Service Note

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9120UVD (S.N number: SNLC-202103-03)

How to calibrate the monochromator of 9120 UVD

Update date: Mar.30th, 2021

When you replace an internal part of monochromator such as Grating, Beam splitter or any other part, it is necessary to perform the calibration step. When the position of each internal part is not arranged properly, the detector response is lower than usual. Furthermore, it is hard to analyze the trace level of compound, and also the wavelength accuracy is out of normal range. This process requires a precise alignment skill, so please follow the steps in this service note carefully.

Figure 1. YL9120 UVD monochromator

I. Access to the inside of YL9120 UVD

1. Loosen 6 Torx screws and 1 hex bolt as shown in Figure 2 to open the top cover of 9120 UVD.

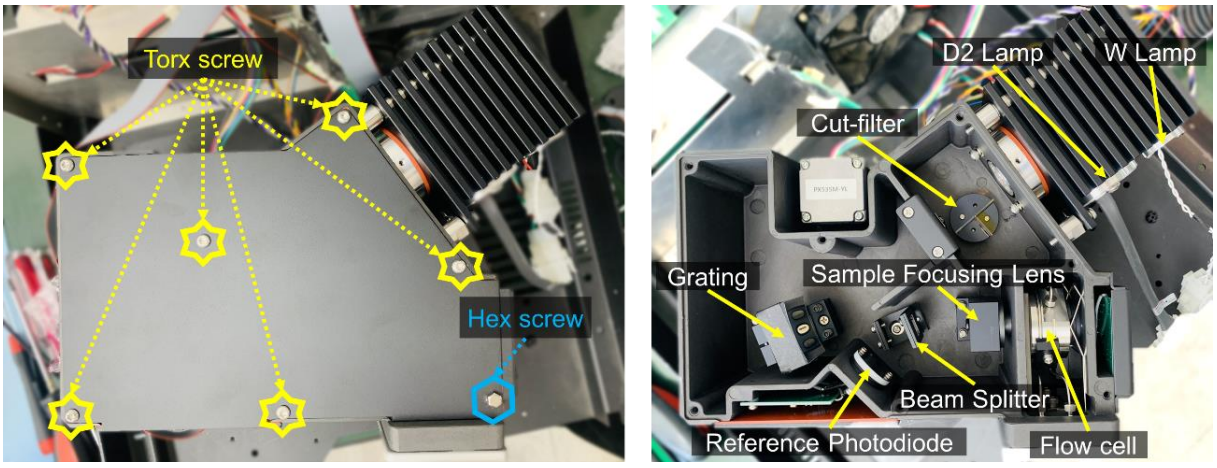

Figure 2. Inside of the monochromator

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II. Grating replacement

1. Turn on UVD, and wait until initialization step is finished.
2. After initialization step, go to UV method window and turn on W and D2 lamp.
3. Loosen the headless hex screw located rear side of the grating (see Figure 3) to remove the old grating.
4. Install the new Grating with the arrow direction ahead to indicated point and slightly fasten the hex screw (as shown in Figure 3-(b), (c)).

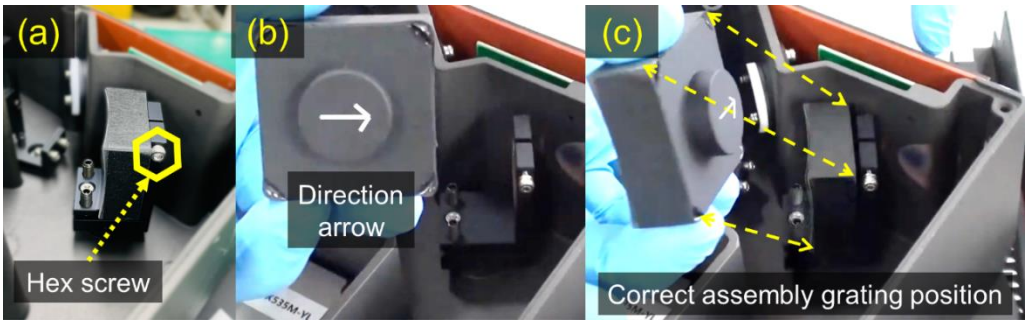

Figure 3. How to remove and replace the grating.

