EMVA 1288 Report Summary Cover Page

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

T3610, T2410, T2110

Refer to the report corresponding with your camera configuration:

- Monochrome models, Standard mode: PDF pages 2-3
- Monochrome models, Binned mode: PDF pages 4-5
- Color models, Standard mode: PDF pages 6-9

The monochrome reports included in this package also apply to T3610-UV and T2410-UV camera models.

Each report summary was generated by Vision Research in accordance with the EMVA 1288 4.0 standard.

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

Rev 2
Compiled January 2025
Specifications subject to change

EMVA 1288 Data Sheet m0467

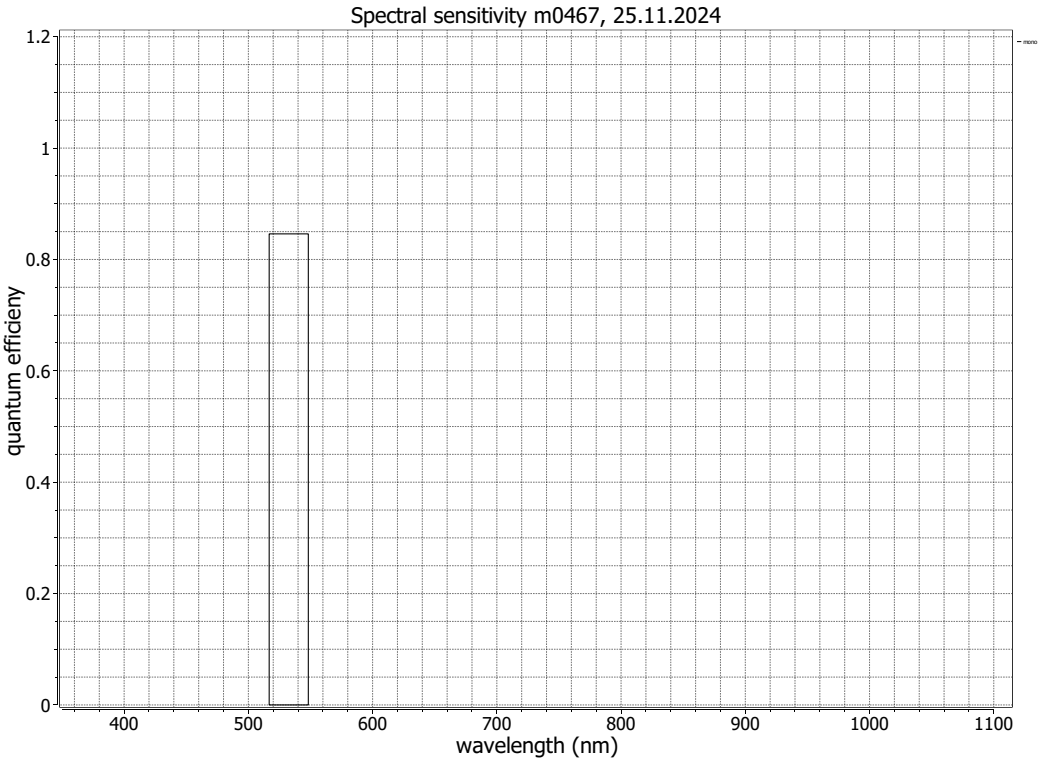
This data sheet describes the specification according to the standard 1288 Release 4.0 Linear issued on 21 June 2021 for "Characterization and Presentation of Specification Data for Image Sensors and Cameras" by the European Machine Vision Association (EMVA), published at `https://www.emva.org/standards-technology/emva-1288/` with proprietary extensions from AEON. The measurements were performed with the AEON ACC2b RGB-IR, Release 9, 31.10.2023, SN 0032(AMETEK), software version 2.0.

Measurements performed by Vision Research.

Type of data presented	Single
Vendor	Vision Research
Model	Phantom T-3610
Serial number	447
Sensor diagonal	27.92 mm
Lens category	F-Mount
Resolution	1280 × 800, 12 bit
Offset/Size used	0 × 0/ 1280 × 800
Pixel size (h×v)	18.50 μm × 18.50 μm
Sensor	Vision Research Proprietary
Sensor type	CMOS
Shutter type	Global
Overlap cap.	Overlapping
Max. frame rate	38043.0 Hz
Interface type	Ethernet

