

TDI camera demo software
TDIScan
Instruction manual

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1. OVERVIEW

This book explains that how the TDI Camera demo software (TDIScan) works. You should carefully read this book before use it.

1-1 SOFTWARE SUMMARY

This software is a demonstration software to control Hamamatsu TDI cameras.

1-2 OPERATIONAL CONDITIONS

The TDIScan needs following computer.

Hardware	PC-AT Compatible
OS	WindowsXP / Windows 7 *1
Memory	More than 2GB (4MB recommended)
Free spare of the HDD	More than 10 GB
Drive	CD-ROM Drive
Graphic	More than 1600 x 1200 pixels

*1) 64bit OS is highly recommended.

WindowXP requires to be used with .NET Framework 2.0 installed.

1-3 FUNCTIONS

The TDIScan has the following functions.

- 1) Moving object speed calculation and line rate calculation
- 2) The best line rate estimation from TDI image
- 3) Live image monitoring and image enhancement in AREA mode
- 4) Image acquisition in TDI mode
- 5) Image enlargement in TDI image
- 6) Image save in and TIFF format
- 7) Histogram and intensity profile

2. FEATURES

2-1 TDI CAMERAS

The TDIScan supports the following Hamamatsu TDI cameras

- 1) C10000-201
- 2) C10000-401
- 3) C10000-701A or C10000-701B
- 4) C9100-03
- 5) C7780-20T
- 6) C10600-10B

3. INSTALLATION

3-1 HOW TO MAKE THE SOFTWARE INSTALLATION

First, install a proper DCAM-API for the camera.

Second, copy "TDIScan.exe" and "TIFFLIB.dll" to any folder.

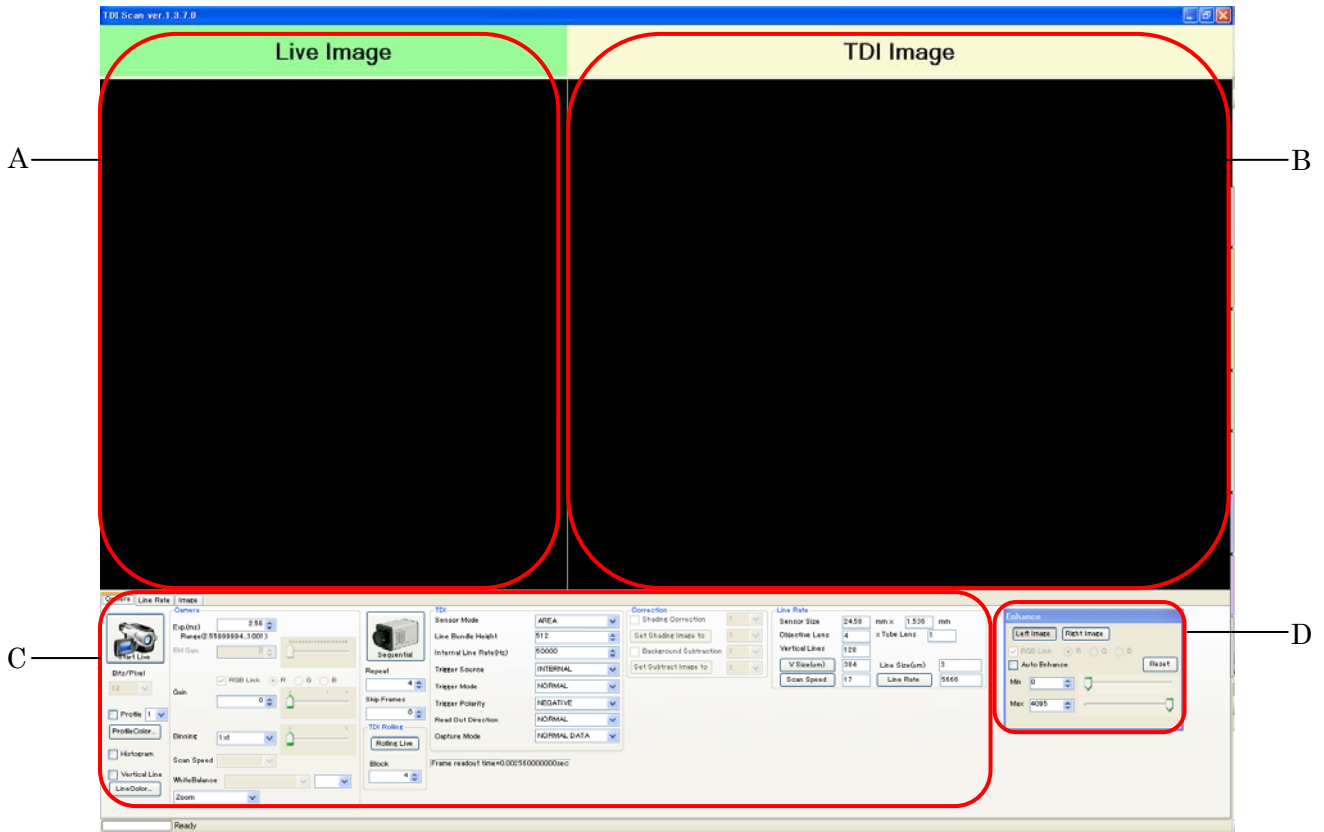
3-2 HOW TO START THE DEMO SOFTWARE

First, turn on the camera power.

Double click "TDIScan.exe" to boot up the software.

