SPECIFIERS' GUIDE

QIOPTIQ
Photonics for Innovation
An Excelitas Technologies Company

Optem® FUSION

Micro-Imaging Lens System
Visible to SWIR (400-1700nm)

Covering the optical, mechanical,
and operational parameters of
FUSION system components.

Now Supports Key Visible, NIR and SWIR wavebands

6th Edition

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How to use this guide

Optem FUSION is a modular Lens System, which can be modified to affect form, function and performance across the Visible (400-700nm), the Near Infrared (NIR – 700-1100nm), and the Short-Wave Infrared (SWIR – 900-1700nm) wavebands. Follow the steps outlined herein to configure an Optem FUSION Lens System to meet your specific optical, functional and physical configuration requirements. Refer to the **Optical Performance Chart** that matches your chosen Fixed-magnification or Zoom configuration (e.g., with or without Objectives, with Standard or Mini Camera Tubes). Following the flow lines in the **FUSION Component Matrix** (p. 4-5), you can identify the components you will require to configure the lens performance you desire.

1 The first step in configuring your Optem FUSION Lens System is to determine whether you require a fixed field-of-view or a zoom system and what your desired operating wavelength will be (from Visible to SWIR). If you require zoom, determine how much zoom range you require, 7:1 or 12.5:1. This decision will direct you to the correct FUSION **Optical Performance chart** (p. 06 - 33).

2 Your second choice is determining what working distance you require for your system. Specify the correct Lower Lens to best fit your working distance requirements. Working distance is the mechanical space between the bottom of the lens system and your specimen. The addition of a ringlight or right-angle module to the bottom of the system will further reduce this working distance. Using the shortest working distance will provide the best resolution for all systems. Choose longer working distances when necessary to increase your desired field-of-view. Working distances for each Lower Lens is listed just below the Lower Lenses shown across the top of each **Optical Performance chart**. You need to know your intended camera format (chip size) to determine the field-of-view for your lens system. If you do not have a particular camera format in mind, use the numbers in the chart to help you determine the best camera chip size selection for your Optem FUSION Lens System.

3 Navigate from the top of the **Component Matrix** down to the Lower Lenses to identify the components needed to complete your FUSION Lens System. Fixed Magnification systems require the Aperture Module 35-07-20-000 for best performance. The correct aperture diameter is provided in the **Fixed Optical Performance Chart** (p. 07 - 13 and p.32).

These steps above are a general guide in configuring your Lens System. Your application may require choosing components in a different order than detailed herein. In this case, refer to the appropriate **Optical Performance chart** and identify your desired parameters (typically field-of-view at high- and low-end zoom) as it relates to your intended camera format.

NOTE:

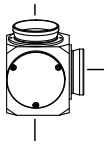
- Now including Optical Performance Charts for FUSION SWIR systems (p. 32-33).
- With the Optem FUSION System,the optical magnification is the product of the magnification of the Lower Lens, Zoom dial setting (if Zoom and the magnification of the Camera Tube. This formula works even when using Qioptiq Microscope Objectives.

Contact your Qioptiq representative or your Qioptiq dealer for additional help determining your specific requirements.

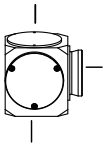
Optem® FUSION Visible/SWIR Compon

ACCESSORIES

35-07-01-000
50/50 CUBE

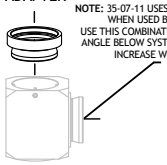


35-07-00-000
MIRROR CUBE

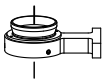


35-07-02-000
MIRROR CUBE ADAPTER

NOTE: 35-07-11 USES 65mm WORKING DISTANCE WHEN USED BELOW LOWER LENS. USE THIS COMBINATION WHEN PLACING RIGHT ANGLE BELOW SYSTEM. REMOVE DOVETAIL TO INCREASE WORKING DISTANCE.



35-07-11-000
INLINE MOUNT



35-07-21-000
25.4MM FILTER HOLDER

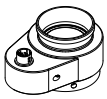
35-07-20-000
APERTURE SET

NOTE: NOT EVERY COMBINATION WILL PRESENT DESIRED RESULTS.

35-07-25-000
ADJUSTABLE IRIS

35-07-04-000
FLUORESENCE CUBE HOLDER UPPER
(**NOTE:** USES ZEISS TYPE 91029 Cube)

35-03-50-000
TUNABLE LENS FOCUS MODULE
(**NOTE:** ATTACH DIRECTLY ABOVE LOWER FUNCTION MODULE ONLY)

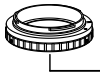


ACCESSORIES

CAMERA

CAMERA MOUNTS

25-60-23-000
EOS CAMERA MOUNT



25-60-24-000
F CAMERA MOUNT

35-08-70-000
C \ CS CAMERA MOUNT

25-60-26-000
4/3 CAMERA MOUNT

CAMERA TUBES

35-08-00-000
CAMERA TUBE
0.4X \ 80 FL

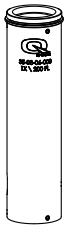
35-08-01-000
CAMERA TUBE
0.5X \ 100 FL

35-08-02-000
CAMERA TUBE
0.6X \ 120 FL

35-08-04-000
CAMERA TUBE
0.8X \ 160 FL

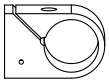
35-08-11-000
MINI CAMERA TUBE
0.8X \ 160 FL

35-08-06-000
CAMERA TUBE
1X \ 200 FL



ACCESSORIES

35-07-10-000
CAMERA TUBE CLAMP



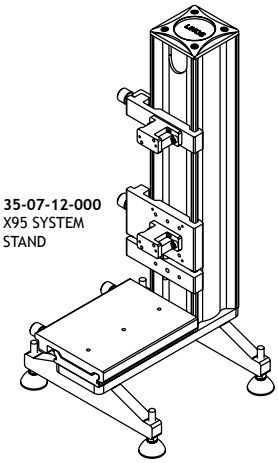
35-07-14-000
TUBE CLAMP MOUNT, 76mm dia.

35-07-15-000
TUBE CLAMP MOUNT, 82mm dia.

35-07-16-000
TUBE CLAMP MOUNT, 83mm dia.

35-07-17-000
TUBE CLAMP MOUNT, 84mm dia.

35-07-12-000
X95 SYSTEM STAND



FIXED MAGNIFICATION

7:1 ZOOM

35-31-10-000
7:1 ZOOM MANUAL

35-31-40-000
7:1 ZOOM MANUAL DETENT

35-31-60-000
7:1 ZOOM STEPPER MOTORIZED

A CONTROL

35-07-20-000
APERTURE SET
REQUIRED FOR FIXED MAGNIFICATION SYSTEMS

SWIR

NOTE:

- Products listed in RED TYPE Indicate SWIR version available.
- For ordering purposes, VISIBLE components are identified by a “35” prefix, while SWIR components use a “45” e.g. 35-XX-XX-XXX VISIBLE, and 45-YY-YY-YYY SWIR
- All “35-XX” modules are compatible with one another; and all “45-YY” modules are compatible with one another.
- Using “35-XX” and “45-YY” modules with one another is not recommended.
- Non-optics mounts/modules are cross-compatible between VISIBLE and SWIR

LOWER FUNCTION MODULES

35-03-10-000
15mm FOCUS MANUAL

35-03-30-000
15mm FOCUS STEPPER MOTOR

35-07-03-000
FLUORESENT CUBE HOLDER LOWER

NOTE: USES ZEISS TYPE 91029 CUBE. USE WITH 35-01-00-000 BASIC LOWER FUNCTION MODULE RECOMMENDED.

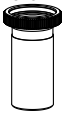
35-01-00-000
BASIC

B CONTROL

ILLUMINATION

35-00-03-000
2X \ 100 FL

42-35-41-000
INFINITY MACRO LENS



LOWER LENSES

35-00-11-000
0.4X \ 500 FL

35-00-10-000
0.5X \ 400 FL

35-00-09-000
0.67X \ 300 FL

35-00-08-000
1X \ 200 FL

35-00-06-000
1.25X \ 160 FL

QIOPTIQ
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ment Matrix

ILLUMINATION

25-60-27-000
MICRO 4/3
CAMERA MOUNT

25-60-28-000
SONY ALPHA
CAMERA MOUNT

25-60-29-000
PENTAX K
CAMERA MOUNT

MINI CAMERA TUBES

35-08-12-000
MINI
CAMERA TUBE
1X \ 200 FL

35-08-13-000
MINI CAMERA TUBE
1.5X \ 300 FL

35-08-14-000
MINI CAMERA TUBE
2X \ 400 FL

35-08-15-000
MINI CAMERA TUBE
2.5X \ 500 FL

35-08-16-000
MINI CAMERA TUBE
3X \ 600 FL

12.5:1 ZOOM

35-41-10-000
12.5:1 ZOOM
MANUAL

35-41-40-000
12.5:1 ZOOM
MANUAL
DETENT

35-41-60-000
12.5:1 ZOOM
STEPPER
MOTORIZED

4401-592-000-22
Fetura+
12.5:1 ZOOM
(SELF-CONTROLLED)

ACCESSORIES

A CONTROL

35-04-00-000
COAX
ILLUMINATION

35-04-10-000
COAX ILLUMINATION 5mm FOCUS
MANUAL

35-04-30-000
COAX ILLUMINATION 5mm FOCUS
STEPPER MOTOR

35-04-03-000
COAX
ILLUMINATION
WITH
ANALYZER

ILLUMINATION

35-04-13-000
COAX ILLUMINATION 5mm FOCUS
MANUAL W/ANALYZER

ILLUMINATION

35-04-33-000
COAX ILLUMINATION 5mm FOCUS
STEPPER MOTOR
W/ANALYZER

B CONTROL

ACCESSORIES

ILLUMINATION

35-00-05-000
1.43X \ 140 FL

35-00-04-000
1.67X \ 120 FL

35-00-03-000
2X \ 100 FL

35-00-01-000
3X \ 67 FL

35-00-02-000
4X \ 50 FL

NOTE: COAX ILLUMINATION HAS LIMITED FIELD ILLUMINATION WITH LARGE FOVs.

LIGHTING ACCESSORIES

35-07-50-000
LED COAX
ILLUMINATOR

29-69-13-000
LED COAX
RIGHT ANGLE

29-69-02-000
POLARIZER

30-16-02-000
FIBER OPTIC
LAMPHOUSE

30-16-01-000
10mm FIBER
OPTIC ADAPTER

30-16-60-000
60" FLEXIBLE
FIBER OPTIC

COAX

OBLIQUE

29-69-21-000
FIBER OPTIC
RINGLIGHT
ADAPTER

29-60-81-000
FIBER OPTIC
RINGLIGHT

29-60-83-000
110v HALOGEN
ILLUMINATOR

35-07-35-000
LED ILLUMINATOR
90/264V 50/60Hz

29-60-84-000
220v HALOGEN
ILLUMINATOR

35-07-40-000
LED RINGLIGHT
ADAPTER

35-07-41-000
LED
RINGLIGHT

A CONTROL

35-05-20-000
2 AXIS STEPPER CONTROLLER
24v POWER SUPPLY INC

30-17-37-000
(N. AMER CORD)

35-05-00-000
2 AXIS STEPPER CONTROLLER
OEM BOARD

30-17-36-000
(EURO CORD)

30-17-33-000
(U.K. CORD)

B CONTROL

35-05-99-000
CONTROLLER
ADAPTER
FOR FOCUS
MODULES

(REQUIRED FOR
ALL MOTORIZED
FOCUS MODULES.)

30-17-03-000
OBJECTIVE
ADAPTER

LWD OBJECTIVES
28-21-02-001 2X M PLAN APO
28-21-05-001 5X M PLAN APO
28-21-10-000 10X M PLAN APO
28-21-11-001 20X M PLAN APO
28-21-50-001 50X M PLAN APO

28-20-44-000 5X HI-RES
28-20-45-000 10X HI-RES
28-20-46-000 20X HI-RES

CERTAIN LIMITATIONS APPLY WITH HI-RES OBJECTIVES.
SEE BROCHURE FOR DETAILS.

30-16-50-000
OBJECTIVE RINGLIGHT
40 INCHES

Optical Performance - Fixed Magnification with Lower

Chart 1A

			0.4X Lower Lens 35-00-11-000 WD: 490mm EFL: 500mm	0.5X Lower Lens 35-00-10-000 WD: 390mm EFL: 400mm	0.67X Lower Lens 35-00-09-000 WD: 290mm EFL: 300mm	1X Lower Lens 35-00-08-000 WD: 190mm EFL: 200mm
Max FOV Dia.			100	80	60	40
Max Coax FOV Dia.			13	13	14	12
0.4X Camera Tube 35-08-00-000 EFL: 80mm **5mm Stop**		NA	0.0050	0.0063	0.0083	0.013
		Res (lp/mm)	15	19	25	38
		Mag	0.16	0.20	0.27	0.40
		DOF (mm)	23	15	8.2	3.6
	FOV (mm) Cam Format	1/3"	23 x 30	18 x 24	14 x 18	9.0 x 12
		1/2"	30 x 40	24 x 32	18 x 24	12 x 16
		2/3"	41 x 55	33 x 44	25 x 33	17 x 22
0.5X Camera Tube 35-08-01-000 EFL: 100mm **5mm Stop**		NA	0.0050	0.0063	0.0083	0.013
		Res (lp/mm)	15	19	25	38
		Mag	0.20	0.25	0.33	0.50
		DOF (mm)	23	15	8.2	3.6
	FOV (mm) Cam Format	1/3"	18 x 24	14 x 19	11 x 14	7.2 x 9.6
		1/2"	24 x 32	19 x 26	14 x 19	9.6 x 13
		2/3"	33 x 44	26 x 35	20 x 26	13 x 18
0.6X Camera Tube 35-08-02-000 EFL: 120mm **8mm Stop**		NA	0.0080	0.010	0.013	0.020
		Res (lp/mm)	24	30	40	60
		Mag	0.24	0.30	0.40	0.60
		DOF (mm)	8.9	5.7	3.2	1.4
	FOV (mm) Cam Format	1/3"	15 x 20	12 x 16	9.0 x 12	6.0 x 8.0
		1/2"	20 x 27	16 x 21	12 x 16	8.0 x 11
		2/3"	28 x 37	22 x 29	17 x 22	11 x 15
0.8X Camera Tube 35-08-04-000 EFL: 160mm **12mm Stop**		NA	0.012	0.015	0.020	0.030
		Res (lp/mm)	36	45	60	90
		Mag	0.32	0.40	0.53	0.80
		DOF (mm)	3.9	2.5	1.4	0.63
	FOV (mm) Cam Format	1/3"	11 x 15	9.0 x 12	6.8 x 9.0	4.5 x 6.0
		1/2"	15 x 20	12 x 16	9.0 x 12	6.0 x 8.0
		2/3"	21 x 28	17 x 22	12 x 17	8.3 x 11
1X Camera Tube 35-08-06-000 EFL: 200mm **18mm Stop**		NA	0.018	0.023	0.030	0.045
		Res (lp/mm)	54	68	90	135
		Mag	0.40	0.50	0.67	1.0
		DOF (mm)	1.8	1.1	0.63	0.28
	FOV (mm) Cam Format	1/3"	9.0 x 12	7.2 x 9.6	5.4 x 7.2	3.6 x 4.8
		1/2"	12 x 16	9.6 x 13	7.2 x 9.6	4.8 x 6.4
		2/3"	17 x 22	13 x 18	9.9 x 13	6.6 x 8.8