5. Perform the calibration with chapter V for the adjustment of grating.

III. W lamp replacement (You can skip this step if not replaced.)

1. Disconnect the W lamp cable.
2. Loosen two screws located top of the lamp housing and open the W lamp cap to remove the old W lamp.
3. Slightly loosen the headless hex screw as shown in Figure 4-(a) and remove the old W lamp.
4. Insert the new W lamp and adjust (rotate) the position of W lamp to find the correct position (as shown in Figure 4-(b)).
5. After adjustment, tighten the headless hex screw.
6. Close the W lamp cap and tighten two screws.

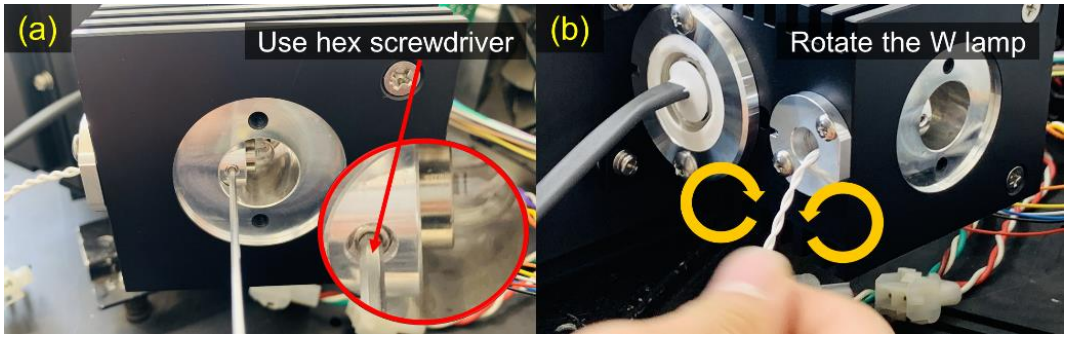

Figure 4. How to remove and replace the grating.

7. Perform the calibration with chapter IV for the adjustment of W lamp and lamp housing.

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IV. W lamp and lamp housing adjustment

1. Prepare the test jig (target paper)

a. Print out the test jig (target paper) and fold according to the blue lines on the drawing as shown in Figure 5.

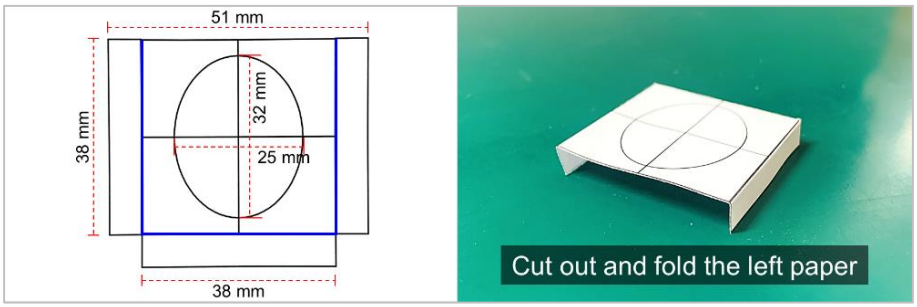

Figure 5. Drawing of the test jig (target paper)

b. Put the test jig (as shown in Figure 6) on the grating.

**If the test jig does not fix well, you can use the adhesive tape.*

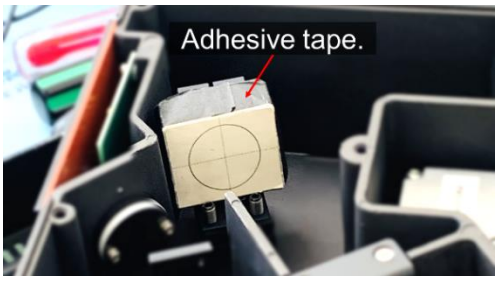

Figure 6. Put the test jig on the center of the grating.

