



Training event “Atmospheric Remote Sensing observation: labs maintenance and methods” LIDAR Measurements

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Mission 4 “Education and Research” - Component 2: “From research to business” - Investment
3.1: “Fund for the realisation of an integrated system of research and innovation infrastructures”



Standard Operation Procedures



High Power Lidar: Standard Operation Procedures for NF operation

Emitter	CARS
Version	01, rev. 09
Issue date	Mar 2025

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Check up of the LIDAR environment

Before switching on the LIDAR, it is important to:

- Check the condition of the exit windows (if any)
- Check the condition of all the emission optics (e.g., mirrors, BEX etc.) that are exposed to dust, humidity or other external factors
- Check all environmental parameters like temperature and humidity



Check up of the LIDAR environment



Check up of the LIDAR environment

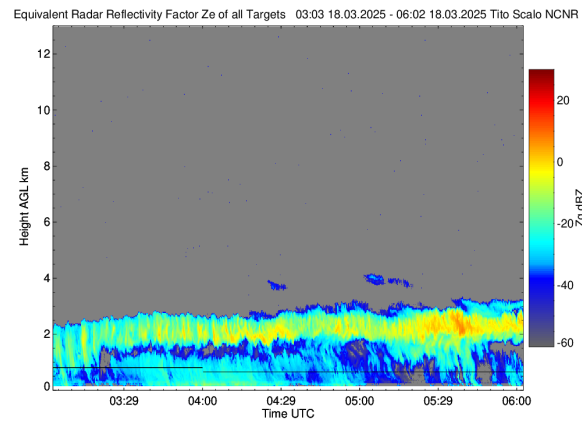
Before switching on the LIDAR, it is important to:

- Check the atmospheric conditions for low clouds (below 5 km) and rain/snow/fog

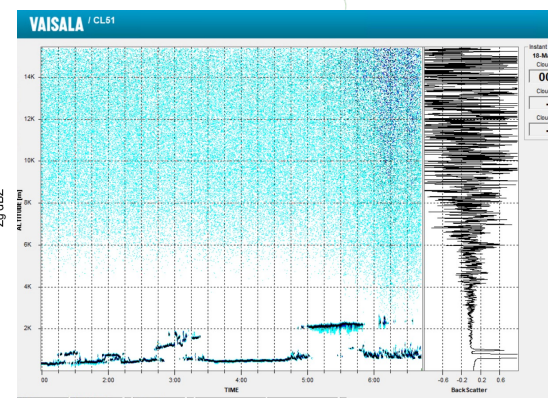
Sky Camera



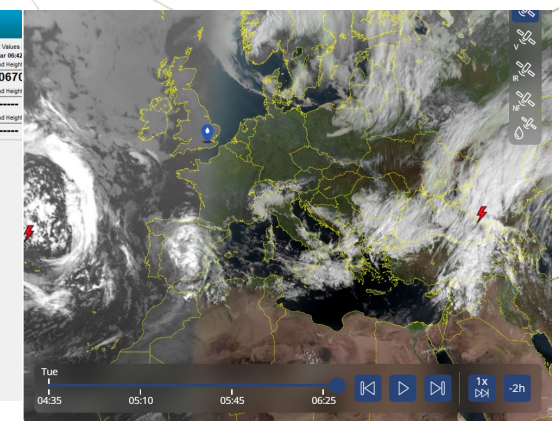
Cloud Radar



Ceilometer



Satellite Observations



Check up of the LIDAR environment

For unattended continuous measurements, the LIDAR should be equipped with failsafe systems able to properly react to external factors:

Switch OFF the LIDAR in case of:

- Fog / Rain / Snow
- Unauthorized movement close to the laser emission
- Presence of aerial vehicles



Check up of the LIDAR environment

- Automatically switch ON the instrument after the factors described above are no longer present
- Switch OFF the LIDAR in case of technical failure / power failures / smoke
- Remotely monitor the status of operation for the LIDAR

Sensors:	Temperature(C)	Humidity(%)	Pressure
RACK	21.0	21.2	NA
HATCH	22.52	NA	929.14
POSEIDON LAST ENTRY: 2025-07-15 01:34:00			
LIDAR ROOM RH			30.9
LIDAR ROOM PRESS			931.4
LIDAR ROOM PPB			63
LIDAR RH			45.9
LIDAR TEMP	27		
LIDAR ROOM TEMP	26		

Check up of the LIDAR

Prior to powering on the LIDAR, it is essential to check each individual module. This includes checking the status of the laser, ensuring proper functioning of the detection system, verifying the integrity of the optics, and evaluating the instrument's resilience against potential power failures.

LASER:

- Check the replacement interval for the laser lamps, filters, water replacement (based on the information provided by the laser manufacturer).

MAINTENANCE



CAUTION: Inadequate cooling system maintenance may result in coolant contamination and/or system damage.

1.0 Scheduled Maintenance

Perform the following maintenance procedures on a regular schedule:

- Turn the Key Switch ON to operate the pump and circulate coolant for at least 30 minutes every month when the laser is not in use.
- Inspect the coolant level in the reservoir through the reservoir-level window on the ICE450.
- Replace the Deionizing cartridge every 6 months and each time the flashlamp is replaced to maintain coolant integrity.
- Replace the flashlamp after every 50 million shots.