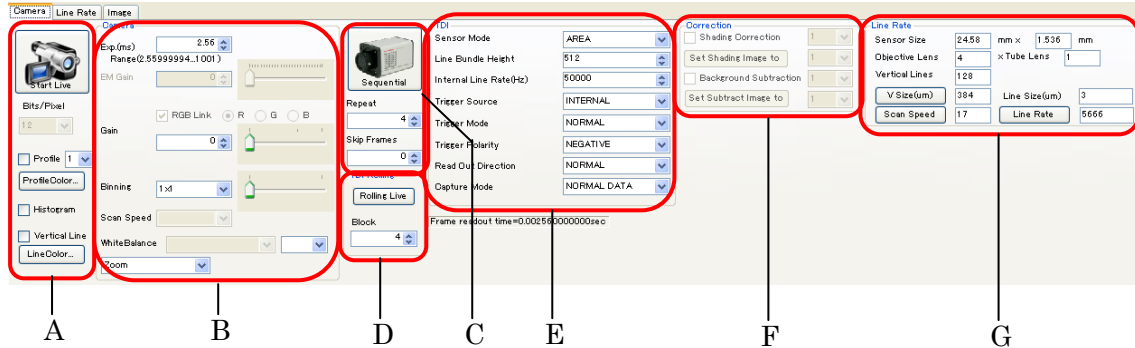
4. SCREEN CONFIGURATION

4-1 MAIN SCREEN

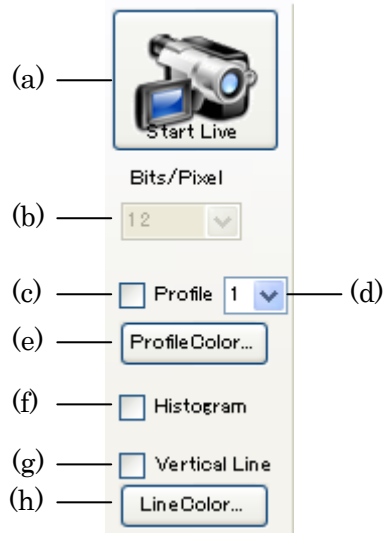


- A. Displays a live image.
- B. Displays a TDI image.
- C. Acquires images and sets various parameters on each tab.
- D. Sets enhancement for image.

4-2 CAMERA TAB



A. Live



- (a) Start Live
Displays a live image.
- (b) Sets the number of bits for one pixel.
- (c) Profile
Displays an intensity profile of a live image.
- (d) Selects the number of lines from center of a live image for displaying a profile of average intensity. It is possible to select from 1 line, 3 lines, and 5 lines.
- (e) Profile Color
Sets a display color of a profile.
- (f) Histogram
Displays a histogram of a live image.

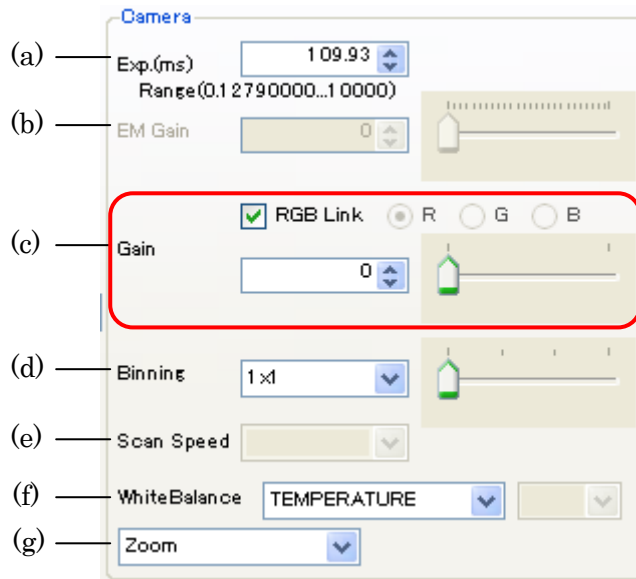
(g) Vertical Line

Displays a vertical line on a live image. It is used to adjust rotation of the camera.

(h) Line Color

Sets a display color of a vertical line.

B. Camera



(a) Exp.

Sets an exposure time. The unit is ms.

(b) EM Gain

Sets an EM gain.

(c) Gain

Sets a gain.

It can be set to RGB each color for the color camera.

(d) Binning

Sets a binning.

(e) Scan Speed

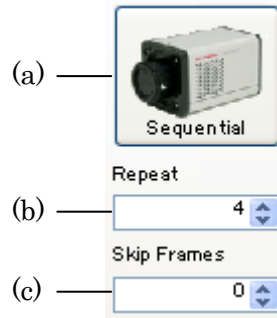
Sets a scan speed.

(f) White Balance

Sets a white balance.

(g) Sets a display mode of a live image.

C. Sequential



(a) Sequential

Acquires sequence images for setting frames.

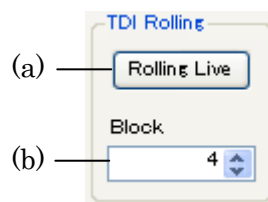
(b) Repeat

Sets the number of acquiring frames.

(c) Skip Frames

Sets the number of skip frames.

D. TDI Rolling



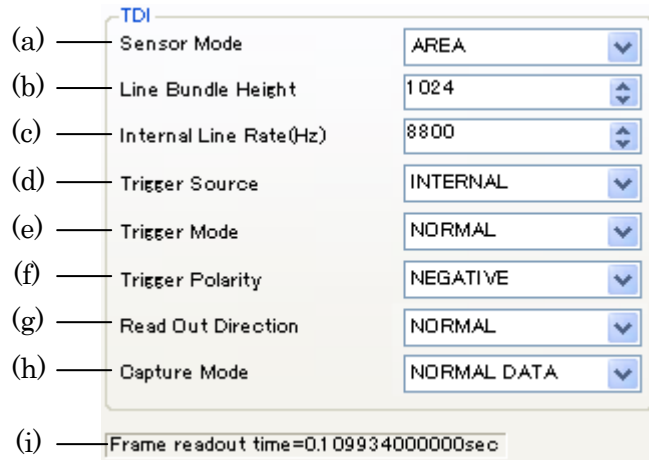
(a) Rolling Live

Acquires live images for setting frames.

