EMVA 1288 Report Summary Cover Page

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

TMX 7510, TMX 6410, TMX 5010

Refer to the report corresponding with your camera configuration:

The monochrome reports included in this package also apply to TMX-UV camera models.

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

Compiled July 2023
Specifications subject to change

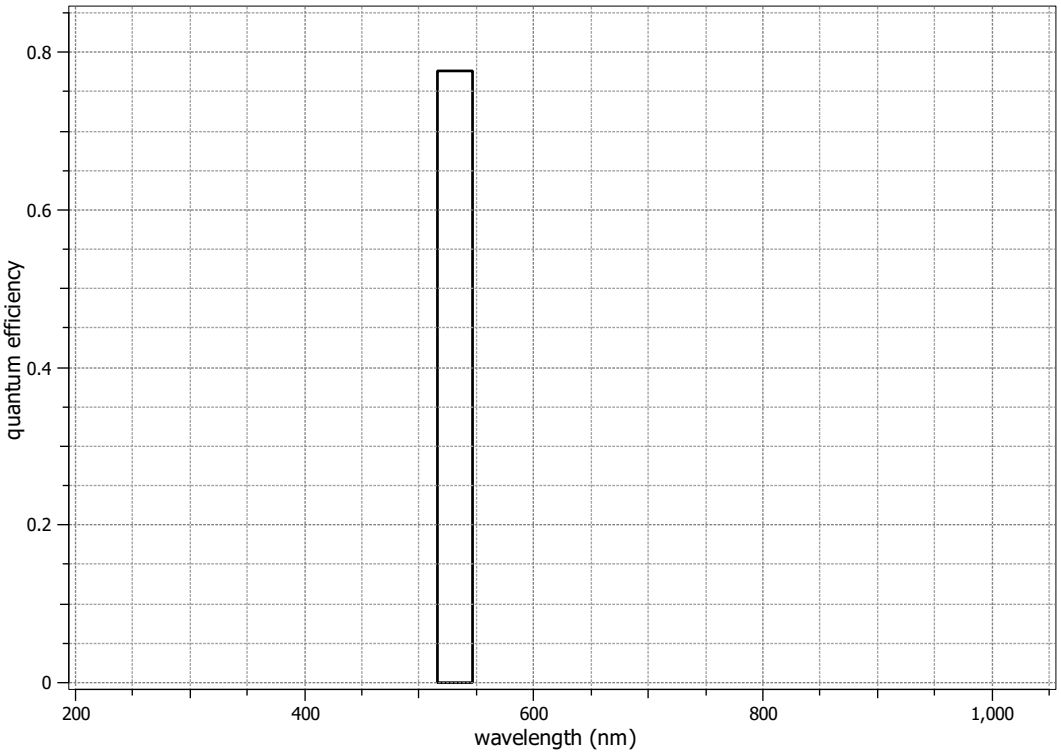
EMVA 1288 Data Sheet m0147

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
Model	Phantom TMX 7510
Serial number	505
Sensor diagonal	27.92 mm
Lens category	F-Mount
Resolution	1280 × 800, 12 bit
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	76086.0 Hz
Interface type	Ethernet

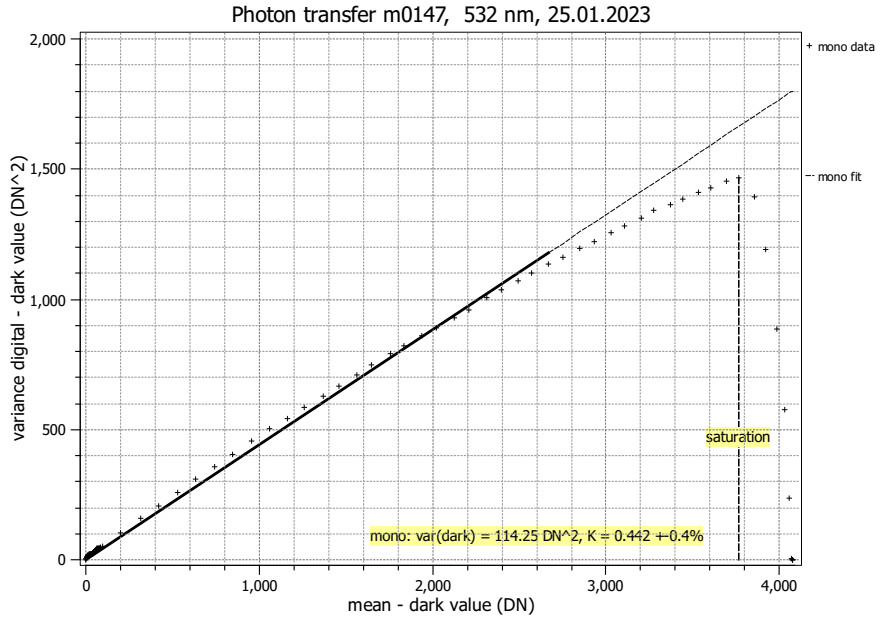
Type of data presented	Single
Operation point 1	
Wavelength centroid	531.5 nm
Wavelength FWHM	31.2 nm
Gain, black-level	1 / 0
Optional data measured	
None	