Nr.	Centroid/FWHM	Gain, blacklevel	t_{exp} (ms)
1	532.5/31.5 nm	1 / 0.4%	0.0150

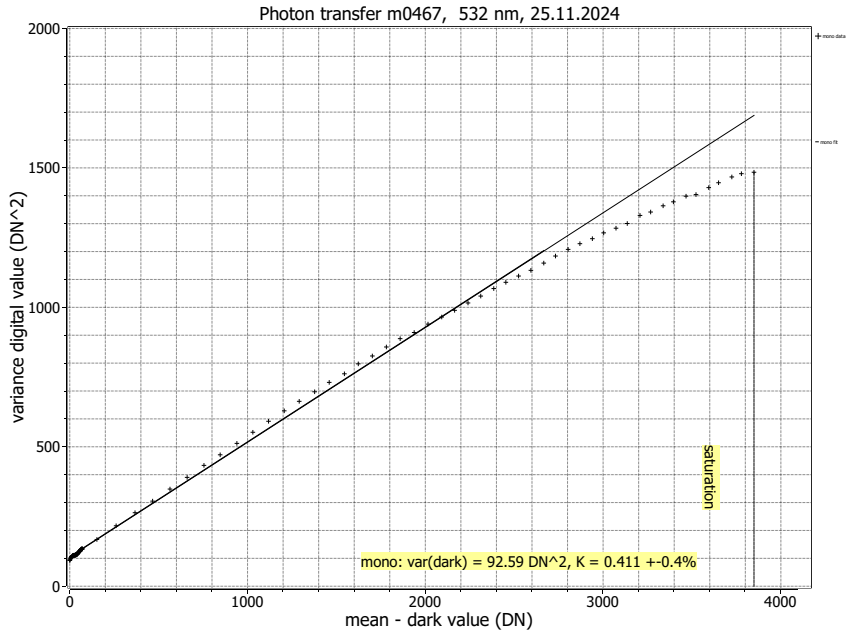
Optional data measured: None



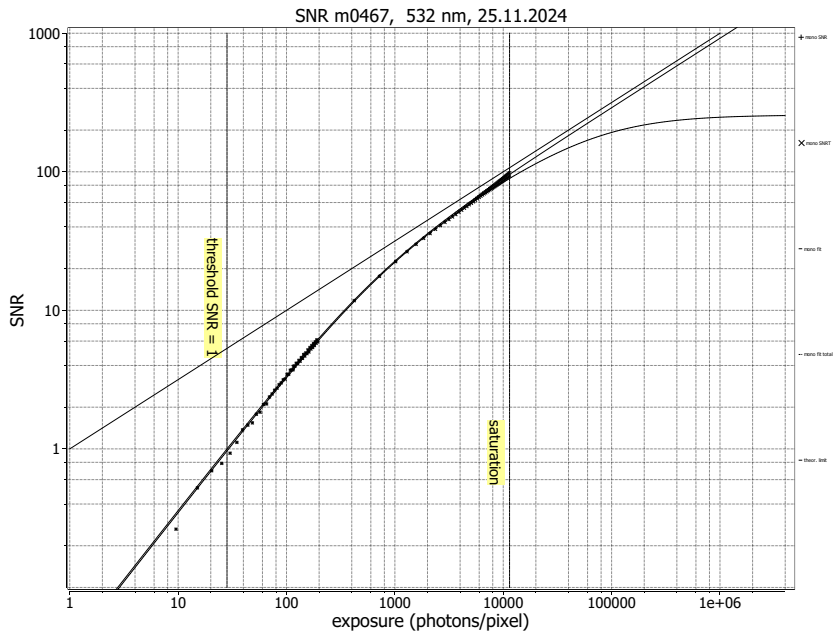
Summary Sheet for Operation Point 1 at a Wavelength of 533 nm

Type of data	Single	Gain, black-level	1 / 0.4%
Exposure control	By irradiance	Environmental temperature	26.5°C
Exposure time	15.000 us	Camera body temperature	27.9°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono 12 (R3C)	Wavelength, centr., FWHM	533 nm, 31.5 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	84.6%

Overall system gain

K	0.4114 DN/e$^-$
$1/K$	2.431 e$^-$/DN

Temporal dark noise

σ_d	23.4 e$^-$
$\sigma_{y.\mathrm{dark}}$	9.62 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\mathrm{max}}$	98.4
	39.9 dB
$1/\mathrm{SNR}_{\mathrm{max}}$	1.017 %

Absolute sensitivity threshold

$\mu_{e.\mathrm{min}}$	23.9 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.0698 e$^-/\mu$m^2

Saturation capacity

$\mu_{e.\mathrm{sat}}$	9675 e$^-$
$\mu_{e.\mathrm{sat.area}}$	28 e$^-/\mu$m^2

Dynamic range

DR	405
	52.15 dB

Spatial nonuniformities

DSNU_{1288}	6.40 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{col}}$	0.16 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{row}}$	0.08 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{pix}}$	6.39 e$^-$
PRNU_{1288}	0.389 %
$\mathrm{PRNU}_{1288.\mathrm{col}}$	0.094 %
$\mathrm{PRNU}_{1288.\mathrm{row}}$	0.030 %
$\mathrm{PRNU}_{1288.\mathrm{pix}}$	0.376 %

