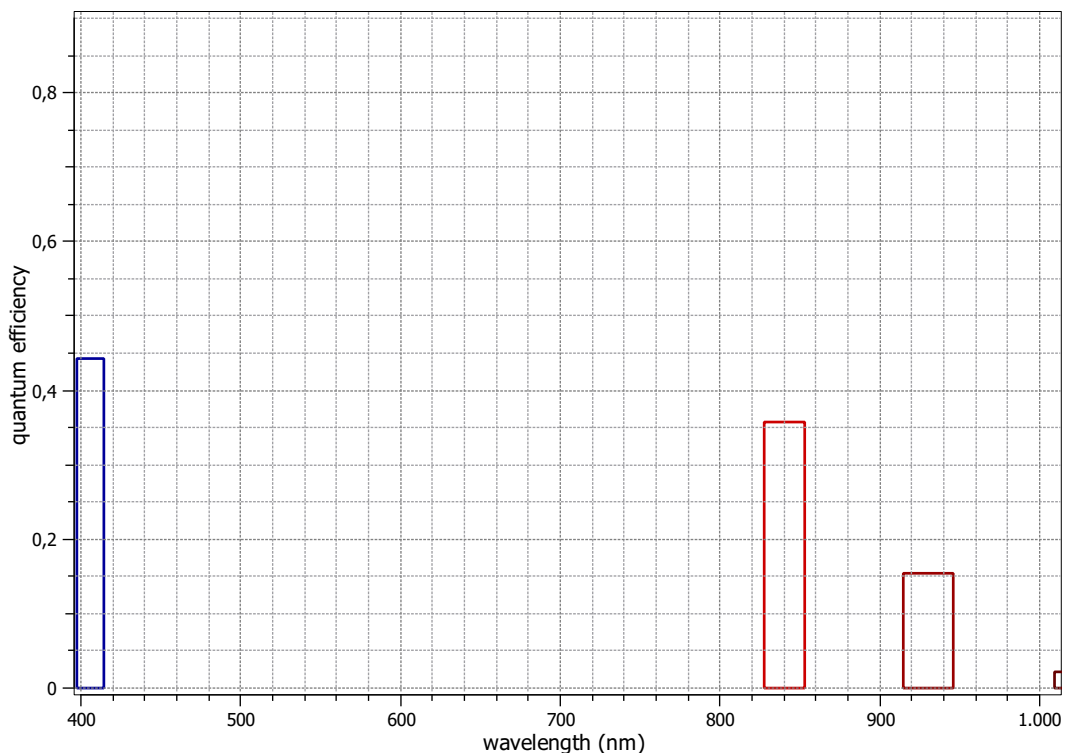


## EMVA 1288 Summary Sheet

This datasheet describes the specification according to the standard 1288 release 3.1 for "Characterization and Presentation of Specification Data for Image Sensors and Cameras" issued on December 30, 2016 by the European Machine Vision Association (EMVA), published at [www.standard1288.org](http://www.standard1288.org) and the *zenodo EMVA 1288 community* with proprietary extensions from AEON. The measurements were performed with the AEON ACC4, Release 3d, 06.10.2019, SN 0003(Baumer).

Measurements performed by Technical and Application Support Center, Baumer Optronic GmbH.