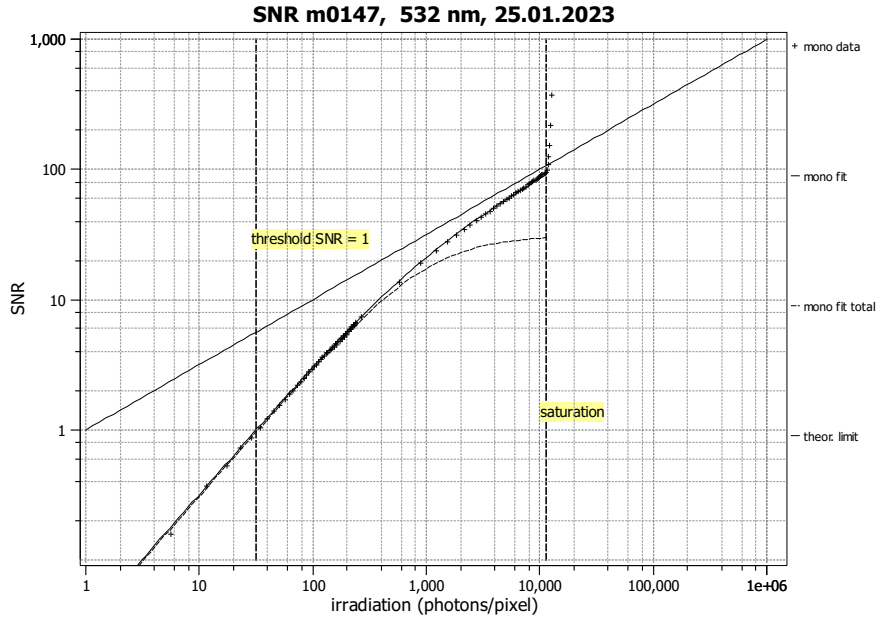
Summary Sheet for Operation Point 1 at a Wavelength of 532 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	26.2°C
Exposure time	50.00 µs	Camera body temperature	37.9°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono 12	Wavelength, centr., FWHM	532 nm, 31.2 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	77.6%

Overall system gain

K	0.442 DN/e$^-$
$1/K$	2.263 e$^-$/DN

Temporal dark noise

σ_d	24.18 e$^-$
$\sigma_{y.\mathrm{dark}}$	10.69 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	93
	39.4 dB
	6.5 bit
$1/\mathrm{SNR}_{\max}$	1.07 %

Absolute sensitivity threshold

$\mu_{p.\mathrm{min}}$	31.8 p
$\mu_{p.\mathrm{min.area}}$	0.09 p/µm^2
$\mu_{e.\mathrm{min}}$	24.7 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.07 e$^-$/µm^2

Saturation capacity

$\mu_{p.\mathrm{sat}}$	11259 p
$\mu_{p.\mathrm{sat.area}}$	33 p/µm^2
$\mu_{e.\mathrm{sat}}$	8736 e$^-$
$\mu_{e.\mathrm{sat.area}}$	26 e$^-$/µm^2

Dynamic range

DR	354
	51.0 dB
	8.5 bit

Spatial nonuniformities

DSNU_{1288}	6.57 e$^-$
	2.90 DN
PRNU_{1288}	3.16 %

Linearity error

$\mathrm{LE}_{\min}$	-1.66%
$\mathrm{LE}_{\max}$	1.26%

Dark current

$\mu_{c.\mathrm{mean}}$	37153 ± 390 e$^-$/s
	16414.5 DN/s
$\mu_{c.\mathrm{var}}$	34898 ± 2293 e$^-$/s
T_d	— °C

