

EMVA 1288 Report Summary Cover Page

Package includes all associated EMVA Report Summaries valid for the following Phantom camera models

Miro C321, C321J, C321-AIR

Refer to the report corresponding with your camera configuration:

- Monochrome models: PDF pages 2-3
- Color models: PDF pages 4-7

Each report summary was generated by Vision Research in accordance with the EMVA 1288 3.1 standard.

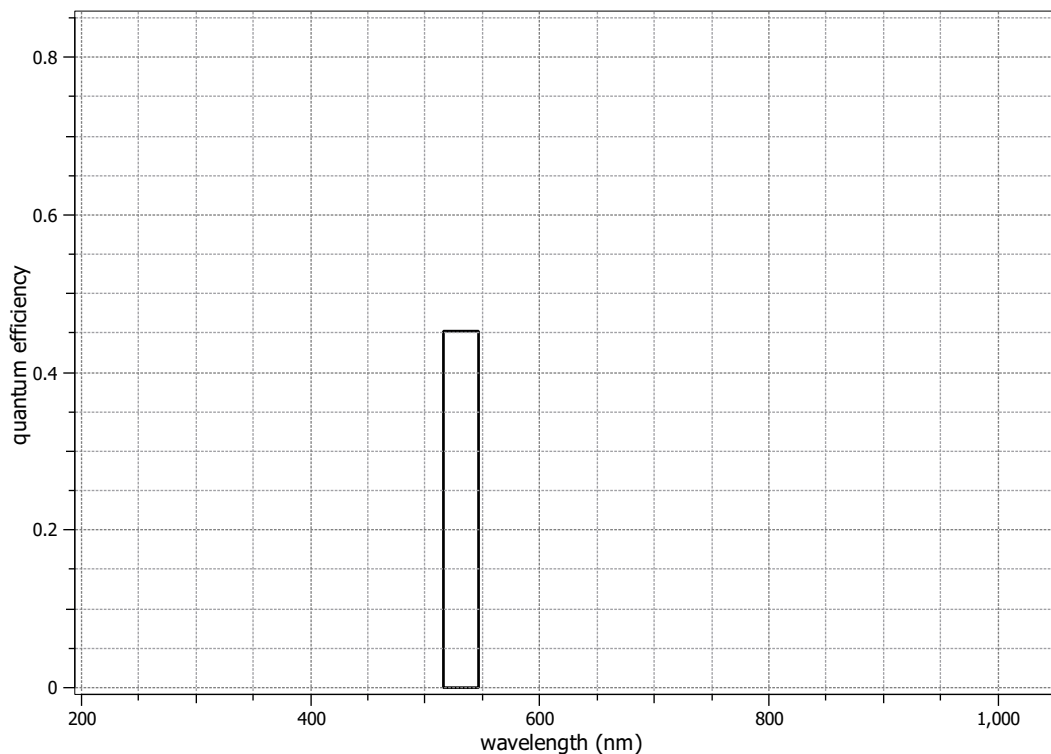
For more information on EMVA 1288 image measurements visit:
www.phantomhighspeed.com/emva

EMVA 1288 Data Sheet m0204

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 and the *zenodo EMVA 1288 community* with proprietary extensions from AEON. The measurements were performed with the AEON ACC2b RGB-IR, Release 9, 30.07.2018, SN 0032(AMETEK).

Measurements were performed by Vision Research. Measurements are on raw sensor data.

Vendor	Vision Research	Type of data presented	Single
Model	Phantom Miro C321 AIR	Operation point 1	
Serial number	502	Wavelength centroid	531.5 nm
Sensor diagonal	22.03 mm	Wavelength FWHM	31.2 nm
Lens category	C-Mount	Gain, black-level	1 / 0
Resolution	1920 × 1080, 10 bit	Optional data measured	
Pixel size (h×v)	10.00 μm × 10.00 μm	None	
Sensor	Vision Research Proprietary		
Sensor type	CMOS		
Shutter type	Global		
Overlap cap.	Overlapping		
Max. frame rate	1400.0 Hz		
Interface type	Ethernet		