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

Lenses

1.25X Lower Lens 35-00-06-000 WD: 155mm EFL: 160mm	1.43X Lower Lens 35-00-05-000 WD: 135mm EFL: 140mm	1.67 Lower Lens 35-00-04-000 WD: 110mm EFL: 120mm	2X Lower Lens 35-00-03-000 WD: 95mm EFL: 100mm	3X Lower Lens 35-00-01-000 WD: 50mm EFL: 67mm	4X Lower Lens 35-00-02-000 WD: 32mm EFL: 50mm
32	28	24	20	15	10
12	13	14	15	15	10
0.016	0.018	0.021	0.025	0.037	0.050
47	54	63	75	112	150
0.50	0.57	0.67	0.80	1.2	1.6
2.3	1.8	1.3	0.91	0.40	0.23
7.2 x 9.6	6.3 x 8.4	5.4 x 7.2	4.5 x 6.0	3.0 x 4.0	2.3 x 3.0
9.6 x 13	8.4 x 11	7.2 x 9.6	6.0 x 8.0	4.0 x 5.3	3.0 x 4.0
13 x 18	12 x 15	9.9 x 13	8.3 x 11	5.5 x 7.3	4.1 x 5.5
0.016	0.018	0.021	0.025	0.037	0.050
47	54	63	75	112	150
0.63	0.71	0.83	1.0	1.5	2.0
2.3	1.8	1.3	0.91	0.40	0.23
5.8 x 7.7	5.0 x 6.7	4.3 x 5.8	3.6 x 4.8	2.4 x 3.2	1.8 x 2.4
7.7 x 10	6.7 x 9.0	5.8 x 7.7	4.8 x 6.4	3.2 x 4.3	2.4 x 3.2
11 x 14	9.2 x 12	7.9 x 11	6.6 x 8.8	4.4 x 5.9	3.3 x 4.4
0.025	0.029	0.033	0.040	0.060	0.080
75	86	100	120	180	240
0.75	0.86	1.0	1.2	1.8	2.4
0.91	0.69	0.51	0.35	0.16	0.089
4.8 x 6.4	4.2 x 5.6	3.6 x 4.8	3.0 x 4.0	2.0 x 2.7	1.5 x 2.0
6.4 x 8.5	5.6 x 7.5	4.8 x 6.4	4.0 x 5.3	2.7 x 3.6	2.0 x 2.7
8.8 x 12	7.7 x 10	6.6 x 8.8	5.5 x 7.3	3.7 x 4.9	2.8 x 3.7
0.038	0.043	0.050	0.060	0.090	0.12
113	129	150	180	270	360
1.0	1.1	1.3	1.6	2.4	3.2
0.40	0.31	0.23	0.16	0.070	0.039
3.6 x 4.8	3.2 x 4.2	2.7 x 3.6	2.3 x 3.0	1.5 x 2.0	1.1 x 1.5
4.8 x 6.4	4.2 x 5.6	3.6 x 4.8	3.0 x 4.0	2.0 x 2.7	1.5 x 2.0
6.6 x 8.8	5.8 x 7.7	5.0 x 6.6	4.1 x 5.5	2.8 x 3.7	2.1 x 2.8
0.056	0.064	0.075	0.090	0.13	0.18
169	193	225	270	405	540
1.25	1.43	1.67	2.0	3.0	4.0
0.18	0.14	0.10	0.070	0.031	0.018
2.9 x 3.8	2.5 x 3.4	2.2 x 2.9	1.8 x 2.4	1.2 x 1.6	0.90 x 1.2
3.8 x 5.1	3.4 x 4.5	2.9 x 3.8	2.4 x 3.2	1.6 x 2.1	1.2 x 1.6
5.3 x 7.0	4.6 x 6.2	4.0 x 5.3	3.3 x 4.4	2.2 x 2.9	1.7 x 2.2

Optical Performance - Fixed Magnification with Lower

Chart 1B

			0.4X Lower Lens 35-00-11-000 WD: 490mm EFL: 500mm	0.5X Lower Lens 35-00-10-000 WD: 390mm EFL: 400mm	0.67X Lower Lens 35-00-09-000 WD: 290mm EFL: 300mm	1X Lower Lens 35-00-08-000 WD: 190mm EFL: 200mm
		Max FOV Dia.	100	80	60	40
		Max Coax FOV Dia.	13	13	14	12
1.5X Mini Camera Tube		NA	0.012	0.015	0.020	0.030
		Res (lp/mm)	36	45	60	90
		Mag	0.60	0.75	1.0	1.5
		DOF (mm)	3.9	2.5	1.4	0.63
35-08-13-000 EFL: 300mm 12mm Stop	FOV (mm) Cam Format	2/3"	11 x 15	8.8 x 12	6.6 x 8.8	4.4 x 5.9
		1"	16 x 21	13 x 17	9.6 x 13	6.4 x 8.5
		4/3"	23 x 30	18 x 24	14 x 18	9.0 x 12
		APS-C	28 x 42	22 x 33	17 x 25	11 x 17
2X Mini Camera Tube		NA	0.018	0.023	0.030	0.045
		Res (lp/mm)	54	68	90	135
		Mag	0.80	1.0	1.3	2.0
		DOF (mm)	1.8	1.1	0.63	0.28
35-08-14-000 EFL: 400mm 18mm Stop	FOV (mm) Cam Format	2/3"	8.3 x 11	6.6 x 8.8	5.0 x 6.6	3.3 x 4.4
		1"	12 x 16	9.6 x 13	7.2 x 9.6	4.8 x 6.4
		4/3"	17 x 23	14 x 18	10 x 14	6.8 x 9.0
		APS-C	21 x 31	17 x 25	13 x 19	8.4 x 13
2.5X Mini Camera Tube		NA	0.018	0.023	0.030	0.045
		Res (lp/mm)	54	68	90	135
		Mag	1.0	1.3	1.7	2.5
		DOF (mm)	1.8	1.1	0.63	0.28
35-08-15-000 EFL: 500mm 18mm Stop	FOV (mm) Cam Format	1"	9.6 x 13	7.7 x 10	5.8 x 7.7	3.8 x 5.1
		4/3"	14 x 18	11 x 14	8.1 x 11	5.4 x 7.2
		APS-C	17 x 25	13 x 20	10 x 15	6.7 x 10
		35mm (FULL)	24 x 36	19 x 29	14 x 22	9.6 x 14
3X Mini Camera Tube		NA	0.018	0.023	0.030	0.045
		Res (lp/mm)	54	68	90	135
		Mag	1.2	1.5	2.0	3.0
		DOF (mm)	1.8	1.1	0.63	0.28
35-08-16-000 EFL: 600mm 18mm Stop	FOV (mm) Cam Format	1"	8.0 x 11	6.4 x 8.5	4.8 x 6.4	3.2 x 4.3
		4/3"	11 x 15	9.0 x 12	6.8 x 9.0	4.5 x 6.0
		APS-C	14 x 21	11 x 17	8.4 x 13	5.6 x 8.4
		35mm (FULL)	20 x 30	16 x 24	12 x 18	8.0 x 12

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Lenses - Mini Camera Tubes

1.25X Lower Lens 35-00-06-000 WD: 155mm EFL: 160mm	1.43X Lower Lens 35-00-05-000 WD: 135mm EFL: 140mm	1.67 Lower Lens 35-00-04-000 WD: 110mm EFL: 120mm	2X Lower Lens 35-00-03-000 WD: 95mm EFL: 100mm	3X Lower Lens 35-00-01-000 WD: 50mm EFL: 67mm	4X Lower Lens 35-00-02-000 WD: 32mm EFL: 50mm
32	28	24	20	15	10
12	13	14	15	15	10
0.038	0.043	0.050	0.060	0.090	0.12
113	129	150	180	270	360
1.9	2.1	2.5	3.0	4.5	6.0
0.40	0.31	0.23	0.16	0.070	0.039
3.5 x 4.7	3.1 x 4.1	2.6 x 3.5	2.2 x 2.9	1.5 x 2.0	1.1 x 1.5
5.1 x 6.8	4.5 x 6.0	3.8 x 5.1	3.2 x 4.3	2.1 x 2.8	1.6 x 2.1
7.2 x 9.6	6.3 x 8.4	5.4 x 7.2	4.5 x 6.0	3.0 x 4.0	2.3 x 3.0
8.9 x 13	7.8 x 12	6.7 x 10	5.6 x 8.4	3.7 x 5.6	2.8 x 4.2
0.056	0.064	0.075	0.090	0.13	0.18
169	193	225	270	405	540
2.5	2.9	3.3	4.0	6.0	8.0
0.18	0.14	0.101	0.070	0.031	0.018
2.6 x 3.5	2.3 x 3.1	2.0 x 2.6	1.7 x 2.2	1.1 x 1.5	0.83 x 1.1
3.8 x 5.1	3.4 x 4.5	2.9 x 3.8	2.4 x 3.2	1.6 x 2.1	1.2 x 1.6
5.4 x 7.2	4.7 x 6.3	4.1 x 5.4	3.4 x 4.5	2.3 x 3.0	1.7 x 2.3
6.7 x 10	5.8 x 8.8	5.0 x 7.5	4.2 x 6.3	2.8 x 4.2	2.1 x 3.1
0.056	0.064	0.075	0.090	0.13	0.18
169	193	225	270	405	540
3.1	3.6	4.2	5.0	7.5	10
0.18	0.14	0.10	0.070	0.031	0.018
3.1 x 4.1	2.7 x 3.6	2.3 x 3.1	1.9 x 2.6	1.3 x 1.7	0.96 x 1.3
4.3 x 5.8	3.8 x 5.0	3.2 x 4.3	2.7 x 3.6	1.8 x 2.4	1.4 x 1.8
5.3 x 8.0	4.7 x 7.0	4.0 x 6.0	3.3 x 5.0	2.2 x 3.3	1.7 x 2.5
7.7 x 12	6.7 x 10	5.8 x 8.6	4.8 x 7.2	3.2 x 4.8	2.4 x 3.6
0.056	0.064	0.075	0.090	0.13	0.18
169	193	225	270	405	540
3.8	4.3	5.0	6.0	9.0	12
0.18	0.14	0.10	0.070	0.031	0.018
2.6 x 3.4	2.2 x 3.0	1.9 x 2.6	1.6 x 2.1	1.1 x 1.4	0.80 x 1.1
3.6 x 4.8	3.2 x 4.2	2.7 x 3.6	2.3 x 3.0	1.5 x 2.0	1.1 x 1.5
4.5 x 6.7	3.9 x 5.9	3.3 x 5.0	2.8 x 4.2	1.9 x 2.8	1.4 x 2.1
6.4 x 9.6	5.6 x 8.4	4.8 x 7.2	4.0 x 6.0	2.7 x 4.0	2.0 x 3.0

Optical Performance - Fixed Magnification with LWD

Chart 1C

			2X M Plan Apo 28-21-02-001 WD: 34mm	5X M Plan Apo 28-21-05-001 WD: 41mm	10X M Plan Apo 28-21-10-000 WD: 34mm	20X M Plan Apo 28-21-11-001 WD: 20mm
		Max FOV Dia.	17	16	10	5.4
		Max Coax FOV Dia.	16	11	5.0	2.6
0.4X Camera Tube 35-08-00-000 EFL: 80mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	0.80	2.0	4.0	8.0
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1/3"	4.5 x 6.0	1.8 x 2.4	0.90 x 1.2	0.45 x 0.60
		1/2"	6.0 x 8.0	2.4 x 3.2	1.2 x 1.6	0.60 x 0.80
		2/3"	8.3 x 11	3.3 x 4.4	1.7 x 2.2	0.83 x 1.1
0.5X Camera Tube 35-08-01-000 EFL: 100mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	1.0	2.5	5.0	10
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1/3"	3.6 x 4.8	1.4 x 1.9	0.72 x 0.96	0.36 x 0.48
		1/2"	4.8 x 6.4	1.9 x 2.6	0.96 x 1.3	0.48 x 0.64
		2/3"	6.6 x 8.8	2.6 x 3.5	1.3 x 1.8	0.66 x 0.88
0.6X Camera Tube 35-08-02-000 EFL: 120mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	1.2	3.0	6.0	12
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1/3"	3.0 x 4.0	1.2 x 1.6	0.60 x 0.80	0.30 x 0.40
		1/2"	4.0 x 5.3	1.6 x 2.1	0.80 x 1.1	0.40 x 0.53
		2/3"	5.5 x 7.3	2.2 x 2.9	1.1 x 1.5	0.55 x 0.73
0.8X Camera Tube 35-08-04-000 EFL: 160mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	1.6	4.0	8.0	16
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1/3"	2.3 x 3.0	0.90 x 1.2	0.45 x 0.60	0.23 x 0.30
		1/2"	3.0 x 4.0	1.2 x 1.6	0.60 x 0.80	0.30 x 0.40
		2/3"	4.1 x 5.5	1.7 x 2.2	0.83 x 1.1	0.41 x 0.55
1X Camera Tube 35-08-06-000 EFL: 200mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	2.0	5.0	10	20
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1/3"	1.8 x 2.4	0.72 x 0.96	0.36 x 0.48	0.18 x 0.24
		1/2"	2.4 x 3.2	0.96 x 1.3	0.48 x 0.64	0.24 x 0.32
		2/3"	3.3 x 4.4	1.3 x 1.8	0.66 x 0.88	0.33 x 0.44

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

Objectives

50X M Plan Apo 28-21-50-001 WD: 13mm	5X HiRes 28-20-44-000 WD: 34mm	10X HiRes 28-20-45-000 WD: 19mm	20X HiRes 28-20-46-000 WD: 13mm
2.3	10	5.2	4.5
1.1	7.0	2.8	2.1
0.55	0.225	0.45	0.60
1650	675	1350	1800
20	2.0	4.0	8.0
0.0019	0.011	0.0028	0.0016
0.18 x 0.24	1.8 x 2.4	0.90 x 1.2	0.45 x 0.60
0.24 x 0.32	2.4 x 3.2	1.2 x 1.6	0.60 x 0.80
0.33 x 0.44	3.3 x 4.4	1.7 x 2.2	0.83 x 1.1
0.55	0.225	0.45	0.60
1650	675	1350	1800
25	2.5	5.0	10
0.0019	0.011	0.0028	0.0016
0.14 x 0.19	1.4 x 1.9	0.72 x 0.96	0.36 x 0.48
0.19 x 0.26	1.9 x 2.6	0.96 x 1.3	0.48 x 0.64
0.26 x 0.35	2.6 x 3.5	1.3 x 1.8	0.66 x 0.88
0.55	0.225	0.45	0.60
1650	675	1350	1800
30	3.0	6.0	12
0.0019	0.011	0.0028	0.0016
0.12 x 0.16	1.2 x 1.6	0.60 x 0.80	0.30 x 0.40
0.16 x 0.21	1.6 x 2.1	0.80 x 1.1	0.40 x 0.53
0.22 x 0.29	2.2 x 2.9	1.1 x 1.5	0.55 x 0.73
0.55	0.225	0.45	0.60
1650	675	1350	1800
40	4.0	8.0	16
0.0019	0.011	0.0028	0.0016
0.090 x 0.12	0.90 x 1.2	0.45 x 0.60	0.23 x 0.30
0.12 x 0.16	1.2 x 1.6	0.60 x 0.80	0.30 x 0.40
0.17 x 0.22	1.7 x 2.2	0.83 x 1.1	0.41 x 0.55
0.55	0.225	0.45	0.60
1650	675	1350	1800
50	5.0	10	20
0.0019	0.011	0.0028	0.0016
0.072 x 0.096	0.72 x 0.96	0.36 x 0.48	0.18 x 0.24
0.096 x 0.13	0.96 x 1.3	0.48 x 0.64	0.24 x 0.32
0.13 x 0.18	1.3 x 1.8	0.66 x 0.88	0.33 x 0.44

Note: Hi Res Objectives are not flat-field and therefore limited by field curvature at lower magnifications with both fixed and zoom systems.