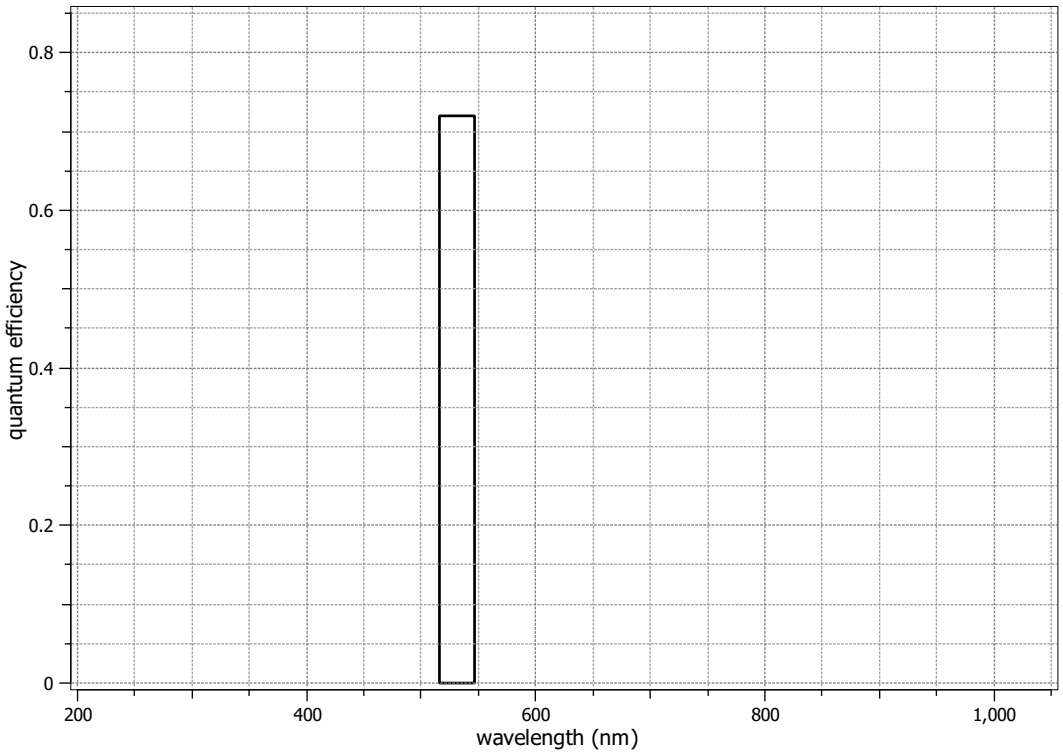
EMVA 1288 Data Sheet m0148

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
Model	Phantom TMX 7510
Serial number	505
Sensor diagonal	27.62 mm
Lens category	F-Mount
Resolution	640 × 384, 12 bit
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	308823.0 Hz
Interface type	Ethernet

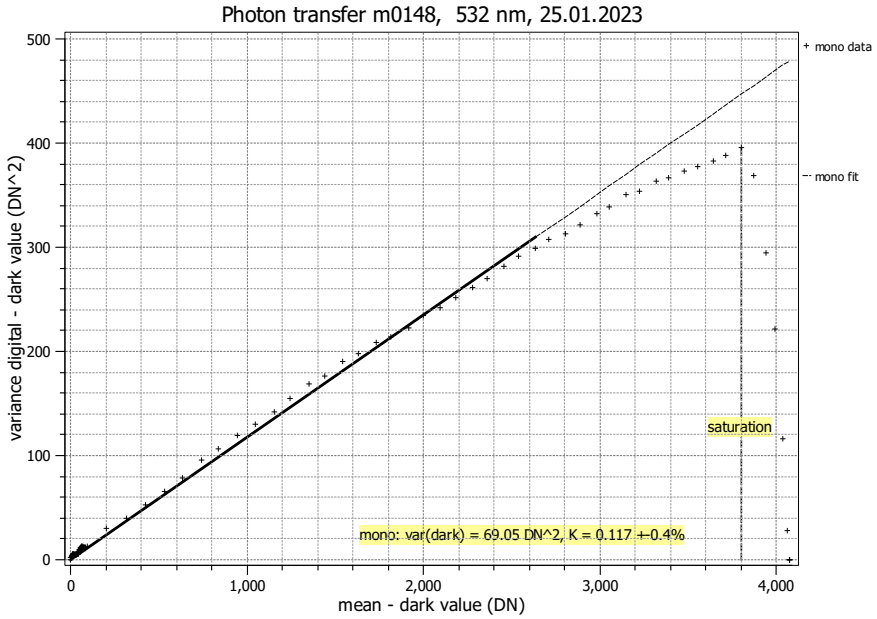
Type of data presented	Single
Operation point 1	
Wavelength centroid	531.5 nm
Wavelength FWHM	31.2 nm
Gain, black-level	1 / 0
Optional data measured	
None	