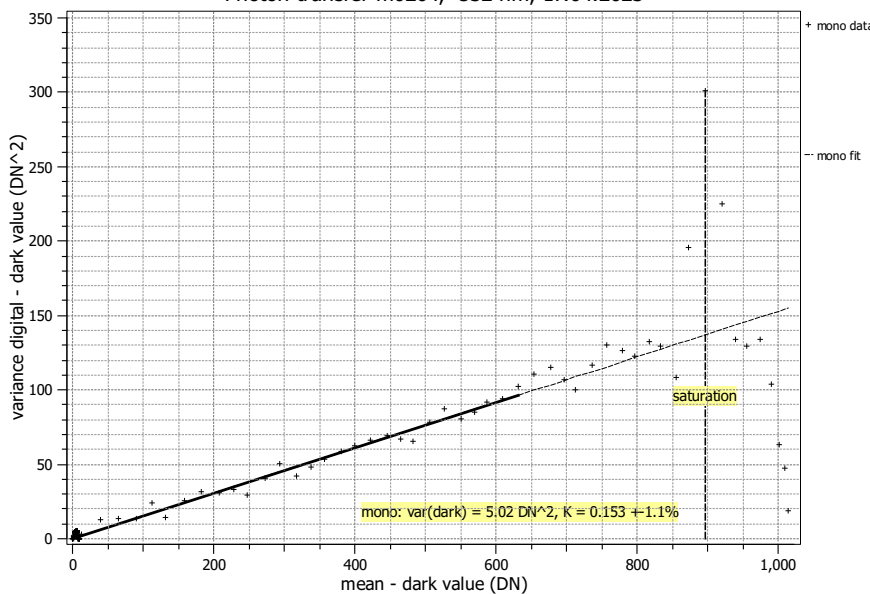


Summary Sheet for Operation Point 1 at a Wavelength of 532 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	24.3°C
Exposure time	50.00 μ s	Camera body temperature	41.8°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono 10	Wavelength, centr., FWHM	532 nm, 31.2 nm