Check up of the LIDAR

LASER:

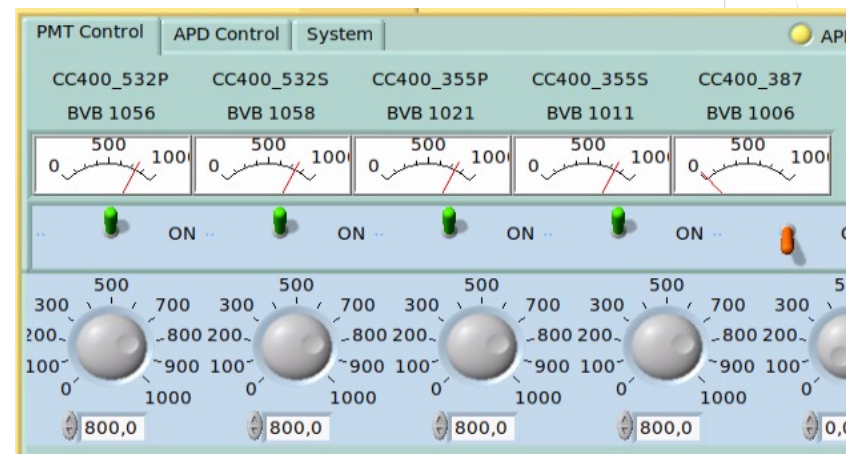
- Check the water level and the temperature values of the laser (e.g. harmonic generators, cooling unit) and any other parameters provided by each laser unit (e.g. laser power, humidity inside the laser cavity, coolant flow) and any other parameter indicated by the laser manufacturer in the user manual.



2025-07-15 00:13:08	CFR	QSMART
STATUS	BNC Intlk in	BNC Intlk in
MODE	EE	EE
QS-DELAY(us)	175	8
T1(°C)	38.0	37.9
T2(°C)	17.9	49.59
T3(°C)	41.5	27.61
FL SHOTS	10329855	87094187

Switching on the LIDAR

- Remove any covers or shutters from the Emission/Reception unit
- Make sure the laser radiation is not obstructed
- Power on all modules that are used for the measurement (Laser, electronics, detectors, other controllers) according to the specific procedure used for each module



Switching on the LIDAR

LASER

Turn on the flashlamp of the laser.

Turn on the Q-switch of the laser.

The screenshot shows the 'Oscillator' control interface. At the top, the system status is 'Laser ready', the control version is 'Oscillator 10.15.0.1', and the shutter is 'Open'. The interface is divided into several sections:

- Flashlamp Control:** Includes a 'Flashlamp' button (a yellow triangle) and a 'STOP' button (a grey octagon).
- Q-Switch Control:** Includes a 'Q-Switch' button (a grey triangle) and a 'STOP' button (a grey octagon).
- Parameters Section:** A yellow background area containing two sets of controls, each with an 'EDIT' button.
 - Flash Parameters:** Flash repetition rate is set to 10 Hz, and Flashlamp synchronisation mode is set to External.
 - Q-Switch Parameters:** Q-Switch repetition rate is set to 10 Hz, Q-Switch synchronisation mode is set to Internal, Q-Switch out synchronisation is set to +0 ns, and FL-Q-Switch delay is set to 0 μs.
- Right Sidebar:** Contains icons for a laser beam, a wrench and screwdriver (settings), a floppy disk (save), and an information icon.

Switching on the LIDAR

Polarization calibrator:

- Make sure the polarization calibrator is set to the zero position (normal measurement) for each polarization channel



Status:

- [1064-CC400: DONE, CP=185.5 NP=185.5]
- [532-CC400: DONE, CP=103.5 NP=103.5]
- [355-CC400: DONE, CP=139 NP=139]
- [1064-DK200: DONE, CP=119.5 NP=119.5]
- [532-DK200: DONE, CP=172 NP=172]
- [355-DK200: DONE, CP=136.5 NP=136.5]