(b) Block

Sets the number of displaying frames.

E. TDI



(a) Sensor Mode

Sets a sensor mode. The AREA mode and the TDI mode, etc. can be set.

(b) Line Bundle Height

Sets a line bundle height. It is the number of vertical lines for one frame.

(c) Internal Line Rate

Sets an internal line rate. The unit is Hz.

(d) Trigger Source

Sets a trigger source. The internal trigger mode and the external trigger mode, etc. can be set.

(e) Trigger Mode

Sets a trigger mode.

(f) Trigger Polarity

Sets a trigger polarity.

(g) Read Out Direction

Sets a read out direction.

(h) Capture Mode

Sets a capture mode.

(i) Frame readout time

Displays read out time of one frame. The unit is s.

F. Correction

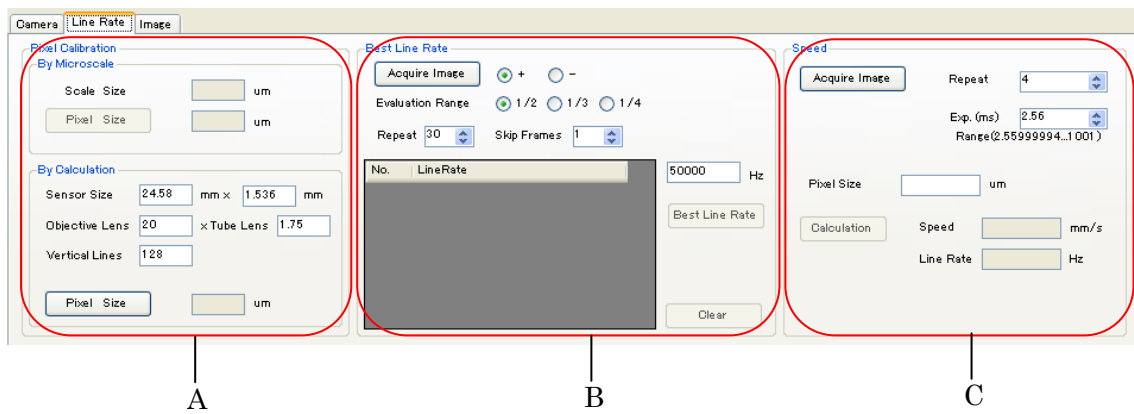
- (a) Shading Correction
Corrects shading of an image.
- (b) Set Shading Image to
Acquires a shading data.
- (c) Background Subtraction
Subtracts the background of an image.
- (d) Set Subtract Image to
Acquires a subtract data.

G. Line Rate

Calculates a line rate theoretically.

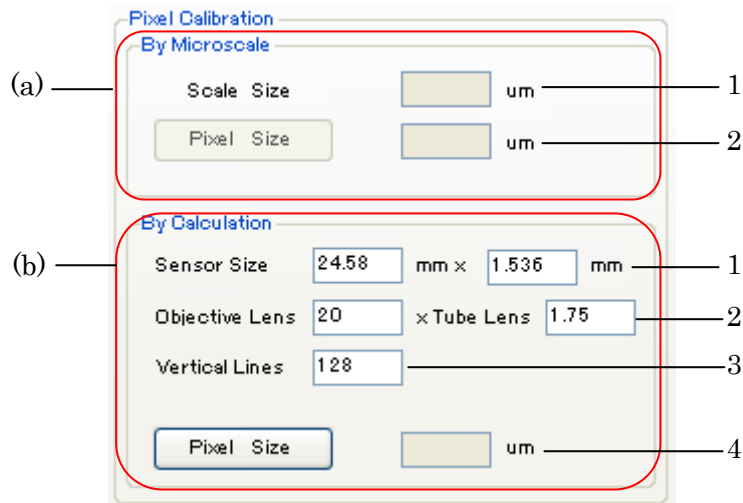
- (a) Sensor Size
Inputs a sensor size of camera. The unit is mm.
- (b) Objective Lens/Tube Lens
Inputs magnification of an objective lens and a tube lens.
- (c) Vertical Lines
Input the number of vertical lines of camera.
- (d) V Size/Line Size
Calculates a vertical view size and one line size from a sensor size, lens magnification and the number of vertical lines. The unit is μm .
- (e) Scan Speed
Calculates a scan speed from one line size and a line rate. The unit is mm/s.
- (f) Line Rate
Calculates a line rate from one line size and a scan speed. The unit is Hz.

4-3 LINE RATE TAB



A. Pixel Calibration

Calculates a size of one pixel.



(a) By Micro scale

Calculates a size of one pixel with a micro scale.

1. Scale Size
Input a length on micro scale.
2. Pixel Size
Calculates and displays a size of one pixel.

(b) By Calculation

Calculates a size of one pixel theoretically.

1. Sensor Size

Input a sensor size of camera. The unit is mm.

2. Objective Lens/Tube Lens

Input magnification of an objective lens and a tube lens.

3. Vertical Lines

Input the number of vertical lines of camera.

