

SLM Software

User Manual V3.2

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1 Hardware Requirements

One laptop computer or desktop computer.

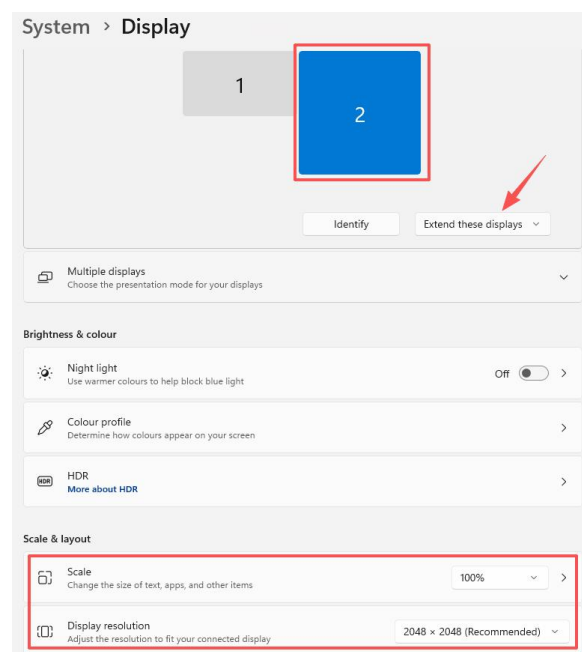
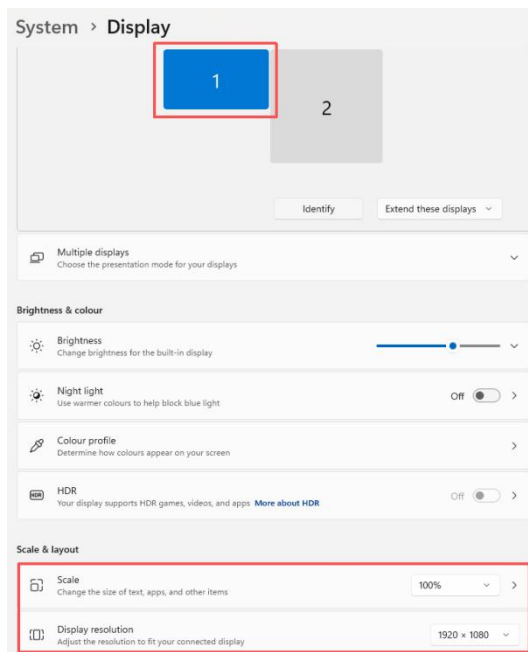
Hardware interfaces: DP, HDMI, and USB ports.

Memory: ≥ 2 GB

Software environment: Microsoft Windows 7 Simplified Chinese Enterprise SP1 or later.

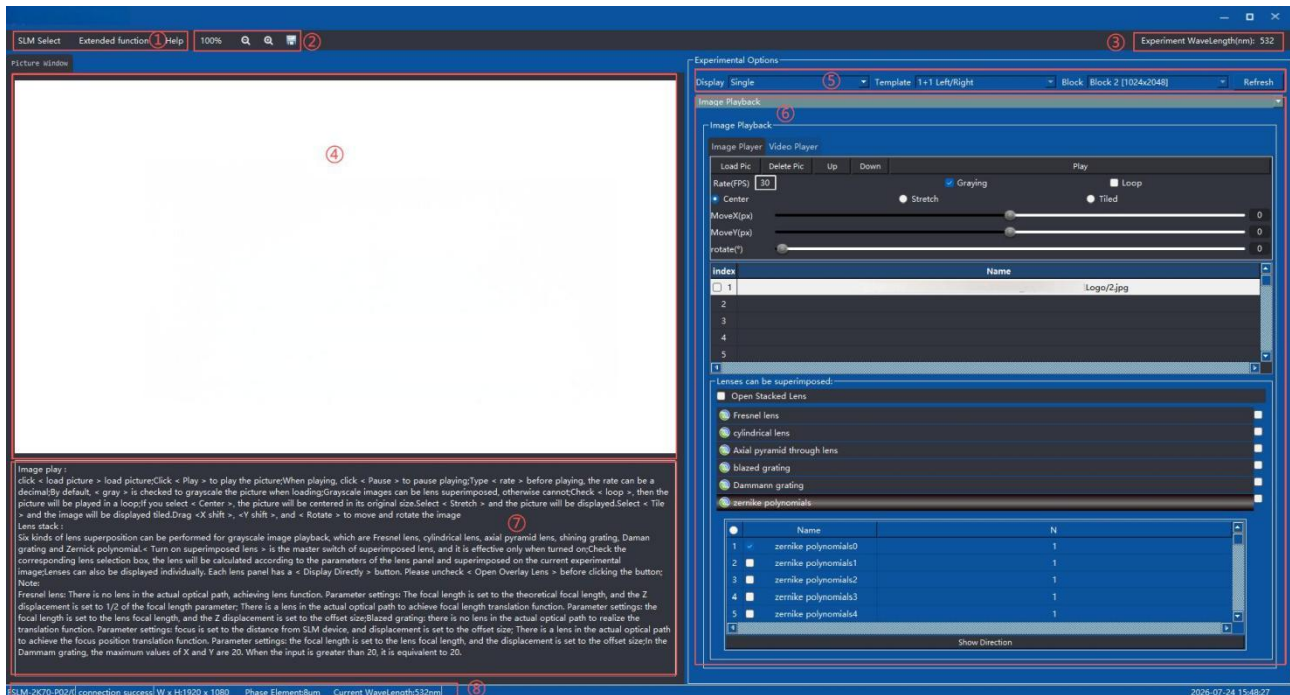
2 Windows Display Environment

- The display mode must be set to extended display. The primary display is normally used for computer operation, while the SLM is used as the secondary display output.
- The display scaling of both the computer monitor and the SLM must be set to 100%.
- Set the SLM resolution to the corresponding native resolution.
- For a desktop computer, connect both the computer monitor and the SLM to the motherboard or to the graphics card at the same time.



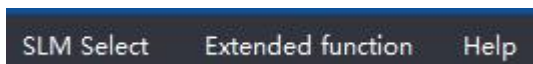
1: Main Screen Display Settings; 2: 2K73 Series Display Settings

3 Software Function Overview



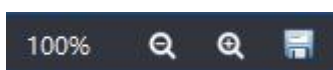
The main interface consists of eight areas: (1) Menu Bar, (2) Quick Access Toolbar, (3) Experimental Wavelength Setting Area, (4) Image Window, (5) Experiment Options Area, (6) Experimental Function Area, (7) Operation Instructions Area, and (8) Status Bar. The functions of each area are described below:

1) Menu Bar



Function Item	Description
Modulator Selection	Used to select the currently connected spatial light modulator model.
Extended Function	Provides image processing and auxiliary functions, such as image flipping, grayscale inversion, gamma correction, and wavefront correction.
Help	Used to view the software instructions and switch the interface language.

2) Quick Access Toolbar



Function Item	Description
100%	Indicates the current display ratio of the image.
Zoom In/Out	Used to adjust the preview size in the Image Window.

Save	Used to save the current image or the processed image.
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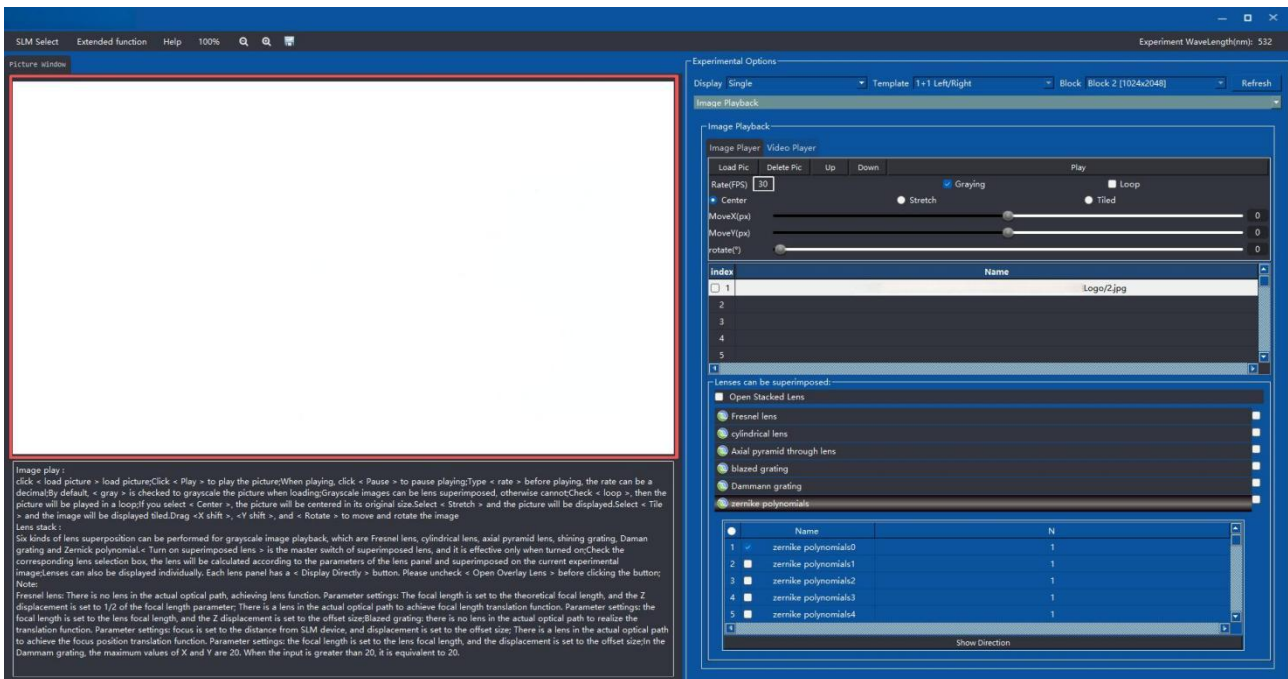
3) Experimental Wavelength Setting Area

Experiment WaveLength(nm): 532

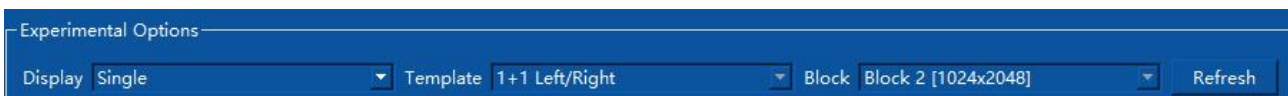
The Experimental Wavelength Setting Area is located in the upper-right corner of the software interface and is labeled "Experimental Wavelength (nm)". Enter the wavelength used in the current experiment and press Enter to confirm.

4) Image Window

The Image Window is located on the left side of the software interface and is used to preview the currently loaded image, generated image, or processed image.



5) Experiment Options Area



5.1 Display Mode

Display Mode	Description
Single-Image Display	Displays one complete image and is suitable for loading, previewing, and displaying a single image.
Block Stitching	Stitches images from multiple block into one composite image and is suitable for combined display of multiple images.

- When Single-Image Display is selected, only one image needs to be loaded or generated. The stitching template, current block, and Refresh Composite Image functions do not need to be configured.
- When Partition Stitching is selected, set the stitching template first, and then load images into the different partitions.

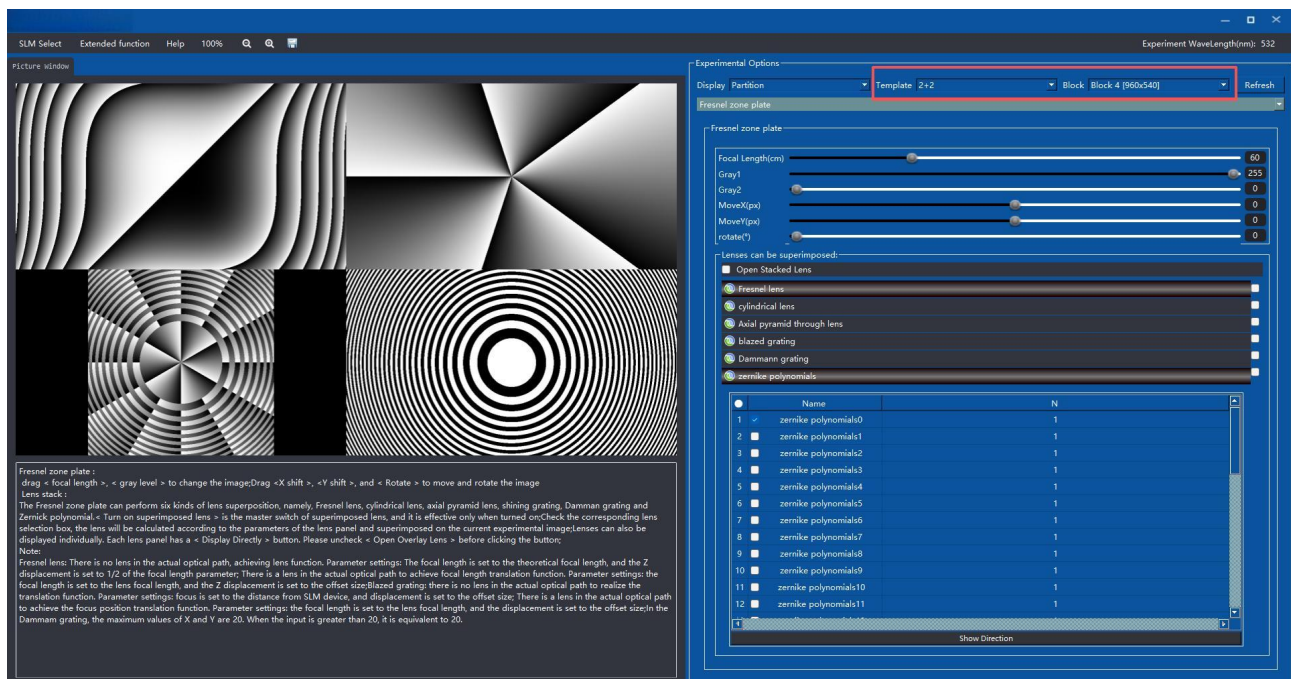
5.2 Stitching Template

The stitching template is used only in Partition Stitching mode. The current software supports the following stitching layouts:

Stitching Template	Description
1+1 Left/Right	Divides the composite image into left and right regions. After two images are loaded, they are stitched and displayed side by side.
1+1 Top/Bottom	Divides the composite image into upper and lower regions. After two images are loaded, they are stitched and displayed vertically.
2+2	Divides the composite image into four regions and displays them in a 2 x 2 layout.

5.3 Current Block

After the stitching template is set, the software automatically generates the corresponding blocks. Select the block into which the image is to be loaded from the current block drop-down list, and add images to each block separately.