Optical Performance - Fixed Magnification with LWD

Chart 1D

			2X M Plan Apo 28-21-02-001 WD: 34mm	5X M Plan Apo 28-21-05-001 WD: 41mm	10X M Plan Apo 28-21-10-000 WD: 34mm	20X M Plan Apo 28-21-11-001 WD: 20mm
		Max FOV Dia.	17	16	10	5.4
		Max Coax FOV Dia.	16	11	5.0	2.6
1.5X Mini Camera Tube 35-08-13-000 EFL: 300mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	3.0	7.5	15	30
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	2/3"	2.2 x 2.9	0.88 x 1.2	0.44 x 0.59	0.22 x 0.29
		1"	3.2 x 4.3	1.3 x 1.7	0.64 x 0.85	0.32 x 0.43
		4/3"	4.5 x 6.0	1.8 x 2.4	0.90 x 1.2	0.45 x 0.60
		APS-C	5.6 x 8.4	2.2 x 3.3	1.1 x 1.7	0.56 x 0.84
2X Mini Camera Tube 35-08-14-000 EFL: 400mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	4.0	10	20	40
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	2/3"	1.7 x 2.2	0.66 x 0.88	0.33 x 0.44	0.17 x 0.22
		1"	2.4 x 3.2	0.96 x 1.3	0.48 x 0.64	0.24 x 0.32
		4/3"	3.4 x 4.5	1.4 x 1.8	0.68 x 0.90	0.34 x 0.45
		APS-C	4.2 x 6.3	1.7 x 2.5	0.84 x 1.3	0.42 x 0.63
2.5X Mini Camera Tube 35-08-15-000 EFL: 500mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	5.0	12.5	25	50
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1"	1.9 x 2.6	0.77 x 1.0	0.38 x 0.51	0.19 x 0.26
		4/3"	2.7 x 3.6	1.1 x 1.4	0.54 x 0.72	0.27 x 0.36
		APS-C	3.3 x 5.0	1.3 x 2.0	0.67 x 1.0	0.33 x 0.50
		35mm(Full)	4.8 x 7.2	1.9 x 2.9	1.0 x 1.4	0.48 x 0.72
3X Mini Camera Tube 35-08-16-000 EFL: 600mm NO Stop		NA	0.057	0.14	0.30	0.42
		Res (lp/mm)	170	420	900	1260
		Mag	6.0	15	30	60
		DOF (mm)	0.18	0.029	0.0063	0.0032
	FOV (mm) Cam Format	1"	1.6 x 2.1	0.64 x 0.85	0.32 x 0.43	0.16 x 0.21
		4/3"	2.3 x 3.0	0.90 x 1.2	0.45 x 0.60	0.23 x 0.30
		APS-C	2.8 x 4.2	1.1 x 1.7	0.56 x 0.84	0.28 x 0.42
		35mm(Full)	4.0 x 6.0	1.6 x 2.4	0.80 x 1.2	0.40 x 0.60

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Objectives - Mini Camera Tubes

50X M Plan Apo 28-21-50-001 WD: 13mm			5X HiRes 28-20-44-000 WD: 34mm			10X HiRes 28-20-45-000 WD: 19mm			20X HiRes 28-20-46-000 WD: 13mm		
2.3			10			5.2			4.5		
1.1			7.0			2.8			2.1		
0.55			0.225			0.45			0.60		
1650			675			1350			1800		
75			7.5			15			30		
0.0019			0.011			0.0028			0.0016		
0.088	x	0.12	0.88	x	1.2	0.44	x	0.59	0.22	x	0.29
0.13	x	0.17	1.3	x	1.7	0.64	x	0.85	0.32	x	0.43
0.18	x	0.24	1.8	x	2.4	0.90	x	1.2	0.45	x	0.60
0.22	x	0.33	2.2	x	3.3	1.1	x	1.7	0.56	x	0.84
0.55			0.225			0.45			0.60		
1650			675			1350			1800		
100			10			20			40		
0.0019			0.011			0.0028			0.0016		
0.066	x	0.088	0.66	x	0.88	0.33	x	0.44	0.17	x	0.22
0.096	x	0.13	0.96	x	1.3	0.48	x	0.64	0.24	x	0.32
0.14	x	0.18	1.4	x	1.8	0.68	x	0.90	0.34	x	0.45
0.17	x	0.25	1.7	x	2.5	0.84	x	1.3	0.42	x	0.63
0.55			0.225			0.45			0.60		
1650			675			1350			1800		
125			12.5			25			50		
0.0019			0.011			0.0028			0.0016		
0.08	x	0.10	0.77	x	1.0	0.38	x	0.51	0.19	x	0.26
0.11	x	0.14	1.1	x	1.4	0.54	x	0.72	0.27	x	0.36
0.13	x	0.20	1.3	x	2.0	0.67	x	1.0	0.33	x	0.50
0.19	x	0.29	1.9	x	2.9	0.96	x	1.4	0.48	x	0.72
0.55			0.225			0.45			0.60		
1650			675			1350			1800		
150			15			30			60		
0.0019			0.011			0.0028			0.0016		
0.064	x	0.085	0.64	x	0.85	0.32	x	0.43	0.16	x	0.21
0.090	x	0.12	0.90	x	1.2	0.45	x	0.60	0.23	x	0.30
0.11	x	0.17	1.1	x	1.7	0.56	x	0.84	0.28	x	0.42
0.16	x	0.24	1.6	x	2.4	0.80	x	1.2	0.40	x	0.60

Note: Hi Res Objectives are not flat-field and therefore limited by field curvature at lower magnifications with both fixed and zoom systems.

Optical Performance - OPTEM 7:1 Zoom with Lower

Chart 2A

			0.4X Lower Lens 35-00-11-000 WD: 490mm EFL: 500mm		0.5X Lower Lens 35-00-10-000 WD: 390mm EFL: 400mm		0.67X Lower Lens 35-00-09-000 WD: 290mm EFL: 300mm		1X Lower Lens 35-00-08-000 WD: 190mm EFL: 200mm	
Max FOV Dia.			156		125		94		63	
Max Coax FOV Dia.			NR		NR		NR		19	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.4X Camera Tube 35-08-00-000 EFL: 80mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.067	0.46	0.084	0.58	0.11	0.77	0.17	1.2
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1/3"	54 x 71	7.8 x 10	43 x 57	6.2 x 8.3	32 x 43	4.7 x 6.2	21 x 29	3.1 x 4.1
		1/2"	71 x 95	10 x 14	57 x 76	8.3 x 11	43 x 57	6.2 x 8.3	29 x 38	4.1 x 5.5
		2/3"	98 x 131	14 x 19	79 x 105	11 x 15	59 x 79	8.5 x 11	39 x 52	5.7 x 7.6
0.5X Camera Tube 35-08-01-000 EFL: 100mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.084	0.58	0.11	0.73	0.14	0.97	0.21	1.5
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1/3"	43 x 57	6.2 x 8.3	34 x 46	5.0 x 6.6	26 x 34	3.7 x 5.0	17 x 23	2.5 x 3.3
		1/2"	57 x 76	8.3 x 11	46 x 61	6.6 x 8.8	34 x 46	5.0 x 6.6	23 x 30	3.3 x 4.4
		2/3"	79 x 105	11 x 15	63 x 84	9.1 x 12	47 x 63	6.8 x 9.1	31 x 42	4.6 x 6.1
0.6X Camera Tube 35-08-02-000 EFL: 120mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.10	0.70	0.13	0.87	0.17	1.2	0.25	1.7
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1/3"	36 x 48	5.2 x 6.9	29 x 38	4.1 x 5.5	21 x 29	3.1 x 4.1	14 x 19	2.1 x 2.8
		1/2"	48 x 63	6.9 x 9.2	38 x 51	5.5 x 7.4	29 x 38	4.1 x 5.5	19 x 25	2.8 x 3.7
		2/3"	65 x 87	9.5 x 13	52 x 70	7.6 x 10	39 x 52	5.7 x 7.6	26 x 35	3.8 x 5.1
0.8X Camera Tube 35-08-04-000 EFL: 160mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.13	0.93	0.17	1.2	0.22	1.5	0.34	2.3
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1/3"	27 x 36	3.9 x 5.2	21 x 29	3.1 x 4.1	16 x 21	2.3 x 3.1	11 x 14	1.6 x 2.1
		1/2"	36 x 48	5.2 x 6.9	29 x 38	4.1 x 5.5	21 x 29	3.1 x 4.1	14 x 19	2.1 x 2.8
		2/3"	49 x 65	7.1 x 9.5	39 x 52	5.7 x 7.6	29 x 39	4.3 x 5.7	20 x 26	2.8 x 3.8
1X Camera Tube 35-08-06-000 EFL: 200mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.17	1.2	0.21	1.5	0.28	1.9	0.42	2.9
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1/3"	21 x 29	3.1 x 4.1	17 x 23	2.5 x 3.3	13 x 17	1.9 x 2.5	8.6 x 11	1.2 x 1.7
		1/2"	29 x 38	4.1 x 5.5	23 x 30	3.3 x 4.4	17 x 23	2.5 x 3.3	11 x 15	1.7 x 2.2
		2/3"	39 x 52	5.7 x 7.6	31 x 42	4.6 x 6.1	24 x 31	3.4 x 4.6	16 x 21	2.3 x 3.0

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

NR = Not recommended for Coax illumination

Lens

1.25X Lower Lens 35-00-06-000 WD: 155mm EFL: 160mm		1.43X Lower Lens 35-00-05-000 WD: 135mm EFL: 140mm		1.67 Lower Lens 35-00-04-000 WD: 110mm EFL: 120mm		2X Lower Lens 35-00-03-000 WD: 95mm EFL: 100mm		3X Lower Lens 35-00-01-000 WD: 50mm EFL: 67mm		4X Lower Lens 35-00-02-000 WD: 32mm EFL: 50mm	
50		44		38		31		21		16	
19		19		18		19		13		9.4	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
0.21	1.5	0.24	1.7	0.28	1.9	0.34	2.3	0.50	3.5	0.67	4.6
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
17 x 23	2.5 x 3.3	15 x 20	2.2 x 2.9	13 x 17	1.9 x 2.5	11 x 14	1.6 x 2.1	7.1 x 9.5	1.0 x 1.4	5.4 x 7.1	0.78 x 1.0
23 x 30	3.3 x 4.4	20 x 27	2.9 x 3.9	17 x 23	2.5 x 3.3	14 x 19	2.1 x 2.8	9.5 x 13	1.4 x 1.8	7.1 x 10	1.0 x 1.4
31 x 42	4.6 x 6.1	28 x 37	4.0 x 5.3	24 x 31	3.4 x 4.6	20 x 26	2.8 x 3.8	13 x 17	1.9 x 2.5	10 x 13	1.4 x 1.9
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
0.26	1.8	0.30	2.1	0.35	2.4	0.42	2.9	0.63	4.3	0.84	5.8
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
14 x 18	2.0 x 2.6	12 x 16	1.7 x 2.3	10 x 14	1.5 x 2.0	8.6 x 11	1.24 x 1.7	5.7 x 7.6	0.83 x 1.1	4.3 x 5.7	0.62 x 0.83
18 x 24	2.6 x 3.5	16 x 21	2.3 x 3.1	14 x 18	2.0 x 2.6	11 x 15	1.7 x 2.2	7.6 x 10	1.1 x 1.5	5.7 x 7.6	0.83 x 1.1
25 x 34	3.6 x 4.9	22 x 29	3.2 x 4.2	19 x 25	2.7 x 3.6	16 x 21	2.3 x 3.0	10 x 14	1.5 x 2.0	7.9 x 10	1.1 x 1.5
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
0.32	2.2	0.36	2.5	0.42	2.9	0.50	3.5	0.76	5.2	1.0	7.0
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
11 x 15	1.7 x 2.2	10 x 13	1.4 x 1.9	8.6 x 11	1.2 x 1.7	7.1 x 9.5	1.0 x 1.4	4.8 x 6.4	0.69 x 0.92	3.6 x 4.8	0.52 x 0.69
15 x 20	2.2 x 2.9	13 x 18	1.9 x 2.6	11 x 15	1.7 x 2.2	9.5 x 13	1.4 x 1.8	6.4 x 8.5	0.92 x 1.2	4.8 x 6.3	0.69 x 0.92
21 x 28	3.0 x 4.0	18 x 24	2.7 x 3.5	16 x 21	2.3 x 3.0	13 x 17	1.9 x 2.5	8.7 x 12	1.3 x 1.7	6.5 x 8.7	0.95 x 1.3
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
0.42	2.9	0.48	3.3	0.56	3.9	0.67	4.6	1.0	7.0	1.3	9.3
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
8.6 x 11	1.2 x 1.7	7.5 x 10	1.1 x 1.4	6.4 x 8.6	0.93 x 1.2	5.4 x 7.1	0.78 x 1.0	3.6 x 4.8	0.52 x 0.69	2.7 x 3.6	0.39 x 0.52
11 x 15	1.7 x 2.2	10 x 13	1.4 x 1.9	8.6 x 11	1.2 x 1.7	7.1 x 9.5	1.0 x 1.4	4.8 x 6.4	0.69 x 0.92	3.6 x 4.8	0.52 x 0.69
16 x 21	2.3 x 3.0	14 x 18	2.0 x 2.7	12 x 16	1.7 x 2.3	9.8 x 13	1.4 x 1.9	6.6 x 8.7	0.95 x 1.3	4.9 x 6.5	0.71 x 0.95
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
0.53	3.6	0.60	4.1	0.70	4.8	0.84	5.8	1.3	8.7	1.7	12
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
6.9 x 9.1	0.99 x 1.3	6.0 x 8.0	0.87 x 1.2	5.1 x 6.9	0.74 x 0.99	4.3 x 5.7	0.62 x 0.83	2.9 x 3.8	0.41 x 0.55	2.1 x 2.9	0.31 x 0.41
9.1 x 12	1.3 x 1.8	8.0 x 11	1.2 x 1.5	6.9 x 9.1	0.99 x 1.3	5.7 x 7.6	0.83 x 1.1	3.8 x 5.1	0.55 x 0.74	2.9 x 3.8	0.41 x 0.55
13 x 17	1.8 x 2.4	11 x 15	1.6 x 2.1	9.4 x 13	1.4 x 1.8	7.9 x 10	1.1 x 1.5	5.2 x 7.0	0.76 x 1.0	3.9 x 5.2	0.57 x 0.76

