mind the gap

19/02/2025 | 3D–4CH

Geert Verhoeven

universität wien

PLEASE NOTE

This PDF does **not** display the GIFs used to explain the concept of camera shutter (slides 48–66).

For the **original *.pptx file** with all GIFs working, visit https://zenodo.org/records/14894580.

3D DATAFICATION

3D DATAFICATION



raw

3D DATAFICATION

raw | surface



3D DATAFICATION

raw | surface | volume



3D DATAFICATION

raw | **surface** | volume



3D DATAFICATION



raw | surface | volume

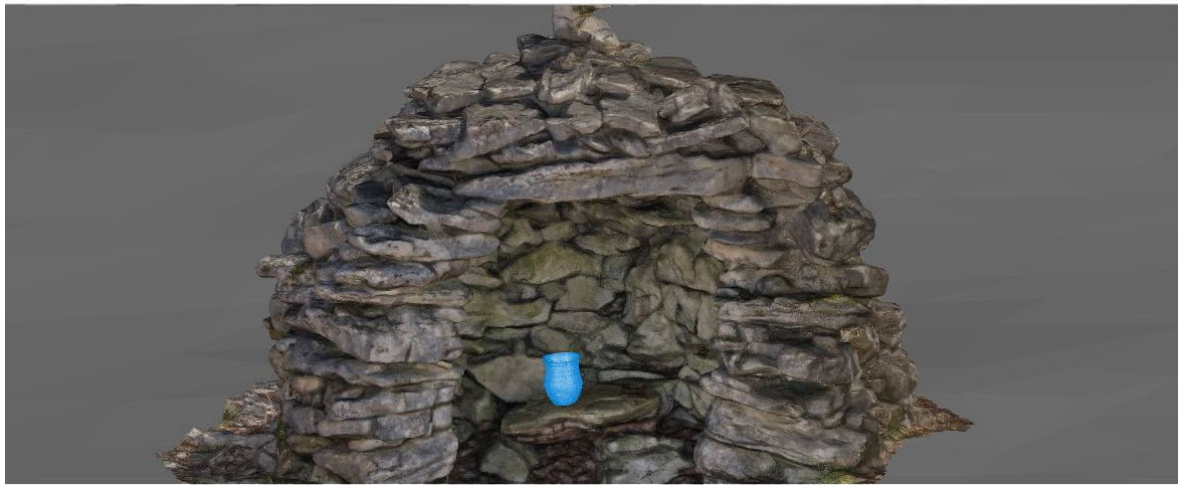
artefact

3D DATAFICATION

raw | surface | volume

artefact | site



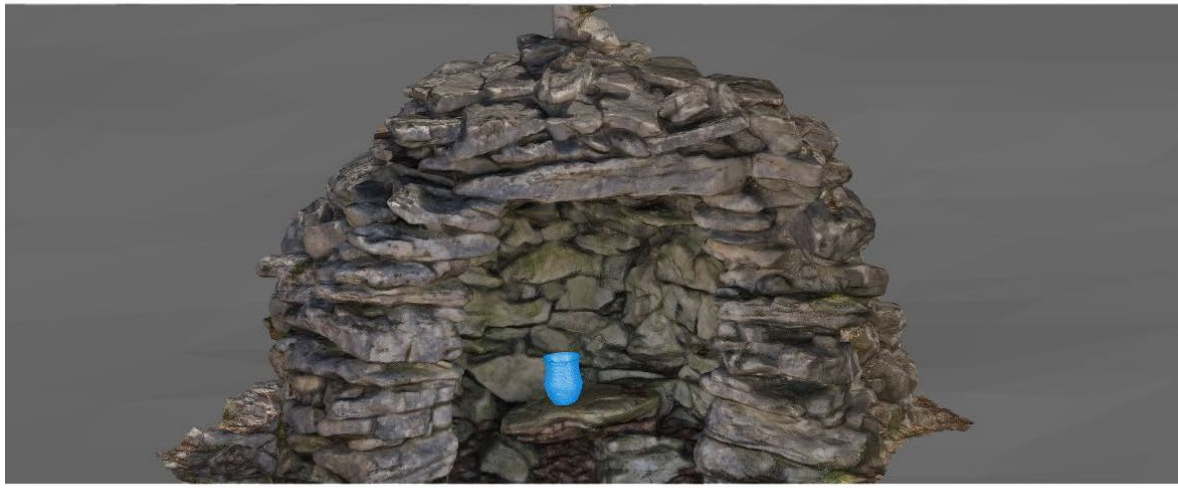


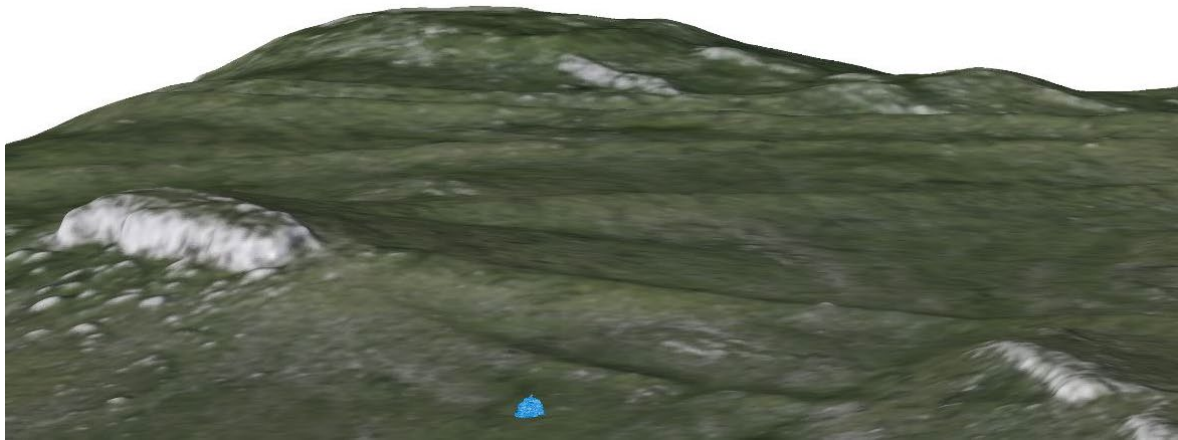
3D DATAFICATION

raw | surface | volume

artefact | site | landscape





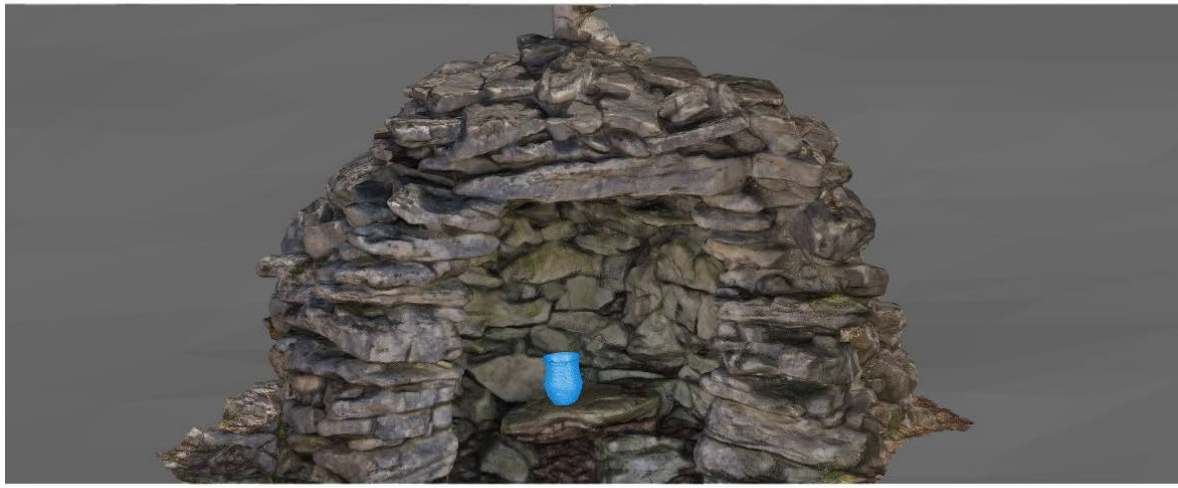


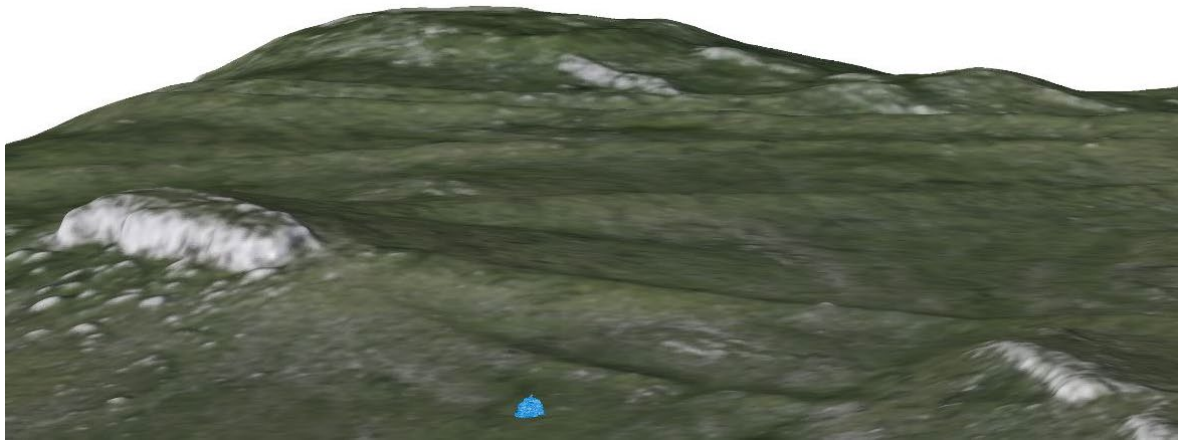
3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape







3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

≠ techniques



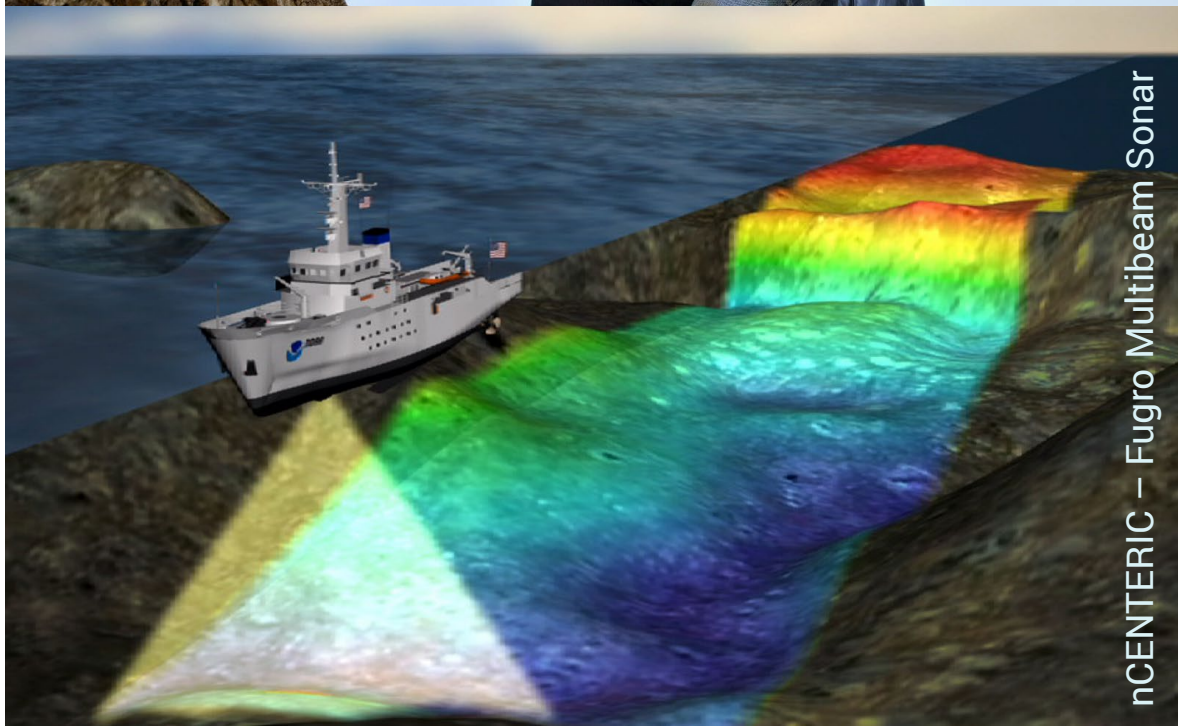
3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

≠ techniques





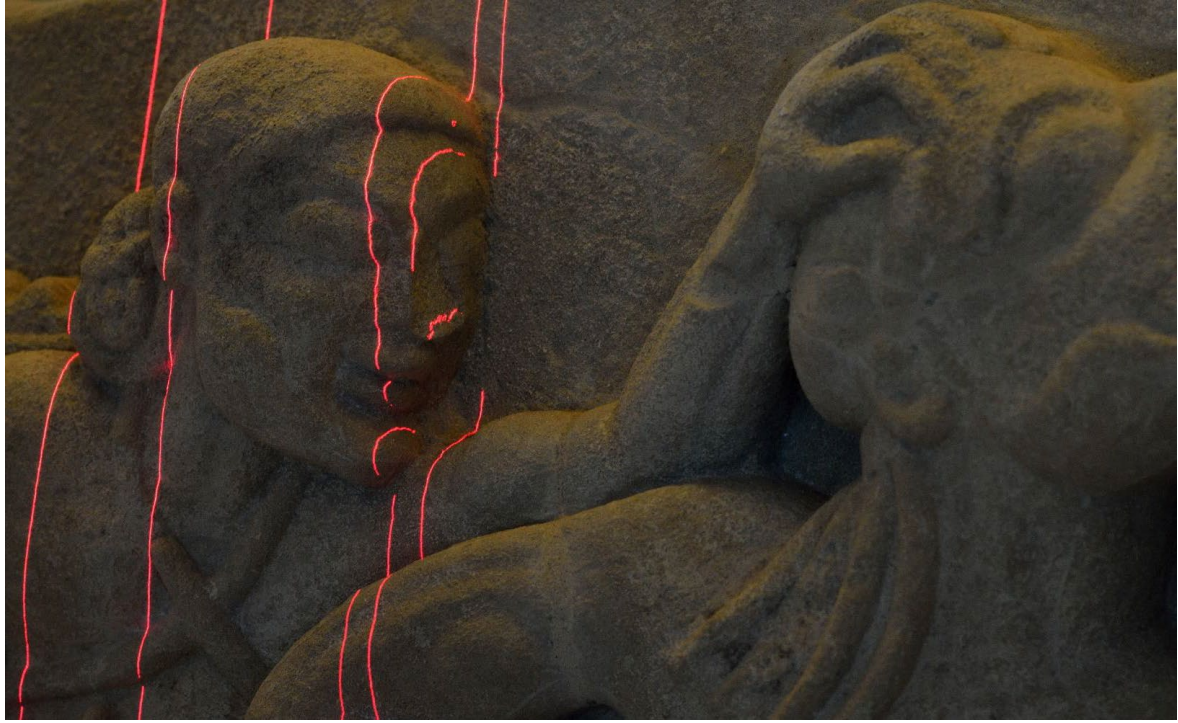
nCENTERIC – Fugro Multibeam Sonar

3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

≠ techniques

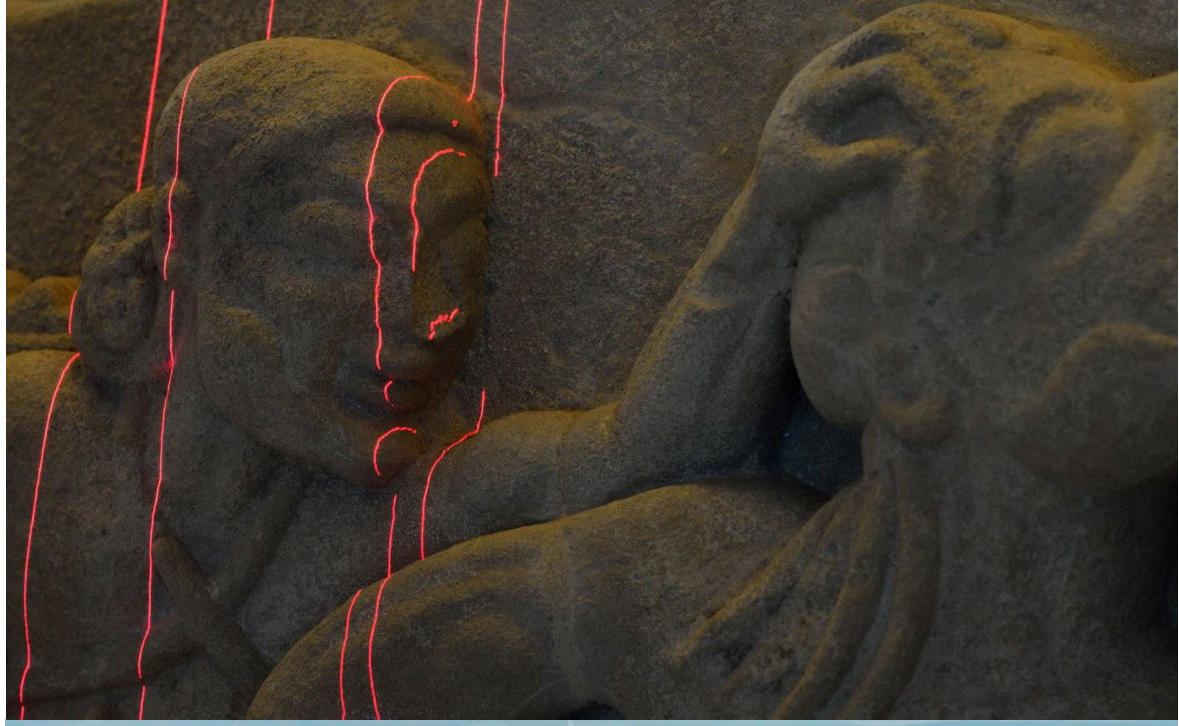


3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

≠ techniques





3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

≠ techniques



3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

≠ techniques





3D DATAFICATION

raw | **surface** | volume

artefact | **site** | landscape

image-based modelling





IMAGE-BASED (3D) (SURFACE) MODELLING

?