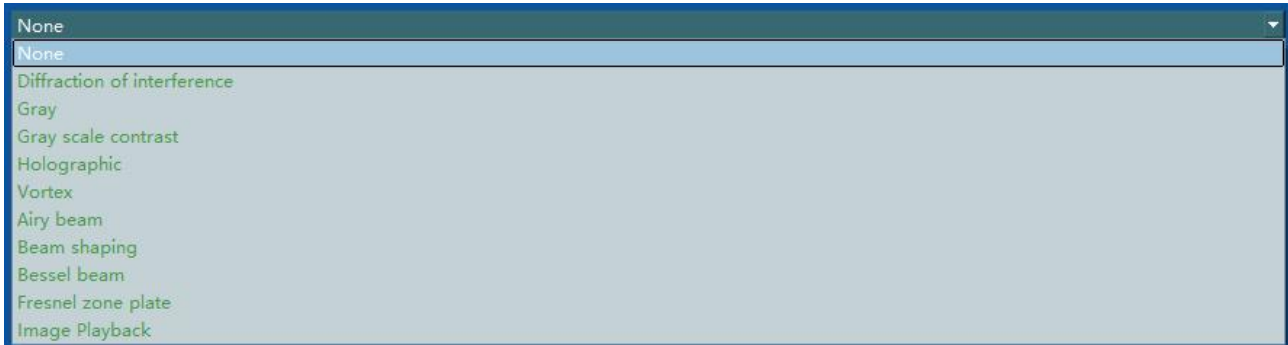
5.4 Refresh Composite Image

After the images in all partitions have been loaded, click Refresh Composite Image. The software regenerates the

composite image according to the current stitching template and the image content in each partition, and updates the display in the Image Window.

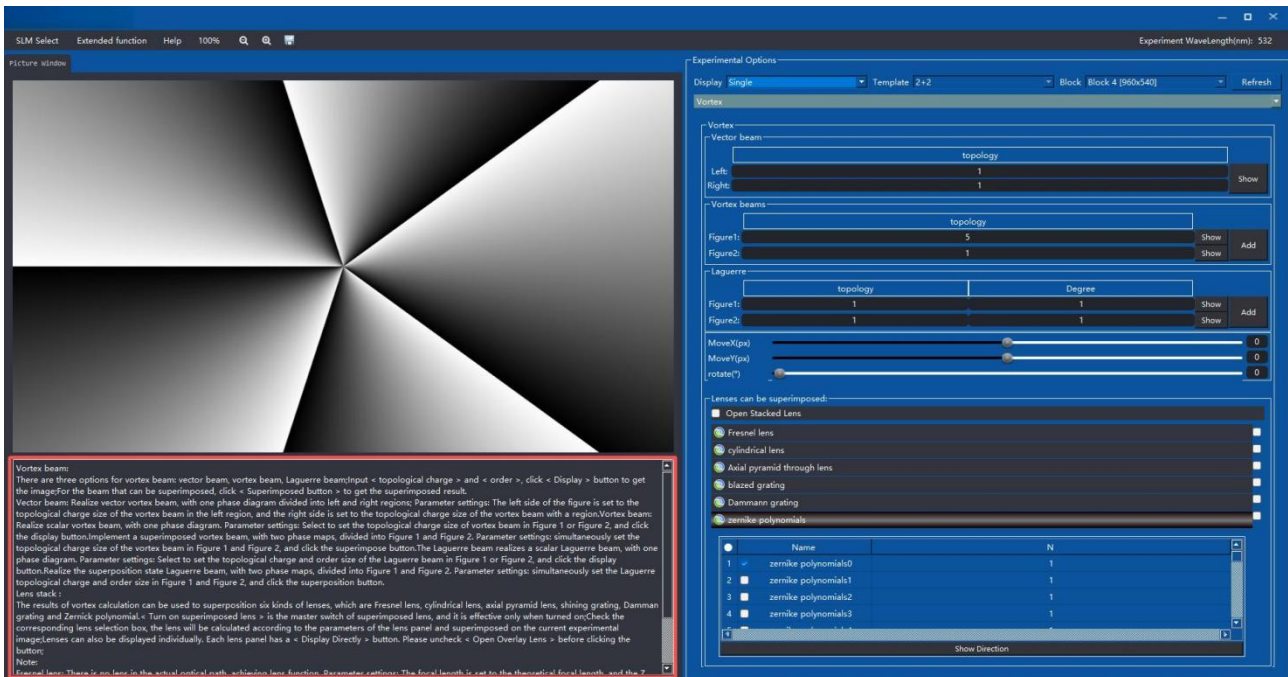
6) Experimental Function Area

The Experimental Function Area is located below the Experiment Options Area and is used to select the experimental function module to be used.



7) Operation Instructions Area

The Operation Instructions Area is located at the lower-left side of the software interface.



8) Status Bar

Displays the SLM model, connection status, resolution, pixel pitch, and current wavelength.

FSLM-2K73-P02/c 连接成功 宽 x 高:2048 x 2048 像元大小:6.4um 当前波长:532nm

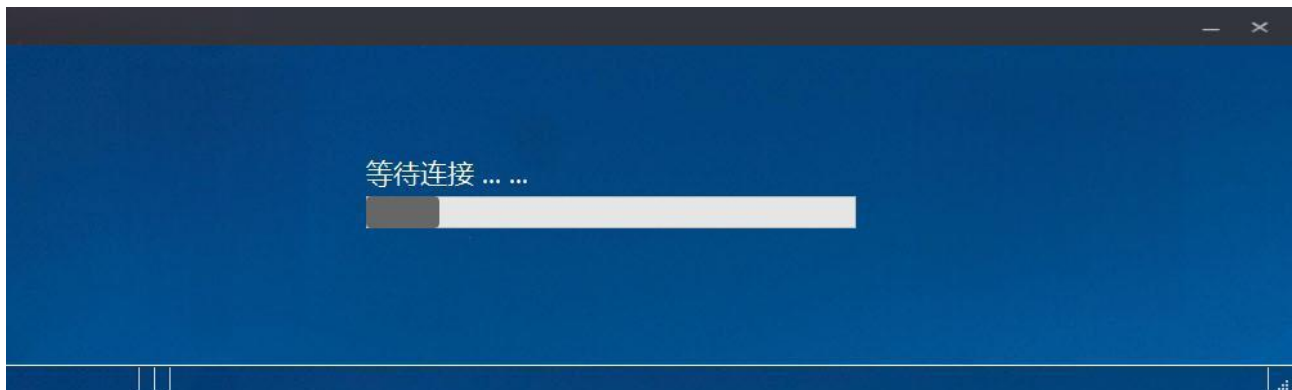
2026-07-24 16:51:50

4 Software Operation Procedure

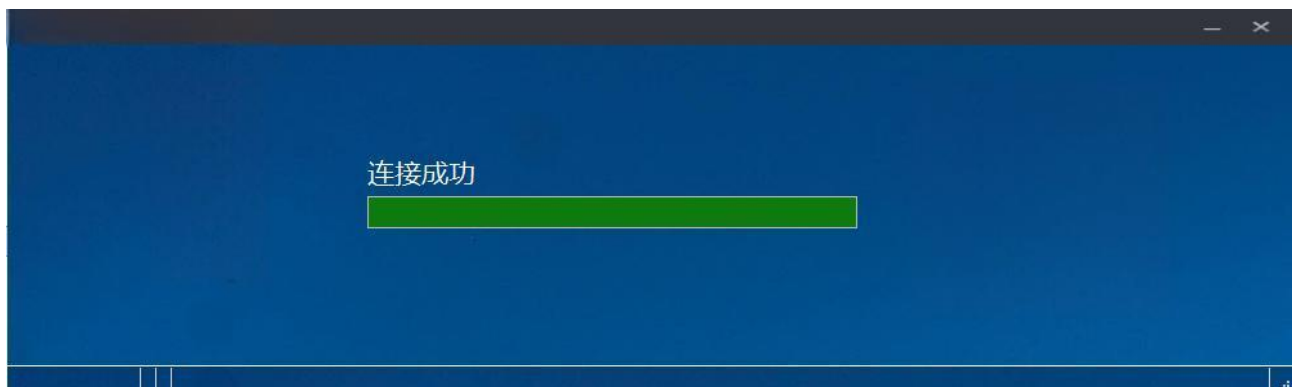
- 1) Correctly connect the SLM video cable and power cable, and power on the SLM. After startup, check the Windows display environment.

- 2) Locate the corresponding .exe program in the software folder and double-click it to run. The welcome screen will display Waiting for Connection.

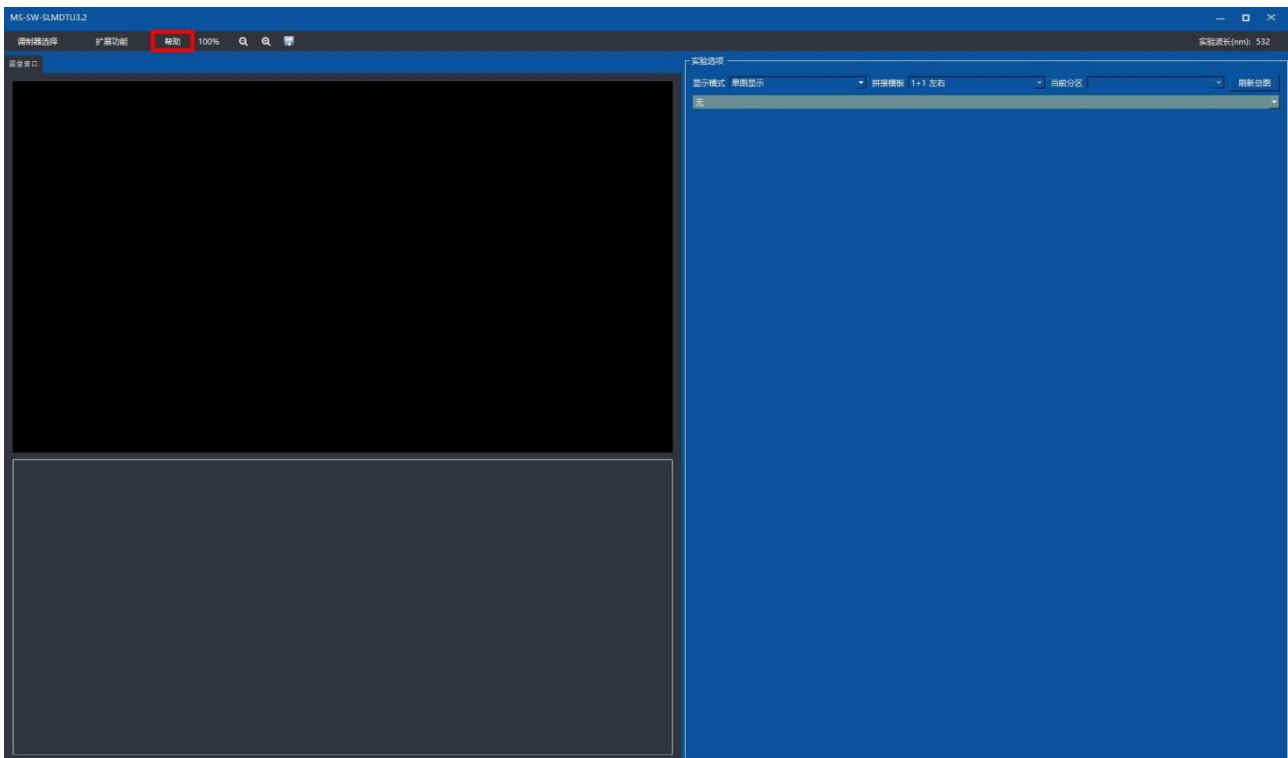
 libgl32.dll	2023/10/26 16:40	64 KB
 libGLv2d.dll	2020/11/6 13:30	17,200 KB
 MS-SW-SLM_DTU64D.exe	2026/8/11 17:40	3,514 KB
 MS-SW-SLM_DTU64D.exe.manifest	2026/7/24 14:27	1 KB
 msvcp140_1d.dll	2025/7/15 19:19	30 KB



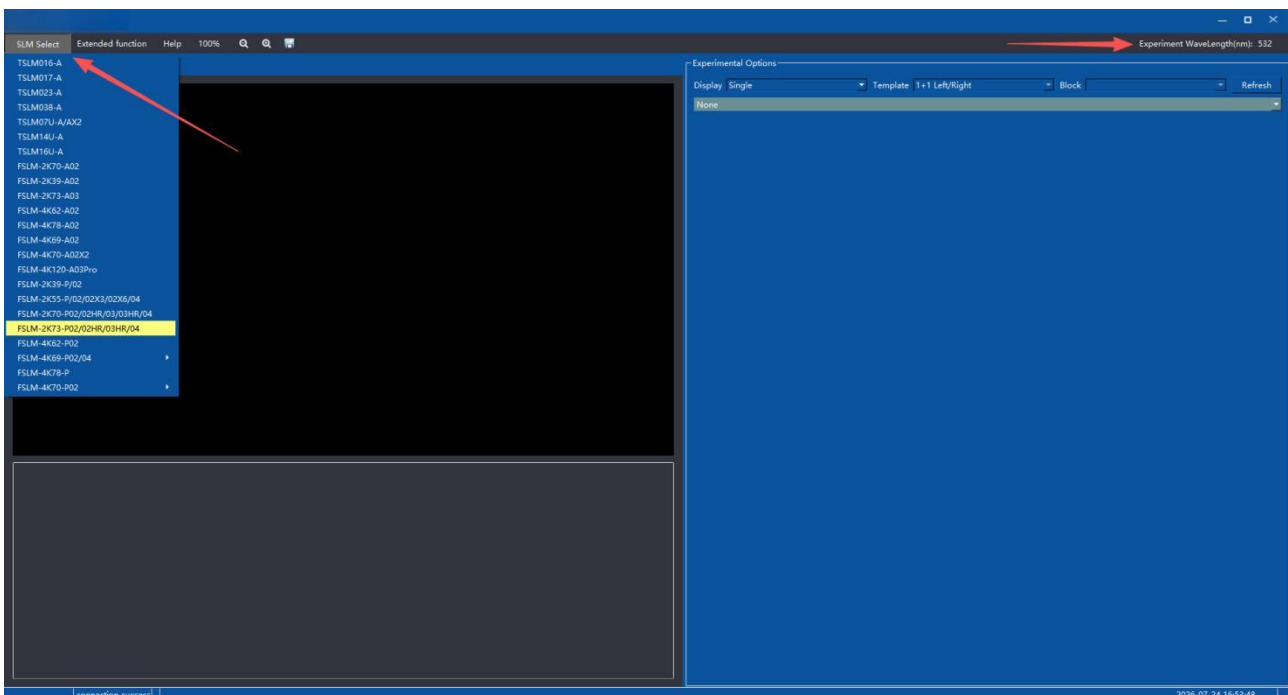
- 3) After the SLM is correctly connected and the program runs successfully, the welcome screen will display Connection Successful.