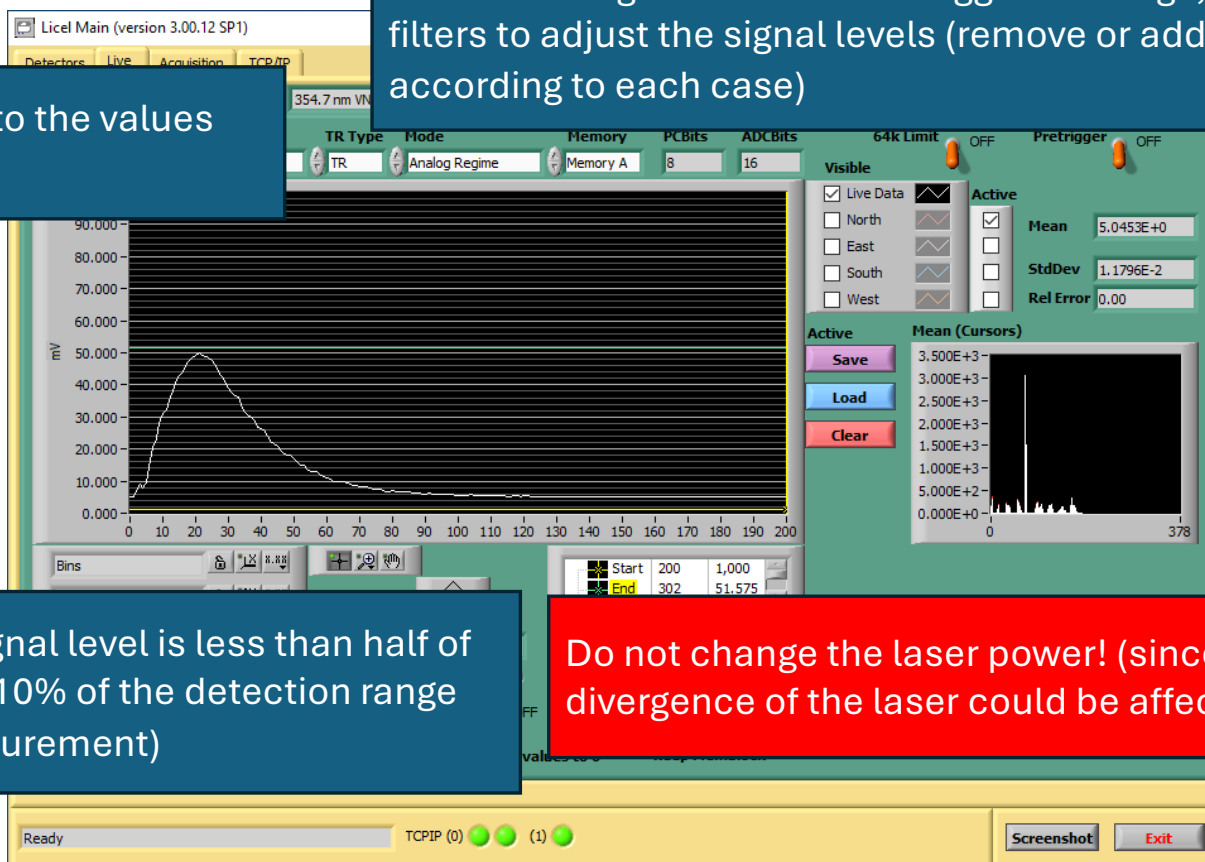
The image shows a 3D perspective view of a rectangular box representing a polarization calibrator. A green laser beam is shown entering from the left side of the box and reflecting off a mirror inside. The beam is shown as a series of small green spheres. The box has a small red and white label on its front-left corner.

Switching on the LIDAR

Electronics (Licel based detection modules)

Set the detector HV levels according to the values provided by the instrument supplier

In case the signal is out of the suggested range, use ND filters to adjust the signal levels (remove or add according to each case)



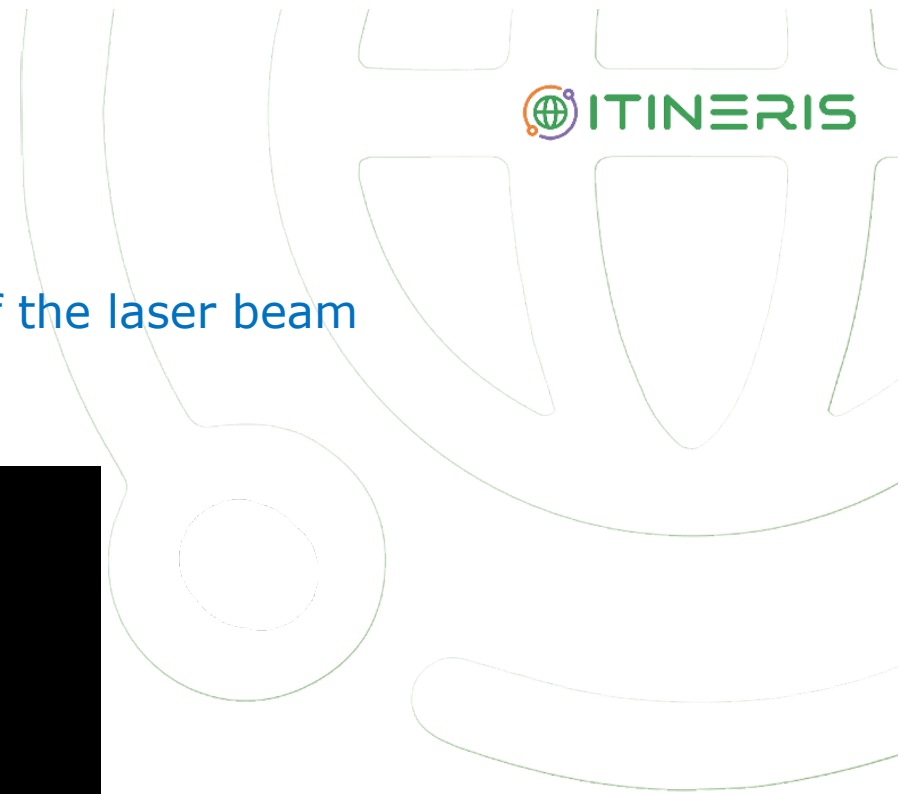
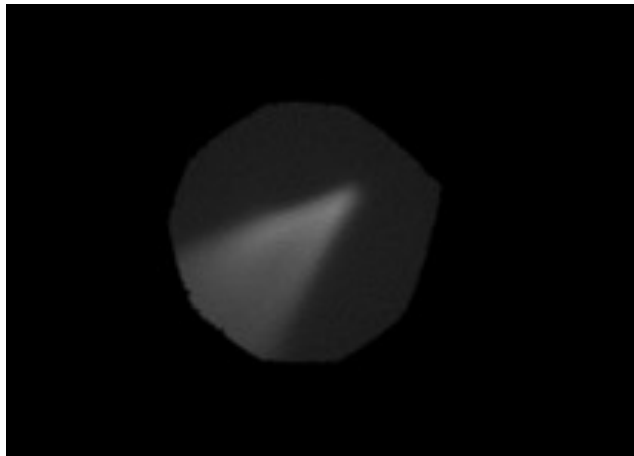
Check that the maximum analogue signal level is less than half of the detection range and not less than 10% of the detection range (for all channels used during the measurement)