geometry

IMAGE-BASED (3D) (SURFACE) MODELLING





geometry

IMAGE-BASED (3D) (SURFACE) MODELLING

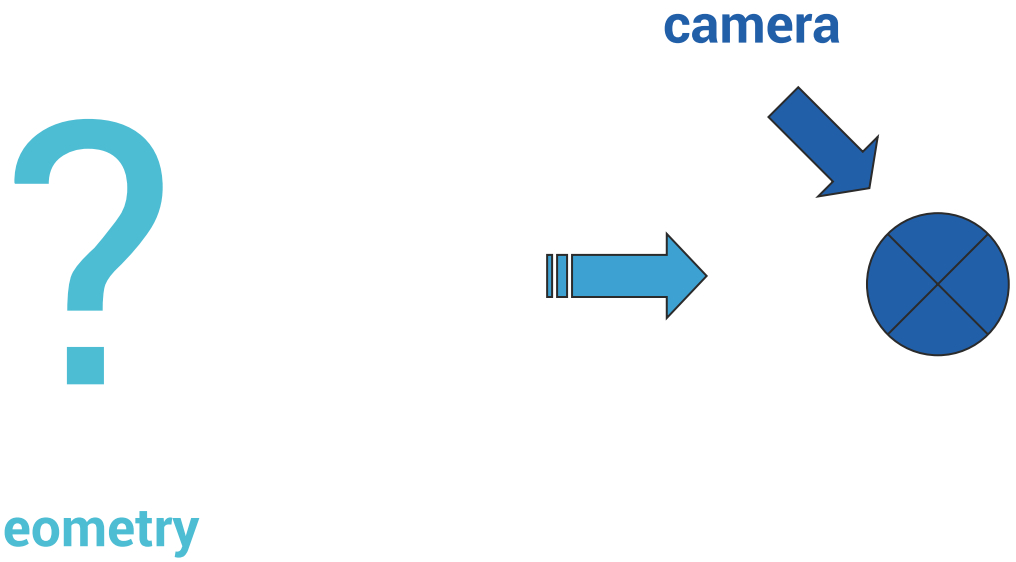


IMAGE-BASED (3D) (SURFACE) MODELLING

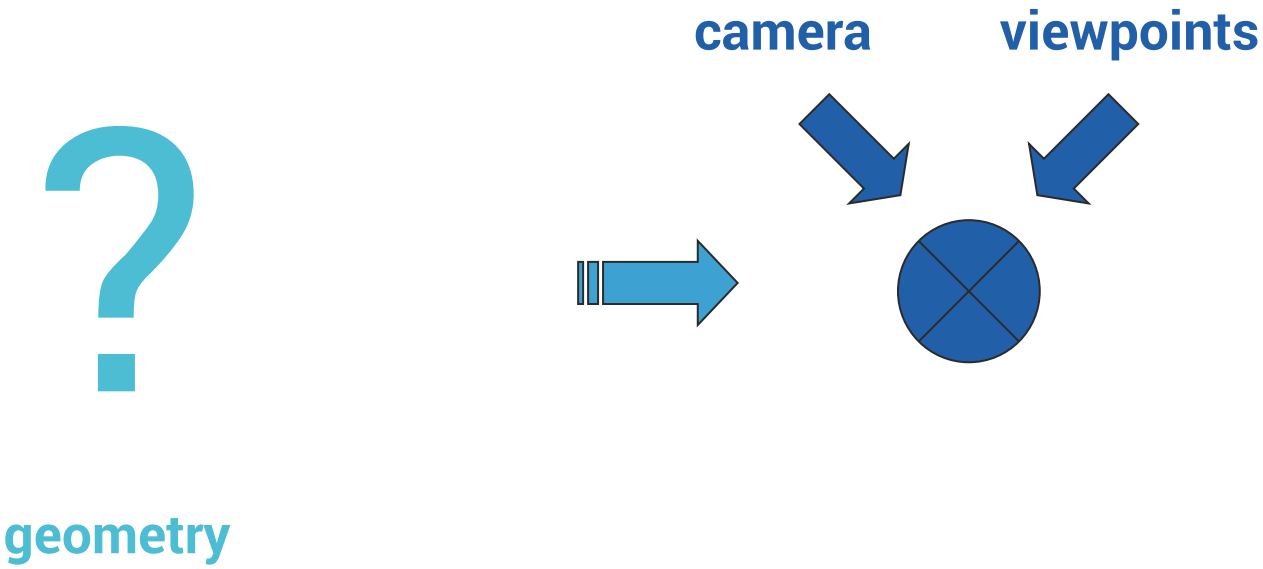


IMAGE-BASED (3D) (SURFACE) MODELLING

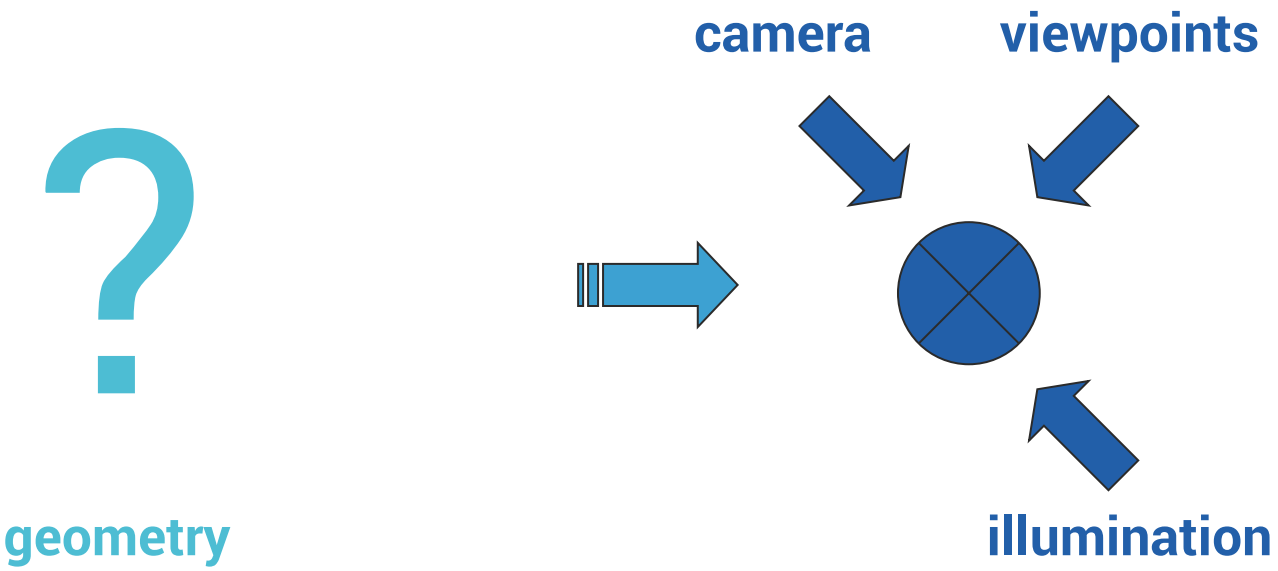


IMAGE-BASED (3D) (SURFACE) MODELLING

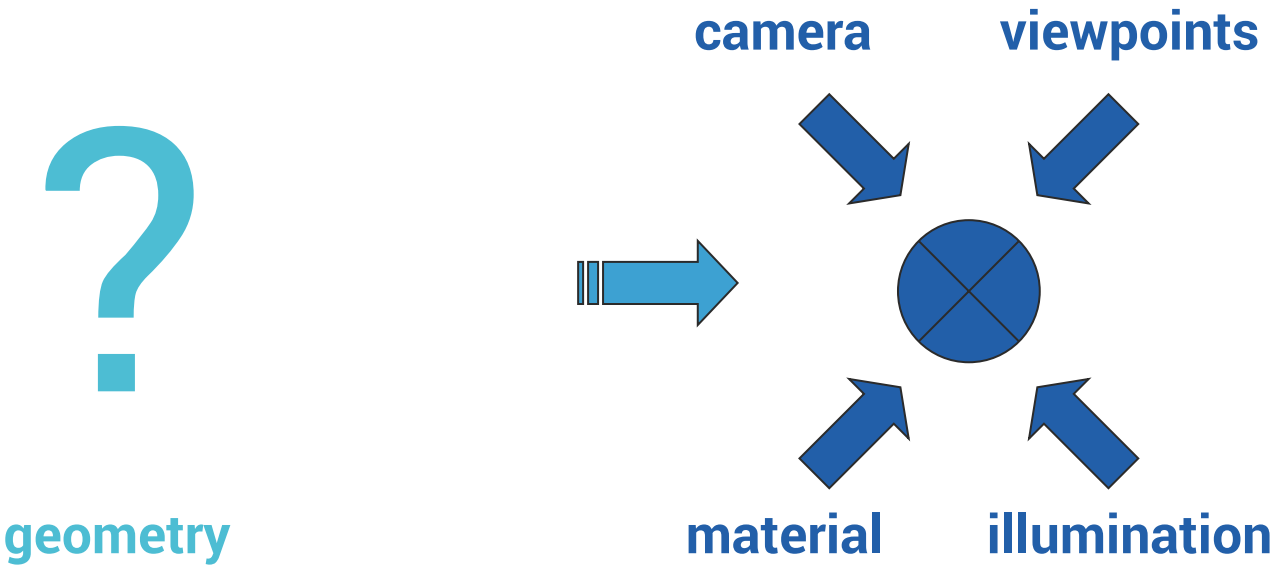


IMAGE-BASED (3D) (SURFACE) MODELLING

?

geometry

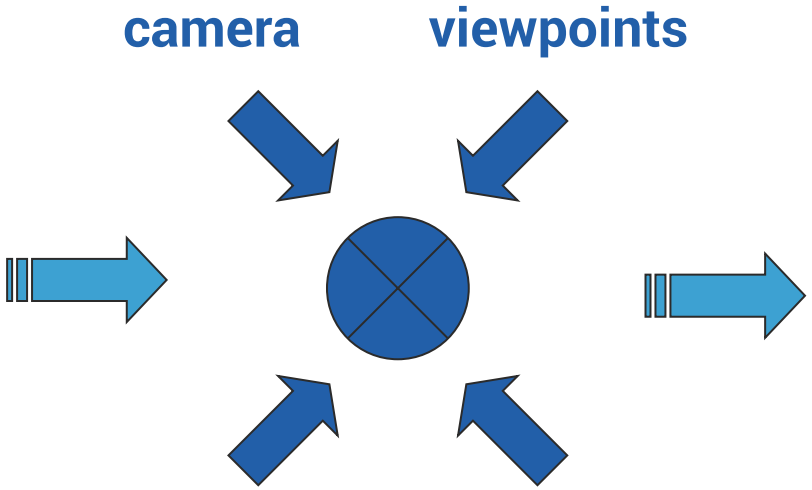
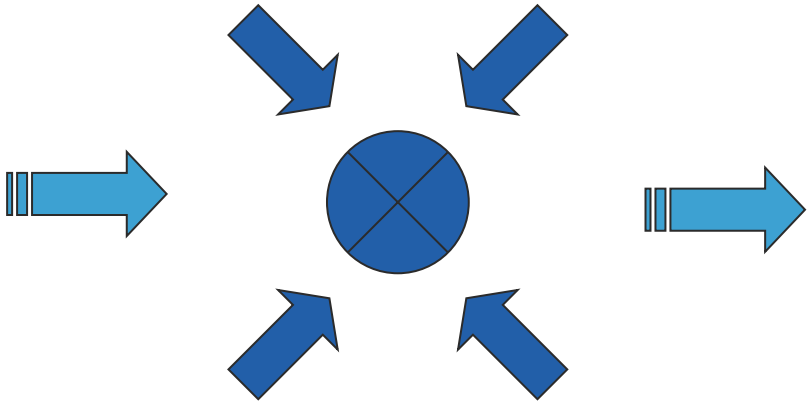


IMAGE-BASED (3D) (SURFACE) MODELLING

?

geometry





images

IMAGE-BASED (3D) (SURFACE) MODELLING

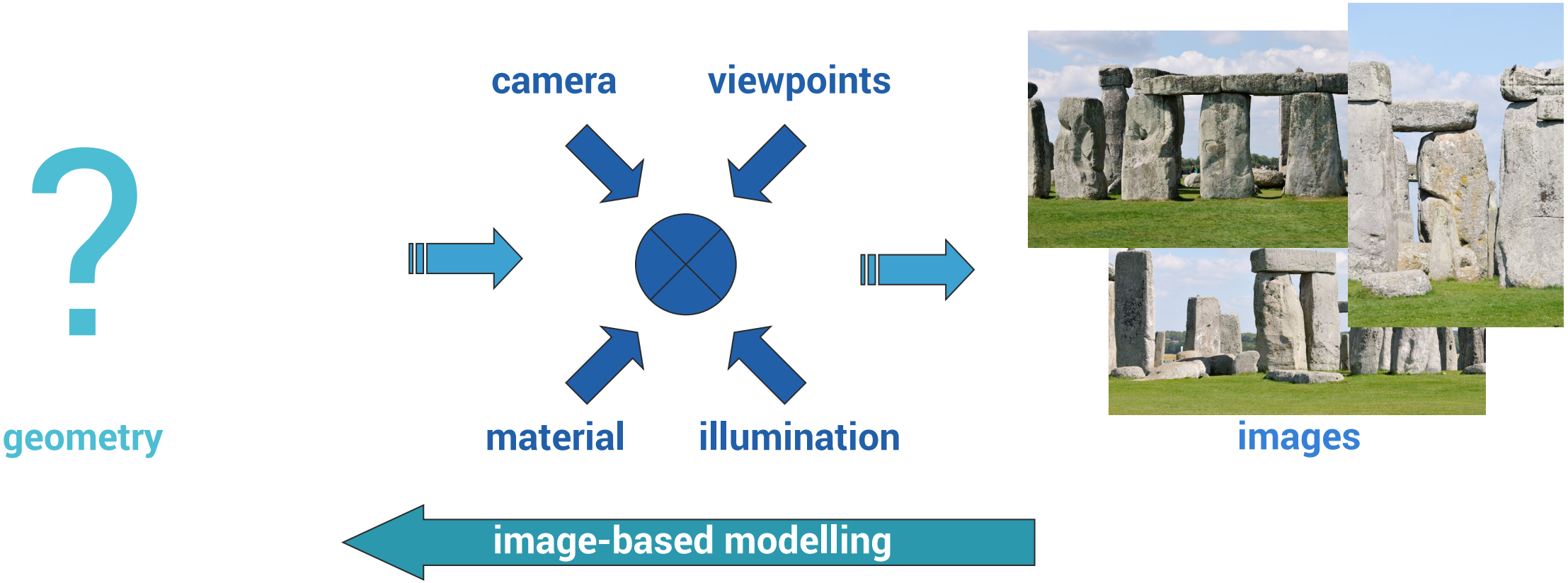
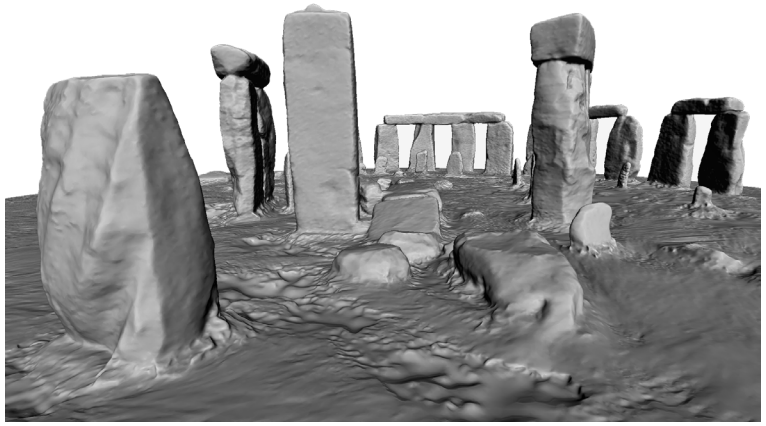


