Tensile Testing Machine and Flat Panel Procedure

Device Overview

-The tensile testing machine is a device capable of measuring scattering while elongating the sample. The specifications are as follows:

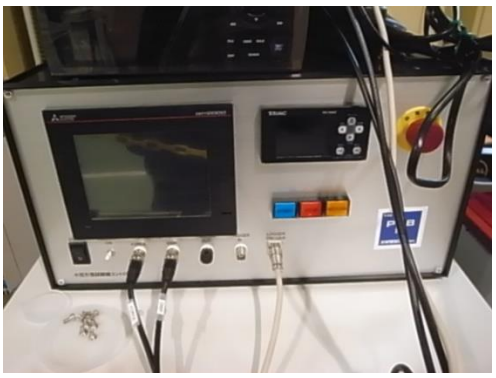
Test Mode	Uniaxial Tensile Test	Operate at the set speed up to the set elongation
Sample	Sample dimensions	Dumbbell shape, chuck distance: 10mm Sample dimensions including grips: 10mm × 30mm, Maximum: 12 × 60
Chuck distance	Initial chuck distance	10mm
	Maximum chuck distance	200mm
	Stroke	190mm
	Stroke setting	0.1-190mm
	Position reset	Can be set at any position as the initial position
Extension rate	Extension rate	0.1-1000.0mm/min
Load detection	Method	Detected by a load cell
	detection range	200N
	resolution	0.01N

-At BL-6A, measurements of SAXS (Small-Angle X-ray Scattering) with PILATUS 1M and WAXS (Wide-Angle X-ray Scattering) with PILATUS 100K are available. At BL-10C and BL-15A2, measurements of SAXS with PILATUS 2M, WAXS with PILATUS 200K or 300K, and SAXS with a Flatpanel detector are possible." The extension start of the tensile testing machine can be synchronized with the start of SAXS and WAXS measurements. However, the tensile testing machine and Flatpanel cannot be synchronized for extension and measurement, so they need to be started separately.

equipment configuration

-The tensile testing machine consists of a controller, stage, handheld control box, and data logger. The attached USB memory to the logger saves date, time, load value (N), and

elongation (mm) in CSV format.



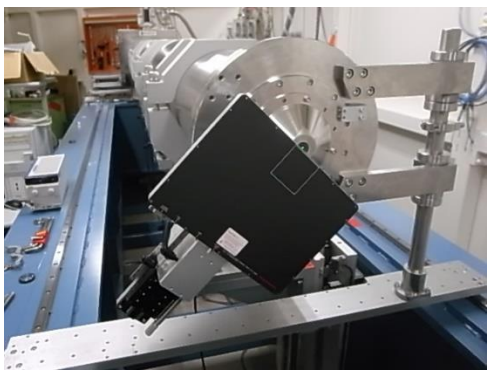
Controller

Stage

Handheld control box

Data logger

-The detectors are SAXS (PILATUS 1M or PILATUS 2M), WAXS (PILATUS 100K, PILATUS 200K, or PILATUS 300K), and a Flatpanel detector. SAXS and the Flatpanel detector are controlled by separate PCs.



Flatpanel detector

The PC (inside the frame) controls the Flatpanel detector.

Origin reset after power-on

- When you turn on the power, you will be prompted for origin reset. Please follow the steps

below: Press the "Origin Reset(原点復帰)" button and navigate to the page for starting the origin reset process.

"Origin Reset(原点復帰)" button

-Please press 'Start Origin Reset. (原点復帰開始スイッチ)'

Mounting the sample onto the equipment

- Please set the sample onto the grips of the tensile testing machine. Use a Phillips screwdriver to attach and remove the grips.

-Remove any slack in the sample. Use the jog [←→] buttons on the handheld control box to open the grips of the tensile testing machine. If there is no slack in the sample, this step is not necessary.

-After opening the grips to remove any slack in the sample, press "Origin Reset(原点復帰)" to navigate to the page for performing the origin reset.

- Press and hold the "Origin Reset(原点リセット)" button to set the current elongation

display to 0.

-Please press "Test(試験)" to navigate to the page for elongation and elongation rate.

-Please input the elongation rate and elongation value. When you touch each value, a numeric keypad will appear. The maximum absolute value for elongation is 190mm.

-Press the ESC button on the controller to reset the load value.

- Press the external trigger (外部トリガー) on the tensile testing machine.

