

NH-3MA Optical quality evaluation functions

Effective Focal Length (EFL)

The Effective Focal Length (EFL) of the lens is evaluated by this function..

In using this function, the double-slit is inserted in optical path. NH system measures those slit width y' that is imaged on CCD camera by evaluated lens.

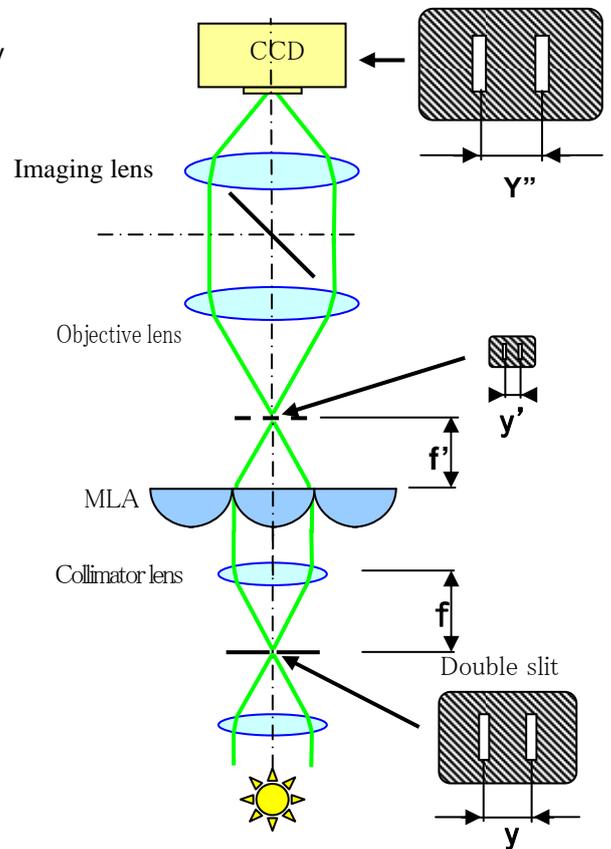
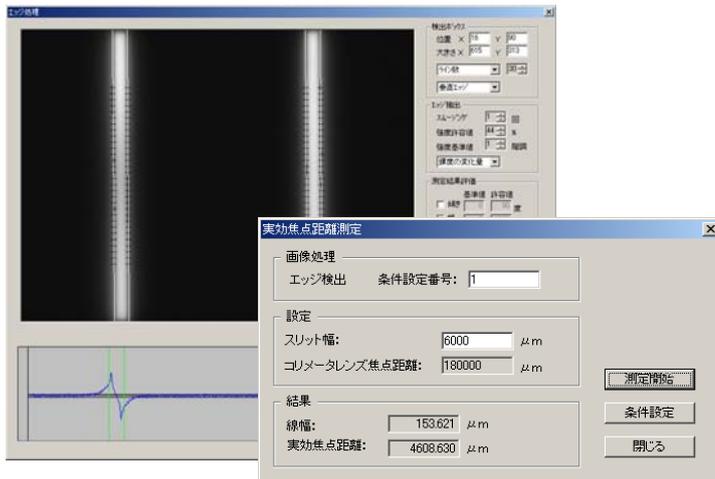
When EFL is named f' , the f' is calculated by below formula.

$$f' = f y' / y$$

In NH-3MA system, parameter f and y are as follows;

f :Focal length of collimators lens(180mm)

y :Width of double-slit(6.0mm)



{The evaluation method of EFL}

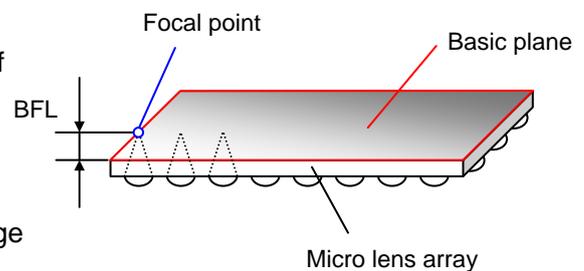
Back focal length (BFL)

The distance (Z) between basic plane and focal points of each lens can be evaluated by this function.

The basic plane is made on back surface by laser probe.

