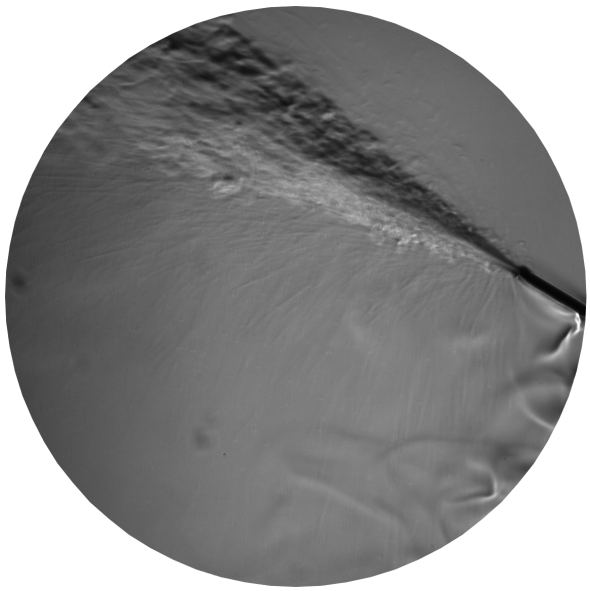
STRIA Draft Procedures

Test ID: BLANK
STRIA

Saturday 1st January, 2022

Test Location:
Optical Laboratory, Faculty of Science, Leiden University
Niels Bohrweg 2
2333CA Leiden

SUP:	David
OSO:	David/Remko
TC:	Kira
TO:	Cristina
CP:	Lukas



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Version:
V1.0

In case of emergency: +31 (0)71 527 5737

Low risk	**Medium risk**	**High risk**
• Test-setup is safe to approach • No safety gear required	• Only authorized personnel in test area • Wear appropriate safety gear	• Clear all personnel from test area • Do not approach the test-setup

Abbreviations

CAM	Camera / livestream person
CP	Command post
OSO	Operations Safety Officer
SUP	External Supervisor
TC	Test Conductor
TL	Test Leader
TO	Test Operator

HE	Helium gas
LN2	Liquid Nitrogen
LOX	Liquid oxygen
MA	Mirror Assembly
N2	Nitrogen gas
KE	Knife Edge
OP	Optical Platform
RTFM	Read The Full Manual
TS	Translation Stage

Summary of the setup

The physical system is a schlieren imager consisting of two separate assemblies: the optical platform and the mirror assembly.
By cutting the incoming beam in half, differences in the refractive index over some area of the media cross section in the beam are shown as brighter or darker regions.
In these procedures the assembly, calibration and usage of the STRIA system are covered.

Test Summary

The main goal of this test is to image a medium in flux:
1. Assembly:
2. Preparation: Pack the STRIA system and the sample.
3. Calibration: Calibrate the STRIA system for the specific test setup.
4. Test: Image the sample.
5. Clean-up.

Test Goals and Operations

The following primary and secondary goalsare as follows:

Primary Goals:

- Image flow of a medium
- Find [TBD for specific test]
- Verify safe operations of the STRIA system
- Verify the timing sequence

Secondary Goals:

- Verify STRIA procedures
- Have fun

The following tests are preliminary covered by these procedures:

- TBD: Compressed N2 Up, Slow
- TBD: Compressed N2 Up, Fast
- TBD: Compressed N2 Down, Slow
- TBD: Compressed N2 Down, Fast
- TBD: Candle
- TBD: Flow over Surface
- TBD: Soldering Iron
- TBD: Flow over Cylinder

Automated Sequence

The automated sequence that will be run has the following timeline:

Time [ms]	Action
-500	Start high speed data logging
0	Release the medium
Test Duration	Stop releasing the medium
Test Duration + 500	Stop high speed data logging
Attention	Timing preliminary, to be determined with test data

Emergency and Unpowered System States

When an emergency button is pressed the systems will go to the emergency state. When all power is cut, they will go to their unpowered state.

System	Emergency state	Unpowered state
CAM	NA	Off
LED	NA	Off
Arduino	NA	Off
Laptop	NA	Off

System Schematics

Below a diagram of the OP is shown.

