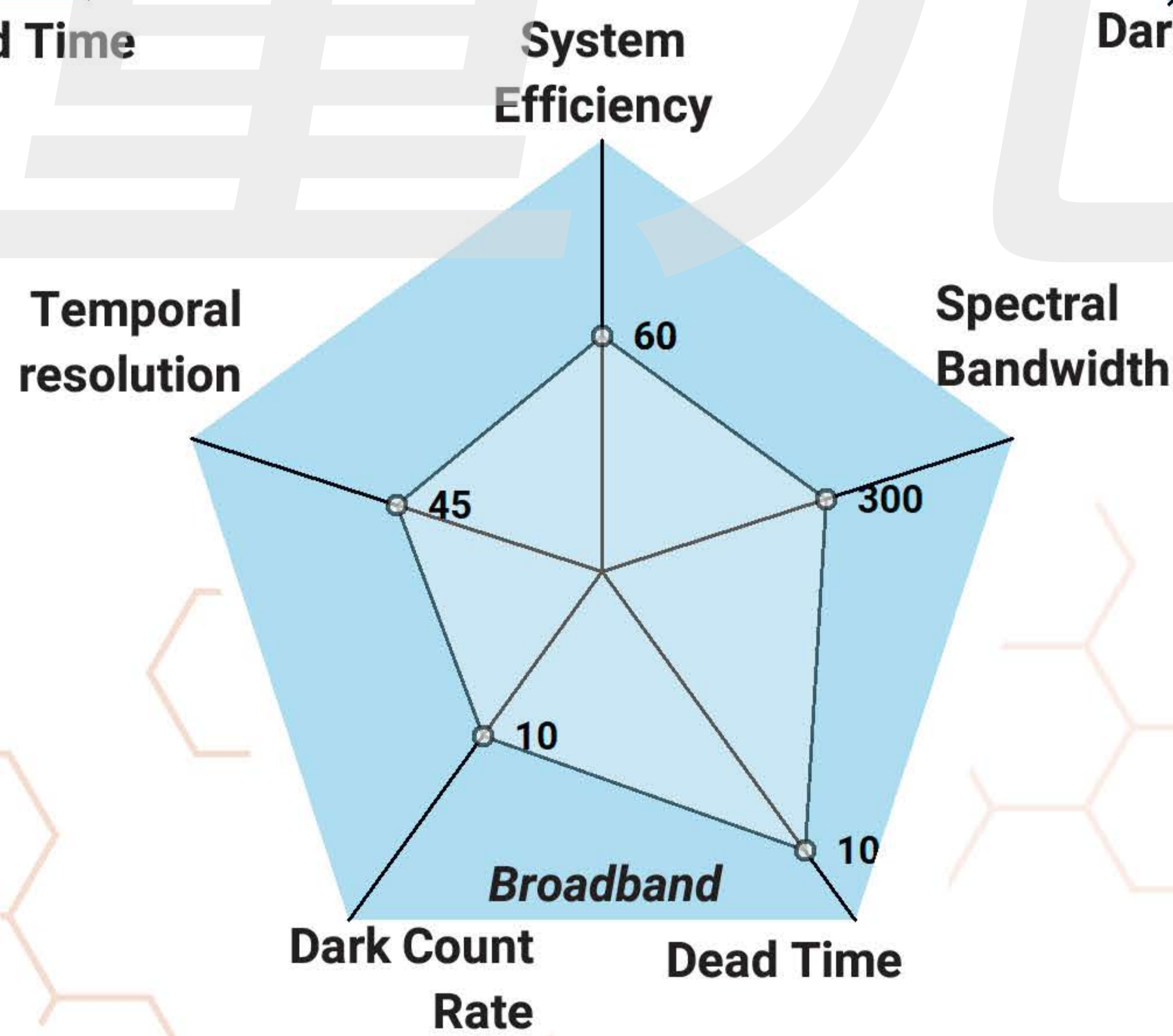
\* For more accurate values refer to a paragraph of selected detector type or contact us at [scontel@scontel.ru](mailto:scontel@scontel.ru)



We readily offer different types of SSPDs which can satisfy practically all the possible experimental demands in the single photon world. To choose the most suitable detector, select the overriding parameters for your purposes, such as system efficiency, dark count rate, jitter, and spectral operation range. Depending on these requirements, we will configure the best possible system for you.