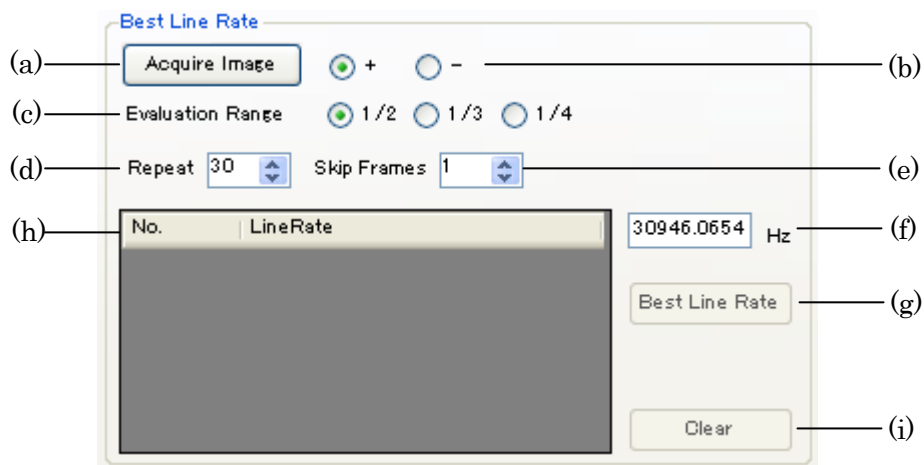
4. Pixel Size

Calculates and displays a size of one pixel.

※Refer to "[7. Pixel calibration](#)" for operation.

B. Best Line Rate

Detects the best line rate by acquiring images while changing a line rate.



(a) Acquire Image

Acquires a TDI image.

(b) +/-

Sets that the line rate is increased or decreased. For example when setting "+", the line rate is increased and the image is acquired with "(a)" button click.

(c) Evaluation Range

Selects a fraction of acquired image with reference to center of an image for detecting the best line rate.

(d) Repeat

Sets the number of acquiring frames.

(e) Skip Frames

Sets the number of skip frames.

(f) Inputs a standard line rate. The line rate is increased or decreased with reference to this value.

(g) Best Line Rate

Detects the best line rate from acquiring images at step (a).

(h) Displays line rates of acquiring images.

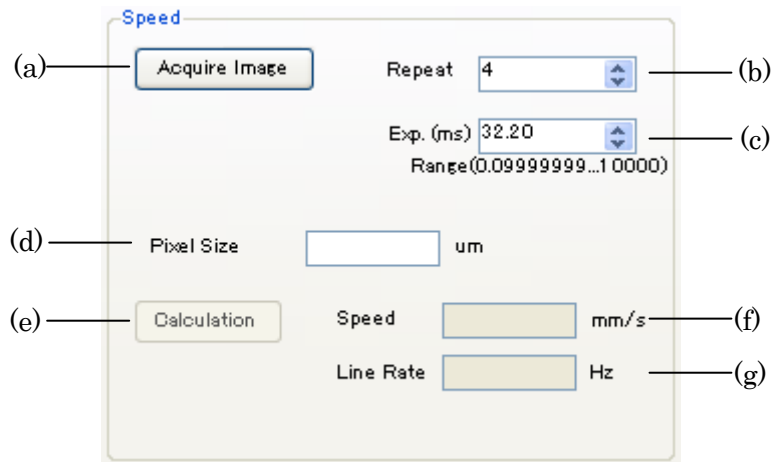
(i) Clear

Clears the list of (h).

※Refer to "[9. Detecting the best line rate](#)" for operation.

C. Speed

Calculates a moving speed of a sample and a line rate by acquiring images.



(a) Acquire Image

Acquires images on AREA mode.

(b) Repeat

Sets the number of acquiring images.

(c) Exp.

Sets an exposure time.

(d) Pixel Size

Inputs a size of one pixel. The unit is um.

(e) Calculation

Calculates a moving speed of a sample and a line rate.

(f) Speed

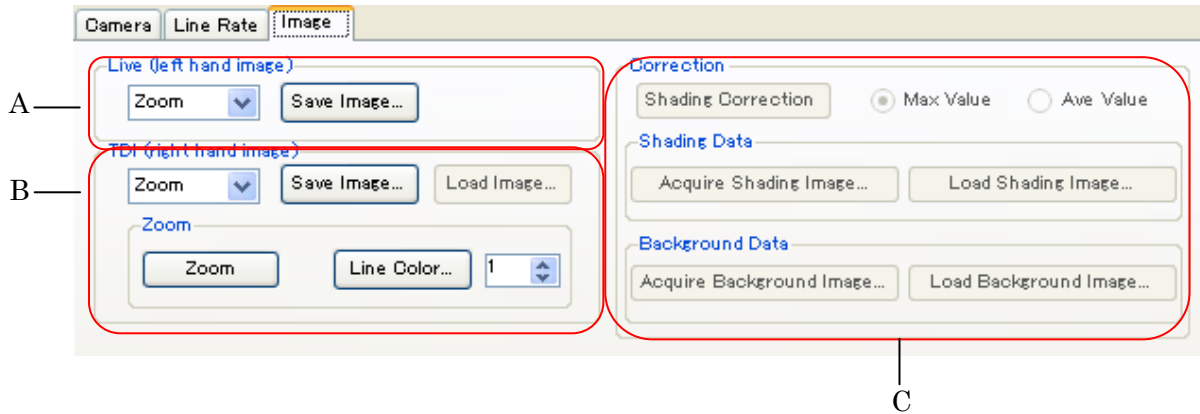
Displays a moving speed of a sample calculated at step (e). The unit is mm/s.

(g) Line Rate

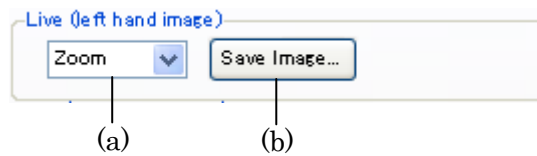
Displays a line rate calculated at step (e). The unit is Hz.

※Refer to "[8. Calculating a moving speed of sample](#)" for operation.