IMAGE-BASED (3D) (SURFACE) MODELLING



camera viewpoints

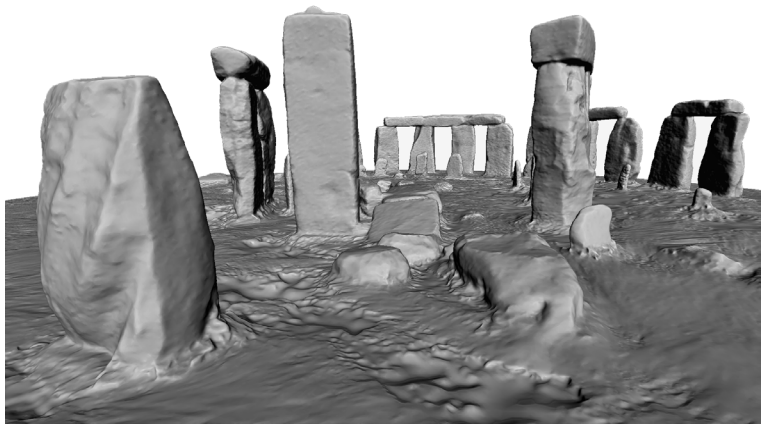
material illumination

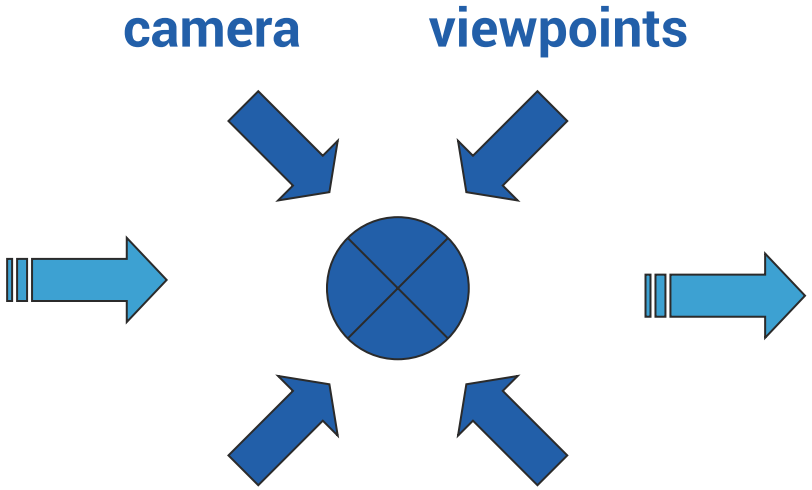


images

image-based modelling

IMAGE-BASED (3D) (SURFACE) MODELLING







images

image-based modelling

structure from motion

multi-view stereo

IMAGE-BASED (3D) (SURFACE) MODELLING

camera viewpoints

material illumination



images

image-based modelling

structure from motion

multi-view stereo

2 PARTS



BODY
parameter



LENS
parameter

2 PARTS

Negatively affect IBM



BODY
parameter



LENS
parameter

2 PARTS

Negatively affect IBM

Need more research



BODY
parameter



LENS
parameter



PART 1

CAMERA SHUTTER

CAMERA SHUTTER



prevents | allows light to pass

CAMERA SHUTTER



prevents | allows light to pass



variable: 2 s, 1/50 s, 1/1000 s

CAMERA SHUTTER



prevents | allows light to pass



variable: 2 s, 1/50 s, 1/1000 s



freeze movement → short shutter speed

SHUTTER SPEED



CAMERA SHUTTER

electronic



mechanical

CAMERA SHUTTER

electronic  mechanical

global | progressive  leaf | rotary disc | rolling-blind

CAMERA SHUTTER

electronic



mechanical

global | progressive



leaf | rotary disc | rolling-blind

focal plane



central | behind-the-lens | focal plane

CAMERA SHUTTER

electronic  **mechanical**

global | progressive  leaf | rotary disc | **rolling-blind**

focal plane  central | behind-the-lens | **focal plane**