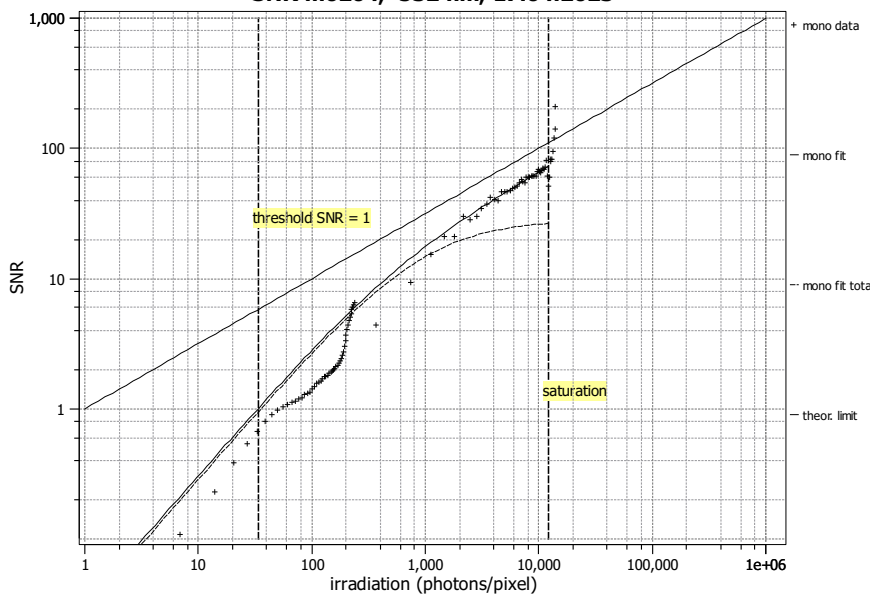
Photon Transfer

Photon transfer m0204, 532 nm, 17.04.2023



Signal-to-Noise Ratio

SNR m0204, 532 nm, 17.04.2023



Quantum efficiency

η 45.3%

Overall system gain

K 0.153 DN/e⁻

1/ K 6.544 e⁻/DN

Temporal dark noise

σ_d 14.55 e⁻

$\sigma_{y,\text{dark}}$ 2.24 DN

Signal-to-noise ratio

SNR_{max} 74

37.4 dB

6.2 bit

1/SNR_{max} 1.35 %

Absolute sensitivity threshold

$\mu_{p,\text{min}}$ 33.5 p

$\mu_{p,\text{min,area}}$ 0.34 p/ μ m²

$\mu_{e,\text{min}}$ 15.2 e⁻

$\mu_{e,\text{min,area}}$ 0.15 e⁻/ μ m²

Saturation capacity

$\mu_{p,\text{sat}}$ 12150 p

$\mu_{p,\text{sat,area}}$ 121 p/ μ m²

$\mu_{e,\text{sat}}$ 5501 e⁻

$\mu_{e,\text{sat,area}}$ 55 e⁻/ μ m²

Dynamic range

DR 362

51.2 dB

8.5 bit

Spatial nonuniformities

DSNU₁₂₈₈ 5.53 e⁻

0.84 DN

PRNU₁₂₈₈ 3.51 %

Linearity error

LE_{min} -5.35%

LE_{max} 4.19%

Dark current

$\mu_{c,\text{mean}}$ 3106 ± 100 e⁻/s

474.5 DN/s

$\mu_{c,\text{var}}$ -7048 ± 5674 e⁻/s

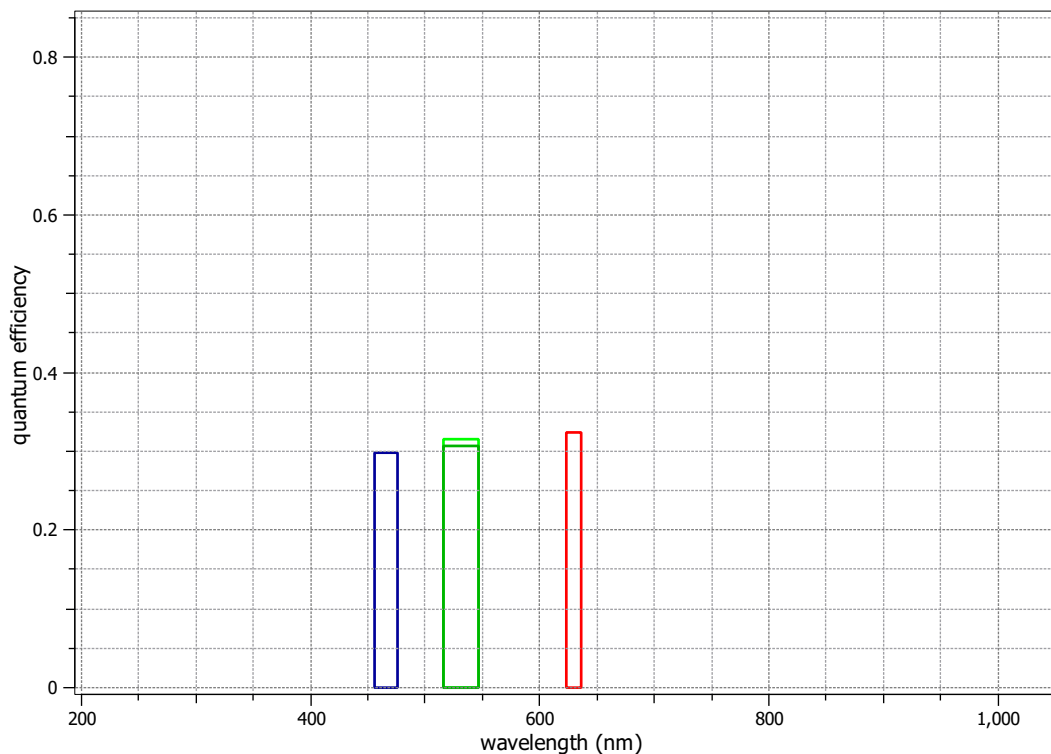
T_d — °C

EMVA 1288 Data Sheet m0207

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 and the *zenodo EMVA 1288 community* with proprietary extensions from AEON. The measurements were performed with the AEON ACC2b RGB-IR, Release 9, 30.07.2018, SN 0032(AMETEK).

Measurements were performed by Vision Research. Measurements are on raw sensor data.