Data for performance comparison in SW range

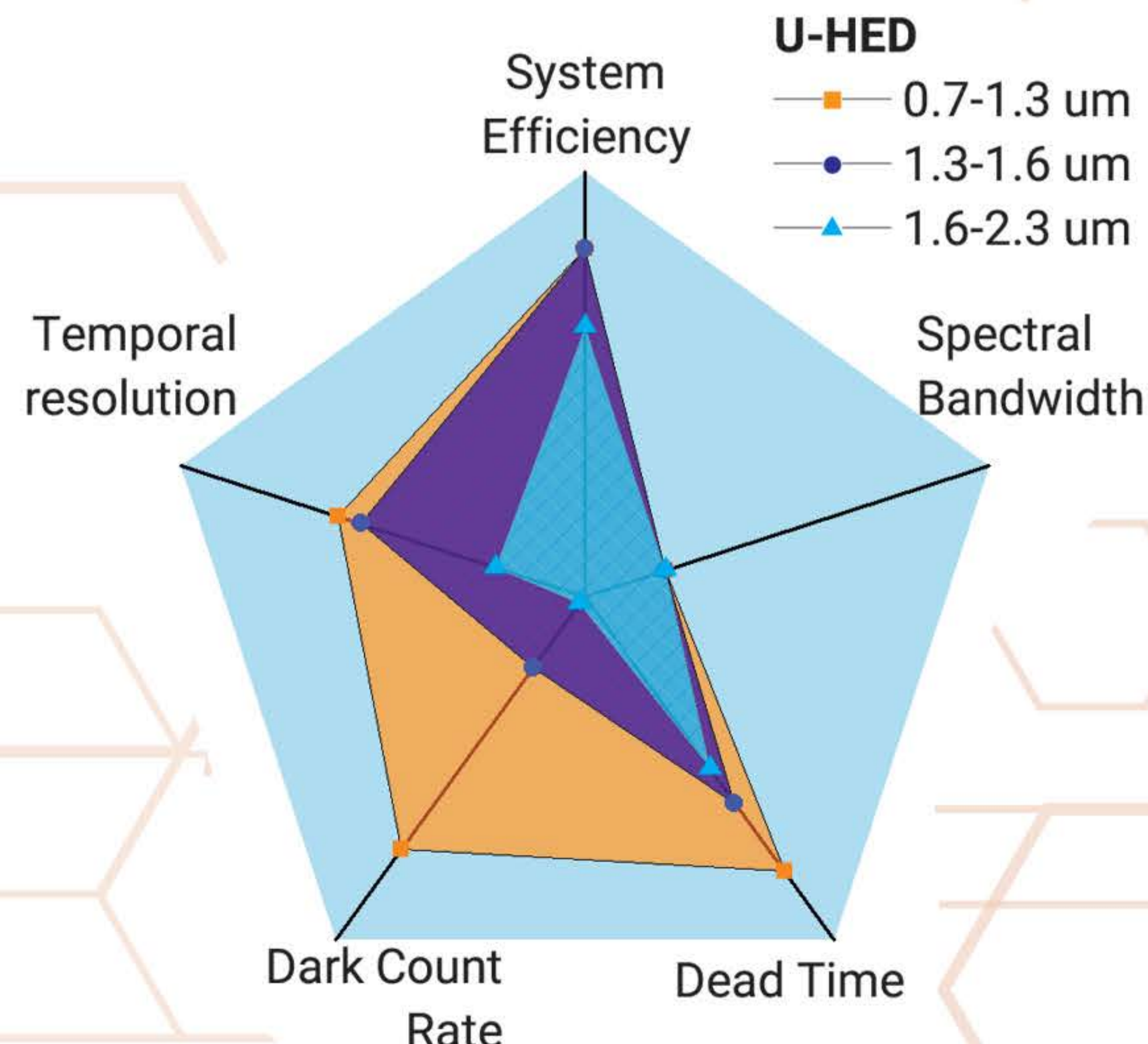
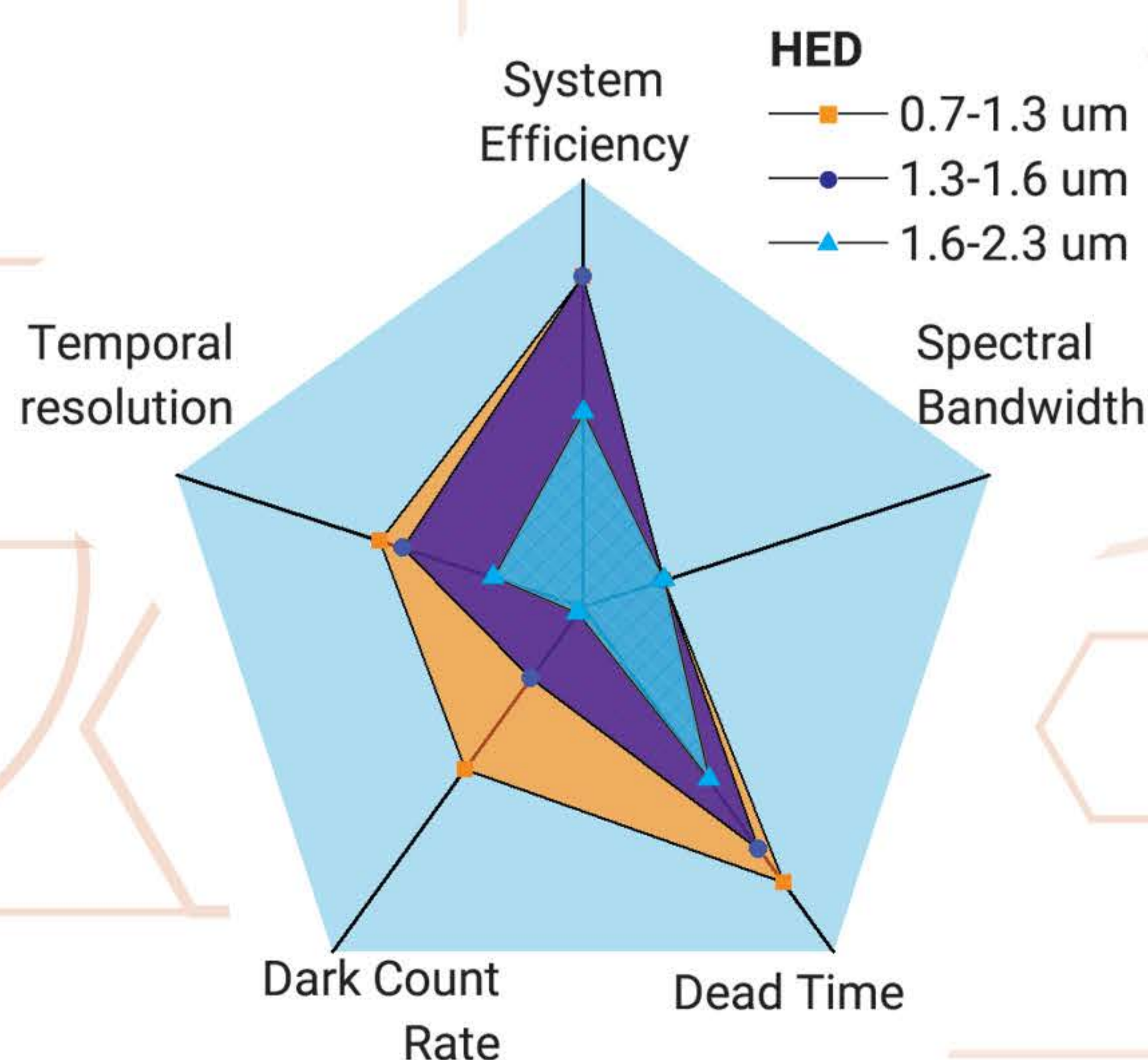