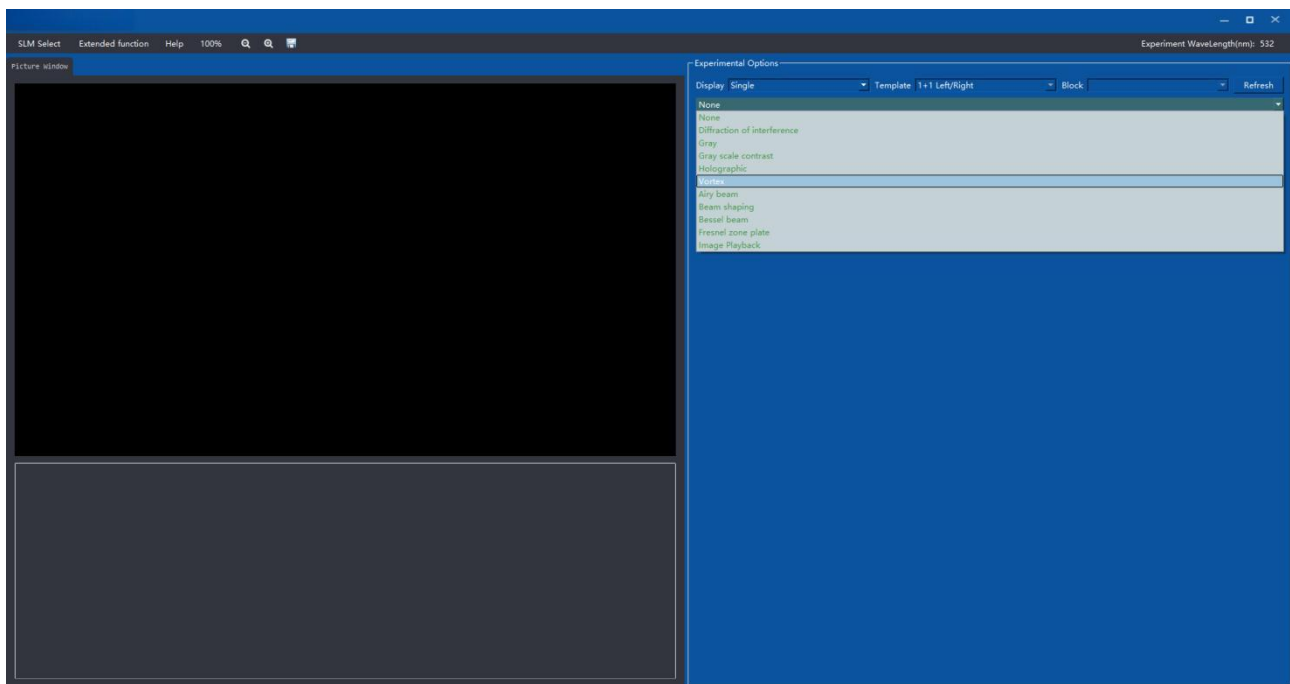
After a successful connection, click Help in the upper-left corner to switch between Chinese and English (the label/icon to the left of 100%).



- 4) After the software is connected successfully, enter the main interface, select the corresponding SLM model, and set the experimental wavelength to the calibration wavelength of the SLM.



- 5) Set the display mode: Single-Image Display or Partition Stitching, and select the stitching template (1+1 Left/Right, 1+1 Top/Bottom, or 2+2).
- 6) Open the experimental function selection list and select a single-image experimental item. If Partition Stitching is selected, first select Current Block and then select the experimental item for each partition in sequence.

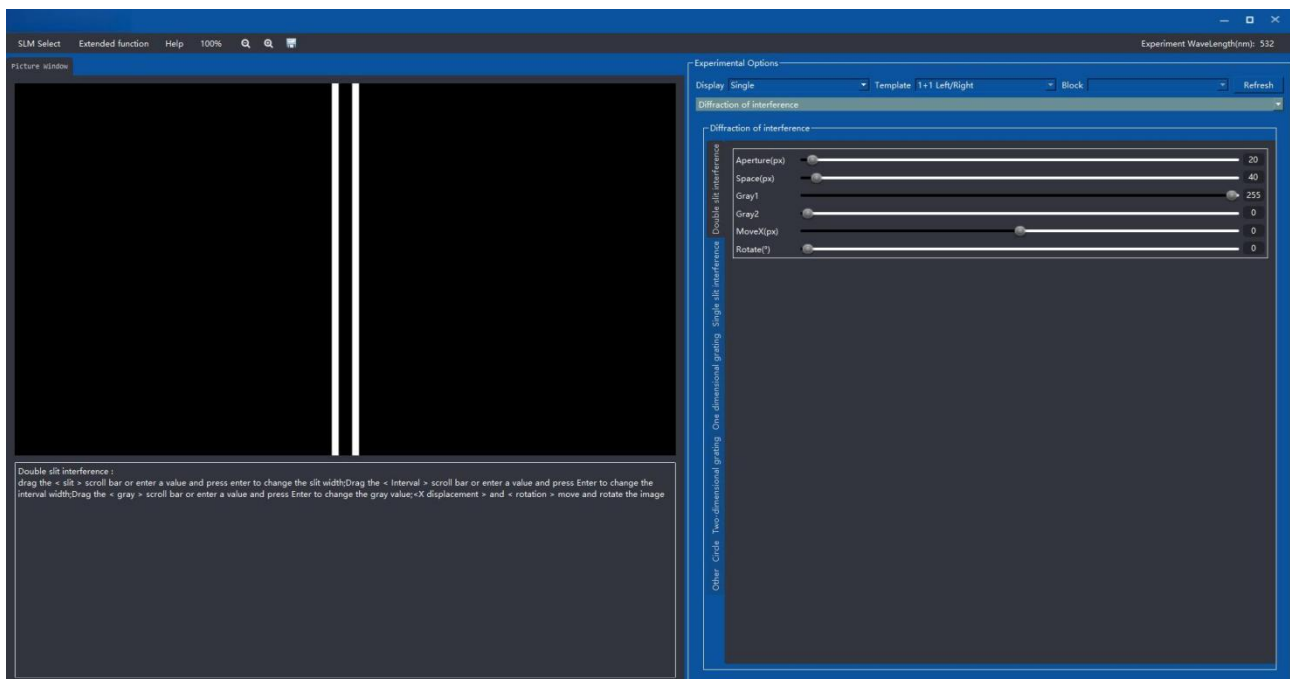


5 Experimental Function Overview

5.1 Interference and Diffraction Experiments

After Interference and Diffraction Experiments is selected, the sub-list contains six experimental sub-items. Under each sub-item, the image can be changed by dragging sliders or entering values and pressing Enter.

5.1.1 <Double-Slit Interference> Operation Instructions

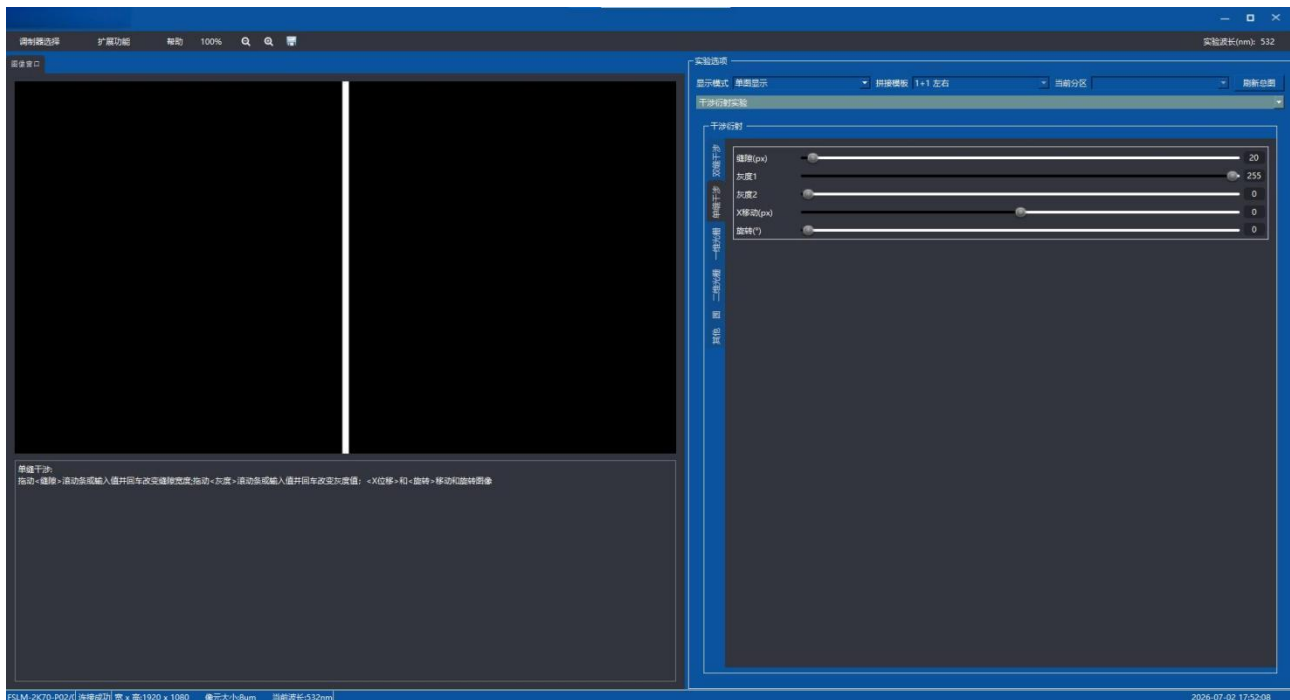


- Drag the <Aperture> slider or enter a specific value to change the slit width, in px;
- Drag the <Space> slider or enter a specific value to change the double-slit spacing, in px;

- c. Drag the <Gray 1> and <Gray 2> sliders or enter specific values to change the image grayscale;
- d. <Move X> is used to move the double-slit position horizontally, in px;
- e. <Rotate> is used to rotate the double slit.

Note: In the experiment, the fringe space is related to the optical wavelength, slit spacing, and the distance from the screen to the aperture.

5.1.2 <Single-Slit Interference> Operation Instructions

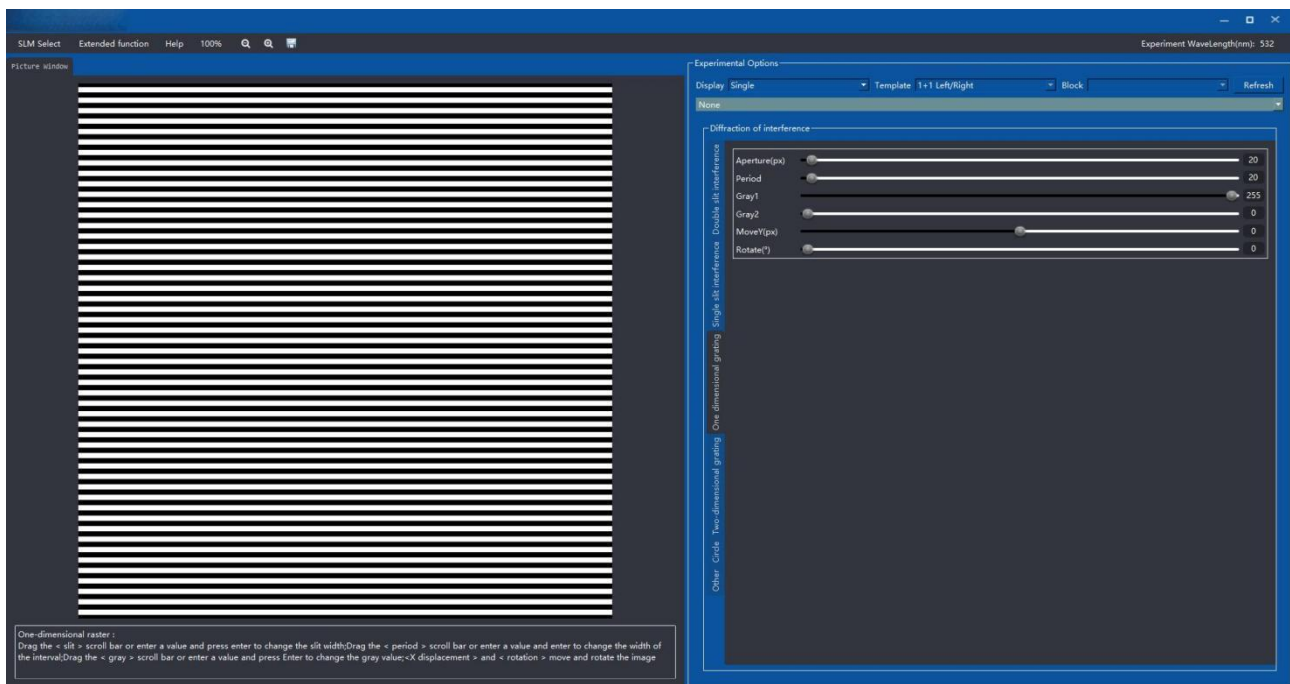


- a. Drag the <Aperture> slider or enter a specific value to change the slit width, in px;
- b. Drag the <Gray 1> and <Gray 2> sliders or enter specific values to change the image grayscale;
- c. <Move X> is used to move the single-slit position horizontally, in px;
- e. <Rotate> is used to rotate the single slit.