4-4 IMAGE TAB

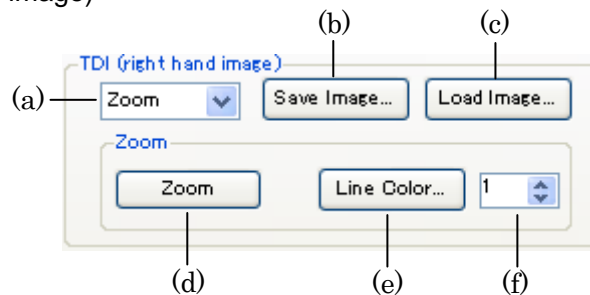


A. Live (left hand image)



- (a) Sets a display mode of a live image.
- (b) Save Image
Saves a live image and a clipped TDI image.

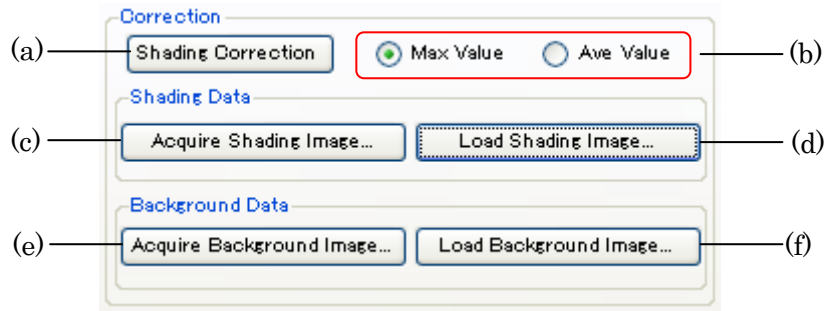
B. TDI (right hand image)



- (a) Sets a display mode of a TDI image.
- (b) Save Image
Saves a TDI image.
- (c) Load Image
Loads a TDI image.
- (d) Zoom
Zooms a TDI image.

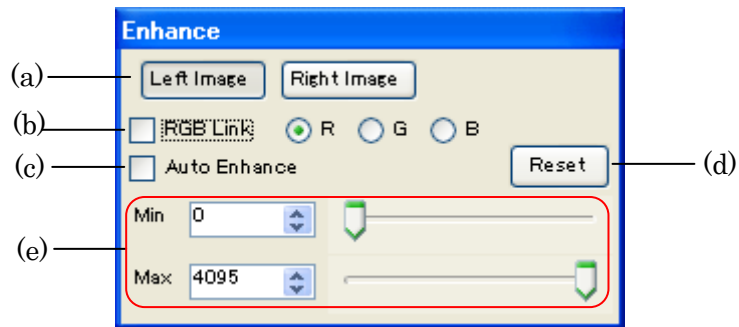
- (e) Line Color
Sets a border color of a zoom area.
- (f) Sets a border width of a zoom area.

C. Correction



- (a) Shading Correction
Corrects shading of an image.
- (b) Max Value/Ave Value
Selects using maximum intensity or average intensity when calculates for shading correction.
- (c) Acquire Shading Image
Acquires an image for shading correction.
- (d) Load Shading Image
Loads an image for shading correction.
- (e) Acquire Background Image
Acquires an image for background subtraction.
- (f) Load Background Image
Loads an image for background subtraction.

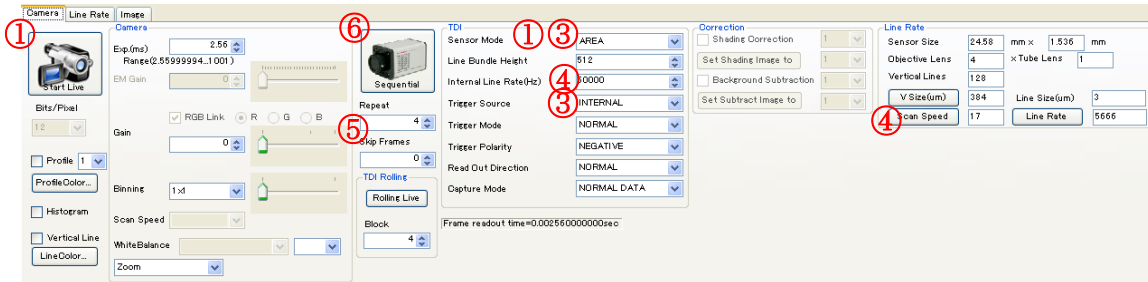
4-5 ENHANCE SETTING WINDOW



- (a) Left Image/Right Image
Selects an image for enhance settings.
- (b) Selects the setting for all RGB color or each RGB color when you use a color camera.
- (c) Auto Enhance
Sets enhancement automatically.
- (d) Reset
Resets enhance settings.
- (e) Sets enhancement manually.