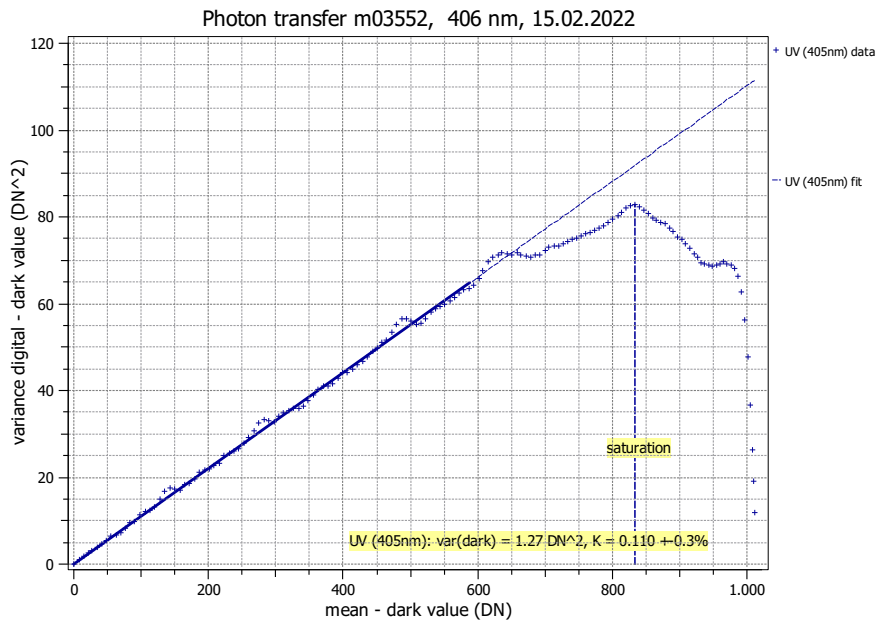
Vendor	Baumer	Type of data presented	Single	<b>Optional data measured</b> None
Model	VCXG-13NIR	<b>Operation point 1</b>		
Serial number	700005397592	Wavelength centroid	405.8 nm	
Sensor diagonal	7.87 mm	Wavelength FWHM	16.8 nm	
Lens category	C-Mount	Gain, black-level	1.0 / 7.0	
Resolution	1280 × 1024, 10 bit	<b>Operation point 2</b>		
Pixel size (h×v)	4.80 μm × 4.80 μm	Wavelength centroid	840.1 nm	
Sensor	OnSemi PYTHON1300	Wavelength FWHM	24.9 nm	
Sensor type	CMOS	Gain, black-level	1.0 / 7.0	
Shutter type	Global shutter	<b>Operation point 3</b>		
Overlap cap.	Overlapped	Wavelength centroid	930.1 nm	
Max. frame rate	0.0 Hz	Wavelength FWHM	31.1 nm	
Interface type	GEV	Gain, black-level	1.0 / 7.0	
		<b>Operation point 4</b>		
		Wavelength centroid	1041.5 nm	
		Wavelength FWHM	64.1 nm	
		Gain, black-level	1.0 / 7.0	



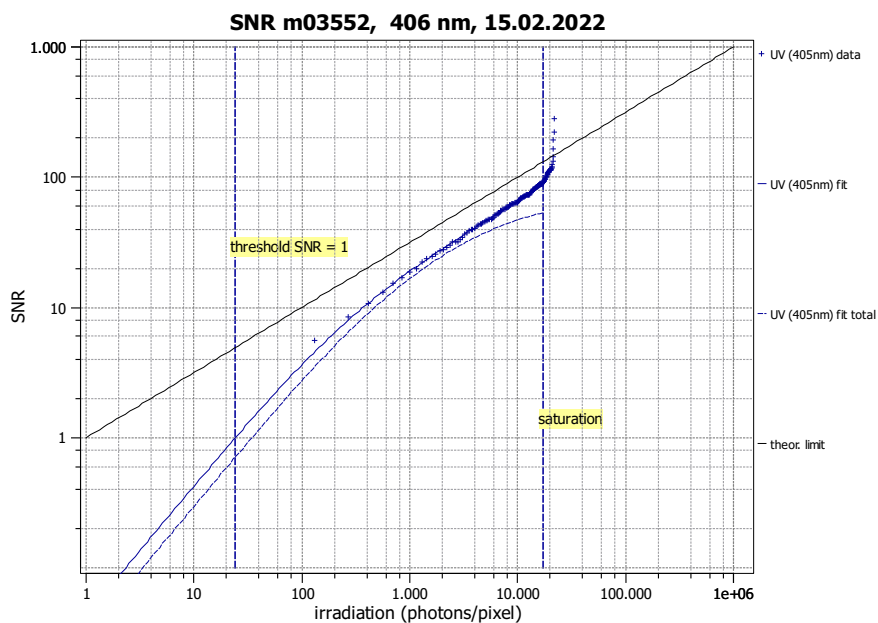
## Summary Sheet for Operation Point 1 at a Wavelength of 406 nm