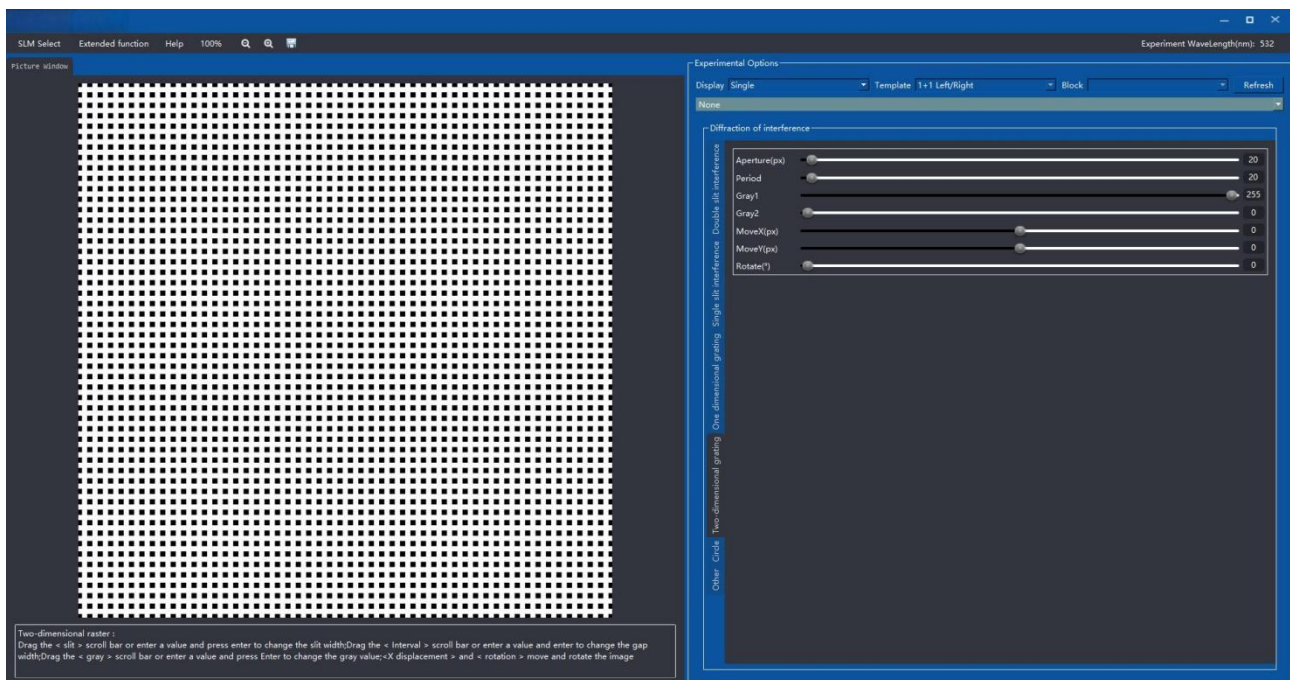
Note: The aperture width significantly affects the width of the central bright fringe in the single-slit diffraction experiment, and the diffraction distance also affects the diffraction result.

5.1.3 <One-Dimensional Grating> Operation Instructions

- a. Drag the <Aperture> slider or enter a specific value to change the slit width, in px;
- b. Drag the <Period> slider or enter a specific value to change the grating period;
- c. Drag the <Gray 1> and <Gray 2> sliders or enter specific values to change the image grayscale;
- e. <Move Y> is used to move the grating position horizontally, in px;
- f. <Rotate> is used to rotate the grating.

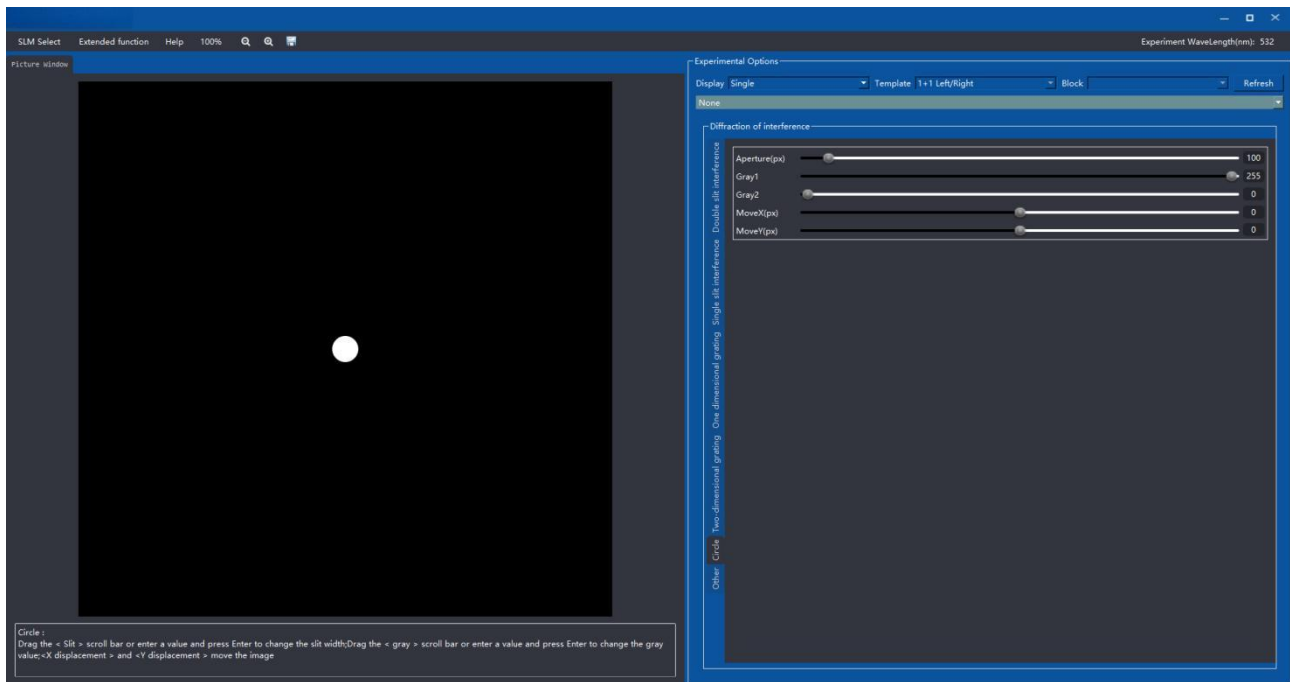


5.1.4 <Two-Dimensional Grating> Operation Instructions



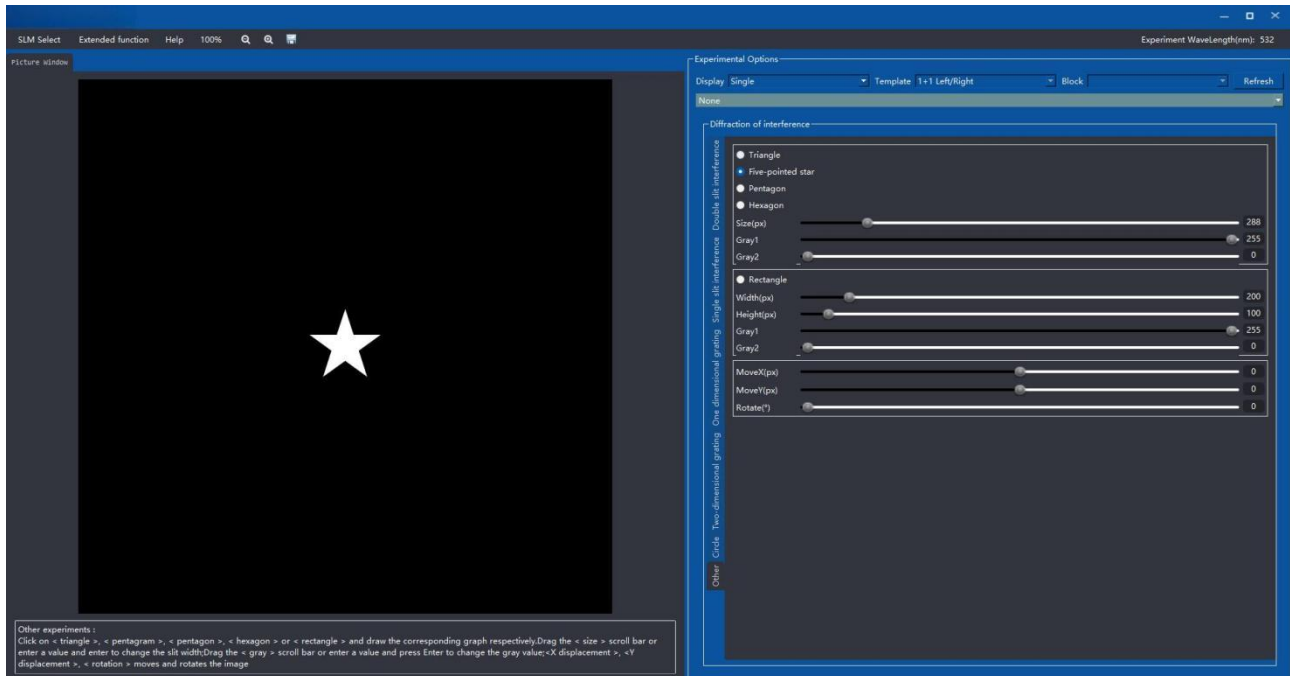
- Drag the <Aperture> slider or enter a specific value to change the slit width, in px;
- Drag the <Period> slider or enter a specific value to change the grating period;
- Drag the <Gray 1> and <Gray 2> sliders or enter specific values to change the image grayscale;
- <Move X> and <Move Y> are used to move the grating horizontally and vertically, in px;
- <Rotate> is used to rotate the grating.

5.1.5 <Circle> Operation Instructions



- Drag the < Aperture > slider or enter a specific value to change the circle diameter, in px;
- Drag the <Gray 1> and <Gray 2> sliders or enter specific values to change the image grayscale;
- <Move X> and <Move Y> are used to move the circle horizontally and vertically, in px.

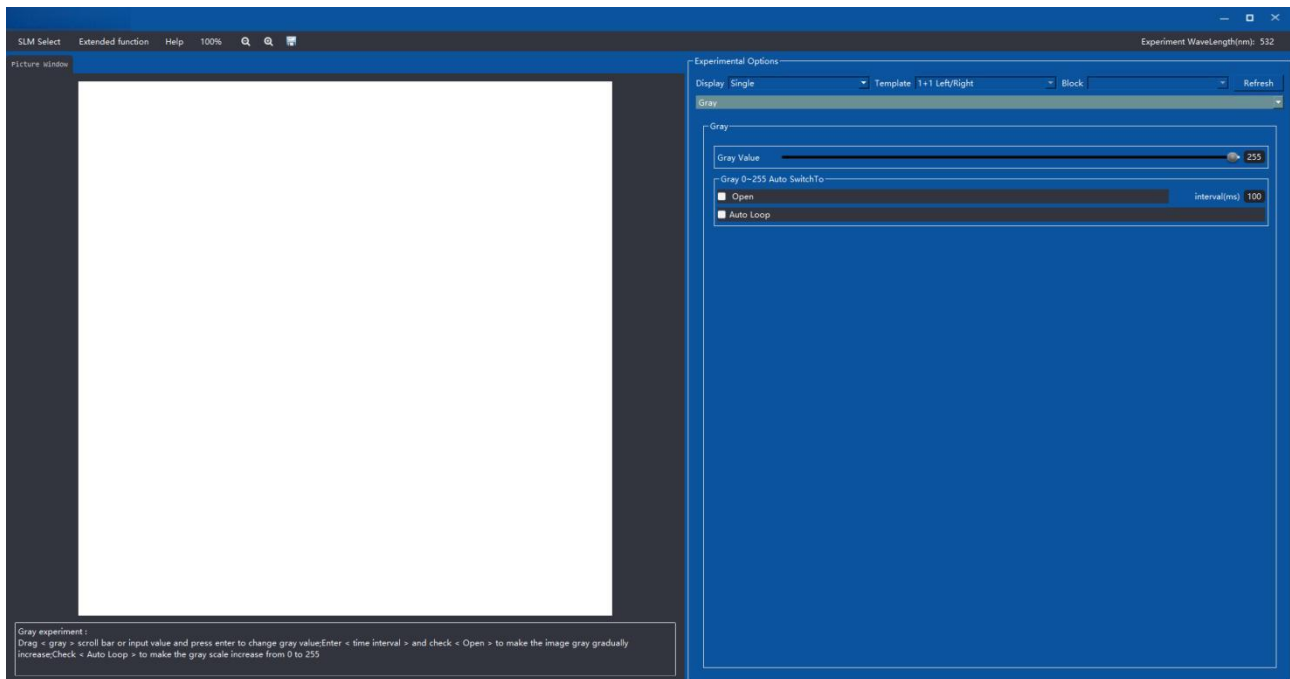
5.1.5 <Other> Operation Instructions



- Click <Triangle>, <Pentagram>, <Pentagon>, <Hexagon>, or <Rectangle> to draw the corresponding shape. The width and height of the <Rectangle> can be set separately, in px;
- Drag the <Gray 1> and <Gray 2> sliders or enter specific values to change the image grayscale;
- <Move X> and <Move Y> are used to move the shape horizontally and vertically, in px;

e. <Rotate> is used to rotate the shape.

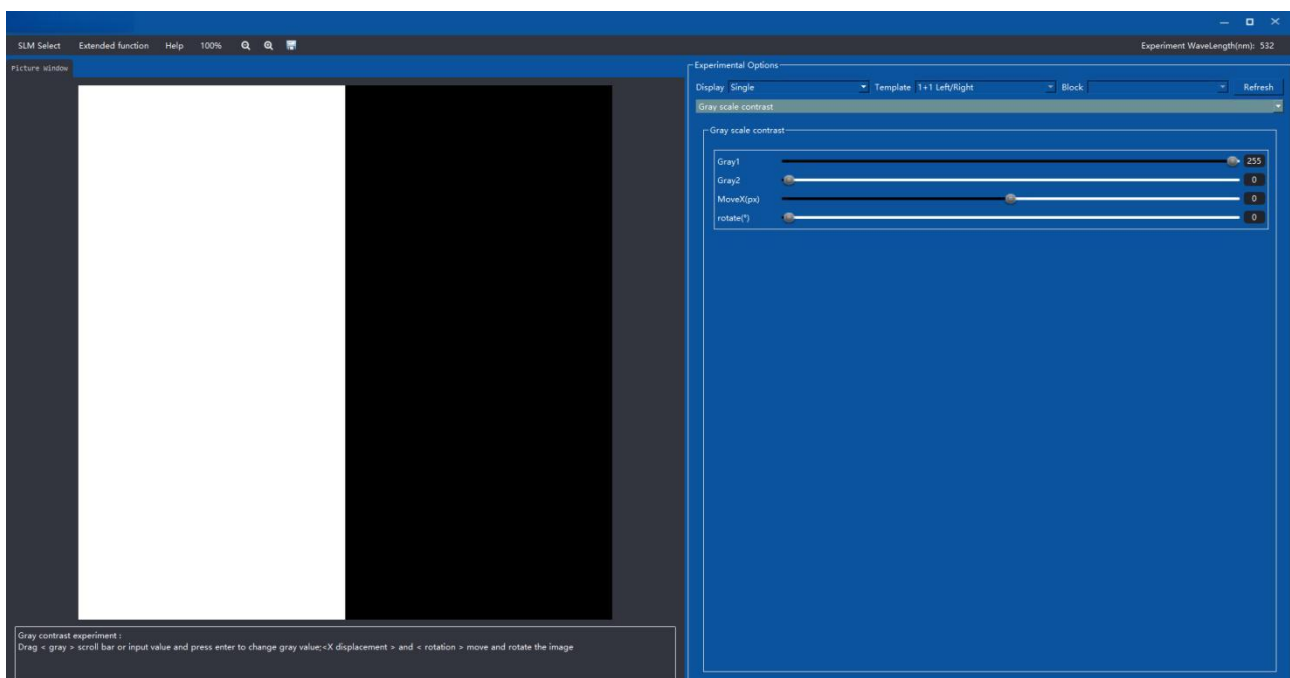
5.2 Grayscale Experiment



Operation Instructions:

- Drag the <Gray value> slider or enter a value and press Enter to change the grayscale value;
- Enter a value in <Interval> and select <Open> to make the image grayscale increase progressively;
- Select <Auto Loop> to increase the grayscale cyclically from 0 to 255 according to the <Interval>.