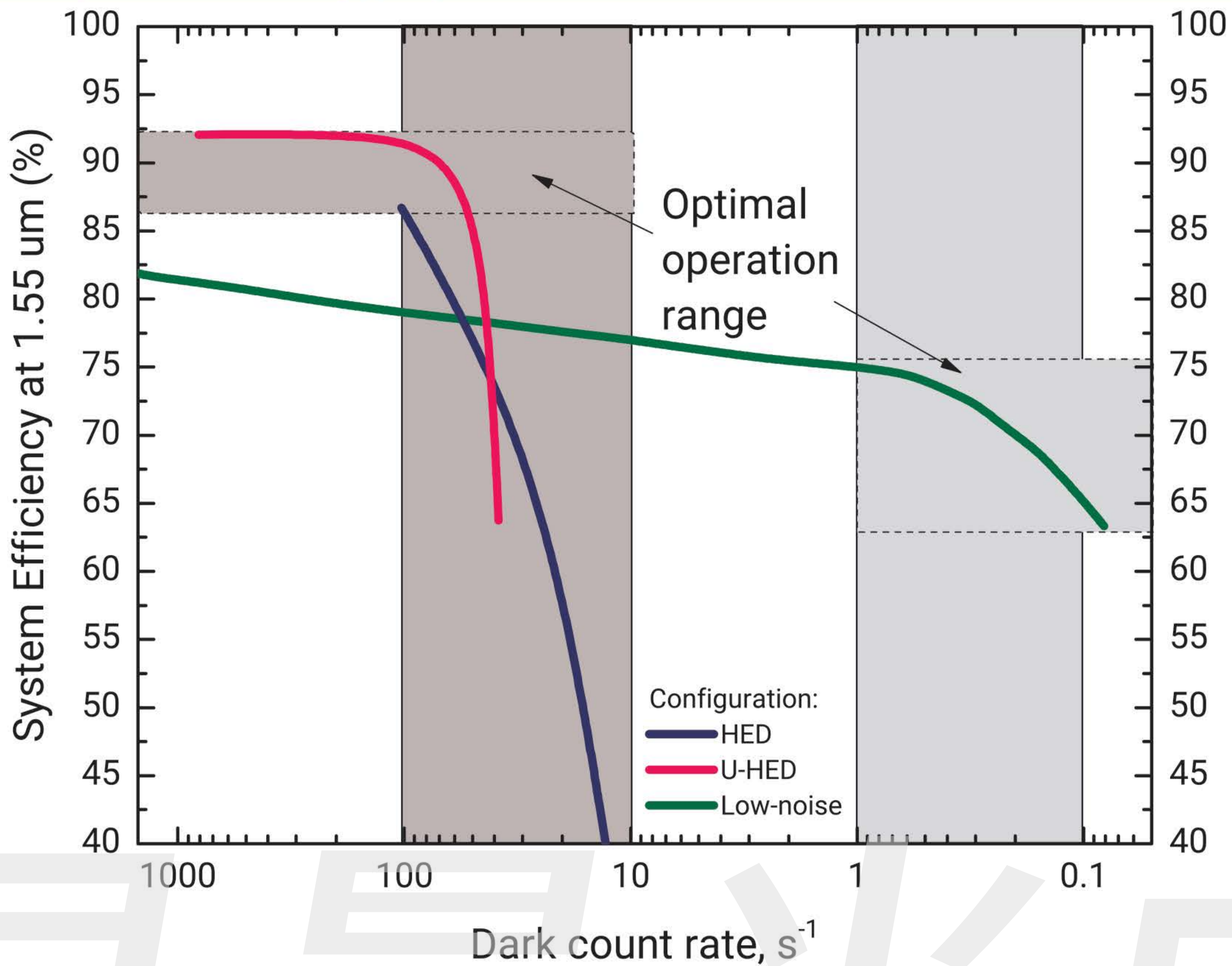
## HIGH- AND ULTRA-HIGH-EFFICIENCY DETECTORS

HED configuration is an all-in-one solution for most of the experiments. Its high efficiency is achieved without sacrificing other important parameters. Its moderate spectral width is customized by request to achieve the peak system efficiency values at the wavelengths of interest. U-HED is a modified version that utilizes the sorption stage in addition to the standard Gifford-McMahon cryocooler, which lowers the operating temperature down to 0.8 K and enhances the performance of detectors. Despite the change, our system is easy-to-use and requires only basic skills related to cryogenic and vacuum techniques.

