NC(2503)

# Operation Manual of

# PLCTSScope

Mar., 2025

Document Version, V6.0

# Contents

# Chapter 1: Introduction

The PLCTSScope is a highperformance beam profiler designed forad vanced laser beam analysis. It supports multiple interface options includingG igabit Ethernet (GigE), USB 3.0, and 10 Gigabit Ethernet (10GigE), makingi t versatile and suitable for a wide range of applications.

Key Features:

➢High-Speed, High-Resolution Display: Offers 2D and 3D pseudo-color displays of laser beam profiles with exceptional speed and resolution.

➢Compatibility: Supports Windows 10 and later operating systems, ensuring compatibility with modern computing environments.

➢Camera Control: Enables users to adjust camera settings such as exposure, gain, and resolution directly from the software interface.

➢Real-Time Analysis: Provides real-time pseudo-color 2D display of the laser spot, along with Gaussian curve displays for both major and minor axes.

➢Continuous Zoom: Offers continuous zoom functionality in 2D mode for detailed examination of the laser spot.

➢Measurement Tools: Measures critical parameters including the major and minor axes, ellipticity, and rotation angle of the laser spot.

➢Statistical Analysis: Supports statistical analysis of measured parameters, enabling users to evaluate the consistency and quality of their laser beams.

➢Data Management: Allows users to record and export measured parameters or generate reports for documentation and further analysis.

➢Image Processing: Can read and measure parameters from laser spot images, providing flexibility for post-processing and analysis.

- Image Saving: Offers multiple options for saving processed images, facilitating documentation and sharing of results.
- Connectivity: Supports USB 3.0 and Ethernet interfaces for seamless integration with hardware devices.
- Customizable Extensions: Can be extended with custom features and functionalities.

# Chapter 2: Installation and Configuration Requirements

Recommended Configuration:

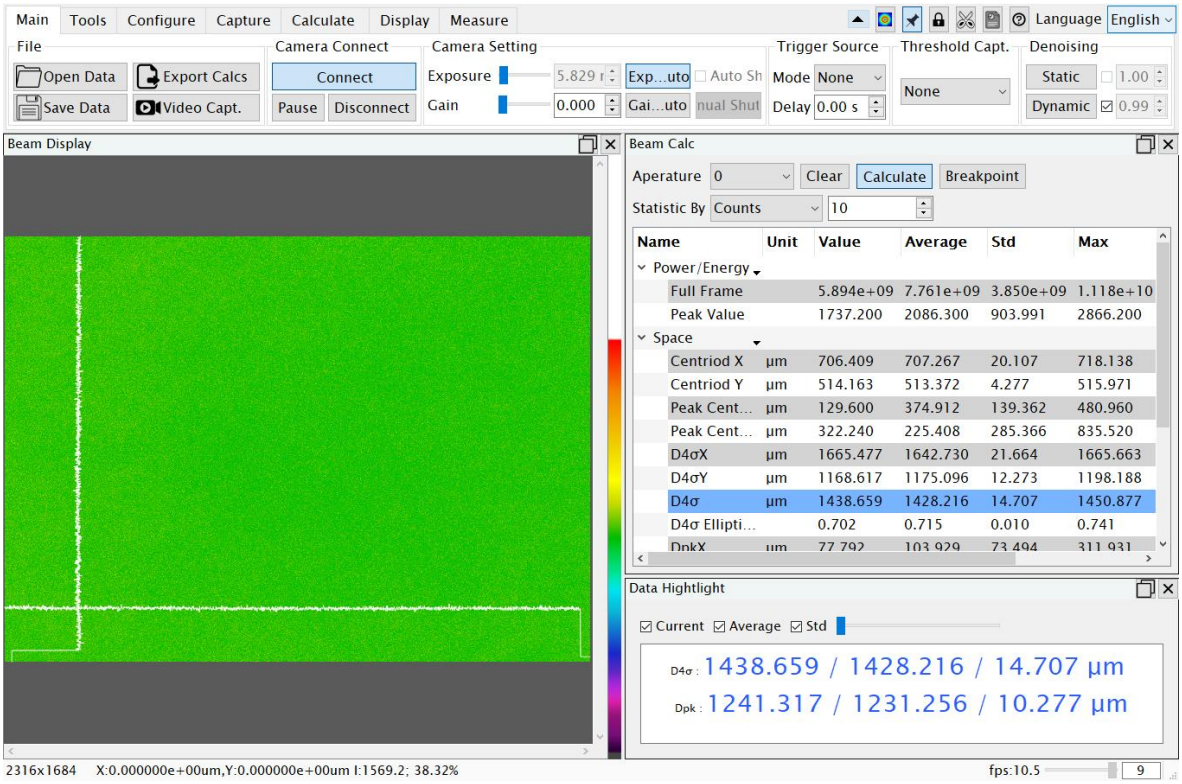
- Operating System: Windows 10/11, 64-bit, with pre-installed MS Office or WPS.
- Hardware Configuration: Memory ≥8 GB, Clock speed ≥2.5 GHz, cores ≥4, i5 or equivalent model and above.
- Optimal Display Resolution: 1920 × 1080.
- USB: USB 3.0 port.
- Network Card: Gigabit Ethernet card.

# Chapter 3: Installation and Configuration Process

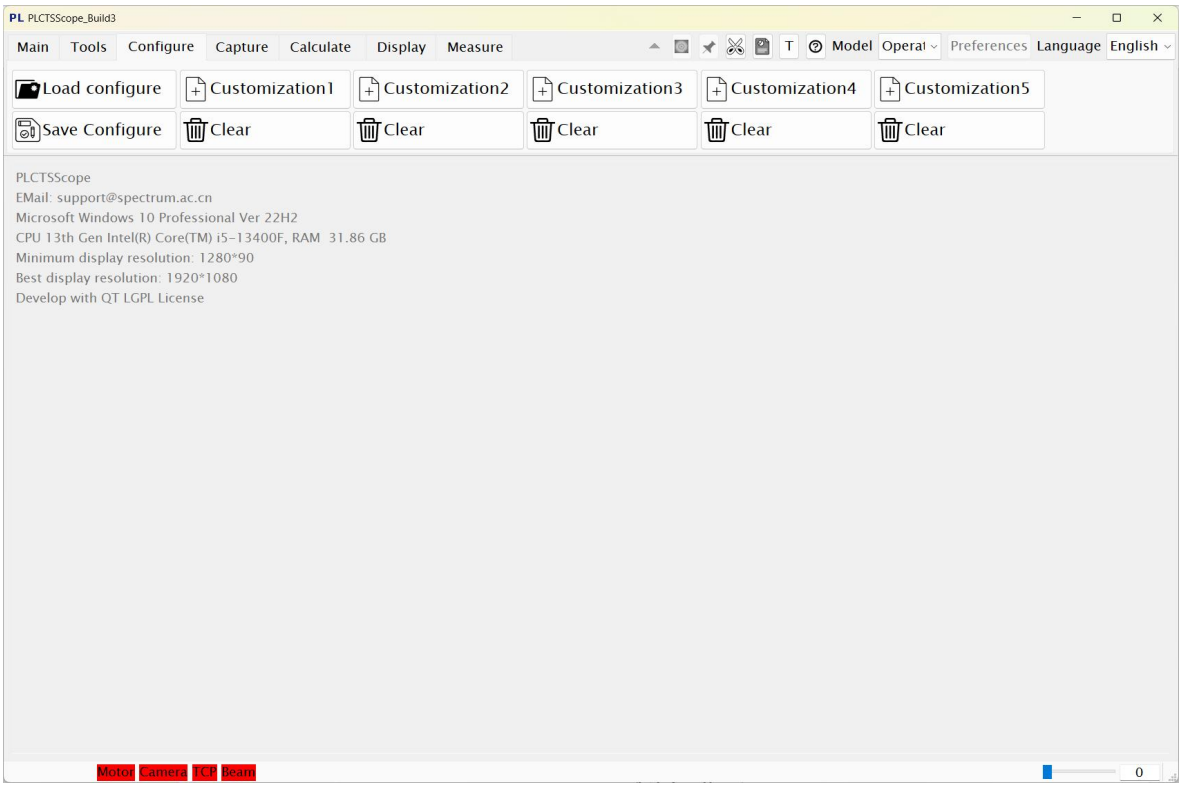
For detailed instructions, please refer to the Quick Installation Guide (Quick Installing Guide V2.03.pdf).

# Chapter 4: Interface and Functionality Description

## 4.1 Main Interface




When the beam display, calculation, and other tool windows are not open, the main interface will display software-related information.




4.2 Toolbar

The toolbar consists of 7 tabs and quick access icons in the upper right corner.

## 4.2.1 Main Menu


File:

➢Open Data: Opens the beam and displays it in the beam display window.

➢Save Data: Saves the current beam displayed on the interface.

➢Export Calcs: Exports the accumulated beam data to a file.

➢Video Capt.: Saves the displayed beam as a video file.

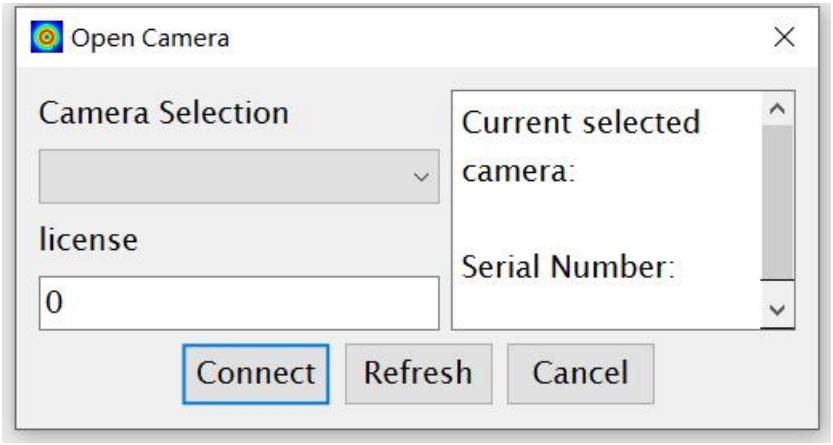
Connect:

➢Connect: Opens the camera connection window.

➢Disconnect: Disconnects the camera.

➢Play/Pause: Can be used once the camera is successfully connected; plays or pauses the camera image.

Camera Connection Window:




➢Camera Selection: Choose a camera from the dropdown list.

➢License: Enter the password for the selected camera.

➢Connect: Connects the camera.

➢Refresh: Refreshes the camera list.

➢Cancel: Closes the window without connecting the camera.

➢Adjust:

-Exposure Time: Sets the camera exposure time (in the camera's native units, usually microseconds).

-Exposure Auto: Enables auto-exposure.

-Gain Coefficient: Sets the gain for the camera image.

-Gain Auto: Enables auto-gain.

-Auto shutter, manual shutter: Shutter function for special cameras

➢Trigger Source: Selects the trigger mode (no trigger, soft trigger, hard trigger) and sets the trigger delay.

➢Threshold Capture: Sets the threshold range and value based on the camera settings.

➢Denoising:

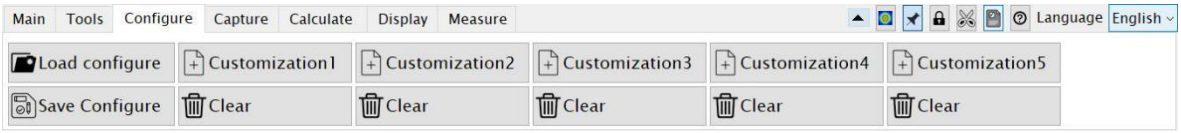
-Static: Reduces noise in the acquired data. The checkbox indicates whether noise reduction is enabled, followed by the coefficient.

