Intervention Report

Sender :
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France

Recipient :
Nuclear Research Center – Negev
P.O. Box 9001 Beer Sheva
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Les Loges-en-Josas, le 2022/11/16

Instrument model : TX 1000

Instrument purchase order number : 4240001216

iUMTEK technical support : Kévin BOUDOULEC and Yannis CHIBANE

Intervention date and duration : 2022/11/16 from 10 AM to 11 AM (Paris time).

Context :

Following your email of the 31st of October 2022 and a first Skype meeting on the 7th of October 2022, a dysfunction occurred on your TX 1000 instrument.

Specifically, the autofocus does not work properly. The images sent from the viewing camera show a shift between the alignment of pointers 1 and 2 with the crater. The corresponding spectrum has a lower intensity value than the one obtained during the TX 1000 installation in April 2022.

Intervention steps :

A Skype meeting has been organized to achieve several tests under iUMTEK's guidelines. For all the following steps below, the relevant data are contained in the Appendices.

1) The reference aluminum sample has been put inside the analytical chamber.
2) An autofocus is performed.

   An analysis is performed at the corresponding focal position with the control chart protocol.

   An image of the viewing camera is captured, showing the pointers 1 and 2, and the green point of the viewing camera.
3) The sample is moved following the Z focal axis until the crater and the green point of the viewing camera are as closed as possible. An analysis is performed on a clean area with the control chart protocol.

   Several images of the viewing camera are captured showing the crater, viewing camera green point and pointers 1 and 2 positions.

   Note : due to a manual moving of the sample, this step is repeated twice. The second time, the focal axis is changed according to the green point and pointer 1 alignment. The green point, crater, and pointer 1 seem to be on the same Y axis position, so it is not changing the results of the performed test.

Interpretation :

Following the same numbering as the intervention steps above:

1) OK, nothing relevant
2) The pointers 1 and 2 are not overlapping accordingly with the viewing camera green point.

   The analysis shows global loss of intensity up to 2000, compared to the installation acceptance average spectrum, except for the wavelengths of the ambient air H, N and O which is normal due to the incorrect focal setting.
3) The alignment between the viewing camera and the crater shows a shift of 164 µm in X axis and 22 µm in Y axis.

   The alignment between the viewing camera and the pointer 1 shows a shift of 135 µm in X axis and 28 µm in Y axis.

   The alignment between the viewing camera and the pointer 2 shows a shift of 300 µm in X axis and 242 µm in Y axis.

   The spectrum obtained shows an intensity of the same order than the installation acceptance average spectrum. Therefore:

   a) This proves that the laser and spectrometers optical path are correctly set at this position.

   b) The pointer 2 is not correctly set and the pointer 1 and viewing camera have a little shift.

Conclusion :

With the autofocus function, the spectrum intensity is lower than usual, and the optical paths show a shift in alignment. The autofocus is not performing properly.

The spectrum intensity is better when the pointer 1, the viewing camera and the crater are as closed as possible.

The pointer 2 is clearly unaligned and the autofocus is performed mainly based on pointer 2.

That explains why the autofocus does not work properly.

The correct level of spectrum intensity observed, proves that the laser and spectrometers alignment has not move.

Hypothesis about the reason of the dysfunction :

To our knowledge based on our return on experience, a shift may happen when:

- The instrument is moved, due to vibrations. Therefore, an alignment is performed during the installation;
- The casing is opened, due to mechanical strains and internal components manipulation.

Regarding these two cases, the customer ensures that the instrument has not been moved or shocked nor opened.

During our discussion, and if we understood properly, the client has mentioned a high fluctuation of thermal condition inside the room. The temperature can increase by 15°C during night and day cycle, up to 40 °C, while the instrument is switch off. Consequently, the instrument AC does not maintain an internal stable temperature.

According to the Interface Control Document (ICD), *"to fulfill the specifications, room temperature in which the Product is installed shall be kept within the following boundaries: +18°C to +25°C with a temperature gradient less than 1°C per hour* " (Part 5.1.).

A shift could have happened due to high thermic fluctuation. Under the influence of temperature fluctuation, the optomechanical parts and/or optics could move. These movements follow a cycle of shrinkage and dilatation which is a hysteresis function, nonlinear nor reproducible.

More precisely, the opto-mechanical parts of the pointers use a spring effect that can suffer from a too high hysteresis fluctuation.

Therefore, the temperature of the room must not shift too far from the recommended standard range.

At this point, the thermal effect is the most probable reason why the shift occurred.

This shift is particularly visible due to the viewing camera high-resolution quality.