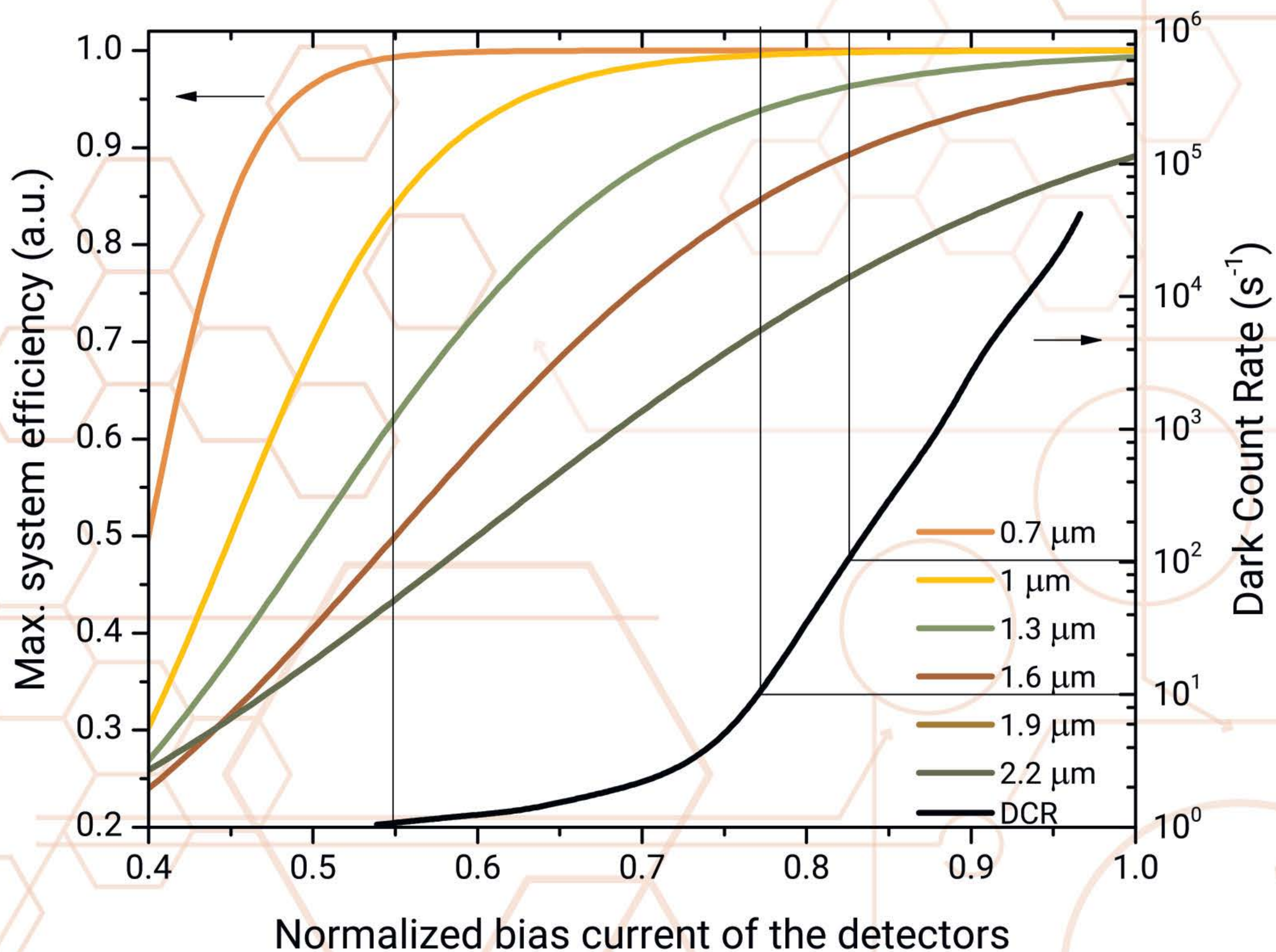
Characteristics	Short-Wave (0.7-1.3 $\mu\text{m}$ )	Telecom-Wave (1.3-1.6 $\mu\text{m}$ )	Long-Wave (1.6-2.3 $\mu\text{m}$ )	Detector type
System efficiency (%)	35	85	50	<b>HED</b> High-efficiency detector
Spectral width (nm)	100	100	100	
Dead time (ns)	10	15	25	
Dark count rate (cps)	10	100	500	
Minimal jitter (ps)	45	50	70	
System type	Closed cycle; LHe dipstick		CC	
System efficiency (%)	90	90	70	<b>U-HED</b> Ultra-high-efficiency detector
Spectral width (nm)	100	100	100	
Dead time (ns)	10	20	25	
Dark count rate (cps)	1	100	500	
Minimal jitter (ps)	35	40	70	
System type	Closed cycle			







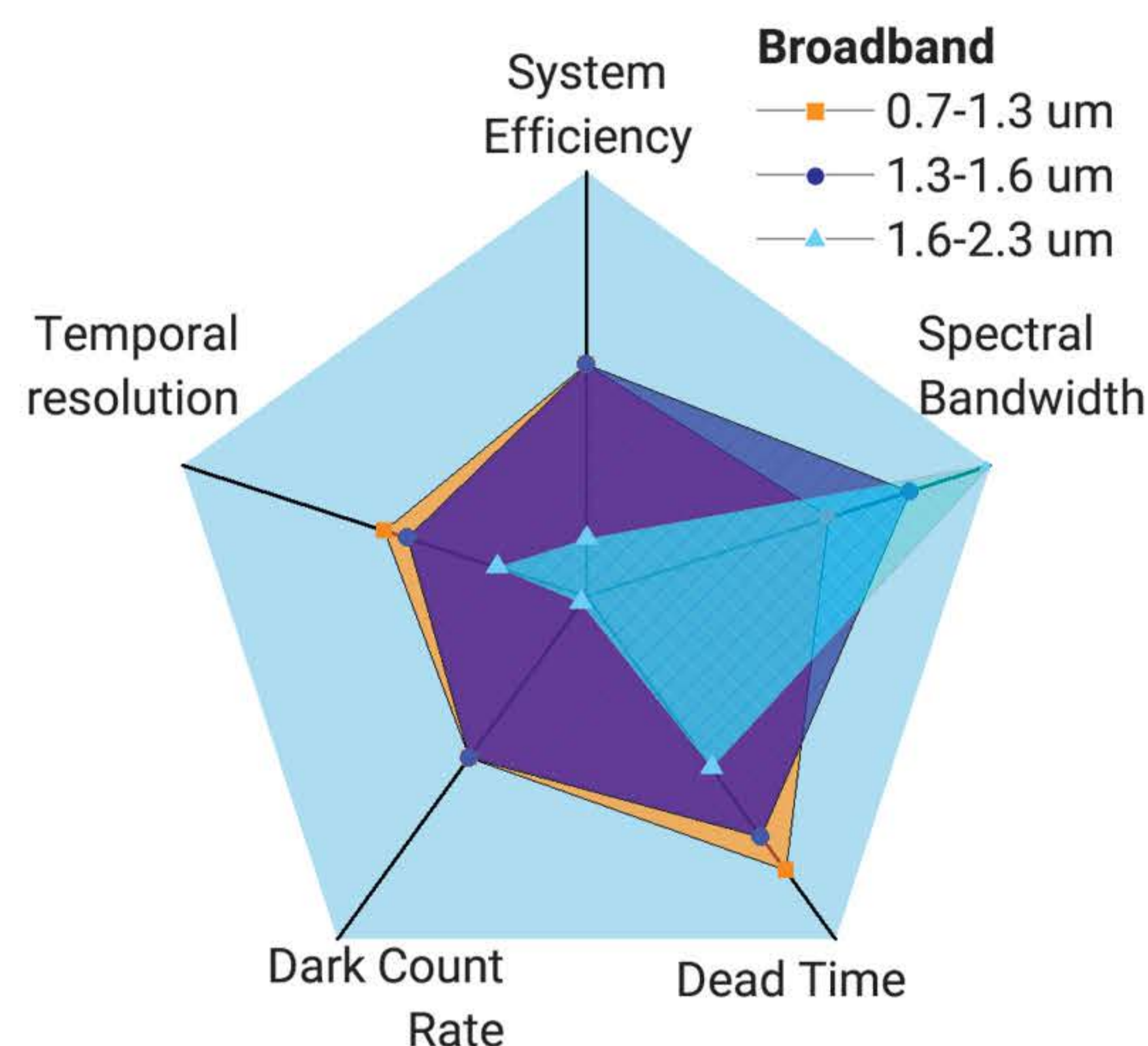
In SSPDs, system efficiency, dark count rate and photon energy establish the performance of the device. There is always a trade-off between reaching the highest efficiency and keeping the noise level low. For lower photon energies this relation is more prominent. To adjust the detector efficiency it is possible to vary its bias current as shown below.