-Dynamic: Reduces background noise in real-time on the beam display interface. The checkbox indicates whether noise reduction is enabled, followed by the coefficient.

### 4.2.2 Tools


Opens or closes tool windows. Detailed information about the windows is provided below.

### 4.2.3 Configure




Configuration management includes opening windows, selecting images, and choosing camera models. Configuration files are in .ini format.

➢Save Configure: Saves the current configuration to a configuration file.

➢Load Configure: Opens an existing configuration file.

➢Customization: Finds and opens an existing configuration as a quick-access method, and changes the customization to this file name.

➢Clear: Clears the quick-access method and returns to the customization mode.

### 4.2.4 Capture


Settings related to camera resolution:

➢Resolution: Set the width and height of the camera frame; there are two modes, one scales based on the top-left corner as a reference, and the other scales with the center as a reference. In cases where the frame exceeds the area, adjustments will be made to the top-left corner and center positions accordingly.

➢Pixel merge: Merges multiple pixels (number depends on the camera and selection) for display.

➢Pixel Size: Size of the camera pixels (in micrometers).

➢Extra:

-Pixel Depth: Selects the bit depth from the available options based on the camera.

-Black Level: Adjusts the black level based on the camera's availability and range.

-Threshold: Image threshold, range 0 to 1.

-Binarizate: Checks to binarize the image based on the threshold.

-Convolution: Applies convolution to the image based on the selected option.

➢Frame:

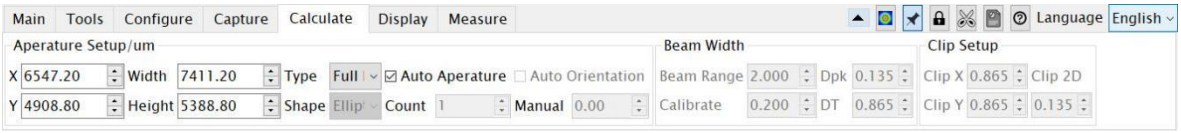
-Average Frame: Averages data from multiple frames.

-Sum Frame: Sums data from multiple frames.

➢Cache:

-Cache Frame: Sets the number of frames to cache, used for saving beam data to the cache.

## 4.2.5 Calculate




➢Aperture:

-Position and Size: Top-left position and width/height.

-Type: Sets the aperture mode (manual, full image, or partitioned).

-Shape: Sets the shape of the aperture (circular, elliptical, square, or rectangular).

-Auto Aperture: Enables or disables auto-aperture.

-Count: For full image partitioning, multiple apertures are m*n; otherwise, it is the number of apertures. Full image and partitioned modes disable the aperture rotation angle and shape. Full image mode also disables the number of apertures.

-Auto Orientation: Automatically calculates the aperture angle.

-Manual: Sets the rotation angle of the aperture (positive for counterclockwise, negative for clockwise).

➢Beam Width:

-Beam Range: In auto-aperture, the larger the multiplier, the larger the resulting aperture size.

-Calibrate: Lens magnification factor, which scales the beam size.

-Dpk: Energy ratio range 0 to 1.

-DT: Energy ratio range 0 to 1.

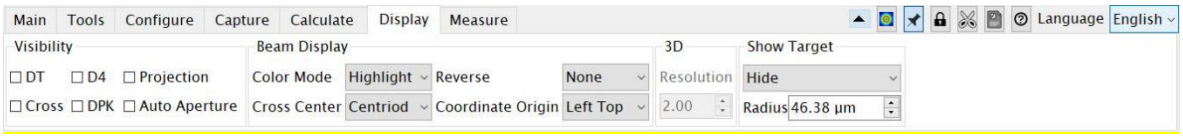
➢Clip Setup:

-Clip X: Ratio of the vertical coordinate of the horizontal cursor to its bit depth in X projection.

-Clip Y: Ratio of the vertical coordinate of the horizontal cursor to its bit depth in Y projection.

-Clip 2D: Sets the 2D threshold value.

## 4.2.6 Display




➢Visibility: Controls the visibility of components in the aperture display. Checked items are visible, unchecked items are not.

➢Beam Display:

-Color Mode: Includes grayscale, normal, emphasized diffraction, and rainbow.

-Cross Center: Includes centroid, peak, and manual. Manual indicates the user-defined aperture center.

-Reverse: Image reverse options include none, horizontal, vertical, 90° clockwise, and 90° counterclockwise.

-Coordinate Origin: Options include top-left, top-right, bottom-left, bottom-right, image center, and manual aperture center.

➢3D Resolution:

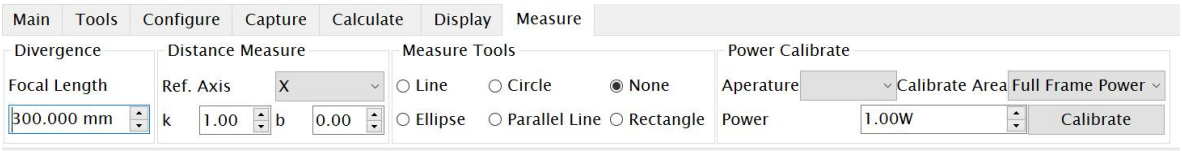
-Resolution: Adjusts the 3D display resolution, actual range 100-1000000, displayed value 0.01-100.

➢Display Targets:

-Target Status: Hidden, Cross Center, Image Center;

-Radius: The size of the radius of the target.

### 4.2.7 Measurement




➢Focal Length: Controls the lens focal length.

➢Distance Measure:

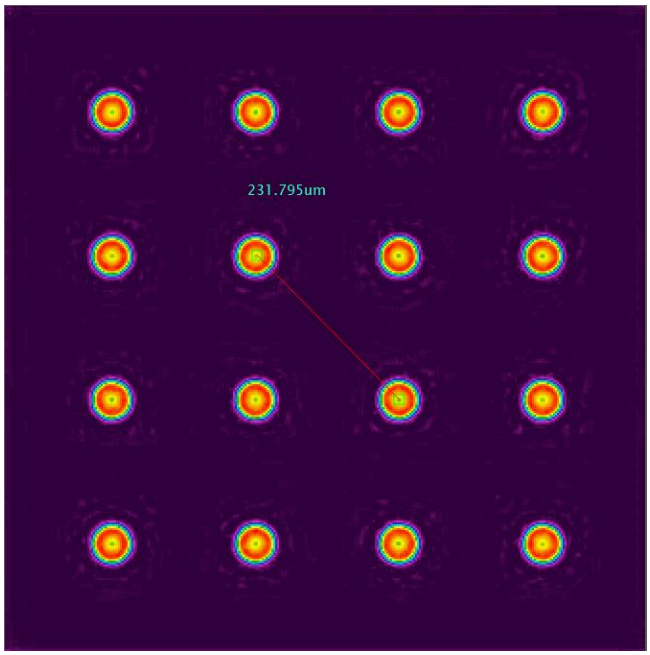
-Reference Axis: X-axis or Y-axis.

-k: Slope.

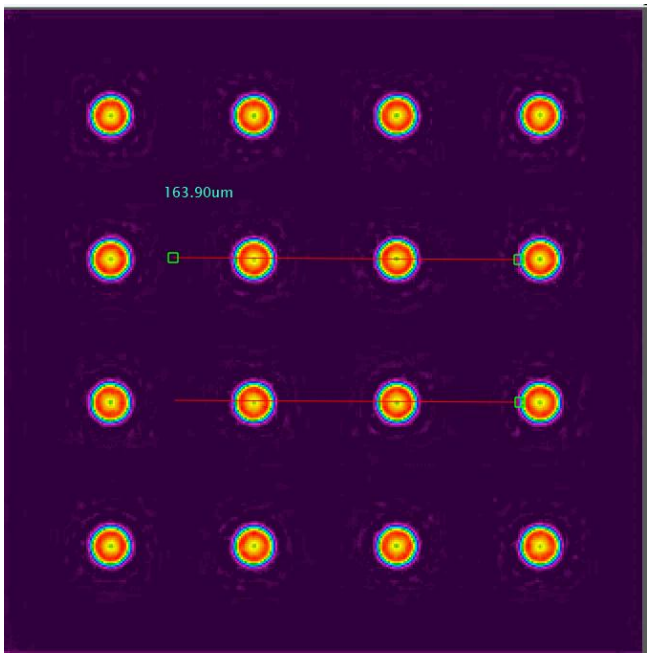
-b: Intercept.

➢Measurement Tools:

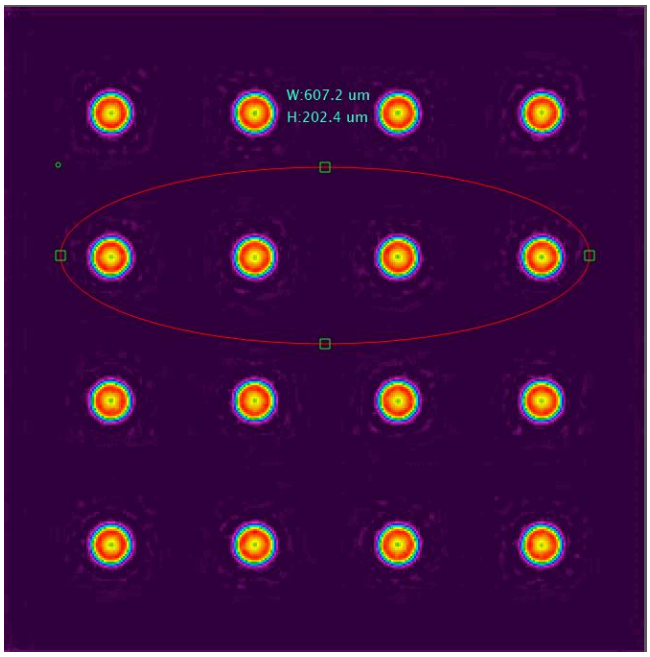
-Line Measurement:



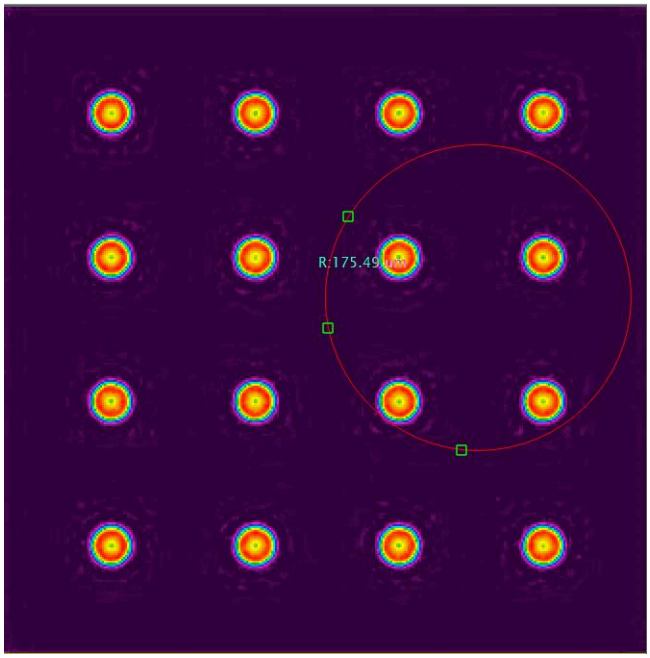

-Parallel Line Measurement:



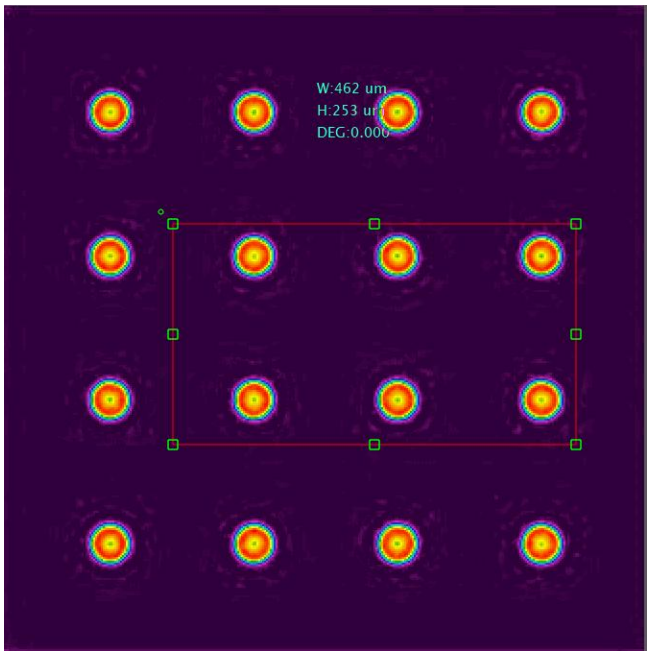

-Ellipse Measurement:



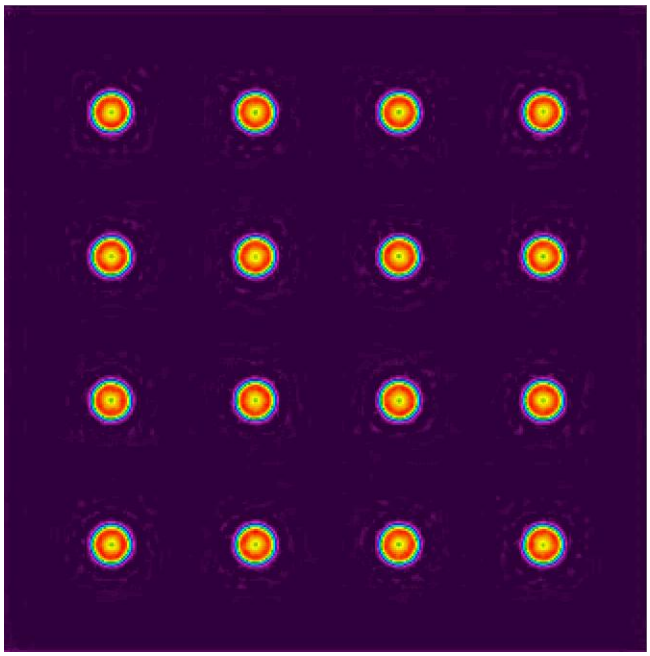

-Three-Point Circle Measurement:




-Rectangle Measurement:




-None:



➢Power Calibrate:

-Set the reference aperture, calibration power, and calibration item. Click the calibration button to perform the calibration. This is used to calibrate the laser power. After entering the calibration power(power units can be switched between kW, W, mW, and uW.), click the calibration button to complete the

calibration and convert the total power of the selected area to the calibrated power. Once calibrated, the laser power can be measured in real-time in this window.

➢Aperture uniformity:

-Display Calculation Area: Displays the calculated aperture

-Tracking: Select tracking items (D4, DPK, DT, Manual Aperture);

-Correction coefficients: including correction coefficients in the X and Y directions;

-Shape: The shape of the calculation area (rectangle, ellipse).

### 4.2.8 Quick Function Buttons


 Represents control for opening/closing sub-toolbars.

 Minimize to Tray.

 Represents fixed or toggle opening of sub-toolbars, which automatically close when the mouse leaves the sub-toolbar area.

 Represents locked software functions that require a password to unlock.

 Left-click to take a screenshot of the current main screen.

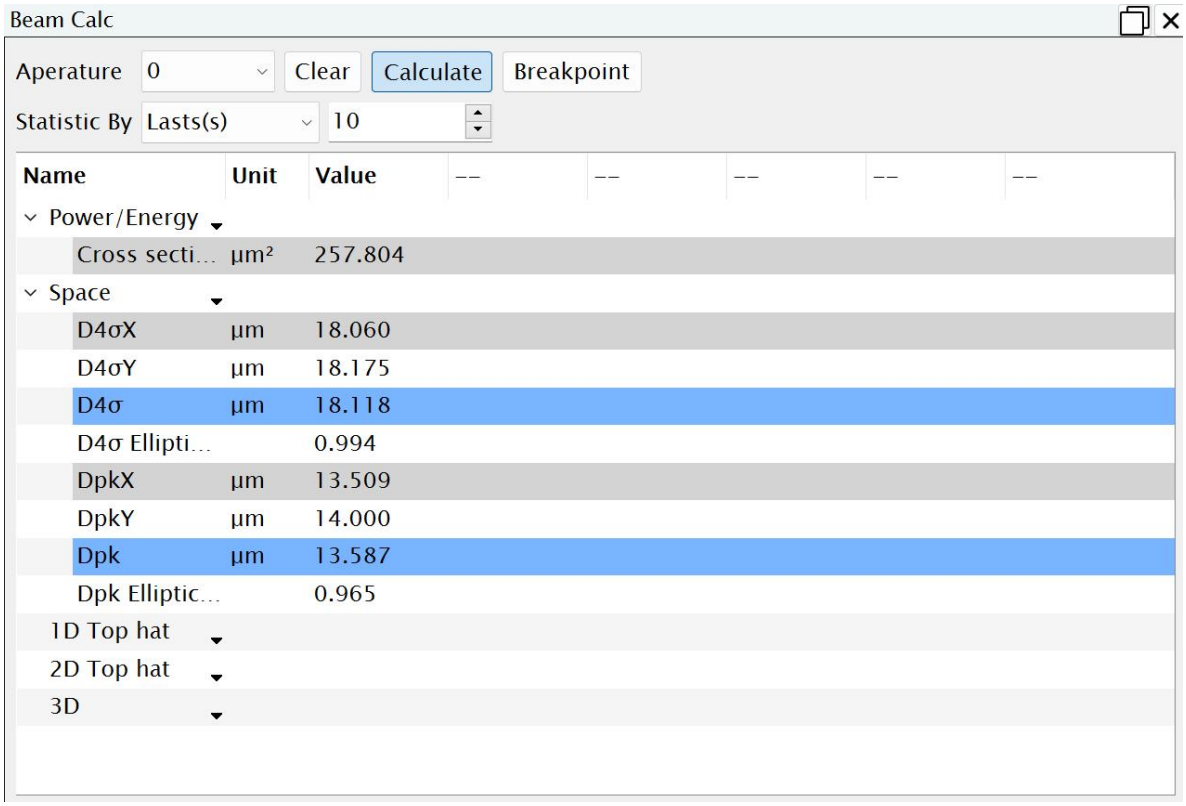
 Save report.

 Represents help; left-click to open the user manual.

Language selection to switch between Chinese and English interfaces.

# 4.3 Window Details

## 4.3.1 Beam Calculation




➢Beam Number: The current number of the aperture being analyzed.

➢Clear Data:Resets the data to zero.

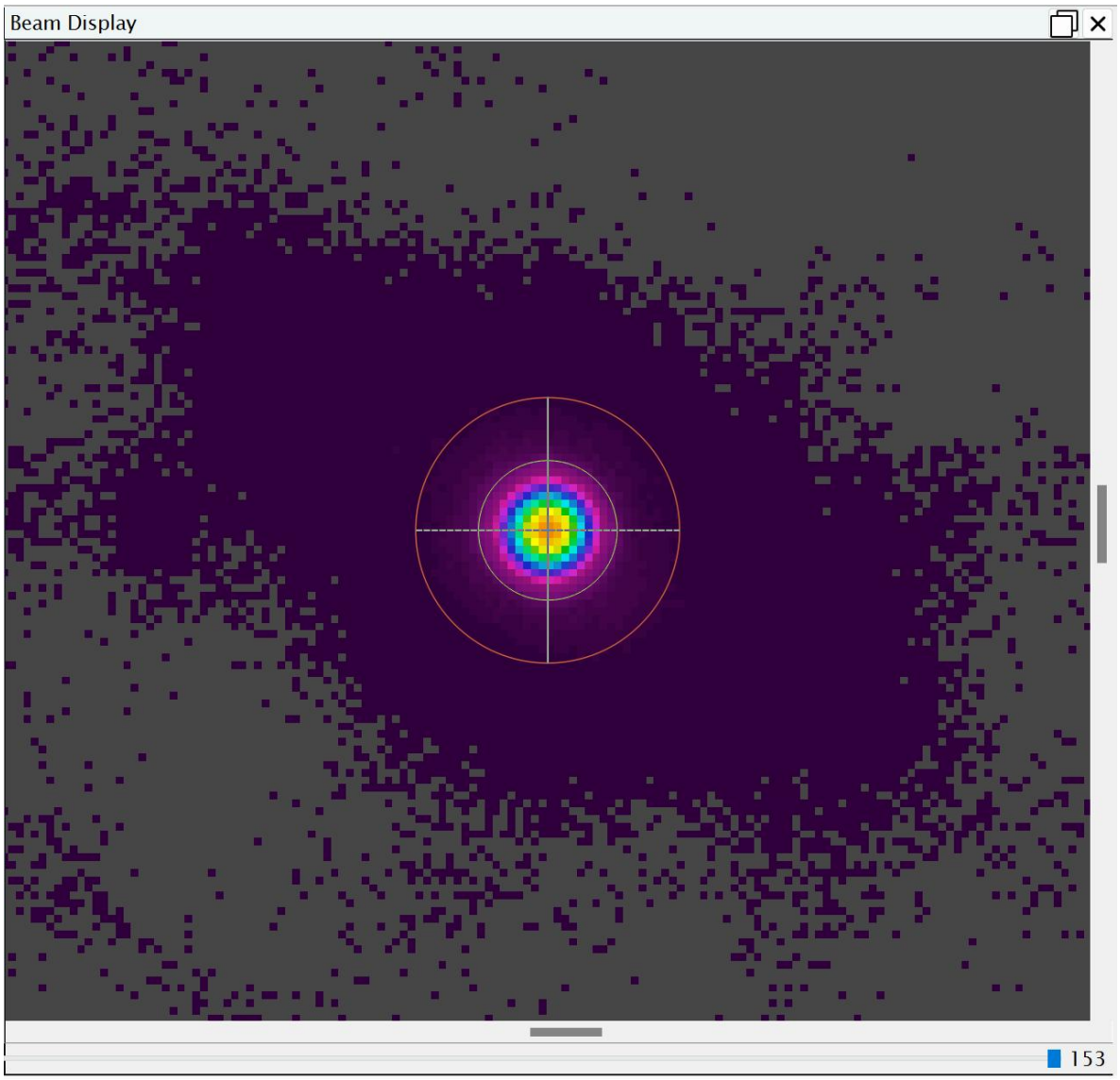
➢Enable Calculation: If calculation is not enabled, no data will be output.

➢Breakpoint Acquisition: Enables breakpoint acquisition, which does not clear data and automatically stops acquisition after a specified duration or number of samples.

➢Statistics Mode: Choose between statistics duration (in seconds) or number of samples, followed by the specific time length or sample count.