Do not change the laser power! (since the divergence of the laser could be affected)

Switching on the LIDAR

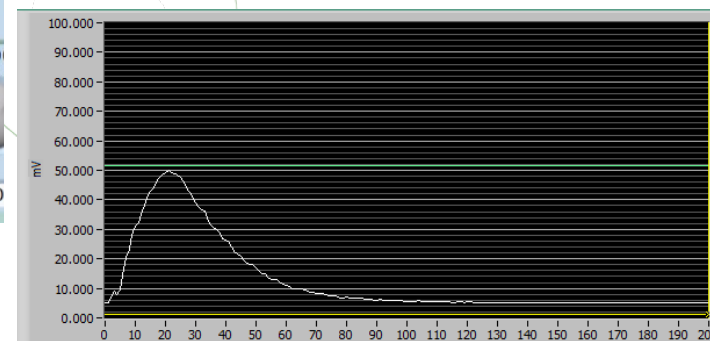
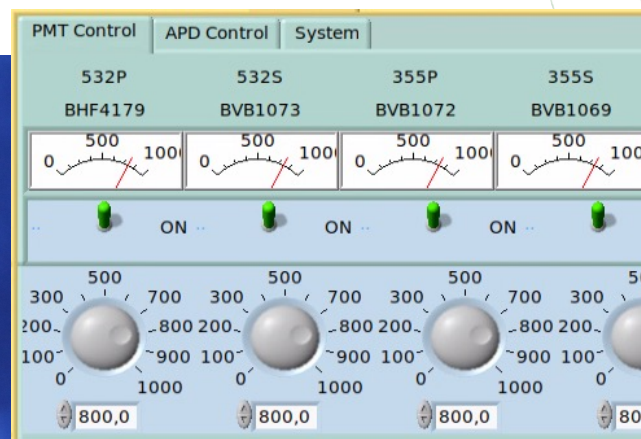
Checking the alignment:

Turn on the CCD camera and check the alignment of the laser beam



Performing the measurements

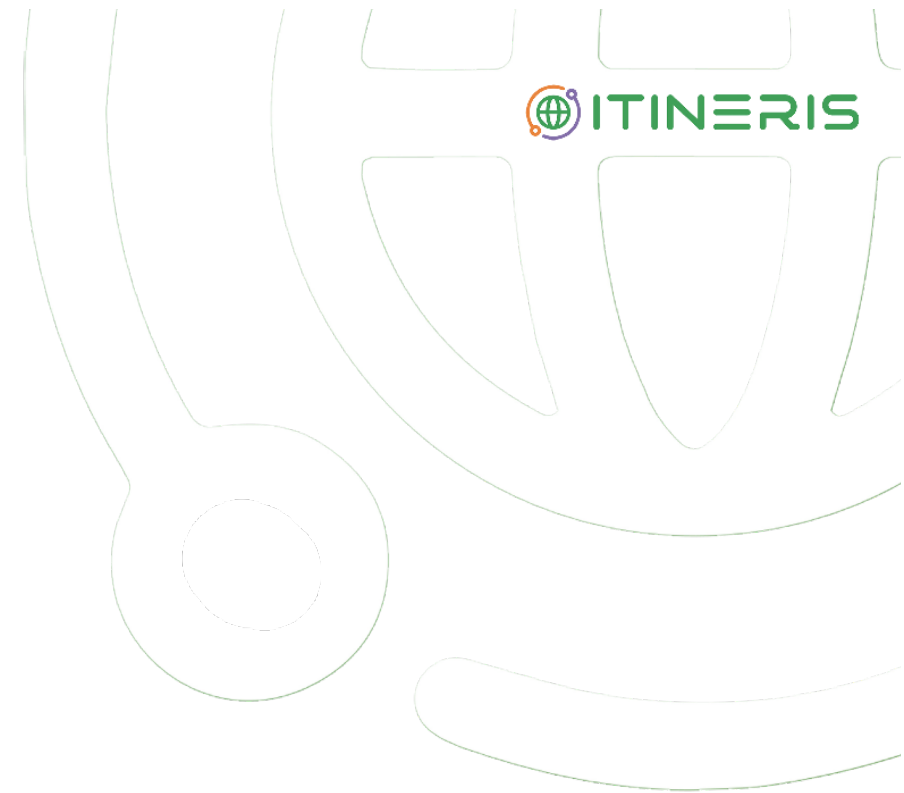
Laser and Detectors ON



Warm up the system for at least 30 min before any measurement

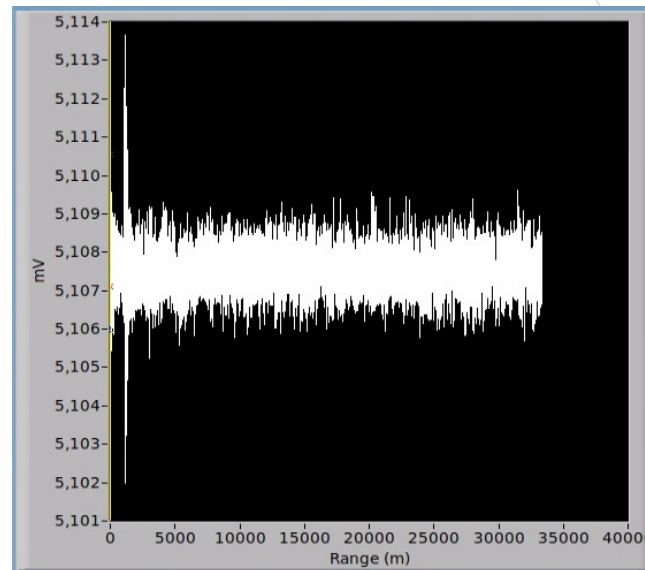
Performing the measurements

- Dark measurement
- Normal measurement
- Polarization measurement



Performing the measurements – Dark measurement

The Dark measurement should be performed for all analogue channels of the lidar instrument.



