Camera System Training

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Agenda

- Basics
- Line Camera
- Image Filters
- Edge Detection
- Stain Detection

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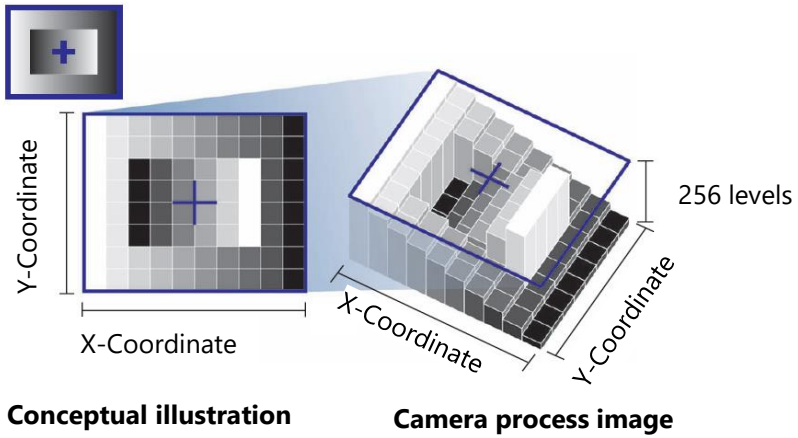
Basics

- What is a digital image?
- How is a digital image produced?
- Lenses
- Light

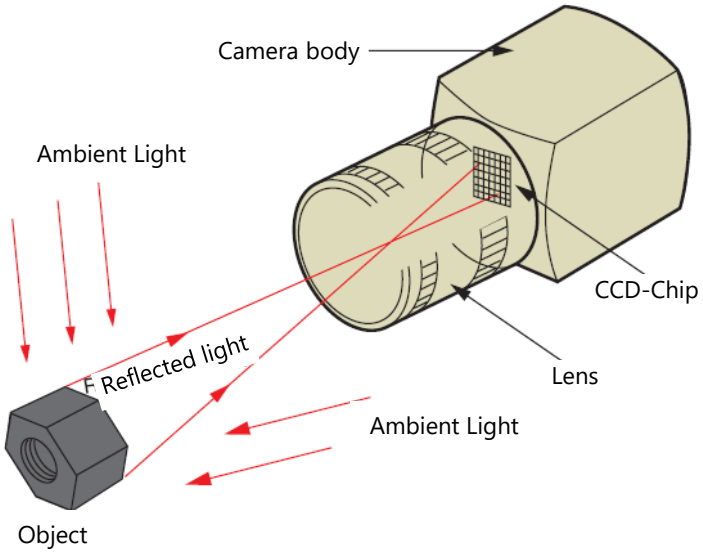
What is a digital image?

- Defined number of picture elements (Pixels)
- Coordinate system of Pixels (X- and Y-Coordinates)
- Attribute the intensity to a Greyscale Pixel
- Attribute the intensity to Red-,Green- and Blue channel at Colour Pixel



How is a digital Image produced?

- Incidence of ambient light to the object
- Partly or complete reflection
- Focusing of reflection in direction to camera (Lens)
- Imaging of reflection to CCD
- Illuminate the Pixel
- Saving the "Illumination pattern"

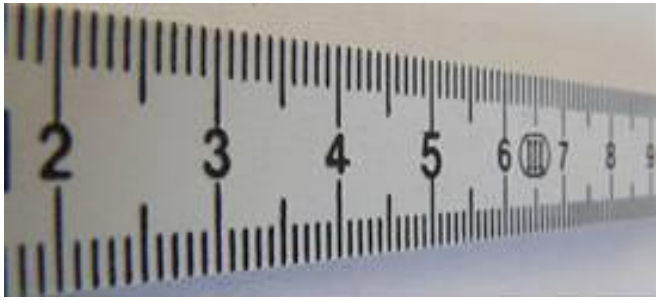


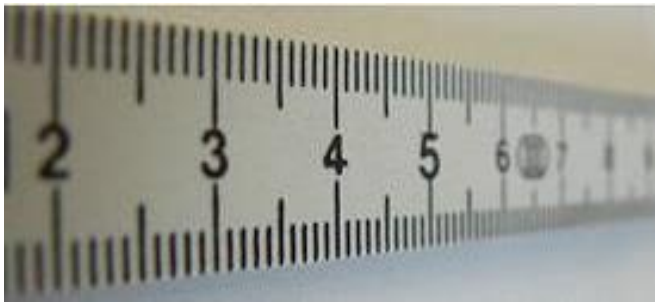
Lenses: Configuration

- F-number ring controls the incident of light
- Focus distance ring controls the sharpness of the image
- Focal distance defined field of view / working distance ratio
- F-number expresses the diameter of the entrance pupil in terms of the focal distance of the lens