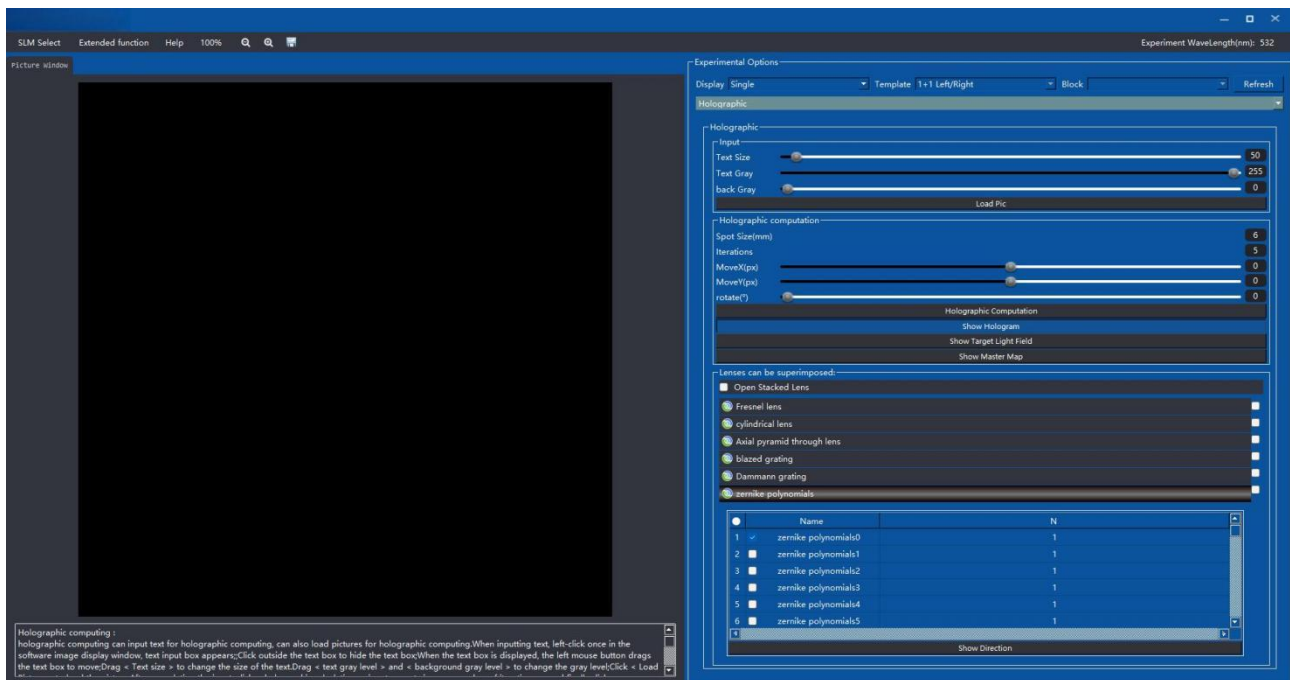
5.3 Grayscale Contrast Experiment



Operation Instructions:

- Drag the <Gray 1> and <Gray 2> sliders or enter values and press Enter to change the grayscale values;
- <Move X> moves the image position, in px;
- <Rotate> rotates the image.

5.4 Hologram Calculation



Basic Principle:

This experimental function is based on the classical Gerchberg-Saxton (GS) algorithm. Under the constraints set for the object plane and hologram plane, multiple iterations of Fourier transforms and inverse Fourier transforms are performed to obtain a holographic phase pattern with high diffraction efficiency. In this section, the Spot Size setting corresponds to the initial calculated amplitude value, and the Number of Iterations refers to the number of image-processing cycles performed under the required error tolerance.

Operation Instructions:

Hologram calculation supports two methods: text <input> and <load pic>.

1) Hologram Calculation by Text Input

- Left-click inside the Image Window to open the text input box;
- Enter the text to be used for hologram calculation in the text box;
- After entering the text, left-click outside the text box to hide it;
- Use <Text Size>, <Text Gray>, and <Back Gray> to adjust the display of the text and background;
- Use <Move X>, <Move Y>, and <Rotate> to adjust the position and angle of the text image;

f. Enter <Spot Size> and < Iterations>, and click <Hologram Calculation>. The software automatically generates and displays the hologram result.

2) Hologram Calculation by <Load pic>

- Click < Load pic > to import the target image to be calculated;
- Use <Move X>, <Move Y>, and <Rotate> to adjust the position and angle of the image;
- Enter <Spot Size> and < Iterations>;
- Click <Hologram Calculation>. The software automatically generates and displays the hologram result.

Note:

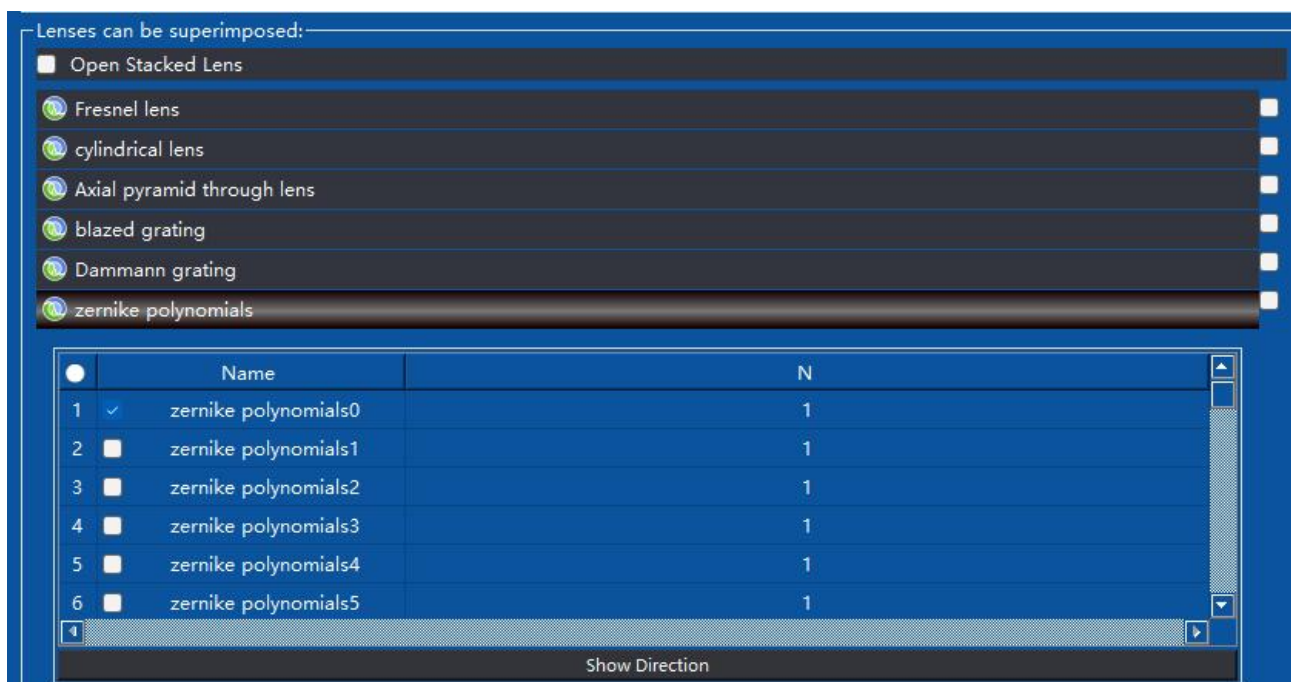
a. When using text for hologram calculation, after entering the text, click outside the text box to hide it before starting the calculation.

b. <X Shift>, <Y Shift>, and <Rotate> can also be used to adjust the position and orientation of the phase pattern after hologram calculation.

3) Result Display

After hologram calculation is complete, click <Show Hologram> to view the phase hologram, click <Show Target Light Field> to view the reconstructed target optical field, or click <Show Master Map> to return to the original image.

5.5 Lens Overlay



<Hologram Calculation>, <Vortex>, <Airy Beam>, <Beam Shaping>, <Bessel Beam>, <Fresnel Zone Plate>, and <Image Playback> all support the lens overlay function. This function overlays the phase pattern with the lens

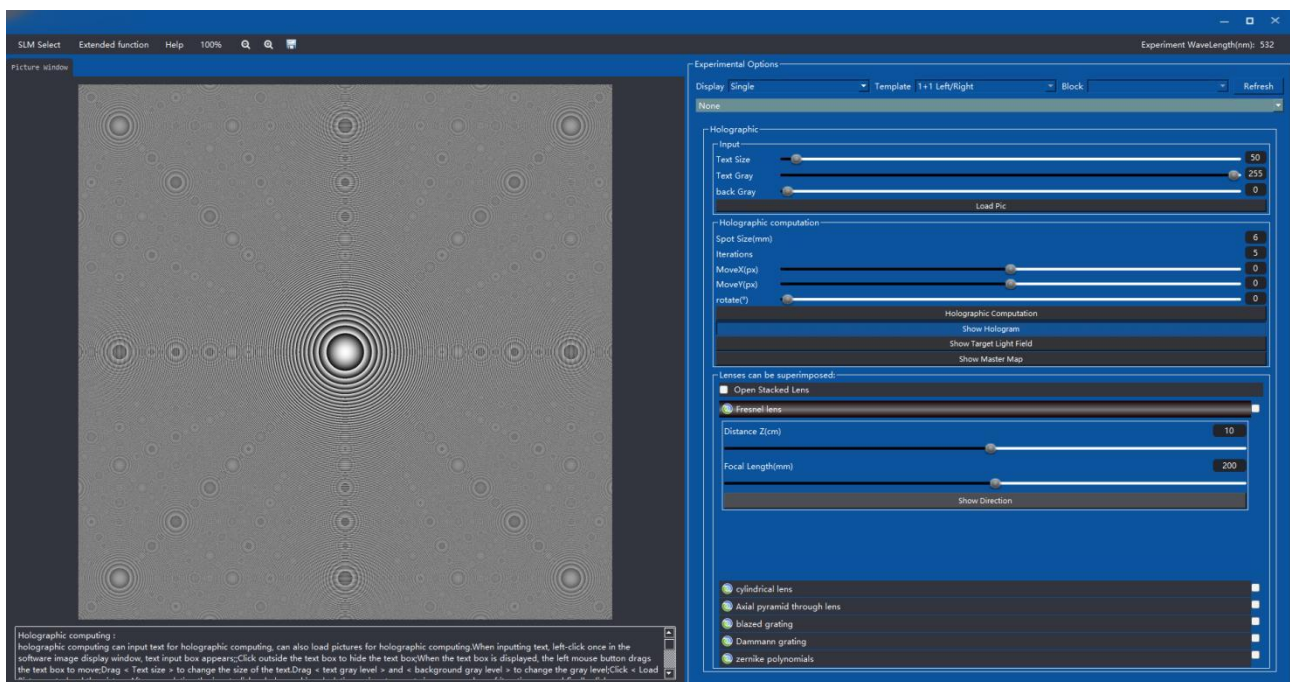
phases in <Open Stacked Lens>. **Overlayable lenses include <Fresnel Lens>, <Cylindrical Lens>, <Axicon pyramid through lens>, <Blazed Grating>, <Dammann Grating>, and <Zernike Polynomials>.**

Operation Instructions:

- Select <Open Stacked Lens> to turn on the lens overlay function. If it is not selected, the lens will not be overlaid on the current experimental image.
- Select the lens checkbox to be overlaid. The software calculates according to the parameters in the corresponding lens panel and overlays the result on the current experimental image.
- After modifying lens parameters, select the corresponding lens checkbox again for the modified parameters to take effect.
- To display a lens alone, first clear < Open Stacked Lens >, then select the corresponding lens and click <Show direction>. If parameters are modified, click <Show direction> again to update the phase pattern.

5.5.1 Fresnel Lens

The phase distribution of a Fresnel lens has a ring-zone structure. Each zone corresponds to a different phase delay, and a focusing effect similar to that of a conventional lens is achieved through phase wrapping.

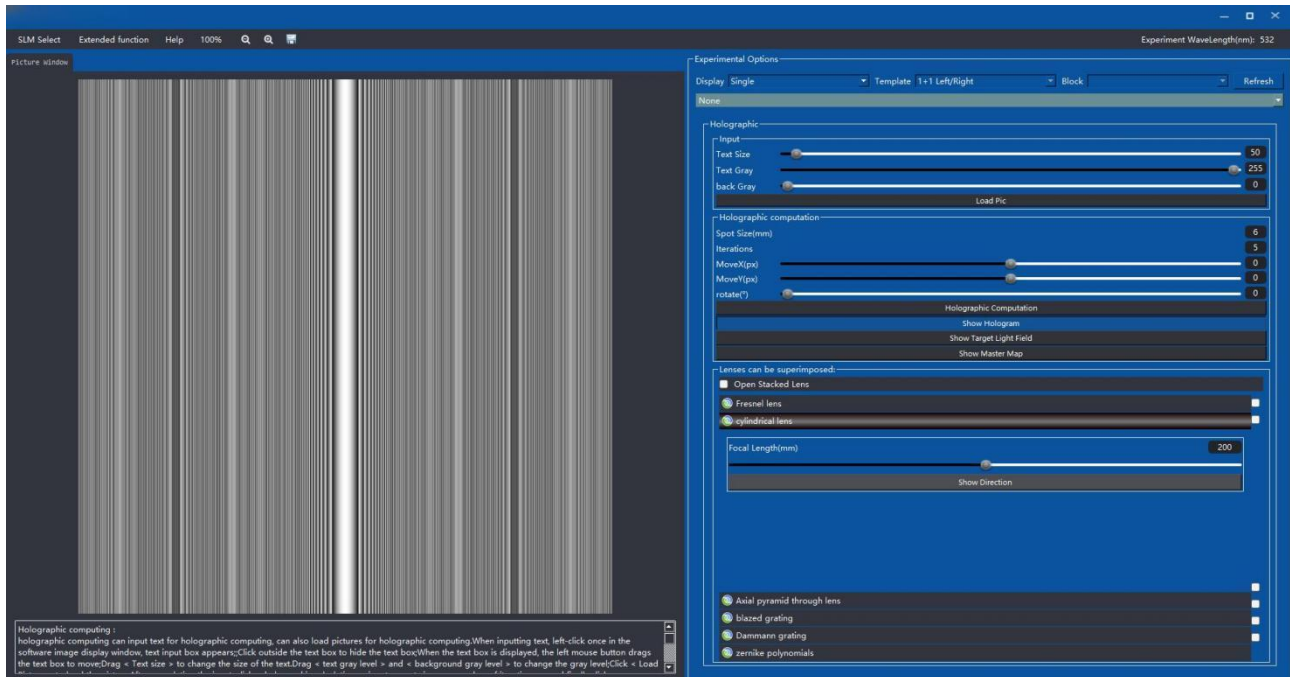


The <Distance z> is the positional offset of the lens itself along the optical axis (z-axis) relative to the reference plane. It can be used to adjust the overall matching condition of the optical path. The focal length is the distance from the optical center of the lens to its focal point.