Performing the measurements – Dark measurement

Cover the telescope or Close the main (global) telescope shutter
(in case the instrument has multiple telescopes close all telescope shutters)

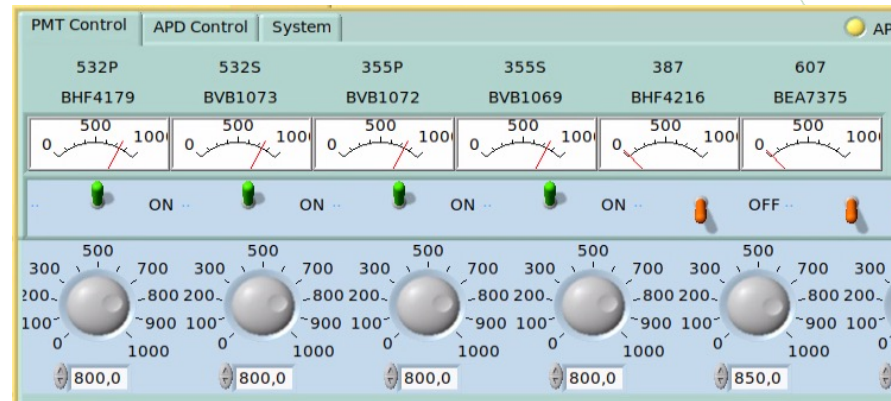


GLOBAL_SHUTTER	1	ON=1 OFF=0
1064P(2)	0	OPTIMIZER=1
1064S	0	CALIB=6 OPTIM=1
532P	0	OPTIMIZER=1
532S	0	CALIB=6 OPTIM=1
355P	0	OPTIMIZER=1
355S	0	CALIB=6 OPTIM=1
387	6	DARK=6 OPTIM=1
607	6	DARK=6 OPTIM=1

Performing the measurements – Dark measurement

Perform a Dark measurement:

- Same setup as the normal measurement



- Average over an increased time period (5-20 minutes or more)

Performing the measurements – Normal measurement



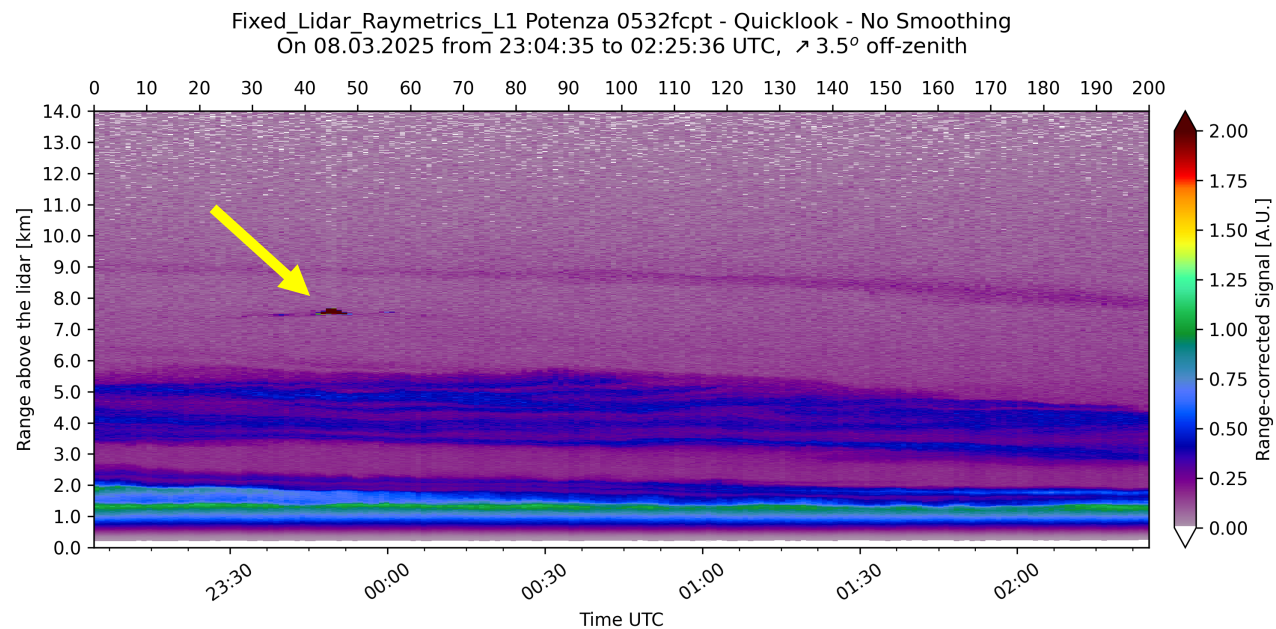
- Very close to the Dark measurement
- Keep the same setup as used for the Dark measurement
- Open the main telescope shutter
(in case the instrument has multiple telescopes open all telescope shutters)

A screenshot of a control interface with a dark background and white text. It displays a list of parameters for different telescopes. The 'GLOBAL_SHUTTER' parameter is highlighted with a green oval and is set to 0. Other parameters include 1064P(2), 1064S, 532P, 532S, 355P, 355S, 387, and 607, each with a value and associated settings.