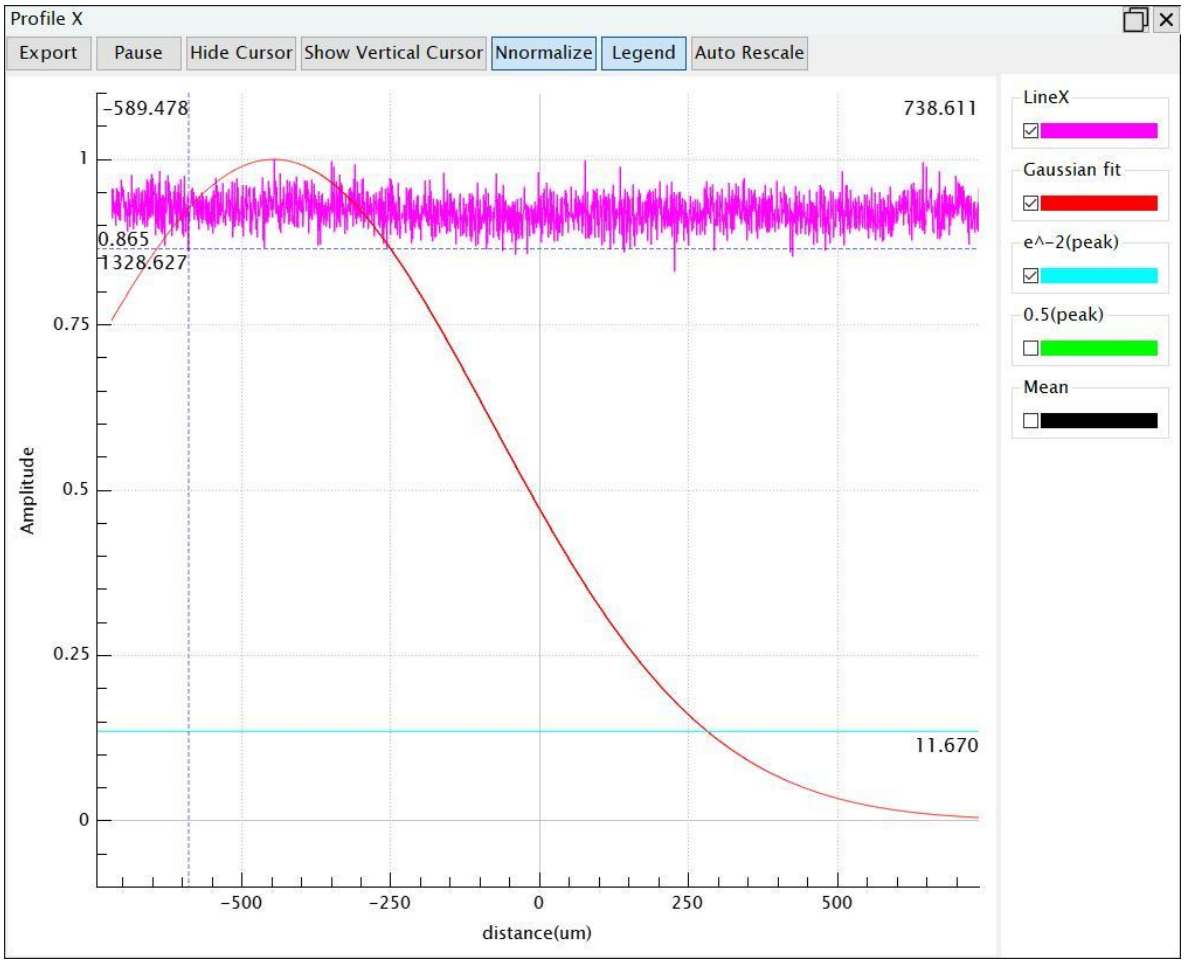
The beam calculation data display shows the parameters of the beam specified by the selected ROI number. You can open a sub-window by clicking the dropdown menu and select the parameters to display. If a parameter is checked, it will be displayed; Clicking it again will display it as a square marker, and the parameters will be highlighted with larger fonts in the status box. Click the dropdown arrow and then "Statistics" to open the calculation data (mean, standard deviation, maximum, minimum).

### 4.3.2 Beam Display



➢Displays the spot image, or camera frame.

### 4.3.3 XY Projection




➢Shows the projection curves of the spot in the X and Y directions. On the right are five curves; check to display, uncheck to hide.

➢Open Cursor: Displays cursor lines (one horizontal and two vertical). The value ratio of the horizontal cursor is consistent with the toolbar's XY projection.

➢Export: Exports and saves the projection data.

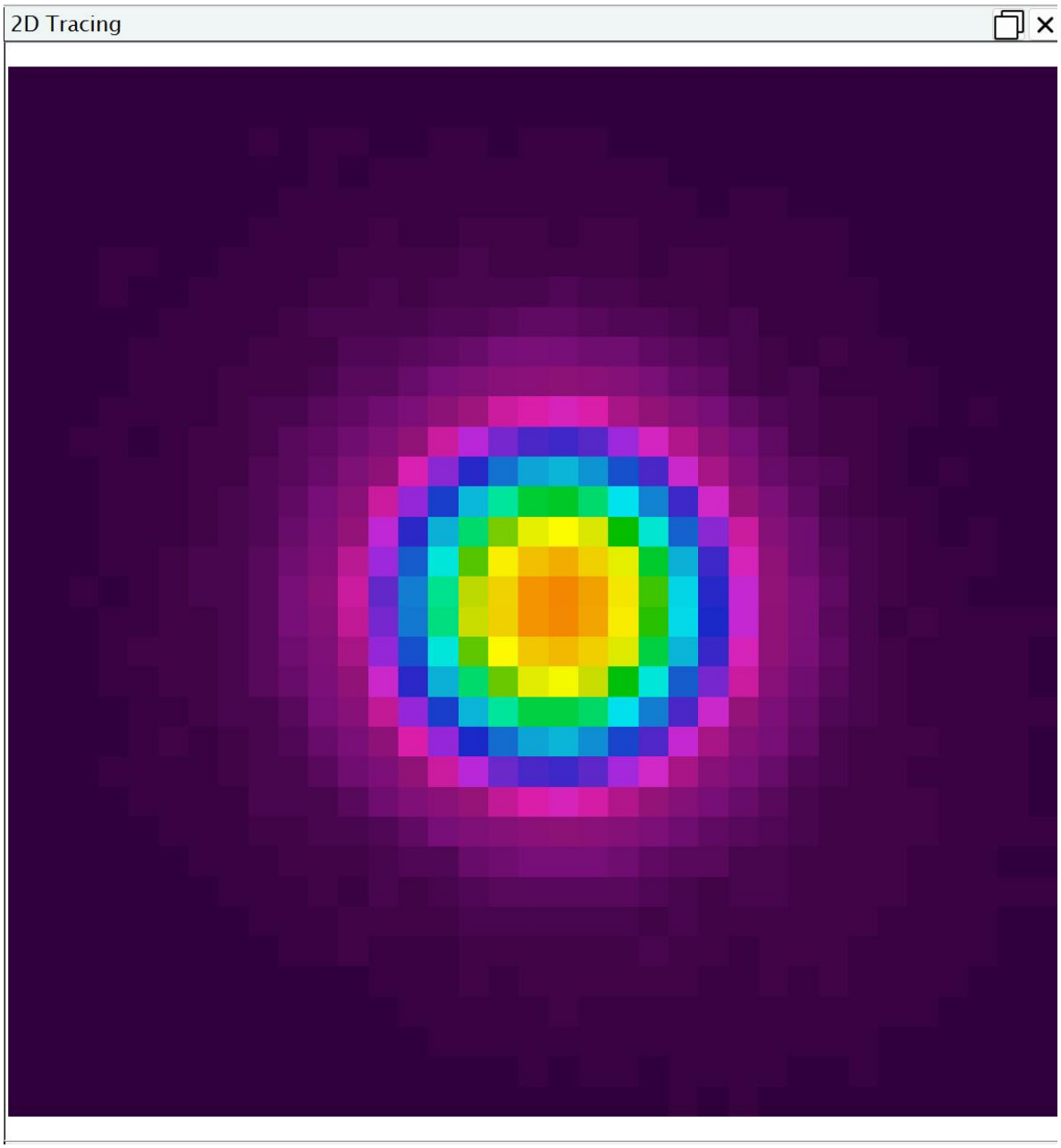
➢Screenshot: Captures a screenshot of the current projection interface.

➢Curve: Represents the curve itself.

➢Show Cursor: Shows/hides a single cursor

- Normalize: Curve normalization
- Legend: Shows or hides the legend window on the right
- Autoscale: The curve returns to the autoscale state
- Curve: represents the curve itself;
- Gaussian Fit: Performs Gaussian fitting on the points of the curve, excluding the endpoints.
- e^-2: A horizontal line at e^-2 times the peak value of the beam, with the intersection distance displayed on the right.
- 0.5: A horizontal line at 0.5 times the peak value of the beam, with the intersection distance displayed on the right.
- Mean: The average value of the y-coordinates between the two blue vertical axes.

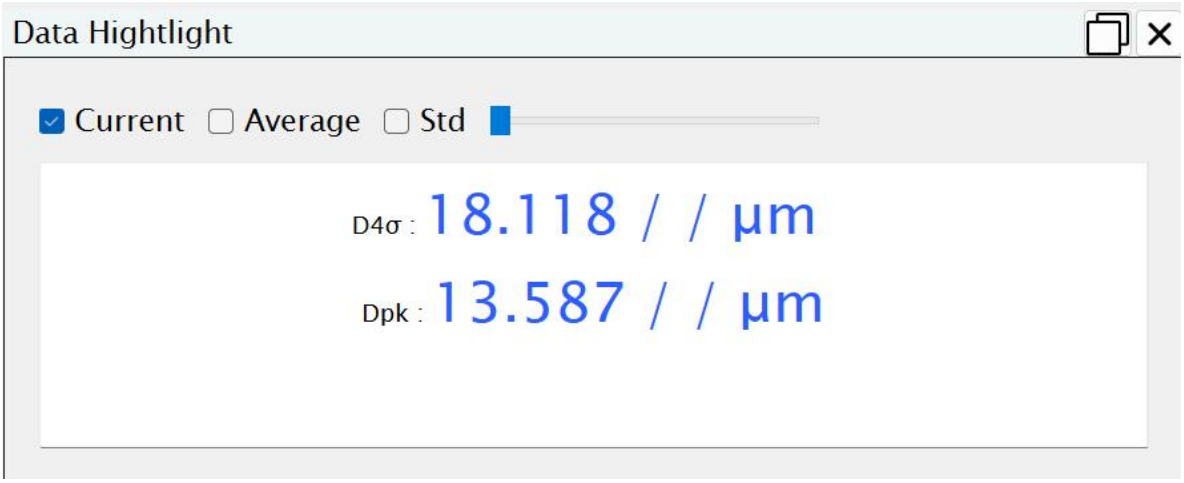
### 4.3.4 2D Tracking




➢Displays the real-time updated area within the selected ROI.

### 4.3.5 Enhanced Display

Displays the options that are in the third state (▣) in the beam calculation.