5.5.2 Cylindrical Lens

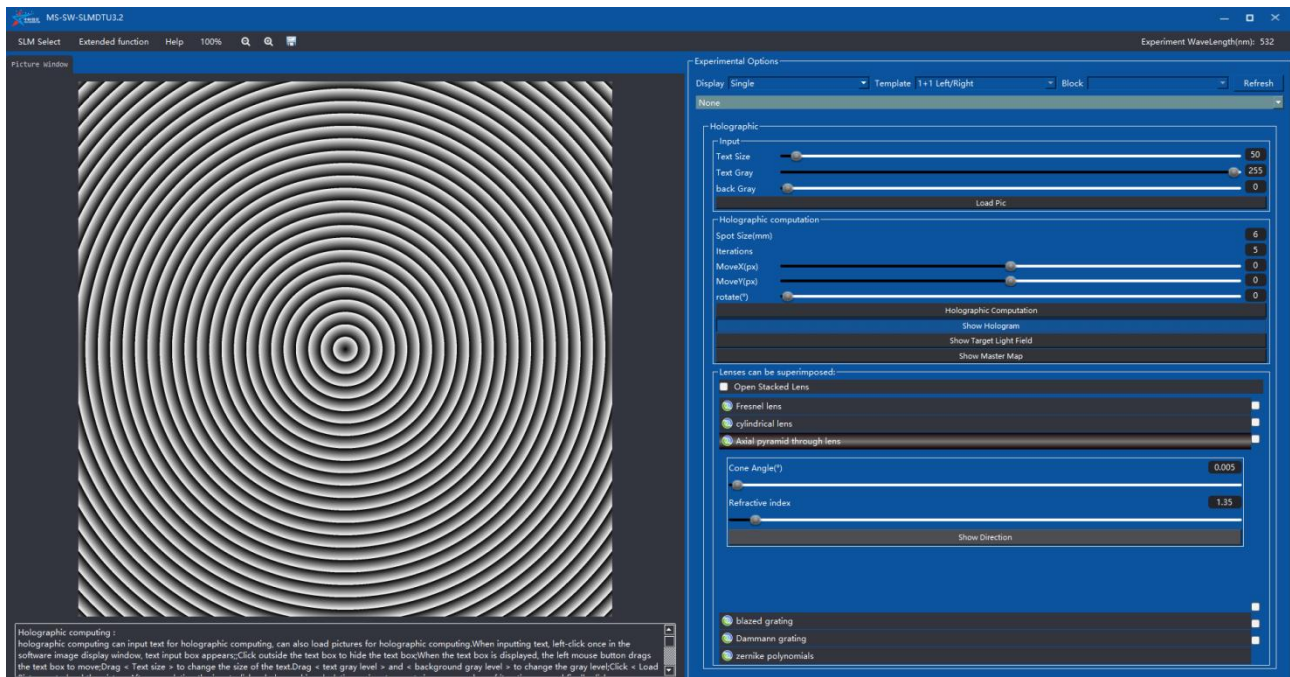
A cylindrical lens is used for focusing modulation in one direction and can shape a beam into a line focus or stripe

optical field.



5.5.3 Axicon pyramid through lens

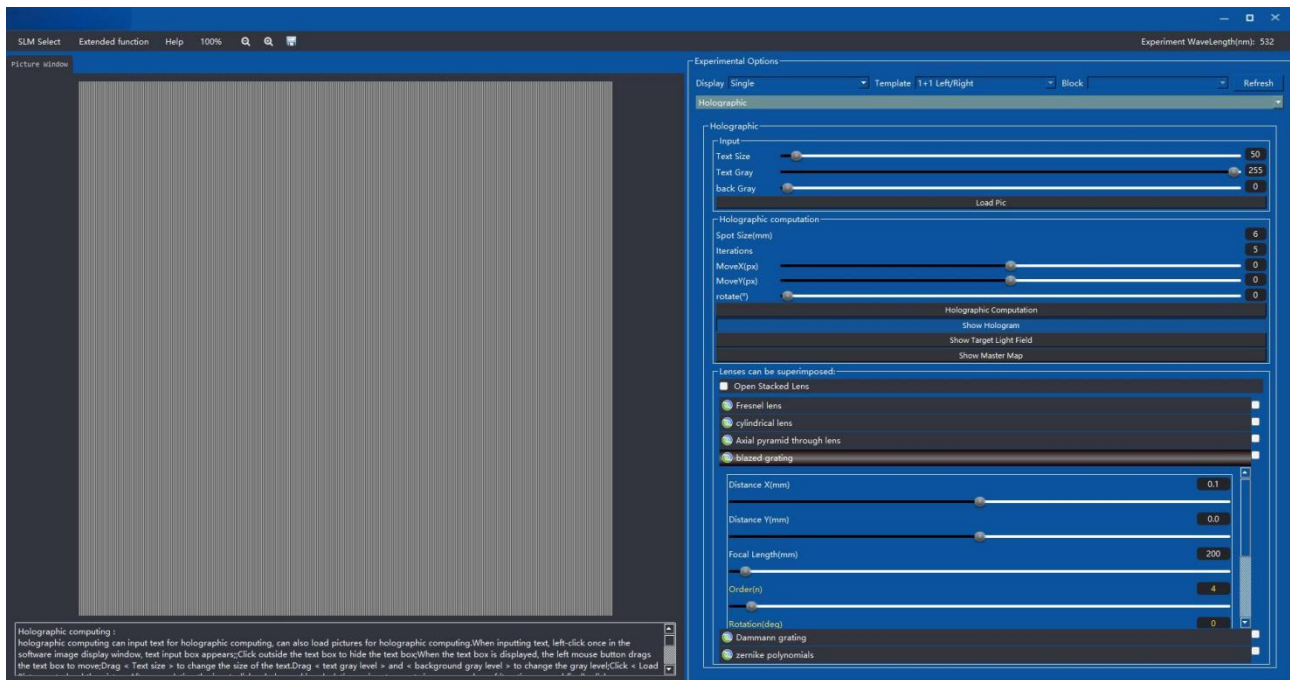
Basic Principle: An axicon lens is a special lens with a conical phase distribution. It can modulate the incident light into a Bessel beam or annular optical field, producing an optical-field distribution with a long depth of focus and nearly non-diffracting characteristics. The axicon refractive index and cone angle affect the beam modulation result. These two variables can be set separately in the SLM software interface to realize phase modulation.



5.5.4 Blazed Grating

Two modes are available: x/y offset and blazed-grating order. These two modes must be configured independently.

The yellow text indicates the current mode. To switch to the other mode, first click <Reset XY Offset > or <Reset Order/Rotation >.

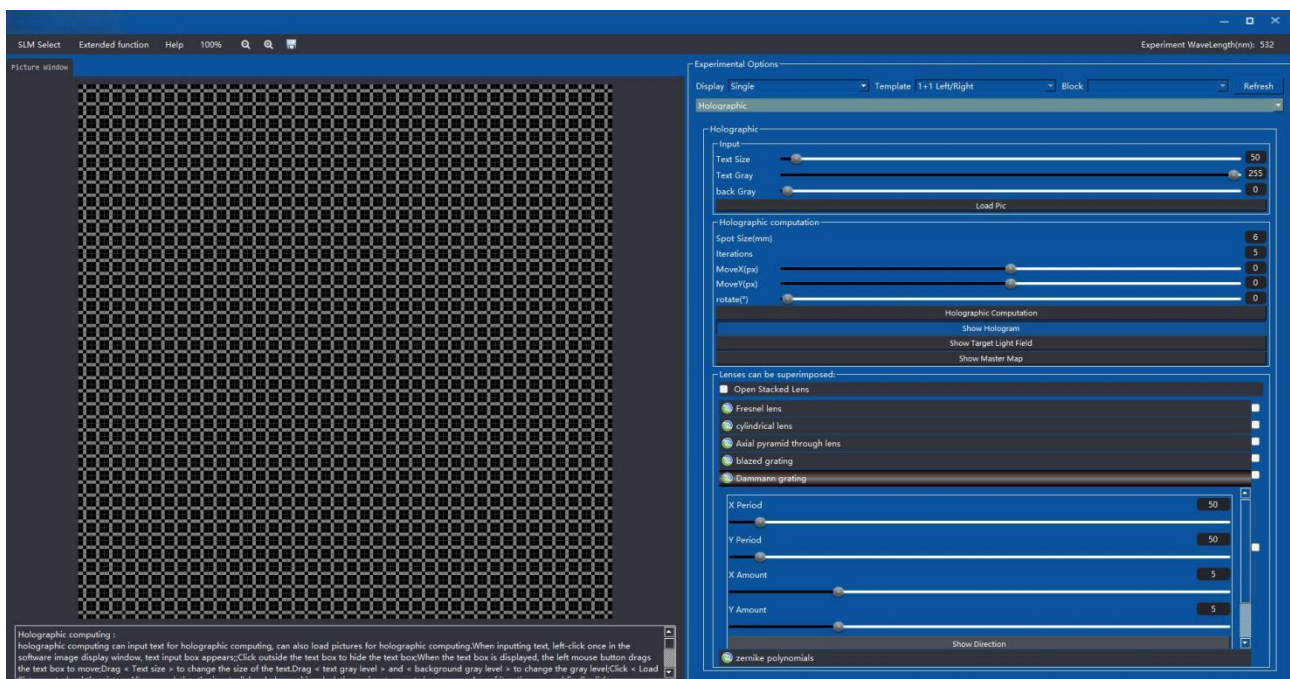


5.5.5 Dammann Grating

Basic Principle: A Dammann grating (DG) is a binary phase grating with a special aperture function. It can generate a uniform-intensity spot array from incident monochromatic light in the far field with high diffraction efficiency.

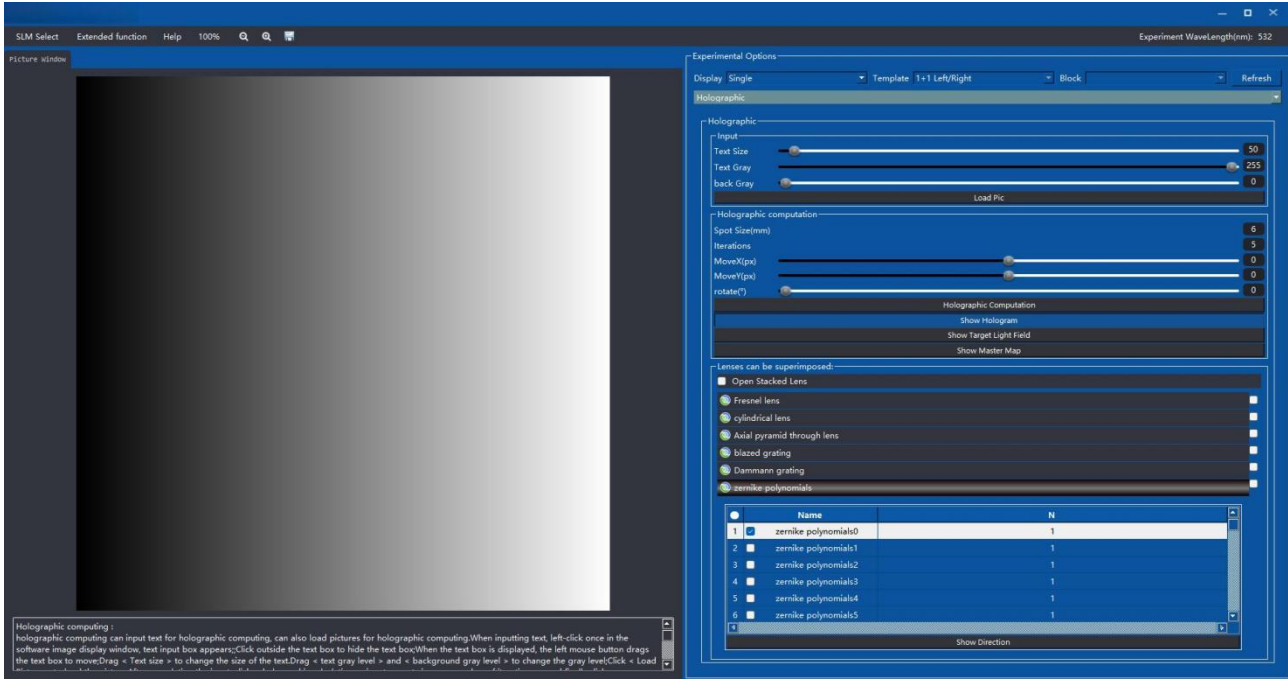
When the Dammann grating is placed before a Fourier transform lens and illuminated by a plane wave with unit amplitude, an equally spaced spot array is obtained at the rear focal plane of the lens, namely the frequency plane.

Operation Instructions: The x/y amount and x/y period of the binary phase grating can be set.



5.5.6 Zernike Polynomials

The software integrates 35 Zernike polynomial terms. Users can select individual terms for overlay according to experimental requirements.



The weight in the software indicates the range of phase modulation. Generally, grayscale values from 0 to 255 correspond to a modulation range of 0 to 2pi. When the weight is 2, the corresponding phase range is 0 to 4pi. Since the SLM modulation range is 0 to 2pi, any phase greater than 2pi enters the next SLM modulation period, and the resulting phase pattern is a wrapped phase.

5.6 Vortex Beam

Basic Principle: A vortex beam is a beam with a special spatial phase and a continuous phase distribution. Its central intensity or axial intensity along the propagation direction is zero; therefore, it is also called a dark hollow beam or hollow beam. A vortex beam has a helical form, and its phase distribution evolves helically with propagation direction and distance. Therefore, it is also called a helical beam. Compared with an ordinary beam, a vortex beam has a continuous helical wavefront. The phase is undefined on the propagation axis, which is the phase singularity. Its optical-field expression contains a phase factor $\exp(il\theta)$, where the topological charge l is included, and the optical-field expression can be written as:

$$E(x, y) = u(r, z) \exp(il\theta) \exp(-ikz)$$

where $u(r, z)$, $\exp(il\theta)$, k denote the optical-field amplitude expression, the phase factor, and the wave number, respectively.