Vendor	Vision Research	Type of data presented	Single
Model	Phantom Miro C321 AIR	Operation point 1	
Serial number	493	Wavelength centroid	466.2 nm
Sensor diagonal	22.03 mm	Wavelength FWHM	20.3 nm
Lens category	F-Mount	Gain, black-level	1 / 0
Resolution	1920 × 1080, 10 bit	Operation point 2	
Pixel size (h×v)	10.00 μm × 10.00 μm	Wavelength centroid	531.5 nm
Sensor	Vision Research Proprietary	Wavelength FWHM	31.2 nm
Sensor type	CMOS	Gain, black-level	1 / 0
Shutter type	Global	Operation point 3	
Overlap cap.	Overlapping	Wavelength centroid	629.4 nm
Max. frame rate	1400.0 Hz	Wavelength FWHM	13.3 nm
Interface type	Ethernet	Gain, black-level	1 / 0
		Optional data measured	None

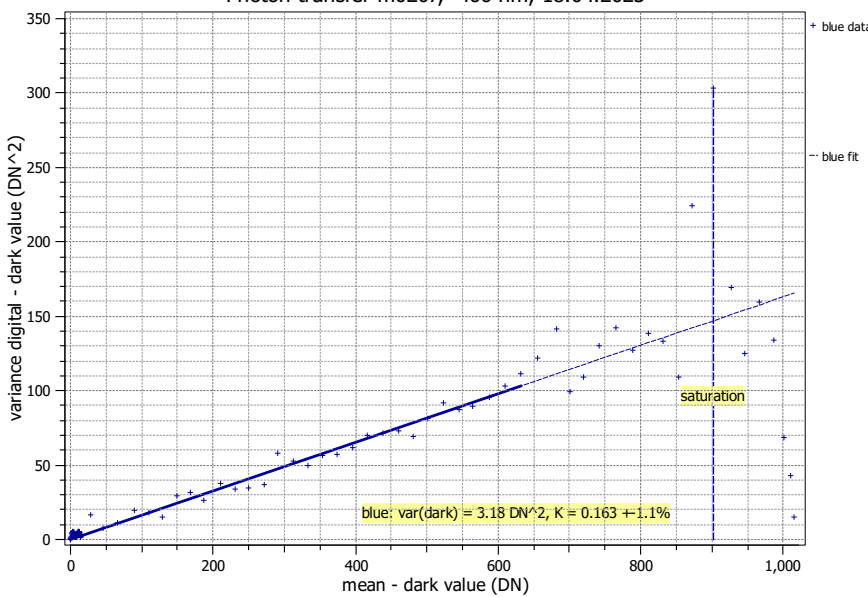


Summary Sheet for Operation Point 1 at a Wavelength of 466 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	24.4°C
Exposure time	90.00 μ s	Camera body temperature	35.4°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 10	Wavelength, centr., FWHM	466 nm, 20.3 nm