Type of data	Single	Gain, black-level	1.0 / 7.0
Exposure control	By irradiance	Environmental temperature	26.4 °C
Exposure time	410.00 $\mu$ s	Camera body temperature	25.0 °C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	406 nm, 16.8 nm

### Photon Transfer



### Signal-to-Noise Ratio



#### Quantum efficiency

$\eta$  44.2%

#### Overall system gain

$K$  0.110 DN/e<sup>-</sup>

$1/K$  9.072 e<sup>-</sup>/DN

#### Temporal dark noise

$\sigma_d$  9.88 e<sup>-</sup>

$\sigma_{y,\text{dark}}$  1.13 DN

#### Signal-to-noise ratio

SNR<sub>max</sub> 87

38.8 dB

6.4 bit

$1/\text{SNR}_{\text{max}}$  1.15 %

#### Absolute sensitivity threshold

$\mu_{p,\text{min}}$  24.3 p

$\mu_{p,\text{min,area}}$  1.05 p/ $\mu\text{m}^2$

$\mu_{e,\text{min}}$  10.7 e<sup>-</sup>

$\mu_{e,\text{min,area}}$  0.47 e<sup>-</sup>/ $\mu\text{m}^2$

#### Saturation capacity

$\mu_{p,\text{sat}}$  17162 p

$\mu_{p,\text{sat,area}}$  745 p/ $\mu\text{m}^2$

$\mu_{e,\text{sat}}$  7594 e<sup>-</sup>

$\mu_{e,\text{sat,area}}$  330 e<sup>-</sup>/ $\mu\text{m}^2$

#### Dynamic range

DR 708

57.0 dB

9.5 bit

#### Spatial nonuniformities

DSNU<sub>1288</sub> 10.65 e<sup>-</sup>

1.17 DN

PRNU<sub>1288</sub> 1.47 %

#### Linearity error

LE<sub>min</sub> -1.18%

LE<sub>max</sub> 1.48%

#### Dark current

$\mu_{c,\text{mean}}$  119  $\pm$  3 e<sup>-</sup>/s

13.1 DN/s

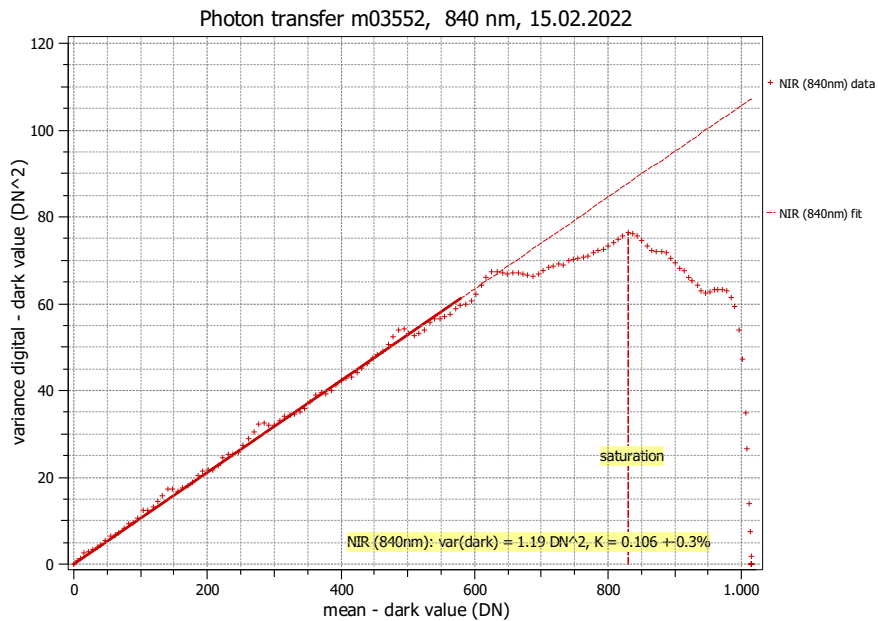
$\mu_{c,\text{var}}$  143  $\pm$  9 e<sup>-</sup>/s