Parameter	Value	Settings
GLOBAL_SHUTTER	0	ON=1 OFF=0
1064P(2)	0	OPTIMIZER=1
1064S	0	CALIB=6 OPTIM=1
532P	0	OPTIMIZER=1
532S	0	CALIB=6 OPTIM=1
355P	0	OPTIMIZER=1
355S	0	CALIB=6 OPTIM=1
387	6	DARK=6 OPTIM=1
607	6	DARK=6 OPTIM=1

Performing the measurements – Normal measurement

Set the acquisition software to store the averaged profiles between 10-60 s. (it is suggested to use a shorter time interval to reduce the risk of cloud contamination: e.g. 10 s)



Performing the measurements – Polarization measurement

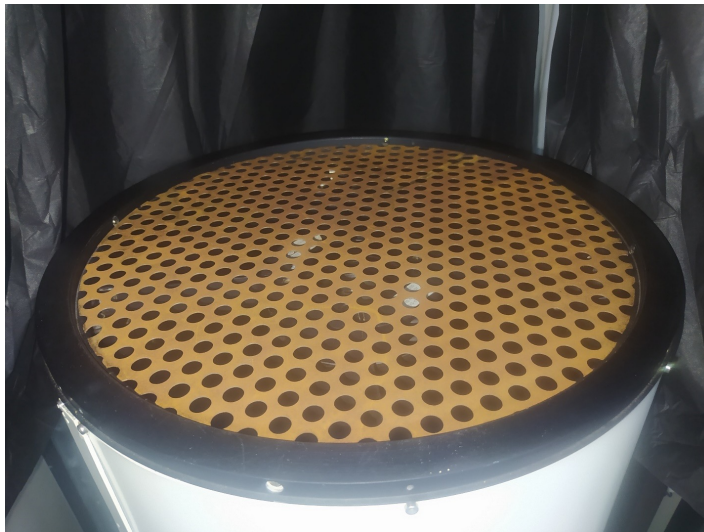


- Rotate the polarization calibrator to the $\pm 45^\circ$ position with respect to the 0° position.
- Increase light intensity in the cross channels – Saturation.

Performing the measurements – Polarization measurement

BEFORE

- Put ND filters in front of the cross channels
- Attenuate the incoming light

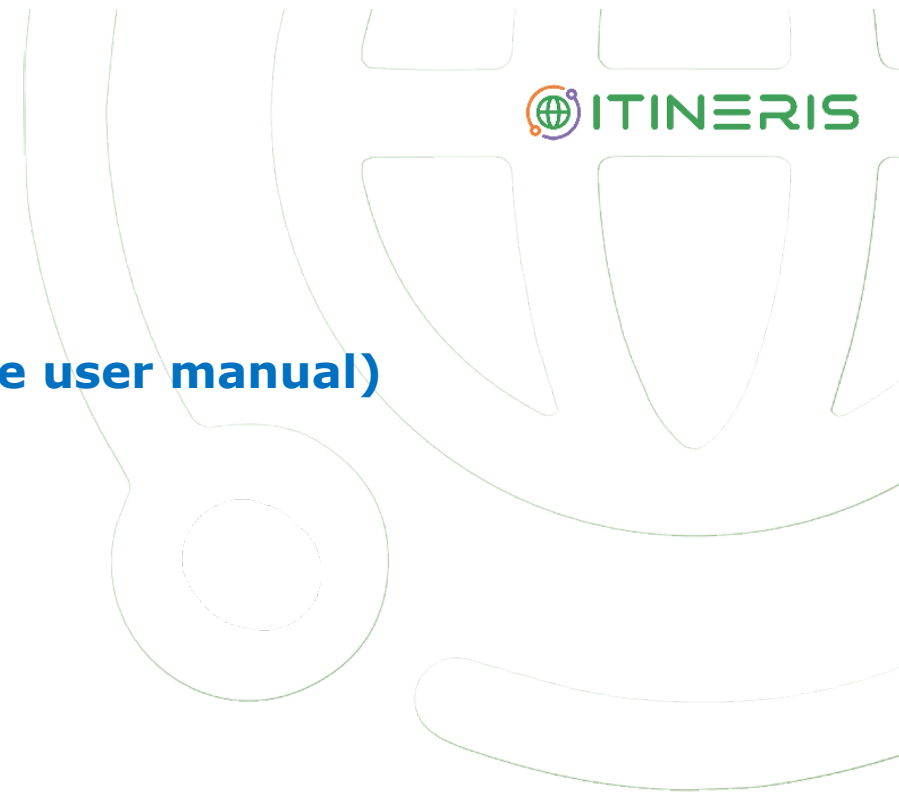


GLOBAL_SHUTTER	<input type="text" value="0"/>	ON=1 OFF=0
1064P(2)	<input type="text" value="0"/>	OPTIMIZER=1
1064S	<input type="text" value="6"/>	CALIB=6 OPTIM=1
532P	<input type="text" value="0"/>	OPTIMIZER=1
532S	<input type="text" value="6"/>	CALIB=6 OPTIM=1
355P	<input type="text" value="0"/>	OPTIMIZER=1
355S	<input type="text" value="6"/>	CALIB=6 OPTIM=1
387	<input type="text" value="6"/>	DARK=6 OPTIM=1
607	<input type="text" value="6"/>	DARK=6 OPTIM=1