Linearity error

LE	1.32%

Dark current

$\mu_{c.\mathrm{mean}}$	26717 e$^-$/s
$\mu_{c.\mathrm{var}}$	28202 e$^-$/s

Release 4.0 Linear issued on 21 June 2021

EMVA 1288 Data Sheet m0468

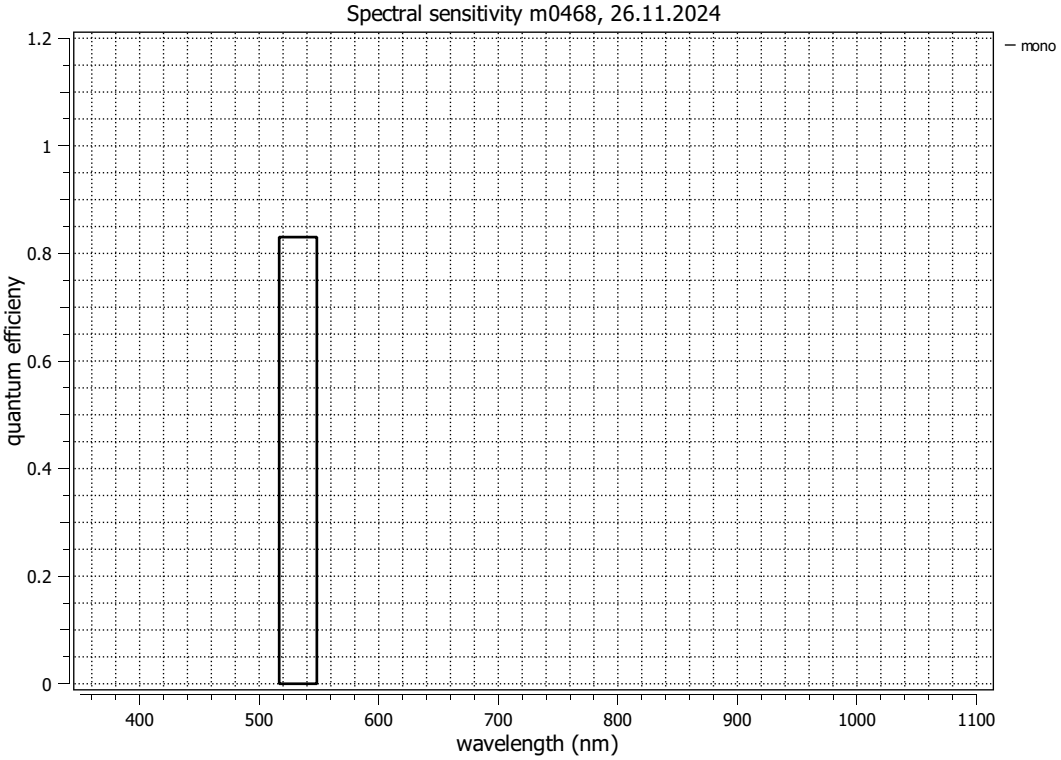
This data sheet describes the specification according to the standard 1288 Release 4.0 Linear issued on 21 June 2021 for "Characterization and Presentation of Specification Data for Image Sensors and Cameras" by the European Machine Vision Association (EMVA), published at `https://www.emva.org/standards-technology/emva-1288/` with proprietary extensions from AEON. The measurements were performed with the AEON ACC2b RGB-IR, Release 9, 31.10.2023, SN 0032(AMETEK), software version 2.0.

Measurements performed by Vision Research.

Type of data presented	Single
Vendor	Vision Research
Model	Phantom T-3610
Serial number	447
Sensor diagonal	27.62 mm
Lens category	F-Mount
Resolution	640 × 384, 12 bit
Offset/Size used	0 × 0/ 640 × 384
Pixel size (h×v)	37.00 μm × 37.00 μm
Sensor	Vision Research Proprietary
Sensor type	CMOS
Shutter type	Global
Overlap cap.	Overlapping
Max. frame rate	156716.0 Hz
Interface type	Ethernet