CAMERA SHUTTER

electronic | mechanical



global | progressive



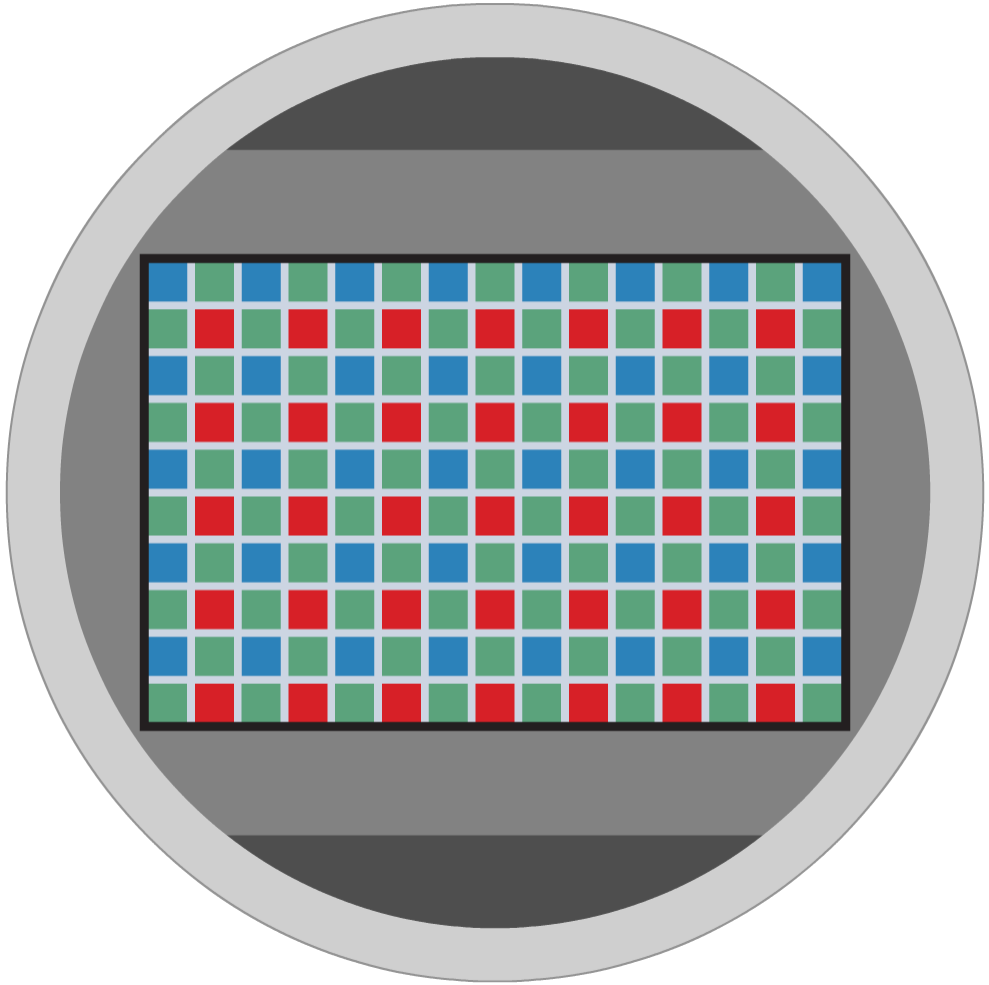
leaf | rotary disc | rolling-blind

focal plane

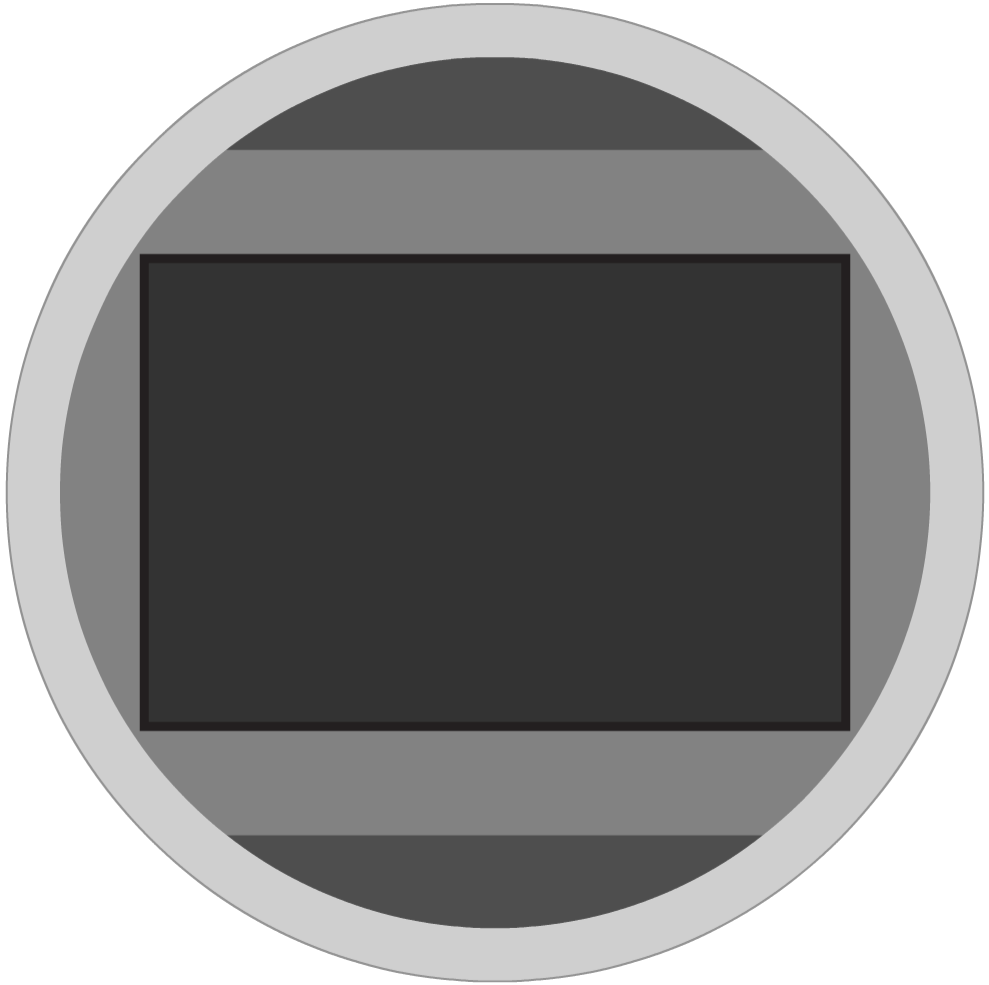


central | behind-the-lens | focal plane

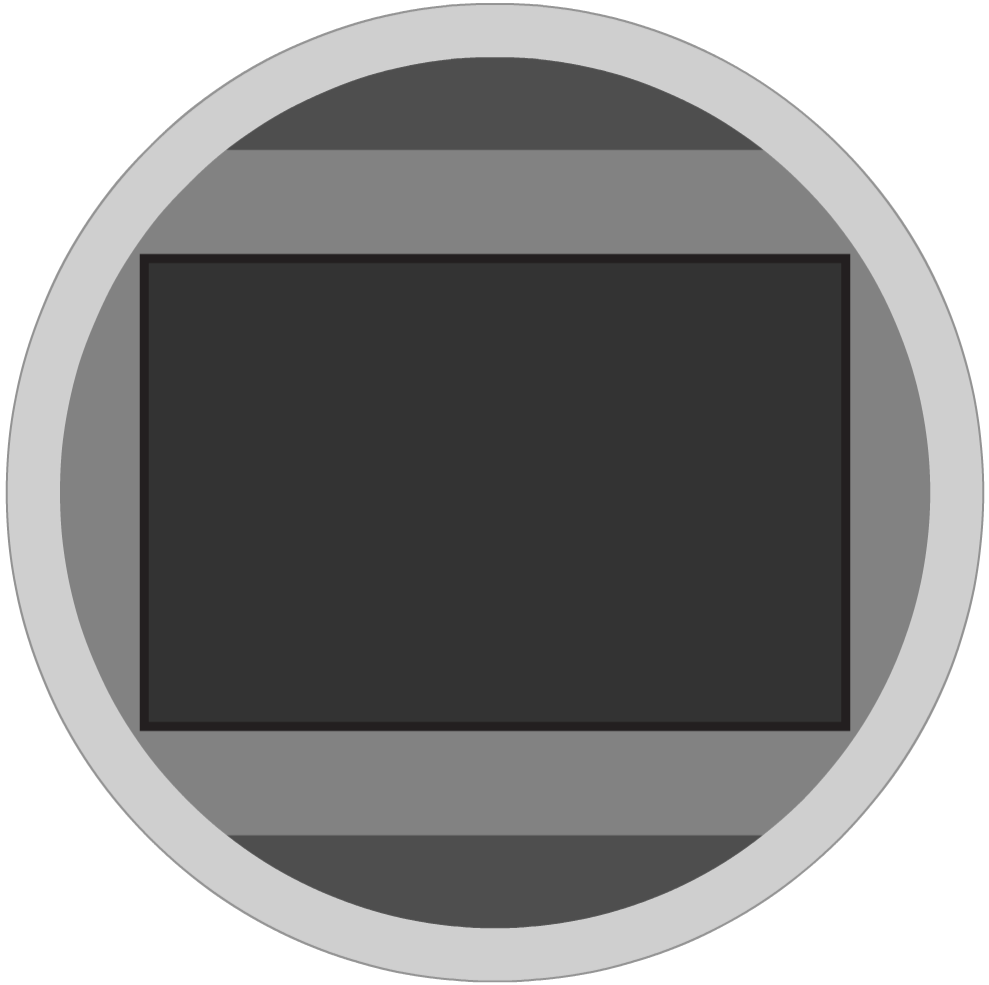
ROLLING-BLIND FOCAL PLANE SHUTTER



ROLLING-BLIND FOCAL PLANE SHUTTER

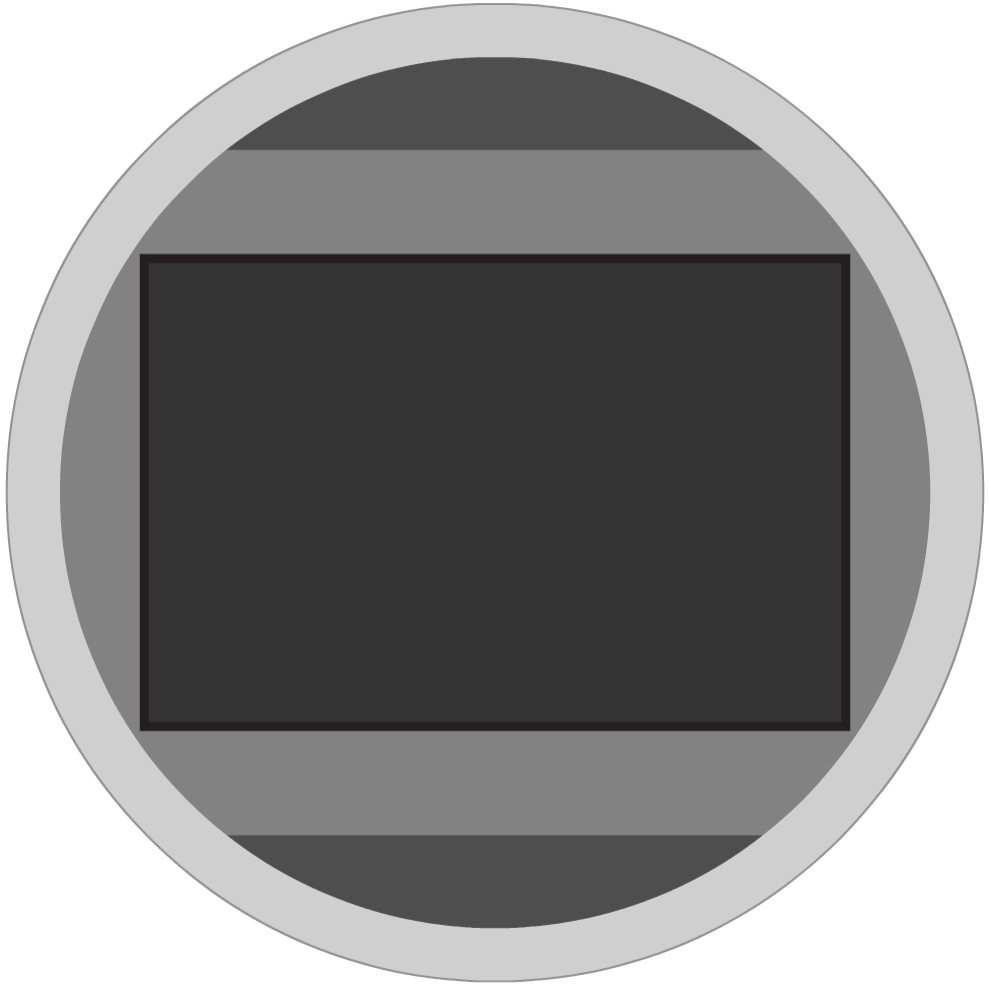


ROLLING-BLIND FOCAL PLANE SHUTTER



1s

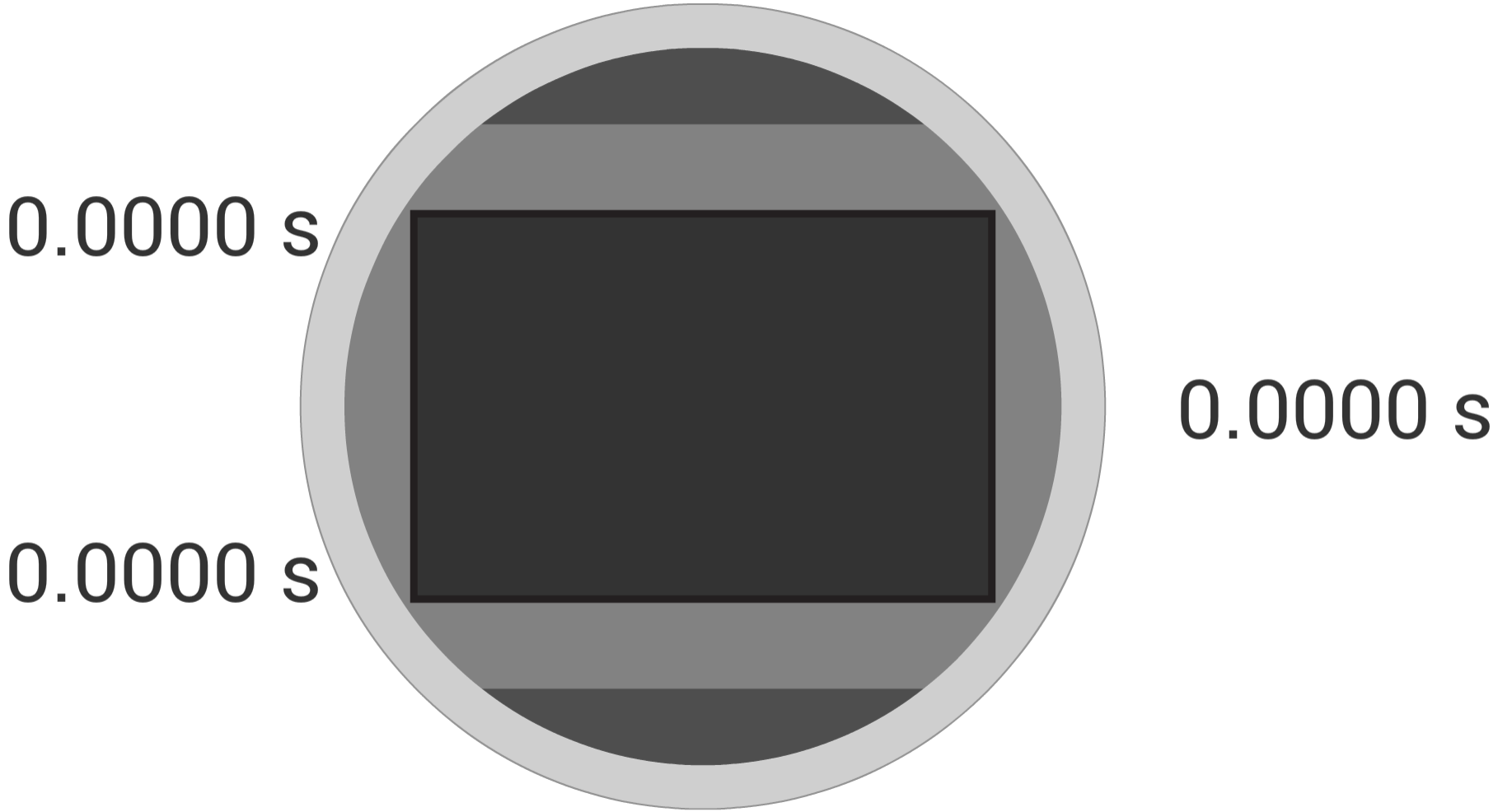
ROLLING-BLIND FOCAL PLANE SHUTTER



0.0000 s

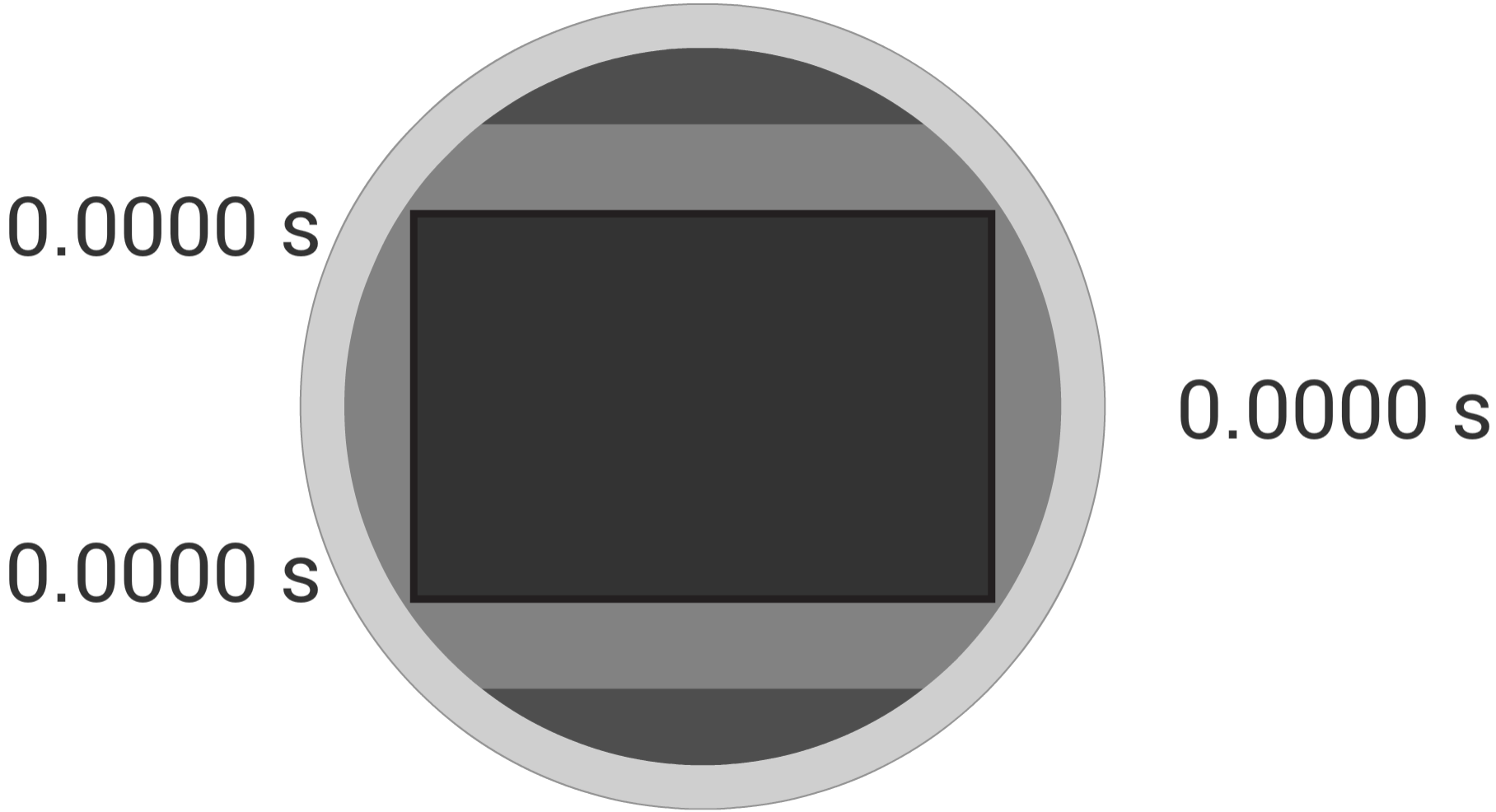
1 s

ROLLING-BLIND FOCAL PLANE SHUTTER



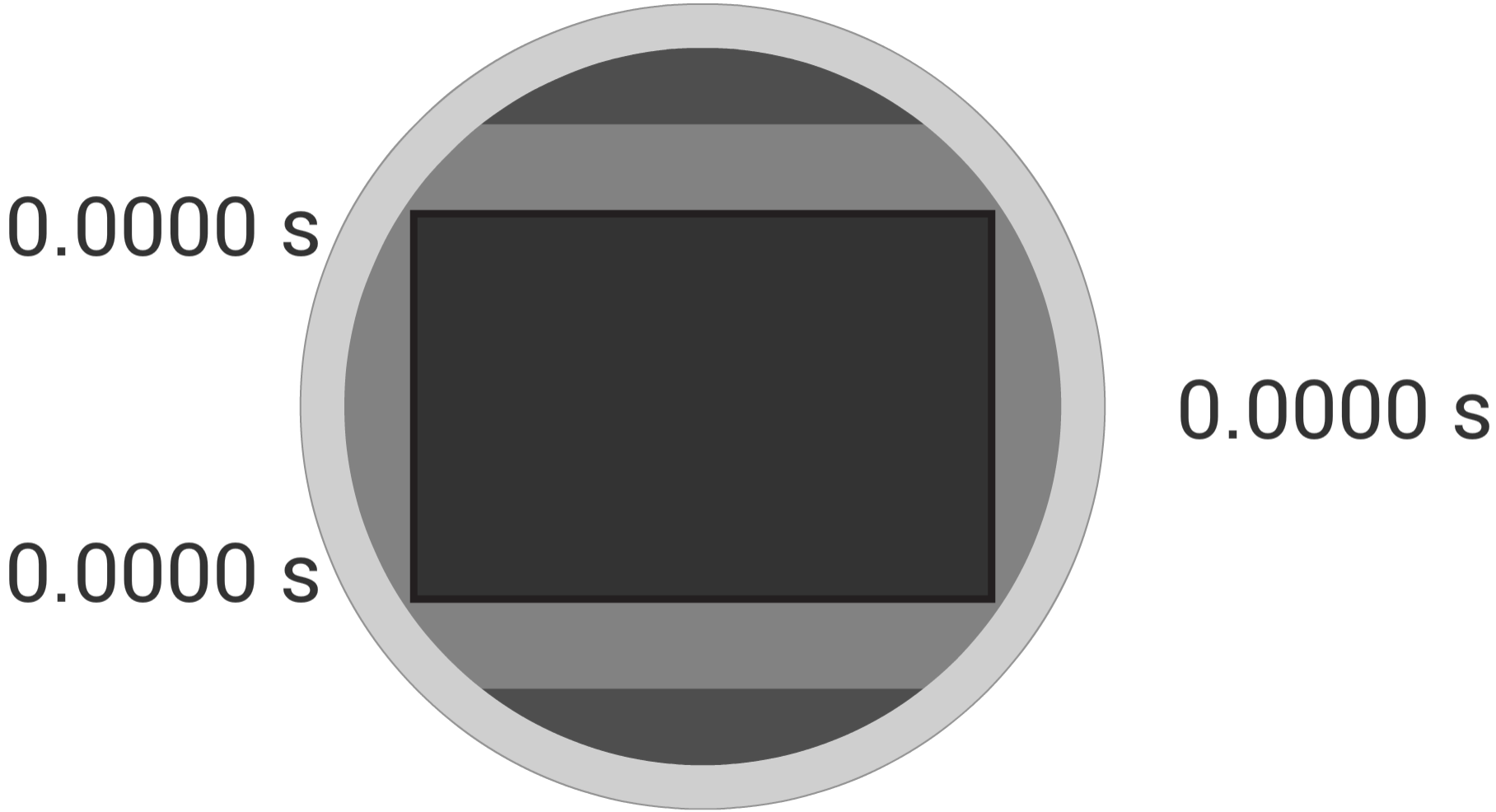
1 s

ROLLING-BLIND FOCAL PLANE SHUTTER



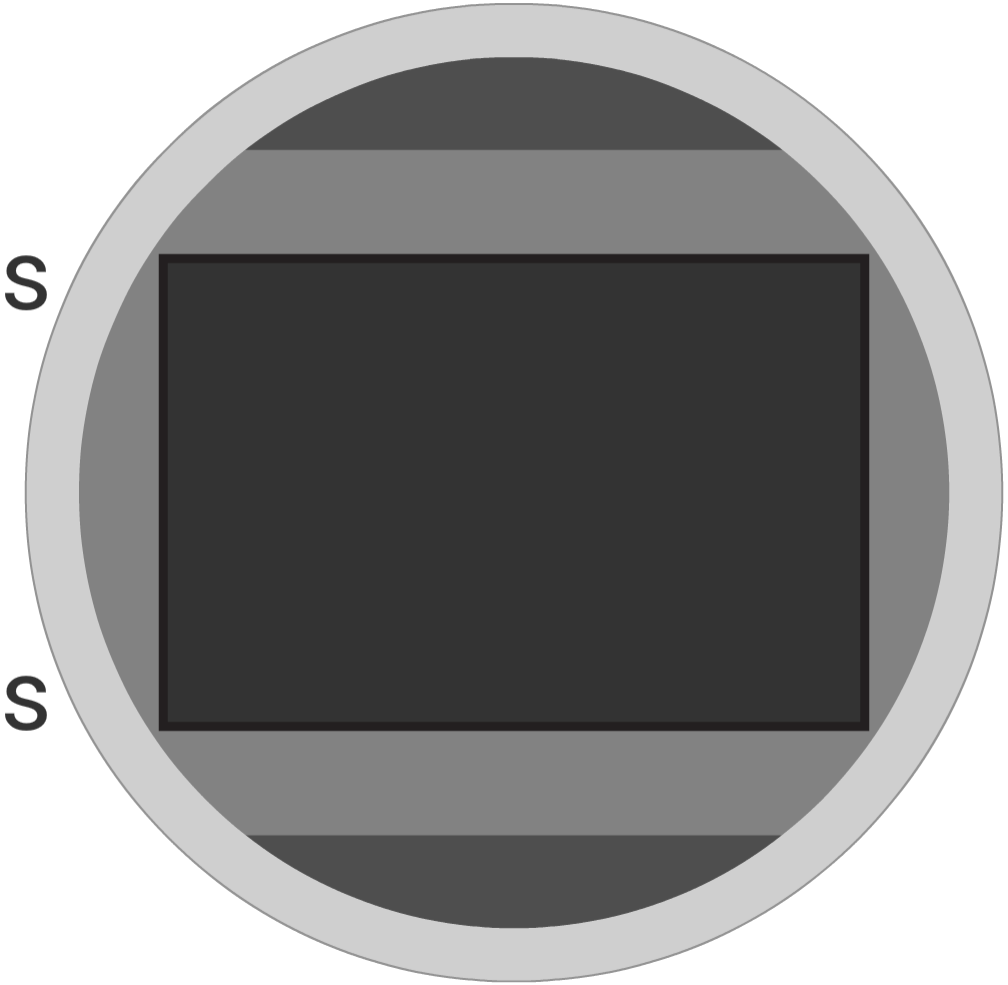
1 s

ROLLING-BLIND FOCAL PLANE SHUTTER



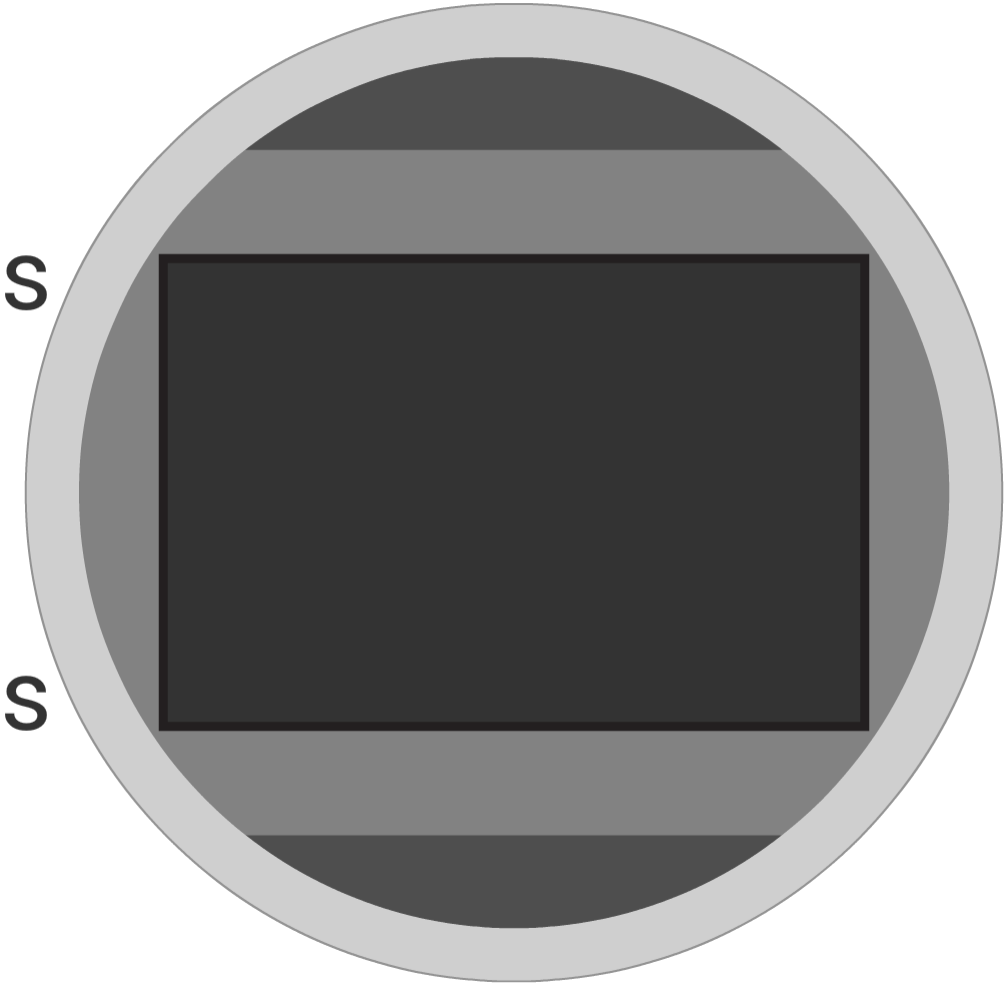
1 s

ROLLING-BLIND FOCAL PLANE SHUTTER



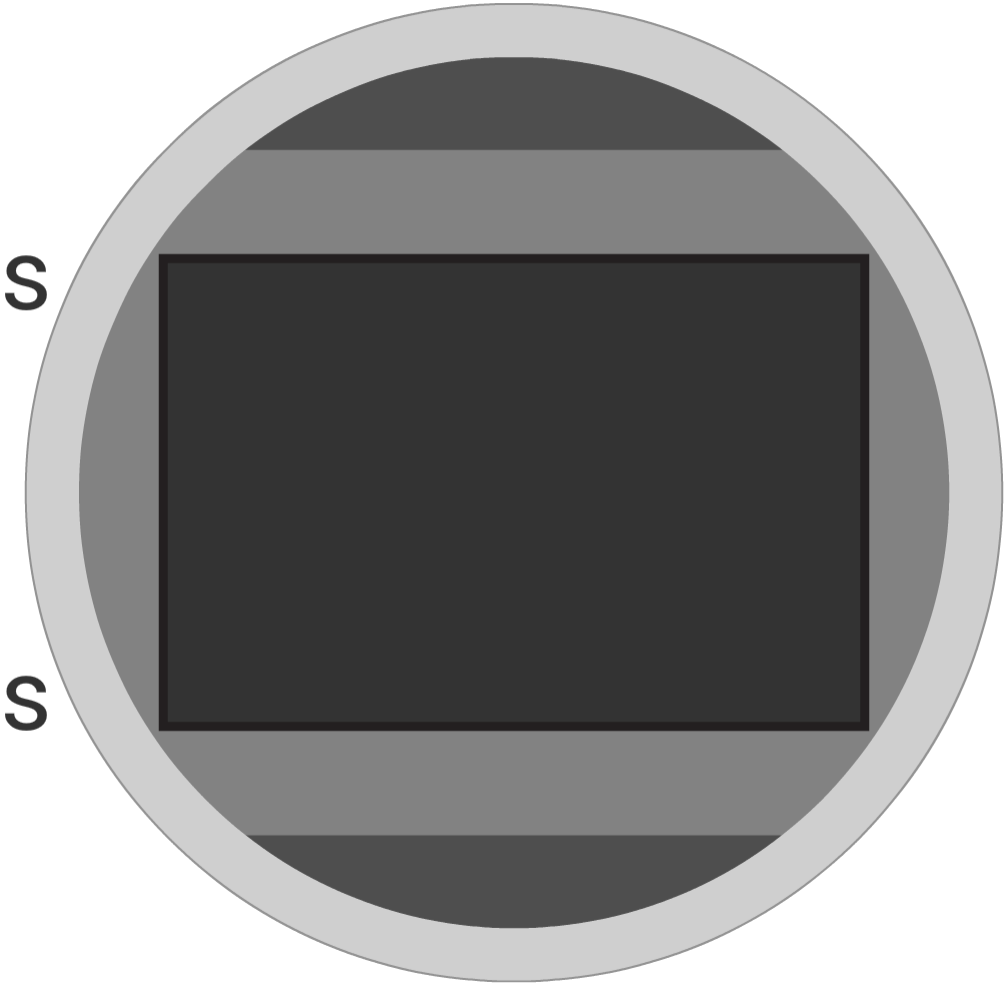
1 s
300

ROLLING-BLIND FOCAL PLANE SHUTTER



1 s / 1000

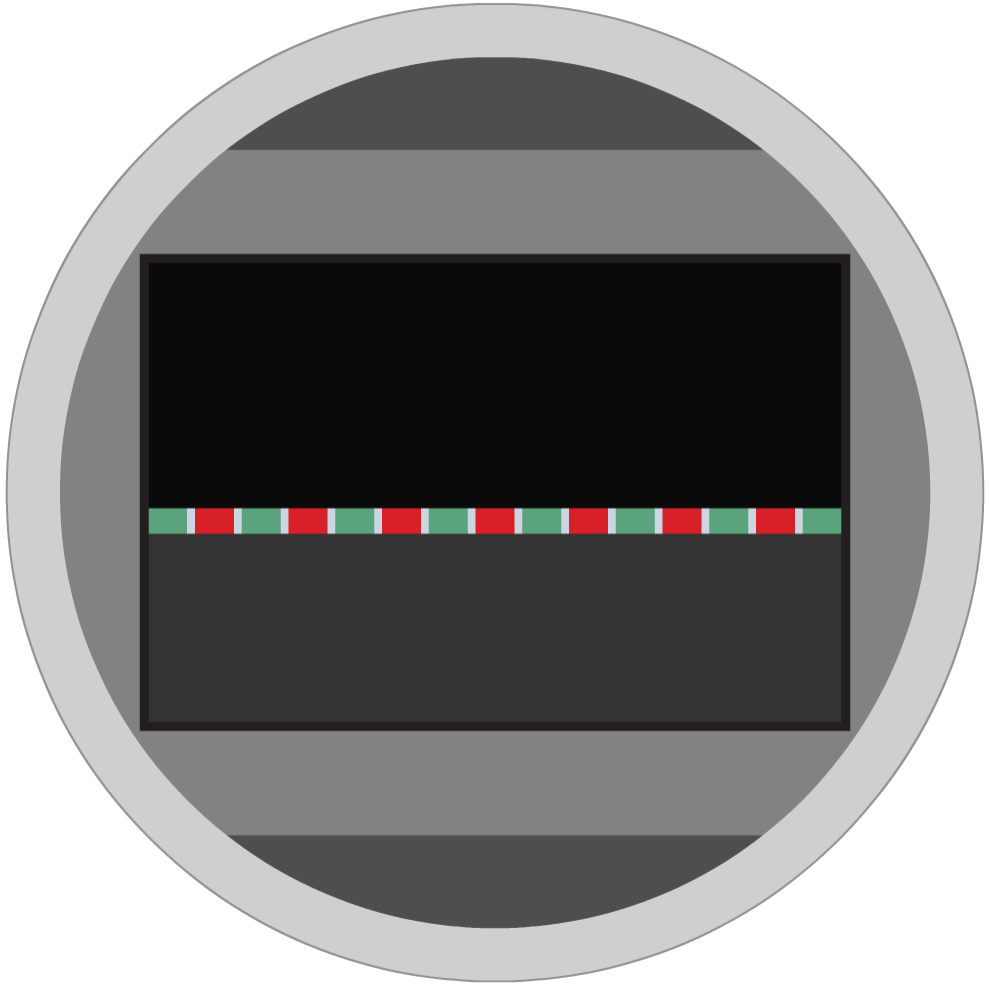
ROLLING-BLIND FOCAL PLANE SHUTTER



1 s
5000

ROLLING-BLIND FOCAL PLANE SHUTTER

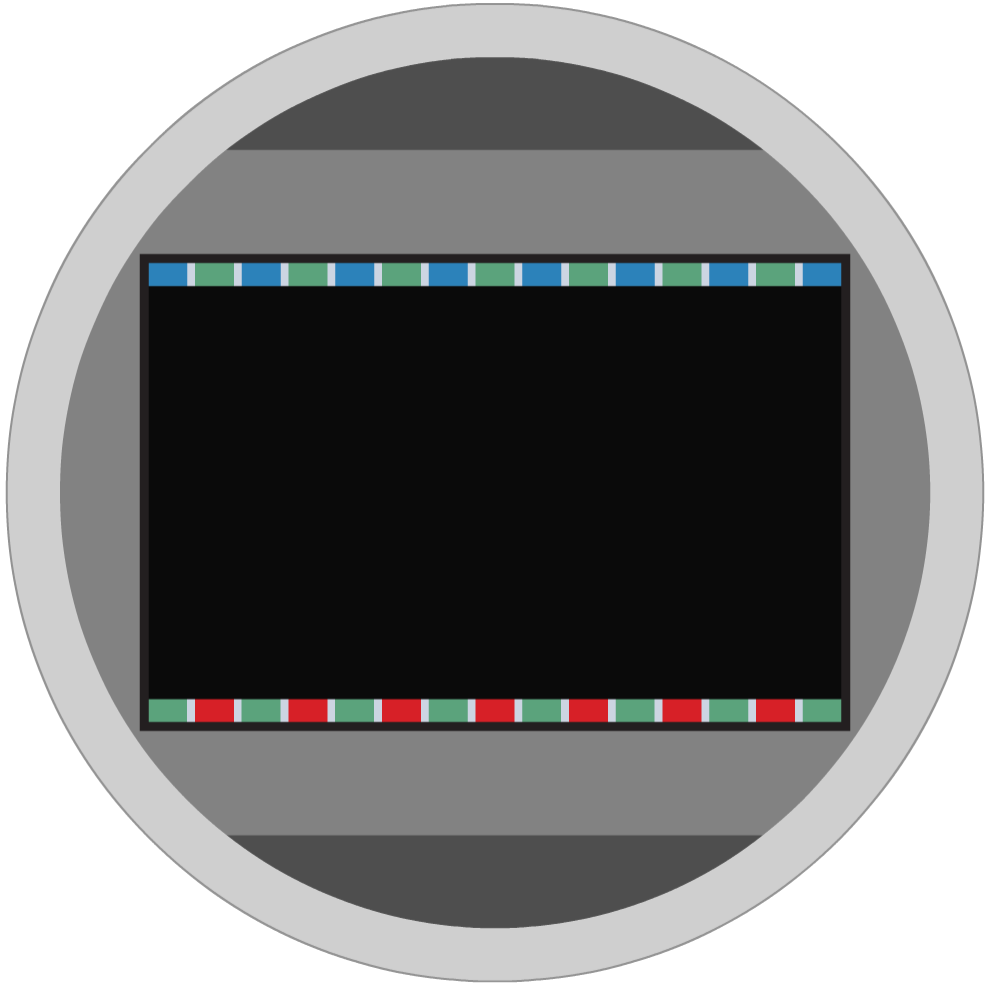
0.0002 s



1 s
5000

ROLLING-BLIND FOCAL PLANE SHUTTER

0.0002 s

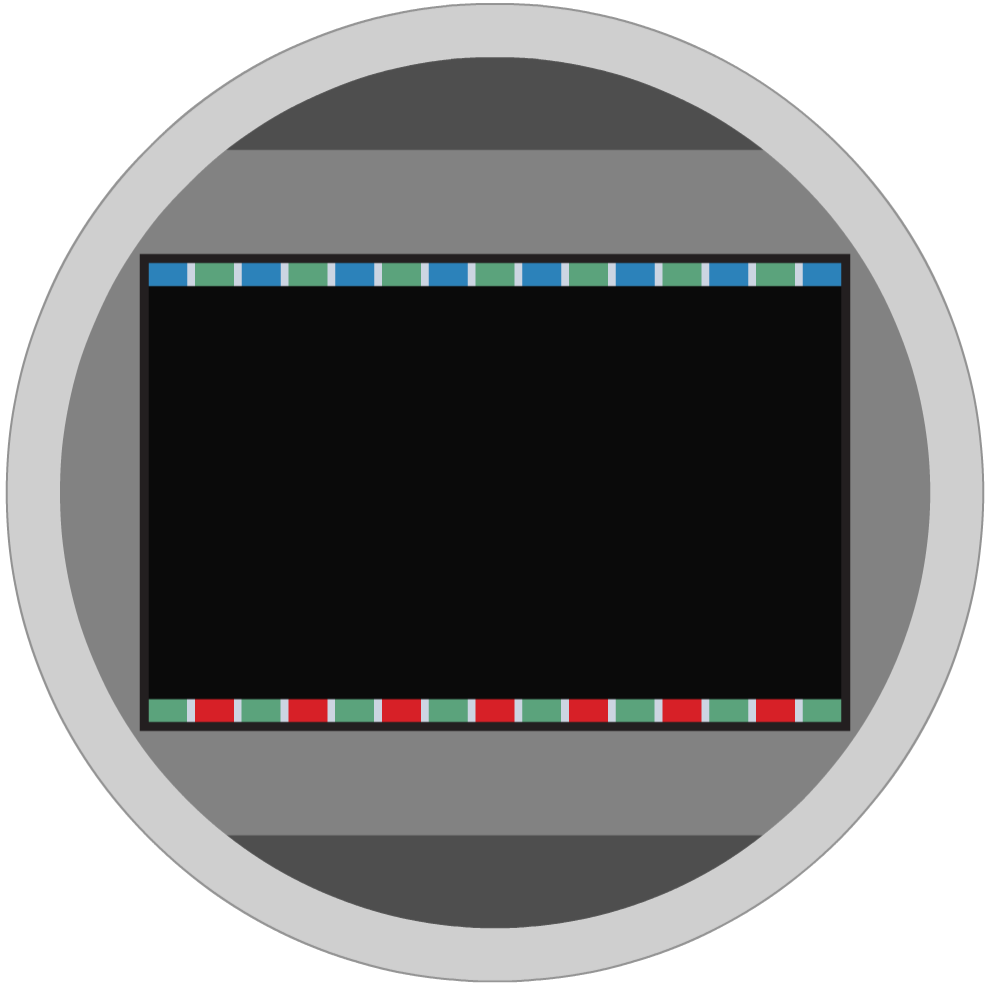


0.0002 s

1 s
5000

ROLLING-BLIND FOCAL PLANE SHUTTER

0.0002 s

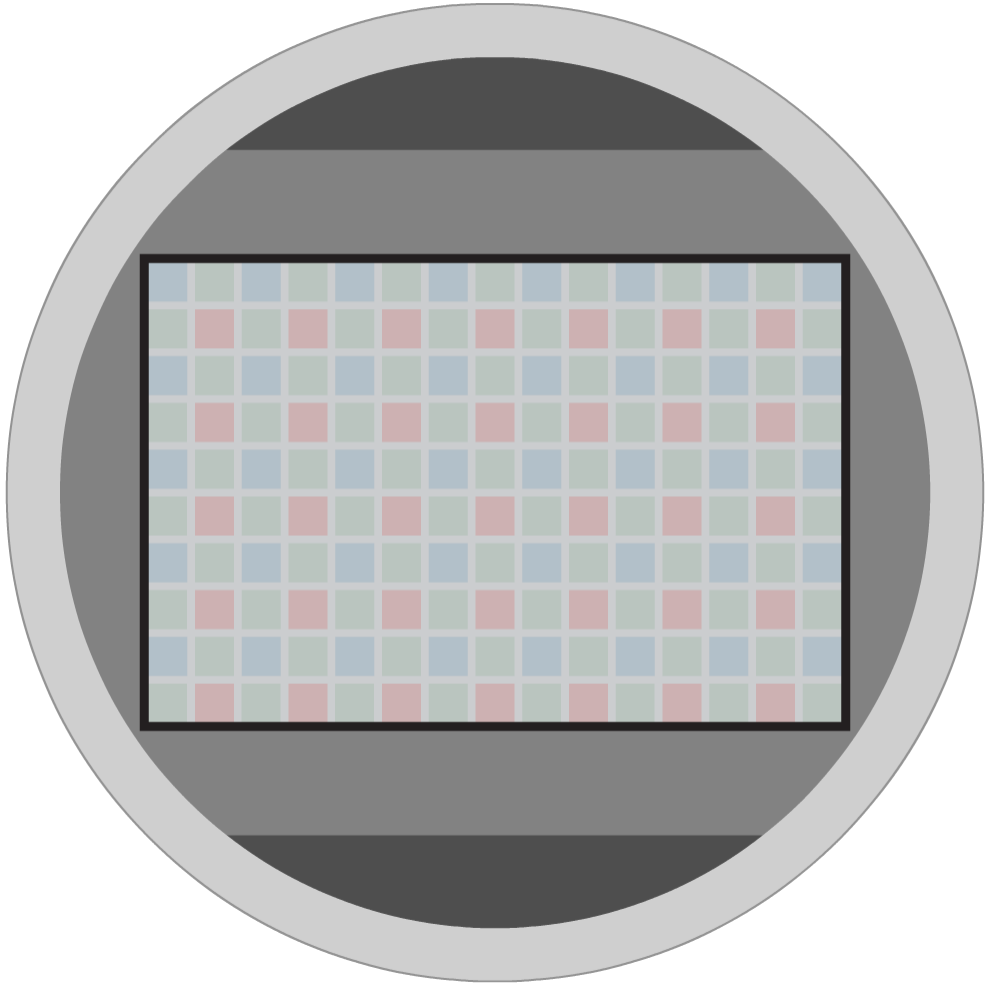


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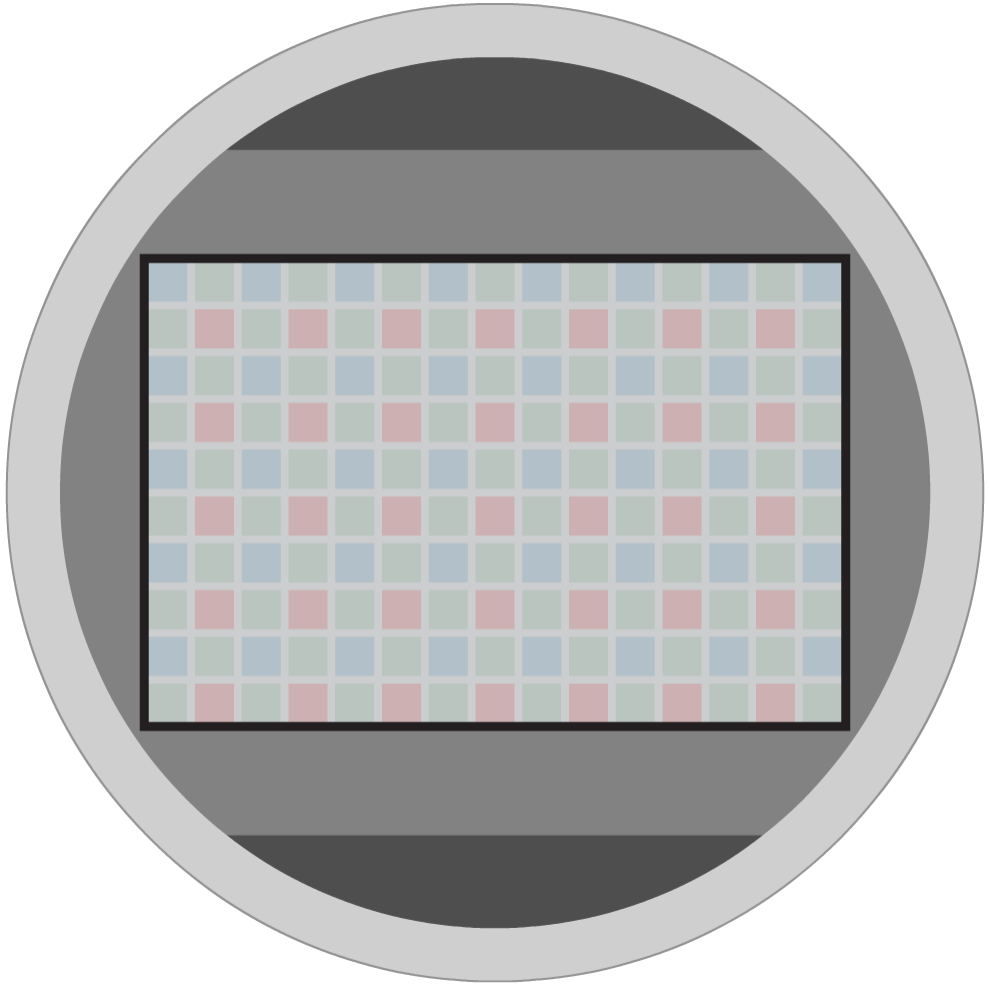
0.0002 s