2. Lamp housing adjustment

a. Turn on UVD and wait until initialization step is finished.

b. After initialization step, go to UV method window and turn on D2 and W lamp.

c. Set the wavelength of 230nm then the light beam that is passing through the center of the slit as like Figure 7.

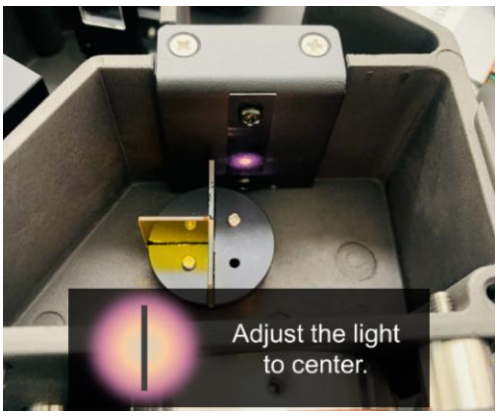

Figure 7. Check the light beam to center of slit.

d. If the light beam is not positioned on the center of slit, loosen four fixing screws on the lamp housing (refer to Figure 8-(a)) and two fixing screws located back

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side of D2 lens (refer to Figure 8-(b)).

e. Adjust the housing to focus the light beam on the center of the slit. At this moment, use a screwdriver for adjustment of the lamp housing between the lamp housing and body of the spectroscope as shown in Figure 8-(c).

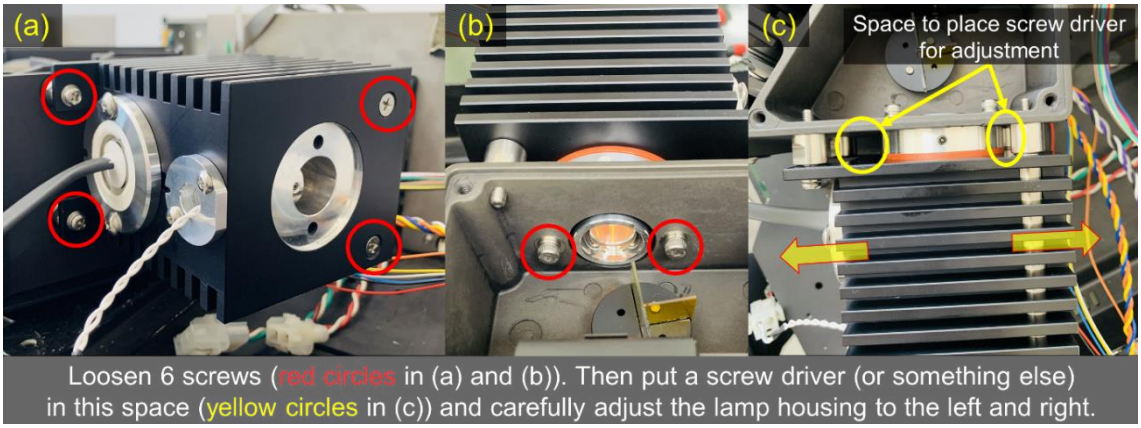

Figure 8. (a),(b) Location of screws to be opened for adjustment.
(c) Method for adjustment the lamp housing.

f. When the light beam is well centered (adjusted), tighten all screws at lamp housing adjustment step.

3. W lamp adjustment

a. Go to UV method window and turn on W lamp and off D2 lamp

b. Slightly loosen the headless hex screw as shown in Figure 4-(a).

c. Adjust (rotate) the position of W lamp to find the correct position as shown in Figure 4-(b).

d. The light beam can be adjusted by moving/rotating the position of the W lamp (see Figure 9).