The Laguerre-Gaussian (LG) beam is a representative vortex beam, and its optical-field expression is:

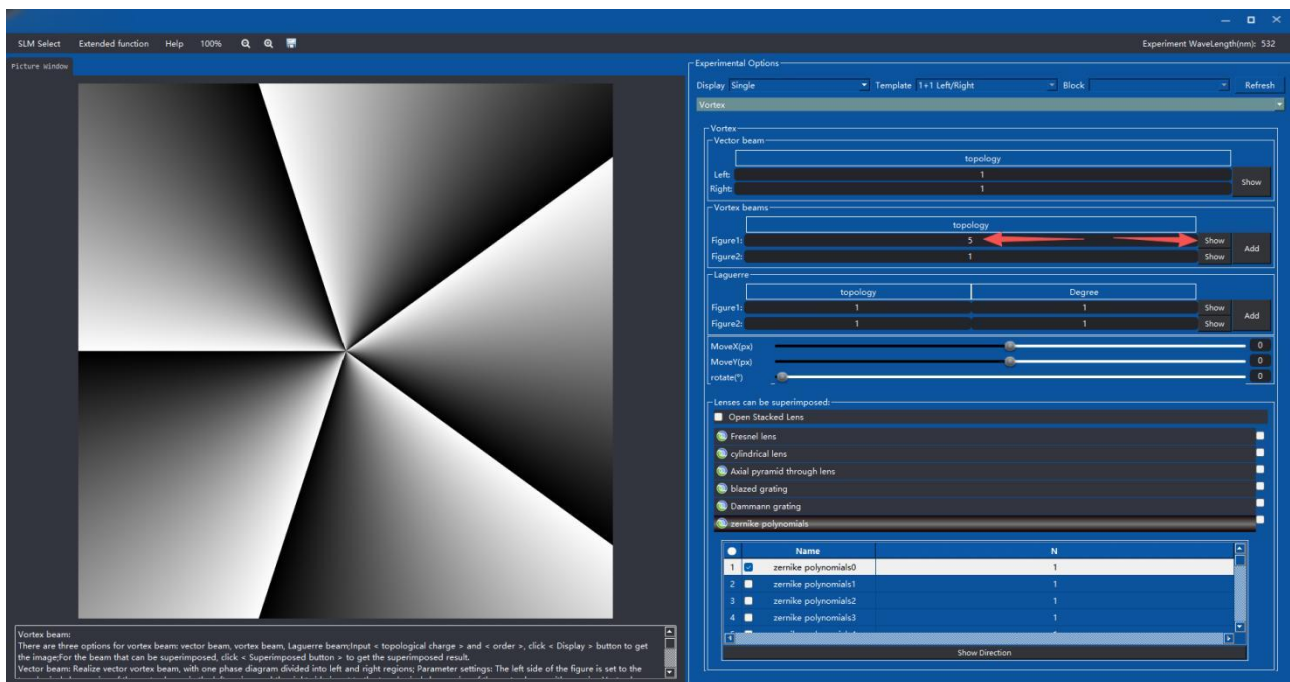
$$E(r, z) = \sqrt{\frac{2p!}{\pi(p + |l|)!} \frac{P_0}{\omega^2(z)}} \exp \left[-\frac{r^2}{\omega^2(z)} \right] \left[\frac{2r^2}{\omega^2(z)} \right]^{\frac{|l|}{2}} \left\{ L_p^{|l|} \left[\frac{2r^2}{\omega^2(z)} \right] \right\} \exp(il\theta)$$

where p , $p + 1$, $L_p^{|l|}$, l , P_0 , $\omega(z)$ denote the radial index, the number of hollow rings in the beam cross section, the Laguerre polynomial, the topological charge, the laser emission power, and the beam waist radius, respectively.

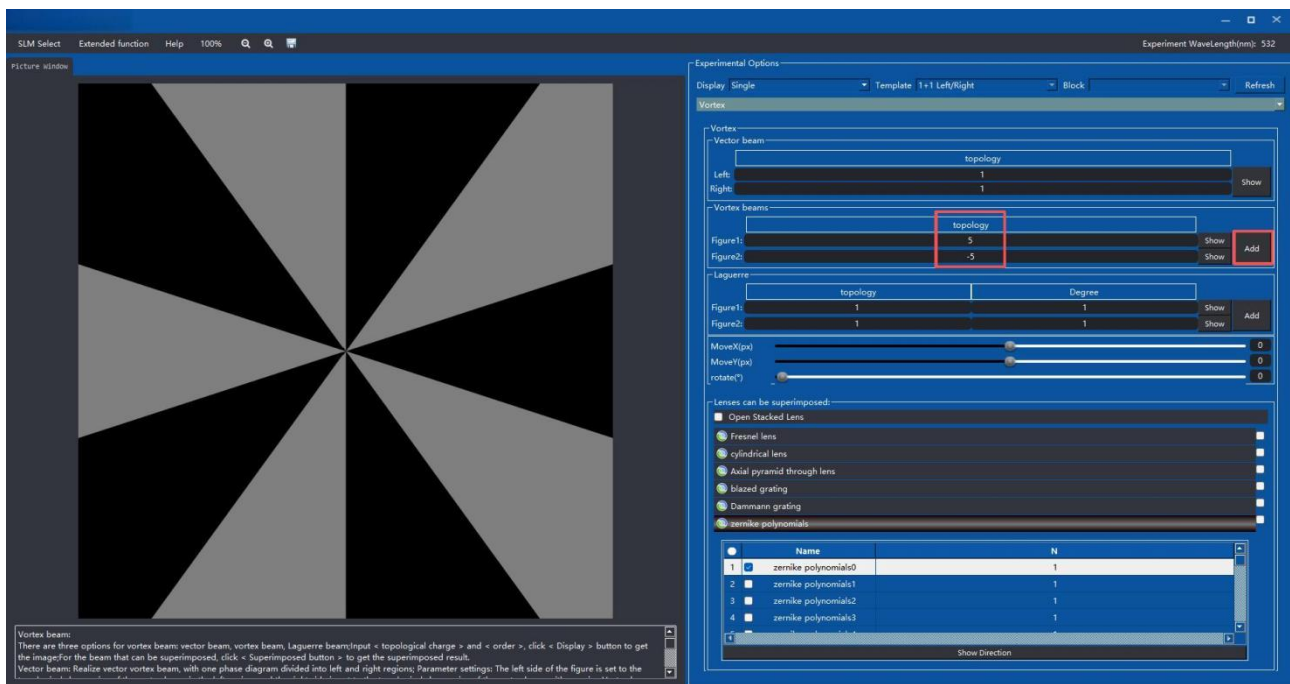
Note: the p and l in the software are Order and Topological Charge.

Operation Instructions:

Three options are available for vortex beams: Vector Beam, Vortex Beam, and Laguerre Beam. Enter <Topology> or <Degree> (the topology and order can be set as an integer or fraction), and click <Show> to generate the image. For beams that can be overlaid, click <Add> to obtain the overlay result.



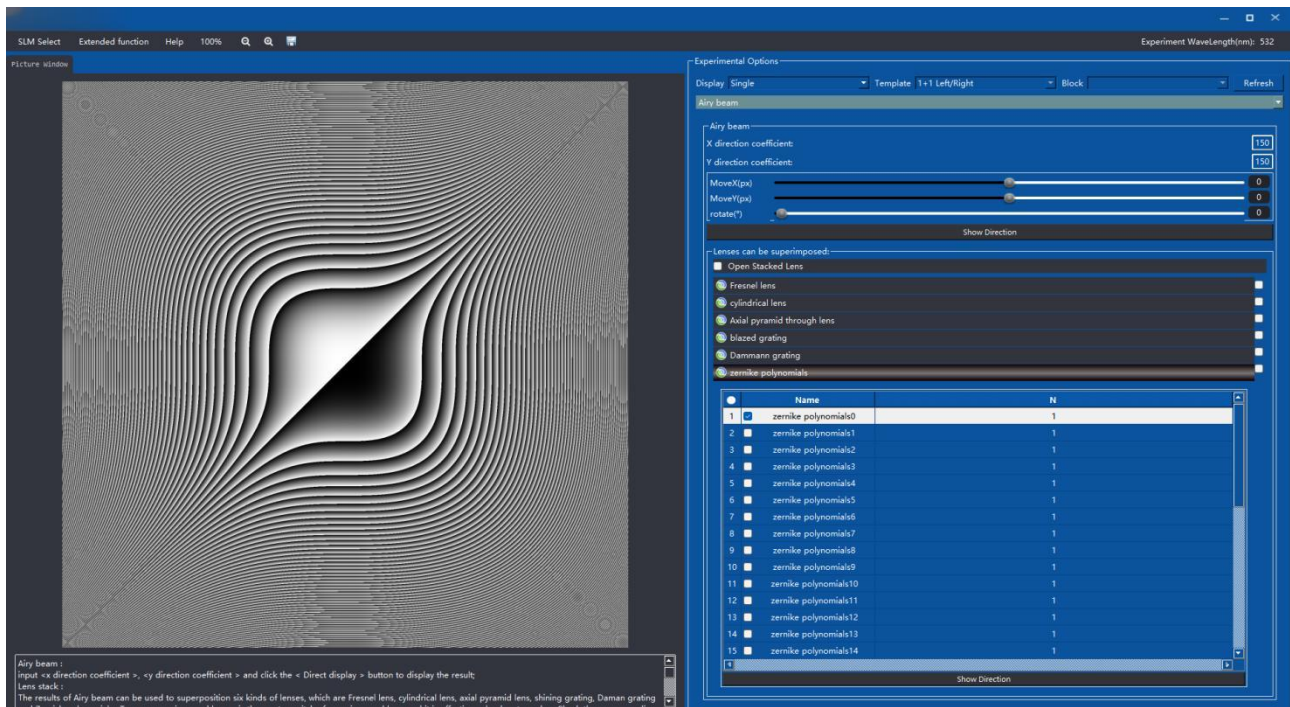
The example of direct display



The example of the overlay result

5.7 Airy Beam

Basic Principle: An Airy beam is a special type of beam with favorable properties such as non-diffraction, self-bending, and self-healing.



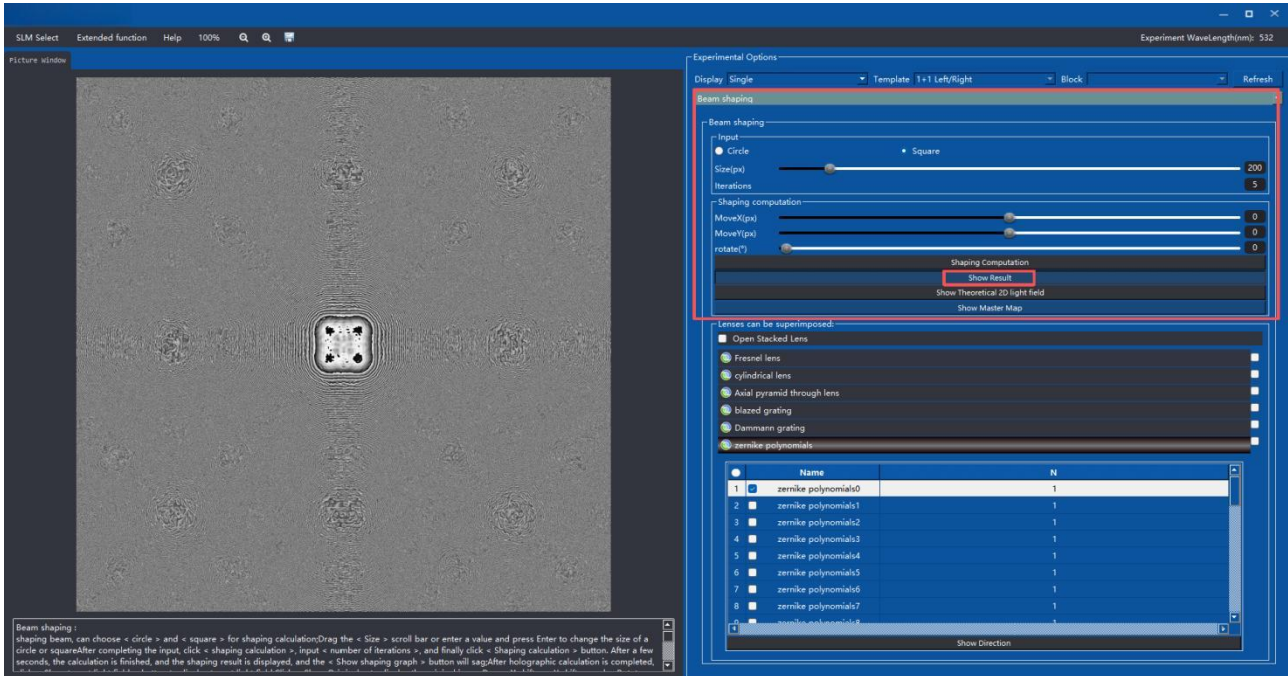
Operation Instructions:

Enter <X Direction Coefficient> and <Y Direction Coefficient>, and click <Show Direction> to show the result.

The <X-Direction Coefficient> and <Y-Direction Coefficient> indicate the scaling factors of the Airy beam.

5.8 Beam Shaping

Basic Principle: Beam shaping is an optical process in which incident light, such as a Gaussian beam, vortex beam, or plane wave, is converted into a flat-top beam through an optical system. The resulting flat-top beam has good uniformity.



Operation Instructions:

- In the Beam Shaping function, select <Circle> or <Square> as the target optical field for shaping calculation;
- Drag the <Size> slider or enter a value and press Enter to adjust the size of the circle or square;
- Enter < Iterations> and click <Shaping Calculation>. The software automatically calculates and displays the shaping result, and the <Show Result> button is selected;
- Click <Show Theoretical 2D Light Field> to view the target optical field;
- Click <Show Master Map> to return to the original image;
- Use <Move X>, <Move Y>, and <Rotate> to adjust the position and angle of the image.