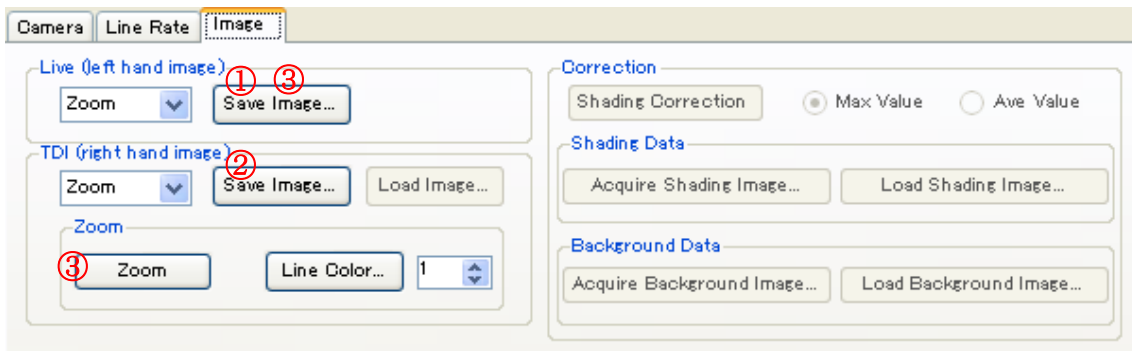
5. BASIC OPERATION

5-1 ACQUIRE AN IMAGE



- ① Set a sensor mode to “AREA” on “TDI” section of “Camera” tab, and display a live image clicking “Start Live” button.
- ② Adjust a focus and a light while confirming a live image. Stop live clicking the “Stop Live” button after adjusting.
- ③ To change the TDI internal trigger mode, set a sensor mode to “TDI” and a trigger source to “INTERNAL” on “TDI” section of “Camera” tab.
- ④ Set an internal line rate. When you know a moving speed of sample, input a sensor size of camera, magnification of an objective lens and tube lens, and vertical lines of camera. And calculate a vertical view size clicking “V Size” button. After that, input a moving speed of sample, and calculate a line rate clicking “Line Rate” button.
When you don't know a moving speed of sample, calculate a line rate by using [“8. Calculating a moving speed of sample”](#) and [“9. Detecting the best line rate”](#).
- ⑤ Set “Repeat” and “Skip Frames”.
- ⑥ Acquire a TDI image clicking “Sequential” button.

5-2 SAVE AND LOAD AN IMAGE

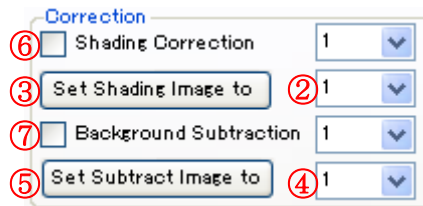


- ① Save a live image. The image is saved as 16 bit TIFF format.
- ② Save a TDI image. The image is saved as 16 bit TIFF format.
- ③ When you save a clipped TDI image, specify the clipped area clicking the "Zoom" button and display a zoom image. Save an image clicking "Save Image" button on "Live (left hand image)" section. The image is saved as 16 bit TIFF format.

6. SHADING CORRECTION

6-1 WHEN THE CAMERA HAS A SHADING CORRECTION FUNCTION

Use the "Correction" section on "Camera" tab.

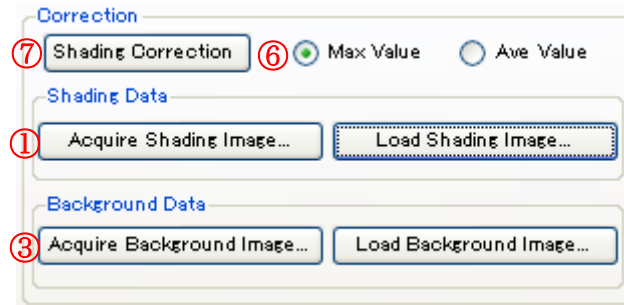


- ① Set the lighting environment same as acquiring a TDI image.
- ② Set a sensor mode to "TDI" on "TDI" section of "Camera" tab.
- ③ Select the memory of saving a shading data.
- ④ Displace focus substantially or shift an imaging area not to display a sample on the image, and acquire the shading data clicking the "Set Shading Image to" button.
- ⑤ Select the memory of saving a data for background subtraction.
- ⑥ Block the light to the camera and acquire the data for background subtraction clicking the "Set Subtract Image to" button.
- ⑦ Select the memory of saved shading data and check the "Shading Correction" check box.
- ⑧ Select the memory of saved data for background subtraction and check the "Background Subtraction" check box.
- ⑨ The shading correction image is acquired when you scan by TDI mode.

If you acquire a TDI image in similar environment after acquiring the shading data and the data for background subtraction, it is possible to skip at step ②~⑤.

6-2 WHEN THE CAMERA DOESN'T HAVE A SHADING CORRECTION FUNCTION

Use the "Correction" section on "Image" tab.



- ① Displace focus substantially or shift an imaging area not to display a sample on the image, and acquire the shading data clicking the "Acquire Shading Image" button.
- ② Save this image if you use the same shading data later.
- ③ Block the light to the camera and acquire the data for background subtraction clicking the "Acquire Background Image" button.
- ④ Save this image if you use the same data for background subtraction later.
- ⑤ Acquire a TDI image.
- ⑥ Select using maximum intensity or average intensity when calculates for shading correction.
- ⑦ The acquired image is corrected shading clicking the "Shading Correction" button.

If you use the correction data that is saved at step ② or ④, load the data clicking the "Load Shading Image" or the "Load Background Image" button instead of step ① and ③.

7. PIXEL CALIBRATION

7-1 USING A MICRO SCALE

By Microscale

④ Scale Size um

⑤ Pixel Size um

- ① Set up a micro scale.
- ② Display a live image clicking the “Start Live” button on “Camera” tab. Adjust focus and to display a micro scale on the image.
- ③ Specify two points on micro scale by the mouse click.
- ④ Input a distance of two points specified at step ③ to “Scale Size”.
- ⑤ Calculate and display a pixel size clicking the “Pixel Size” button.