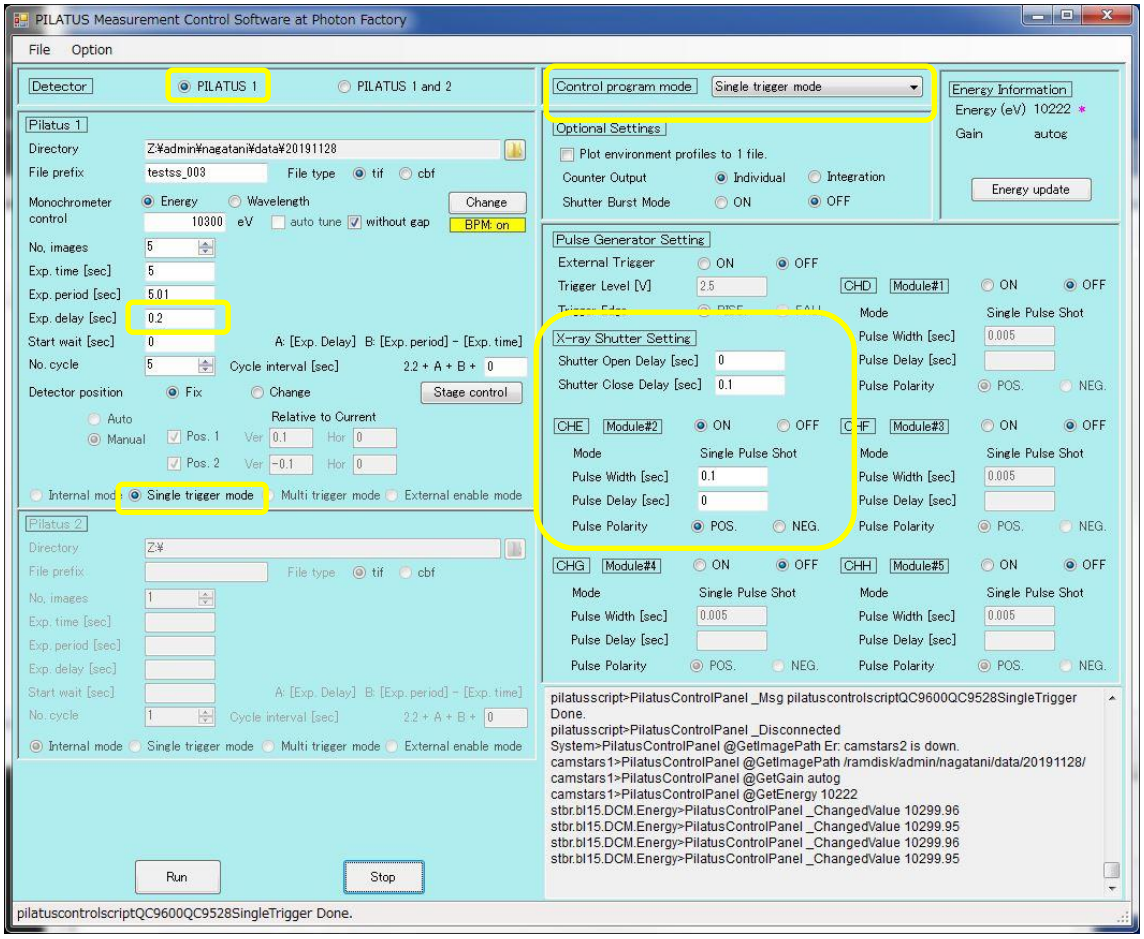
- Press the "Start" button on the tensile testing machine to put it in a trigger-ready state.

-The logger is in free-running (フリーランニング) mode, and data is not being saved. Please press START/STOP.

-Press ENTER to put it in a trigger-ready state. It may take several seconds to enter the trigger-ready state. Now, the tensile testing machine is ready for elongation.

Measurement with SAXS.

-Configure the measurement GUI as follows: Select "PILATUS 1" from the Detector option. Set the Control program mode to "Single trigger mode." Set the Exp. delay[sec] to 0.2 to account for the 0.2-second delay between the start of PILATUS measurement and the extension start of the tensile testing machine. For X-ray Shutter Setting, set Shutter Open Delay[sec] to 0 and Shutter Close Delay[sec] to 0.1. Turn CHE ON, set Pulse Width[sec] to 0.1, Pulse Delay[sec] to 0, and Pulse Polarity to POS.



-Please press the 'Run' button on the GUI to start the measurement.

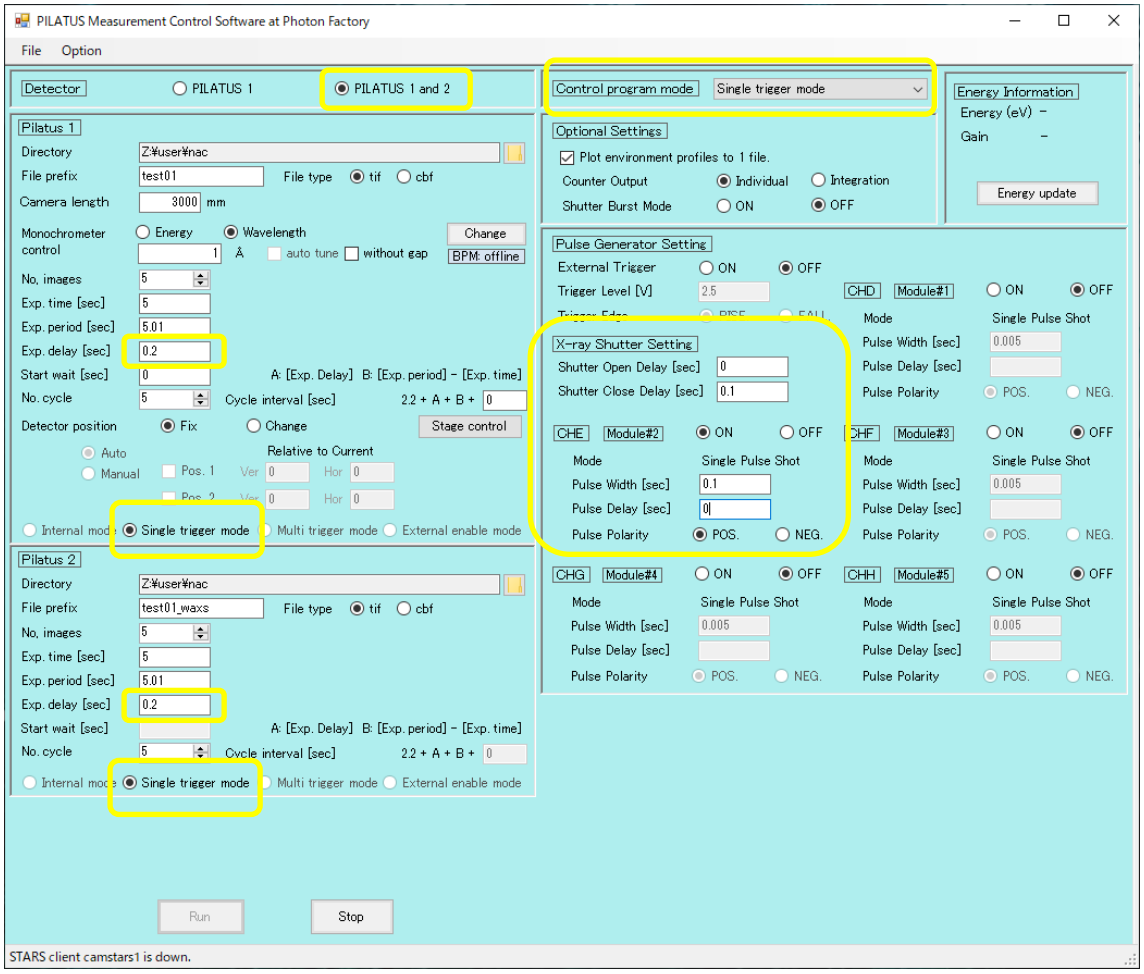
-Even after the measurement is completed, the tensile testing machine will continue to elongate. Please press the STOP button on the controller to halt the extension. Press the RETURN button on the controller to bring the chuck distance back to 10mm. Also, please stop the data logging.