Finalizing the measurements

Once all measurements are completed:

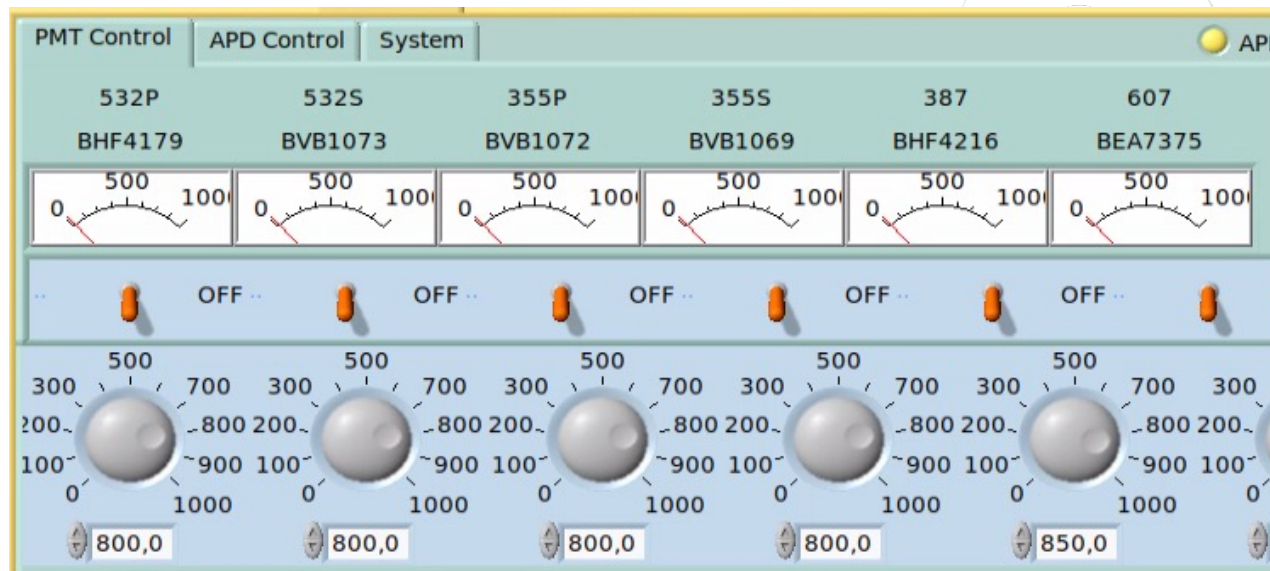
- **Turn off the laser emission (according to the user manual)**



Finalizing the measurements

Once all measurements are completed:

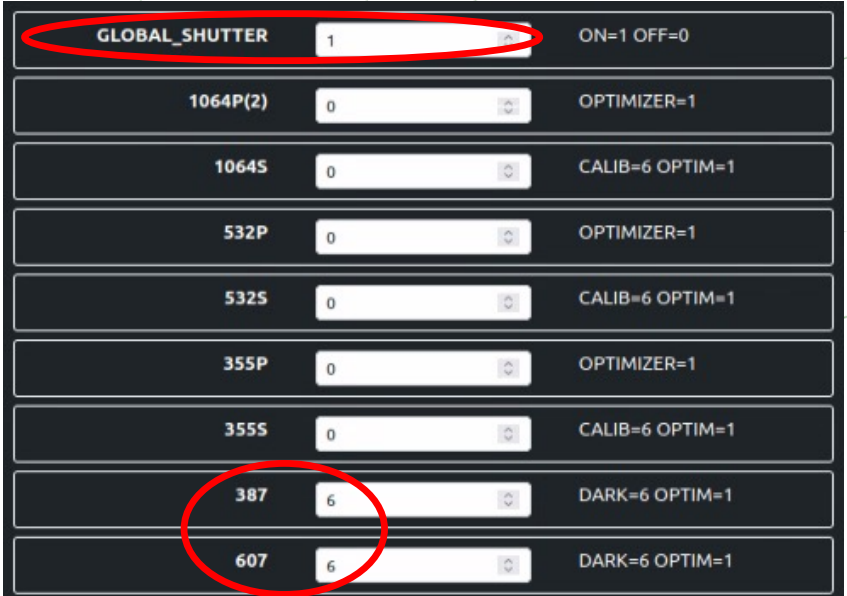
- Turn off the laser emission (according to the user manual)
- **Turn off the detectors HV**



Finalizing the measurements

Once all measurements are completed:

- Turn off the laser emission (according to the user manual)
- Turn off the detectors HV
- **Close the shutters (cover the telescope)**