Optical Performance - OPTEM 7:1 Zoom with Lower

Chart 2B

			0.4X Lower Lens 35-00-11-000 WD: 490mm EFL: 500mm		0.5X Lower Lens 35-00-10-000 WD: 390mm EFL: 400mm		0.67X Lower Lens 35-00-09-000 WD: 290mm EFL: 300mm		1X Lower Lens 35-00-08-000 WD: 190mm EFL: 200mm	
Max FOV Dia.			156		125		94		63	
Max Coax FOV Dia.			NR		NR		NR		19	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
1.5X Mini Camera Tube 35-08-13-000 EFL: 300mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.25	1.7	0.32	2.2	0.42	2.9	0.63	4.4
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	2/3"	26 x 35	3.8 x 5.1	21 x 28	3.0 x 4.0	16 x 21	2.3 x 3.0	10 x 14	1.5 x 2.0
		1"	38 x 51	5.5 x 7.4	30 x 41	4.4 x 5.9	23 x 30	3.3 x 4.4	15 x 20	2.2 x 2.9
		4/3"	54 x 71	7.8 x 10	43 x 57	6.2 x 8.3	32 x 43	4.7 x 6.2	21 x 29	3.1 x 4.1
		APS-C	66 x 100	10 x 14	53 x 80	7.7 x 12	40 x 60	5.8 x 8.7	27 x 40	3.8 x 5.8
2X Mini Camera Tube 35-08-14-000 EFL: 400mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.34	2.3	0.42	2.9	0.56	3.9	0.84	5.8
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	2/3"	20 x 26	2.8 x 3.8	16 x 21	2.3 x 3.0	12 x 16	1.7 x 2.3	7.9 x 10	1.1 x 1.5
		1"	29 x 38	4.1 x 5.5	23 x 30	3.3 x 4.4	17 x 23	2.5 x 3.3	11 x 15	1.7 x 2.2
		4/3"	40 x 54	5.8 x 7.8	32 x 43	4.7 x 6.2	24 x 32	3.5 x 4.7	16 x 21	2.3 x 3.1
		APS-C	50 x 75	7.2 x 11	40 x 60	5.8 x 8.7	30 x 45	4.3 x 6.5	20 x 30	2.9 x 4.3
2.5X Mini Camera Tube 35-08-15-000 EFL: 500mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.42	2.9	0.53	3.6	0.70	4.8	1.1	7.3
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1"	23 x 30	3.3 x 4.4	18 x 24	2.6 x 3.5	14 x 18	2.0 x 2.6	9.1 x 12	1.3 x 1.8
		4/3"	32 x 43	4.7 x 6.2	26 x 34	3.7 x 5.0	19 x 26	2.8 x 3.7	13 x 17	1.9 x 2.5
		APS-C	40 x 60	5.8 x 8.7	32 x 48	4.6 x 6.9	24 x 36	3.5 x 5.2	16 x 24	2.3 x 3.5
		35mm(Full)	57 x 86	8.3 x 12	46 x 69	6.6 x 9.9	34 x 51	5.0 x 7.4	23 x 34	3.3 x 5.0
3X Mini Camera Tube 35-08-16-000 EFL: 600mm		NA	0.0047	0.016	0.0059	0.019	0.0079	0.026	0.012	0.039
		Res (lp/mm)	14	47	18	58	24	78	35	116
		Mag	0.50	3.5	0.63	4.4	0.84	5.8	1.3	8.7
		DOF (mm)	25	2.4	16	1.5	9.2	0.85	4.1	0.38
	FOV (mm) Cam Format	1"	19 x 25	2.8 x 3.7	15 x 20	2.2 x 2.9	11 x 15	1.7 x 2.2	7.6 x 10	1.1 x 1.5
		4/3"	27 x 36	3.9 x 5.2	21 x 29	3.1 x 4.1	16 x 21	2.3 x 3.1	11 x 14	1.6 x 2.1
		APS-C	33 x 50	4.8 x 7.2	27 x 40	3.8 x 5.8	20 x 30	2.9 x 4.3	13 x 20	1.9 x 2.9
		35mm(Full)	48 x 71	6.9 x 10	38 x 57	5.5 x 8.3	29 x 43	4.1 x 6.2	19 x 29	2.8 x 4.1

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

NR = Not recommended for Coax illumination

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Lens - Mini Camera Tubes

1.25X Lower Lens 35-00-06-000 WD: 155mm EFL: 160mm		1.43X Lower Lens 35-00-05-000 WD: 135mm EFL: 140mm		1.67 Lower Lens 35-00-04-000 WD: 110mm EFL: 120mm		2X Lower Lens 35-00-03-000 WD: 95mm EFL: 100mm		3X Lower Lens 35-00-01-000 WD: 50mm EFL: 67mm		4X Lower Lens 35-00-02-000 WD: 32mm EFL: 50mm	
50		44		38		31		21		16	
19		19		18		19		13		9.4	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
0.79	5.4	0.90	6.2	1.1	7.3	1.3	8.7	1.9	13	2.5	17
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
8.4 x 11	1.2 x 1.6	7.3 x 10	1.1 x 1.4	6.3 x 8.4	0.91 x 1.2	5.2 x 7.0	0.76 x 1.0	3.5 x 4.7	0.51 x 0.67	2.6 x 3.5	0.38 x 0.51
12 x 16	1.8 x 2.4	11 x 14	1.5 x 2.1	9.1 x 12	1.3 x 1.8	7.6 x 10	1.1 x 1.5	5.1 x 6.8	0.74 x 0.98	3.8 x 5.1	0.55 x 0.74
17 x 23	2.5 x 3.3	15 x 20	2.2 x 2.9	13 x 17	1.9 x 2.5	11 x 14	1.6 x 2.1	7.1 x 9.5	1.0 x 1.4	5.4 x 7.1	0.78 x 1.0
21 x 32	3.1 x 4.6	19 x 28	2.7 x 4.0	16 x 24	2.3 x 3.5	13 x 20	1.9 x 2.9	8.8 x 13	1.3 x 1.9	6.6 x 10	0.96 x 1.4
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
1.1	7.3	1.2	8.3	1.4	9.7	1.7	12	2.5	17	3.4	23
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
6.3 x 8.4	0.91 x 1.2	5.5 x 7.3	0.80 x 1.1	4.7 x 6.3	0.68 x 0.91	3.9 x 5.2	0.57 x 0.76	2.6 x 3.5	0.38 x 0.51	2.0 x 2.6	0.28 x 0.38
9.1 x 12	1.3 x 1.8	8.0 x 11	1.2 x 1.5	6.9 x 9.1	0.99 x 1.3	5.7 x 7.6	0.83 x 1.1	3.8 x 5.1	0.55 x 0.74	2.9 x 3.8	0.41 x 0.55
13 x 17	1.9 x 2.5	11 x 15	1.6 x 2.2	9.6 x 13	1.4 x 1.9	8.0 x 11	1.2 x 1.6	5.4 x 7.1	0.78 x 1.0	4.0 x 5.4	0.58 x 0.78
16 x 24	2.3 x 3.5	14 x 21	2.0 x 3.0	12 x 18	1.7 x 2.6	9.9 x 15	1.4 x 2.2	6.6 x 10	0.96 x 1.4	5.0 x 7.5	0.72 x 1.1
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
1.3	9.1	1.5	10	1.8	12	2.1	15	3.1	22	4.2	29
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
7.3 x 9.8	1.1 x 1.4	6.4 x 8.5	0.93 x 1.2	5.5 x 7.3	0.79 x 1.1	4.6 x 6.1	0.66 x 0.88	3.0 x 4.1	0.44 x 0.59	2.3 x 3.0	0.33 x 0.44
10 x 14	1.5 x 2.0	9.0 x 12	1.3 x 1.7	7.7 x 10	1.1 x 1.5	6.4 x 8.6	0.93 x 1.2	4.3 x 5.7	0.62 x 0.83	3.2 x 4.3	0.47 x 0.62
13 x 19	1.8 x 2.8	11 x 17	1.6 x 2.4	9.5 x 14	1.4 x 2.1	8.0 x 12	1.2 x 1.7	5.3 x 8.0	0.77 x 1.2	4.0 x 6.0	0.58 x 0.87
18 x 27	2.6 x 4.0	16 x 24	2.3 x 3.5	14 x 21	2.0 x 3.0	11 x 17	1.7 x 2.5	7.6 x 11	1.1 x 1.7	5.7 x 8.6	0.83 x 1.2
0.015	0.048	0.017	0.055	0.020	0.065	0.024	0.078	0.035	0.12	0.047	0.16
44	145	51	166	59	194	71	233	106	349	142	465
1.6	11	1.8	12	2.1	15	2.5	17	3.8	26	5.0	35
2.6	0.24	2.0	0.19	1.5	0.14	1.0	0.094	0.45	0.042	0.25	0.024
6.1 x 8.1	0.88 x 1.2	5.3 x 7.1	0.77 x 1.0	4.6 x 6.1	0.66 x 0.88	3.8 x 5.1	0.55 x 0.74	2.5 x 3.4	0.37 x 0.49	1.9 x 2.5	0.28 x 0.37
8.6 x 11	1.2 x 1.7	7.5 x 10	1.1 x 1.4	6.4 x 8.6	0.93 x 1.2	5.4 x 7.1	0.78 x 1.0	3.6 x 4.8	0.52 x 0.69	2.7 x 3.6	0.39 x 0.52
11 x 16	1.5 x 2.3	9.3 x 14	1.3 x 2.0	8.0 x 12	1.2 x 1.7	6.6 x 10	0.96 x 1.4	4.4 x 6.6	0.64 x 0.96	3.3 x 5.0	0.48 x 0.72
15 x 23	2.2 x 3.3	13 x 20	1.9 x 2.9	11 x 17	1.7 x 2.5	9.5 x 14	1.4 x 2.1	6.4 x 9.5	0.92 x 1.4	4.8 x 7.1	0.69 x 1.0

Optical Performance - OPTEM 7:1 Zoom with LWD

Chart 2C

			2X M Plan Apo 28-21-02-001 WD: 34mm		5X M Plan Apo 28-21-05-001 WD: 41mm		10X M Plan Apo 28-21-10-000 WD: 34mm	
Max FOV Dia.			14		6.9		3.2	
Max Coax FOV Dia.			11		6.5		2.2	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.4X Camera Tube 35-08-00-000 EFL: 80mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	0.34	2.3	0.84	5.8	1.7	12
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1/3"	11 x 14	1.6 x 2.1	4.3 x 5.7	0.62 x 0.83	2.1 x 2.9	0.31 x 0.41
		1/2"	14 x 19	2.1 x 2.8	5.7 x 7.6	0.83 x 1.1	2.9 x 3.8	0.41 x 0.55
		2/3"	20 x 26	2.8 x 3.8	7.9 x 10	1.1 x 1.5	3.9 x 5.2	0.57 x 0.76
0.5X Camera Tube 35-08-01-000 EFL: 100mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	0.42	2.9	1.1	7.3	2.1	15
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1/3"	8.6 x 11	1.2 x 1.7	3.4 x 4.6	0.50 x 0.66	1.7 x 2.3	0.25 x 0.33
		1/2"	11 x 15	1.7 x 2.2	4.6 x 6.1	0.66 x 0.88	2.3 x 3.0	0.33 x 0.44
		2/3"	16 x 21	2.3 x 3.0	6.3 x 8.4	0.91 x 1.2	3.1 x 4.2	0.46 x 0.61
0.6X Camera Tube 35-08-02-000 EFL: 120mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	0.50	3.5	1.3	8.7	2.5	17
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1/3"	7.1 x 9.5	1.0 x 1.4	2.9 x 3.8	0.41 x 0.55	1.4 x 1.9	0.21 x 0.28
		1/2"	9.5 x 13	1.4 x 1.8	3.8 x 5.1	0.55 x 0.74	1.9 x 2.5	0.28 x 0.37
		2/3"	13 x 17	1.9 x 2.5	5.2 x 7.0	0.76 x 1.0	2.6 x 3.5	0.38 x 0.51
0.8X Camera Tube 35-08-04-000 EFL: 160mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	0.67	4.6	1.7	12	3.4	23
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1/3"	5.4 x 7.1	0.78 x 1.0	2.1 x 2.9	0.31 x 0.41	1.1 x 1.4	0.16 x 0.21
		1/2"	7.1 x 9.5	1.0 x 1.4	2.9 x 3.8	0.41 x 0.55	1.4 x 1.9	0.21 x 0.28
		2/3"	9.8 x 13	1.4 x 1.9	3.9 x 5.2	0.57 x 0.76	2.0 x 2.6	0.28 x 0.38
1X Camera Tube 35-08-06-000 EFL: 200mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	0.84	5.8	2.1	15	4.2	29
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1/3"	4.3 x 5.7	0.62 x 0.83	1.7 x 2.3	0.25 x 0.33	0.86 x 1.1	0.12 x 0.17
		1/2"	5.7 x 7.6	0.83 x 1.1	2.3 x 3.0	0.33 x 0.44	1.1 x 1.5	0.17 x 0.22
		2/3"	7.9 x 10	1.1 x 1.5	3.1 x 4.2	0.46 x 0.61	1.6 x 2.1	0.23 x 0.30

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

50X M Plan Apo is NOT recommended for use with a 7:1 Zoom
0.4X and 0.5X Camera Tubes are not recommended for use with a 7:1 Zoom and Microscope Objectives.