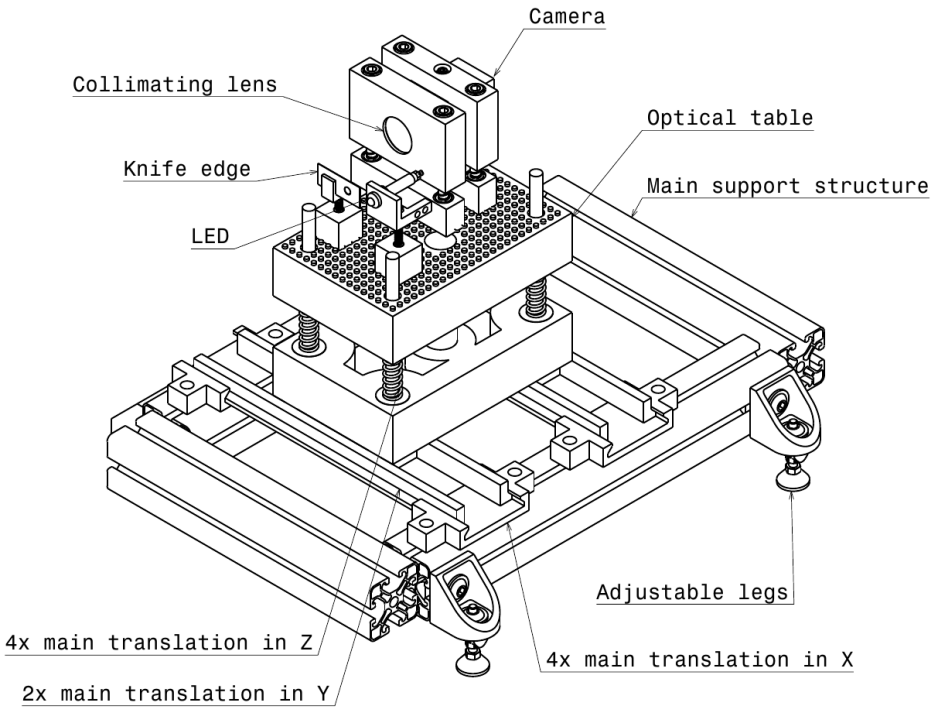


Figure 1: Schematic of the OP.

"We can easily forgive a child who is afraid of the dark; the real tragedy of life is when men are afraid of the light."

Plato

Packing list

A - General				
ID	**Check**		**Description**	**Comments**
A1			PR kit	
A2			Nitrile gloves	
A3			at least 3 x Clipboards	
A4			at least 3 x Procedures	print single sided, two copies (TC, SO) need to be printed in color

B - Test Setup				
ID	**Check**		**Description**	**Comments**
B1			MA	
B2			OP	

C - Electronics				
ID	**Check**		**Description**	**Comments**
C1			Laptop + charger	
C2			USB - Ethernet adapter	
C3			HDD/USB stick/SD card with min 64 GB	only needed if the data needs the be recovered from the laptop immediately

D - Safety				
ID	**Check**		**Description**	**Comments**
D1			First Aid Kit	
D2			$\geq$ 2 sets of nitrile gloves	
D3			CO2 Fire extinguisher	

Checklist

			E - Preparation, day before leaving	
ID	**Check**		**Description**	**Comments**
E1			Confirm all items on packing list are packed	
E2			Check again	

Assembly

Item Lists for Assembly

F - Item List for MA				
ID	**Check**		**Description**	**Comments**
F1			Mirror	
F2			2 x Mirror Mount Leg (Thorlabs)	
F3			Mirror Mount	
F4			4 x M6x20	mounting the MA to the optical table
F5			4 x M6x16	mounting the mirror mount to the mirror mount legs
F6			2 x M6x70 (partially threaded)	mounting the mirror mount to the mirror mount legs

Lego pieces are given as WxLxH.