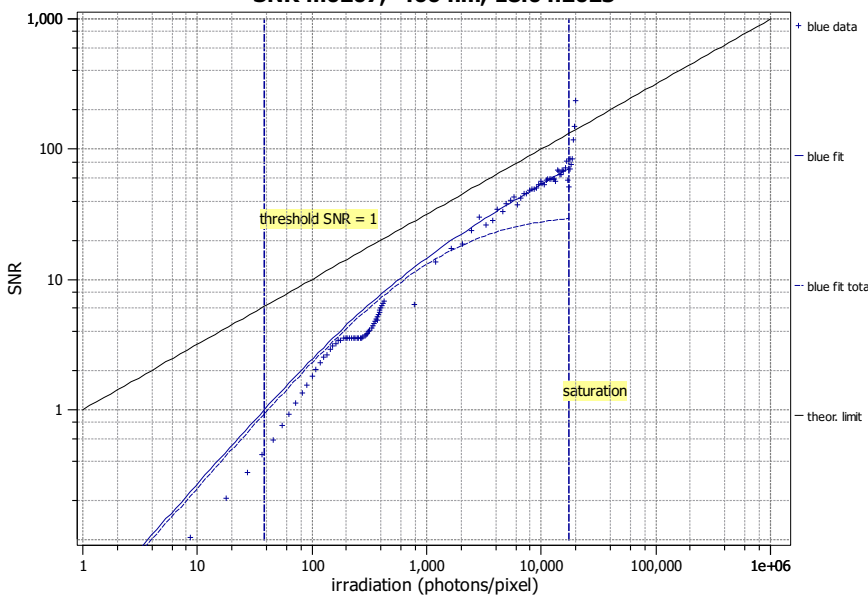
Photon Transfer

Photon transfer m0207, 466 nm, 18.04.2023



Signal-to-Noise Ratio

SNR m0207, 466 nm, 18.04.2023



Quantum efficiency

η 29.7%

Overall system gain

K 0.163 DN/e⁻

1/ K 6.132 e⁻/DN

Temporal dark noise

σ_d 10.79 e⁻

$\sigma_{y,\text{dark}}$ 1.78 DN

Signal-to-noise ratio

SNR_{max} 72

37.1 dB

6.2 bit

1/SNR_{max} 1.40 %

Absolute sensitivity threshold

$\mu_{p,\text{min}}$ 38.5 p

$\mu_{p,\text{min,area}}$ 0.38 p/ μ m²

$\mu_{e,\text{min}}$ 11.4 e⁻

$\mu_{e,\text{min,area}}$ 0.11 e⁻/ μ m²

Saturation capacity

$\mu_{p,\text{sat}}$ 17246 p

$\mu_{p,\text{sat,area}}$ 172 p/ μ m²

$\mu_{e,\text{sat}}$ 5128 e⁻

$\mu_{e,\text{sat,area}}$ 51 e⁻/ μ m²

Dynamic range

DR 448

53.0 dB

8.8 bit

Spatial nonuniformities

DSNU₁₂₈₈ 4.46 e⁻

0.73 DN

PRNU₁₂₈₈ 3.10 %

Linearity error

LE_{min} -3.77%

LE_{max} 3.99%

Dark current

$\mu_{c,\text{mean}}$ 1302 ± 76 e⁻/s

212.3 DN/s

$\mu_{c,\text{var}}$ 11564 ± 1445 e⁻/s

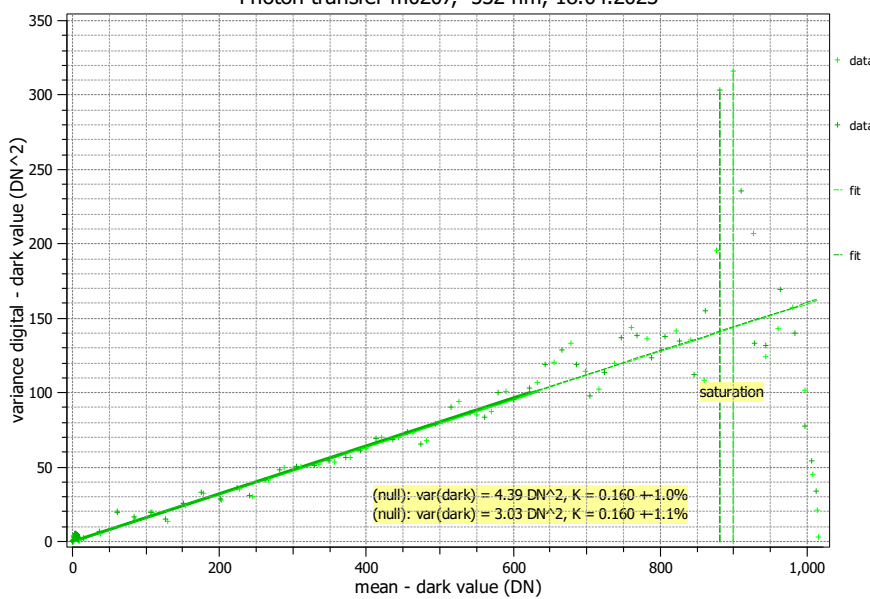
T_d — °C

Summary Sheet for Operation Point 2 at a Wavelength of 532 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	24.4°C
Exposure time	90.00 μ s	Camera body temperature	35.5°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 10	Wavelength, centr., FWHM	532 nm, 31.2 nm