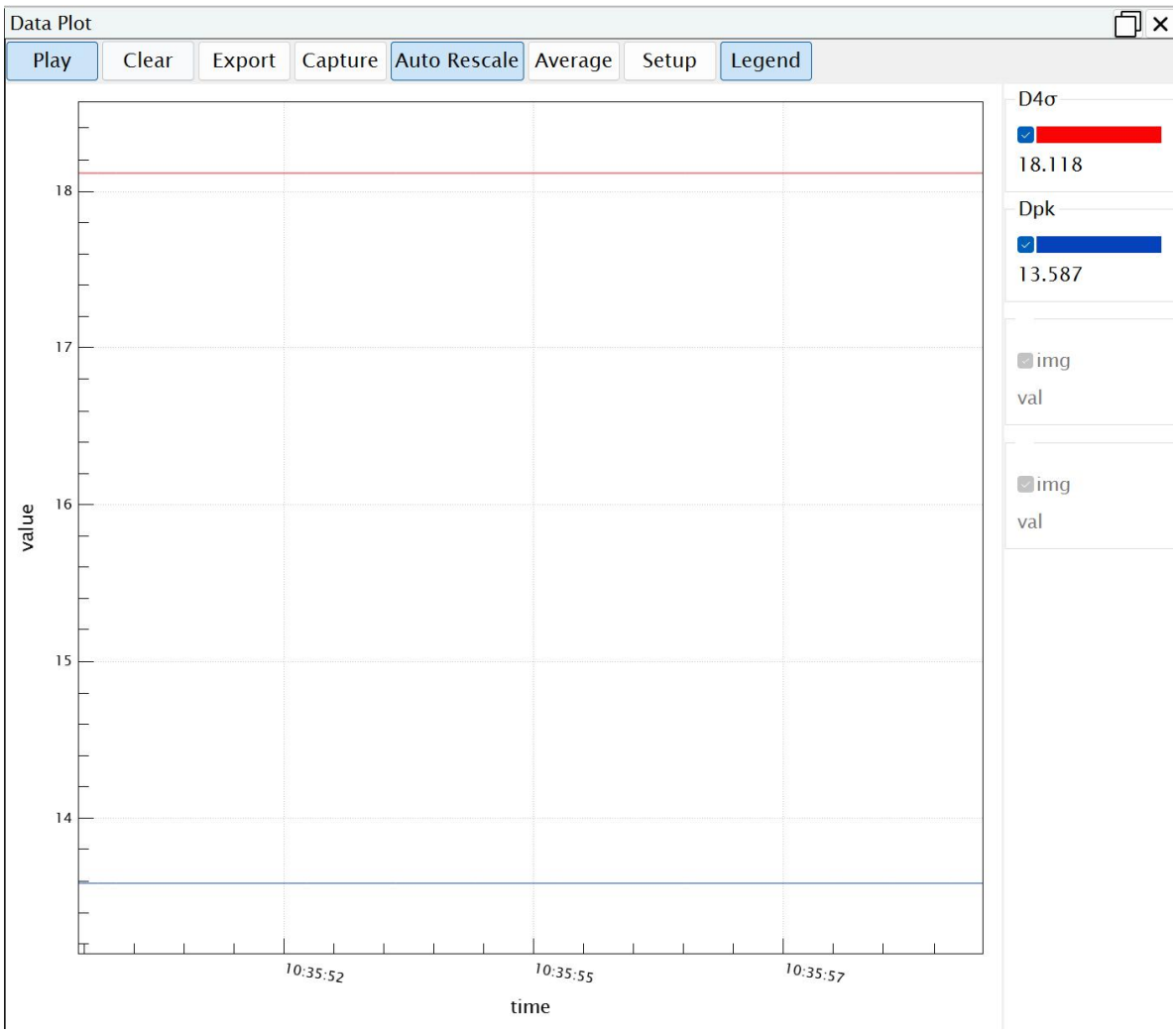



➢Slider: Adjusts the font size.

➢Checkbox: Determines which items to display.

### 4.3.6 Data Curve

Displays the data curves for the options that are in the third state (▣) in the beam calculation (consistent with the enhanced display).




➢Legend Checkbox: Shows or hides the corresponding curve.

➢Play: Starts receiving data and clears previous data.

➢Clear: Clears the current accumulated data.

➢Export: Exports the current accumulated data.

➢Screenshot: Captures the current image.

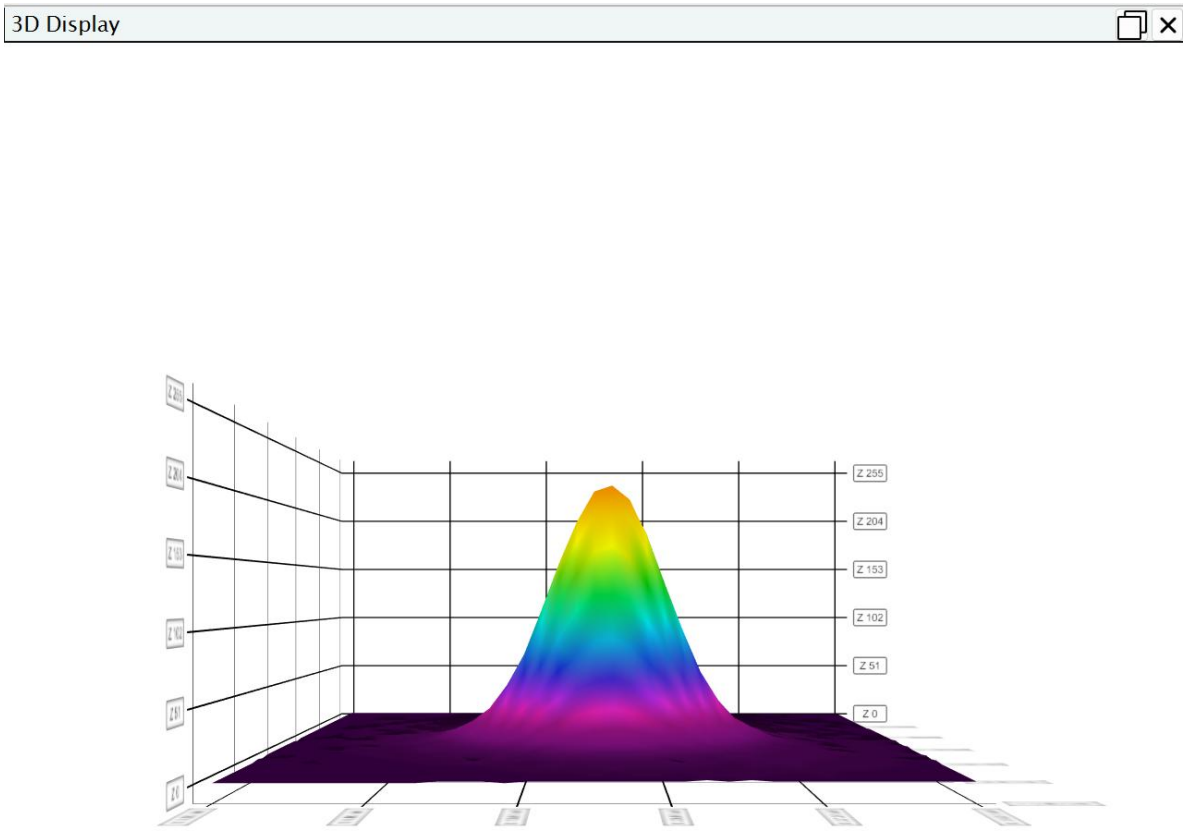
➢Auto Scale: Switches the curve to auto-scaling mode.

➢Mean: Displays the mean/ original values.

➢Settings: Configures the display of the horizontal and vertical cursors, as well as the statistics, number of samples, and averaging.

➢Legend: Shows or hides the legend.

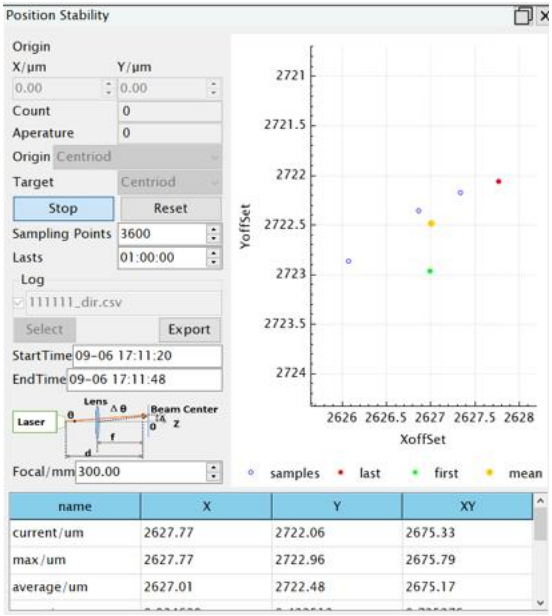
## 4.3.7 3D Display




Displays the 3D model of the current spot. Right-click and move the mouse to change the viewing angle of the 3D display.

## 4.3.8 Pointing Stability

Pointing stability is divided into three parts: the menu on the top left, the point cloud diagram on the top right, and the table below.




➢Menu:

-Origin Coordinates: The origin coordinates of the point cloud diagram.

-Statistics Data: The number of data points after starting the statistics.

-Origin Setting: Sets the origin as one of the centroid, peak center, or manual aperture center.

➢Centroid: Sets the origin to the current centroid position and displays only the centroid offset.

➢Peak: Sets the origin to the current peak position and displays only the peak center offset.

➢Manual Aperture Center: Customizes the origin coordinates and displays both peak and centroid offsets.

➢Point Cloud Tracking Settings: Sets the tracking of the centroid or peak center during statistics.

➢Start Statistics: Resets and clears the data, then starts the statistics. The button changes to "Stop Statistics," which can be clicked to stop the statistics.

➢Reset: Clears the data.

➢Statistics Duration: The upper limit of the statistics time.

➢Statistics Points: The upper limit of the number of points.

➢Save Data: Selects or inputs the path to save the data. When selected, the data will be saved continuously during statistics (this may cause high resource usage, leading to software lag and reduced frame rate).

➢Export: Exports the accumulated statistical data to a file.

➢Start and End Time: Displays the start and end times of the statistics.

➢Lens Focal Length: Displays the focal length of the lens during the statistics.

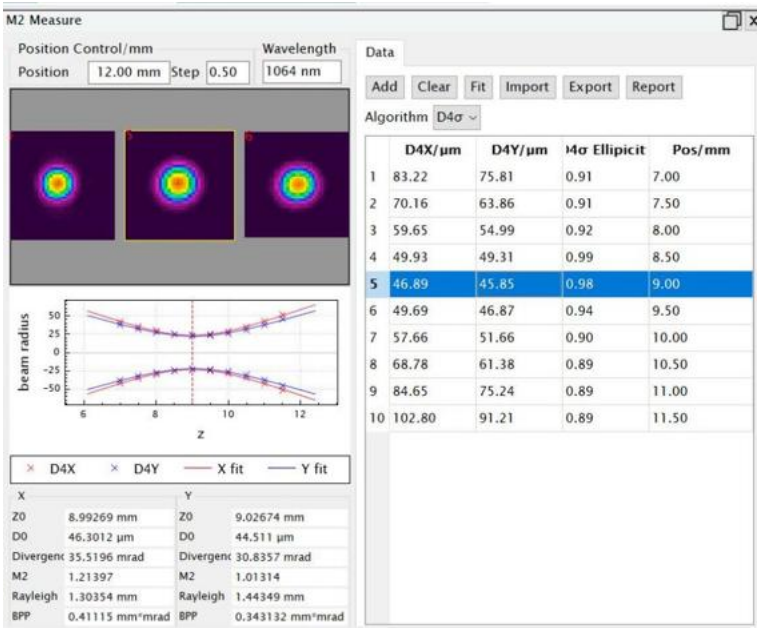
➢Point Cloud Diagram: Displays the data points on the diagram based on the settings in the left menu, forming a point cloud.