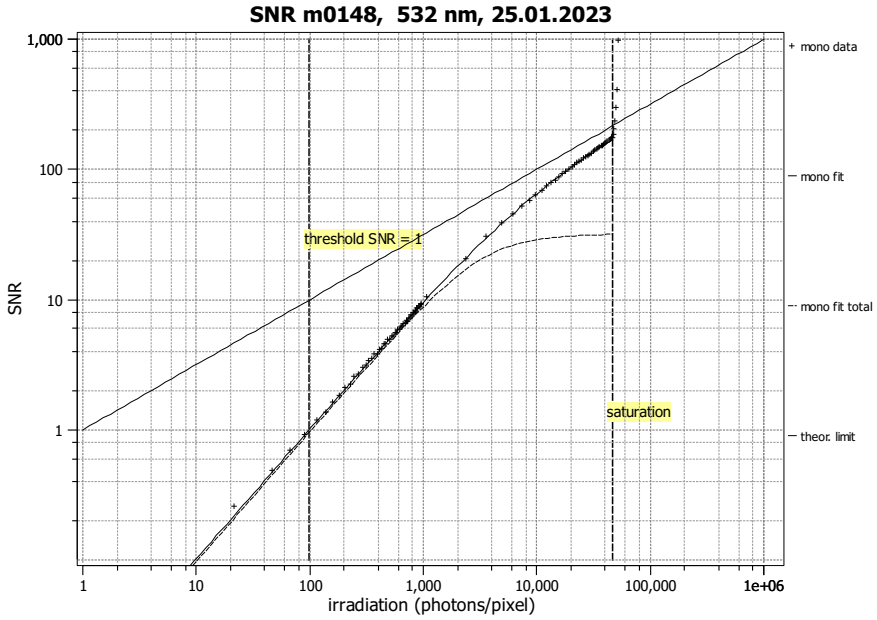
Summary Sheet for Operation Point 1 at a Wavelength of 532 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	26.1°C
Exposure time	50.00 µs	Camera body temperature	37.8°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono 12 (Binning)	Wavelength, centr., FWHM	532 nm, 31.2 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	72.0%

Overall system gain

K	0.117 DN/e$^-$
$1/K$	8.512 e$^-$/DN

Temporal dark noise

σ_d	70.69 e$^-$
$\sigma_{y.\mathrm{dark}}$	8.31 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	182
	45.2 dB
	7.5 bit
$1/\mathrm{SNR}_{\max}$	0.55 %

Absolute sensitivity threshold

$\mu_{p.\mathrm{min}}$	98.9 p
$\mu_{p.\mathrm{min.area}}$	0.07 p/µm^2
$\mu_{e.\mathrm{min}}$	71.2 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.05 e$^-$/µm^2

Saturation capacity

$\mu_{p.\mathrm{sat}}$	46086 p
$\mu_{p.\mathrm{sat.area}}$	34 p/µm^2
$\mu_{e.\mathrm{sat}}$	33184 e$^-$
$\mu_{e.\mathrm{sat.area}}$	24 e$^-$/µm^2

Dynamic range

DR	466
	53.4 dB
	8.9 bit

Spatial nonuniformities

DSNU_{1288}	22.81 e$^-$
	2.68 DN
PRNU_{1288}	3.11 %

Linearity error

$\mathrm{LE}_{\min}$	-2.44%
$\mathrm{LE}_{\max}$	1.42%

Dark current

$\mu_{c.\mathrm{mean}}$	147862 ± 1534 e$^-$/s
	17372.0 DN/s
$\mu_{c.\mathrm{var}}$	177850 ± 28612 e$^-$/s
T_d	— °C