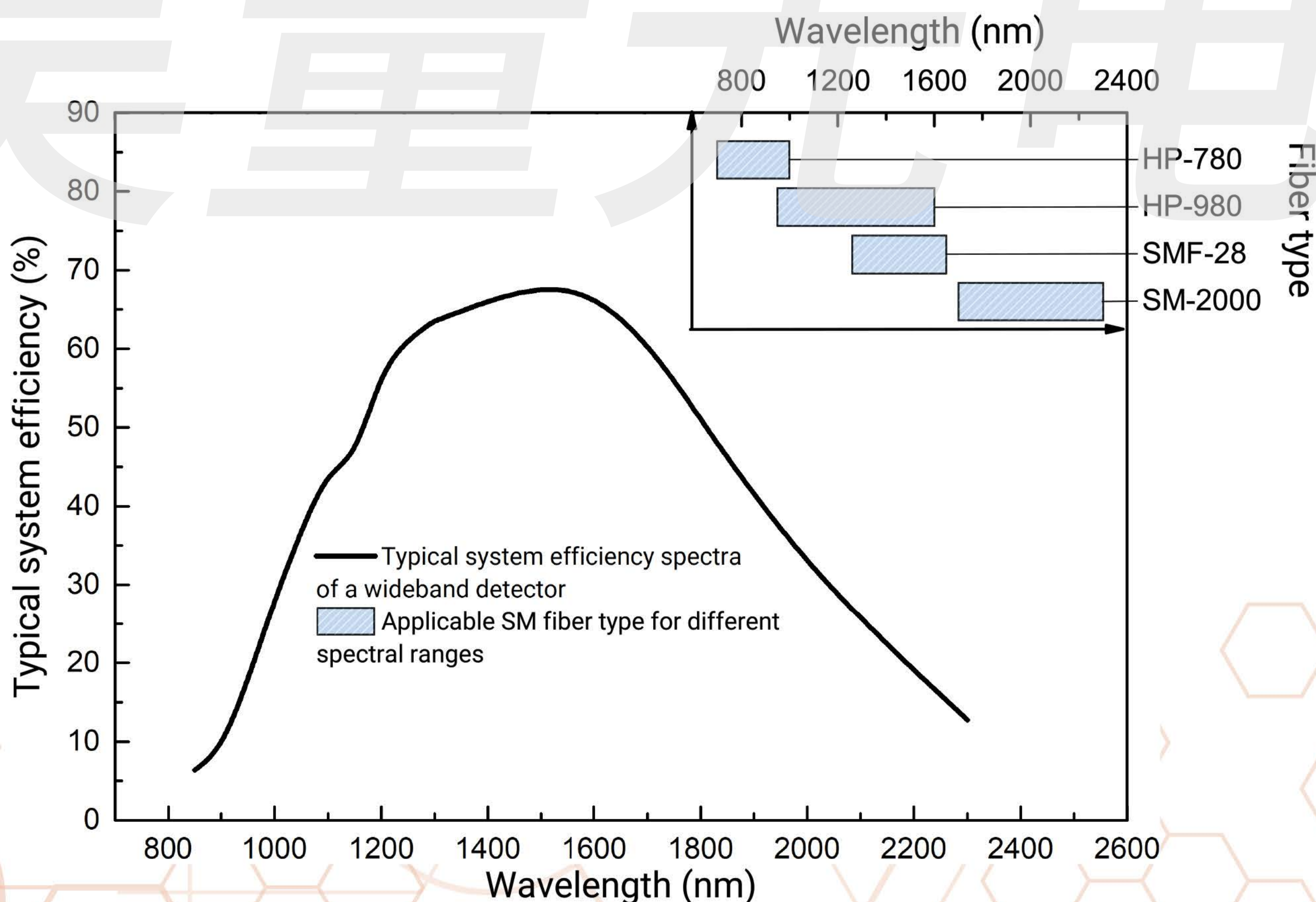


## BROADBAND DETECTORS

Characteristics	Short-Wave (0.7-1.3 $\mu\text{m}$ )	Telecom-Wave (1.3-1.6 $\mu\text{m}$ )	Long-Wave (1.6-2.3 $\mu\text{m}$ )
System efficiency (%)	60	60	15
Spectral width (nm)	300	400	500
Dead time (ns)	10	15	25
Dark count rate (cps)	10	10	500
Minimal jitter (ps)	45	50	70
System type	Closed cycle; LHe dipstick		CC



This configuration is an excellent option for the systems intended for collaborative and shared usage or for the newly designed experiments in which the exact narrow-band range of the interest has not been determined yet.