Objectives

20X M Plan Apo 28-21-11-001 WD: 20mm		5X HiRes 28-20-44-000 WD: 34mm		10X HiRes 28-20-45-000 WD: 19mm		20X HiRes 28-20-46-000 WD: 13mm	
1.2		6.4		3.1		1.7	
0.83		4.9		2.2		1.1	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
3.4	23	0.84	5.8	1.7	12	3.4	23
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.00158
1.1 x 1.4	0.16 x 0.21	4.3 x 5.7	0.62 x 0.83	2.1 x 2.9	0.31 x 0.41	1.1 x 1.4	0.16 x 0.21
1.4 x 1.9	0.21 x 0.28	5.7 x 7.6	0.83 x 1.1	2.9 x 3.8	0.41 x 0.55	1.4 x 1.9	0.21 x 0.28
2.0 x 2.6	0.28 x 0.38	7.9 x 10	1.1 x 1.5	3.9 x 5.2	0.57 x 0.76	2.0 x 2.6	0.28 x 0.38
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
4.2	29	1.1	7.3	2.1	15	4.2	29
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.00158
0.86 x 1.1	0.12 x 0.17	3.4 x 4.6	0.50 x 0.66	1.7 x 2.3	0.25 x 0.33	0.9 x 1.1	0.12 x 0.17
1.1 x 1.5	0.17 x 0.22	4.6 x 6.1	0.66 x 0.88	2.3 x 3.0	0.33 x 0.44	1.1 x 1.5	0.17 x 0.22
1.6 x 2.1	0.23 x 0.30	6.3 x 8.4	0.91 x 1.2	3.1 x 4.2	0.46 x 0.61	1.6 x 2.1	0.23 x 0.30
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
5.0	35	1.3	8.7	2.5	17	5.0	35
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.00158
0.71 x 0.95	0.10 x 0.14	2.9 x 3.8	0.41 x 0.55	1.4 x 1.9	0.21 x 0.28	0.71 x 0.95	0.10 x 0.14
0.95 x 1.3	0.14 x 0.18	3.8 x 5.1	0.55 x 0.74	1.9 x 2.5	0.28 x 0.37	0.95 x 1.3	0.14 x 0.18
1.3 x 1.7	0.19 x 0.25	5.2 x 7.0	0.76 x 1.0	2.6 x 3.5	0.38 x 0.51	1.3 x 1.7	0.19 x 0.25
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
6.7	46	1.7	12	3.4	23	6.7	46
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.00158
0.54 x 0.71	0.078 x 0.10	2.1 x 2.9	0.31 x 0.41	1.1 x 1.4	0.16 x 0.21	0.54 x 0.71	0.078 x 0.10
0.71 x 0.95	0.10 x 0.14	2.9 x 3.8	0.41 x 0.55	1.4 x 1.9	0.21 x 0.28	0.71 x 0.95	0.10 x 0.14
0.98 x 1.3	0.14 x 0.19	3.9 x 5.2	0.57 x 0.76	2.0 x 2.6	0.28 x 0.38	0.98 x 1.3	0.14 x 0.19
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
8.4	58	2.1	15	4.2	29	8.4	58
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.00158
0.43 x 0.57	0.062 x 0.083	1.7 x 2.3	0.25 x 0.33	0.86 x 1.1	0.12 x 0.17	0.43 x 0.57	0.062 x 0.083
0.57 x 0.76	0.083 x 0.11	2.3 x 3.0	0.33 x 0.44	1.1 x 1.5	0.17 x 0.22	0.57 x 0.76	0.083 x 0.11
0.79 x 1.0	0.11 x 0.15	3.1 x 4.2	0.46 x 0.61	1.6 x 2.1	0.23 x 0.30	0.79 x 1.0	0.11 x 0.15

Note: Hi Res Objectives are not flat-field and therefore limited by field curvature at lower magnifications with both fixed and zoom systems.

Optical Performance - OPTEM 7:1 Zoom with LWD

Chart 2D

			2X M Plan Apo 28-21-02-001 WD: 34mm		5X M Plan Apo 28-21-05-001 WD: 41mm		10X M Plan Apo 28-21-10-000 WD: 34mm	
Max FOV Dia.			14		6.9		3.2	
Max Coax FOV Dia.			11		6.5		2.2	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
1.5X Mini Camera Tube 35-08-13-000 EFL: 300mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	1.3	8.7	3.2	22	6.30	44
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	2/3"	5.2 x 7.0	0.76 x 1.0	2.1 x 2.8	0.30 x 0.40	1.0 x 1.4	0.15 x 0.20
		1"	7.6 x 10	1.1 x 1.5	3.0 x 4.1	0.44 x 0.59	1.5 x 2.0	0.22 x 0.29
		4/3"	11 x 14	1.6 x 2.1	4.3 x 5.7	0.62 x 0.83	2.1 x 2.9	0.31 x 0.41
		APS-C	13 x 20	1.9 x 2.9	5.3 x 8.0	0.77 x 1.2	2.7 x 4.0	0.38 x 0.58
2X Mini Camera Tube 35-08-14-000 EFL: 400mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	1.7	12	4.2	29	8.4	58
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	2/3"	3.9 x 5.2	0.57 x 0.76	1.6 x 2.1	0.23 x 0.30	0.79 x 1.0	0.11 x 0.15
		1"	5.7 x 7.6	0.83 x 1.1	2.3 x 3.0	0.33 x 0.44	1.1 x 1.5	0.17 x 0.22
		4/3"	8.0 x 11	1.2 x 1.6	3.2 x 4.3	0.47 x 0.62	1.6 x 2.1	0.23 x 0.31
		APS-C	10 x 15	1.4 x 2.2	4.0 x 6.0	0.58 x 0.87	2.0 x 3.0	0.29 x 0.43
2.5X Mini Camera Tube 35-08-15-000 EFL: 500mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	2.1	15	5.3	36	11	73
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1"	4.6 x 6.1	0.66 x 0.88	1.8 x 2.4	0.26 x 0.35	0.91 x 1.2	0.13 x 0.18
		4/3"	6.4 x 8.6	0.93 x 1.2	2.6 x 3.4	0.37 x 0.50	1.3 x 1.7	0.19 x 0.25
		APS-C	8.0 x 12	1.2 x 1.7	3.2 x 4.8	0.46 x 0.69	1.6 x 2.4	0.23 x 0.35
		35mm(Full)	11 x 17	1.7 x 2.5	4.6 x 6.9	0.66 x 0.99	2.3 x 3.4	0.33 x 0.50
3X Mini Camera Tube 35-08-16-000 EFL: 600mm		NA	0.024	0.057	0.059	0.14	0.12	0.30
		Res (lp/mm)	71	170	177	420	354	900
		Mag	2.5	17	6.3	44	13	87
		DOF (mm)	1.0	0.18	0.16	0.029	0.041	0.0063
	FOV (mm) Cam Format	1"	3.8 x 5.1	0.55 x 0.74	1.5 x 2.0	0.22 x 0.29	0.76 x 1.0	0.11 x 0.15
		4/3"	5.4 x 7.1	0.78 x 1.0	2.1 x 2.9	0.31 x 0.41	1.1 x 1.4	0.16 x 0.21
		APS-C	6.6 x 10	0.96 x 1.4	2.7 x 4.0	0.38 x 0.58	1.3 x 2.0	0.19 x 0.29
		35mm(Full)	10 x 14	1.4 x 2.1	3.8 x 5.7	0.55 x 0.83	1.9 x 2.9	0.28 x 0.41

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

50X M Plan Apo is NOT recommended for use with a 7:1 Zoom 0.4X and 0.5X Camera Tubes are not recommended for use with a 7:1 Zoom and Microscope Objectives.

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Objectives - Mini Camera Tubes

20X M Plan Apo 28-21-11-001 WD: 20mm		5X HiRes 28-20-44-000 WD: 34mm		10X HiRes 28-20-45-000 WD: 19mm		20X HiRes 28-20-46-000 WD: 13mm	
1.2		6.4		3.1		1.7	
0.83		4.9		2.2		1.1	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
13	87	3.2	22	6.3	44	13	87
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.0016
0.52 x 0.70	0.076 x 0.10	2.1 x 2.8	0.30 x 0.40	1.0 x 1.4	0.15 x 0.20	0.52 x 0.70	0.076 x 0.10
0.76 x 1.0	0.11 x 0.15	3.0 x 4.1	0.44 x 0.59	1.5 x 2.0	0.22 x 0.29	0.76 x 1.02	0.11 x 0.15
1.1 x 1.4	0.16 x 0.21	4.3 x 5.7	0.62 x 0.83	2.1 x 2.9	0.31 x 0.41	1.1 x 1.4	0.16 x 0.21
1.3 x 2.0	0.19 x 0.29	5.3 x 8.0	0.77 x 1.2	2.7 x 4.0	0.38 x 0.58	1.3 x 2.0	0.19 x 0.29
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
17	116	4.2	29	8.4	58	17	116
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.0016
0.39 x 0.52	0.057 x 0.076	1.6 x 2.1	0.23 x 0.30	0.79 x 1.0	0.11 x 0.15	0.39 x 0.52	0.057 x 0.076
0.57 x 0.76	0.083 x 0.11	2.3 x 3.0	0.33 x 0.44	1.1 x 1.5	0.17 x 0.22	0.57 x 0.76	0.083 x 0.11
0.80 x 1.1	0.12 x 0.16	3.2 x 4.3	0.47 x 0.62	1.6 x 2.1	0.23 x 0.31	0.80 x 1.1	0.12 x 0.16
0.99 x 1.5	0.14 x 0.22	4.0 x 6.0	0.58 x 0.87	2.0 x 3.0	0.29 x 0.43	0.99 x 1.5	0.14 x 0.22
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
21	145	5.3	36	11	73	21	145
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.0016
0.46 x 0.61	0.066 x 0.088	1.8 x 2.4	0.26 x 0.35	0.91 x 1.2	0.13 x 0.18	0.46 x 0.61	0.066 x 0.088
0.64 x 0.86	0.093 x 0.12	2.6 x 3.4	0.37 x 0.50	1.3 x 1.7	0.19 x 0.25	0.64 x 0.86	0.093 x 0.12
0.80 x 1.2	0.12 x 0.17	3.2 x 4.8	0.46 x 0.69	1.6 x 2.4	0.23 x 0.35	0.80 x 1.2	0.12 x 0.17
1.1 x 1.7	0.17 x 0.25	4.6 x 6.9	0.66 x 0.99	2.3 x 3.4	0.33 x 0.50	1.1 x 1.7	0.17 x 0.25
0.24	0.42	0.059	0.19	0.12	0.39	0.24	0.60
708	1260	177	581	354	1163	708	1800
25	174	6.3	44	13	87	25	174
0.010	0.0032	0.16	0.015	0.041	0.0038	0.010	0.0016
0.38 x 0.51	0.055 x 0.074	1.5 x 2.0	0.22 x 0.29	0.76 x 1.0	0.11 x 0.15	0.38 x 0.51	0.055 x 0.074
0.54 x 0.71	0.078 x 0.10	2.1 x 2.9	0.31 x 0.41	1.1 x 1.4	0.16 x 0.21	0.54 x 0.71	0.078 x 0.10
0.66 x 1.0	0.096 x 0.14	2.7 x 4.0	0.38 x 0.58	1.3 x 2.0	0.19 x 0.29	0.66 x 1.0	0.096 x 0.14
0.95 x 1.4	0.14 x 0.21	3.8 x 5.7	0.55 x 0.83	1.9 x 2.9	0.28 x 0.41	0.95 x 1.4	0.14 x 0.21

Note: Hi Res Objectives are not flat-field and therefore limited by field curvature at lower magnifications with both fixed and zoom systems.

Optical Performance - OPTEM 12.5:1 Zoom and

Chart 3A

			0.4X Lower Lens 35-00-11-000 WD: 490mm EFL: 500mm		0.5X Lower Lens 35-00-10-000 WD: 390mm EFL: 400mm		0.67X Lower Lens 35-00-09-000 WD: 290mm EFL: 300mm		1X Lower Lens 35-00-08-000 WD: 190mm EFL: 200mm	
Max FOV Dia.			145		116		87		58	
Max Coax FOV Dia.			NR		NR		NR		20	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.4X Camera Tube		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.045	0.55	0.056	0.69	0.075	0.92	0.11	1.4
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
35-08-00-000 EFL: 80mm	FOV (mm) Cam Format	1/3"	80 x 107	6.5 x 8.7	64 x 86	5.2 x 7.0	48 x 64	3.9 x 5.2	32 x 43	2.6 x 3.5
		1/2"	107 x 143	8.7 x 12	86 x 114	7.0 x 9.3	64 x 86	5.2 x 7.0	43 x 57	3.5 x 4.6
		2/3"	147 x 196	12 x 16	118 x 157	9.6 x 13	88 x 118	7.2 x 9.6	59 x 79	4.8 x 6.4
0.5X Camera Tube		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.056	0.69	0.070	0.86	0.093	1.2	0.14	1.7
		DOF (m m)	44	1.5	28	0.98	16	0.55	7.0	0.25
35-08-01-000 EFL: 100mm	FOV (mm) Cam Format	1/3"	64 x 86	5.2 x 7.0	51 x 69	4.2 x 5.6	39 x 51	3.1 x 4.2	26 x 34	2.1 x 2.8
		1/2"	86 x 114	7.0 x 9.3	69 x 91	5.6 x 7.4	51 x 69	4.2 x 5.6	34 x 46	2.8 x 3.7
		2/3"	118 x 157	9.6 x 13	94 x 126	7.7 x 10	71 x 94	5.7 x 7.7	47 x 63	3.8 x 5.1
0.6X Camera Tube		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.067	0.83	0.084	1.0	0.11	1.4	0.17	2.1
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
35-08-02-000 EFL: 120mm	FOV (mm) Cam Format	1/3"	54 x 71	4.3 x 5.8	43 x 57	3.5 x 4.6	32 x 43	2.6 x 3.5	21 x 29	1.7 x 2.3
		1/2"	71 x 95	5.8 x 7.7	57 x 76	4.6 x 6.2	43 x 57	3.5 x 4.6	29 x 38	2.3 x 3.1
		2/3"	98 x 131	8.0 x 11	79 x 105	6.4 x 8.5	59 x 79	4.8 x 6.4	39 x 52	3.2 x 4.3
0.8X Camera Tube		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.090	1.1	0.11	1.4	0.15	1.8	0.22	2.8
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
35-08-04-000 EFL: 160mm	FOV (mm) Cam Format	1/3"	40 x 54	3.3 x 4.3	32 x 43	2.6 x 3.5	24 x 32	2.0 x 2.6	16 x 21	1.3 x 1.7
		1/2"	54 x 71	4.3 x 5.8	43 x 57	3.5 x 4.6	32 x 43	2.6 x 3.5	21 x 29	1.7 x 2.3
		2/3"	74 x 98	6.0 x 8.0	59 x 79	4.8 x 6.4	44 x 59	3.6 x 4.8	29 x 39	2.4 x 3.2
1X Camera Tube		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.11	1.4	0.14	1.7	0.19	2.3	0.28	3.5
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
35-08-06-000 EFL: 200mm	FOV (mm) Cam Format	1/3"	32 x 43	2.6 x 3.5	26 x 34	2.1 x 2.8	19 x 26	1.6 x 2.1	13 x 17	1.0 x 1.4
		1/2"	43 x 57	3.5 x 4.6	34 x 46	2.8 x 3.7	26 x 34	2.1 x 2.8	17 x 23	1.4 x 1.9
		2/3"	59 x 79	4.8 x 6.4	47 x 63	3.8 x 5.1	35 x 47	2.9 x 3.8	24 x 31	1.9 x 2.6