1 s / 5000

ELECTRONIC SHUTTER



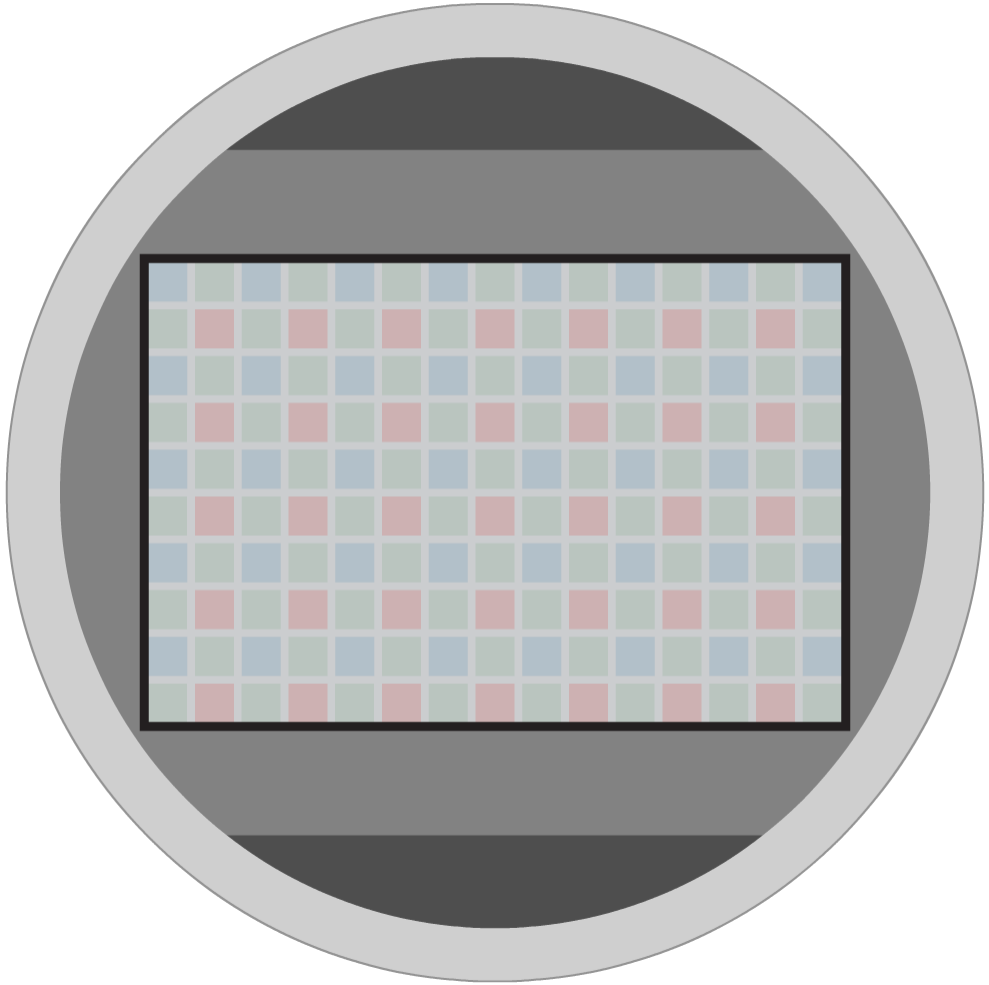
GLOBAL ELECTRONIC SHUTTER



0.00 s

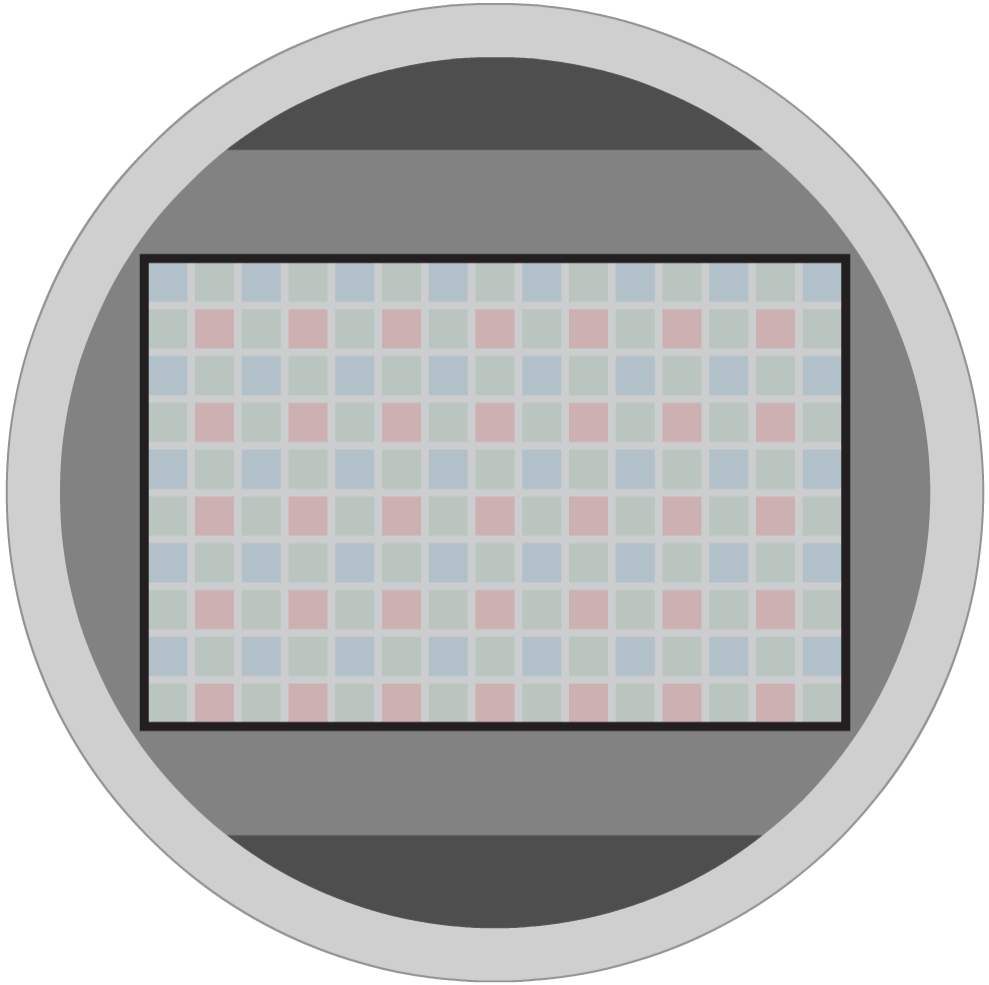
1 s

PROGRESSIVE ELECTRONIC SHUTTER



1 s

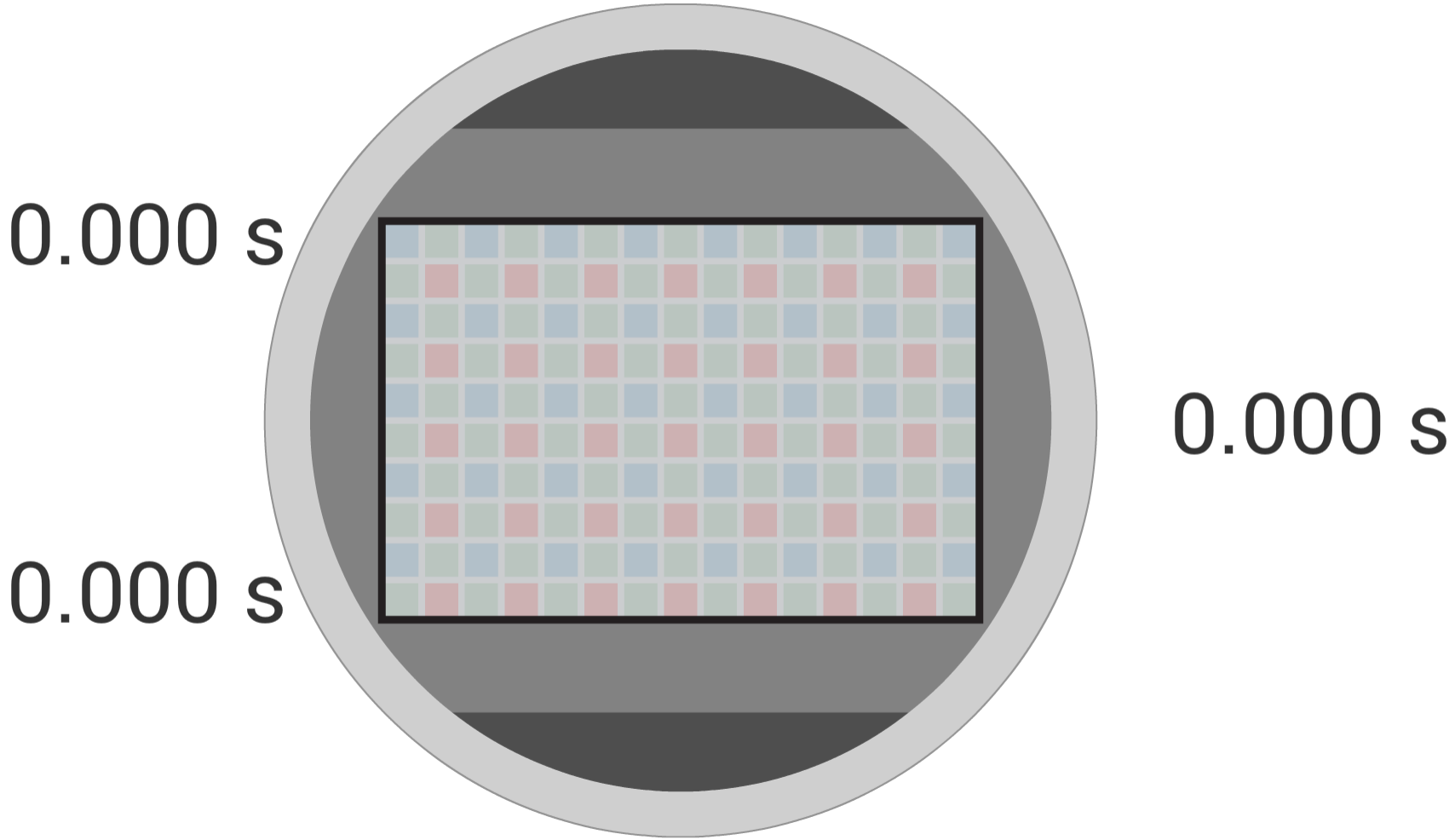
PROGRESSIVE ELECTRONIC SHUTTER



0.000 s

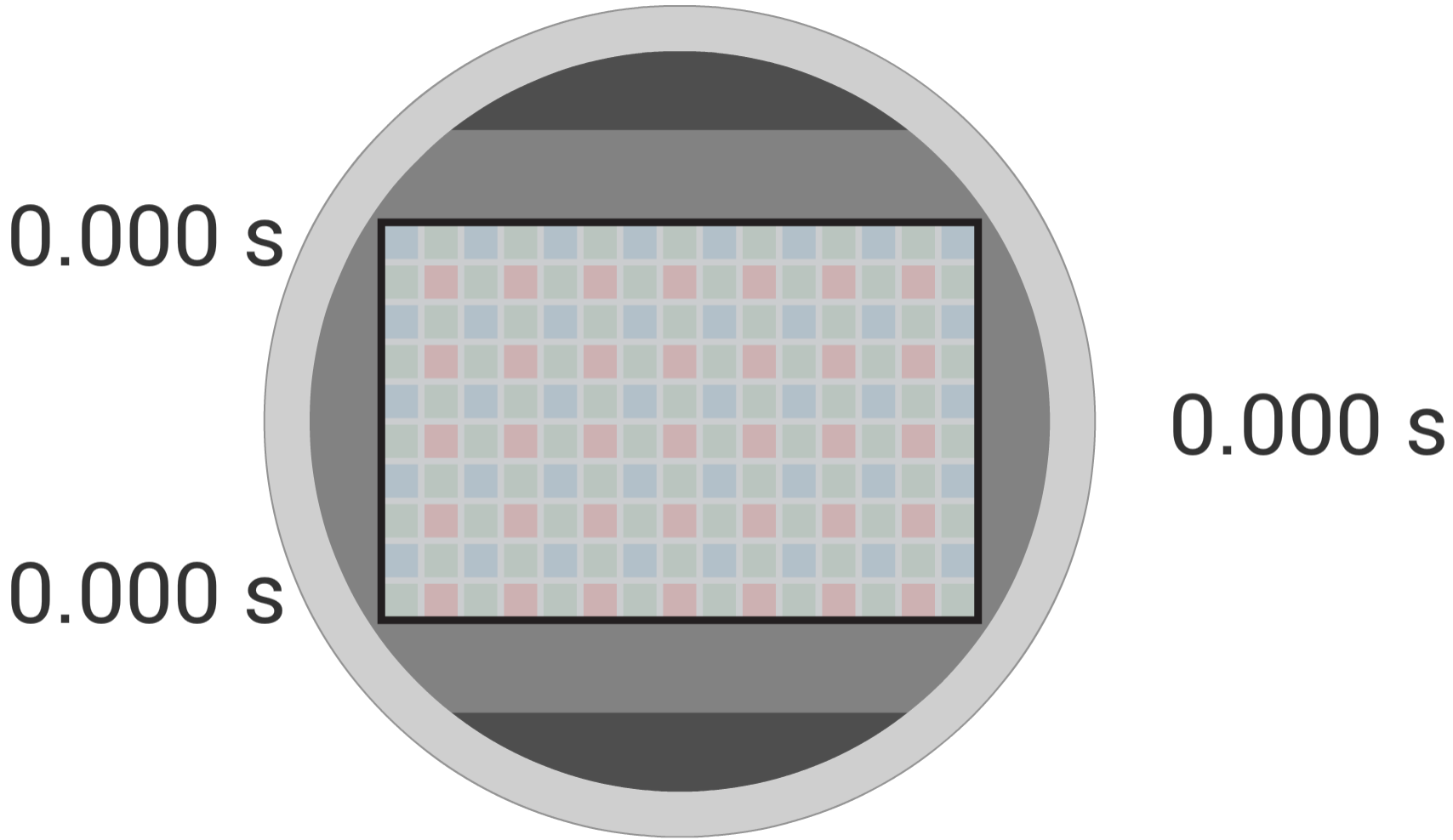
1 s

PROGRESSIVE ELECTRONIC SHUTTER



1 s

PROGRESSIVE ELECTRONIC SHUTTER



1 s
250

PROGRESSIVE ELECTRONIC SHUTTER



Zuzana Zizkova 2022

CAMERA TESTS

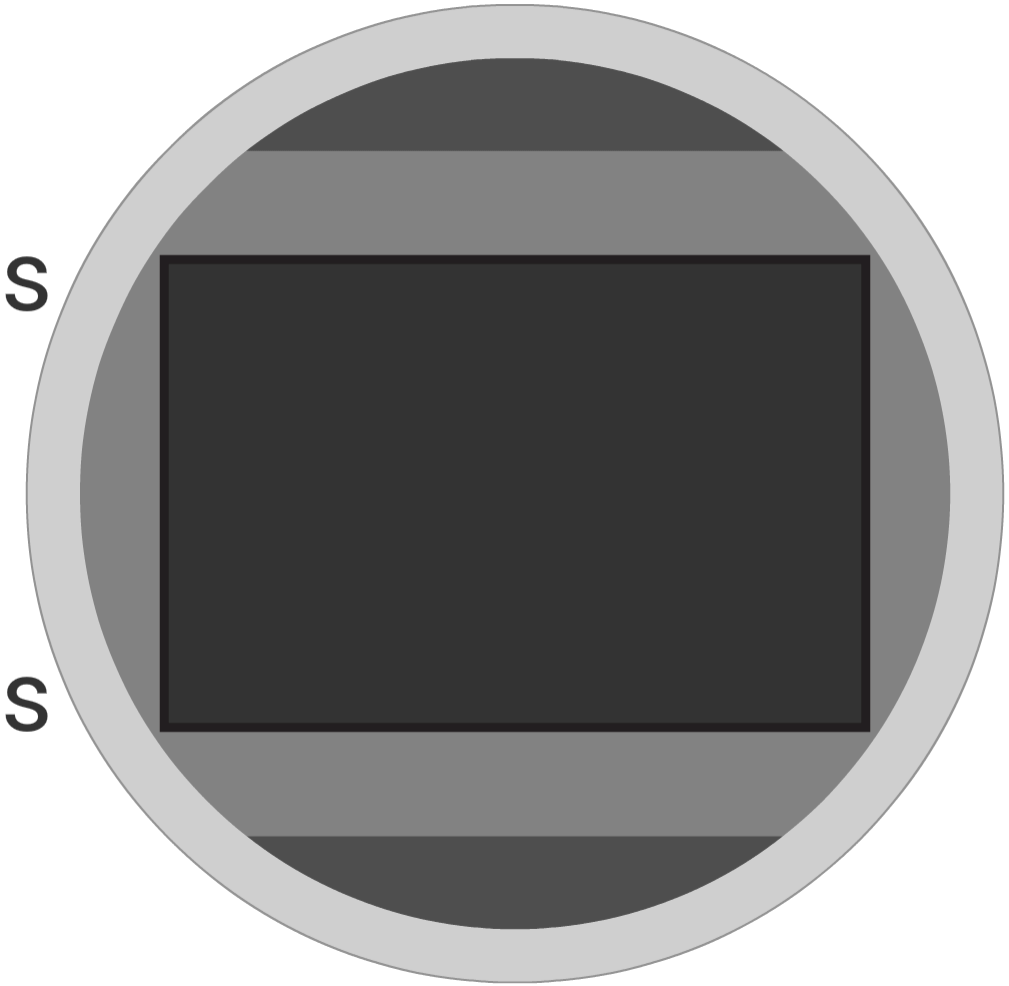


Nikon Z 7II



GoPro HERO11 Black

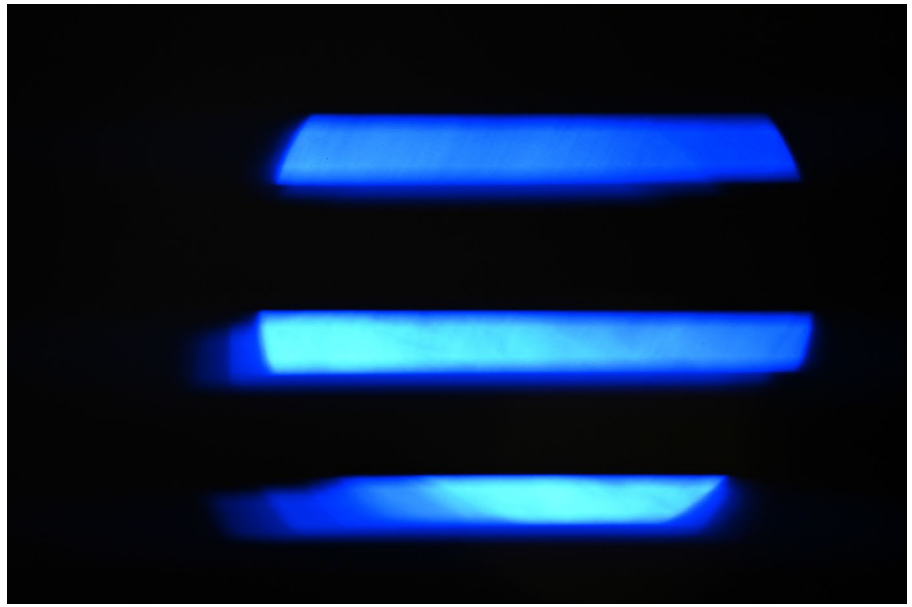
SHUTTER (READ-OUT) SPEED

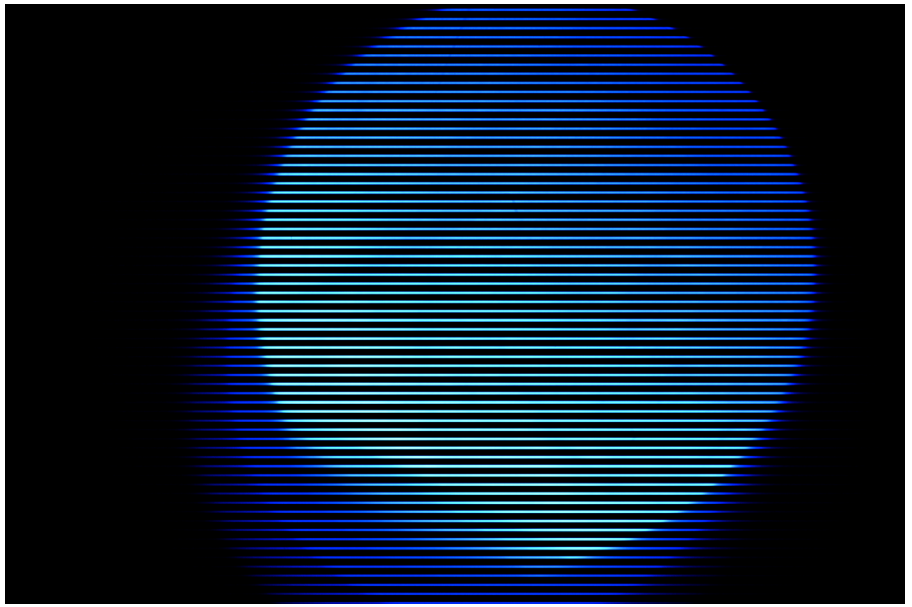


SHUTTER (READ-OUT) SPEED



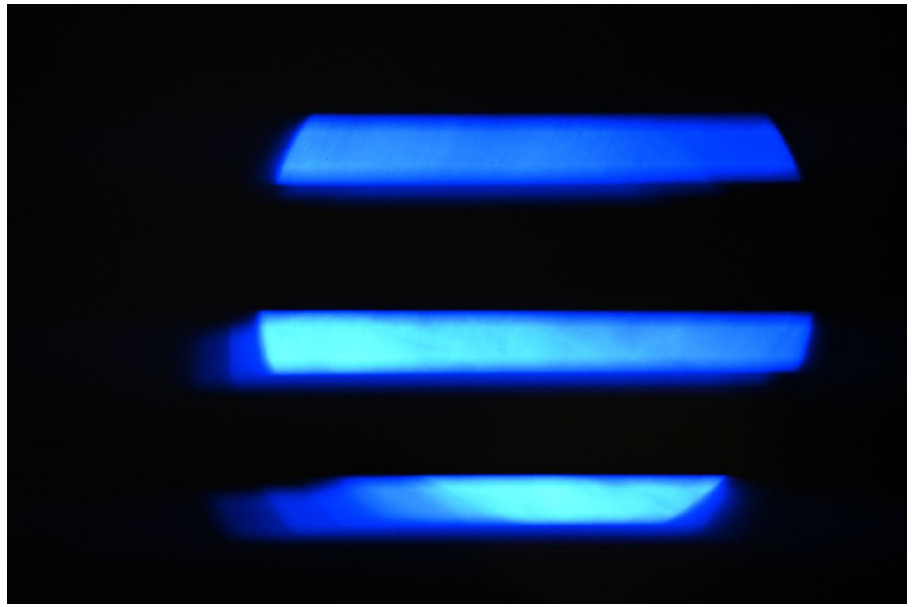
SHUTTER (READ-OUT) SPEED

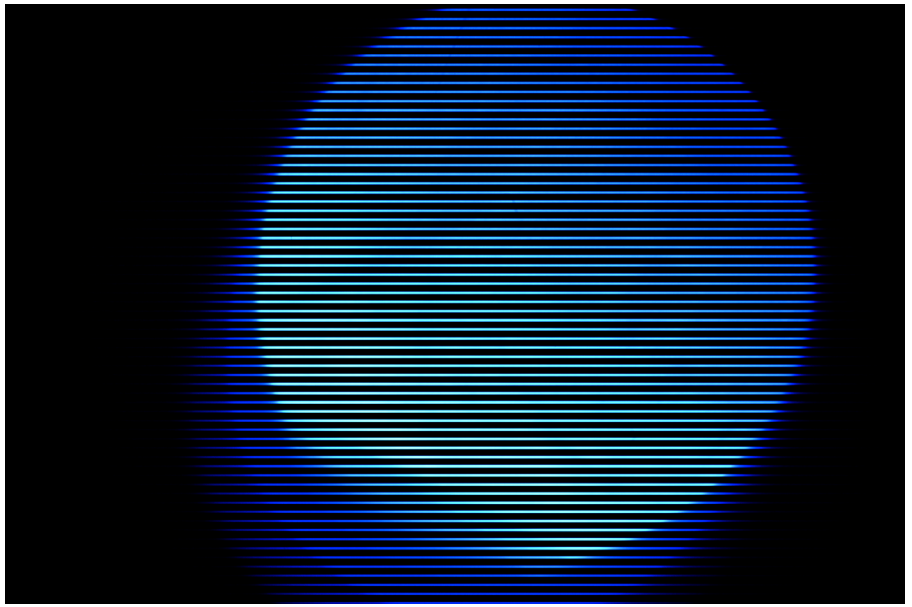


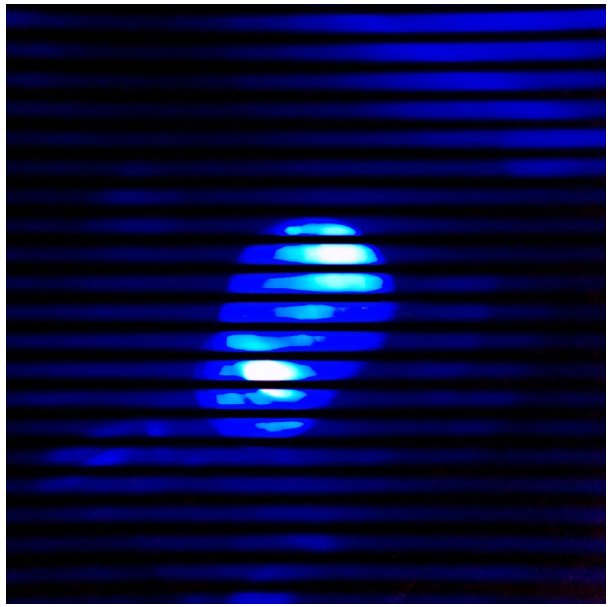


Nikon Z 7II

SHUTTER (READ-OUT) SPEED



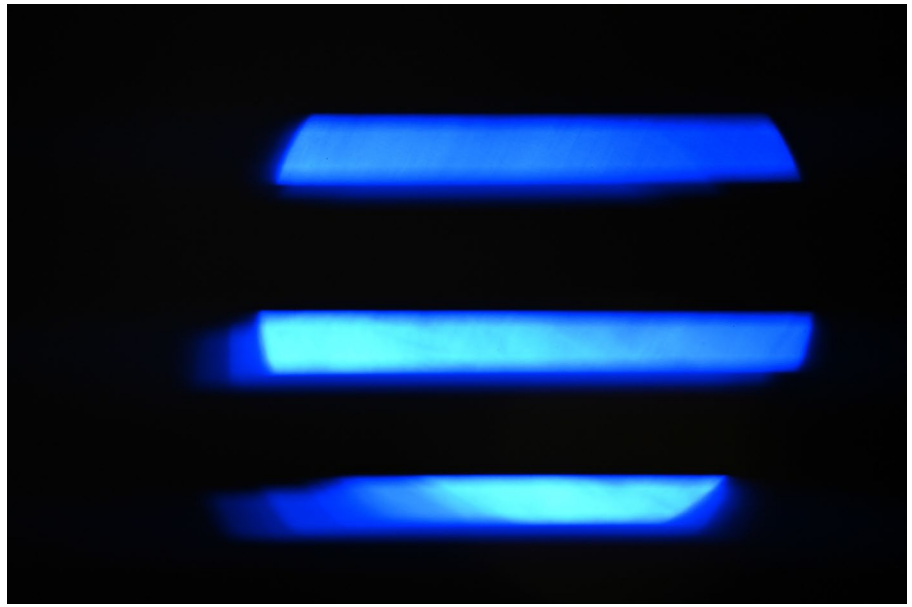


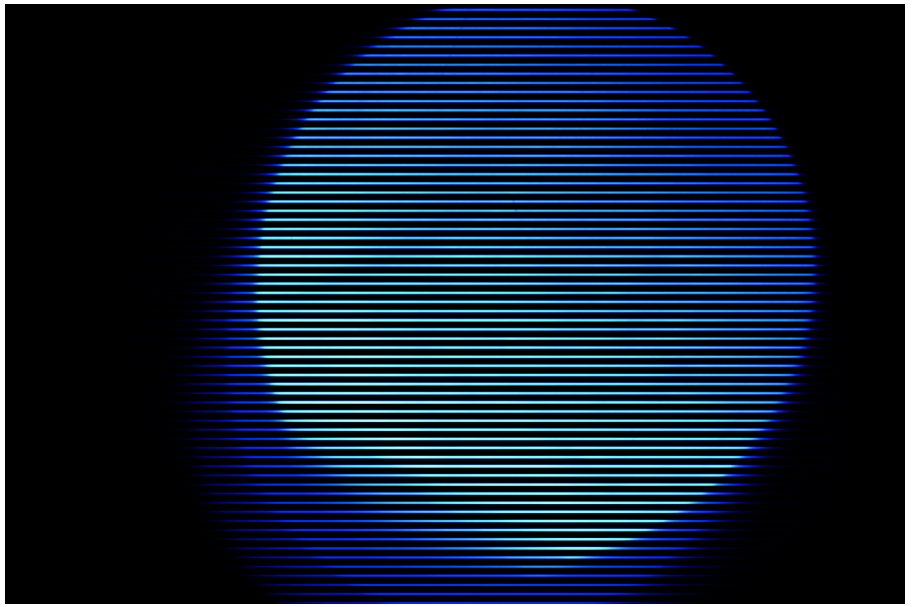


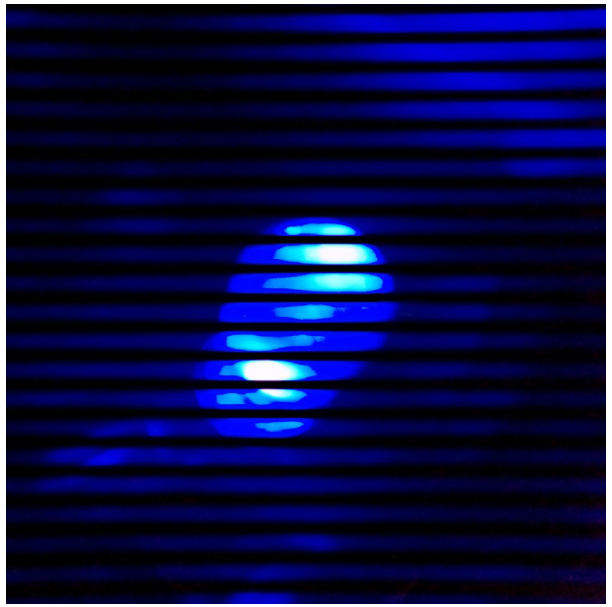
Nikon Z 7II