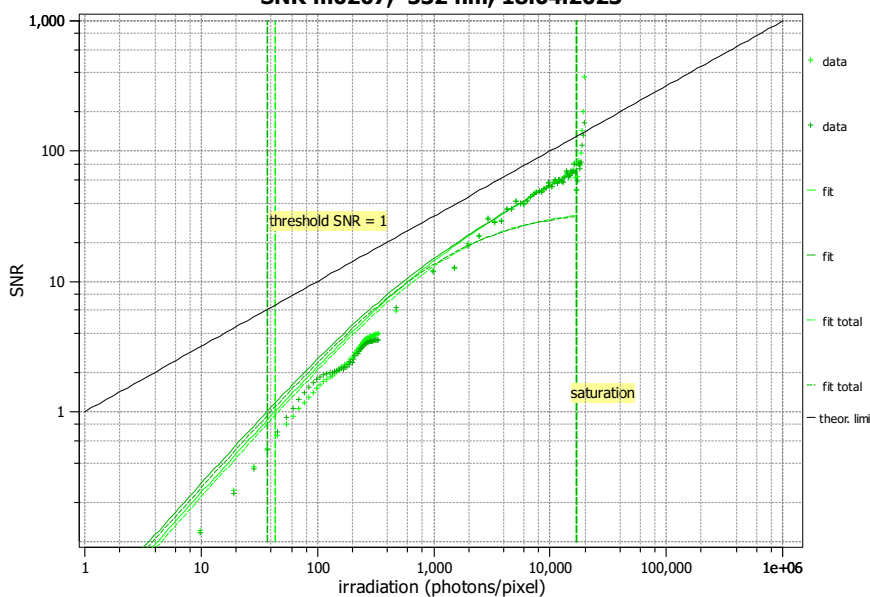
Photon Transfer

Photon transfer m0207, 532 nm, 18.04.2023



Signal-to-Noise Ratio

SNR m0207, 532 nm, 18.04.2023



Quantum efficiency

η 31.5%

Overall system gain

K 0.160 DN/ e^-

$1/K$ 6.266 e^- /DN

Temporal dark noise

σ_d 13.01 e^-

$\sigma_{y,\text{dark}}$ 2.10 DN

Signal-to-noise ratio

SNR_{max} 73

37.3 dB

6.2 bit

$1/SNR_{\text{max}}$ 1.37 %

Absolute sensitivity threshold

$\mu_{p,\text{min}}$ 43.3 p

$\mu_{p,\text{min},\text{area}}$ 0.43 p/ μm^2

$\mu_{e,\text{min}}$ 13.6 e^-

$\mu_{e,\text{min},\text{area}}$ 0.14 e^- / μm^2

Saturation capacity

$\mu_{p,\text{sat}}$ 16869 p

$\mu_{p,\text{sat},\text{area}}$ 169 p/ μm^2

$\mu_{e,\text{sat}}$ 5311 e^-

$\mu_{e,\text{sat},\text{area}}$ 53 e^- / μm^2

Dynamic range

DR 389

51.8 dB

8.6 bit

Spatial nonuniformities

$DSNU_{1288}$ 5.21 e^-

0.83 DN

$PRNU_{1288}$ 2.80 %

Linearity error

LE_{min} -4.35%

LE_{max} 6.06%

Dark current

$\mu_{c,\text{mean}}$ 1170 \pm 40 e^- /s

186.7 DN/s

$\mu_{c,\text{var}}$ 11726 \pm 959 e^- /s

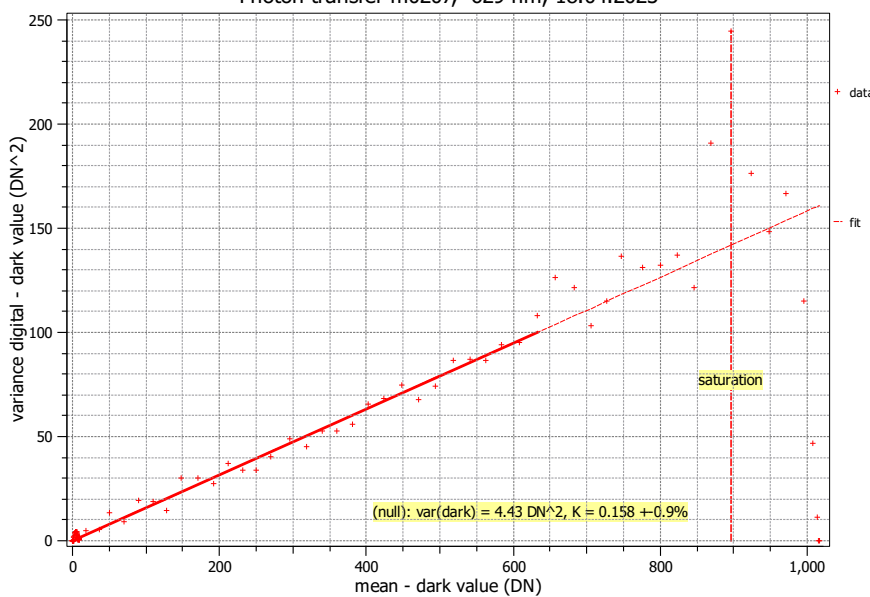
T_d — °C

Summary Sheet for Operation Point 3 at a Wavelength of 629 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	24.4°C