**Criteria: the light beam is determined to be correctly positioned if the two black circles should be symmetrically centered on the paper target and also the filament is visible between two black circles (refer to Figure 7).*

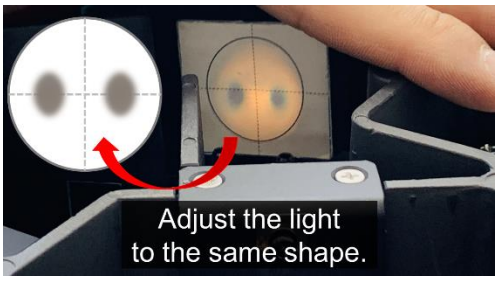

Figure 9. Correct shape and position of the light beam on the paper target.

e. After adjustment, tighten the headless hex screw.

f. Close the W lamp cap and tighten two screws.

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V. Grating and Beam splitter position adjustment

Grating is able to move in three directions as shown in Figure 10. The directions adjusted are (a) and (b). Figure 10-(c) indicates the direction in which can be moved by hand without the motor cable connection.

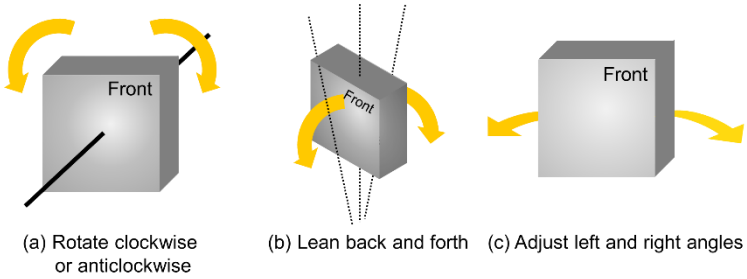

Figure 10. Three directions that allow the grating to move.

1. Adjust the grating position (lean back and forth) – purple light beam.
   a. Turn on UVD, and wait until initialization step is finished.
   b. After initialization step, go to UV method window and turn off the W lamp and set the wavelength of 254 nm.
   c. Disconnect the grating motor cable (see Figure 11).

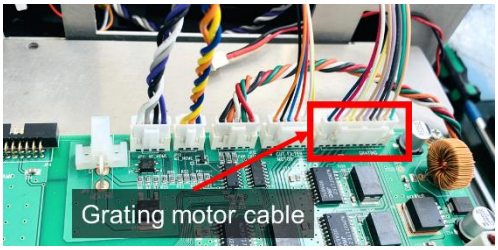

Figure 11. Location of the grating motor cable

   d. Carefully move the grating holder to the direction indicated with yellow arrow in Figure 12 with your hand.
   e. Find the purple light beam appears at the location of the red arrow and line shown in the Figure 12.
   f. After checking the purple light at the indicated location, move the grating with your hand to reverse side until the light beam appears on the sample focus slit.

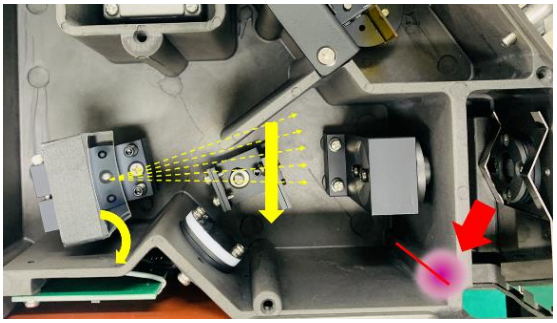

Figure 12. Setting the initial position to adjust the grating position.

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g. Adjust preciously the grating by tightening or loosening the ball plunger screw and center screw as shown in Figure 13 so that the sample energy reaches to the highest value. At this moment, check the purple light beam is centered on sample focus slit (refer to Figure 14).

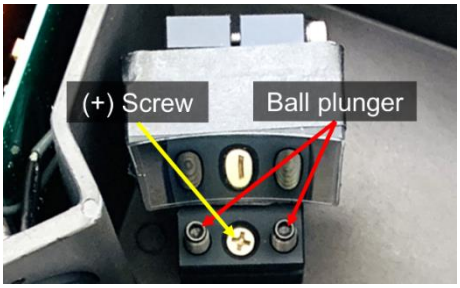

Figure 13. Three screws on the front of the grating.