7-2 THEORETICAL CALCULATION

By Calculation

① Sensor Size mm × mm

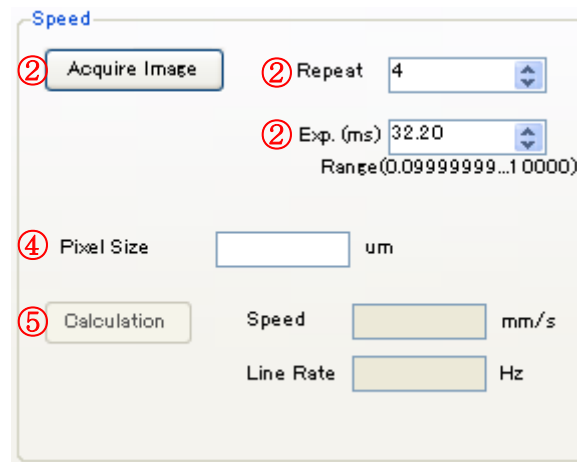
Objective Lens × Tube Lens

Vertical Lines

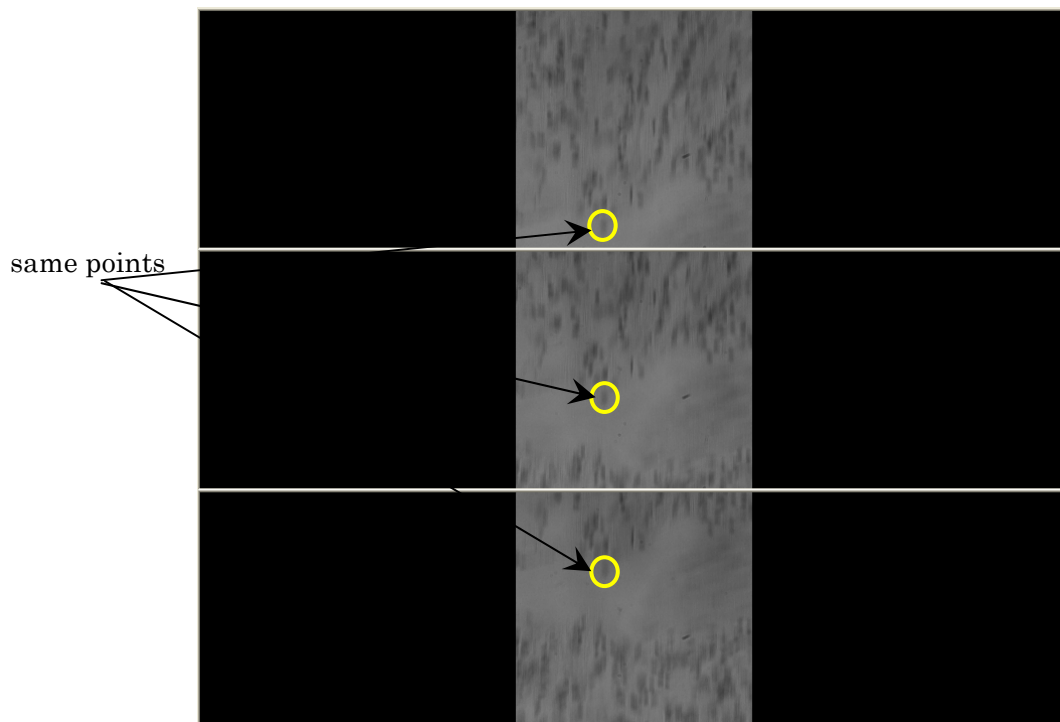
② Pixel Size um

- ① Input a sensor size, lens magnification, and the number of vertical lines.
- ② Calculate and display a pixel size clicking the “Pixel Size” button.

8. CALCULATING A MOVING SPEED OF SAMPLE

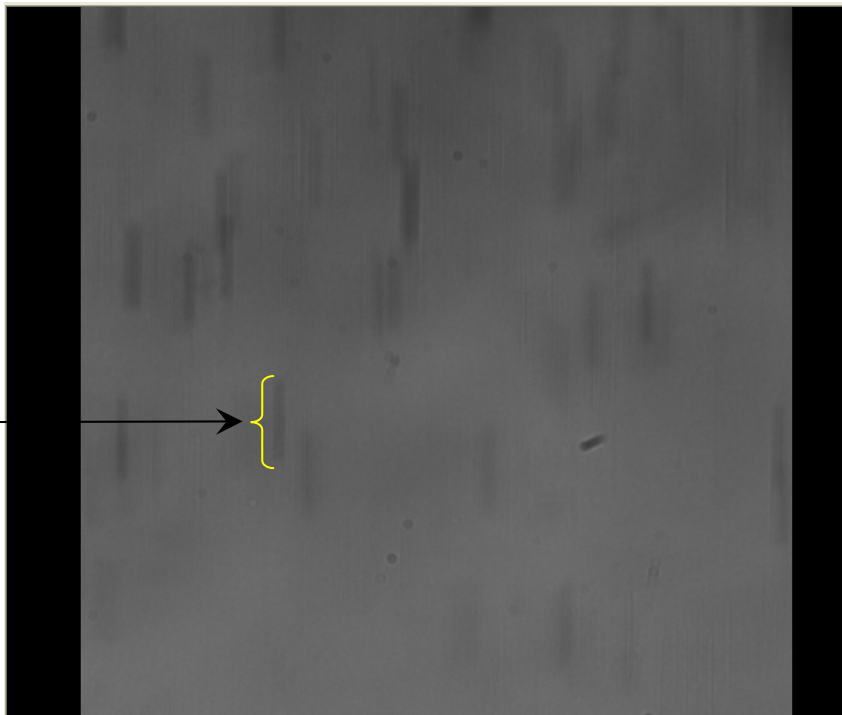


- ① Display a live image clicking the “Start Live” button on “Camera” tab and adjust a focus.
- ② Acquire images of moving sample clicking the “Acquire Image” button on “Speed” section of “Line Rate” tab. Adjust the number of images by “Repeat” and exposure time by “Exp.”, as the same points are displayed on each image as below figure.