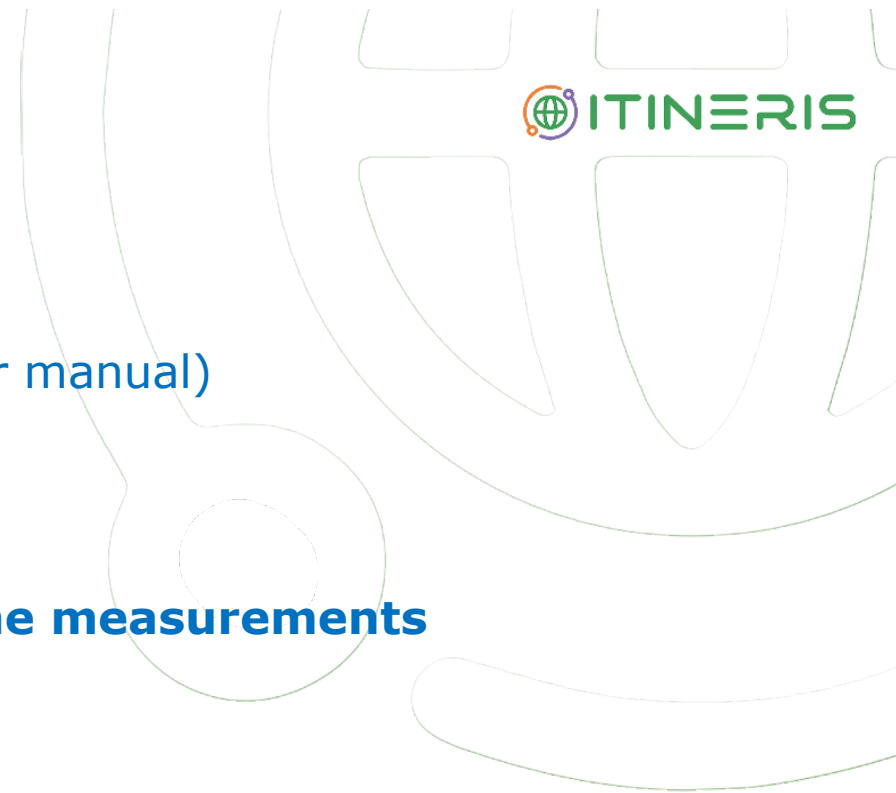
A screenshot of a control panel interface with a dark background and white text. The panel consists of several rows, each representing a different component. The first row is labeled 'GLOBAL_SHUTTER' and has a value of '1' in a white input field, which is circled in red. To the right of this row, it says 'ON=1 OFF=0'. The subsequent rows are labeled with detector IDs: '1064P(2)', '1064S', '532P', '532S', '355P', and '355S', each with a value of '0' in their respective input fields. The last two rows are labeled '387' and '607', both with a value of '6' in their input fields, which are also circled in red. To the right of these two rows, it says 'DARK=6 OPTIM=1'.

GLOBAL_SHUTTER	1	ON=1 OFF=0
1064P(2)	0	OPTIMIZER=1
1064S	0	CALIB=6 OPTIM=1
532P	0	OPTIMIZER=1
532S	0	CALIB=6 OPTIM=1
355P	0	OPTIMIZER=1
355S	0	CALIB=6 OPTIM=1
387	6	DARK=6 OPTIM=1
607	6	DARK=6 OPTIM=1

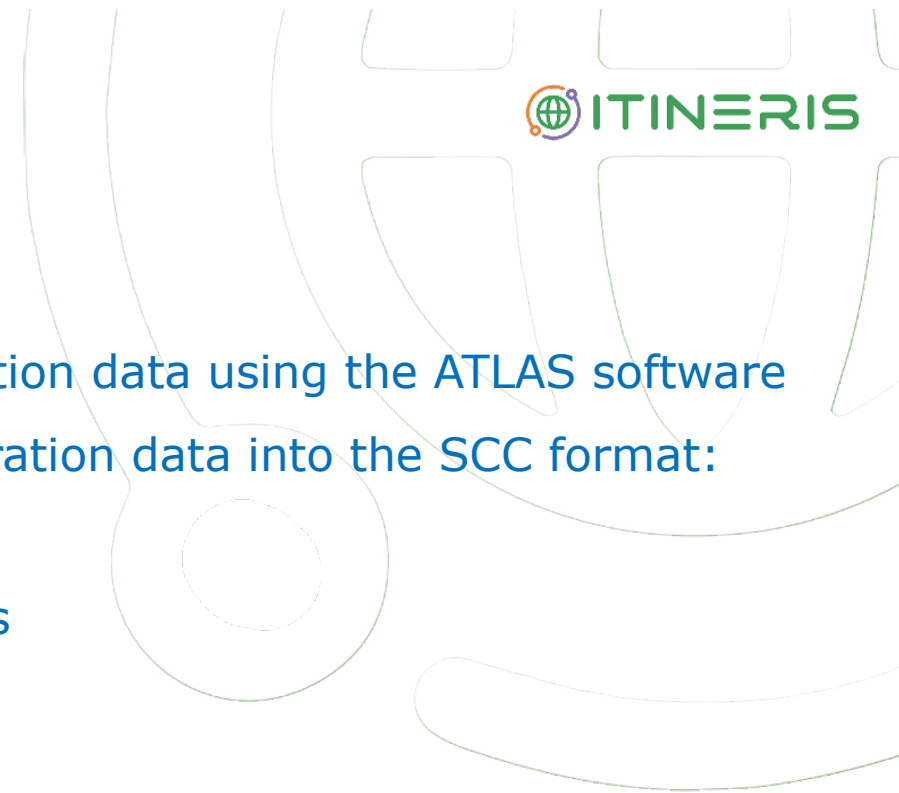
Finalizing the measurements

Once all measurements are completed:

- Turn off the laser emission (according to the user manual)
- Turn off the detectors HV
- Close the shutters (cover the telescope)
- **Close any protective window used during the measurements**



Finalizing the measurements



Submission of the raw data:

- Check the measurement and polarization calibration data using the ATLAS software
- Convert the measurement and polarization calibration data into the SCC format:
 - Obi-Wan
 - Package for atmospheric lidar applications
- Send the data to the SCC
- Check the lidar products returned by the SCC
- For the selected products, submit the corresponding *.nc files to the EARLINET database



THANKS!

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