➢Table: The table shows the offset of the points, including X and Y direction offsets, overall offset, and the current value, maximum, average, range, standard deviation, and root mean square (RMS) of the offsets. It also includes pointing stability and positional stability, totaling eight rows.

### 4.3.9 $M^2$ Measurement

The $M^2$ measurement function primarily checks the beam divergence angle, focal position, focal diameter, $M^2$, Rayleigh length, and beam quality (BPP). This software supports only manual fitting.

Parameter Settings, including current coordinates, step size, wavelength, etc. And the two sets of XY data below are used to display the fitting results.




➢Data Editor:

-Insert Data: Inserts the current data into the table.

-Clear Data: Clears the inserted data in the table.

-Fit: Fits the data in the table, with the results displayed in the left graph.

-Import Data: Opens an $M^2$ saved file.

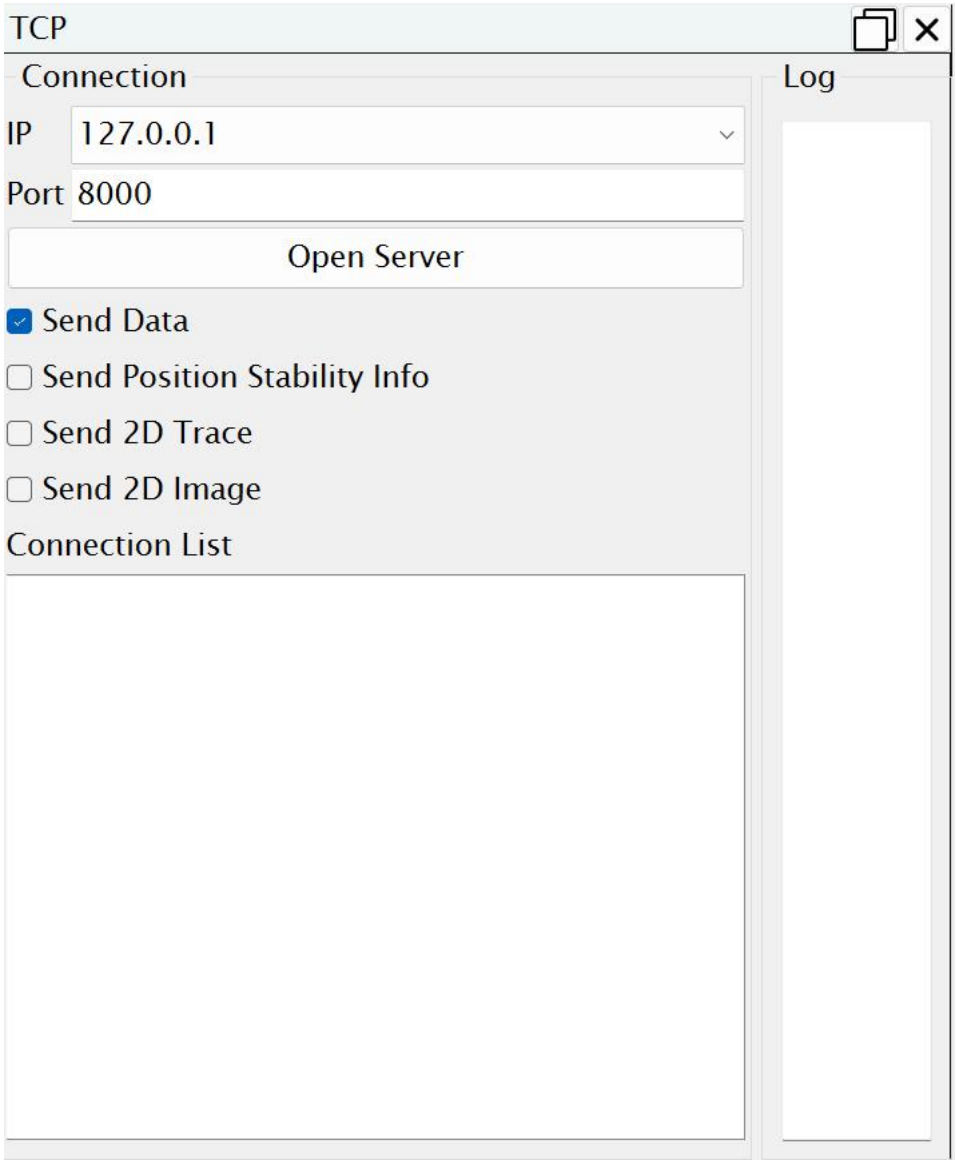
-Save Data: Saves the current data.

-Generate Report: Generates an $M^2$ test result report document.

➢Reference Diameter: Can be set to D4 or DPK.

## 4.3.10 TCP

Sends beam data to the receiver via TCP communication, suitable for secondary development. For more details, see the TCP development documentation in the directory.




➢IP: The IP address provided by this software.

➢Port Number: The port number used for communication, customizable.

➢Open Service: Opens the service, allowing clients to connect.

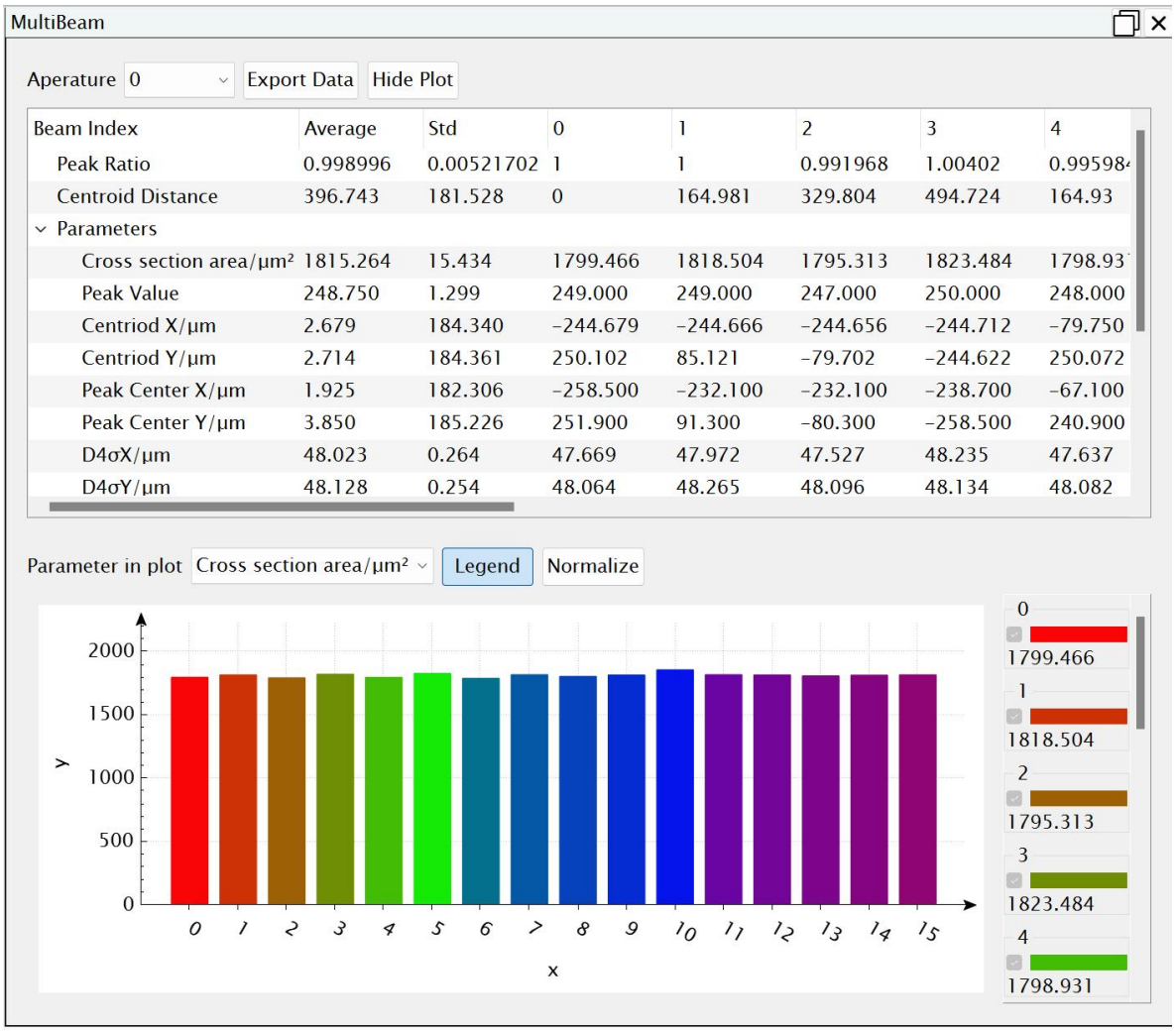
➢Four Checkboxes: Determine whether to send the corresponding data.

➢Connection List: Lists the currently connected devices.

➢Send Record: Records the data sent.

### 4.3.11 Multiple Beams

Displays the parameters of multiple beams.




➢ROI for Comparison: Selects a beam as the reference for comparison.

➢Export Data: Exports the current frame data, the accumulated mean and standard deviation.

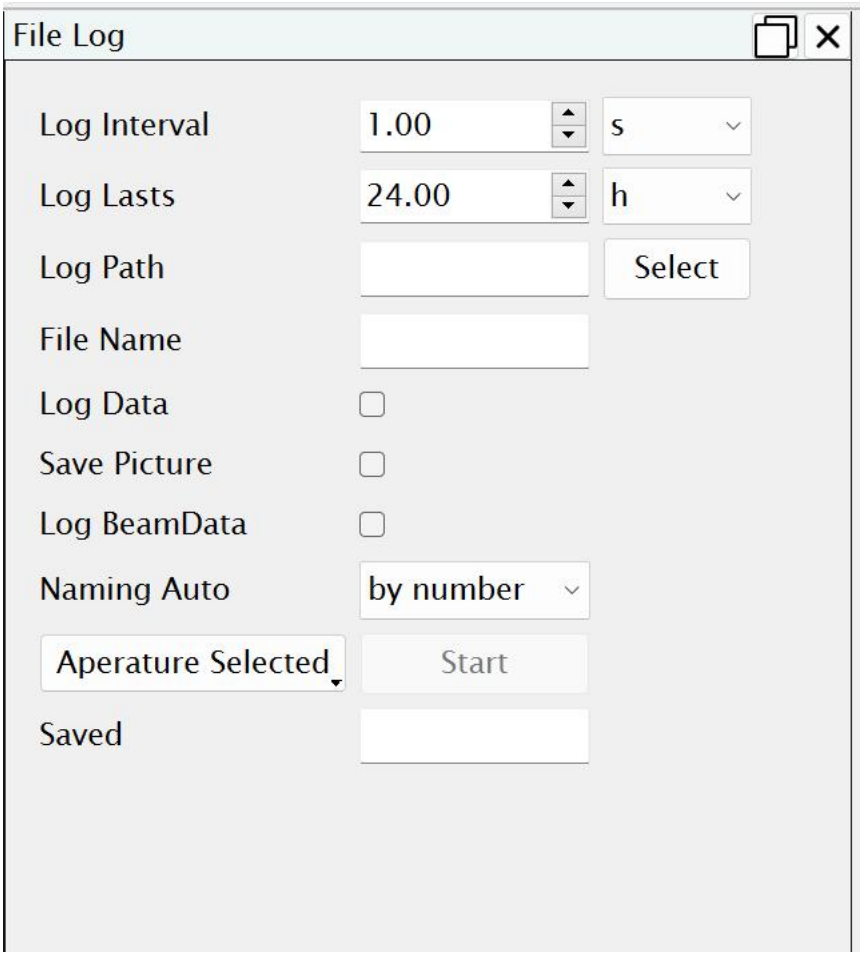
➢Hide Graph: Hides the histogram below.