$T_d$  — °C

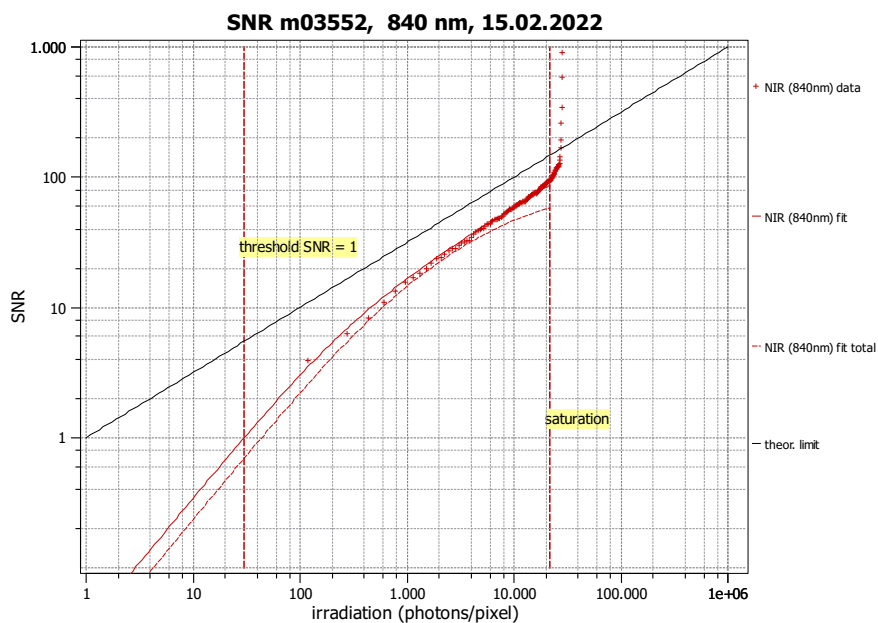
## Summary Sheet for Operation Point 2 at a Wavelength of 840 nm

Type of data	Single	Gain, black-level	1.0 / 7.0
Exposure control	By irradiance	Environmental temperature	26.2°C
Exposure time	410.00 $\mu$ s	Camera body temperature	25.0°C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	840 nm, 24.9 nm