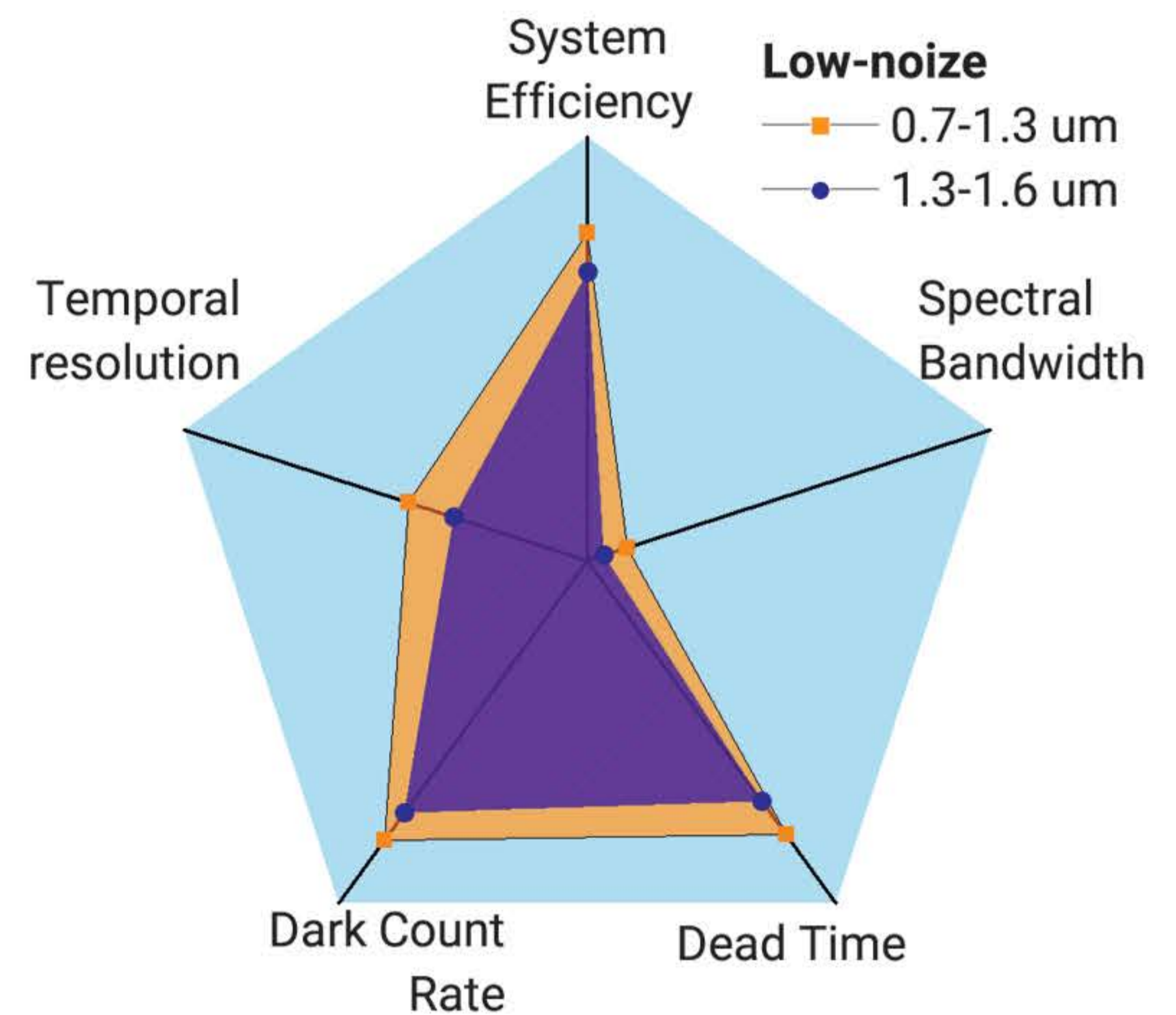


The system efficiency optimum is customizable. The overall spectra will depend on the selected fiber type.