Nr.	Centroid/FWHM	Gain, blacklevel	t_{exp} (ms)
1	532.5/31.5 nm	1 / 0.4%	0.0150

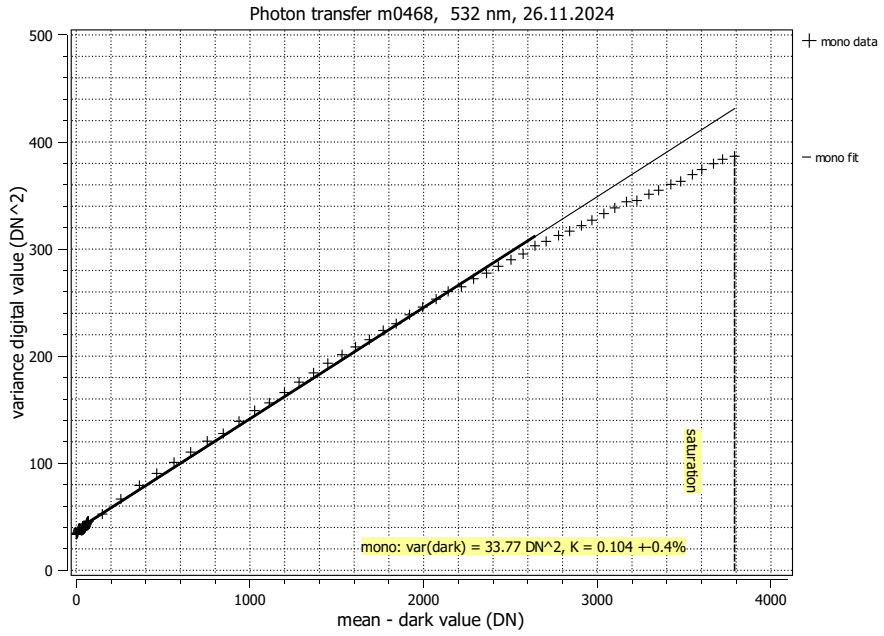
Optional data measured: None



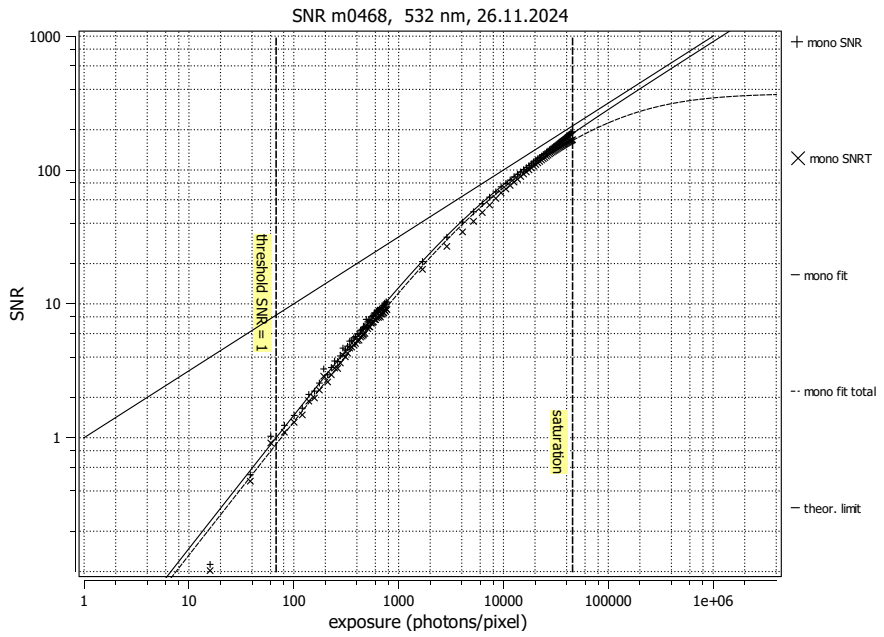
Summary Sheet for Operation Point 1 at a Wavelength of 533 nm

Type of data	Single	Gain, black-level	1 / 0.4%
Exposure control	By irradiance	Environmental temperature	26.5°C
Exposure time	15.000 us	Camera body temperature	28.0°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono 12 (Binning R3C)	Wavelength, centr., FWHM	533 nm, 31.5 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	83.0%

Overall system gain

K	0.1041 DN/e$^-$
$1/K$	9.608 e$^-$/DN

Temporal dark noise

σ_d	55.8 e$^-$
$\sigma_{y.\mathrm{dark}}$	5.81 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\mathrm{max}}$	194.6
	45.8 dB
$1/\mathrm{SNR}_{\mathrm{max}}$	0.514 %

Absolute sensitivity threshold

$\mu_{e.\mathrm{min}}$	56.3 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.0412 e$^-/\mu$m^2

Saturation capacity

$\mu_{e.\mathrm{sat}}$	37882 e$^-$
$\mu_{e.\mathrm{sat.area}}$	28 e$^-/\mu$m^2

Dynamic range

DR	672
	56.55 dB

Spatial nonuniformities

DSNU_{1288}	28.1 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{col}}$	-0.2 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{row}}$	1.1 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{pix}}$	28.1 e$^-$
PRNU_{1288}	0.267 %
$\mathrm{PRNU}_{1288.\mathrm{col}}$	0.080 %
$\mathrm{PRNU}_{1288.\mathrm{row}}$	0.048 %
$\mathrm{PRNU}_{1288.\mathrm{pix}}$	0.250 %