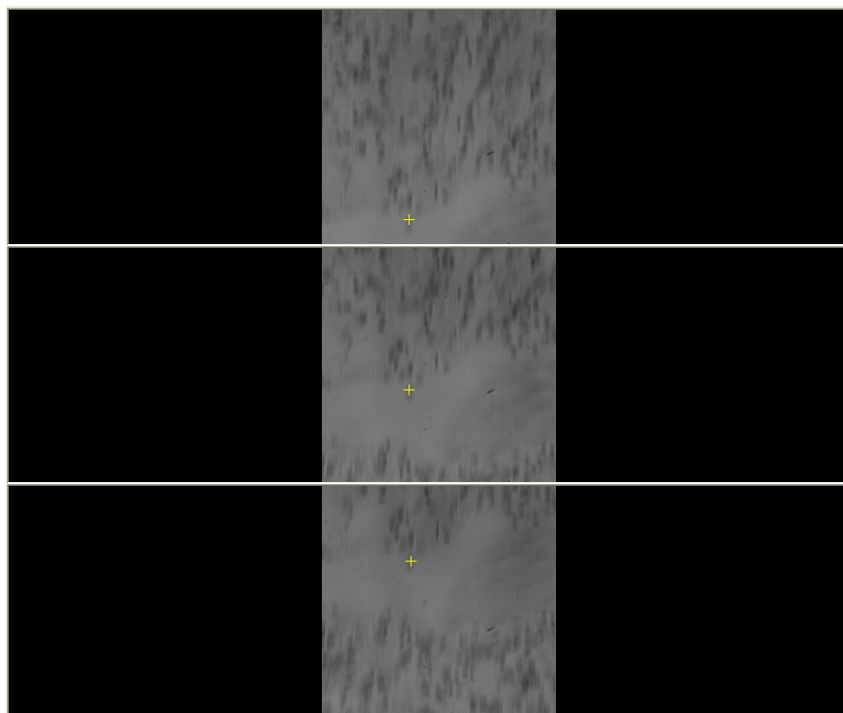


if a moving speed of sample is fast and same points cannot be displayed on multiple images, set "Repeat to "1". And adjust "Exp." to observe the sample moves on one image as below figure.

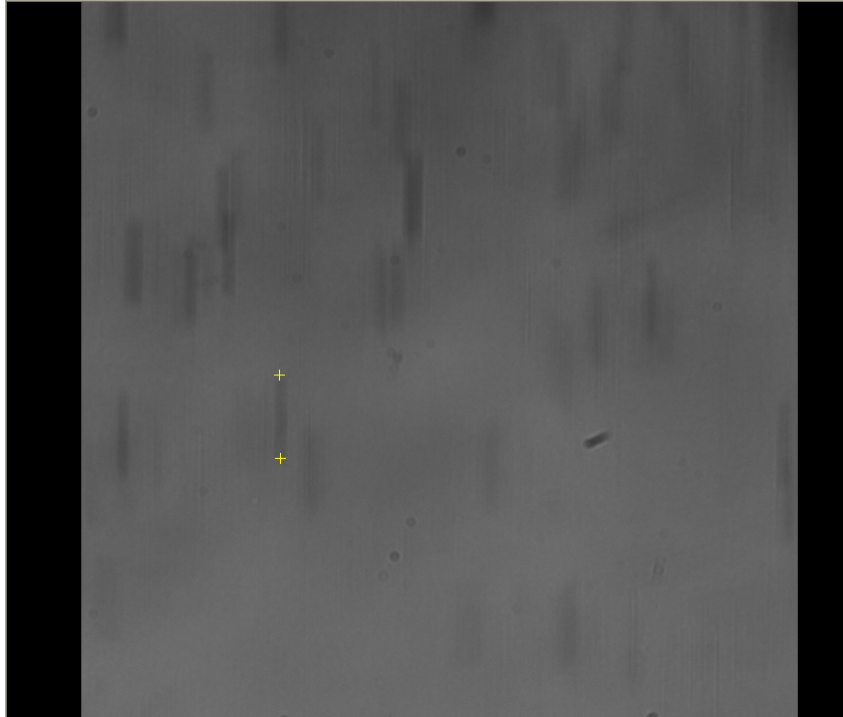
The state that the sample moves can be confirmed.



- ③ Specify the same points by the mouse click on acquired images at step ②. When the mouse is clicked, a cross mark is displayed as shown in the figure below.

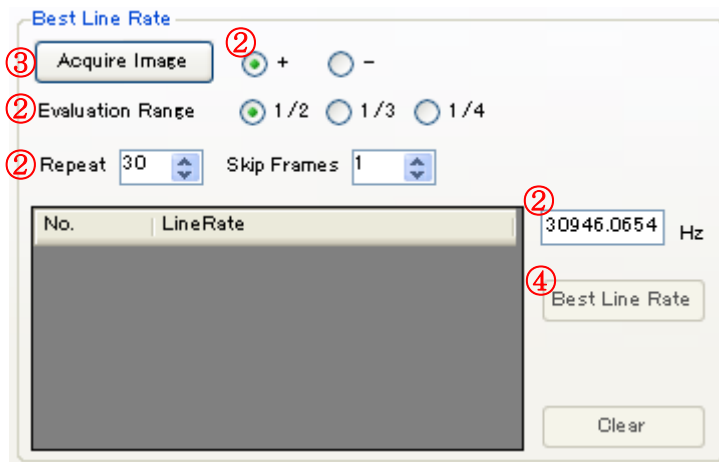


Specify two points on one image when you acquired only one image at step ②.



- ④ Input a pixel size to "Pixel Size". The unit is um.
When you don't know a pixel size, it can be calculated by pixel calibration function. Refer to "[7. Pixel calibration](#)".
- ⑤ Calculate a moving speed of sample and a line rate clicking the "Calculation" button.

9. DETECTING THE BEST LINE RATE



- ① Display a live image clicking the “Start Live” button on “Camera” tab and adjust a focus.
- ② Set “+/-”, “Evaluation Range”, “Repeat”, “Skip Frames”, and a standard line rate.
The line rate is increased with reference to a standard line rate every time you acquire an image when the setting is “+”. The line rate is decreased when the setting is “-”.
- ③ Acquire a TDI image clicking the “Acquire Image” button. The image is acquired two or more times, and data in a variety of line rates is acquired.
- ④ Click the “Best Line Rate” button and detect the best line rate from acquired images at step ③ after acquiring images. The best line rate is displayed in aqua on the list.