### Photon Transfer



### Signal-to-Noise Ratio



#### Quantum efficiency

$\eta$  35.8%

#### Overall system gain

$K$  0.106 DN/e<sup>-</sup>

$1/K$  9.461 e<sup>-</sup>/DN

#### Temporal dark noise

$\sigma_d$  9.94 e<sup>-</sup>

$\sigma_{y,\text{dark}}$  1.09 DN

#### Signal-to-noise ratio

SNR<sub>max</sub> 88

38.9 dB

6.5 bit

$1/\text{SNR}_{\text{max}}$  1.13 %

#### Absolute sensitivity threshold

$\mu_{p,\text{min}}$  30.2 p

$\mu_{p,\text{min,area}}$  1.31 p/ $\mu\text{m}^2$

$\mu_{e,\text{min}}$  10.8 e<sup>-</sup>

$\mu_{e,\text{min,area}}$  0.47 e<sup>-</sup>/ $\mu\text{m}^2$

#### Saturation capacity

$\mu_{p,\text{sat}}$  21831 p

$\mu_{p,\text{sat,area}}$  948 p/ $\mu\text{m}^2$

$\mu_{e,\text{sat}}$  7817 e<sup>-</sup>

$\mu_{e,\text{sat,area}}$  339 e<sup>-</sup>/ $\mu\text{m}^2$

#### Dynamic range

DR 723

57.2 dB

9.5 bit

#### Spatial nonuniformities

DSNU<sub>1288</sub> 11.11 e<sup>-</sup>

1.17 DN

PRNU<sub>1288</sub> 1.28 %

#### Linearity error

LE<sub>min</sub> -1.09%

LE<sub>max</sub> 2.42%

#### Dark current

$\mu_{c,\text{mean}}$  124  $\pm$  4 e<sup>-</sup>/s

13.1 DN/s

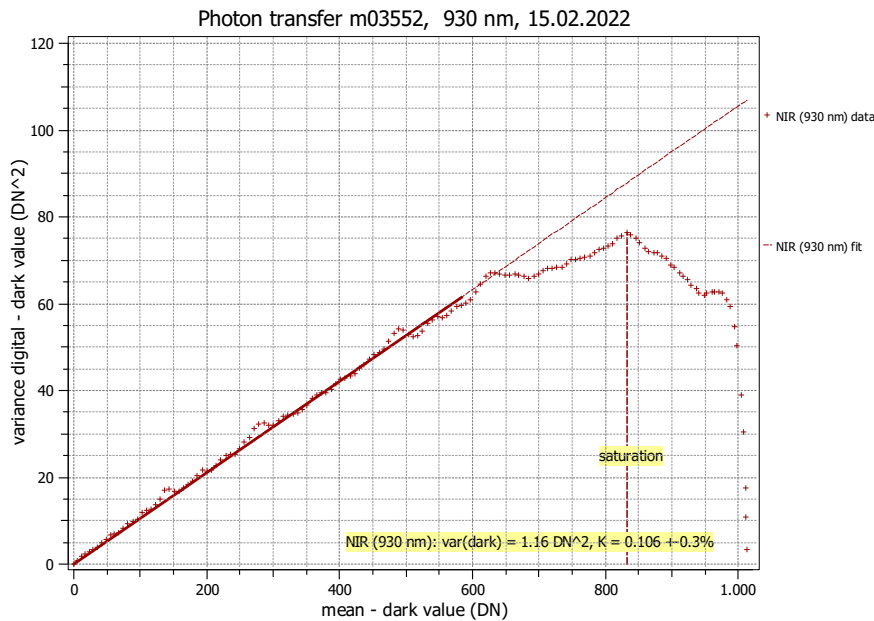
$\mu_{c,\text{var}}$  155  $\pm$  9 e<sup>-</sup>/s

$T_d$  — °C

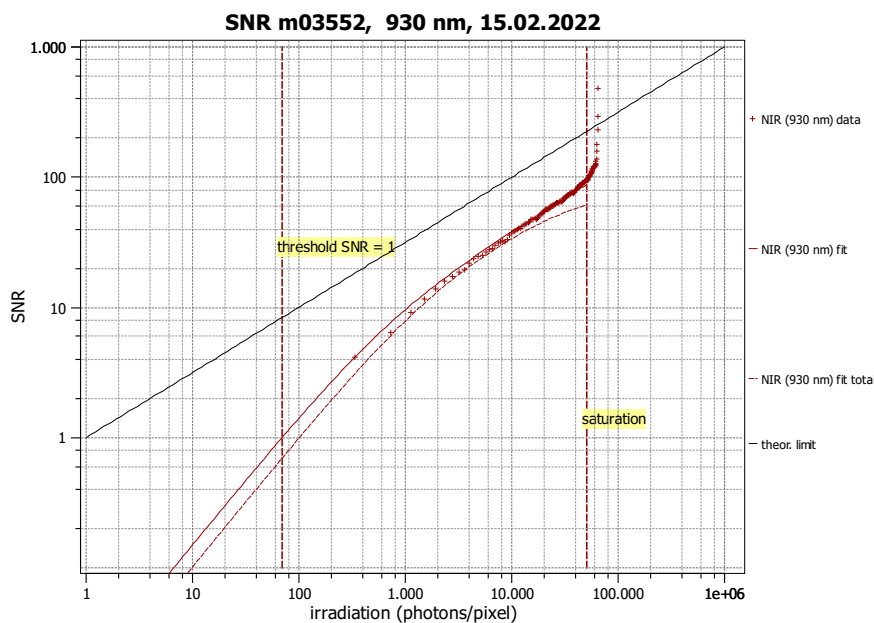
## Summary Sheet for Operation Point 3 at a Wavelength of 930 nm