➢Parameters for Curve Display: Selects which parameters' data to display.

➢Legend: Shows the legend for the histogram.

➢Normalization: Normalizes the histogram.

### 4.3.12 Data Recording




➢Interval Time: The interval at which data is recorded (only effective when recording data).

➢Recording Duration: The duration of data recording. Initially set to 0, indicating no limit on recording duration. If not 0, it indicates the recording duration (unit automatically converted to seconds after starting to save data). When the duration reaches zero, recording stops automatically.

➢Save Path, Select Folder: Selects or inputs the folder to save the files.

➢File Name: Inputs the name of the file to save.

➢Record Image, Record Data, Record BeamData Format File: Checks to record these items.

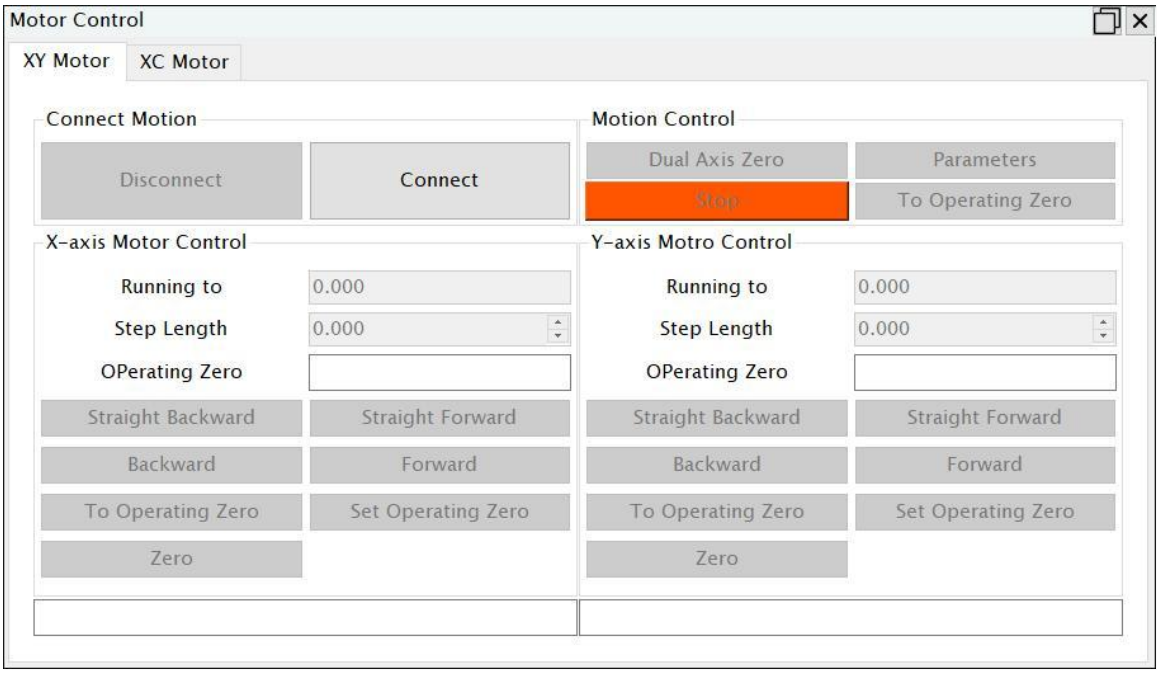
➢File Naming: Options for naming the recorded images, including unchanged, time, and incremental numbers.

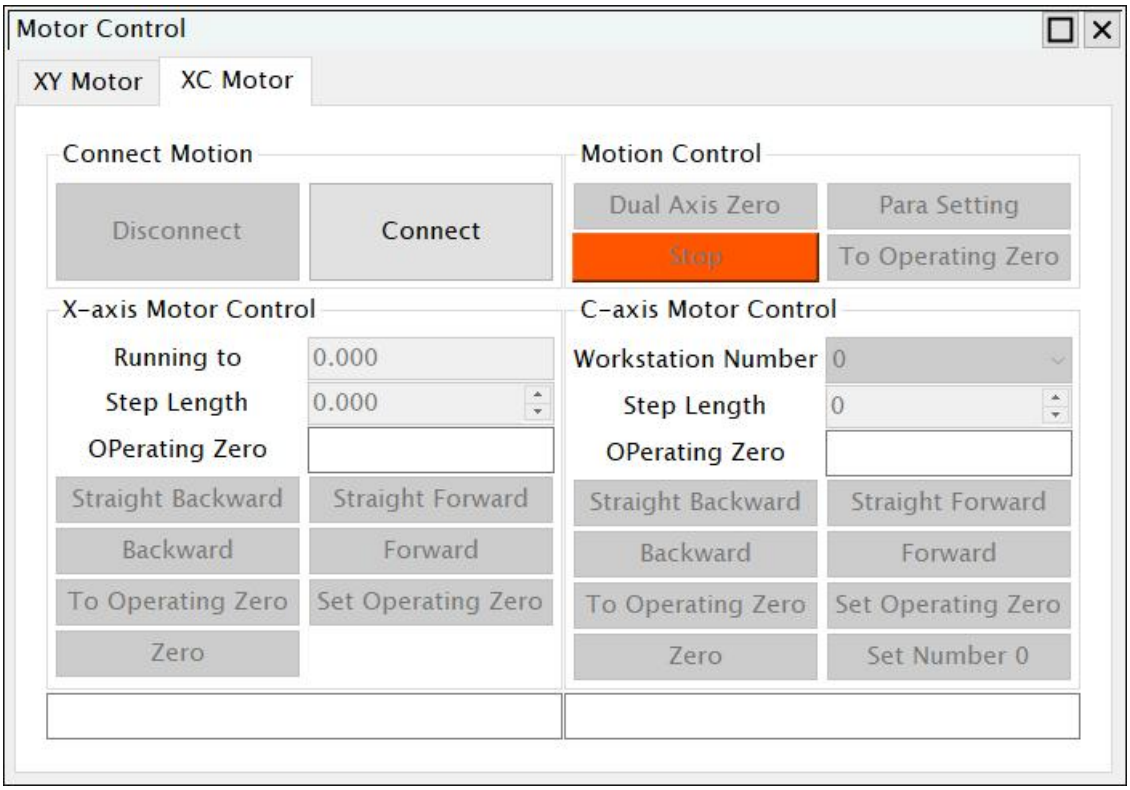
➢Selected Apertures: Specifies which apertures' data to save.

➢Save Data: Starts the data saving operation.

➢Saved Count: Indicates the number of data records saved so far.

## 4.3.13.Motor Control






➢Controller Connection:

-Connection: Open the connection pop-up window;

-Disconnect: Disconnect the motor.

➢Motion Control:

-Dual-axis zeroing: Dual-axis return to zero together

-Parameters: Open a pop-up window to set relevant parameters;

-Emergency stop: the motor stops moving;

-To Working Zero: Dual-axis movement to Working Zero.

➢X-axis motion control:

-Motion to: Enter the coordinates, and the motor moves to the corresponding coordinates;

-Step Size: Set the step size for forward/backward;

-Working Zero: the coordinates of the working zero;

-Continuous backward: long press the button, the motor continuously

retreats;

-Continuous advancement: Long press the button, the motor continues to advance;

-Forward: Advance a long distance;

-Backward: the distance of the step back;

-To the working zero: movement to the working zero;

-Set to Working Zero: Set the current position as the working zero;

-Return to zero: single axis back to zero;

-Motion status bar: display the status of the motor, in motion or stopped.

- The Y-axis motion control is consistent with the X-axis;
- C-axis motion control:

-Station number: the station number of the movement to the C axis;

-Step size: same as X-axis;

-Working zero position: same as X-axis;

-Continuous Retreat: Same as X-axis;

-Continuous Advance: Same as X-axis;

-Forward: same as X-axis;

-Backward: Same as X-axis;

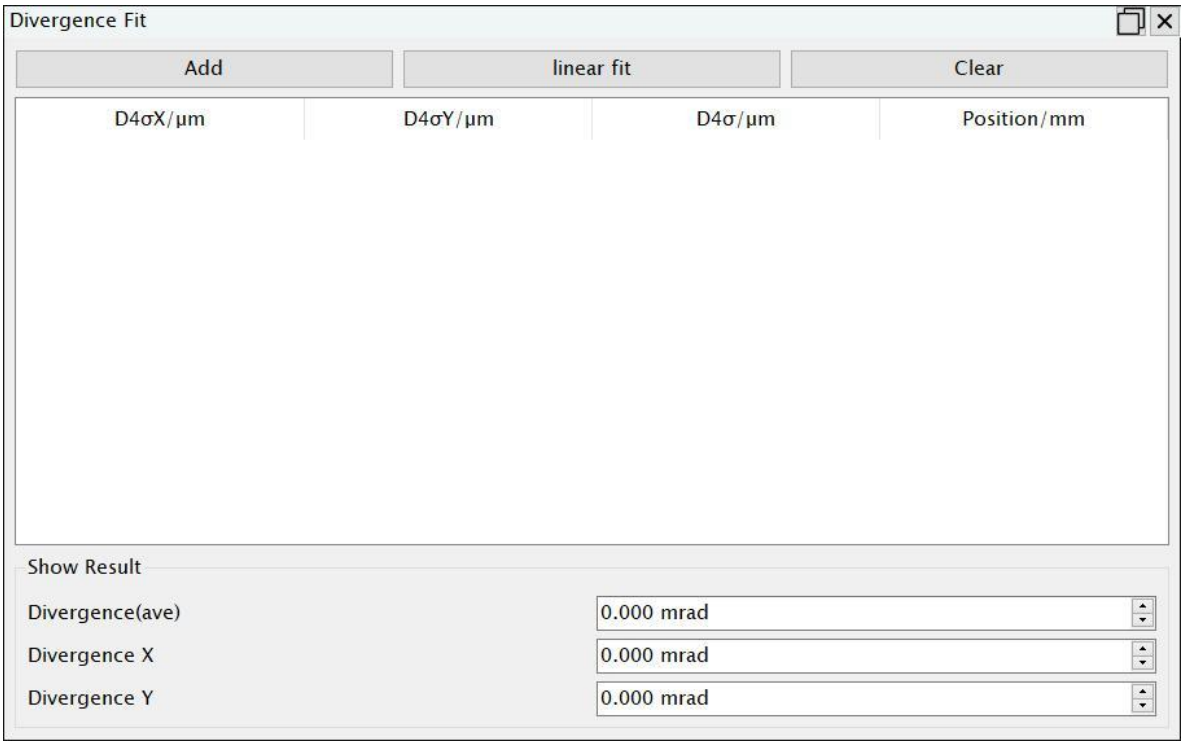
-To the working zero position: the same as the X-axis;

-Set to working zero: same as X-axis;

-Return to zero: same as X-axis;

-Set as Zero Desk: Set the current desk as zero desk.