Linearity error

LE	1.54%

Dark current

$\mu_{c.\mathrm{mean}}$	114086 e$^-$/s
$\mu_{c.\mathrm{var}}$	130746 e$^-$/s

Release 4.0 Linear issued on 21 June 2021

EMVA 1288 Data Sheet m0472

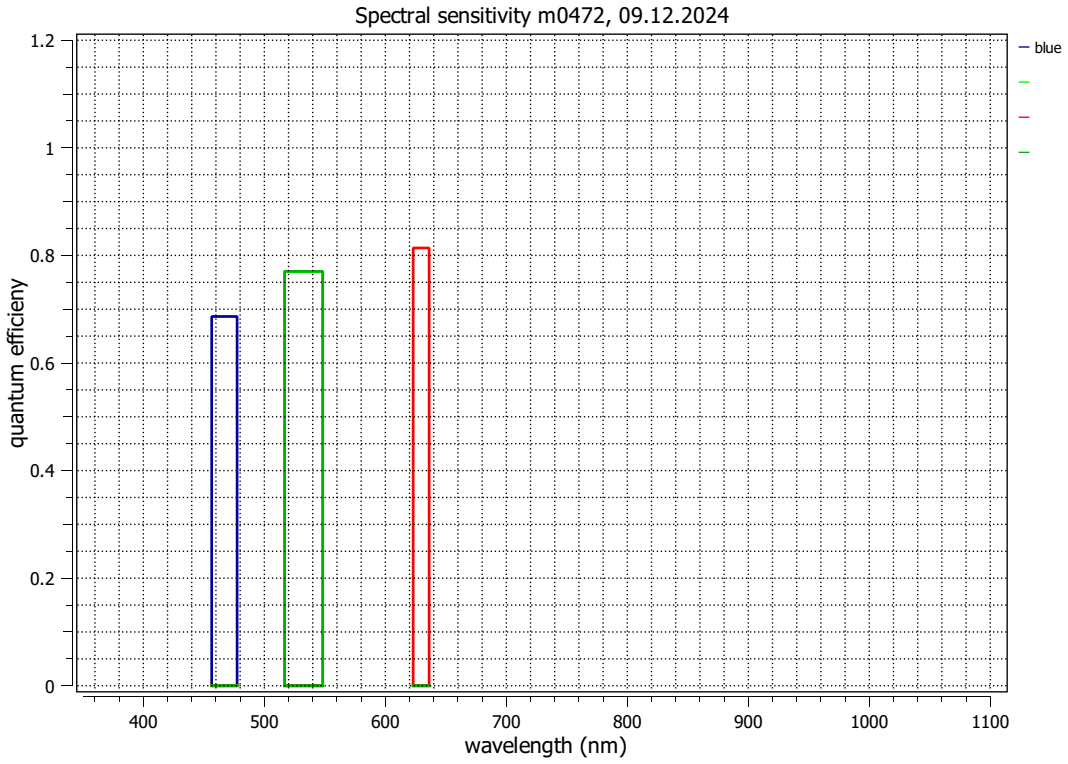
This data sheet describes the specification according to the standard 1288 Release 4.0 Linear issued on 21 June 2021 for "Characterization and Presentation of Specification Data for Image Sensors and Cameras" by the European Machine Vision Association (EMVA), published at `https://www.emva.org/standards-technology/emva-1288/` with proprietary extensions from AEON. The measurements were performed with the AEON ACC2b RGB-IR, Release 9, 31.10.2023, SN 0032(AMETEK), software version 2.0.

Measurements performed by Vision Research.

Type of data presented	Single
Vendor	Vision Research
Model	Phantom T-3610
Serial number	446
Sensor diagonal	27.92 mm
Lens category	F-Mount
Resolution	1280 × 800, 12 bit
Offset/Size used	0 × 0/ 1280 × 800
Pixel size (h×v)	18.50 μm × 18.50 μm
Sensor	Vision Research Proprietary
Sensor type	CMOS
Shutter type	Global
Overlap cap.	Overlapping
Max. frame rate	38043.0 Hz
Interface type	Ethernet

Nr.	Centroid/FWHM	Gain, blacklevel	t_{exp} (ms)
1	467.0/21.0 nm	1 / 0.5%	0.0150
2	532.5/31.5 nm	1 / 0.5%	0.0150
3	629.6/13.2 nm	1 / 0.5%	0.0150