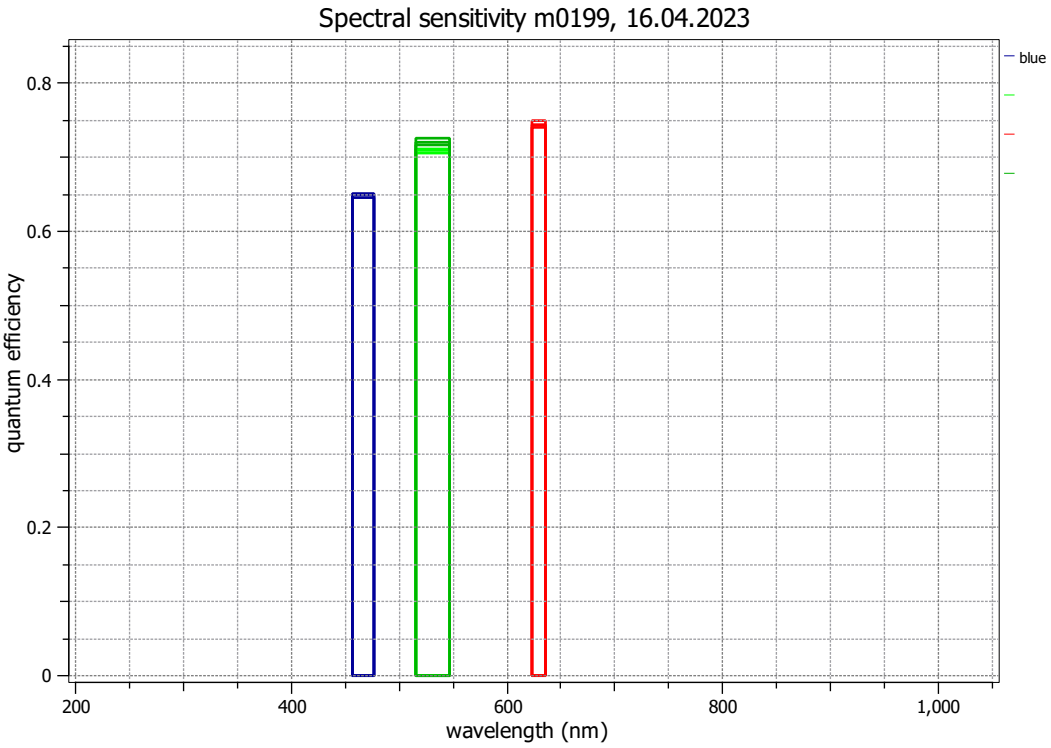
EMVA 1288 Data Sheet m0200

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
Model	Phantom TMX 7510
Serial number	26265
Sensor diagonal	27.92 mm
Lens category	F-Mount
Resolution	1280 × 800, 12 bit
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	76086.0 Hz
Interface type	Ethernet

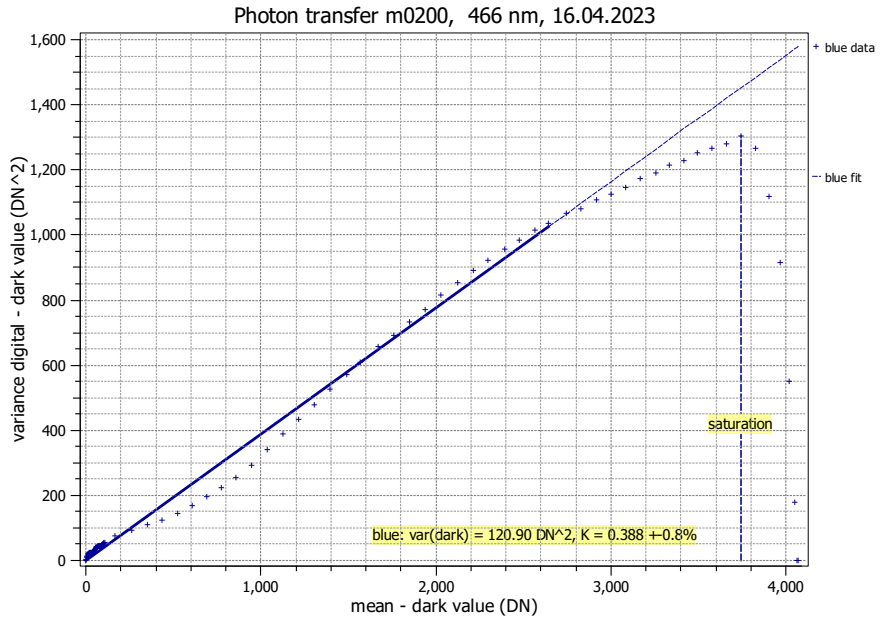
Type of data presented	Single
Operation point 1	
Wavelength centroid	466.2 nm
Wavelength FWHM	20.3 nm
Gain, black-level	1 / 0
Operation point 2	
Wavelength centroid	531.5 nm
Wavelength FWHM	31.2 nm
Gain, black-level	1 / 0
Operation point 3	
Wavelength centroid	629.4 nm
Wavelength FWHM	13.3 nm
Gain, black-level	1 / 0
Optional data measured	
None	