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

NR = Not recommended for Coax illumination

Fetura+ with Lower Lens

1.25X Lower Lens 35-00-06-000 WD: 155mm EFL: 160mm		1.43X Lower Lens 35-00-05-000 WD: 135mm EFL: 140mm		1.67 Lower Lens 35-00-04-000 WD: 110mm EFL: 120mm		2X Lower Lens 35-00-03-000 WD: 95mm EFL: 100mm		3X Lower Lens 35-00-01-000 WD: 50mm EFL: 67mm		4X Lower Lens 35-00-02-000 WD: 32mm EFL: 50mm	
46		41		35		29		19		15	
19		19		17		20		13		9.9	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.14	1.7	0.16	2.0	0.19	2.3	0.22	2.8	0.34	4.1	0.45	5.5
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
26 x 34	2.1 x 2.8	23 x 30	1.8 x 2.4	19 x 26	1.6 x 2.1	16 x 21	1.3 x 1.7	11 x 14	0.87 x 1.2	8.0 x 11	0.65 x 0.87
34 x 46	2.8 x 3.7	30 x 40	2.4 x 3.2	26 x 34	2.1 x 2.8	21 x 29	1.7 x 2.3	14 x 19	1.2 x 1.5	11 x 14	0.87 x 1.2
47 x 63	3.8 x 5.1	41 x 55	3.3 x 4.5	35 x 47	2.9 x 3.8	29 x 39	2.4 x 3.2	20 x 26	1.6 x 2.1	15 x 20	1.2 x 1.6
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.18	2.2	0.20	2.5	0.23	2.9	0.28	3.5	0.42	5.2	0.56	6.9
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
21 x 27	1.7 x 2.2	18 x 24	1.5 x 1.9	15 x 21	1.3 x 1.7	13 x 17	1.0 x 1.4	8.6 x 11	0.70 x 0.9	6.4 x 8.6	0.52 x 0.70
27 x 37	2.2 x 3.0	24 x 32	1.9 x 2.6	21 x 27	1.7 x 2.2	17 x 23	1.4 x 1.9	11 x 15	0.9 x 1.2	8.6 x 11	0.70 x 0.93
38 x 50	3.1 x 4.1	33 x 44	2.7 x 3.6	28 x 38	2.3 x 3.1	24 x 31	1.9 x 2.6	16 x 21	1.3 x 1.7	12 x 16	0.96 x 1.3
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.21	2.6	0.24	3.0	0.28	3.5	0.34	4.1	0.50	6.2	0.67	8.3
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
17 x 23	1.4 x 1.9	15 x 20	1.2 x 1.6	13 x 17	1.0 x 1.4	11 x 14	0.87 x 1.2	7.1 x 10	0.58 x 0.77	5.4 x 7.1	0.43 x 0.58
23 x 30	1.9 x 2.5	20 x 27	1.6 x 2.2	17 x 23	1.4 x 1.9	14 x 19	1.2 x 1.5	10 x 13	0.77 x 1.0	7.1 x 9.5	0.58 x 0.77
31 x 42	2.6 x 3.4	28 x 37	2.2 x 3.0	24 x 31	1.9 x 2.6	20 x 26	1.6 x 2.1	13 x 17	1.1 x 1.4	9.8 x 13	0.80 x 1.1
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.28	3.5	0.32	3.9	0.37	4.6	0.45	5.5	0.67	8	0.90	11
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
13 x 17	1.0 x 1.4	11 x 15	0.91 x 1.2	9.6 x 13	0.78 x 1.0	8.0 x 11	0.65 x 0.87	5.4 x 7.1	0.44 x 0.58	4.0 x 5.4	0.33 x 0.43
17 x 23	1.4 x 1.9	15 x 20	1.2 x 1.6	13 x 17	1.0 x 1.4	11 x 14	0.87 x 1.2	7.1 x 10	0.58 x 0.77	5.4 x 7.1	0.43 x 0.58
24 x 31	1.9 x 2.6	21 x 28	1.7 x 2.2	18 x 24	1.4 x 1.9	15 x 20	1.2 x 1.6	10 x 13	0.80 x 1.1	7.4 x 9.8	0.60 x 0.80
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.35	4.3	0.40	4.9	0.47	5.8	0.56	6.9	0.84	10.3	1.1	14
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
10 x 14	0.83 x 1.1	9.0 x 12	0.73 x 0.97	7.7 x 10	0.63 x 0.83	6.4 x 8.6	0.52 x 0.70	4.3 x 5.7	0.35 x 0.46	3.2 x 4.3	0.26 x 0.35
14 x 18	1.1 x 1.5	12 x 16	0.97 x 1.3	10 x 14	0.83 x 1.1	8.6 x 11	0.70 x 0.93	5.7 x 7.6	0.46 x 0.62	4.3 x 5.7	0.35 x 0.46
19 x 25	1.5 x 2.0	17 x 22	1.3 x 1.8	14 x 19	1.1 x 1.5	12 x 16	0.96 x 1.3	7.9 x 10	0.64 x 0.85	5.9 x 7.9	0.48 x 0.64

Optical Performance - OPTEM 12.5:1 Zoom and

Chart 3B

			0.4X Lower Lens 35-00-11-000 WD: 490mm EFL: 500mm		0.5X Lower Lens 35-00-10-000 WD: 390mm EFL: 400mm		0.67X Lower Lens 35-00-09-000 WD: 290mm EFL: 300mm		1X Lower Lens 35-00-08-000 WD: 190mm EFL: 200mm	
		Max FOV Dia.	145		116		87		58	
		Max Coax FOV Dia.	NR		NR		NR		20	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
1.5X Mini Camera Tube 35-08-13-000 EFL: 300mm		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.17	2.1	0.21	2.6	0.28	3.5	0.42	5.2
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
	FOV (mm) Cam Format	2/3"	39 x 52	3.2 x 4.3	31 x 42	2.6 x 3.4	24 x 31	1.9 x 2.6	16 x 21	1.3 x 1.7
		1"	57 x 76	4.6 x 6.2	46 x 61	3.7 x 4.9	34 x 46	2.8 x 3.7	23 x 30	1.9 x 2.5
		4/3"	80 x 107	6.5 x 8.7	64 x 86	5.2 x 7.0	48 x 64	3.9 x 5.2	32 x 43	2.6 x 3.5
		APS-C	99 x 149	8.1 x 12	80 x 120	6.5 x 9.7	60 x 90	4.8 x 7.3	40 x 60	3.2 x 4.9
2X Mini Camera Tube 35-08-14-000 EFL: 400mm		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.22	2.8	0.28	3.5	0.37	4.6	0.56	6.9
		DOF (m m)	44	1.5	28	0.98	16	0.55	7.0	0.25
	FOV (mm) Cam Format	2/3"	29 x 39	2.4 x 3.2	24 x 31	1.9 x 2.6	18 x 24	1.4 x 1.9	12 x 16	0.96 x 1.3
		1"	43 x 57	3.5 x 4.6	34 x 46	2.8 x 3.7	26 x 34	2.1 x 2.8	17 x 23	1.4 x 1.9
		4/3"	60 x 80	4.9 x 6.5	48 x 64	3.9 x 5.2	36 x 48	2.9 x 3.9	24 x 32	2.0 x 2.6
		APS-C	75 x 112	6.1 x 9.1	60 x 90	4.8 x 7.3	45 x 67	3.6 x 5.5	30 x 45	2.4 x 3.6
2.5X Mini Camera Tube 35-08-15-000 EFL: 500mm		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.28	3.5	0.35	4.3	0.47	5.8	0.70	8.6
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
	FOV (mm) Cam Format	1"	34 x 46	2.8 x 3.7	27 x 37	2.2 x 3.0	21 x 27	1.7 x 2.2	14 x 18	1.1 x 1.5
		4/3"	48 x 64	3.9 x 5.2	39 x 51	3.1 x 4.2	29 x 39	2.3 x 3.1	19 x 26	1.6 x 2.1
		APS-C	60 x 90	4.8 x 7.3	48 x 72	3.9 x 5.8	36 x 54	2.9 x 4.4	24 x 36	1.9 x 2.9
		35mm(Full)	86 x 129	7.0 x 10	69 x 103	5.6 x 8.3	51 x 77	4.2 x 6.3	34 x 51	2.8 x 4.2
3X Mini Camera Tube 35-08-16-000 EFL: 600mm		NA	0.0036	0.019	0.0045	0.024	0.0060	0.032	0.0090	0.048
		Res (lp/mm)	11	58	14	72	18	96	27	144
		Mag	0.34	4.1	0.42	5.2	0.56	6.9	0.84	10
		DOF (mm)	44	1.5	28	0.98	16	0.55	7.0	0.25
	FOV (mm) Cam Format	1"	29 x 38	2.3 x 3.1	23 x 30	1.9 x 2.5	17 x 23	1.4 x 1.9	11 x 15	0.93 x 1.2
		4/3"	40 x 54	3.3 x 4.3	32 x 43	2.6 x 3.5	24 x 32	2.0 x 2.6	16 x 21	1.3 x 1.7
		APS-C	50 x 75	4.0 x 6.1	40 x 60	3.2 x 4.9	30 x 45	2.4 x 3.6	20 x 30	1.6 x 2.4
		35mm(Full)	71 x 107	5.8 x 8.7	57 x 86	4.6 x 7.0	43 x 64	3.5 x 5.2	29 x 43	2.3 x 3.5

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

NR = Not recommended for Coax illumination

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Fetura+ with Lower Lens - Mini Camera Tubes

1.25X Lower Lens 35-00-06-000 WD: 155mm EFL: 160mm		1.43X Lower Lens 35-00-05-000 WD: 135mm EFL: 140mm		1.67 Lower Lens 35-00-04-000 WD: 110mm EFL: 120mm		2X Lower Lens 35-00-03-000 WD: 95mm EFL: 100mm		3X Lower Lens 35-00-01-000 WD: 50mm EFL: 67mm		4X Lower Lens 35-00-02-000 WD: 32mm EFL: 50mm	
46		41		35		29		19		15	
19		19		17		20		13		9.9	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.53	6.5	0.60	7.4	0.70	8.6	0.84	10	1.3	16	1.7	21
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
13 x 17	1.0 x 1.4	11 x 15	0.89 x 1.2	9.4 x 13	0.77 x 1.0	7.9 x 10	0.64 x 0.85	5.2 x 7.0	0.43 x 0.57	3.9 x 5.2	0.32 x 0.43
18 x 24	1.5 x 2.0	16 x 21	1.3 x 1.7	14 x 18	1.1 x 1.5	11 x 15	0.93 x 1.2	7.6 x 10	0.62 x 0.82	5.7 x 7.6	0.46 x 0.62
26 x 34	2.1 x 2.8	23 x 30	1.8 x 2.4	19 x 26	1.6 x 2.1	16 x 21	1.3 x 1.7	11 x 14	0.87 x 1.2	8.0 x 11	0.65 x 0.87
32 x 48	2.6 x 3.9	28 x 42	2.3 x 3.4	24 x 36	1.9 x 2.9	20 x 30	1.6 x 2.4	13 x 20	1.1 x 1.6	9.9 x 15	0.81 x 1.2
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.70	8.6	0.80	9.9	0.93	12	1.1	14	1.7	21	2.2	28
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
9.4 x 13	0.77 x 1.0	8.3 x 11	0.67 x 0.89	7.1 x 9.4	0.57 x 0.77	5.9 x 7.9	0.48 x 0.64	3.9 x 5.2	0.32 x 0.43	2.9 x 3.9	0.24 x 0.32
14 x 18	1.1 x 1.5	12 x 16	0.97 x 1.3	10 x 14	0.83 x 1.1	8.6 x 11	0.70 x 0.93	5.7 x 7.6	0.46 x 0.62	4.3 x 5.7	0.35 x 0.46
19 x 26	1.6 x 2.1	17 x 23	1.4 x 1.8	14 x 19	1.2 x 1.6	12 x 16	0.98 x 1.3	8.0 x 11	0.65 x 0.87	6.0 x 8.0	0.49 x 0.65
24 x 36	1.9 x 2.9	21 x 31	1.7 x 2.5	18 x 27	1.5 x 2.2	15 x 22	1.2 x 1.8	9.9 x 15	0.81 x 1.2	7.5 x 11	0.61 x 0.91
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
0.88	11	1.0	12	1.2	14	1.4	17	2.1	26	2.8	35
4.5	0.16	3.4	0.12	2.5	0.09	1.8	0.062	0.78	0.027	0.44	0.015
11 x 15	0.89 x 1.2	9.6 x 13	0.78 x 1.0	8.2 x 11	0.67 x 0.89	6.9 x 9.1	0.56 x 0.74	4.6 x 6.1	0.37 x 0.49	3.4 x 4.6	0.28 x 0.37
15 x 21	1.3 x 1.7	14 x 18	1.1 x 1.5	12 x 15	0.94 x 1.3	9.6 x 13	0.78 x 1.0	6.4 x 8.6	0.52 x 0.70	4.8 x 6.4	0.39 x 0.52
19 x 29	1.5 x 2.3	17 x 25	1.4 x 2.0	14 x 22	1.2 x 1.7	12 x 18	0.97 x 1.5	8.0 x 12	0.65 x 0.97	6.0 x 9.0	0.48 x 0.73
27 x 41	2.2 x 3.3	24 x 36	1.9 x 2.9	21 x 31	1.7 x 2.5	17 x 26	1.4 x 2.1	11 x 17	0.93 x 1.4	8.6 x 13	0.70 x 1.0
0.011	0.060	0.013	0.069	0.015	0.080	0.018	0.096	0.027	0.14	0.036	0.19
34	180	39	206	45	240	54	288	81	432	108	576
1.1	13	1.2	15	1.4	17	1.7	21	2.5	31	3.4	41
4.5	0.16	3.4	0.12	2.5	0.089	1.8	0.062	0.78	0.027	0.44	0.015
9.1 x 12	0.74 x 0.99	8.0 x 11	0.65 x 0.87	6.9 x 9.1	0.56 x 0.74	5.7 x 7.6	0.46 x 0.62	3.8 x 5.1	0.31 x 0.41	2.9 x 3.8	0.23 x 0.31
13 x 17	1.0 x 1.4	11 x 15	0.91 x 1.2	9.6 x 13	0.78 x 1.0	8.0 x 11	0.65 x 0.87	5.4 x 7.1	0.44 x 0.58	4.0 x 5.4	0.33 x 0.43
16 x 24	1.3 x 1.9	14 x 21	1.1 x 1.7	12 x 18	0.97 x 1.5	9.9 x 15	0.81 x 1.2	6.6 x 10	0.54 x 0.81	5.0 x 7.5	0.40 x 0.61
23 x 34	1.9 x 2.8	20 x 30	1.6 x 2.4	17 x 26	1.4 x 2.1	14 x 21	1.2 x 1.7	9.5 x 14	0.77 x 1.2	7.1 x 11	0.58 x 0.87

Optical Performance - OPTEM 12.5:1 Zoom and

Chart 3C

				2X M Plan Apo 28-21-02-001 WD: 34mm		5X M Plan Apo 28-21-05-001 WD: 41mm		10X M Plan Apo 28-21-10-000 WD: 34mm	
			Max FOV Dia.	14		6.8		3.3	
			Max Coax FOV Dia.	11		4.6		2.2	
				Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.4X Camera Tube			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	0.22	2.8	0.56	6.9	1.1	14
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
35-08-00-000 EFL: 80mm	FOV (mm)	Cam Format	1/3"	16 x 21	1.3 x 1.7	6.4 x 8.6	0.52 x 0.70	3.2 x 4.3	0.26 x 0.35
			1/2"	21 x 29	1.7 x 2.3	8.6 x 11	0.70 x 0.93	4.3 x 5.7	0.35 x 0.46
			2/3"	29 x 39	2.4 x 3.2	12 x 16	0.96 x 1.3	5.9 x 7.9	0.48 x 0.64
0.5X Camera Tube			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	0.28	3.5	0.70	8.6	1.4	17
			DOF (m m)	1.8	0.18	0.28	0.029	0.070	0.0063
35-08-01-000 EFL: 100mm	FOV (mm)	Cam Format	1/3"	13 x 17	1.0 x 1.4	5.1 x 6.9	0.42 x 0.56	2.6 x 3.4	0.21 x 0.28
			1/2"	17 x 23	1.4 x 1.9	6.9 x 9.1	0.56 x 0.74	3.4 x 4.6	0.28 x 0.37
			2/3"	24 x 31	1.9 x 2.6	9.4 x 13	0.77 x 1.0	4.7 x 6.3	0.38 x 0.51
0.6X Camera Tube			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	0.34	4.1	0.84	10	1.7	21
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
35-08-02-000 EFL: 120mm	FOV (mm)	Cam Format	1/3"	11 x 14	0.87 x 1.2	4.3 x 5.7	0.35 x 0.46	2.1 x 2.9	0.17 x 0.23
			1/2"	14 x 19	1.2 x 1.5	5.7 x 7.6	0.46 x 0.62	2.9 x 3.8	0.23 x 0.31
			2/3"	20 x 26	1.6 x 2.1	7.9 x 10	0.64 x 0.85	3.9 x 5.2	0.32 x 0.43
0.8X Camera Tube			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	0.45	5.5	1.1	14	2.2	28
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
35-08-04-000 EFL: 160mm	FOV (mm)	Cam Format	1/3"	8.0 x 11	0.65 x 0.87	3.2 x 4.3	0.26 x 0.35	1.6 x 2.1	0.13 x 0.17
			1/2"	11 x 14	0.87 x 1.2	4.3 x 5.7	0.35 x 0.46	2.1 x 2.9	0.17 x 0.23
			2/3"	15 x 20	1.2 x 1.6	5.9 x 7.9	0.48 x 0.64	2.9 x 3.9	0.24 x 0.32
1X Camera Tube			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	0.56	6.9	1.4	17	2.8	35
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
35-08-06-000 EFL: 200mm	FOV (mm)	Cam Format	1/3"	6.4 x 8.6	0.52 x 0.70	2.6 x 3.4	0.21 x 0.28	1.3 x 1.7	0.10 x 0.14
			1/2"	8.6 x 11	0.70 x 0.93	3.4 x 4.6	0.28 x 0.37	1.7 x 2.3	0.14 x 0.19
			2/3"	12 x 16	0.96 x 1.3	4.7 x 6.3	0.38 x 0.51	2.4 x 3.1	0.19 x 0.26

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

50X M Plan Apo is NOT recommended for use with a 12.5:1 Zoom 0.4X and 0.5X Camera Tubes are not recommended for use with a 12.5:1 Zoom and Microscope Objectives.