## 4.3.14.Divergence Fit




➢Insert data: collect the data of the current frame, insert the corresponding data into the table, and enter the position manually;

➢Linear fitting: Linear fitting of the data in the table to obtain the result;

➢Clear Data: Clear the data in the table;

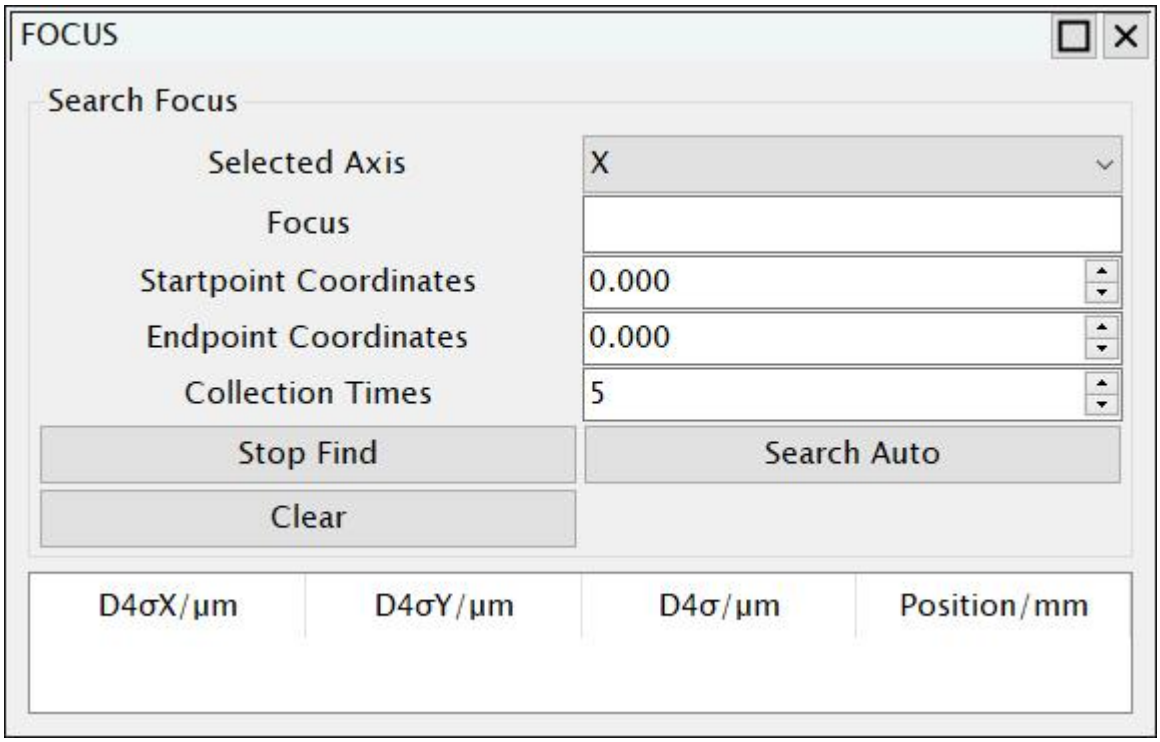
➢Divergence angle: the fitting comprehensive divergence angle;

➢Divergence angle X: the fitted divergence angle in the X direction;

➢Divergence angle Y: the fitted divergence angle in the Y direction;

➢Table: Record the collected data, the data source of the linear fit, and right-click to delete the row.

## 4.3.15.Search Auto




➢Selected axes: X, Y, and Z represent the X-axis, Y-axis, and X-axis of the XC motor, respectively.

➢Current Focus: Displays the focus of the currently selected axis;

➢Start coordinates: the starting coordinates of one-click focusing;

➢End coordinates: the end coordinates of one-click focusing;

➢Number of acquisitions: the number of movements of one-key focus (actual number of acquisitions - 1);

➢Terminate focusing: Stopping in the middle of focusing, it is an emergency stop of the motor;

➢One-key focusing: Start one-key focusing;

➢Clear Data: Clear the data collected in the following table;

The data in the table is collected during the one-click focus process.

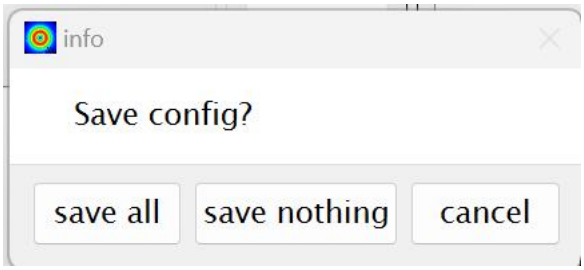
## 4.4 Status Bar


➢Left Side: Includes resolution, X and Y coordinates of the mouse on the frame, and absolute and relative pixel intensity values.

➢Right Side: Displays the frames per second (FPS).

## 4.5 Closing the Software

When closing the software, you will be prompted to save the configuration:




➢Save All: Saves the current configuration as the default configuration and then closes the software.

➢Do Not Save: Closes the software without saving the current configuration.

➢Cancel: Continues running the software.

# Chapter 5: Parameter Descriptions

| Name | Description |
|---|---|
| Frame intensity | The total gray value of the full frame. |
| Frame area /μm² | Total area of the full frame. |
| Frame power/W | The total gray value of the full frame is linearly converted to the calibrated power according to the set power coefficient. |
| Sum of intensity | Total gray value in the actual calculation range, auto iris range when auto iris is on, manual iris range when it is not on. |

| | |
|---|---|
| Area in auto aperature/μm² | Total area within the actual calculation. |
| Power of auto aperature/W | Total spot power linearly converted from the total gray value in the actual calculation range. |
| D4_SumOfIntensity | D4 σ elliptic total amplitude |
| Cross section area/μm² | Beam cross-sectional area. |
| D4_Power | D4 σ elliptic power |
| D4_Density | D4 σ elliptic power density |
| Dpk_SumOfIntensity | Dpk total elliptic amplitude |
| Dpk_Area | Dpk ellipse area |
| Dpk_Power | Dpk elliptic power |
| Dpk_Density | Dpk elliptical power density (W/cm2) |
| DT_SumOfIntensity | Adjustable total amplitude within the bracketing aperture |
| DT_Area | Adjustable bracketing aperture ellipse area |
| DT_Power | Adjustable total power within the bracketing aperture |
| Sum of intensity in ROI | Total gray value in manual aperture. |
| Area in manual Aperature/μm² | Total manual aperture area. |
| Power in ROI/W | Manual aperture total gray value converted power. |
| PercentInAperature | Spot aperture as a percentage of total full-frame energy |
| Peak Value | The peak intensity of the beam. |
| MinVal | Minimum gray value in the aperture range |
| | |
| Centriod X/μm | Spot center of mass X-axis coordinates. |
| Centriod Y/μm | Spot center of mass Y-axis coordinates. |
| Peak Center X | Peak center X-axis coordinates. |

| | |
|---|---|
| Peak Center Y | Peak center Y-axis coordinates. |
| D4σ X/μm | X-axis beam diameter, obtained from second-order moments. |
| D4σ Y/μm | Y-axis beam diameter. |
| D4σ/μm | Integrated beam diameter. |
| D4σ Ellipticity | beam ellipticity. |
| Dpk X/μm | The width of the continuous area above the 0.135 peak of the x-axis cross-section over the center of mass of the spot in the actual calculation area, clamped to the horizontal 0.135 optional. |
| Dpk Y/μm | The width of the continuous area above the 0.135 peak of the y-axis cross-section over the center of mass of the spot in the actual calculation area, clamped to the horizontal 0.135 optional. |
| Dpk/μm | Calculate the diameter of the circle containing the area based on the area of all pixels above the pinch level. |
| Dpk Ellipticity | Spot Gray Peak. |
| DTX/μm | Adjustable bracketing aperture X-axis width. The aperture is placed on the beam and centered on the beam center of mass. Adjust the aperture diameter until it contains 86.5% of the beam power/energy or a specified percentage. |
| DTY/μm | Adjustable bracketing aperture Y-axis width. The aperture is placed on the beam and centered on the beam center of mass. Adjust the aperture diameter until it contains 86.5% of the beam power/energy or a specified percentage. |
| DT/μm | Adjustable bracketing aperture integrated width. |
| DT Ellipticity | Width of the short axis of the envelope . |
| Orientation/° | Spot rotation angle, clockwise positive, x-axis dashed. |

| | |
|---|---|
| Eccentricity | The eccentricity of the D4 σ ellipse |
| FWHM X/μm | Width of the continuous region above the 0.5 peak of the x-axis cross-section over the center of mass of the spot in the actual calculation region. |
| FWHM Y/μm | Width of the continuous region above the 0.5 peak of the y-axis cross-section over the center of mass of the spot in the actual calculation region. |
| FWHM/μm | Peak Half Height Full Width Combined Width. |
| FWHM Ellipticity | Half-height full width short axle width divided by long axle width. |
| DKe X/μm | Knife-edge method X-axis diameter. The spot was progressively masked from left to right, and the distances between the two masking positions where the exposed portion accounted for 0.135 and 0.865 of the total spot amplitude were calculated. |
| DKe Y/μm | Knife-edge method Y-axis diameter. |
| DKe/μm | Knife-edge method of synthesizing shaft. |
| DKe Ellipticity | Knife edge method short axis width divided by long axis width. |
| Dms X/μm | Moving the slit method X-axis diameter. Move the slit from left to right and calculate the distance between the two positions where the normalized amplitude through the slit reaches 0.135. |
| Dms Y/μm | Moving the slit method Y-axis diameter. |
| Dms/μm | Integrated shaft diameter by moving slit method. |
| Dms Ellipticity | Moving slit method short axis width divided by long axis width. |
| | |
| Transfer Region X Left/μm | Width of the portion of the x-axis cross-section to the left that lies between the Dpk energy ratio and the DT energy ratio. |
| Transfer Region X | Width of the portion to the right of the x-axis |

| | |
|---|---|
| Right/μm | cross-section that lies between the Dpk energy ratio and the DT energy ratio. |
| Transfer Region Y Left/μm | Width of the portion of the y-axis cross-section to the left that lies between the Dpk energy ratio and the DT energy ratio. |
| Transfer Region Y Right/μm | Width of the portion of the y-axis cross-section to the right that lies between the Dpk energy ratio and the DT energy ratio. |
| Uniformity_2sX | The difference between the largest and smallest amplitudes in the plus or minus 2 σ range of the X-axis cross section divided by the sum. |
| Uniformity_2sY | The difference between the largest and smallest amplitudes in the plus or minus 2 σ range of the Y-axis cross section divided by the sum. |
| Peak To Average Ratio X | Peak value of x-axis cross-section amplitude divided by mean value. |
| Peak To Average Ratio Y | Peak value of y-axis cross-section amplitude divided by mean value. |
| RSquare Gauss Fit X | The percentage of the X-axis cross-section Gaussian fit curve to the actual total cross-section amplitude is closer to 1, indicating a better fit. |
| RSquare Gauss Fit Y | Y-axis cross-section Gaussian fit curve as a percentage of the actual total cross-section amplitude. |
| | |
| Uniformity_ISO | The standard deviation of the region above the threshold η divided by the mean, with closer to 0 indicating more homogeneity. |
| Plataeu_Uniformity | Half-height full width of the portion of the histogram above 0.1 times the peak value divided by the peak value, with closer to 0 indicating more homogeneity. |
| Edge Steepness | Normalized difference in effective area between 10% and 90% of the peak, closer to 0 means more vertical. |
| Aperature_Uniformity | Specifies the standard deviation divided by the mean of the pixel values within the range Area. |

| | |
|---|---|
| | The range is represented by a separate aperture, which is centered on the center of mass and angled at the spot rotation angle, with a size that can track D4, DT, or Dpk diameters or be customized, and a shape that can be chosen from ellipse or rectangle, etc. |
| | |
| Z | The position of the plane to be measured by spot ranging. Used to measure the position of a plane and its offset when the spot strikes the plane and the center of mass coordinates are linearly related to the distance to the plane. |
| dZ | Z-axis offset. |
| Divergence | Beam divergence angle. |