GoPro HERO11 Black

SHUTTER (READ-OUT) SPEED







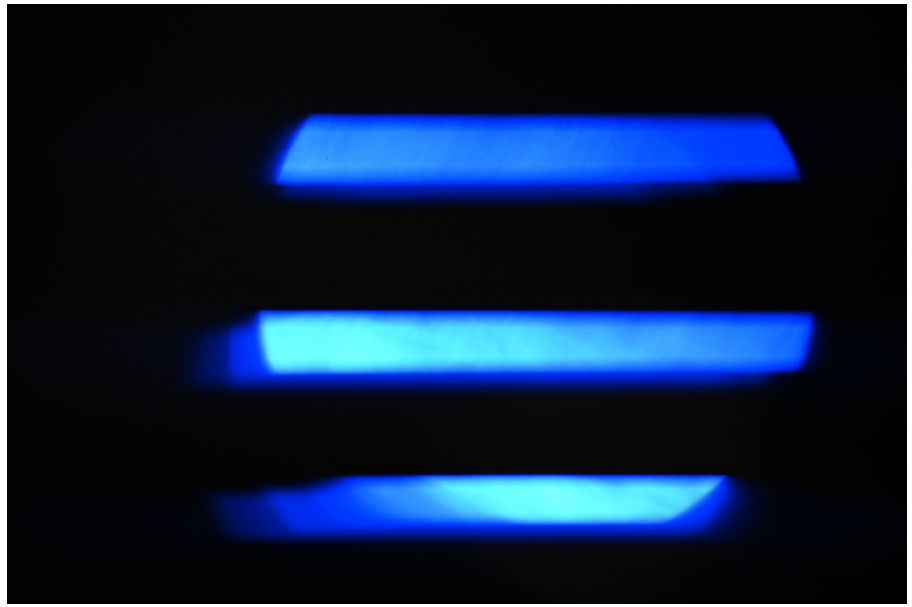
Nikon Z 7II

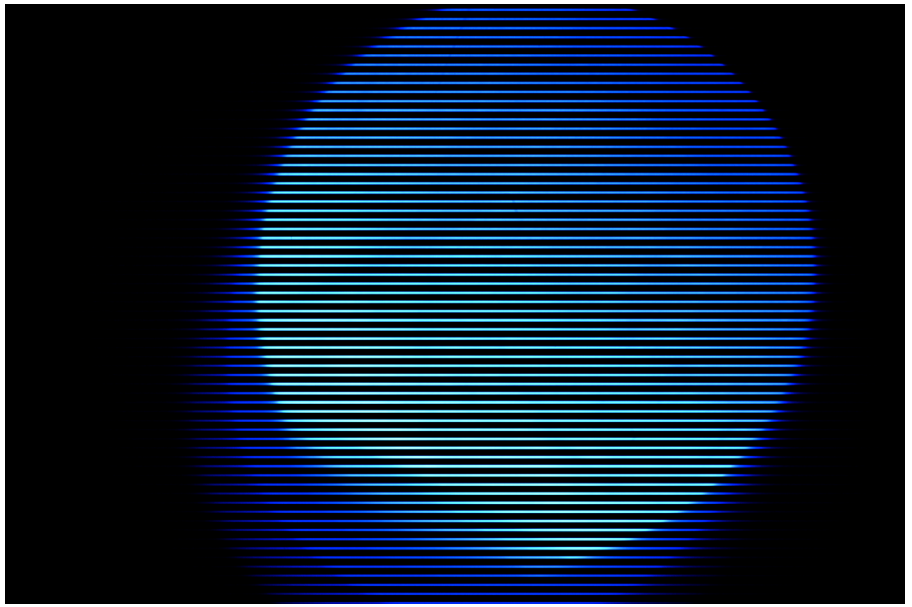
GoPro HERO11 Black

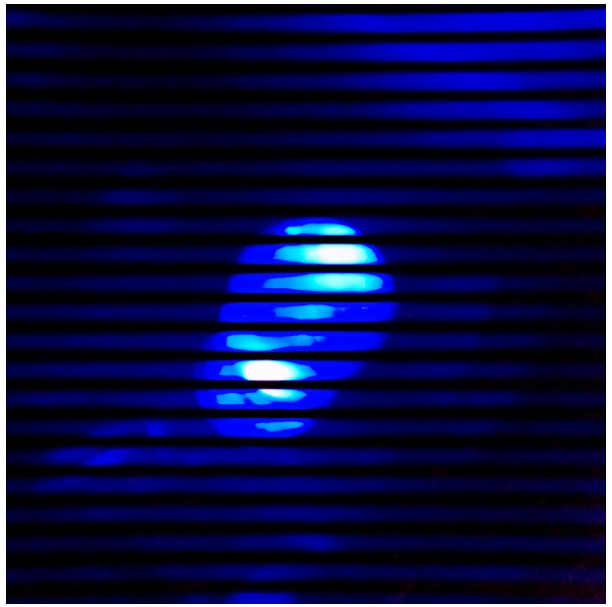
Mechanical shutter

Progressive electronic shutter

SHUTTER (READ-OUT) SPEED







Nikon Z 7II

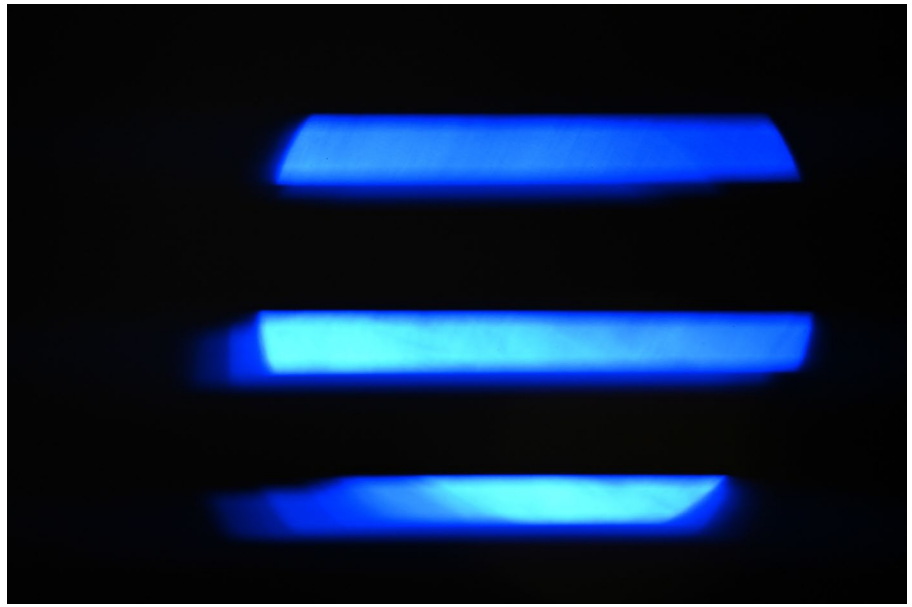
GoPro HERO11 Black

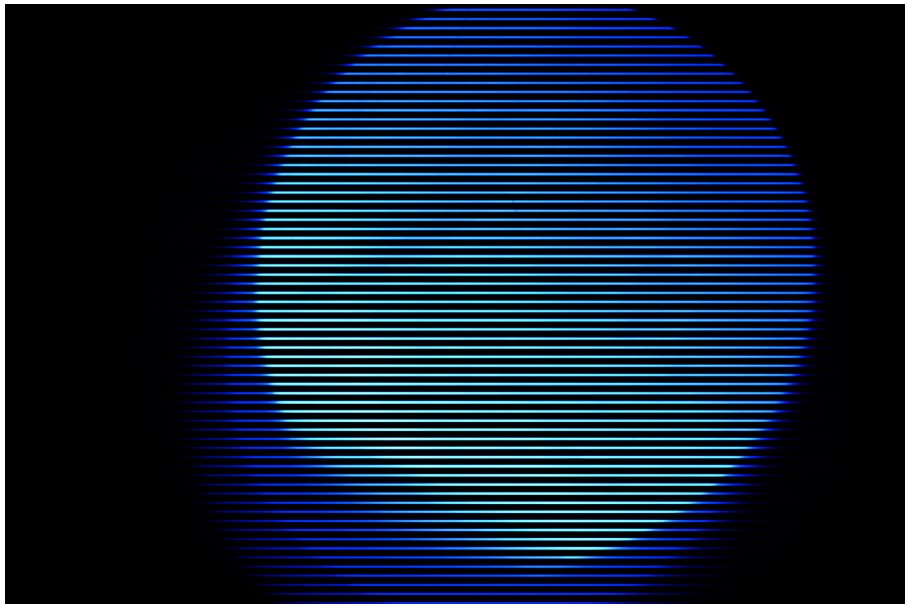
Mechanical shutter

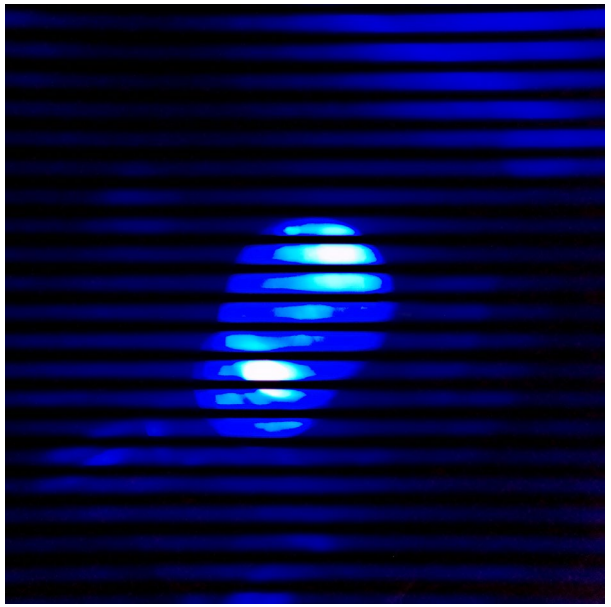
Progressive electronic shutter

1 / 300 s

SHUTTER (READ-OUT) SPEED

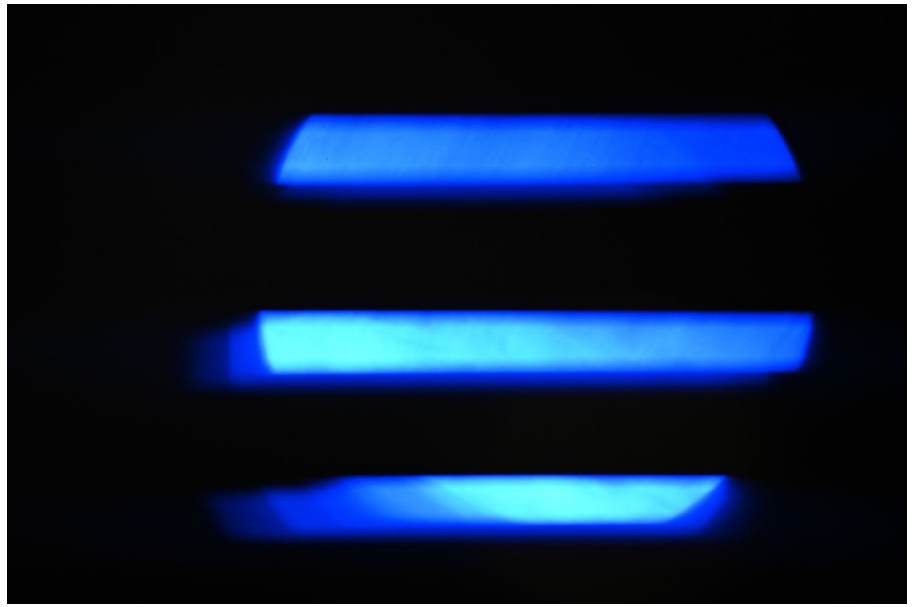


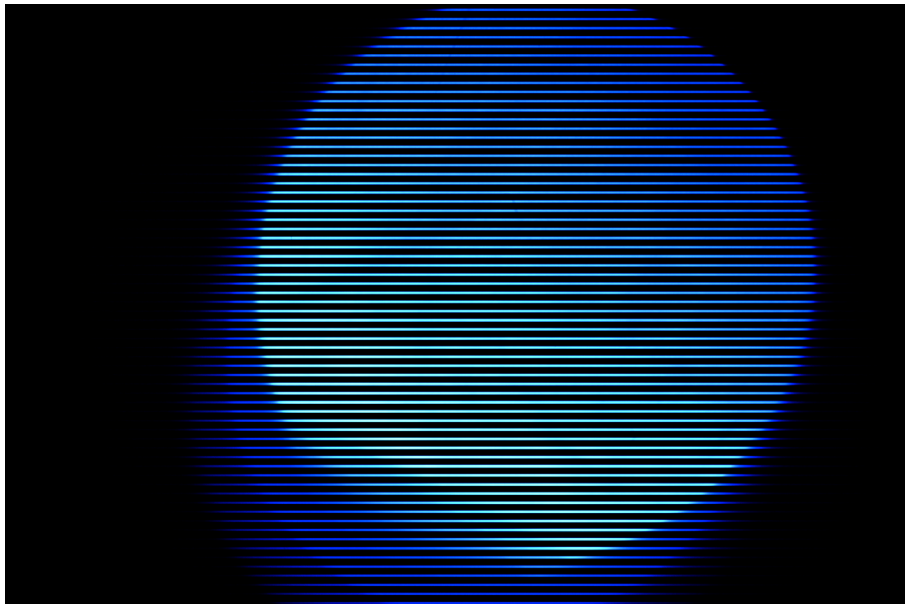


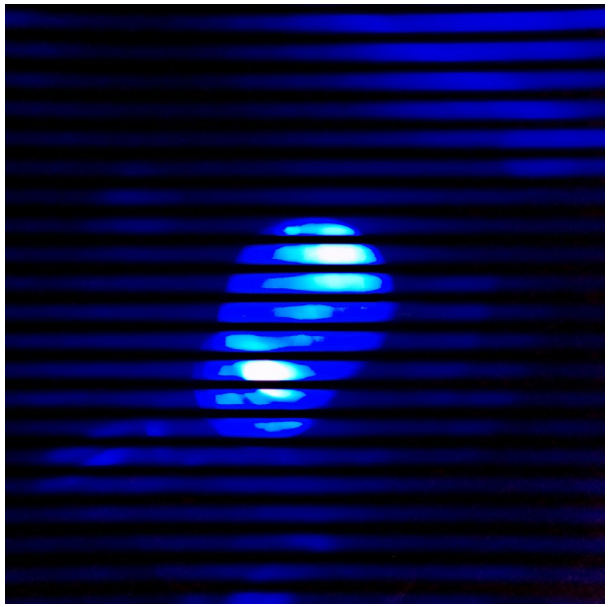


Nikon Z 7II	GoPro HERO11 Black
Mechanical shutter	Progressive electronic shutter
1 / 300 s	~ 1 / 50 s

SHUTTER (READ-OUT) SPEED

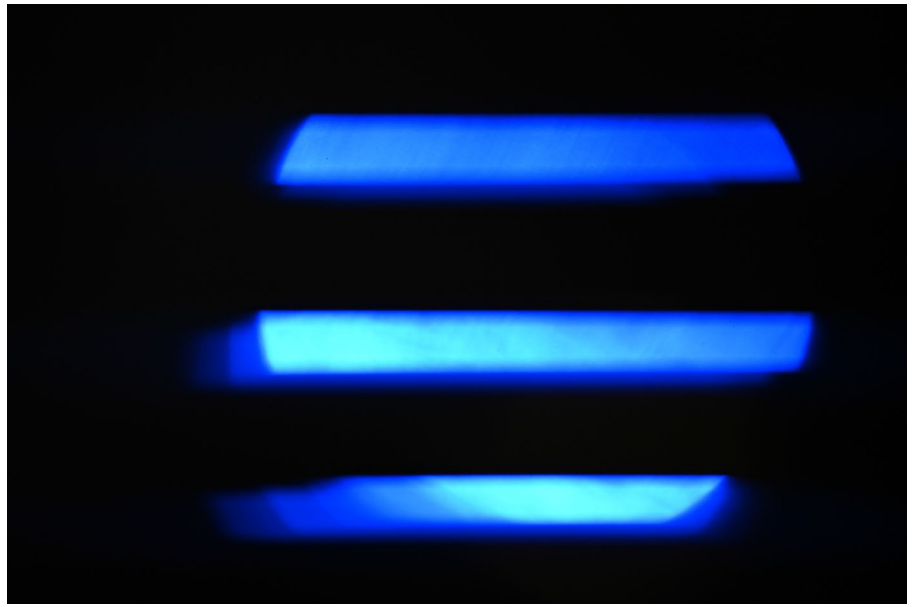


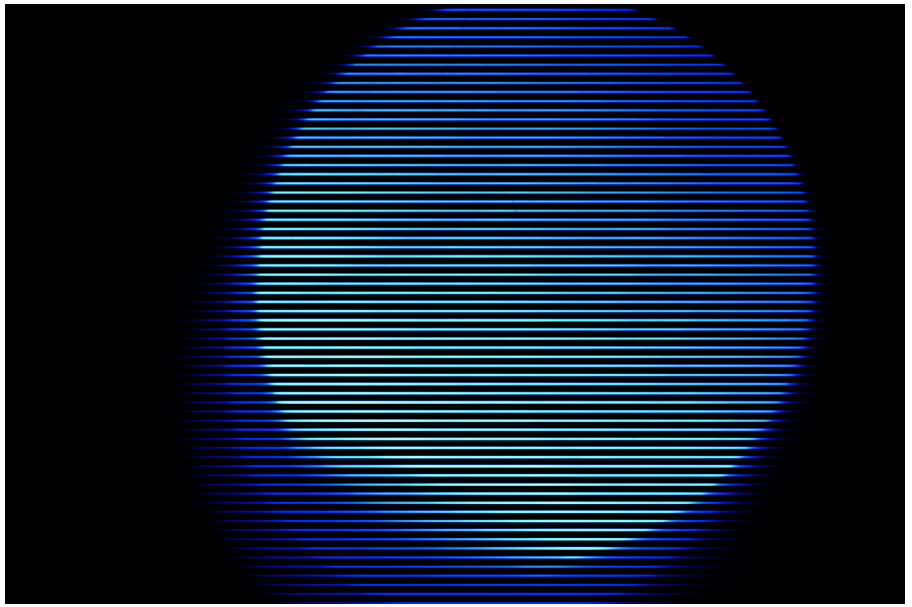


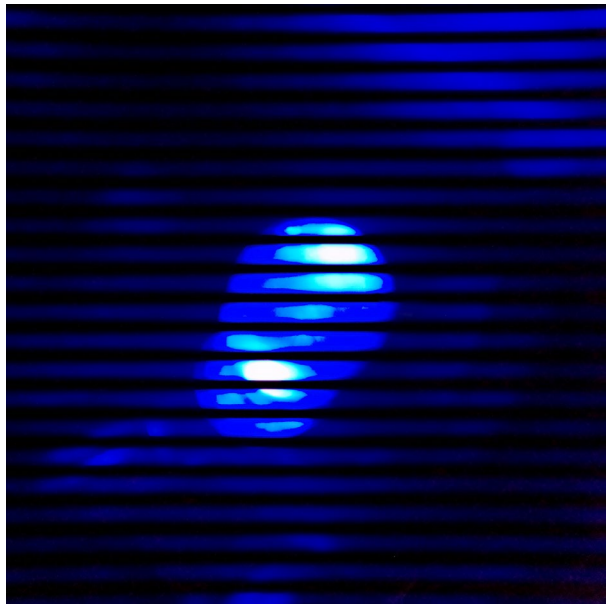


Nikon Z 7II		GoPro HERO11 Black
Mechanical shutter	Progressive electronic shutter	
1 / 300 s	~ 1 / 15 s	~ 1 / 50 s