-After the measurement is complete, please press START/STOP to stop saving the data on the logger.

-Please press ENTER to stop the data saving.

Measurement using SAXS and WAXS.

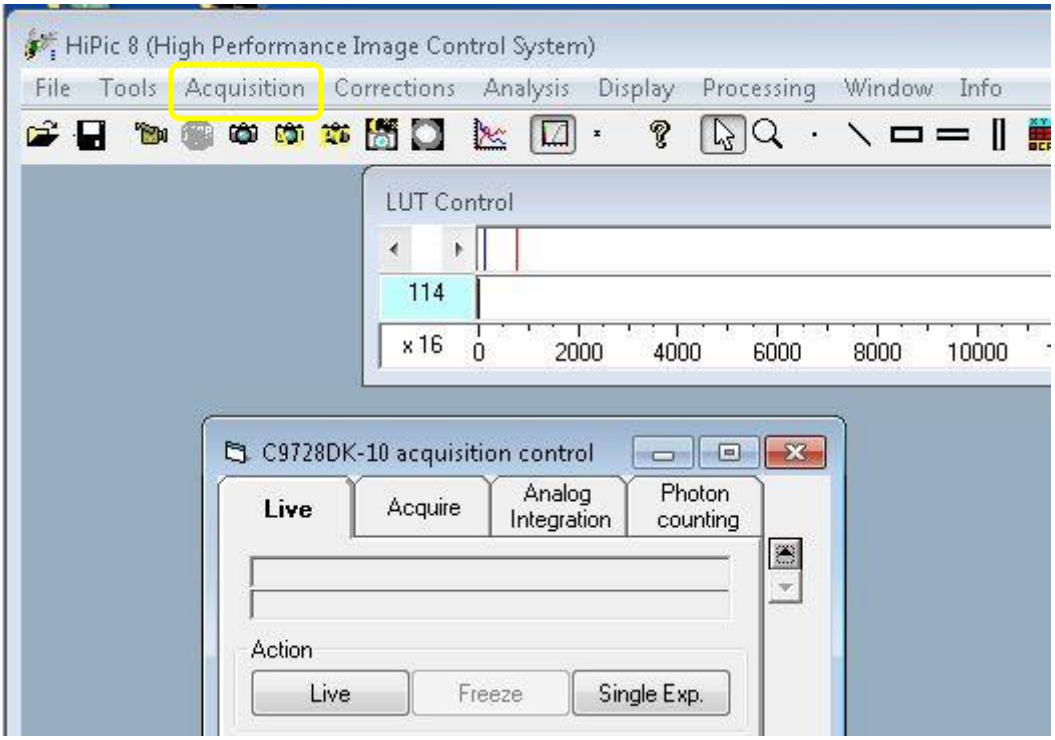
-Select "PILATUS 1 and 2" from the Detector option. Set the Control program mode to "Single trigger mode." Set "Exp. delay[sec]" to 0.2 for both Pilatus 1 and Pilatus 2. Configure X-ray Shutter Setting as follows: "Shutter Open Delay[sec]" to 0, and "Shutter Close Delay[sec]" to 0.1. Turn on CHE, set "Pulse Width[sec]" to 0.1, "Pulse Delay[sec]" to 0, and "Pulse Polarity" to POS.



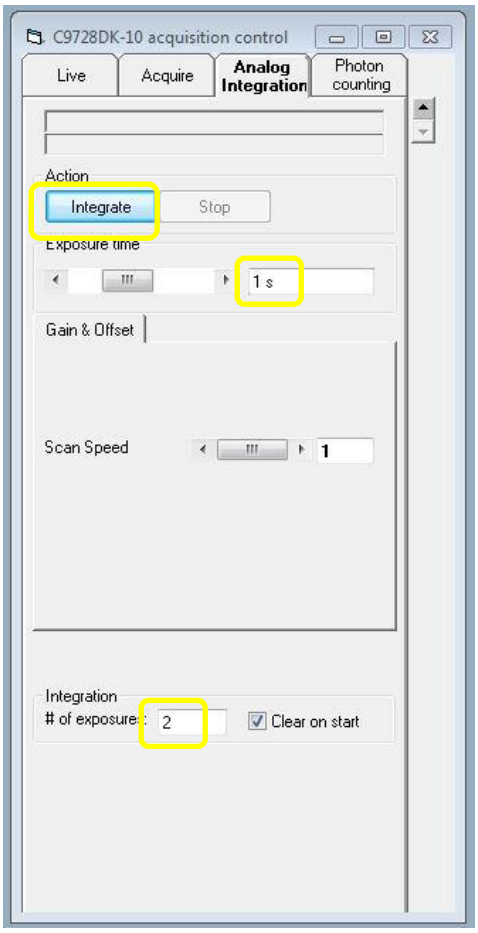
-Please press the "Run" button on the measurement GUI to start the measurement.
- Even after the measurement is complete, the tensile testing machine will continue elongating. Please press the "STOP" button on the controller to stop the elongation. Then, press the "RETURN" button on the controller to bring the chuck spacing back to 10mm. Finally, stop saving data on the logger.

Measurement using SAXS and a flat panel detector.