Type of data	Single	Gain, black-level	1.0 / 7.0
Exposure control	By irradiance	Environmental temperature	26.3°C
Exposure time	801.00 $\mu$ s	Camera body temperature	25.1°C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	930 nm, 31.1 nm

### Photon Transfer



### Signal-to-Noise Ratio



#### Quantum efficiency

$\eta$  15.4%

#### Overall system gain

$K$  0.106 DN/e<sup>-</sup>

$1/K$  9.474 e<sup>-</sup>/DN

#### Temporal dark noise

$\sigma_d$  9.83 e<sup>-</sup>

$\sigma_{y,\text{dark}}$  1.08 DN

#### Signal-to-noise ratio

SNR<sub>max</sub> 89

38.9 dB

6.5 bit

$1/\text{SNR}_{\text{max}}$  1.13 %

#### Absolute sensitivity threshold

$\mu_{p,\text{min}}$  69.6 p

$\mu_{p,\text{min,area}}$  3.02 p/ $\mu\text{m}^2$

$\mu_{e,\text{min}}$  10.7 e<sup>-</sup>

$\mu_{e,\text{min,area}}$  0.46 e<sup>-</sup>/ $\mu\text{m}^2$

#### Saturation capacity

$\mu_{p,\text{sat}}$  50931 p

$\mu_{p,\text{sat,area}}$  2211 p/ $\mu\text{m}^2$

$\mu_{e,\text{sat}}$  7835 e<sup>-</sup>

$\mu_{e,\text{sat,area}}$  340 e<sup>-</sup>/ $\mu\text{m}^2$

#### Dynamic range

DR 731

57.3 dB

9.5 bit

#### Spatial nonuniformities

DSNU<sub>1288</sub> 11.09 e<sup>-</sup>

1.17 DN

PRNU<sub>1288</sub> 1.16 %

#### Linearity error

LE<sub>min</sub> -1.08%

LE<sub>max</sub> 4.06%

#### Dark current

$\mu_{c,\text{mean}}$  125  $\pm$  4 e<sup>-</sup>/s

13.1 DN/s

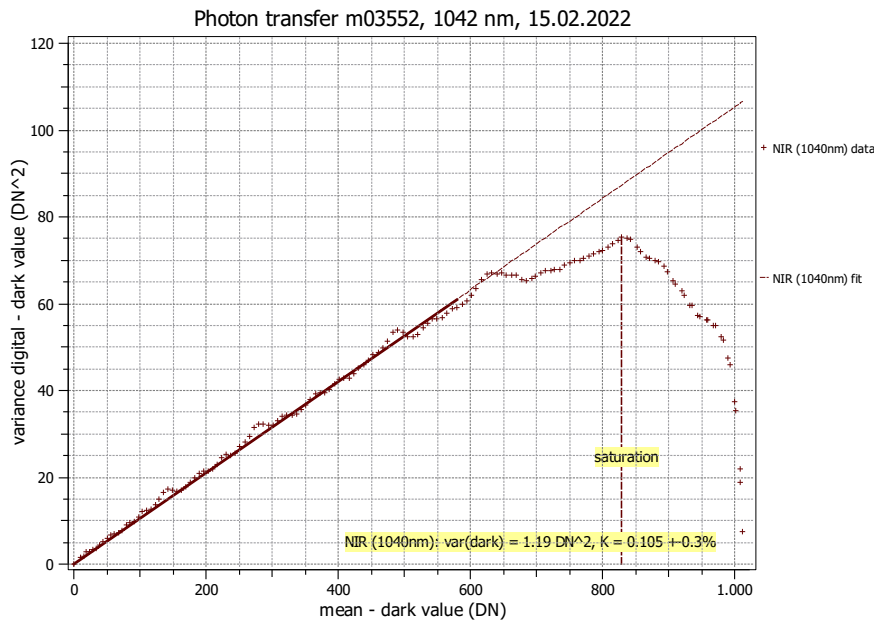
$\mu_{c,\text{var}}$  156  $\pm$  9 e<sup>-</sup>/s