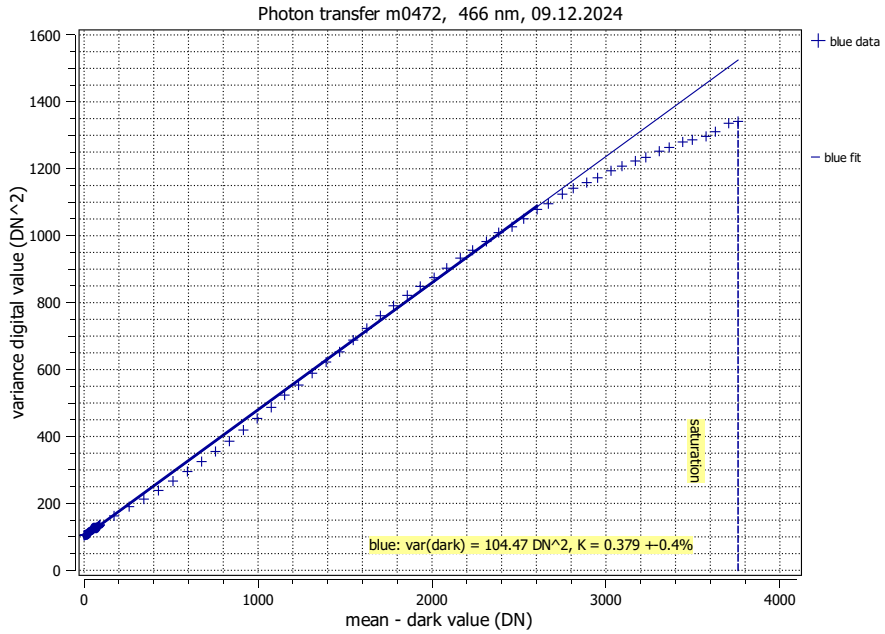
Optional data measured: None



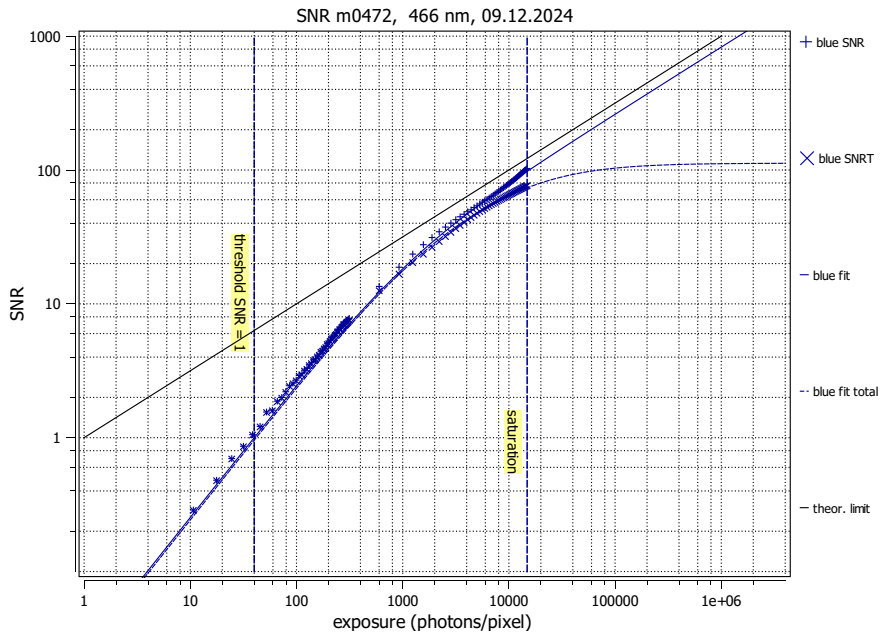
Summary Sheet for Operation Point 1 at a Wavelength of 467 nm

Type of data	Single	Gain, black-level	1 / 0.5%
Exposure control	By irradiance	Environmental temperature	25.5°C
Exposure time	15.000 us	Camera body temperature	30.6°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 12 (R3C)	Wavelength, centr., FWHM	467 nm, 21.0 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	68.6%

Overall system gain

K	0.3793 DN/e$^-$
$1/K$	2.636 e$^-$/DN

Temporal dark noise

σ_d	26.9 e$^-$
$\sigma_{y.\mathrm{dark}}$	10.2 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	101.0
	40.1 dB
$1/\mathrm{SNR}_{\max}$	0.990 %

Absolute sensitivity threshold

$\mu_{e.\mathrm{min}}$	27.4 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.0802 e$^-$/μm^2

Saturation capacity

$\mu_{e.\mathrm{sat}}$	10198 e$^-$
$\mu_{e.\mathrm{sat.area}}$	30 e$^-$/μm^2

Dynamic range

DR	372
	51.40 dB

Spatial nonuniformities

DSNU_{1288}	8.15 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{col}}$	0.13 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{row}}$	0.04 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{pix}}$	8.14 e$^-$
PRNU_{1288}	0.889 %
$\mathrm{PRNU}_{1288.\mathrm{col}}$	0.041 %
$\mathrm{PRNU}_{1288.\mathrm{row}}$	0.135 %
$\mathrm{PRNU}_{1288.\mathrm{pix}}$	0.877 %