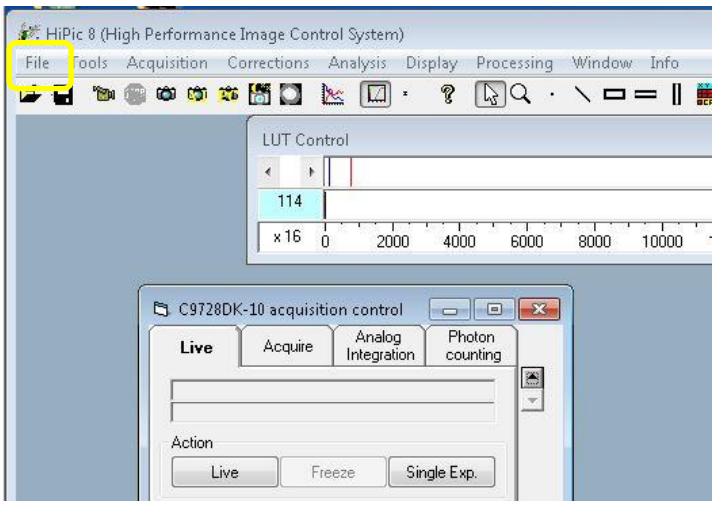
- Please input the measurement GUI in the same way as the SAXS measurement.
- For the measurement, select "Acquisition → Analog Integration" on HiPic8 software running on the PC connected to the flat panel detector.



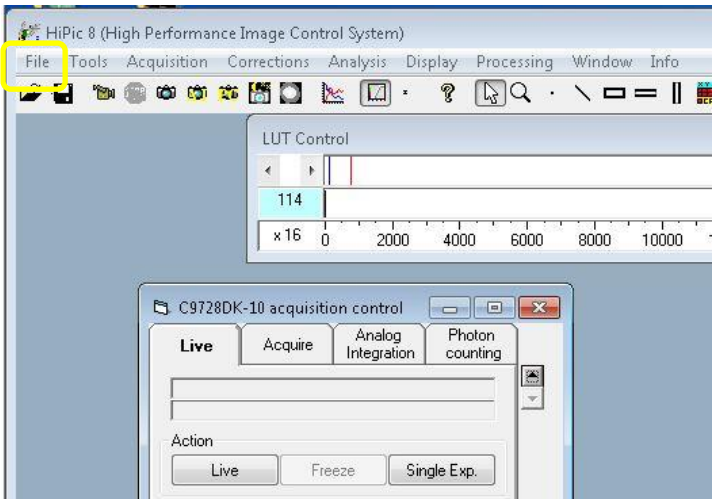
-We will perform a background measurement without emitting X-rays. For example, set the Exposure time to 1 second and #of exposures to 2. This will integrate two scatterings with 1-second exposure each into one file. Press the "Integrate" button to start the measurement.



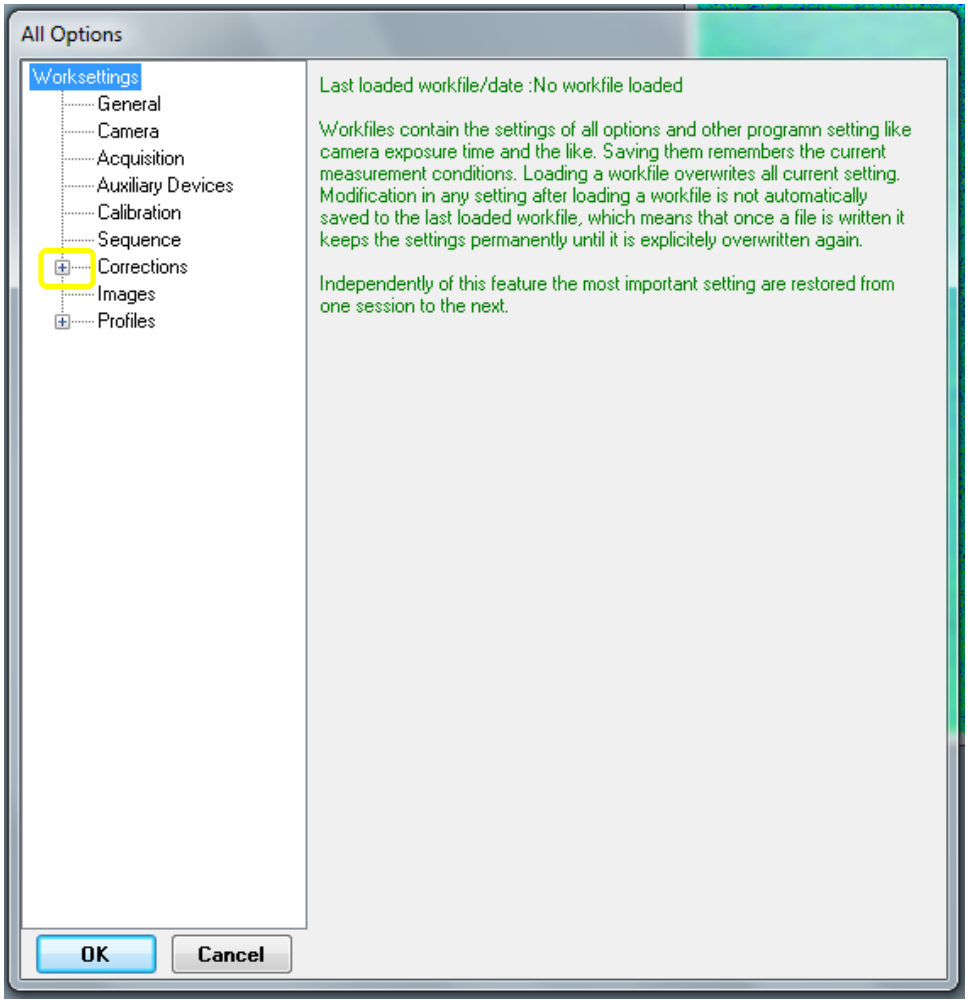
-Save the obtained background image by selecting "File → Save as" or right-clicking on the image and choosing "Save as."