5.9 Bessel Beam

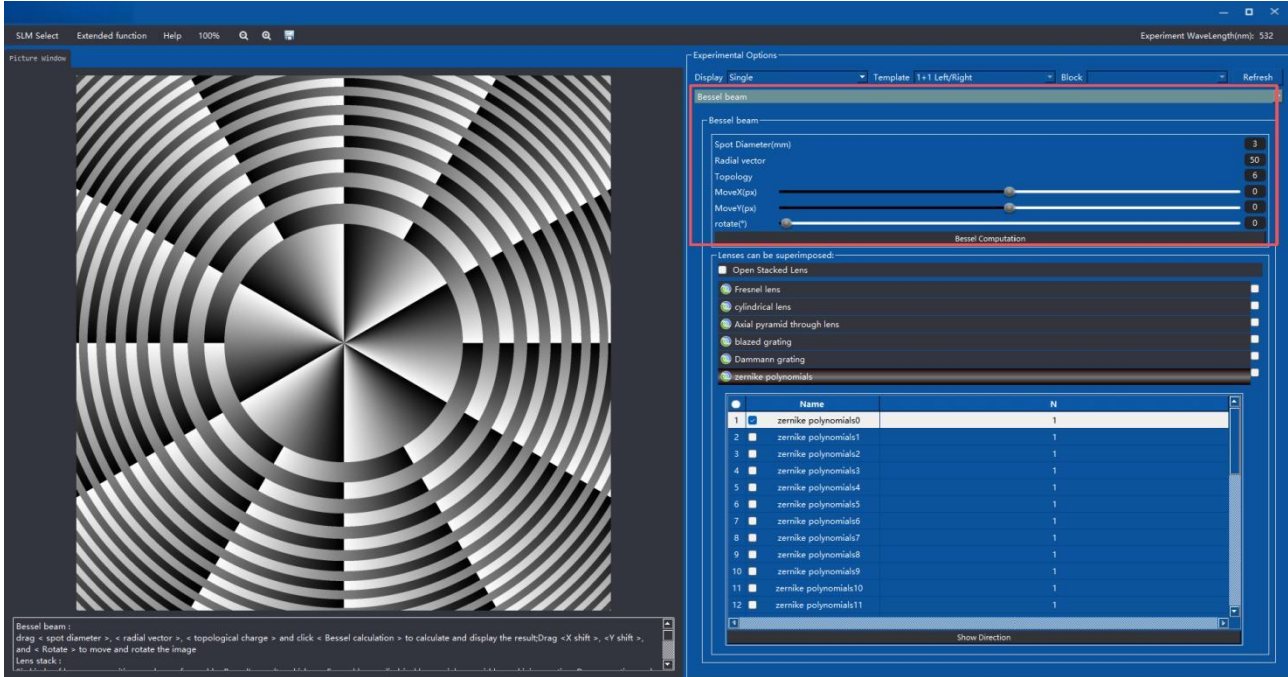
Basic Principle: A Bessel beam is a non-diffracting beam. A higher-order Bessel beam does not expand in the cross section perpendicular to the light propagation direction. When the beam propagates linearly along the z-axis in free space, its optical-field expression is a special solution of the Helmholtz equation and can be written as:

$$E(r, \theta, z, t) = \frac{A}{\omega(z)} J_n(k_r r) \exp(il\theta) \exp(ik_z z)$$

where $\omega(z)$ is the beam waist at propagation distance z ; A is the normalization constant; J_n is the Bessel function

of the n th order; l is the order or topological charge of the vortex beam; and k_r and k_z are the radial and longitudinal components of the wave vector, respectively.

Note: l corresponds to the <Topology> parameter in the software, while k_r corresponds to the <Radial Vector> parameter.



Operation Instructions:

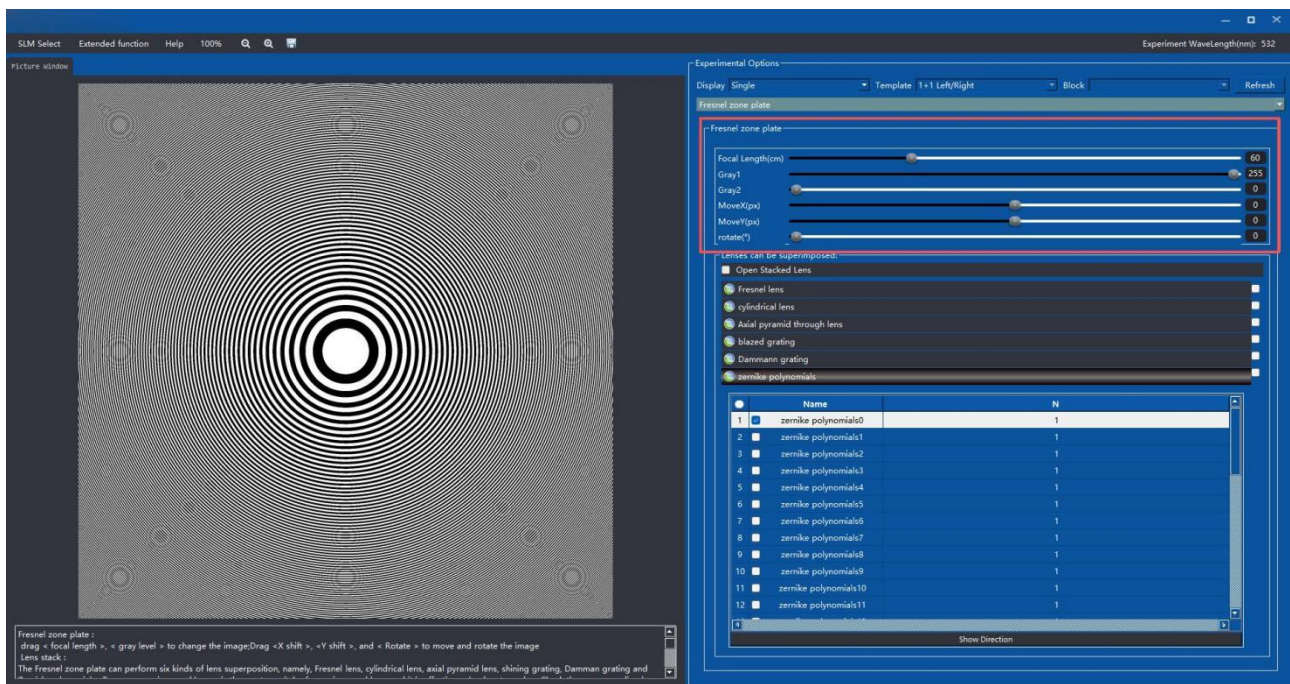
- Set <Spot Diameter>, <Radial Vector>, and <Topology>, and click <Bessel Calculation> to calculate and display the result;
- Drag <Move X>, <Move Y>, and <Rotate> to move and rotate the image.

5.10 Fresnel Zone Plate

Basic Principle: Based on the half-period zone method, a Fresnel zone plate is formed by blocking either the odd or even half-period zones while allowing the remaining zones to transmit light. The theoretical formula for fabricating a zone plate is:

$$\rho_k = \sqrt{\frac{Rb}{R+b} k \lambda} = \sqrt{k} \rho_1 \quad ; \quad \rho_1 = \sqrt{\frac{Rb \lambda}{R+b}} \rightarrow \frac{1}{R} + \frac{1}{b} = \frac{1}{f}$$

The imaging function of a zone plate is similar to that of a lens. From the formula above, the focal length of the zone plate is inversely proportional to the wavelength.

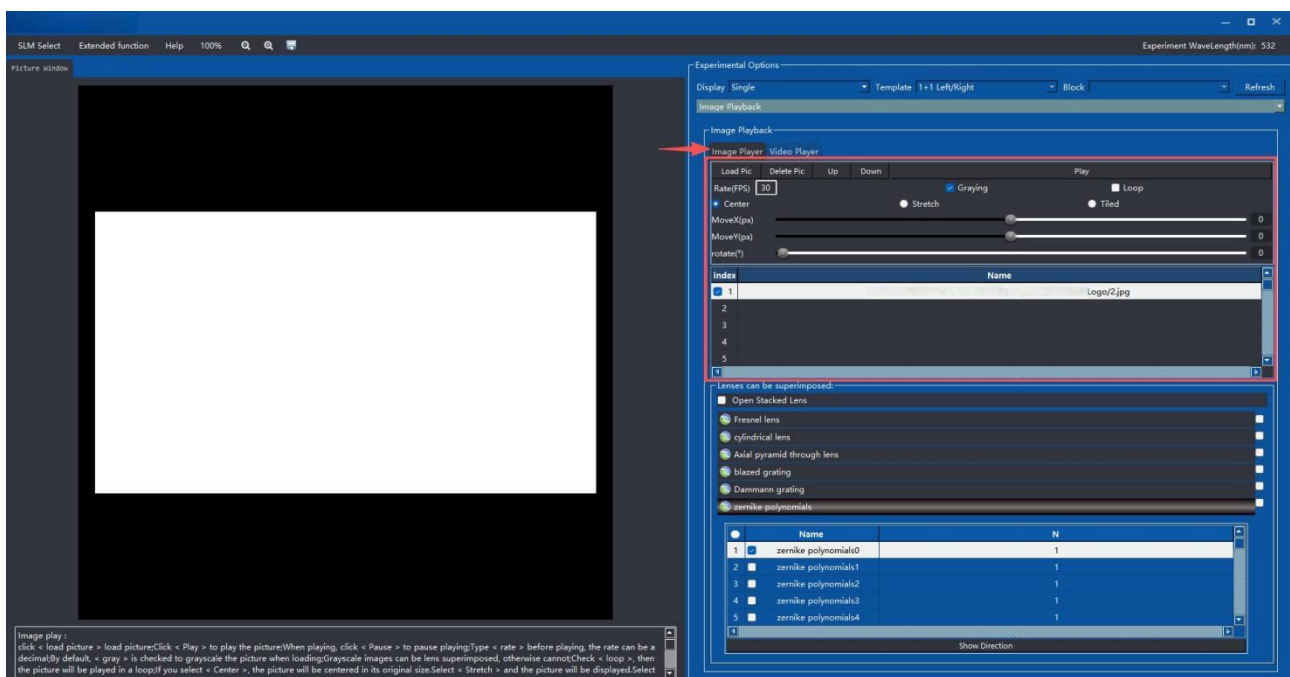


Operation Instructions:

- Drag the <Focal Length> and <Gray1>/<Gray2> sliders, or enter values and press Enter to change the image;
- Drag <Move X>, <Move Y>, and <Rotate> to move and rotate the image.

5.11 Image Playback

Image Player: This function is used to load one or more images and display them in the Image Window according to the specified playback mode. Users can convert images to grayscale, enable loop playback, move or rotate the image, and adjust the display mode. It is suitable for image loading and display, image-sequence playback, and basic display tests.



Operation Instructions:

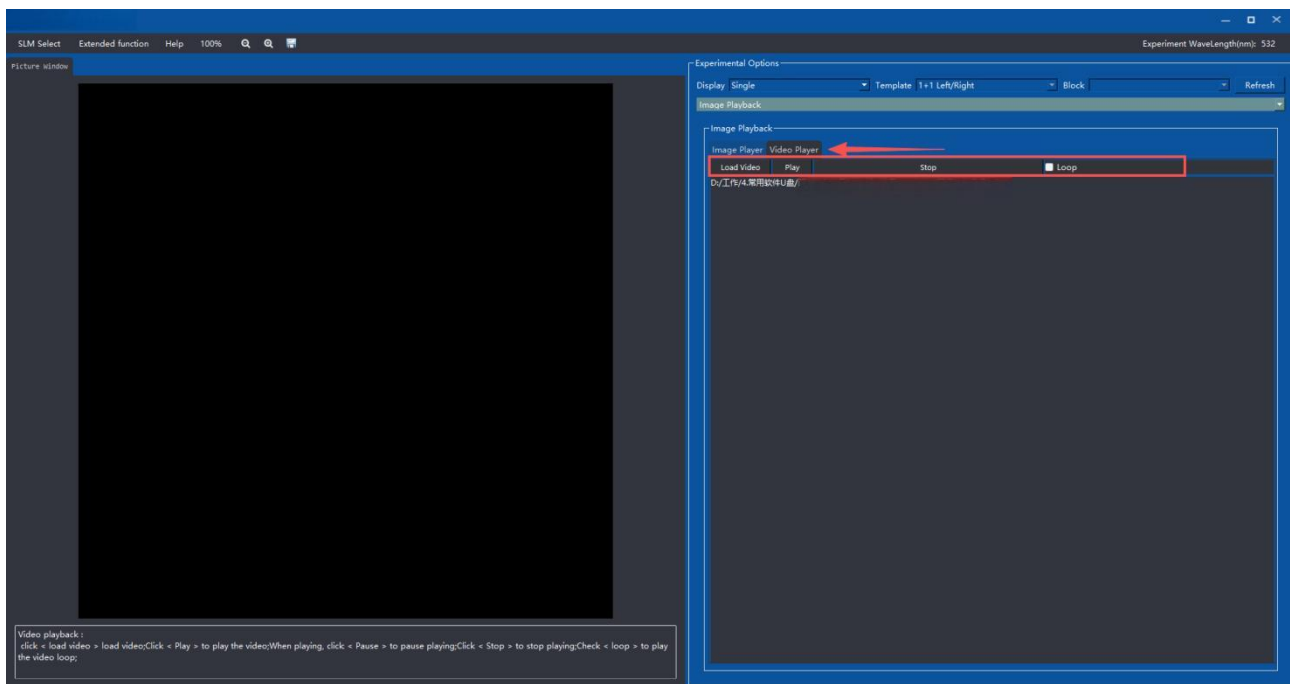
- a. Click <Load Pic> and select the image to be displayed or played. The image will be added to the image list below;
- b. To delete images, select the checkboxes in front of the image list and delete one or more images. Alternatively, directly select one or more images in the list and click <Delete Pic>;
- c. To adjust the playback order, first select the image to be moved, and then click < Up> or < Down> to adjust its position in the list;
- d. Enter the playback frame rate in < Rate (FPS)> to set the playback speed of the image sequence;
- e. <Graying> is selected by default. After an image is loaded, it is displayed as a grayscale image;
- f. After <Loop> is selected, the image sequence will play repeatedly in the order of the list;
- g. Select <Center>, <Stretch>, or <Tiled> to set the display mode of the image in the display area;
- h. Use < Move X> and < Move Y> to adjust the image position in the horizontal and vertical directions;
- i. Use <Rotate> to adjust the rotation angle of the image;
- j. Image Playback supports lens overlay. Select <Open Stacked Lens> and the corresponding lens to overlay the lens phase on the current image;
- k. After setting the parameters, click <Play>. The software plays the images according to the current settings.

Supported image formats: jpg, bmp, png, tif, jpeg, and others.

Video Player:

Click <Video Player> to load a video. Click <Play> to start video playback. During playback, click <Pause> to pause the video, or click <Stop> to stop the video. Select <Loop> to play the video repeatedly.

Supported video formats: mp4, avi, and gif.



6 Technical Support and Help

Thank you for choosing SIMTRUM. This help document is intended to be as comprehensive as possible, but issues not covered here may still occur during actual use. Please contact our technical support team at any time; we will be glad to assist you. We also highly value your experience and suggestions. Please share your feedback with our staff, and we will continue to improve.

We wish you every success!