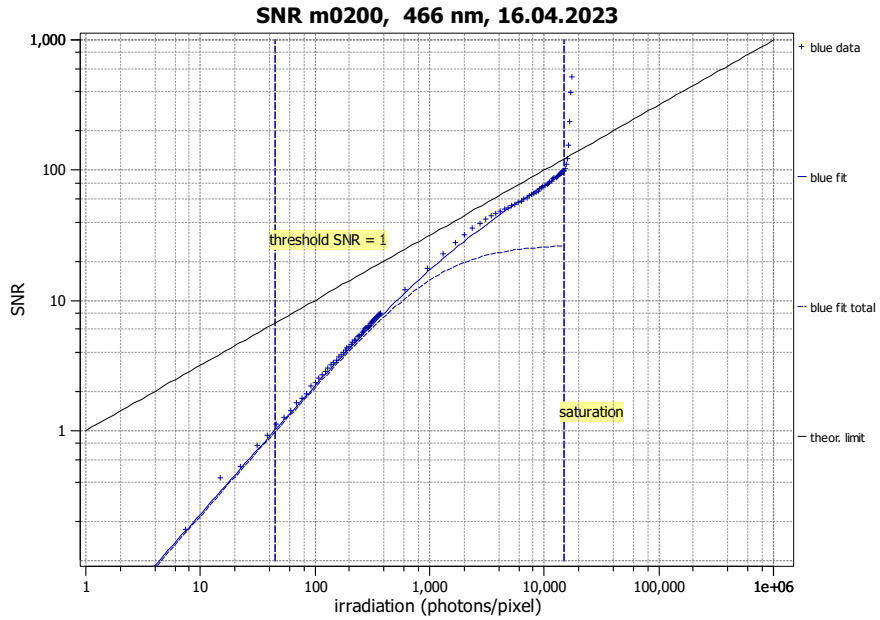
Summary Sheet for Operation Point 1 at a Wavelength of 466 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	$25.5°C$
Exposure time	50.00 μs	Camera body temperature	$36.1°C$
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 12	Wavelength, centr., FWHM	466 nm, 20.3 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	64.9%

Overall system gain

K	0.388 DN/e$^-$
$1/K$	2.577 e$^-$/DN

Temporal dark noise

σ_d	28.33 e$^-$
$\sigma_{y.\mathrm{dark}}$	11.00 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	99
	39.9 dB
	6.6 bit
$1/\mathrm{SNR}_{\max}$	1.01 %

Absolute sensitivity threshold

$\mu_{p.\mathrm{min}}$	44.4 p
$\mu_{p.\mathrm{min.area}}$	0.13 p/μm^2
$\mu_{e.\mathrm{min}}$	28.8 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.08 e$^-$/μm^2

Saturation capacity

$\mu_{p.\mathrm{sat}}$	14978 p
$\mu_{p.\mathrm{sat.area}}$	44 p/μm^2
$\mu_{e.\mathrm{sat}}$	9720 e$^-$
$\mu_{e.\mathrm{sat.area}}$	28 e$^-$/μm^2

Dynamic range

DR	337
	50.6 dB
	8.4 bit

Spatial nonuniformities

DSNU_{1288}	7.61 e$^-$
	2.95 DN
PRNU_{1288}	3.67 %

Linearity error

$\mathrm{LE}_{\min}$	-1.65%
$\mathrm{LE}_{\max}$	1.90%

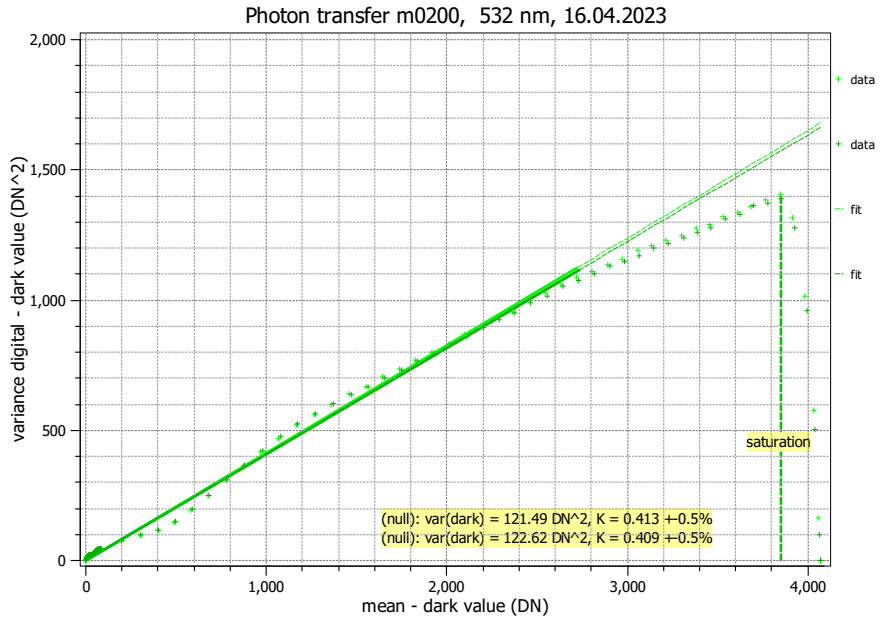
Dark current

$\mu_{c.\mathrm{mean}}$	45756 ± 507 e$^-$/s
	17753.8 DN/s
$\mu_{c.\mathrm{var}}$	53495 ± 4083 e$^-$/s
T_d	— °C