SHUTTER (READ-OUT) SPEED







Nikon Z 7II		GoPro HERO11 Black
Mechanical shutter	Progressive electronic shutter	
1 / 300 s (25.9 km/h)	~ 1 / 15 s (1.3 km/h)	~ 1 / 50 s (1.0 km/h)

CASE STUDY 1

Graffitied wall (Vienna, 2024)



CASE STUDY 1



2x Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

CASE STUDY 1





Mechanical shutter





Progressive electronic shutter

2x Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

CASE STUDY 1





Mechanical shutter

exposure mode	*manual*
shutter speed	*1/400 s*
aperture	*f/4*
ISO	*400*
white balance	*cloudy*





Progressive electronic shutter

focusing	*off*
vibration reduct.	*off*
GSD	*? mm*
network	*51 photos*
image format	*JPG*

2x Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

CASE STUDY 1





Mechanical shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*





Progressive electronic shutter

CASE STUDY 1





Mechanical shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*





Progressive electronic shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
	~~*rolling shutter compens.*~~
	~~*regularised RS compens.*~~
	~~*full RS compensation*~~
	~~*full RS com. + adaptive I0*~~
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*

CASE STUDY 1





Mechanical shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*





Progressive electronic shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
	~~*rolling shutter compens.*~~
	regularised RS compens.
	full RS compensation
	full RS com. + adaptive IO
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points					
RMS reproj. error					
max reproj. error					

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	22.2 k				
RMS reproj. error	0.21 (0.8 pix)				
max reproj. error	0.65 (59.6 pix)				

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	22.2 k	24.6 k			
RMS reproj. error	0.21 (0.8 pix)	0.42 (1.6 pix)			
max reproj. error	0.65 (59.6 pix)	1.29 (84.3 pix)			

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	22.2 k	24.6 k	24.1 k		
RMS reproj. error	0.21 (0.8 pix)	0.42 (1.6 pix)	0.25 (1.0 pix)		
max reproj. error	0.65 (59.6 pix)	1.29 (84.3 pix)	0.77 (64.3 pix)		

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	22.2 k	24.6 k	24.1 k	24.6 k	
RMS reproj. error	0.21 (0.8 pix)	0.42 (1.6 pix)	0.25 (1.0 pix)	0.18 (0.7 pix)	
max reproj. error	0.65 (59.6 pix)	1.29 (84.3 pix)	0.77 (64.3 pix)	0.56 (33.1 pix)	

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	22.2 k	24.6 k	24.1 k	24.6 k	24.6 k
RMS reproj. error	0.21 (0.8 pix)	0.42 (1.6 pix)	0.25 (1.0 pix)	0.18 (0.7 pix)	0.18 (0.7 pix)
max reproj. error	0.65 (59.6 pix)	1.29 (84.3 pix)	0.77 (64.3 pix)	0.56 (33.1 pix)	0.56 (33.1 pix)

CASE STUDY 1

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	22.2 k	24.6 k	24.1 k	24.6 k	24.6 k
RMS reproj. error	0.21 (0.8 pix)	0.42 (1.6 pix)	0.25 (1.0 pix)	0.18 (0.7 pix)	0.18 (0.7 pix)
max reproj. error	0.65 (59.6 pix)	1.29 (84.3 pix)	0.77 (64.3 pix)	0.56 (33.1 pix)	0.56 (33.1 pix)

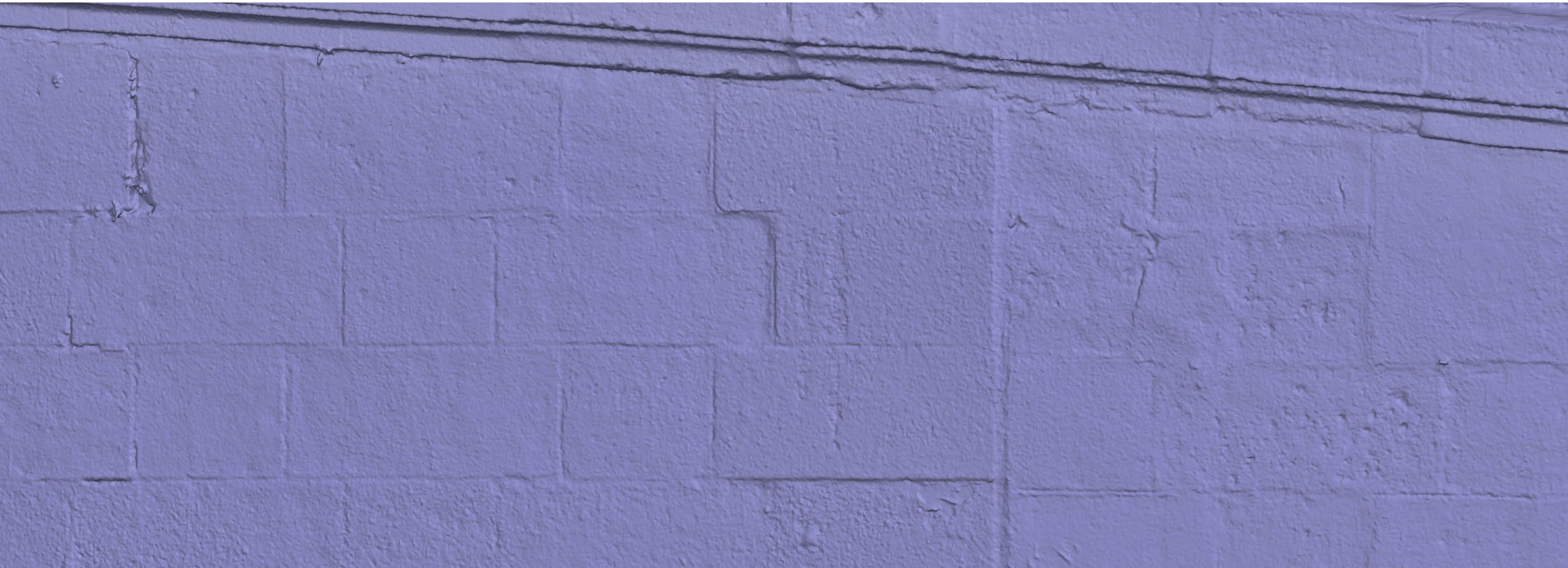
CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



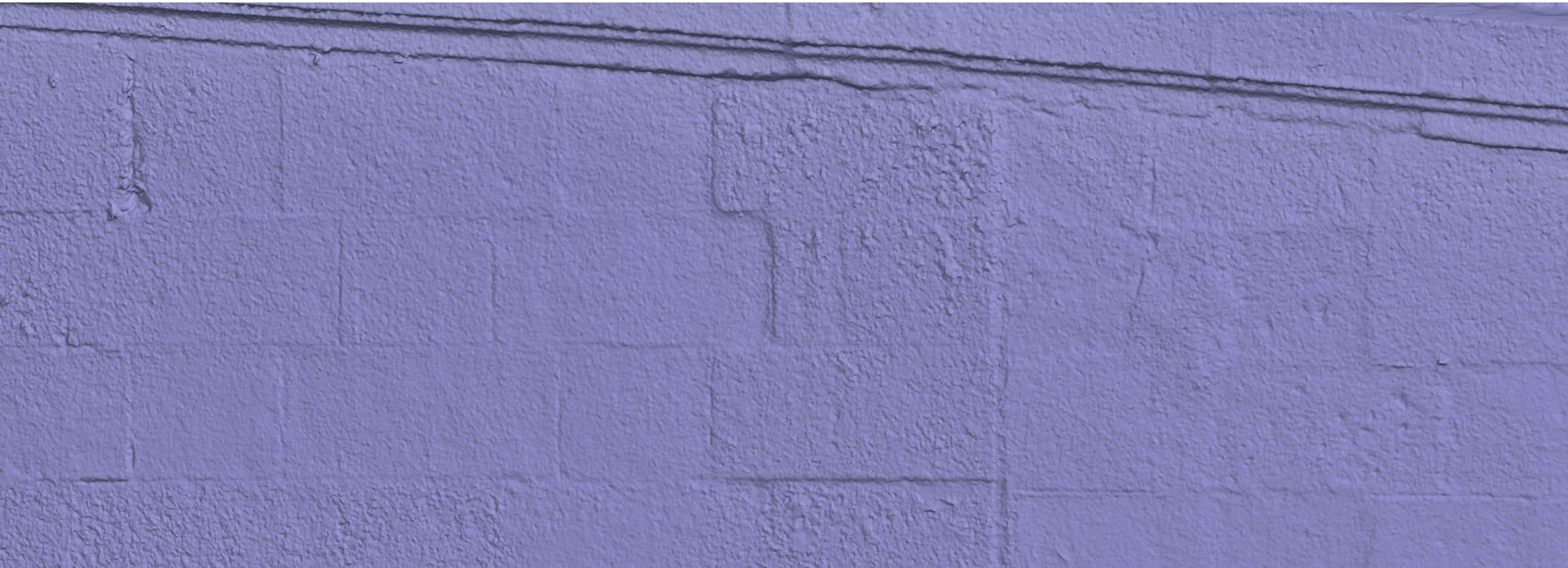
CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



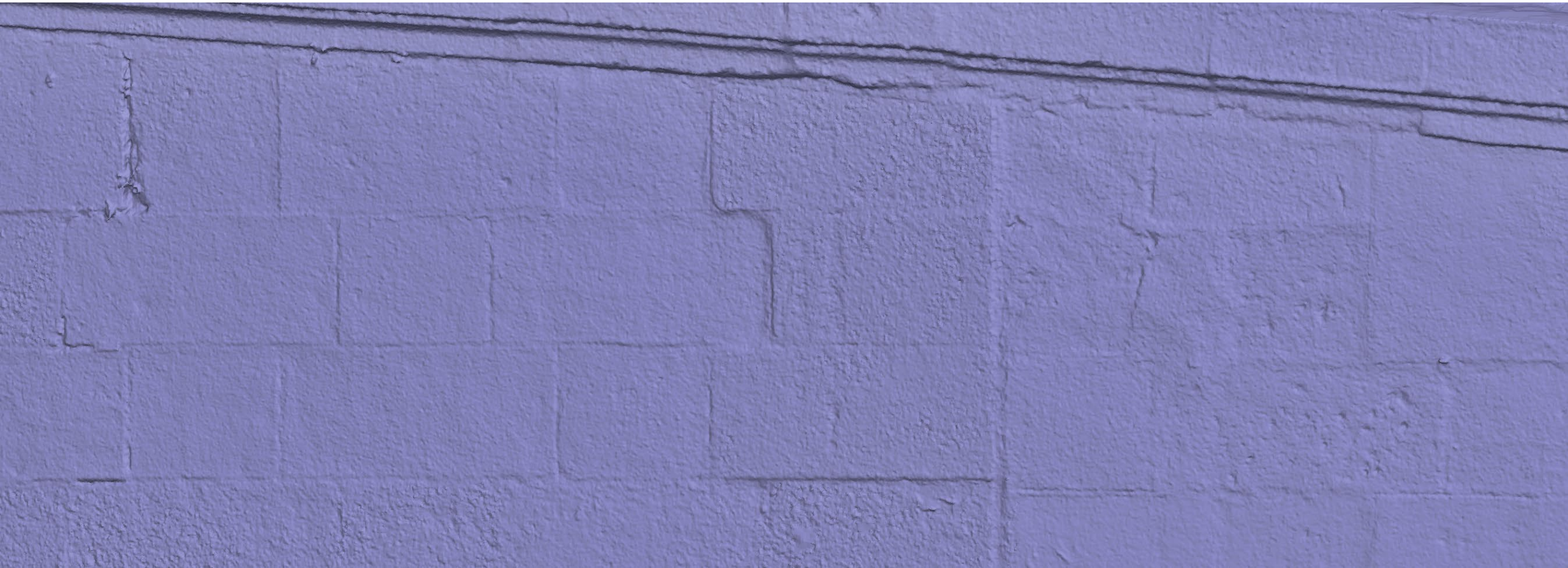
CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



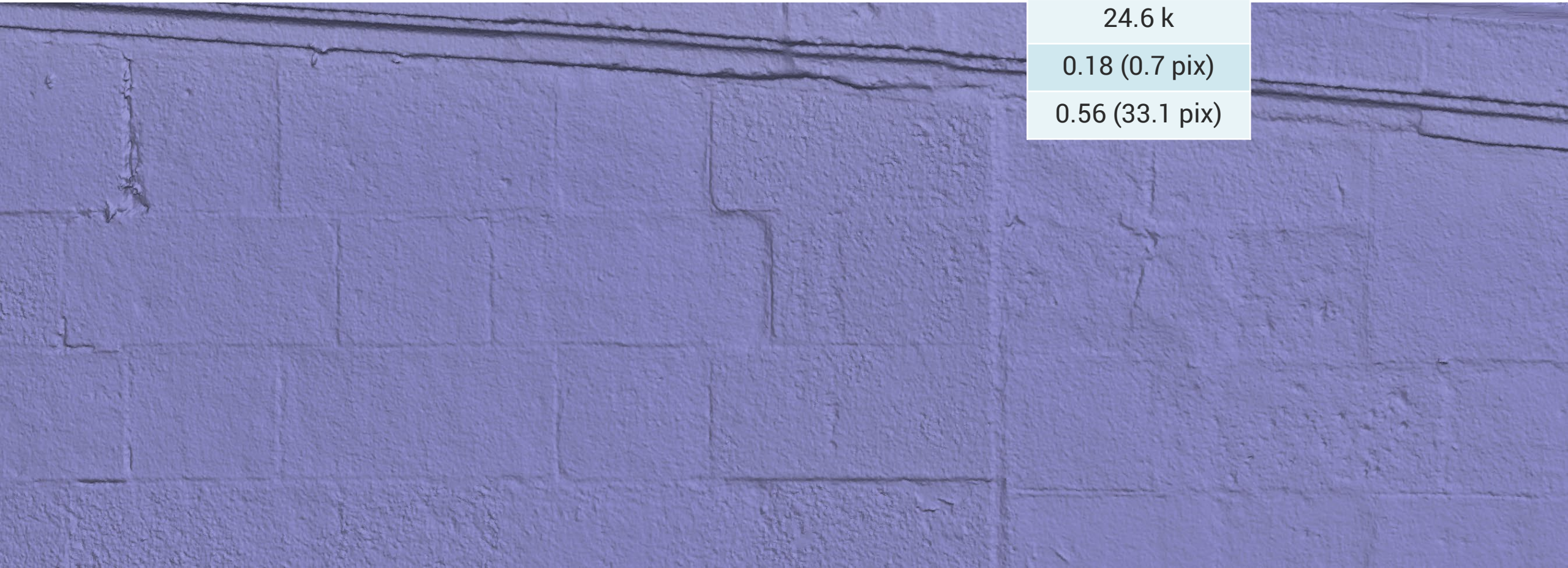
CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



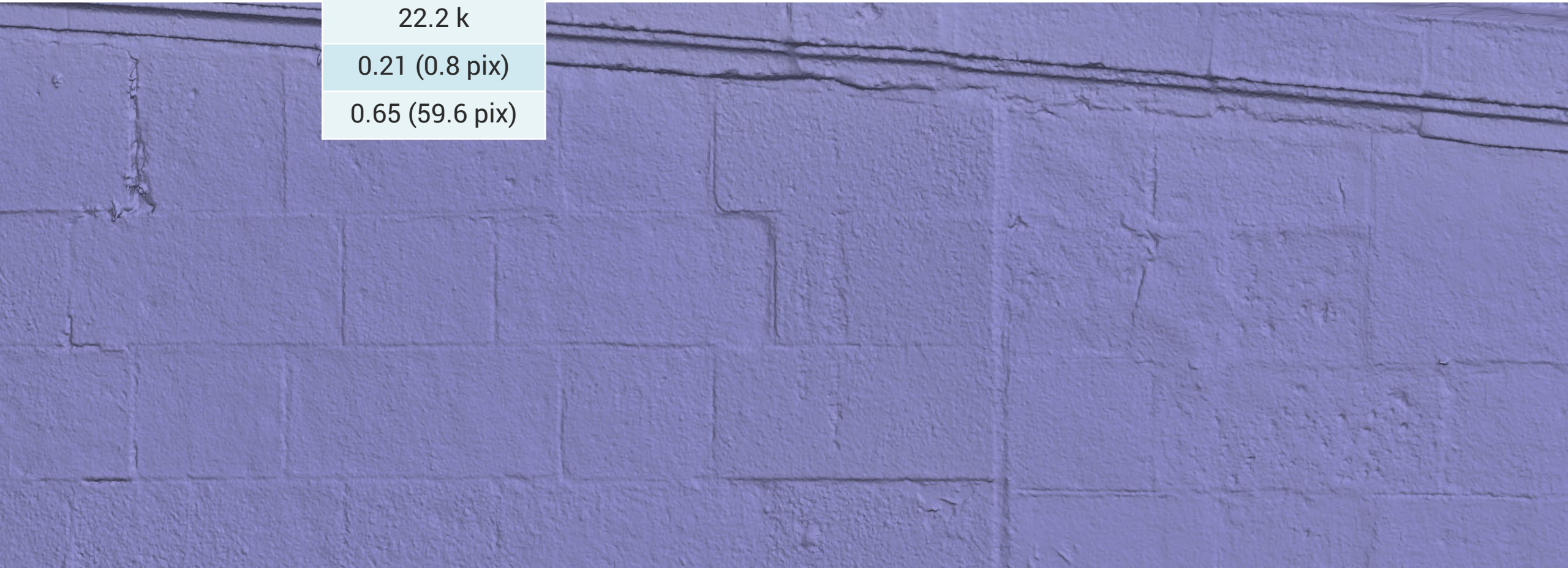
CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO
			24.6 k	
			0.18 (0.7 pix)	
			0.56 (33.1 pix)	



CASE STUDY 1

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO
22.2 k				
0.21 (0.8 pix)				
0.65 (59.6 pix)				



CASE STUDY 2

Otto Wagner Pavilion (Vienna, 1899)



CASE STUDY 2



2x Nikon Z7 II + Nikon NIKKOR Z 50 mm f/1.8 S

CASE STUDY 2



Mechanical shutter



Progressive electronic shutter

2x Nikon Z7 II + Nikon NIKKOR Z 50 mm f/1.8 S

CASE STUDY 2





Mechanical shutter

exposure mode	*manual*
shutter speed	*1/800 s*
aperture	*f/4*
ISO	*250*
white balance	*cloudy*





Progressive electronic shutter

focusing	*off*
vibration reduct.	*off*
GSD	*1.3 mm*
network	*43 photos*
image format	*JPG*

2x Nikon Z7 II + Nikon NIKKOR Z 50 mm f/1.8 S

CASE STUDY 2



Mechanical shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*



Progressive electronic shutter

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
	~~*rolling shutter compens.*~~
	regularised RS compens.
	full RS compensation
	full RS com. + adaptive IO
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points					
RMS reproj. error					
max reproj. error					

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	9.5 k				
RMS reproj. error	0.14 (0.8 pix)				
max reproj. error	0.43 (30.4 pix)				

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	9.5 k	10.0 k			
RMS reproj. error	0.14 (0.8 pix)	0.85 (3.5 pix)			
max reproj. error	0.43 (30.4 pix)	2.67 (96.6 pix)			

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	9.5 k	10.0 k	10.4 k		
RMS reproj. error	0.14 (0.8 pix)	0.85 (3.5 pix)	0.37 (1.7 pix)		
max reproj. error	0.43 (30.4 pix)	2.67 (96.6 pix)	1.14 (77.2 pix)		

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	9.5 k	10.0 k	10.4 k	10.6 k	
RMS reproj. error	0.14 (0.8 pix)	0.85 (3.5 pix)	0.37 (1.7 pix)	0.28 (1.3 pix)	
max reproj. error	0.43 (30.4 pix)	2.67 (96.6 pix)	1.14 (77.2 pix)	0.87 (55.7 pix)	

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	9.5 k	10.0 k	10.4 k	10.6 k	10.6 k
RMS reproj. error	0.14 (0.8 pix)	0.85 (3.5 pix)	0.37 (1.7 pix)	0.28 (1.3 pix)	0.28 (1.3 pix)
max reproj. error	0.43 (30.4 pix)	2.67 (96.6 pix)	1.14 (77.2 pix)	0.87 (55.7 pix)	0.88 (55.7 pix)

CASE STUDY 2

	mechanical	electronic shutter			
		no RSC	regularis. RSC	full RSC	full RSC + adap. IO
tie points	9.5 k	10.0 k	10.4 k	10.6 k	10.6 k
RMS reproj. error	0.14 (0.8 pix)	0.85 (3.5 pix)	0.37 (1.7 pix)	0.28 (1.3 pix)	0.28 (1.3 pix)
max reproj. error	0.43 (30.4 pix)	2.67 (96.6 pix)	1.14 (77.2 pix)	0.87 (55.7 pix)	0.88 (55.7 pix)

CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



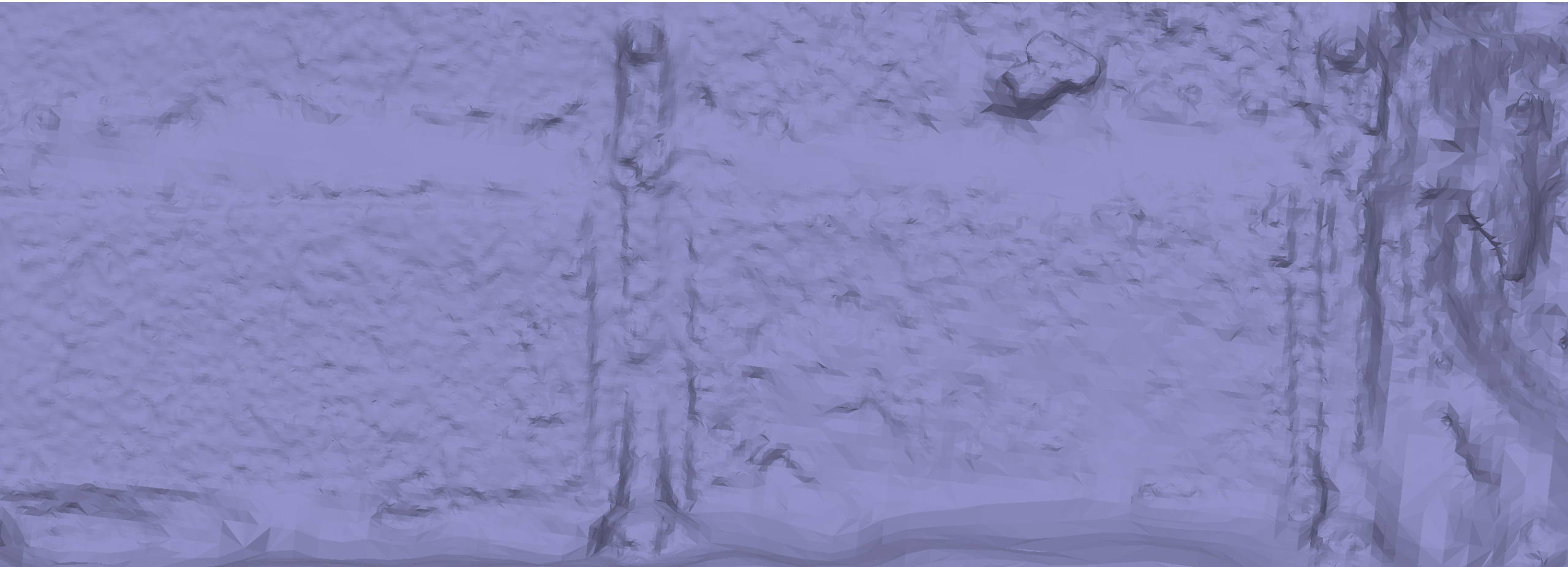
CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO



CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO
			10.6 k	
			0.28 (1.3 pix)	
			0.87 (55.7 pix)	



CASE STUDY 2

mechanical	electronic shutter			
	no RSC	regularis. RSC	full RSC	full RSC + adap. IO
9.5 k				
0.14 (0.8 pix)				
0.43 (30.4 pix)				



CASE STUDY 3

Wotruba Church (Vienna, 1976)



C.Stadler/Bwag 2020

CASE STUDY 3







Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

GoPro HERO11 Black

CASE STUDY 3







Mechanical shutter

Progressive electronic shutter

Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

GoPro HERO11 Black

CASE STUDY 3

exposure mode	*A-priority*
shutter speed	*≥ 1/200 s*
aperture	*f/5.6*
ISO	*≤ 200*
white balance	*auto*



Mechanical shutter





Progressive electronic shutter

focusing	*off*
vibration reduct.	*off*
GSD	*~1.5 mm*
network	*148 photos*
image format	*JPG*

Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

GoPro HERO11 Black

CASE STUDY 3

exposure mode	*A-priority*
shutter speed	*≥ 1/200 s*
aperture	*f/5.6*
ISO	*≤ 200*
white balance	*auto*



Mechanical shutter



focusing	*off*
vibration reduct.	*off*
GSD	*~1.5 mm*
network	*148 photos*
image format	*JPG*

Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

exposure mode	*auto*
shutter speed	*≥ 1/1000 s*
aperture	*f/2.5*
ISO	*≤ 400*
white balance	*auto*



Progressive electronic shutter

focusing	*off*
vibration reduct.	*off*
GSD	*~1.4 mm*
network	*132 photos*
image format	*JPG*

GoPro HERO11 Black

CASE STUDY 3

exposure mode	*A-priority*
shutter speed	*≥ 1/200 s*
aperture	*f/5.6*
ISO	*≤ 200*
white balance	*auto*



Standing still



focusing	*off*
vibration reduct.	*off*
GSD	*~1.5 mm*
network	*148 photos*
image format	*JPG*

Nikon Z7 II + Nikon NIKKOR Z 20 mm f/1.8 S

exposure mode	*auto*
shutter speed	*≥ 1/1000 s*
aperture	*f/2.5*
ISO	*≤ 400*
white balance	*auto*



Walking

focusing	*off*
vibration reduct.	*off*
GSD	*~1.4 mm*
network	*132 photos*
image format	*JPG*

GoPro HERO11 Black

CASE STUDY 3







Standing still

Walking

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*

CASE STUDY 3







Standing still

Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*

Walking

Agisoft Metashape 2.1.0

SfM	*incremental*
	25k IPs / 3k tie points
	~~compens.~~ / regularised / full

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points			
RMS reproj. error			
max reproj. error			

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k		
RMS reproj. error	0.53 (5.0 pix)		
max reproj. error	1.26 (114.2 pix)		

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	**regularis. RSC**	**full RSC**
tie points	24.4 k	28.0 k	
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	**regularis. RSC**	**full RSC**
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	**regularis. RSC**	**full RSC**
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

1 m / s (3.6 km/h)

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

1 m / s (3.6 km/h)

@ 5 m

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

1 m / s (3.6 km/h)

1 / 200 s

@ 5 m

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

1 m / s (3.6 km/h)

1 / 800 s

@ 5 m

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

1 m / s (3.6 km/h)

1 / 2000 s

@ 5 m

CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)

1 m / s (3.6 km/h)

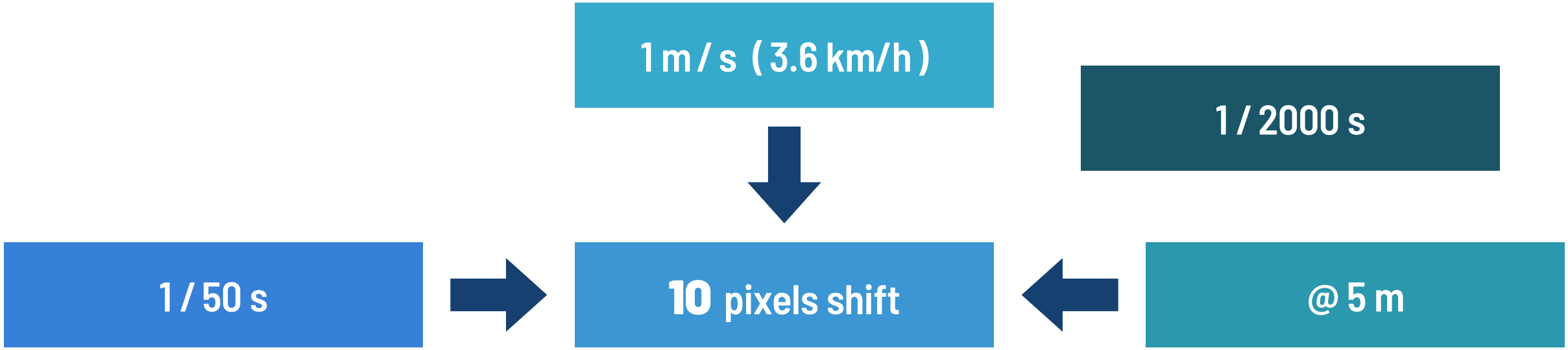
1 / 2000 s

1 / 50 s

@ 5 m

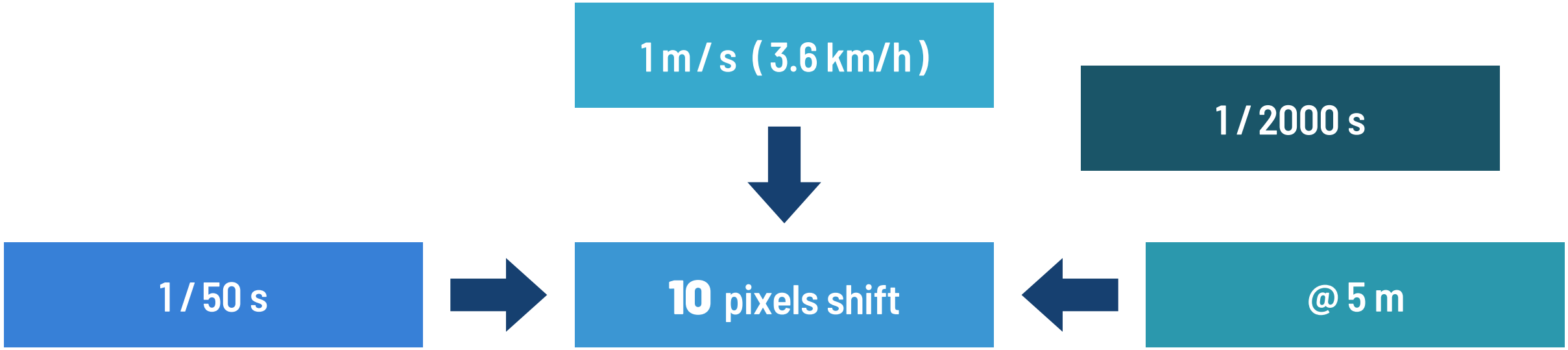
CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)



CASE STUDY 3

	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC
tie points	24.4 k	28.0 k	41.7 k
RMS reproj. error	0.53 (5.0 pix)	0.48 (4.3 pix)	0.30 (2.5 pix)
max reproj. error	1.26 (114.2 pix)	1.19 (113.3 pix)	0.98 (84.4 pix)



CASE STUDY 3

Nikon Z7ii	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC



CASE STUDY 3

Nikon Z7ii	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC



CASE STUDY 3

Nikon Z7ii	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC



CASE STUDY 3

Nikon Z7ii	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC



CASE STUDY 3

Nikon Z7ii	GoPro HERO11 Black		
	no RSC	regularis. RSC	full RSC





PART 2

CASE STUDY 1

Holocaust Memorial (Vienna, 2000)



C.Stadler/Bwag 2018

CASE STUDY 1







3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1









3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1



3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1













3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1



3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1







Mechanical shutter







exposure mode	*manual*
shutter speed	*1/200 s*
aperture	*f/5.6*
ISO	*200*
white balance	*cloudy*

3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1







Mechanical shutter







exposure mode	*manual*
shutter speed	*1/200 s*
aperture	*f/5.6*
ISO	*200*
white balance	*cloudy*

focusing	*off*
vibration reduct.	*off*
GSD	*1.0 mm*
network	*22 photos*
image format	*JPG*

3 ≠ 50 mm lenses + 2x Nikon Z7 II

CASE STUDY 1



Mechanical shutter







Agisoft Metashape 2.1.0

SfM	*40k IPs / 4k tie points*
control	*3 GCPs Helmert transform*
MVS	*polymesh (depth maps)*

CASE STUDY 1



CASE STUDY 1



CASE STUDY 1



CASE STUDY 1



CASE STUDY 1





CASE STUDY 1





CASE STUDY 1





Nikon vs Tamron colours



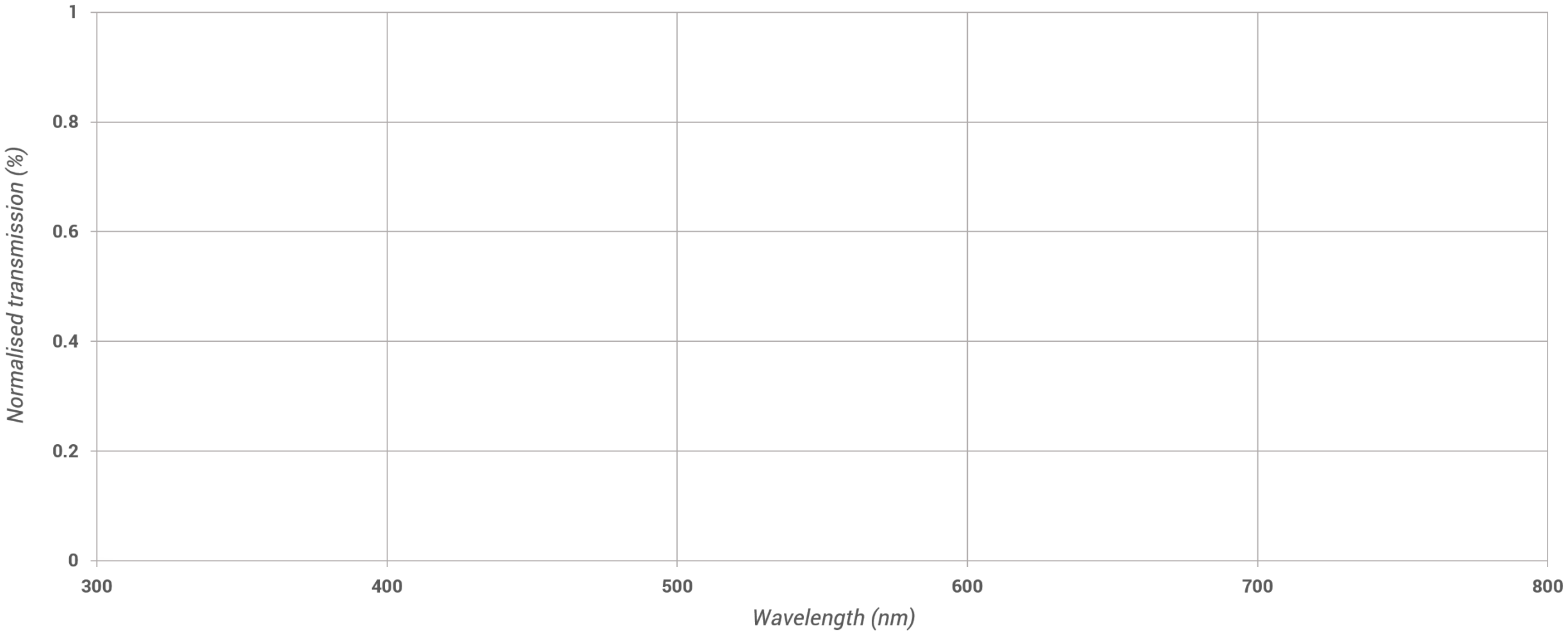
Nikon NIKKOR Z 50mm f/1.8 S

Nikon vs Tamron colours

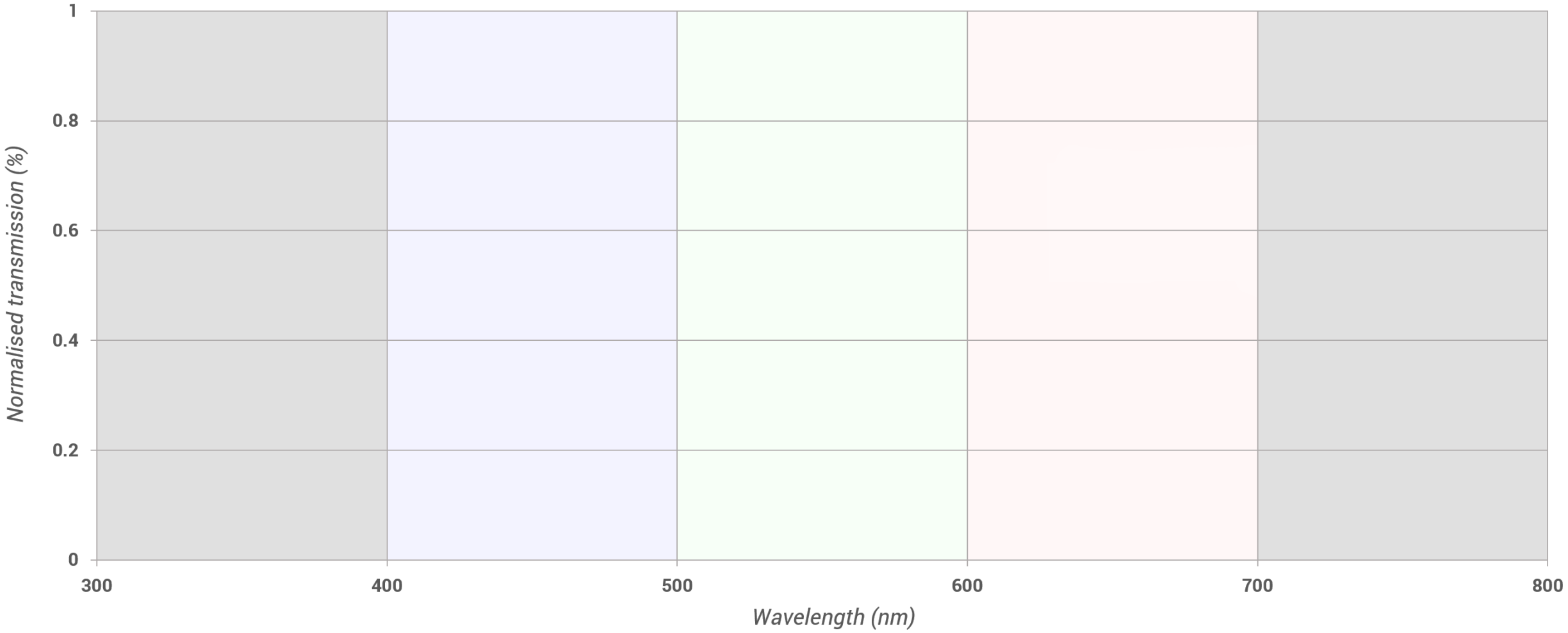


Tamron SP 24-70mm F 2.8 Di VC USD

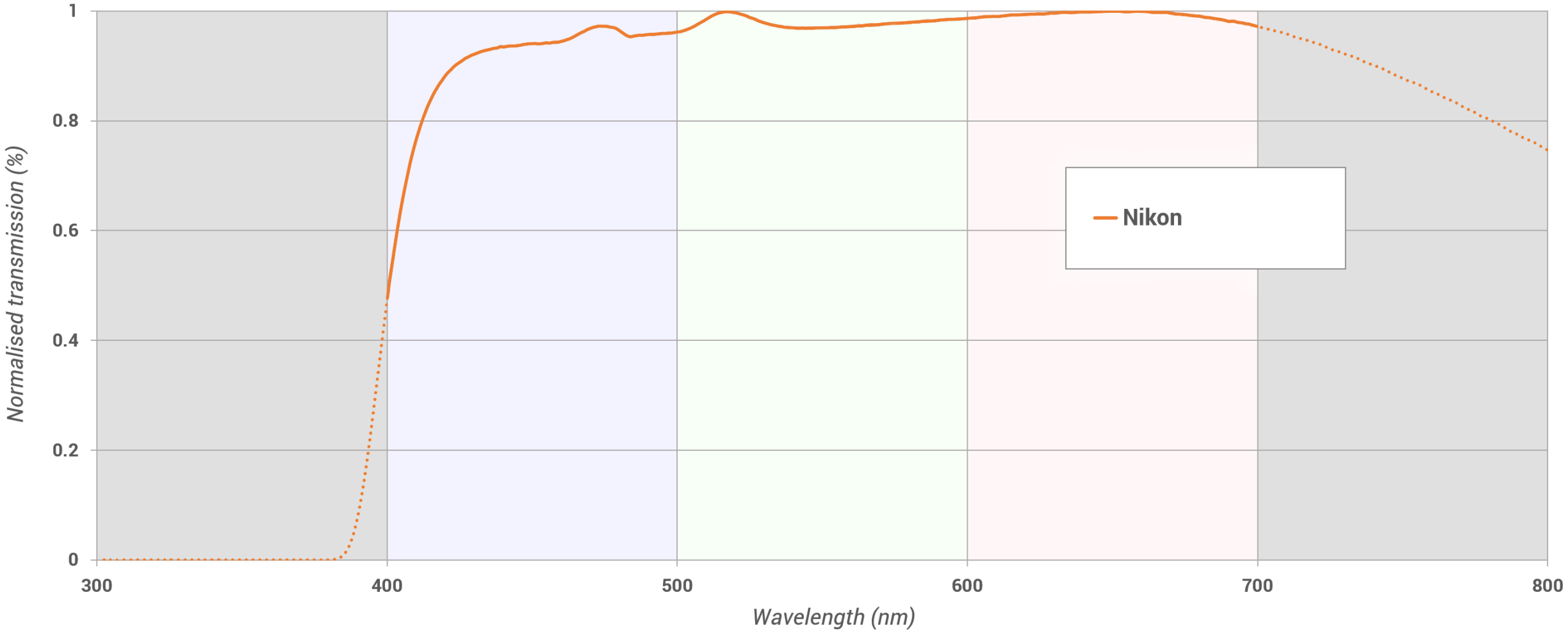
Nikon vs Tamron colours



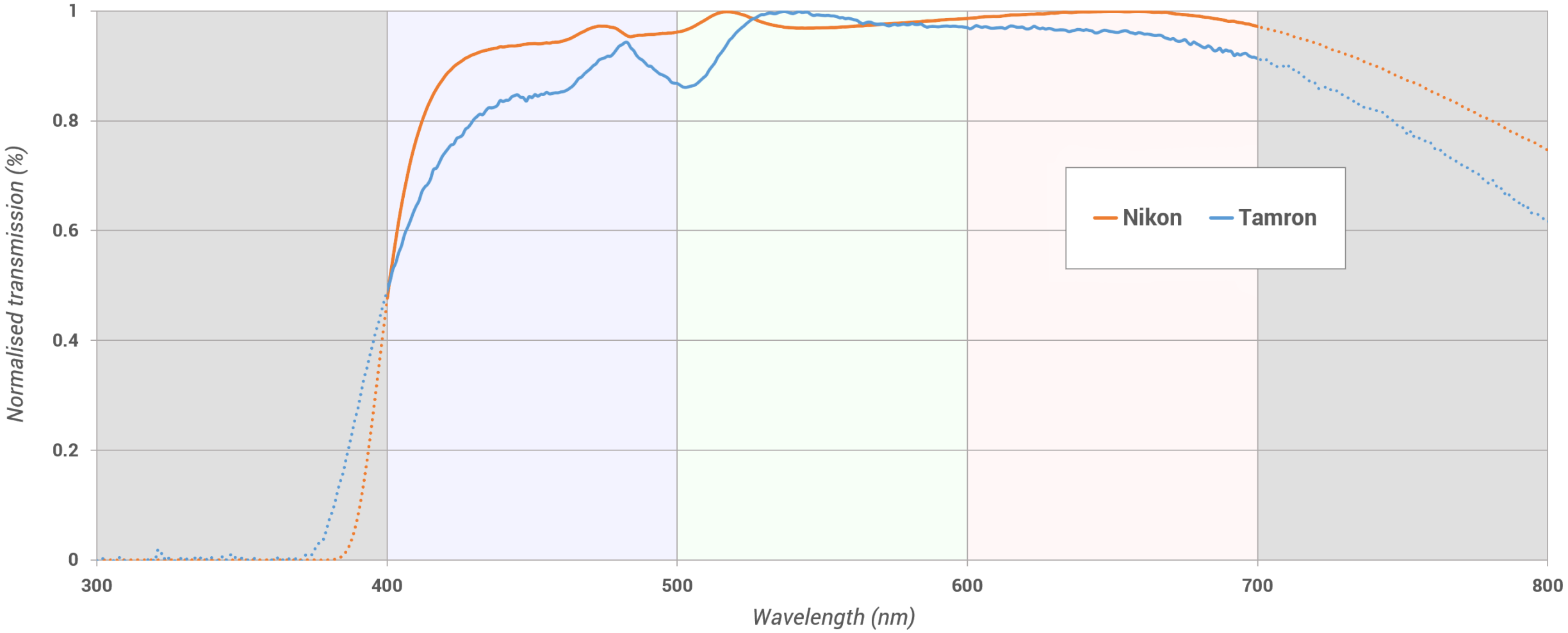
Nikon vs Tamron colours



Nikon vs Tamron colours



Nikon vs Tamron colours



MIND THAT ...

MIND THAT ...



qualitative

MIND THAT ...



qualitative



MVS ~~SfM~~

MIND THAT ...

- qualitative
- MVS ~~SfM~~
- many other parameters

mind the gap

19/02/2025 | 3D–4CH

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universität wien

fill the gap

19/02/2025 | 3D–4CH

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fill the glass

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