Linearity error

LE	0.53%

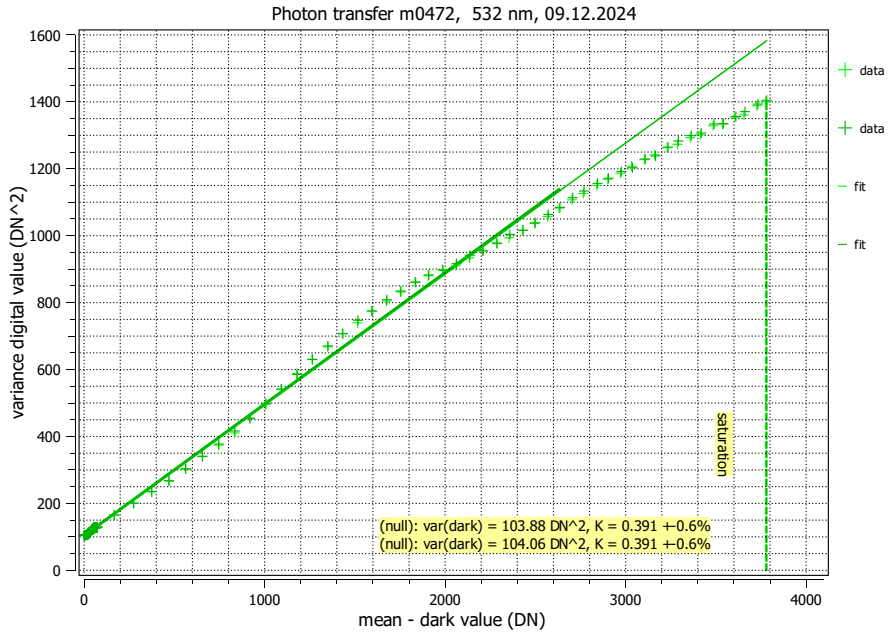
Dark current

$\mu_{c.\mathrm{mean}}$	31540 e$^-$/s
$\mu_{c.\mathrm{var}}$	35219 e$^-$/s

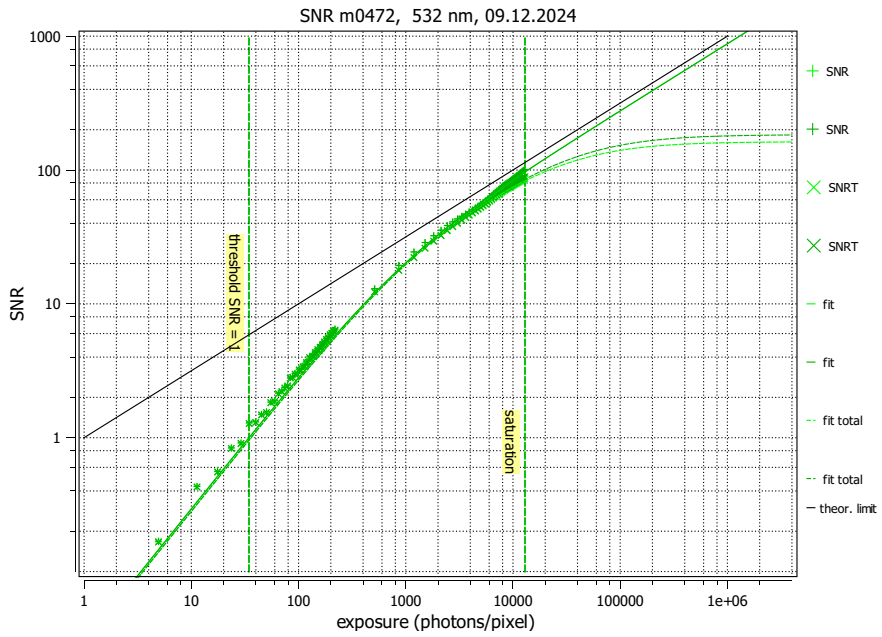
Summary Sheet for Operation Point 2 at a Wavelength of 533 nm

Type of data	Single	Gain, black-level	1 / 0.5%
Exposure control	By irradiance	Environmental temperature	25.5°C
Exposure time	15.000 us	Camera body temperature	31.1°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 12 (R3C)	Wavelength, centr., FWHM	533 nm, 31.5 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	77.0%

Overall system gain

K	0.3909 DN/e$^-$
$1/K$	2.558 e$^-$/DN

Temporal dark noise

σ_d	26.1 e$^-$
$\sigma_{y.\mathrm{dark}}$	10.2 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	99.8
	40.0 dB
$1/\mathrm{SNR}_{\max}$	1.002 %

Absolute sensitivity threshold

$\mu_{e.\mathrm{min}}$	26.6 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.0777 e$^-/\mu$m^2

Saturation capacity

$\mu_{e.\mathrm{sat}}$	9968 e$^-$
$\mu_{e.\mathrm{sat.area}}$	29 e$^-/\mu$m^2

Dynamic range

DR	375
	51.48 dB

Spatial nonuniformities

DSNU_{1288}	7.79 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{col}}$	0.08 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{row}}$	0.19 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{pix}}$	7.78 e$^-$
PRNU_{1288}	0.615 %
$\mathrm{PRNU}_{1288.\mathrm{col}}$	0.019 %
$\mathrm{PRNU}_{1288.\mathrm{row}}$	0.107 %
$\mathrm{PRNU}_{1288.\mathrm{pix}}$	0.604 %