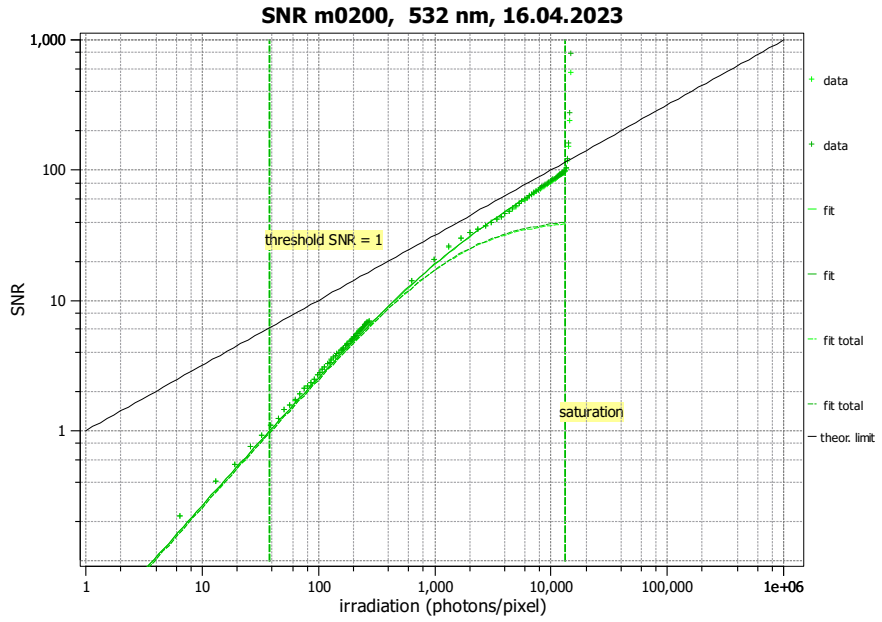
Summary Sheet for Operation Point 2 at a Wavelength of 532 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	25.5°C
Exposure time	50.00 µs	Camera body temperature	36.1°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 12	Wavelength, centr., FWHM	532 nm, 31.2 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	70.9%

Overall system gain

K	0.413 DN/e$^-$
$1/K$	2.423 e$^-$/DN

Temporal dark noise

σ_d	26.69 e$^-$
$\sigma_{y.\mathrm{dark}}$	11.02 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	97
	39.7 dB
	6.6 bit
$1/\mathrm{SNR}_{\max}$	1.03 %

Absolute sensitivity threshold

$\mu_{p.\min}$	38.4 p
$\mu_{p.\min.\mathrm{area}}$	0.11 p/µm^2
$\mu_{e.\min}$	27.2 e$^-$
$\mu_{e.\min.\mathrm{area}}$	0.08 e$^-$/µm^2

Saturation capacity

$\mu_{p.\mathrm{sat}}$	13306 p
$\mu_{p.\mathrm{sat.area}}$	39 p/µm^2
$\mu_{e.\mathrm{sat}}$	9432 e$^-$
$\mu_{e.\mathrm{sat.area}}$	28 e$^-$/µm^2