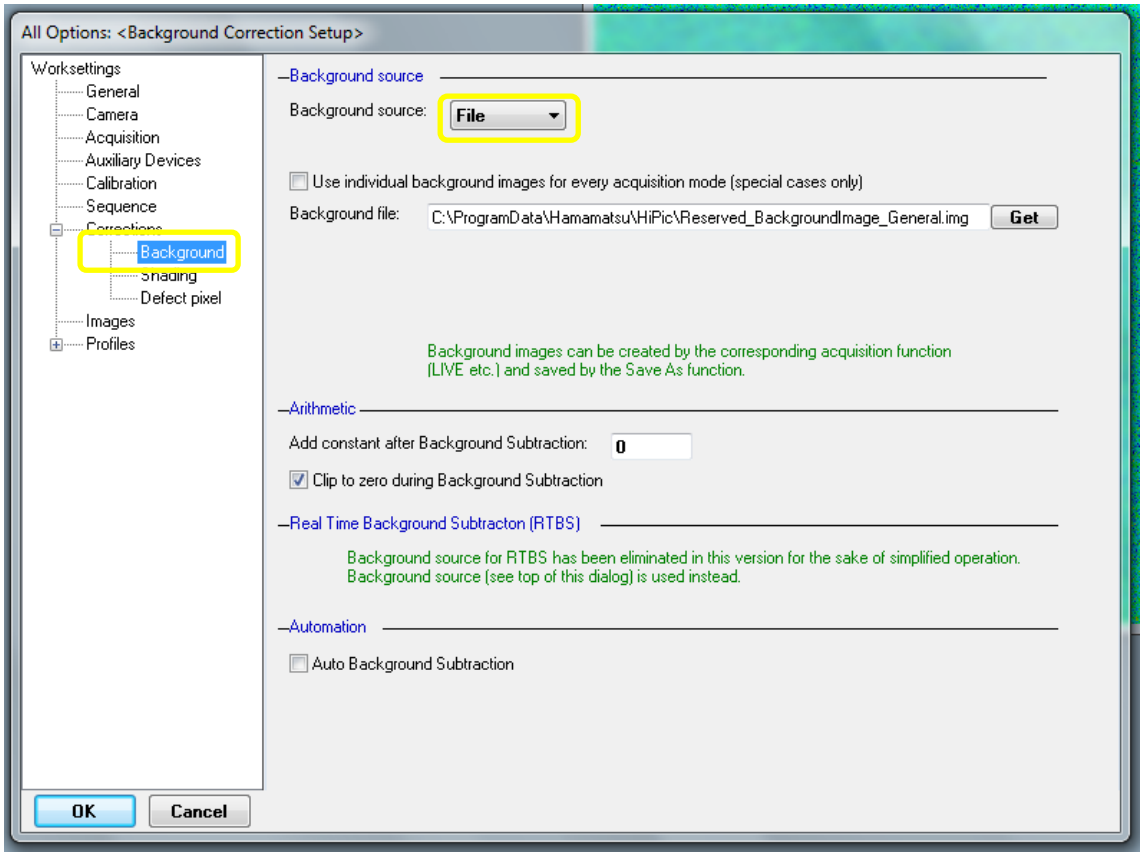
-To subtract the background from the subsequent measurements, select "File → Options."



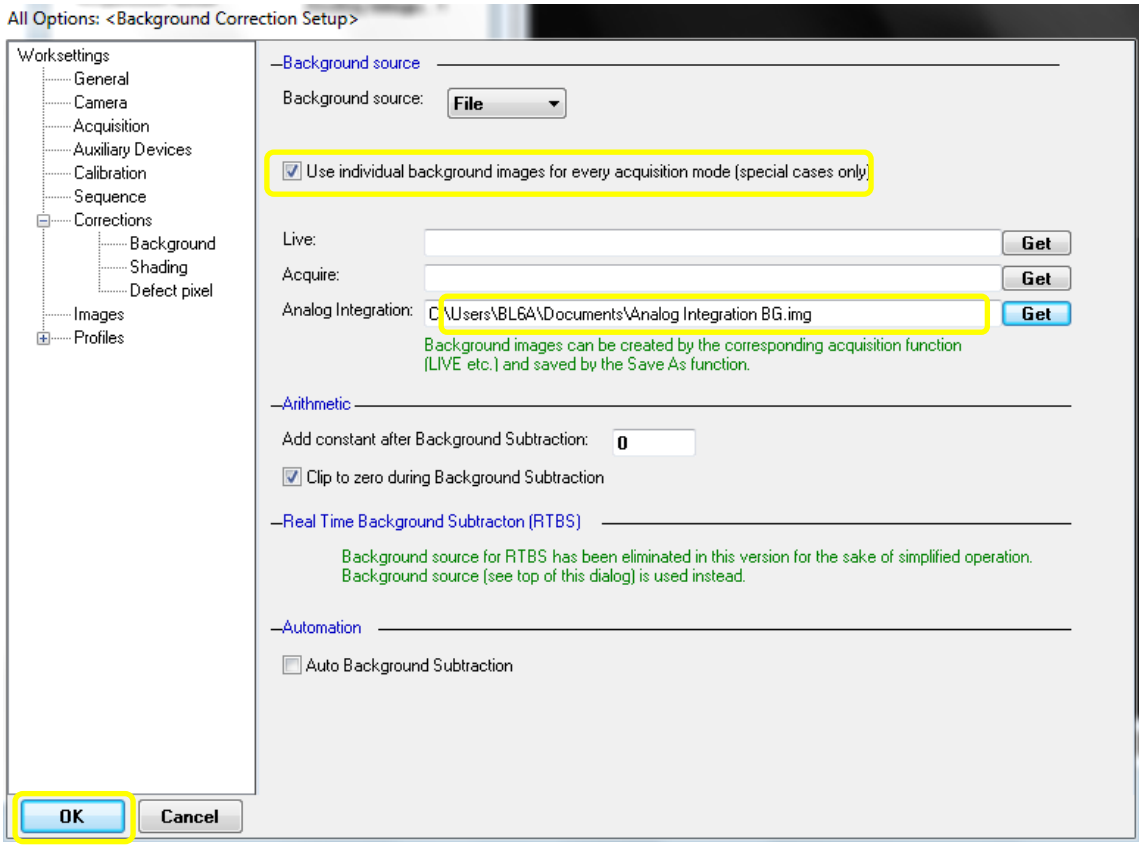
- You will see "All Options" displayed. Open the "+" next to "Corrections" on the left.