G - Item List for OP				
ID	**Check**		**Description**	**Comments**
G1			200x200 Lego platform	
G2			25 x 2x4x3 Lego pieces	
G3			25 x 2x4x1 Lego pieces	
G4			25 x 1x4x3 Lego pieces	
G5			25 x 1x4x1 Lego pieces	
G6			25 x 2x2x3 Lego pieces	
G7			25 x 2x2x1 Lego pieces	
G8			6 x 6x30x1 Lego pieces	
G9			2x single axis LEGO TS	
G10			1x two axis LEGO TS	
G11			2x KE base	
G12			2x KE holder	
G13			4x M3x30	
G14			2x M3 spring	
G15			4x M3 washer	
Continued				

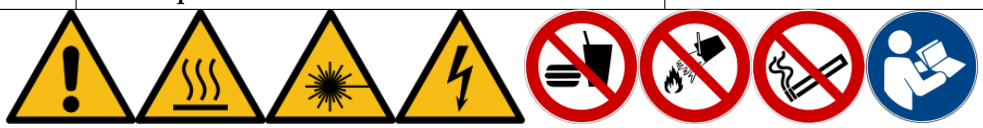
ID	Check		Description	Comments
G16			2x Lens mount base	
G17			1x Lens mount	
G18			1x camera mount	
G19			1x lens	TODO: right lens name
G20			4x rubber bands	
G21			1x KE	
G22			1x LED	
G23			4x M6x80	
G24			4x M6 medium spring	
G25			4x M6 washer	
G26			4x M6 heat set threaded inserts	
G27			5x M3 heat set threaded inserts	
G28			LED assembly	

Assembly Procedures

			H - MA Assembly	
ID	**Check**		**Description**	**Comments**
			Do not touch optical surfaces. Only touch optics using gloves but do not touch their optical surfaces. RTFM of the optics.	
				
H1			Bolt the long side of the legs to the mirror mount	
H2			Bolt the short side of the legs to the optical table	
H3			Insert the mirror carefully into the mirror mount	you will need at least 2 people for the following steps
H4			Make sure the mirror sits flat against the mirror mount	
H5			Fasten the mirror using the plastic screws	
H6			Fasten the protective screen to the mirror mount	

I - OP Assembly				
ID		**Check**	**Description**	**Comments**
				
			The heat set threaded inserts will be pressed in using a soldering iron. RTFM of the inserts.	
				
I1			Press the M6 heat set threaded inserts into the two lens bases from the top using a soldering iron	make sure the top of the inserts sit flush against the countersunk holes of the base
I2			Press the M3 heat set threaded inserts into the two KE holder bases from the top using a soldering iron	make sure the top of the inserts sit flush against the countersunk holes of the base
I3			Press the M3 heat set threaded inserts into the camera holder from the top using a soldering iron	make sure the top of the inserts sit flush against the countersunk holes of the base
I4			Let the parts with the inserts cool down	
I5			Check the alignment of the inserts using bolts 1. Thread a long bolt into the insert 2. Check from all sides if the bolt is sufficiently straight (normal to the surface) 3. If the bolt is not sufficiently straight: (a) Remove the bolt (b) Heat up the insert and improve the alignment by by pushing on it with the soldering iron (c) Let the insert cool down and check straightness (d) I aligning the insert is not possible in that way heat up the insert, quickly insert the bolt and straighten the bolt and insert	make sure the top of the inserts always sit flush against the base
I6			Push the M3 bolts through the KE and LED holder	
I7			Insert a M3 washer, a M3 spring and again a M3 washer onto the M3 bolts	
I8			thread the bolts into the KE and LED bases	
Continued				

ID	Check		Description	Comments
I9			Push the M6 bolts through the bolt holes of the lens and camera holders	
I10			Insert a M6 washer, a medium M6 spring and again a M6 washer onto the M6 bolts	
I11			Thread the M6 bolts into the lens and camera base threaded inserts	
			Do not touch optical surfaces. Only touch optics using gloves but do not touch their optical surfaces. RTFM of the optics.	
				
I12			Insert the lens into the lens mount	the strongly convex side should face away from the lens mount
I13			Insert the lens holder back-plate into the lens mount	be careful to not put too much pressure on the lens
I14			Secure the back-plate to the lens mount using rubber bands	Use at least 4 bands holding it in different places
I15			Carefully make sure the lens sits securely in the mount	
I16			Insert the camera into the camera mount	the c-mount should be aligned with the flat side of the mount
I17			Fasten the camera using three M3 bolts and the heat threaded inserts on top	you might need an insert to protect the camera from the bolts
I18			Mount the sub-assemblies on the Lego TS: • KE: 1 axis (x-direction) • Lens mount: 1 axis (y-direction) • Camera mount: 2 axis (x, y direction)	
I19			Mount the sub-assemblies on the Lego base according to Figure 1	
I20			Mount the LED (-assembly) on the LED holder	
I21			Make sure everyone is aware of the KE being mounted on the OP by informing the TC, SO, SUP that the KE will now be mounted	
I22			Mount the KE on the KE holder	