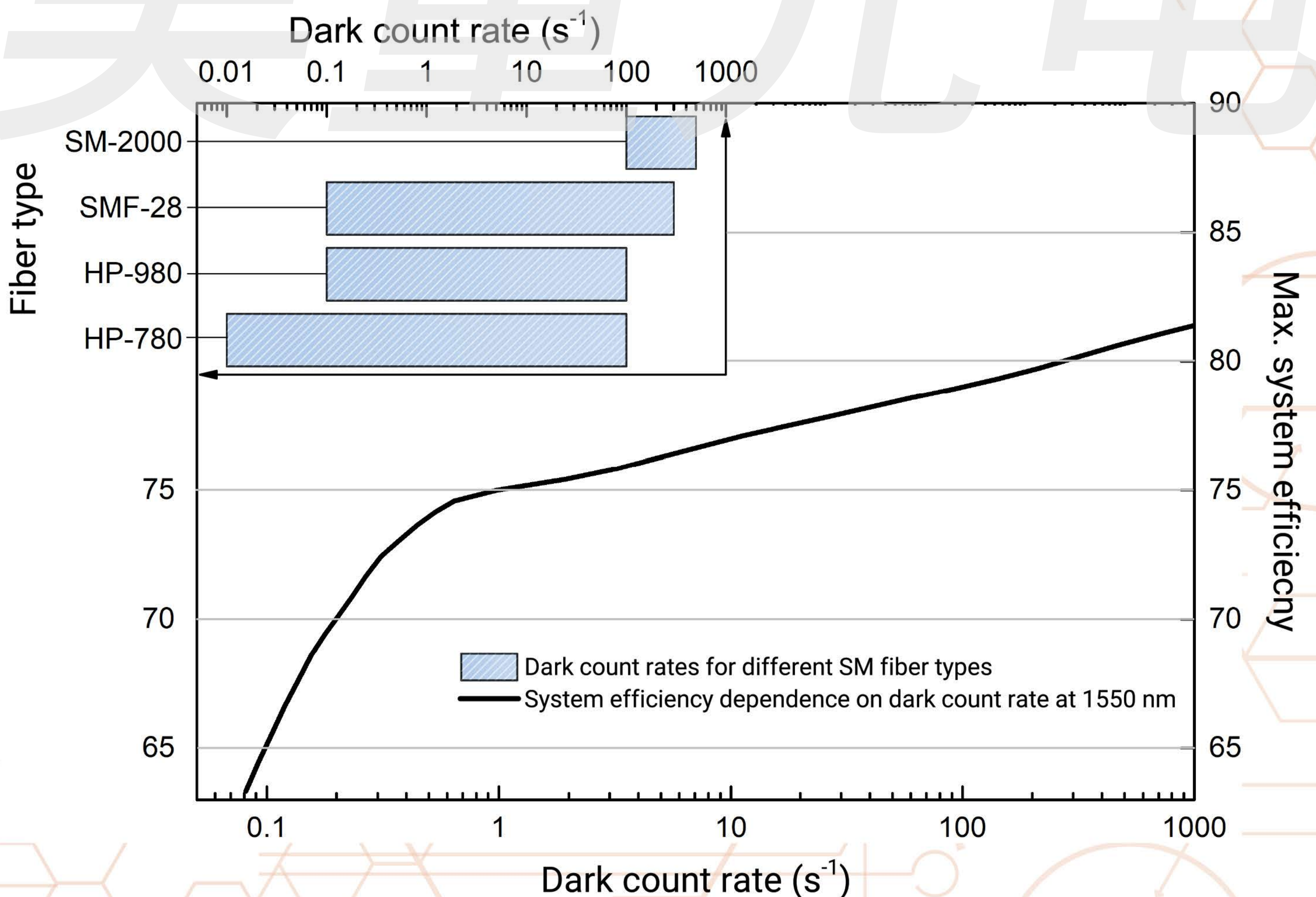
# LOW-NOISE DETECTORS

Characteristics	Short-Wave (0.7-1.3 $\mu\text{m}$ )	Telecom-Wave (1.3-1.6 $\mu\text{m}$ )
System efficiency (%)	85*	75*
Spectral width (nm)	50	20
Dead time (ns)	10	15
Dark count rate (cps)	0.5*	1*
Minimal jitter (ps)	50	60
System type	Closed cycle; LHe dipstick	



\*For more accurate values refer to the graph below or contact us at [scontel@scontel.ru](mailto:scontel@scontel.ru)

Decreased dark count rate of this devices makes them perfectly suitable for quantum communication experiments. Our control unit will sustain long-term stability of the devices for long-lasting experiments with extremely low photon flux.