Next steps :

To have an autofocus functioning normally, we recommend 2 actions :

1) Make an update of the software to change how the autofocus is performed, based on pointer 1
2) Perform a hardware alignment of the pointers and viewing camera

The first action could be quite fast and sent to the client. It needs a software development and an updated autofocus calibration procedure.

The second action requires to open the casing. However, and before any opening and hardware alignment, it is necessary to validate the hypothesis about the thermal effect to avoid any further future shift.

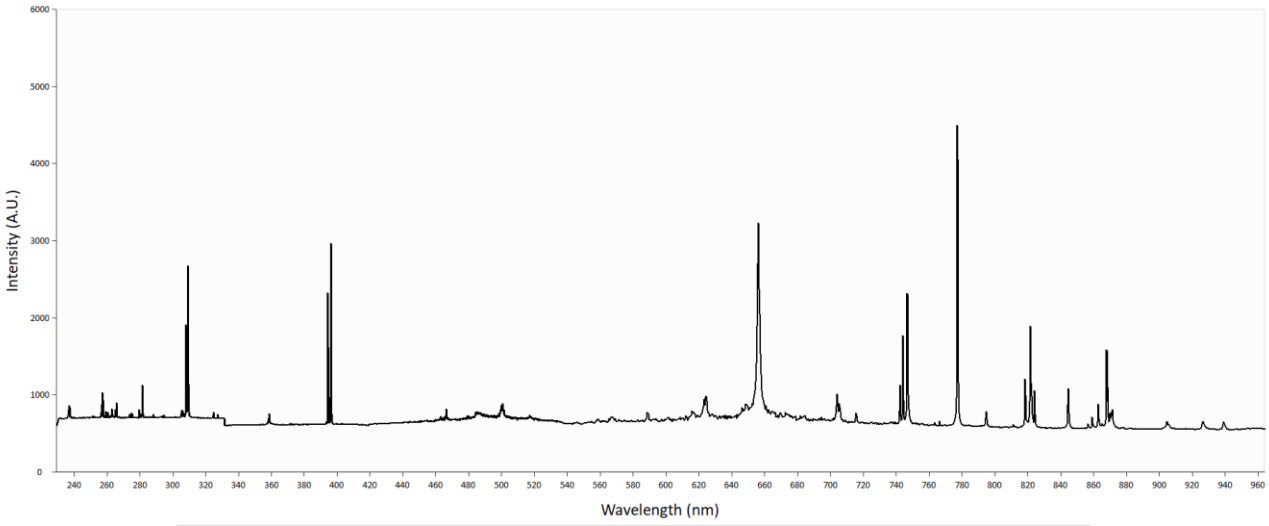
In the meantime, the instrument can be used. The operator must perform the focal setting of the sample manually with pointer 1 as the reference.

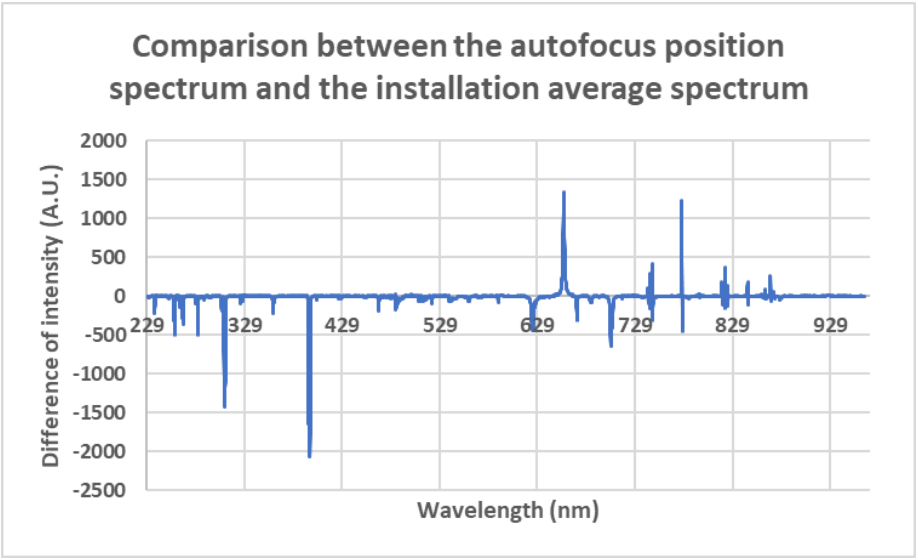
Appendices :

Step 2 : Alignment using autofocus function

Optical alignment :

Signal obtained :





Step 3 : Manual alignment between the crater and the viewing camera (and pointer 1)

Optical alignment :


Crater


Pointer 1


Pointer 2


Pointer 1 & 2

Signal obtained :