			J - Calibration	
ID		**Check**	**Description**	**Comments**
				
	System Status: • System is off • Camera is off • LED is off • Mirror cover is mounted to mount • Knife edge might be uncovered			
J1			Notify CP that calibration will start	
J2			Be aware of the potentially exposed, sharp knife edge	
J3			Make sure that the area between the OP and MA is clear of obstacles	
J4			Make sure that the MA is securely mounted	
J5			Make sure that the cover of the camera is screwed into the C mount (detector is covered)	
J6			Make sure that the OP is securely mounted	
J7			Make sure that the OP is securely assembled	
J8			Make sure that the cable running to the camera is securely plugged into the camera and laptop	
J9			Make sure that the cables running from the LED to the breadboard are securely plugged in	
J10			Make sure that the cables running from the breadboard to the Arduino are securely plugged in	
J11			Make sure that the cable running from the Arduino to the laptop is plugged in	
J12			Position the OP at 2400 mm ± 5 mm from the MA, measured from the OP-knife edge/LED to the MA front plane	
J13			Align the OP and MA by eye 1. The optical axis of the MA should go through the midpoint of the KE-LED line 2. The LED-MA-KE triangle should be symmetric about the MA optical axis	
J14			Start the laptop	
Continued				

ID	Check		Description	Comments
J15			Start the SpinView program	
J16			Start the camera	
J17			Connect the camera to SpinView	You should see a flat, black image
J18			Turn on the camera live view (do not start recording)	
J19			Remove the camera cover from the camera	SpinView should show a gray image
			The LED will now be powered on	
				
J20			Power on the LED	
J21			Align the LED 1. Place a screen behind the MA 2. Turn the light in the lab off 3. Bend the LED until it is roughly centered on the center of the mirror 4. Turn the light in the laboratory back on	
J22			Adjust the distance of the OP to the MA until the spot of the reflected LED is on or near the KE	use a screen between the KE and lens if necessary
J23			Adjust the position of the KE (x, z direction) until the spot is focused on the KE and half of the light is blocked	
J24			Place a screen between the lens and the camera and check if a spot is visible	
			The detector of the camera will now be exposed	
J25			Move the mirror on the z and y axis until the light beam is centered on it	
J26			Move the camera (y,z direction) until the image (mirror and/or sample) is shown	
J27			Place an object with sharp features in the optical path where the sample will be placed	
J28			Move the camera on the x direction until the image of the object becomes sharp	
J29			Remove the object from the optical path	
J30			If the image is still not sharp return to J26	
J31			Make a test recording using the python or SpinView scripts	
Continued				

ID	Check		Description	Comments
J32			Make sure that the recording is successful	
J33			If the image and video is sharp the system is calibrated	
J34			Turn the camera to standby (turn off live feed)	
J35			Turn off the LED	
J36			(Re)Mount the mirror cover to the MA	

System Status:

- System is on standby
- System is calibrated
- Camera is on standby
- LED is on
- Mirror cover is mounted to MA

		K - Perform Imaging		
ID		**Check**	**Description**	**Comments**
				
	System Status: • System is on standby • System is calibrated • Camera is on standby • LED is on • Mirror cover is mounted to MA			
K1			Announce that imaging will be performed	
K2			Prepare the python script to record images	
K3			(optional) Remove the mirror cover	
K4			Ascertain that everybody stands still during the test and only the TO is close to the setup	
K5			Announce that testing will start now	
K6			Count down	
K7			Start high speed recording	
K8			Start flow/other test	
K9			Announce that the test is concluded	
K10			(optional) re-mount the mirror cover	
K11			Ascertain that the data has been saved	
	System Status: • System is on standby • System is calibrated • Camera is on standby • LED is on • Mirror cover is mounted to MA			

			L - Clean up and Setup Disassembly.	
ID		**Check**	**Description**	**Comments**
		Tentative procedures.		
L1			Verify that the system is safe to work on	
L2			Cover the knife edge and take it out of the setup	
L3			Cover the optical instruments	camera, lens
L4			Disconnect all electronics	
L5			Cover the setup	
L6			Clean up test area 1. No trash 2. No exposed optics 3. No loose bolts 4. No loose Lego	
		System Status: • System is packed up		