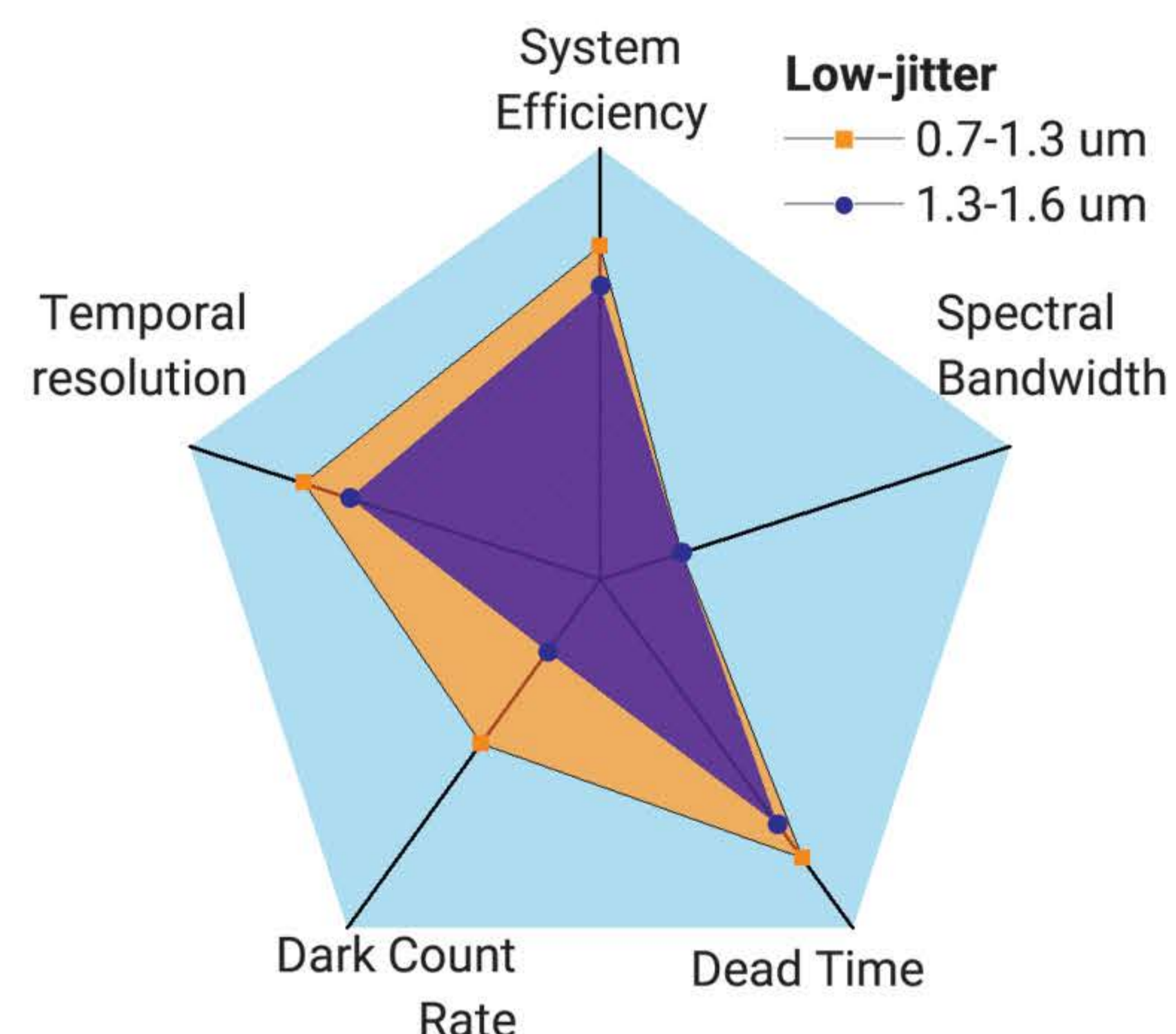




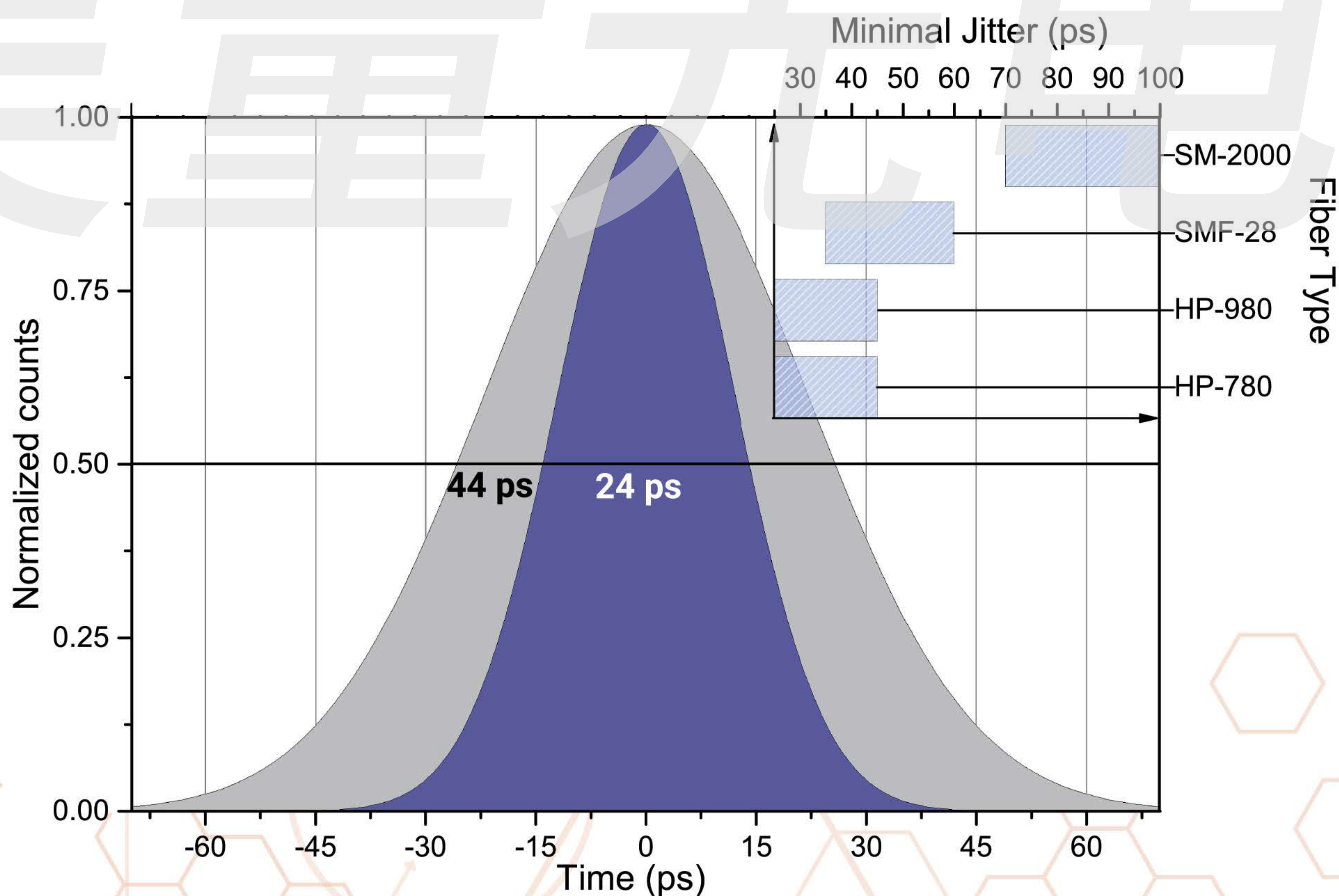
## LOW-JITTER DETECTORS

Characteristics	Short-Wave (0.7-1.3 $\mu\text{m}$ )	Telecom-Wave (1.3-1.6 $\mu\text{m}$ )
System efficiency (%)	85*	75*
Spectral width (nm)	100	100
Dead time (ns)	10	15
Dark count rate (cps)	10	100
Minimal jitter (ps)	25*	35*
System type	Closed cycle; LHe dipstick	

\* For more accurate values refer to assistive graph or contact us at [scontel@scontel.ru](mailto:scontel@scontel.ru)



Jitter is one of the strong sides of SSPDs. The temporal resolution might be a key feature in many single-photon applications, such as LIDAR or single-molecule luminescence.



We do our best to improve the user experience for any measurements with our systems. For the experiments with an ultra-high temporal resolution, we recommend using Becker & Hickl TCSPC products to get the most from SSPDs.



# ADDITIONAL INFORMATION ON SSPD SYSTEMS

All our systems include a control unit for SSPD operation. Depending on the number of channels and requirements of your experiment, we offer a basic version of the control unit with 1 or 2 channels or 4-16 channel modular control unit with additional in-build electronics for pulse counting.

We propose future upgrades for all systems. If you intended to increase the number of channels in your system just contact us at [scontel@scontel.ru](mailto:scontel@scontel.ru). For all systems additional warranty extension is available.

## Information on control units

Control unit type	Number of channels	Output signal type	Control	Features
Nonmodular	1-2	10-40 ns duration; >150 mV (positive/negative) or ~1 V (positive)	Local and remote (via USB; Labview drivers included)	Screen and tuning knobs
Modular	1-16		Local and remote (via LAN; special software for PC and smartphones is included)	Touchscreen (optional); build-in Raspberry Pi hardware; build-in counter

## Dimensions and required equipment for systems' operation

Item	Dimensions (L×W×H in mm)	Weight (kg)	Required accessories
Closed-cycle cryostat with compressor	400×400×700 (standard cryostat model)	15 (cryostat)	Turbopump
	610×390×450 (110/220 V air-cooled compressor)	75 (compressor)	
Dipstick	∅30 (or ∅45) ×1200	3	Vacuum pump
Detector module	12×15×20	0.2	Cryostat