$T_d$  — °C

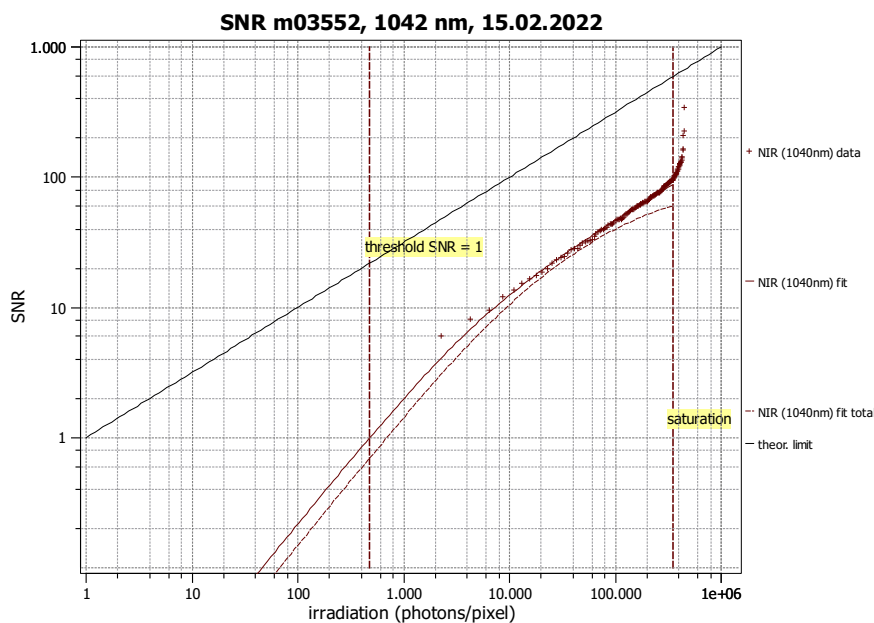
## Summary Sheet for Operation Point 4 at a Wavelength of 1042 nm

Type of data	Single	Gain, black-level	1.0 / 7.0
Exposure control	By irradiance	Environmental temperature	26.7°C
Exposure time	12.52 ms	Camera body temperature	25.0°C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	1042 nm, 64.1 nm

### Photon Transfer



### Signal-to-Noise Ratio



#### Quantum efficiency

$\eta$  2.3%

#### Overall system gain

$K$  0.105 DN/e<sup>-</sup>

$1/K$  9.488 e<sup>-</sup>/DN

#### Temporal dark noise

$\sigma_d$  9.97 e<sup>-</sup>

$\sigma_{y,\text{dark}}$  1.09 DN

#### Signal-to-noise ratio

SNR<sub>max</sub> 89

39.0 dB

6.5 bit

$1/\text{SNR}_{\text{max}}$  1.13 %

#### Absolute sensitivity threshold

$\mu_{p,\text{min}}$  479.7 p

$\mu_{p,\text{min,area}}$  20.82 p/μm<sup>2</sup>

$\mu_{e,\text{min}}$  10.9 e<sup>-</sup>

$\mu_{e,\text{min,area}}$  0.47 e<sup>-</sup>/μm<sup>2</sup>

#### Saturation capacity

$\mu_{p,\text{sat}}$  347758 p

$\mu_{p,\text{sat,area}}$  15094 p/μm<sup>2</sup>

$\mu_{e,\text{sat}}$  7869 e<sup>-</sup>

$\mu_{e,\text{sat,area}}$  342 e<sup>-</sup>/μm<sup>2</sup>

#### Dynamic range

DR 725

57.2 dB

9.5 bit

#### Spatial nonuniformities

DSNU<sub>1288</sub> 11.10 e<sup>-</sup>

1.17 DN

PRNU<sub>1288</sub> 1.20 %

#### Linearity error

LE<sub>min</sub> -1.42%

LE<sub>max</sub> 3.33%

#### Dark current

$\mu_{c,\text{mean}}$  125 ± 4 e<sup>-</sup>/s

13.1 DN/s

$\mu_{c,\text{var}}$  156 ± 10 e<sup>-</sup>/s

$T_d$  — °C