Linearity error

LE	0.65%

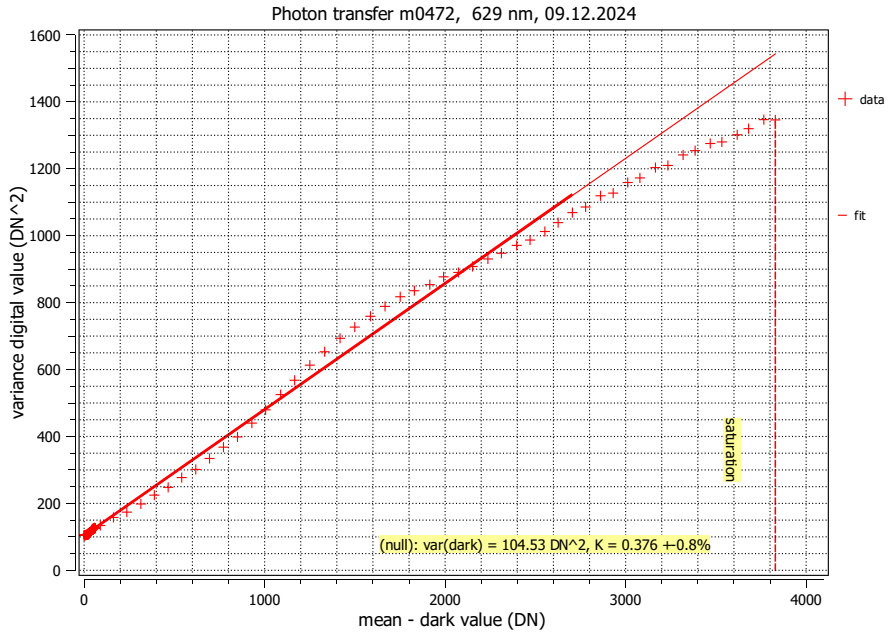
Dark current

$\mu_{c.\mathrm{mean}}$	30630 e$^-$/s
$\mu_{c.\mathrm{var}}$	32290 e$^-$/s

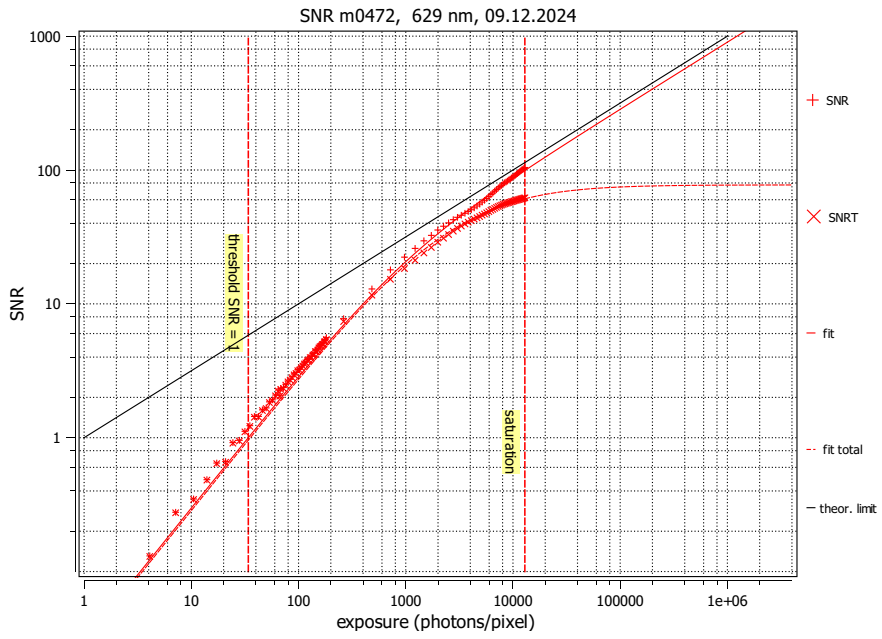
Summary Sheet for Operation Point 3 at a Wavelength of 630 nm

Type of data	Single	Gain, black-level	1 / 0.5%
Exposure control	By irradiance	Environmental temperature	25.5°C
Exposure time	15.000 us	Camera body temperature	31.4°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 12 (R3C)	Wavelength, centr., FWHM	630 nm, 13.2 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	81.4%

Overall system gain

K	0.3763 DN/e$^-$
$1/K$	2.658 e$^-$/DN

Temporal dark noise

σ_d	27.2 e$^-$
$\sigma_{y.\mathrm{dark}}$	10.2 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\mathrm{max}}$	102.5
	40.2 dB
$1/\mathrm{SNR}_{\mathrm{max}}$	0.976 %

Absolute sensitivity threshold

$\mu_{e.\mathrm{min}}$	27.7 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.0809 e$^-/\mu$m^2

Saturation capacity

$\mu_{e.\mathrm{sat}}$	10506 e$^-$
$\mu_{e.\mathrm{sat.area}}$	31 e$^-/\mu$m^2

Dynamic range

DR	380
	51.59 dB

Spatial nonuniformities

DSNU_{1288}	8.26 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{col}}$	0.15 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{row}}$	0.14 e$^-$
$\mathrm{DSNU}_{1288.\mathrm{pix}}$	8.25 e$^-$
PRNU_{1288}	1.29 %
$\mathrm{PRNU}_{1288.\mathrm{col}}$	0.02 %
$\mathrm{PRNU}_{1288.\mathrm{row}}$	0.04 %
$\mathrm{PRNU}_{1288.\mathrm{pix}}$	1.29 %

Linearity error

LE	0.62%

Dark current

$\mu_{c.\mathrm{mean}}$	30347 e$^-$/s
$\mu_{c.\mathrm{var}}$	32855 e$^-$/s

Release 4.0 Linear issued on 21 June 2021