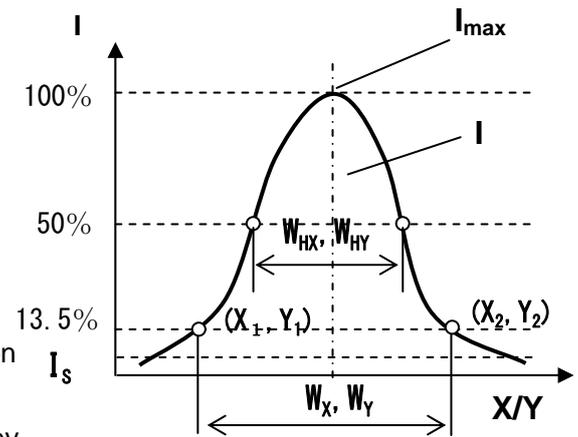
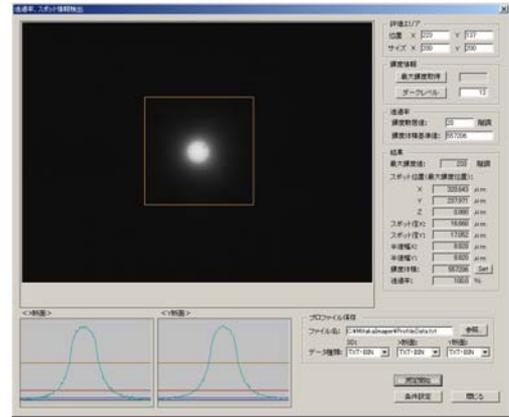
The focal points of each lens are measured by image processing auto-focus function.

(It is also possible to focus by manual.)



■ Spot information

- **Maximum Luminance I_{max}**
Maximum luminance in the spot
- **Spot width W_x, W_y**
The spot width at $1/e^2=13.5\%$ level
- **Half brightness width W_{HX}, W_{HY}**
The spot width at 50% level
- **Integral intensity I_t**
The area of spot profile
- **Spot position S_x, S_y, S_z**
The position of maximum beam brightness
- **Focal position**
The position of maximum I_{max} point for optical axis.
- **Slice position X_1, X_2, Y_1, Y_2**
The cross point between beam-profile and each slice level.
- **Brightness threshold I_s**
The minimum luminance level of beam-profile evaluation
- **Save the luminance profile data function**
The luminance profile can be saved by this function by 2D (X, Y) or 3D data format.



<Spot profile and terms>

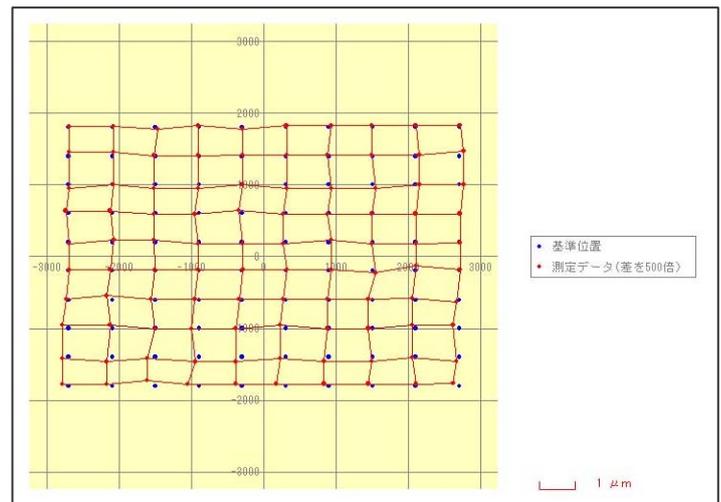
■ Focal point(the gap between measured position and designed position)

The focal points of each lens at micro-lens array can be measured by the function.

And the evaluated gap between measured position and designed position can be shown on the CRT.

The focal points of each lens are measured by image processing auto-focus function.

(It is also possible to focus by manual.)

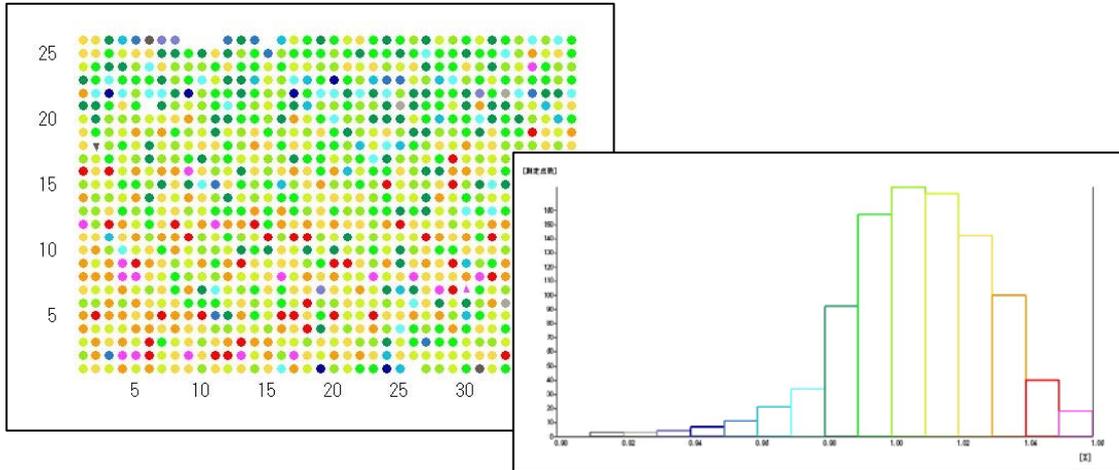


■ Transmittance

This function is for calculation the transmittance (%) of each lens.