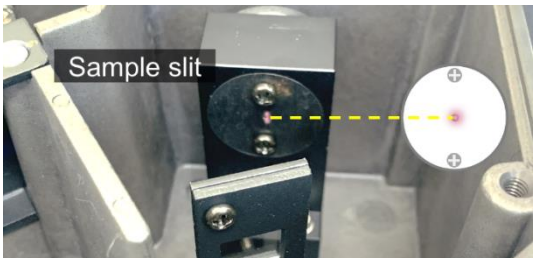

Figure 14. The exact position of the light beam on the sample focus slit.

h. After that, connect the motor cable then set the 656 nm and check that the red light is located in the center of reference slit.

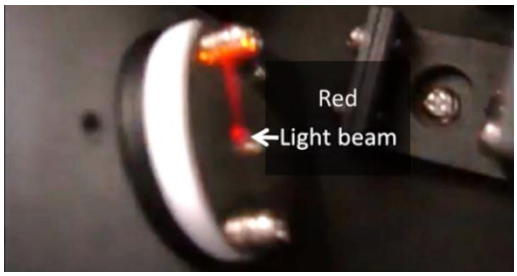

Figure 15. Red light beam on reference slit at the wavelength of 656 nm.

i. If not, you should adjust the beam splitter to left and right side as shown in Figure 16.

Figure 16. How to adjust the beam splitter.

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j. Loosen the screw on the beam splitter and move the beam splitter in right and left side with your hand. Make sure that the red light beam is also centered on the reference slit as like a sample focus slit.

k. After adjustment, tighten the screw and check again if the purple light is located in the center of sample focus slit and reference slit.

2. Adjust the grating position (rotate clockwise or anticlockwise) – spectrum.

a. When the purple light is centered and the first adjustment of the grating is completed, turn off the W lamp and disconnect the motor cable on the main board.

b. Carefully move the grating holder to the direction indicated with yellow arrow in Figure 17 with your hand.

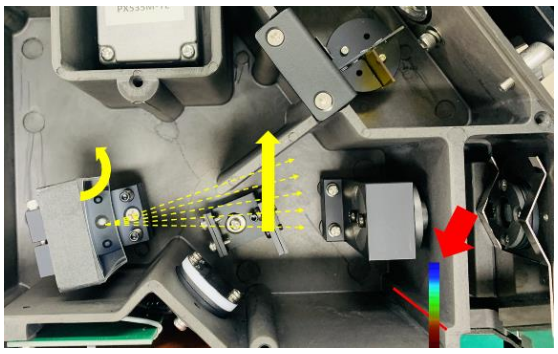

Figure 17. Setting the grating position to find the spectrum.

c. While moving the grating to left and right side slightly, adjust the grating position so that spectrum is positioned at the sample focus slit and reference slit (see Figure 18).

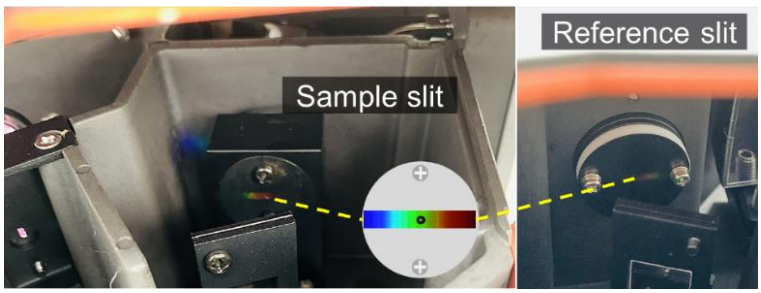

Figure 18. The exact position of the spectrum on the sample focus slit.

d. If the spectrum is not positioned horizontally, loosen the headless hex screw located rear side of the grating (refer to Figure 3-(a)).

e. Carefully rotate the grating clockwise or counterclockwise so that the spectrum is horizontal position. (refer to Figure 10-(a)).

f. After adjusting the horizontal grating position, tighten the headless screw slightly.