Fetura+ with LWD Objectives

20X M Plan Apo 28-21-11-001 WD: 20mm		5X HiRes 28-20-44-000 WD: 34mm		10X HiRes 28-20-45-000 WD: 19mm		20X HiRes 28-20-46-000 WD: 13mm	
1.2		6.6		3.2		1.6	
0.83		5.0		2.3		1.1	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.18	0.42	0.045	0.23	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
2.2	28	0.56	6.9	1.1	14	2.2	28
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
1.6 x 2.1	0.13 x 0.17	6.4 x 8.6	0.52 x 0.70	3.2 x 4.3	0.26 x 0.35	1.6 x 2.1	0.13 x 0.17
2.1 x 2.9	0.17 x 0.23	8.6 x 11	0.70 x 0.93	4.3 x 5.7	0.35 x 0.46	2.1 x 2.9	0.17 x 0.23
2.9 x 3.9	0.24 x 0.32	12 x 16	0.96 x 1.3	5.9 x 7.9	0.48 x 0.64	2.9 x 3.9	0.24 x 0.32
0.18	0.42	0.045	0.23	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
2.8	35	0.70	8.6	1.4	17	2.8	35
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
1.3 x 1.7	0.10 x 0.14	5.1 x 6.9	0.42 x 0.56	2.6 x 3.4	0.21 x 0.28	1.3 x 1.7	0.10 x 0.14
1.7 x 2.3	0.14 x 0.19	6.9 x 9.1	0.56 x 0.74	3.4 x 4.6	0.28 x 0.37	1.7 x 2.3	0.14 x 0.19
2.4 x 3.1	0.19 x 0.26	9.4 x 13	0.77 x 1.0	4.7 x 6.3	0.38 x 0.51	2.4 x 3.1	0.19 x 0.26
0.18	0.42	0.045	0.23	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
3.4	41	0.84	10.4	1.7	21	3.4	41
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
1.1 x 1.4	0.087 x 0.12	4.3 x 5.7	0.35 x 0.46	2.1 x 2.9	0.17 x 0.23	1.1 x 1.4	0.087 x 0.12
1.4 x 1.9	0.12 x 0.15	5.7 x 7.6	0.46 x 0.62	2.9 x 3.8	0.23 x 0.31	1.4 x 1.9	0.12 x 0.15
2.0 x 2.6	0.16 x 0.21	7.9 x 10	0.64 x 0.85	3.9 x 5.2	0.32 x 0.43	2.0 x 2.6	0.16 x 0.21
0.18	0.42	0.045	0.23	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
4.5	55	1.1	14	2.2	28	4.5	55
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
0.80 x 1.1	0.065 x 0.087	3.2 x 4.3	0.26 x 0.35	1.6 x 2.1	0.13 x 0.17	0.80 x 1.1	0.065 x 0.087
1.1 x 1.4	0.087 x 0.12	4.3 x 5.7	0.35 x 0.46	2.1 x 2.9	0.17 x 0.23	1.1 x 1.4	0.087 x 0.12
1.5 x 2.0	0.12 x 0.16	5.9 x 7.9	0.48 x 0.64	2.9 x 3.9	0.24 x 0.32	1.5 x 2.0	0.12 x 0.16
0.18	0.42	0.045	0.23	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
5.6	69	1.4	17	2.8	35	5.6	69
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
0.64 x 0.86	0.052 x 0.070	2.6 x 3.4	0.21 x 0.28	1.3 x 1.7	0.10 x 0.14	0.64 x 0.86	0.052 x 0.070
0.86 x 1.1	0.070 x 0.093	3.4 x 4.6	0.28 x 0.37	1.7 x 2.3	0.14 x 0.19	0.86 x 1.1	0.070 x 0.093
1.2 x 1.6	0.096 x 0.13	4.7 x 6.3	0.38 x 0.51	2.4 x 3.1	0.19 x 0.26	1.2 x 1.6	0.096 x 0.13

Note: Hi Res Objectives are not flat-field and therefore limited by field curvature at lower magnifications with both fixed and zoom systems.

Optical Performance - OPTEM 12.5:1 Zoom and

Chart 3D

				2X M Plan Apo 28-21-02-001 WD: 34mm		5X M Plan Apo 28-21-05-001 WD: 41mm		10X M Plan Apo 28-21-10-000 WD: 34mm	
Max FOV Dia.				14		6.8		3.3	
Max Coax FOV Dia.				11		4.6		2.2	
				Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
1.5X Mini Camera Tube 35-08-13-000 EFL: 300mm			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	0.84	10	2.1	26	4.2	52
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
	FOV (mm)	Cam Format	2/3"	7.9 x 10	0.64 x 0.85	3.1 x 4.2	0.26 x 0.34	1.6 x 2.1	0.13 x 0.17
			1"	11 x 15	0.93 x 1.2	4.6 x 6.1	0.37 x 0.49	2.3 x 3.0	0.19 x 0.25
			4/3"	16 x 21	1.3 x 1.7	6.4 x 8.6	0.52 x 0.70	3.2 x 4.3	0.26 x 0.35
			APS-C	20 x 30	1.6 x 2.4	8.0 x 12	0.65 x 0.97	4.0 x 6.0	0.32 x 0.49
2X Mini Camera Tube 35-08-14-000 EFL: 400mm			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	1.1	14	2.8	35	5.6	69
			DOF (m m)	1.8	0.178	0.28	0.029	0.070	0.0063
	FOV (mm)	Cam Format	2/3"	5.9 x 7.9	0.48 x 0.64	2.4 x 3.1	0.19 x 0.26	1.2 x 1.6	0.096 x 0.13
			1"	8.6 x 11	0.70 x 0.93	3.4 x 4.6	0.28 x 0.37	1.7 x 2.3	0.14 x 0.19
			4/3"	12 x 16	0.98 x 1.3	4.8 x 6.4	0.39 x 0.52	2.4 x 3.2	0.20 x 0.26
			APS-C	15 x 22	1.2 x 1.8	6.0 x 9.0	0.48 x 0.73	3.0 x 4.5	0.24 x 0.36
2.5X Mini Camera Tube 35-08-15-000 EFL: 500mm			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	1.4	17	3.5	43	7.0	86
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
	FOV (mm)	Cam Format	1"	6.9 x 9.1	0.56 x 0.74	2.7 x 3.7	0.22 x 0.30	1.4 x 1.8	0.11 x 0.15
			4/3"	9.6 x 13	0.78 x 1.0	3.9 x 5.1	0.31 x 0.42	1.9 x 2.6	0.16 x 0.21
			APS-C	12 x 18	0.97 x 1.5	4.8 x 7.2	0.39 x 0.58	2.4 x 3.6	0.19 x 0.29
			35mm(Full)	17 x 26	1.4 x 2.1	6.9 x 10	0.56 x 0.83	3.4 x 5.1	0.28 x 0.42
3X Mini Camera Tube 35-08-16-000 EFL: 600mm			NA	0.018	0.057	0.045	0.14	0.090	0.30
			Res (lp/mm)	54	170	135	420	270	900
			Mag	1.7	21	4.2	52	8.4	104
			DOF (mm)	1.8	0.18	0.28	0.029	0.070	0.0063
	FOV (mm)	Cam Format	1"	5.7 x 7.6	0.46 x 0.62	2.3 x 3.0	0.19 x 0.25	1.1 x 1.5	0.093 x 0.12
			4/3"	8.0 x 11	0.65 x 0.87	3.2 x 4.3	0.26 x 0.35	1.6 x 2.1	0.13 x 0.17
			APS-C	9.9 x 15	0.81 x 1.2	4.0 x 6.0	0.32 x 0.49	2.0 x 3.0	0.16 x 0.24
			35mm(Full)	14 x 21	1.2 x 1.7	5.7 x 8.6	0.46 x 0.70	2.9 x 4.3	0.23 x 0.35

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

50X M Plan Apo is NOT recommended for use with a 12.5:1 Zoom 0.4X and 0.5X Camera Tubes are not recommended for use with a 12.5:1 Zoom and Microscope Objectives.

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Fetura+ with LWD Objectives - Mini Camera Tubes

20X M Plan Apo 28-21-11-001 WD: 20mm		5X HiRes 28-20-44-000 WD: 34mm		10X HiRes 28-20-45-000 WD: 19mm		20X HiRes 28-20-46-000 WD: 13mm	
1.2		6.6		3.2		1.6	
0.83		5.0		2.3		1.1	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.18	0.42	0.045	0.225	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
8.4	104	2.1	26	4.2	52	8.4	104
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
0.79 x 1.0	0.064 x 0.085	3.1 x 4.2	0.26 x 0.34	1.6 x 2.1	0.13 x 0.17	0.79 x 1.0	0.064 x 0.085
1.1 x 1.5	0.093 x 0.12	4.6 x 6.1	0.37 x 0.49	2.3 x 3.0	0.19 x 0.25	1.1 x 1.5	0.093 x 0.12
1.6 x 2.1	0.13 x 0.17	6.4 x 8.6	0.52 x 0.70	3.2 x 4.3	0.26 x 0.35	1.6 x 2.1	0.13 x 0.17
2.0 x 3.0	0.16 x 0.24	8.0 x 12	0.65 x 0.97	4.0 x 6.0	0.32 x 0.49	2.0 x 3.0	0.16 x 0.24
0.18	0.42	0.045	0.225	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
11	138	2.8	35	5.6	69	11	138
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
0.59 x 0.79	0.048 x 0.064	2.4 x 3.1	0.19 x 0.26	1.2 x 1.6	0.096 x 0.13	0.59 x 0.79	0.048 x 0.064
0.86 x 1.1	0.070 x 0.093	3.4 x 4.6	0.28 x 0.37	1.7 x 2.3	0.14 x 0.19	0.86 x 1.1	0.070 x 0.093
1.2 x 1.6	0.098 x 0.13	4.8 x 6.4	0.39 x 0.52	2.4 x 3.2	0.20 x 0.26	1.2 x 1.6	0.098 x 0.13
1.5 x 2.2	0.12 x 0.18	6.0 x 9.0	0.48 x 0.73	3.0 x 4.5	0.24 x 0.36	1.5 x 2.2	0.12 x 0.18
0.18	0.42	0.045	0.225	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
14	173	3.5	43	7.0	86	14	173
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
0.69 x 0.91	0.056 x 0.074	2.7 x 3.7	0.22 x 0.30	1.4 x 1.8	0.11 x 0.15	0.69 x 0.91	0.056 x 0.074
0.96 x 1.3	0.078 x 0.10	3.9 x 5.1	0.31 x 0.42	1.9 x 2.6	0.16 x 0.21	0.96 x 1.3	0.078 x 0.10
1.2 x 1.8	0.097 x 0.15	4.8 x 7.2	0.39 x 0.58	2.4 x 3.6	0.19 x 0.29	1.2 x 1.8	0.097 x 0.15
1.7 x 2.6	0.14 x 0.21	6.9 x 10	0.56 x 0.83	3.4 x 5.1	0.28 x 0.42	1.7 x 2.6	0.14 x 0.21
0.18	0.42	0.045	0.225	0.090	0.45	0.18	0.60
540	1260	135	675	270	1350	540	1800
17	207	4.2	52	8.4	104	17	207
0.018	0.0032	0.28	0.011	0.070	0.0028	0.018	0.0016
0.57 x 0.76	0.046 x 0.062	2.3 x 3.0	0.19 x 0.25	1.1 x 1.5	0.093 x 0.12	0.57 x 0.76	0.046 x 0.062
0.80 x 1.1	0.065 x 0.087	3.2 x 4.3	0.26 x 0.35	1.6 x 2.1	0.13 x 0.17	0.80 x 1.1	0.065 x 0.087
0.99 x 1.5	0.081 x 0.12	4.0 x 6.0	0.32 x 0.49	2.0 x 3.0	0.16 x 0.24	0.99 x 1.5	0.081 x 0.12
1.4 x 2.1	0.12 x 0.17	5.7 x 8.6	0.46 x 0.70	2.9 x 4.3	0.23 x 0.35	1.4 x 2.1	0.12 x 0.17

Note: Hi Res Objectives are not flat-field and therefore limited by field curvature at lower magnifications with both fixed and zoom systems.