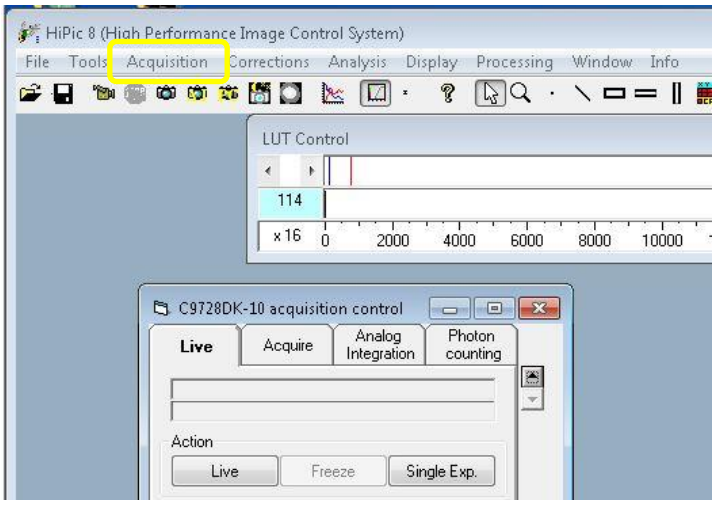
-Select "Background." Set "Background source" to "File."



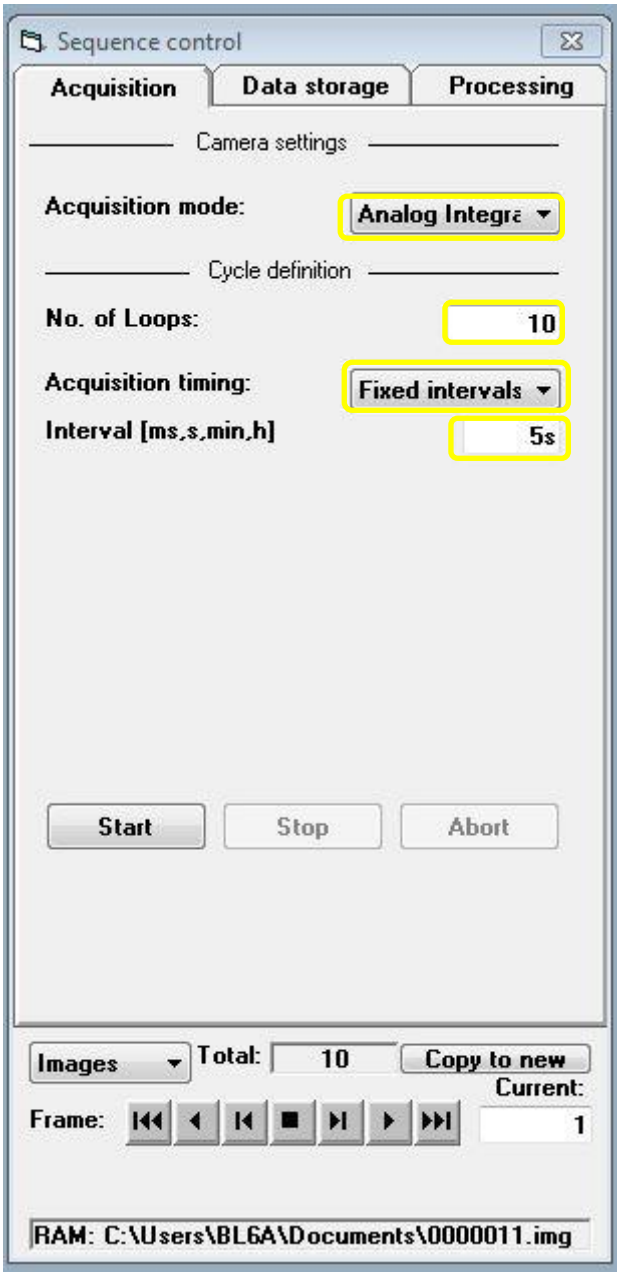
-Check the box for "Use individual background images for every acquisition mode." In the "Analog integration" section, enter the filename of the background image that was measured earlier, including the file path, or use "Get" to browse for the file. Finally, press "OK" at the bottom left to close the window.



-To perform time-resolved measurements, select "Acquisition → Sequence..."