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VI. Diagnosis and verification

1. Turn on the UVD and wait until initialization step is finished. After initialization step, go to “UV method window” and set to wavelength of 254 nm.

   **Repeat the grating adjustment until you get the highest intensity of sample at 254nm.*

2. Check the ratio of sample to reference at 254 nm in the “Device Monitor”. Slightly adjust the screw in front of the beam splitter by a 2 mm headless screwdriver to adjust the ratio to be 1:1. At this time, the flow cell must be empty and clean.

   **If it needs to re-adjust, slightly adjust the beam splitter to get the 1:1 ratio of the sample and reference energy at 254 nm.*

3. After that, turn off the W lamp and set the wavelength to 656 nm.
4. Check the red light beam in the darkness is passing through the center of the reference slit.

   **if need to adjust the beam splitter, to make the red light beam be in the center of the reference slit by adjusting the (+) screw.*

5. If you think the adjustment is wrong, try again carefully from the first step.
6. If it is well adjusted, perform the next chapter.
7. When the grating has been adjusted, run the “YL-Clarity” and go to “Device Monitor” and click on the [Diagnosis]. Then start to check all factors including calibration of wavelength (refer to Figure 19)

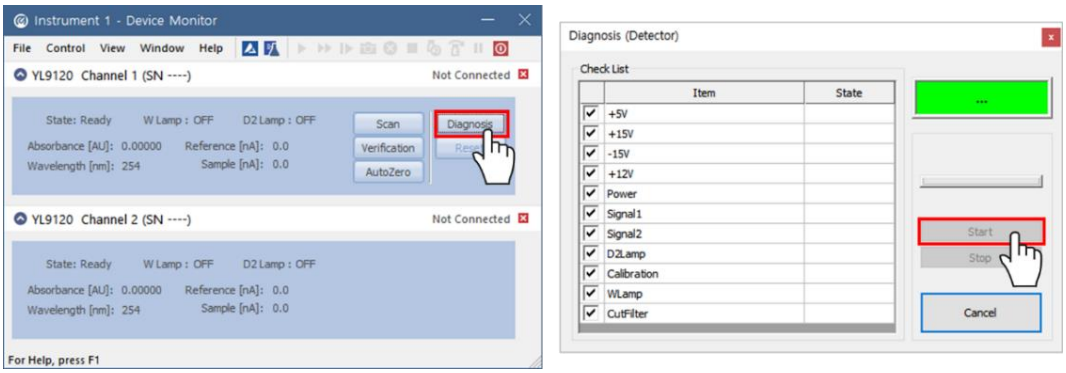

Figure 19. How to run the diagnosis of YL9120 UVD

8. After the diagnosis step, click on the [Cancel] button to close the diagnosis window.
9. Turn off the UVD and perform the following process to initialize the whole wavelength of the 9120 UVD.

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Figure 20. Open the cmd.exe in window.

Run cmd.exe (see Figure 20).

Input 'telnet 10.10.10.20' and then press enter key.

Input 'root' and then press enter key.

Input 'cd /home' and then press enter key.

Input 'vi dwave.cfg' and then press enter key.

Keep pressing 'D' key.

Inpu t'wq' and then press enter key.

Input 'quit' and then press enter key.

10. Turn on UVD, and wait until initialization step is finished.
11. Go to "Device Monitor" and click on the [Verification]. Then click on the [Choose Dir] button to select the directory and input the text file name (see Figure 21).