Each transmittance is calculated from the luminance of origin lens that is selected by operator.

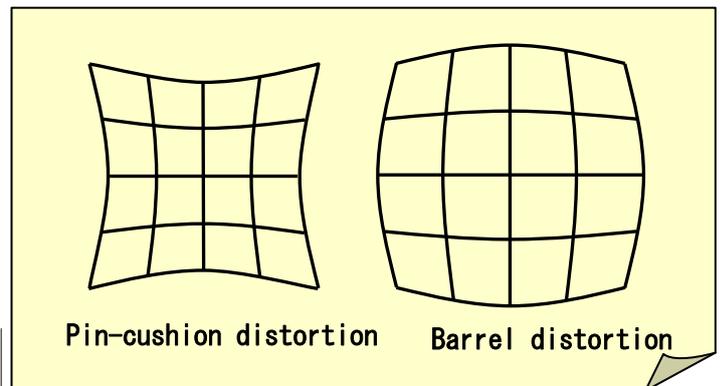
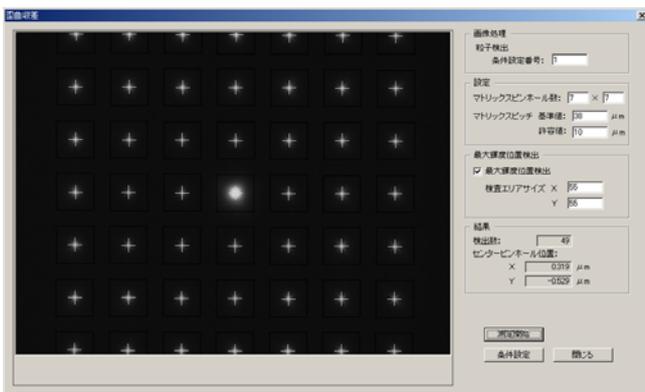
Example, when origin lens luminance is 200 and evaluated lens luminance is 190, the transmittance is 95%.



■ Distortion aberration

The distortion aberration can be measured by this function from each pin-hole position of matrix pin-hole slit.

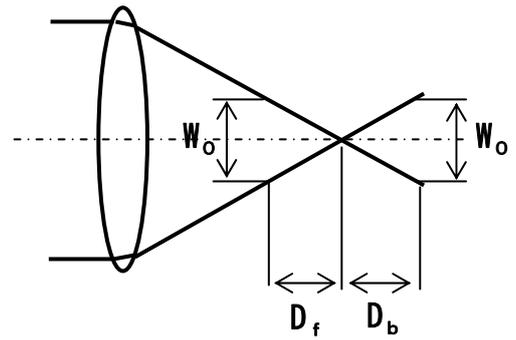
That matrix pin-hole image is imaged on CCD by evaluated lens.



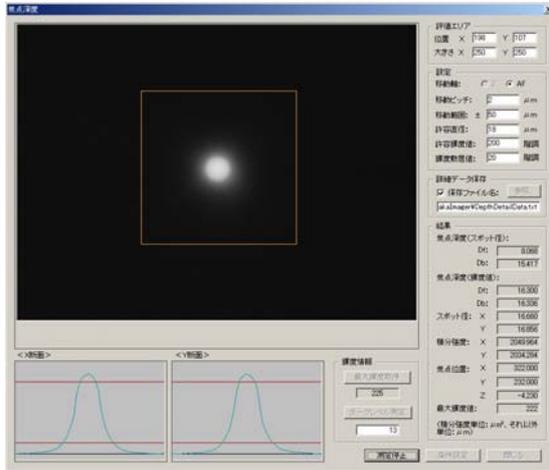
■ Focal depth(Optional function)

The focal depth (D_f , D_b) is measured by 2 pin-hole image between inside of focus area and outside of focus area.

The lens capacity of imaging is evaluated from this result.



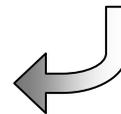
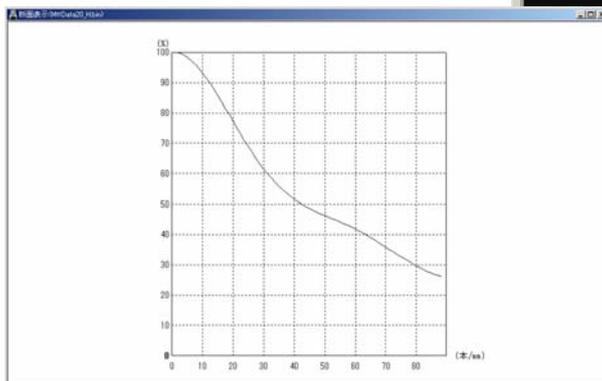
The definition of focal depth



■ MTF evaluation(Optional function)

Lens resolution is calculated from modulated transfer function (MTF) by this function.

The X-axis of MTF graph is spatial frequency (number/mm), and Y-axis is MTF (%).



This graph is calculated result by FFT method from horizontal / vertical 2D brightness profile.