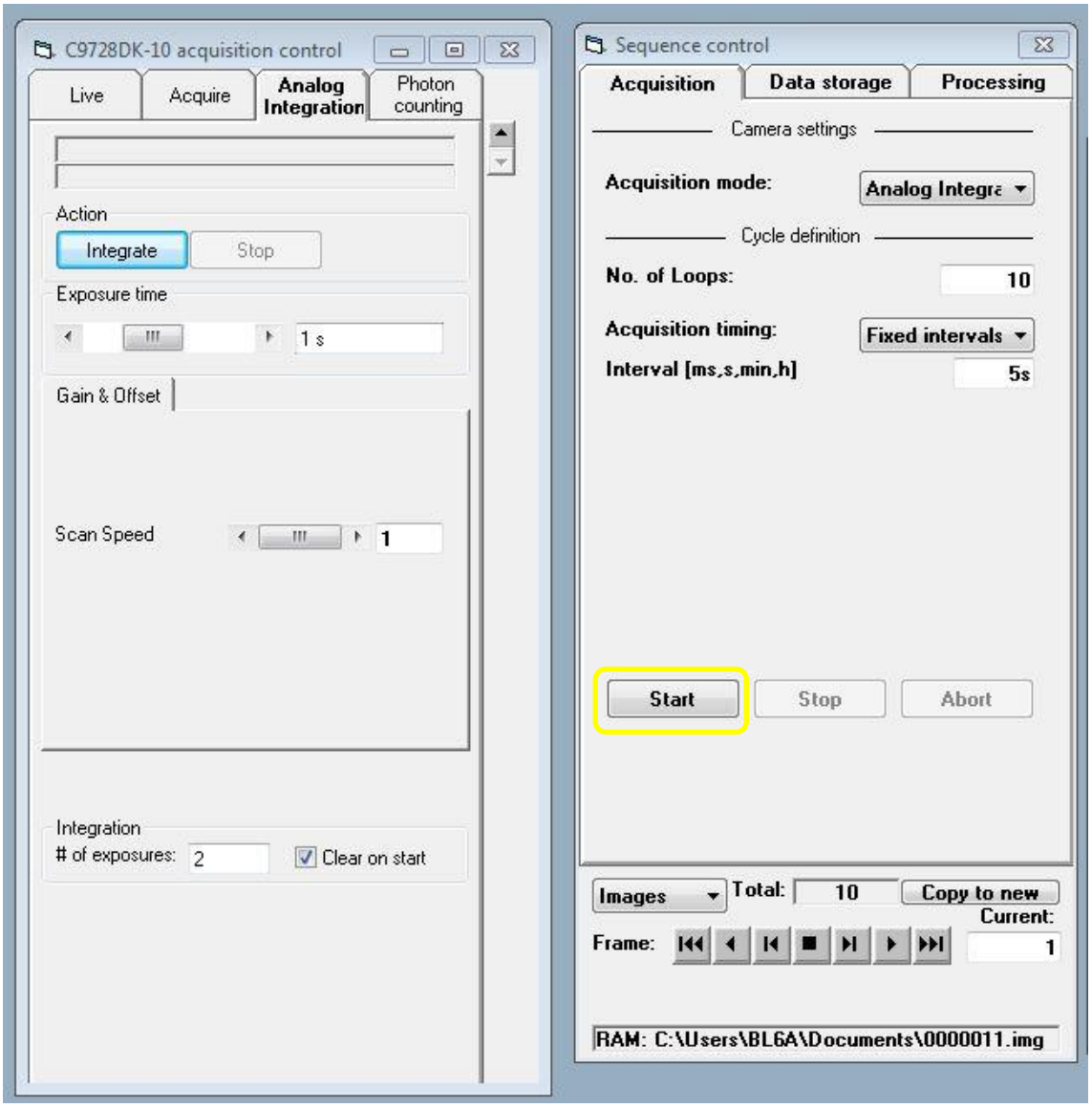
-The Sequence control will appear. Select "Analog Integration" from the Acquisition mode. For example, set "No of Loops" to 10 measurements and "Interval" to 5 seconds. The Interval represents the time between the start of one measurement and the start of the next one. Please enter the unit as ms, s, min, or h.



-With the following settings, press "Start" on the Sequence control to begin the measurement:

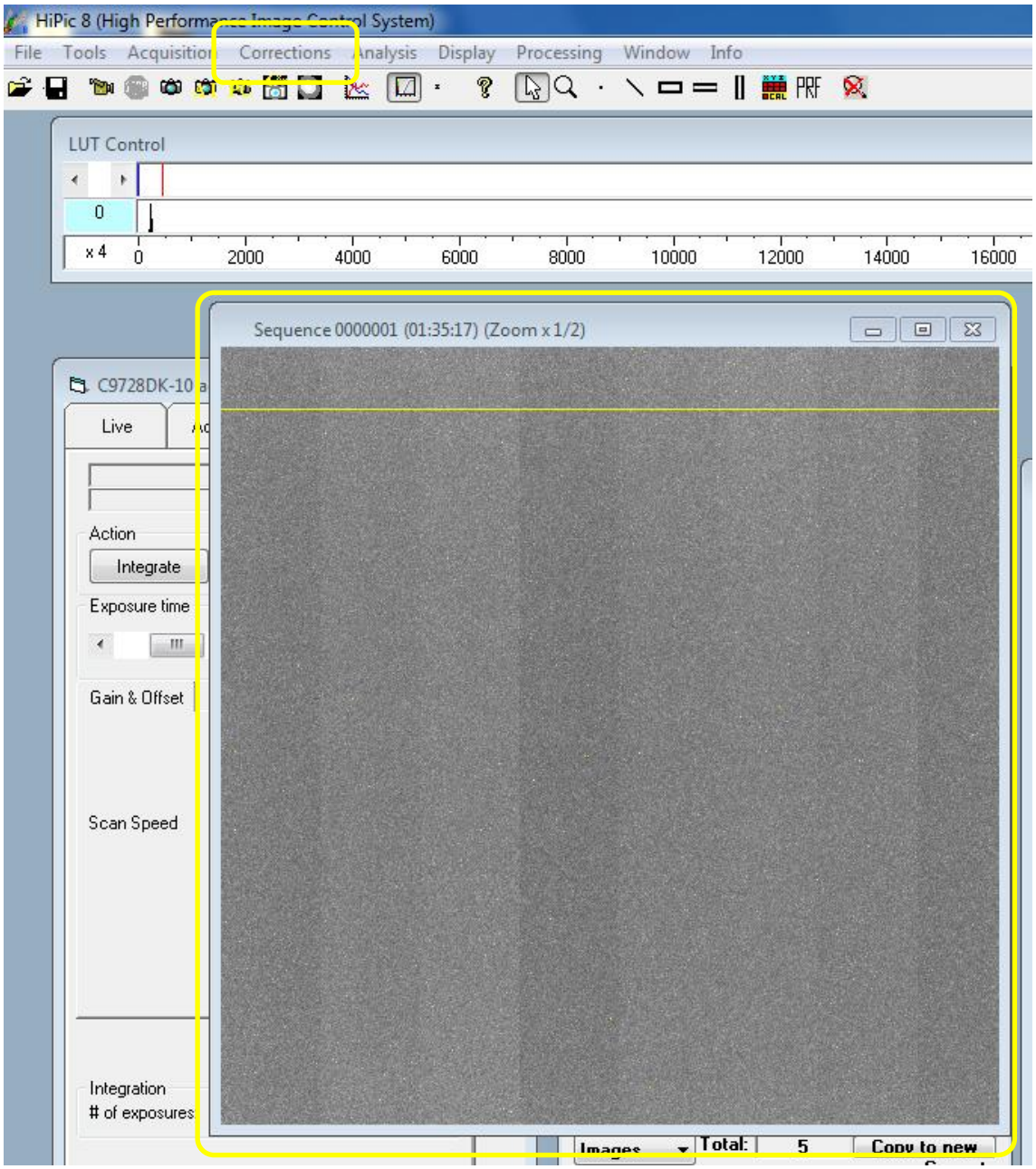
Exposure time: 1 second
Number of exposures: 2 (integrate into one file)
Interval: 5 seconds (time between each measurement)
Number of Loops: 10 (total number of measurements)

Please ensure that the measurement time, the number of exposures, and the measurement cycles are sufficient for the flat panel to be exposed properly. After pressing "Run" on the measurement GUI, immediately press "Start" on the Sequence control to start the Flatpanel measurement. Alternatively, you can press "Run" on the measurement GUI after starting the Flatpanel measurement with the "Start" button on the Sequence control.