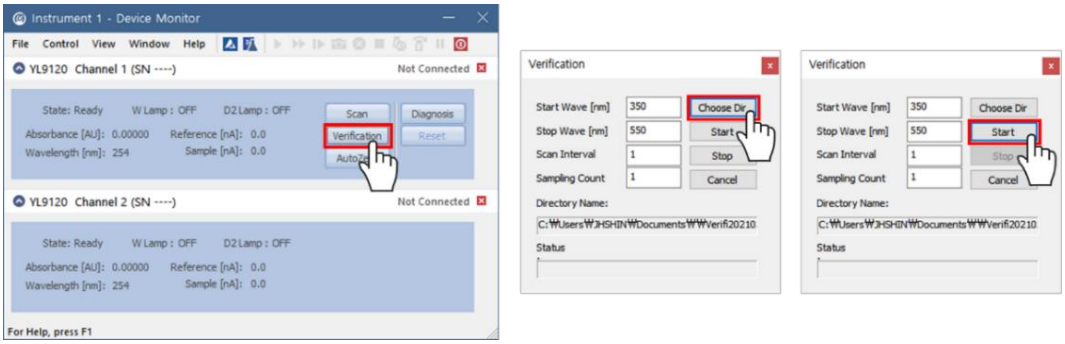

Figure 21. How to run the verification of YL9120 UVD from 350 to 550 nm.

12. Click on the [Start] button to run the verification.

    **Caution: do not stop or turn off the detector during the verification process.*

13. After verification, click on the [Cancel] button to close the window and open the result file where you are instructed to save.
14. You need to check the intensity values at 3 points, 361±1 nm, 418±1 nm, 537±1 nm, are higher than intensity value of adjacent wavenumbers as shown in Figure 22.

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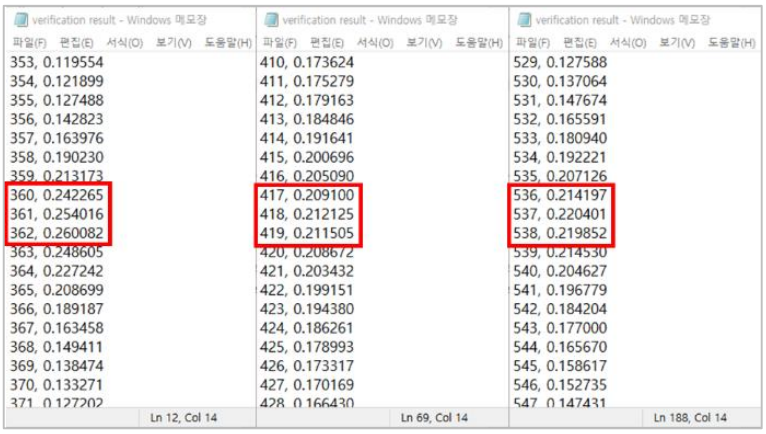

Figure 22. Verification result of the YL9120 UVD

15. Confirm the sample energy value at 190 nm and 720 nm are higher than 20 nA.
    **254 nm 75 nA, 720 nm 15 nA, 190 nm 15 nA for the QC certification. If aging UVD, the value could be less than QC acceptance criteria.*

16. When all calibration processes and adjustments are completed well, close the detector cover and turn on the 9120 UVD for checking the system and noise level.

⚠ Caution

▪ This process requires a precise adjustment skill, so do not adjust any parts roughly when calibration and adjustment.

▪ If you want to proceed with this process due to low light energy, please first check the flow cell and D2 lens surface is not contaminated before proceeding with this calibration. If contamination is found, clean the lens first and check the light energy value again.

Notification

▪ Flow cell should be empty completely, if not, you must purge the cell using the air firstly. If it is not available, fill the flow cell with the HPLC grade water. When you fill the cell with water, the test result at 190 nm is not easy to get.

▪ When you check the light beam inside of the monochromator, it is better to make a dark environment to see the light beam more clearly.

▪ The energy value appears differentially when the detector cover is closed and when it is opened. When checking the energy value, please close the cover then check the value.

▪ When tightening any type of screws, tighten carefully as the screw may change the adjusted position.