Optical Performance - Infinity Macro Lens with 2X

Chart 4

42-35-41-000

			WD: 500mm 0.14X	WD: 400mm 0.17X	WD: 300mm 0.21X
		Max FOV Dia.	275	225	175
Fixed Mag. 1X Camera Tube 35-08-06-000 18mm Stop		NA	0.0061	0.0075	0.0096
		Res (lp/mm)	18	22	29
		Mag	0.14	0.17	0.21
		DOF (mm)	15	10	6.2
	FOV (mm) Cam Format	1/3"	26 x 35	22 x 29	17 x 23
		1/2"	35 x 47	29 x 39	23 x 30
		2/3"	49 x 65	40 x 53	31 x 41

			240		200		150	
		Max FOV Dia.	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
7:1 Zoom 1X Camera Tube 35-08-06-000		NA	0.0016	0.0053	0.0020	0.0064	0.0025	0.0083
		Res (lp/mm)	4.8	16	5.9	19	7.5	25
		Mag	0.057	0.39	0.070	0.48	0.090	0.62
		DOF (mm)	220	20	148	14	90	8.3
	FOV (mm) Cam Format	1/3"	63 x 84	9.1 x 12	52 x 69	7.5 x 10	40 x 54	5.8 x 7.8
		1/2"	84 x 112	12 x 16	69 x 92	10 x 13	54 x 71	7.8 x 10
		2/3"	116 x 154	17 x 22	95 x 126	14 x 18	74 x 98	11 x 14

			210		175		135	
		Max FOV Dia.	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
12:1 Zoom 1X Camera Tube 35-08-06-000		NA	0.0012	0.0065	0.0015	0.0080	0.0019	0.010
		Res (lp/mm)	3.7	20	4.5	24	5.8	31
		Mag	0.038	0.47	0.046	0.57	0.060	0.74
		DOF (mm)	378	13	255	8.9	154	5.4
	FOV (mm) Cam Format	1/3"	95 x 126	7.7 x 10	78 x 103	6.3 x 8.4	60 x 80	4.9 x 6.5
		1/2"	126 x 168	10 x 14	103 x 138	8.4 x 11	80 x 107	6.5 x 8.7
		2/3"	173 x 231	14 x 19	142 x 190	12 x 15	111 x 147	9.0 x 12

-- FOV Limited by vignetting

1X Camera Tube shown. For other Camera tubes, multiply the magnification in the chart by the Camera tube mag., and divide the FOV values by the Camera tube mag. NA, Resolution, and DOF are not affected by the Camera Tube.

NOTE: Wide Angle Objective is not recommended for use with coaxial Illumination.

The Wide Angle Objective can be focused out to infinity. At WDs greater than 1m, it can be thought of as a video lens.

Fixed Mag:	
EFL:	73 *CT mag
f/# :	200/Stop Diameter*CT mag

NOTE: The Camera Tube Magnification will affect the EFL and the f/# of the video lens.

7:1 Zoom:	
EFL (low mag):	30*CT mag
EFL (high mag):	210*CT mag
f/#: (low mag):	18*CT mag
f/#: (high mag):	38*CT mag

Lower Lens

35-00-03-000

WD: 200mm 0.30X	WD: 150mm 0.38X	WD: 100mm 0.50X	WD: 50mm 0.75X
125	100	75	50
0.013	0.017	0.023	0.034
40	51	68	103
0.30	0.38	0.50	0.77
3.1	2.0	1.1	0.48
12 x 16	9.6 x 13	7.1 x 9.5	4.7 x 6.3
16 x 21	13 x 17	9.5 x 13	6.3 x 8.4
22 x 29	18 x 23	13 x 17	8.6 x 11

110		85		65		43	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.0035	0.012	0.0044	0.015	0.0059	0.020	0.0090	0.030
11	35	13	44	18	59	27	89
0.13	0.87	0.16	1.1	0.21	1.5	0.32	2.2
45	4.2	29	2.7	16	1.5	6.9	0.64
29 x 38	4.1 x 5.5	23 x 30	3.3 x 4.4	17 x 23	2.5 x 3.3	11 x 15	1.6 x 2.2
38 x 51	5.5 x 7.4	30 x 41	4.4 x 5.9	23 x 30	3.3 x 4.4	15 x 20	2.2 x 2.9
52 x 70	7.6 x 10	42 x 56	6.1 x 8.1	31 x 42	4.5 x 6.0	21 x 27	3.0 x 4.0

95		77		58		38	
Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.0027	0.014	0.0034	0.018	0.0045	0.024	0.0069	0.037
8.1	43	10	54	14	73	21	110
0.084	1.0	0.11	1.3	0.14	1.7	0.21	2.6
78	2.7	50	1.7	28	0.97	12	0.42
43 x 57	3.5 x 4.6	34 x 46	2.8 x 3.7	26 x 34	2.1 x 2.8	17 x 22	1.4 x 1.8
57 x 76	4.6 x 6.2	46 x 61	3.7 x 4.9	34 x 45	2.8 x 3.7	22 x 30	1.8 x 2.4
79 x 105	6.4 x 8.5	63 x 84	5.1 x 6.8	47 x 62	3.8 x 5.1	31 x 41	2.5 x 3.3

12.5:1 Zoom:	
EFL (low mag):	20*CT mag
EFL (high mag):	250*CT mag
f/#: (low mag):	15.5*CT mag
f/#: (high mag):	36*CT mag

SWIR

Optical Performance - Fixed Magnification SWIR

Chart 5A

			0.5X Lower Lens 45-00-10-000 WD: 390mm EFL: 400mm	1X Lower Lens 45-00-08-000 WD: 190mm EFL: 200mm	1.25X Lower Lens 45-00-06-000 WD: 155mm EFL: 160mm	2X Lower Lens 45-00-03-000 WD: 95mm EFL: 100mm
Max FOV Dia.			80	40	32	20
Max Coax FOV Dia.			13	12	12	15
0.5X Camera Tube 45-08-01-000 EFL: 100mm 8mm Stop		NA	0.010	0.020	0.025	0.040
		Res (lp/mm)	14	28	35	56
		Mag	0.25	0.50	0.63	1.0
		DOF (mm)	11.77	2.94	1.88	0.74
	FOV (mm) Cam Format	1/3"	14.4 x 19.2	7.2 x 9.6	5.8 x 7.7	3.6 x 4.8
		1/2"	19.2 x 25.6	9.6 x 12.8	7.7 x 10.2	4.8 x 6.4
		2/3"	26.4 x 35.2	13.2 x 17.6	10.6 x 14.1	6.6 x 8.8
0.8X Camera Tube 45-08-04-000 EFL: 160mm 8mm Stop		NA	0.010	0.020	0.025	0.040
		Res (lp/mm)	14	28	35	56
		Mag	0.40	0.80	1.0	1.6
		DOF (mm)	11.77	2.94	1.88	0.74
	FOV (mm) Cam Format	1/2"	12.0 x 16.0	6.0 x 8.0	4.8 x 6.4	3.0 x 4.0
		2/3"	16.5 x 22.0	8.3 x 11.0	6.6 x 8.8	4.1 x 5.5
		1"	24.0 x 32.0	12.0 x 16.0	9.6 x 12.8	6.0 x 8.0
1.0X Camera Tube 45-08-06-000 EFL: 200mm 12mm Stop		NA	0.015	0.030	0.038	0.060
		Res (lp/mm)	21	42	52	84
		Mag	0.50	1.00	1.25	2.00
		DOF (mm)	5.23	1.31	0.84	0.33
	FOV (mm) Cam Format	2/3"	13.2 x 17.6	6.6 x 8.8	5.3 x 7.0	3.3 x 4.4
		1"	19.2 x 25.6	9.6 x 12.8	7.7 x 10.2	4.8 x 6.4
		4/3"	27.0 x 36.0	13.5 x 18.0	10.8 x 14.4	6.8 x 9.0
1.5X Mini Camera Tube 45-08-13-000 EFL: 300mm 12mm Stop		NA	0.015	0.030	0.038	0.060
		Res (lp/mm)	21	42	52	84
		Mag	0.75	1.5	1.9	3.0
		DOF (mm)	5.23	1.31	0.84	0.33
	FOV (mm) Cam Format	2/3"	8.8 x 11.7	4.4 x 5.9	3.5 x 4.7	2.2 x 2.9
		1"	12.8 x 17.1	6.4 x 8.5	5.1 x 6.8	3.2 x 4.3
		4/3"	18.0 x 24.0	9.0 x 12.0	7.2 x 9.6	4.5 x 6.0
2.0X Mini Camera Tube 45-08-14-000 EFL: 400mm 12mm Stop		NA	0.015	0.030	0.038	0.060
		Res (lp/mm)	21	42	52	84
		Mag	1.00	2.0	2.50	4.0
		DOF (mm)	5.23	1.31	0.84	0.33
	FOV (mm) Cam Format	2/3"	6.6 x 8.8	3.3 x 4.4	2.6 x 3.5	1.7 x 2.2
		1"	9.6 x 12.8	4.8 x 6.4	3.8 x 5.1	2.4 x 3.2
		4/3"	13.5 x 18.0	6.8 x 9.0	5.4 x 7.2	3.4 x 4.5

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

Note:
- **SWIR** Specifications based on primary wavelength of 1177nm
- FUSION **SWIR** supports operating waveband from 700 - 1700 nm

	Height	x	Width	Diag.
2/3"	6.6	x	8.8	11
1"	9.6	x	12.8	16
4/3"	13.5	x	18	22.5
APS-C*	16.7	x	25.1	30
35mm (Full)	24	x	36	43.3

*Also known as Half Frame 35mm format

Optical Performance - OPTEM 7:1 Zoom SWIR

Chart 5B

			0.5X Lower Lens 45-00-10-000 WD: 390mm EFL: 400mm		1X Lower Lens 45-00-08-000 WD: 190mm EFL: 200mm		1.25X Lower Lens 45-00-06-000 WD: 155mm EFL: 160mm		2X Lower Lens 45-00-03-000 WD: 95mm EFL: 100mm	
Max FOV Dia.			125		63		50		31	
Max Coax FOV Dia.			NR		19		19		19	
			Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag	Low Mag	High Mag
0.5X Camera Tube 45-08-01-000 EFL: 100mm		NA	0.0059	0.019	0.012	0.039	0.015	0.048	0.024	0.078
		Res (lp/mm)	8	26	17	54	21	67	33	109
		Mag	0.11	0.73	0.21	1.45	0.26	1.84	0.42	2.90
		DOF (mm)	34	3.3	8.2	0.77	5.2	0.51	2.0	0.193
	FOV (mm) Cam Format	1/3"	34 x 46	5.0 x 6.6	17 x 23	2.5 x 3.3	14 x 18	2.0 x 2.6	9 x 11	1.2 x 1.7
		1/2"	46 x 61	6.6 x 8.8	23 x 30	3.3 x 4.4	18 x 25	2.6 x 3.5	11 x 15	1.7 x 2.2
		2/3"	63 x 84	9.1 x 12.1	31 x 42	4.6 x 6.1	25 x 34	3.6 x 4.8	16 x 21	2.3 x 3.0
0.8X Camera Tube 45-08-04-000 EFL: 160mm		NA	0.0059	0.019	0.012	0.039	0.015	0.048	0.024	0.078
		Res (lp/mm)	8	26	17	54	21	67	33	109
		Mag	0.17	1.17	0.34	2.30	0.42	2.90	0.67	4.60
		DOF (mm)	34	3.3	8.2	0.77	5.2	0.51	2.0	0.193
	FOV (mm) Cam Format	1/2"	29 x 38	4.1 x 5.5	14 x 19	2.1 x 2.8	11.4 x 15	1.7 x 2.2	7.2 x 9.6	1.0 x 1.4
		2/3"	39 x 52	5.6 x 7.5	20 x 26	2.9 x 3.8	16 x 21	2.3 x 3.0	9.9 x 13	1.4 x 1.9
		1"	57 x 76	8.2 x 10.9	28 x 38	4.2 x 5.6	23 x 30	3.3 x 4.4	14.3 x 19	2.1 x 2.8
1.0X Camera Tube 45-08-06-000 EFL: 200mm		NA	0.0059	0.019	0.012	0.039	0.015	0.048	0.024	0.078
		Res (lp/mm)	8	26	17	54	21	67	33	109
		Mag	0.21	1.45	0.42	2.90	0.53	3.60	0.84	5.80
		DOF (mm)	34	3.3	8.2	0.77	5.2	0.51	2.0	0.193
	FOV (mm) Cam Format	2/3"	31 x 42	4.6 x 6.1	16 x 21	2.3 x 3.0	12.5 x 16.6	1.83 x 2.4	7.9 x 10.5	1.1 x 1.5
		1"	46 x 61	6.6 x 8.8	23 x 30	3.3 x 4.4	18.1 x 24	2.7 x 3.6	11.5 x 15.3	1.7 x 2.2
		4/3"	64 x 86	9.3 x 12.4	32 x 43	4.7 x 6.2	25 x 34	3.8 x 5.0	16.1 x 22	2.3 x 3.1
1.5X Mini Camera Tube 45-08-13-000 EFL: 300mm		NA	0.0059	0.019	0.012	0.039	0.015	0.048	0.024	0.078
		Res (lp/mm)	8	26	17	54	21	67	33	109
		Mag	0.32	2.18	0.63	4.40	0.79	5.40	1.26	8.70
		DOF (mm)	34	3.3	8.2	0.77	5.2	0.51	2.0	0.193
	FOV (mm) Cam Format	2/3"	21 x 28	3.0 x 4.0	10 x 14	1.5 x 2.0	8.4 x 11	1.2 x 1.6	5.2 x 7.0	0.8 x 1.0
		1"	30 x 40	4.4 x 5.9	15 x 20	2.2 x 2.9	12 x 16	1.8 x 2.4	7.6 x 10	1.1 x 1.5
		4/3"	43 x 57	6.2 x 8.3	21 x 29	3.1 x 4.1	17 x 23	2.5 x 3.3	11 x 14	1.6 x 2.1
2.0X Mini Camera Tube 45-08-14-000 EFL: 400mm		NA	0.0059	0.019	0.012	0.039	0.015	0.048	0.024	0.078
		Res (lp/mm)	8	26	17	54	21	67	33	109
		Mag	0.42	2.90	0.84	5.80	1.05	7.29	1.69	11.50
		DOF (mm)	34	3.3	8.2	0.77	5.2	0.51	2.0	0.193
	FOV (mm) Cam Format	2/3"	16 x 21	2.3 x 3.0	7.9 x 10	1.1 x 1.5	6.3 x 8.4	0.9 x 1.2	3.9 x 5.2	0.6 x 0.8
		1"	23 x 30	3.3 x 4.4	11 x 15	1.7 x 2.2	9.1 x 12	1.3 x 1.8	5.7 x 7.6	0.8 x 1.1
		4/3"	32 x 43	4.7 x 6.2	16 x 21	2.3 x 3.1	13 x 17	1.9 x 2.5	8.0 x 11	1.2 x 1.6

-- Useable FOV Limited by Coax illumination (>50% Illumination)

-- FOV Limited by vignetting

FUSION Flexibility...

At the heart of FUSION's extreme versatility, is the simplicity of stacking a variety of modules to affect magnification, function, form and wavelength of the lens system.

Following are the basic required components of a functional FUSION lens assembly. From here, features and accessories are easily swapped in to meet your requirements.

Modular design allows FUSION to evolve quickly and easily

With a simple change-out of a few modules, you can modify FUSION performance, function, form and wavelength to meet the evolving requirements of your system. This streamlines prototyping stages and aids the evolution of your system.

Camera Mount
Mates FUSION with C, CS, F, EOS, 4/3-mount cameras and more

Camera Tube
Modifies magnification to your camera optimizing chip coverage & performance

Core Optical Module
Determines optical function: Fixed, 7:1 or 12.5:1 zoom magnification—motorized or manual

Lower Function Module
Integrates internal focus—motorized or manual—and coaxial LED illumination options

Lower Lens
Modifies taking magnification to affect field of view, NA and working distance

Optem FUSION
Extreme Micro-Imaging Versatility

Notes

Your Key to Photonic Innovation...

Qioptiq serves a wide variety of applications across the industrial manufacturing sector. With a rich history of delivering innovative photonic components, modules and instruments to integrators, engineers and OEMs, we also offer custom-tailored photonic solutions to maximize the potential and capabilities of tomorrow's many processes and industrial manufacturing systems.

...and Manufacturing Advancement

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