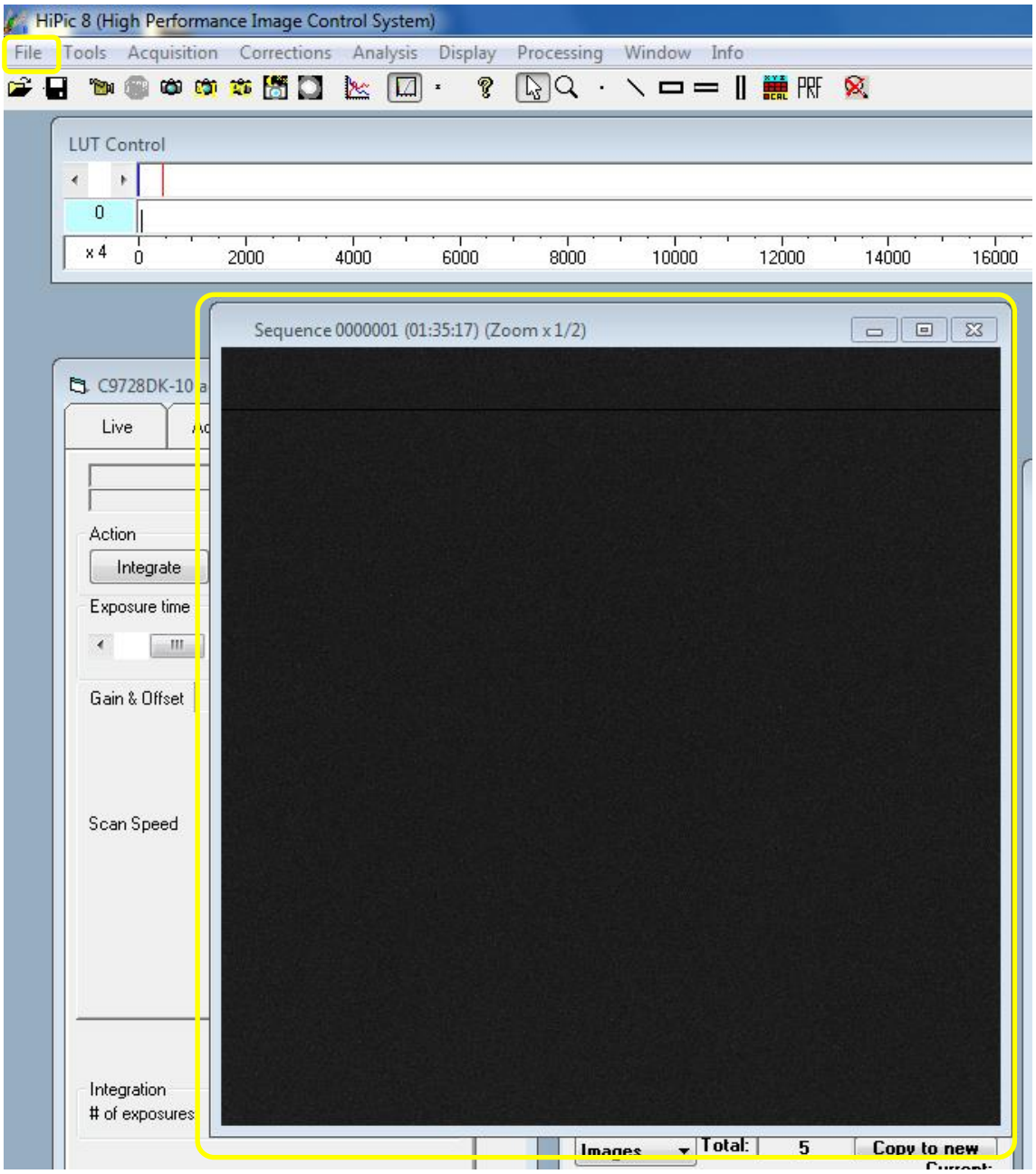


-As the tensile testing machine continues elongating even after the measurement is complete, please press the "STOP" button on the controller to stop the elongation. Then, press the "RETURN" button on the controller to bring the chuck spacing back to 10mm. Finally, stop saving data on the logger.

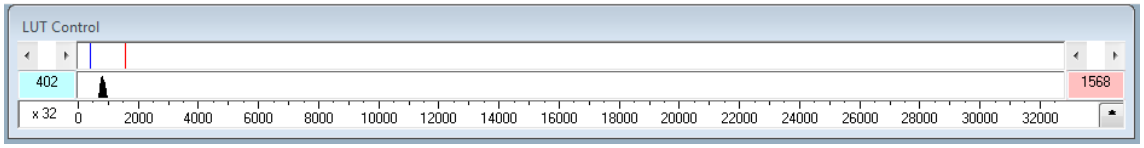
-To subtract the background from the obtained scattering image, select the scattering image and choose "Corrections → Background Subtraction."



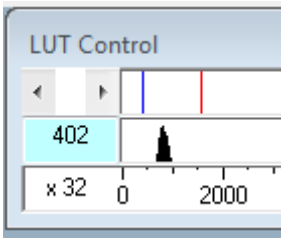
-Save the scattering image by selecting it, then choose "File → Save as" or right-click on the image and select "Save as." Since you have entered 10 in "No of Loop," the images will be saved with file names from 001 to 010.



-When the contrast is low, adjust it using the LUT control.



- In the LUT control peaks may appear. Adjust the lower and upper limit lines on the display to sandwich the peaks, which will increase the contrast and make it easier to visualize. You can move the lower and upper limit lines by holding down the left mouse button.


LUT Control
402
x 32
0
2000