Dynamic range

DR	347
	50.8 dB
	8.4 bit

Spatial nonuniformities

DSNU_{1288}	7.31 e$^-$
	3.02 DN
PRNU_{1288}	2.35 %

Linearity error

$\mathrm{LE}_{\min}$	-2.69%
$\mathrm{LE}_{\max}$	2.41%

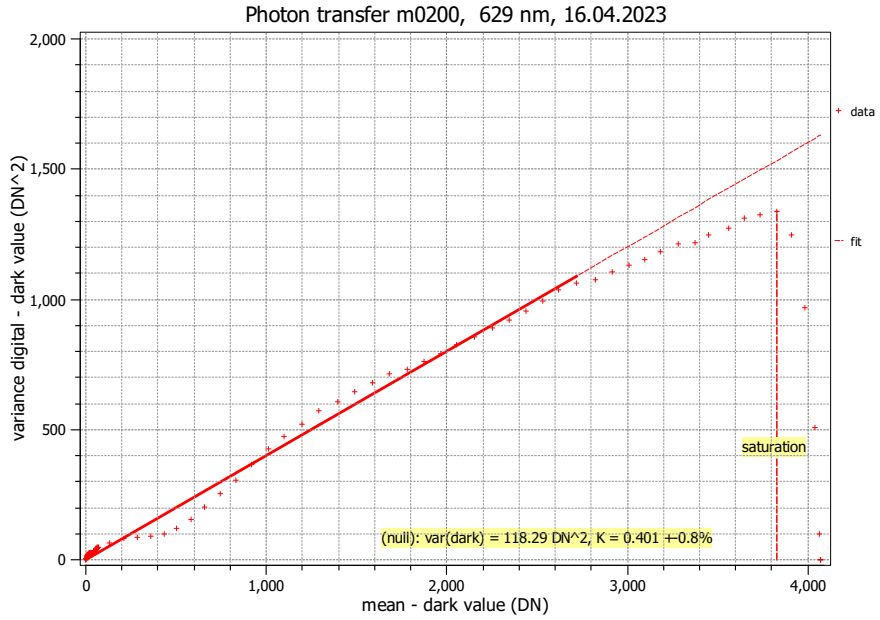
Dark current

$\mu_{c.\mathrm{mean}}$	42924 ± 479 e$^-$/s
	17718.0 DN/s
$\mu_{c.\mathrm{var}}$	46036 ± 3076 e$^-$/s
T_d	— °C

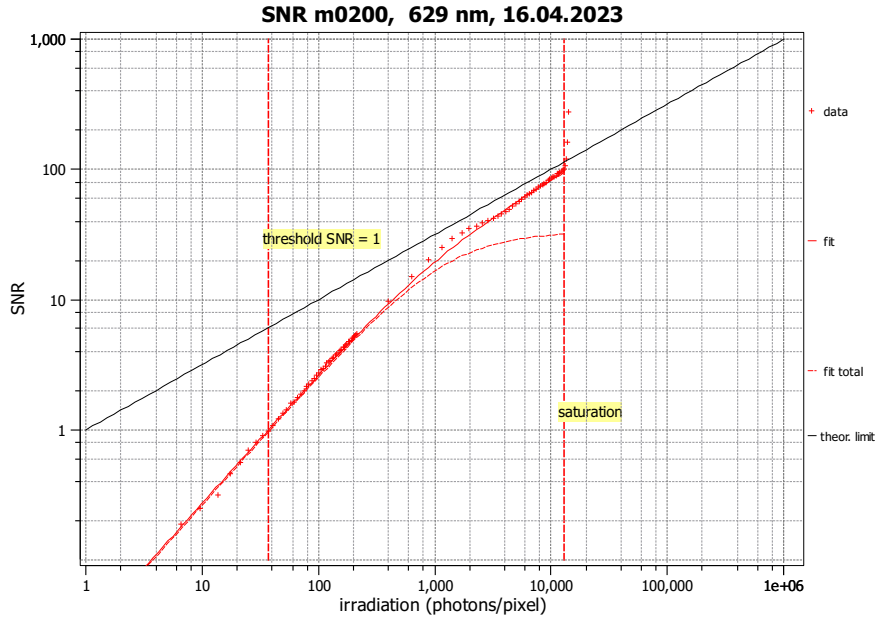
Summary Sheet for Operation Point 3 at a Wavelength of 629 nm

Type of data	Single	Gain, black-level	1 / 0
Exposure control	By irradiance	Environmental temperature	25.6°C
Exposure time	50.00 µs	Camera body temperature	36.2°C
Frame rate	1000.0 Hz	Internal temperature(s)	—
Data transfer mode	Color 12	Wavelength, centr., FWHM	629 nm, 13.3 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

η	74.4%

Overall system gain

K	0.401 DN/e$^-$
$1/K$	2.496 e$^-$/DN

Temporal dark noise

σ_d	27.14 e$^-$
$\sigma_{y.\mathrm{dark}}$	10.88 DN

Signal-to-noise ratio

$\mathrm{SNR}_{\max}$	98
	39.8 dB
	6.6 bit
$1/\mathrm{SNR}_{\max}$	1.02 %

Absolute sensitivity threshold

$\mu_{p.\mathrm{min}}$	37.2 p
$\mu_{p.\mathrm{min.area}}$	0.11 p/µm^2
$\mu_{e.\mathrm{min}}$	27.7 e$^-$
$\mu_{e.\mathrm{min.area}}$	0.08 e$^-$/µm^2

Saturation capacity

$\mu_{p.\mathrm{sat}}$	12902 p
$\mu_{p.\mathrm{sat.area}}$	38 p/µm^2
$\mu_{e.\mathrm{sat}}$	9602 e$^-$
$\mu_{e.\mathrm{sat.area}}$	28 e$^-$/µm^2

Dynamic range

DR	347
	50.8 dB
	8.4 bit

Spatial nonuniformities

DSNU_{1288}	7.37 e$^-$
	2.95 DN
PRNU_{1288}	2.96 %

Linearity error

$\mathrm{LE}_{\min}$	-3.72%
$\mathrm{LE}_{\max}$	3.21%

Dark current

$\mu_{c.\mathrm{mean}}$	43361 ± 467 e$^-$/s
	17714.3 DN/s
$\mu_{c.\mathrm{var}}$	47175 ± 3176 e$^-$/s
T_d	— °C