Exposure time	90.00 μ s	Camera body temperature	35.4°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 10	Wavelength, centr., FWHM	629 nm, 13.3 nm

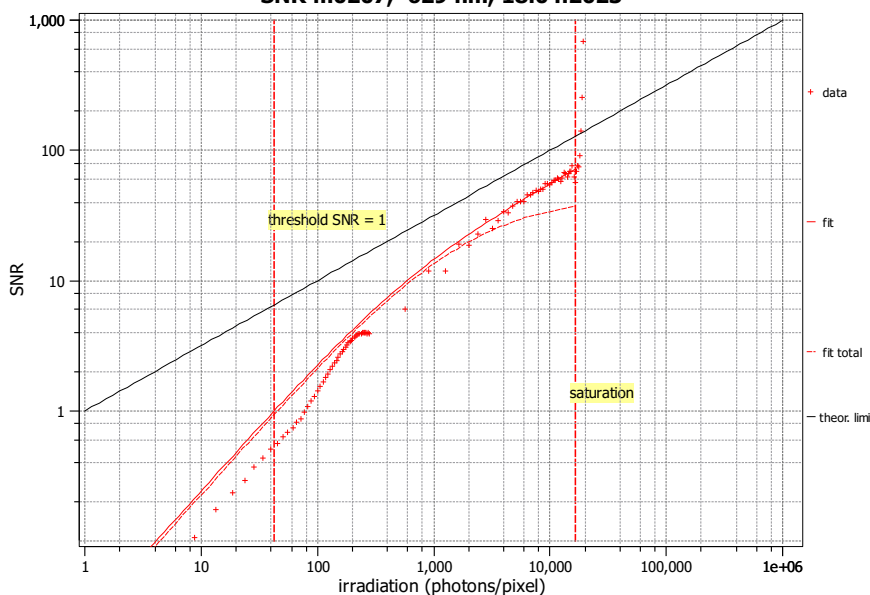
Photon Transfer

Photon transfer m0207, 629 nm, 18.04.2023



Signal-to-Noise Ratio

SNR m0207, 629 nm, 18.04.2023



Quantum efficiency

η 32.4%

Overall system gain

K 0.158 DN/e⁻

1/ K 6.322 e⁻/DN

Temporal dark noise

σ_d 13.18 e⁻

$\sigma_{y,\text{dark}}$ 2.10 DN

Signal-to-noise ratio

SNR_{max} 73

37.3 dB

6.2 bit

1/SNR_{max} 1.37%

Absolute sensitivity threshold

$\mu_{p,\text{min}}$ 42.6 p

$\mu_{p,\text{min,area}}$ 0.43 p/ μ m²

$\mu_{e,\text{min}}$ 13.8 e⁻

$\mu_{e,\text{min,area}}$ 0.14 e⁻/ μ m²

Saturation capacity

$\mu_{p,\text{sat}}$ 16421 p

$\mu_{p,\text{sat,area}}$ 164 p/ μ m²

$\mu_{e,\text{sat}}$ 5319 e⁻

$\mu_{e,\text{sat,area}}$ 53 e⁻/ μ m²

Dynamic range

DR 385

51.7 dB

8.6 bit

Spatial nonuniformities

DSNU₁₂₈₈ 5.20 e⁻

0.82 DN

PRNU₁₂₈₈ 2.31%

Linearity error

LE_{min} -3.20%

LE_{max} 3.21%

Dark current

$\mu_{c,\text{mean}}$ 1194 \pm 37 e⁻/s

191.6 DN/s

$\mu_{c,\text{var}}$ 11809 \pm 1001 e⁻/s

T_d — °C