Lenses: Depth of Focus

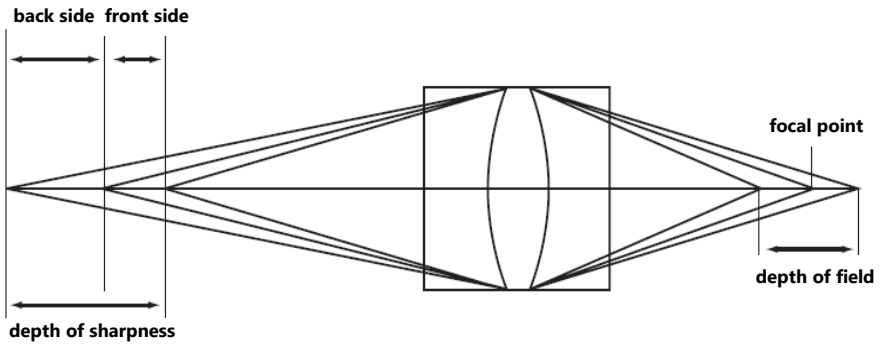
- Closed F-number ring: high depth of focus
- Open F-number ring: low depth of focus





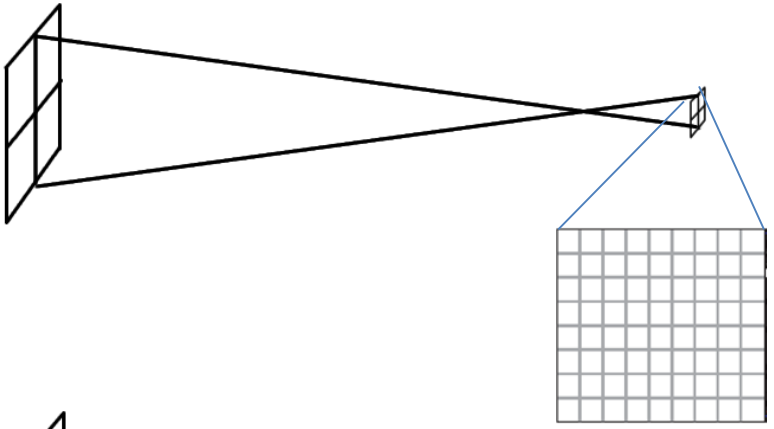
Lenses: Focusing

- Working distance from Near to Endless
- Different working distance needs different focus adjustments
- Only objects in the working distance are shown sharp

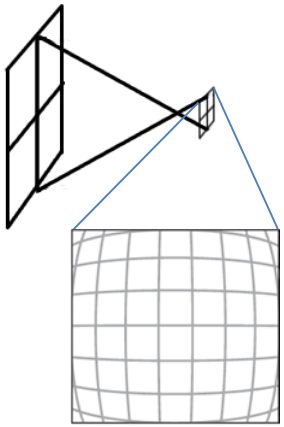


Lenses: Focal distance

- High focal distance means small image angle and low distortion



- Low focal distance means big image angle and high distortion



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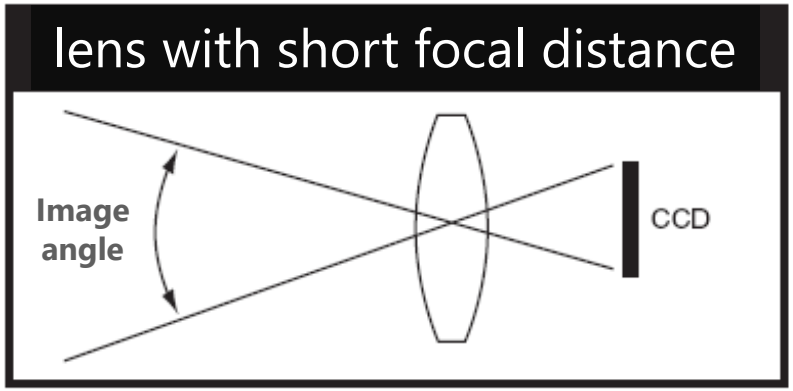
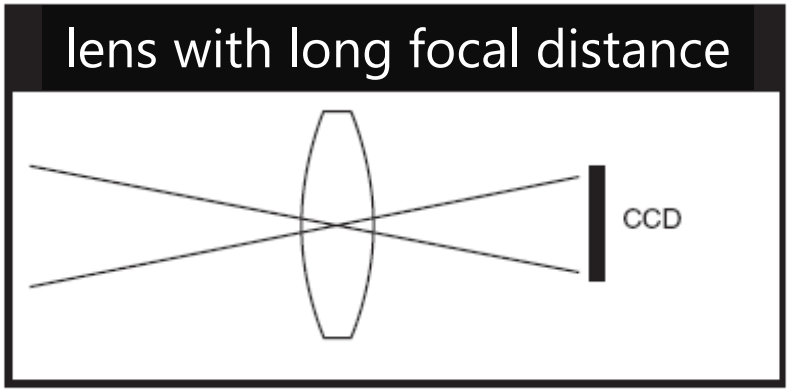
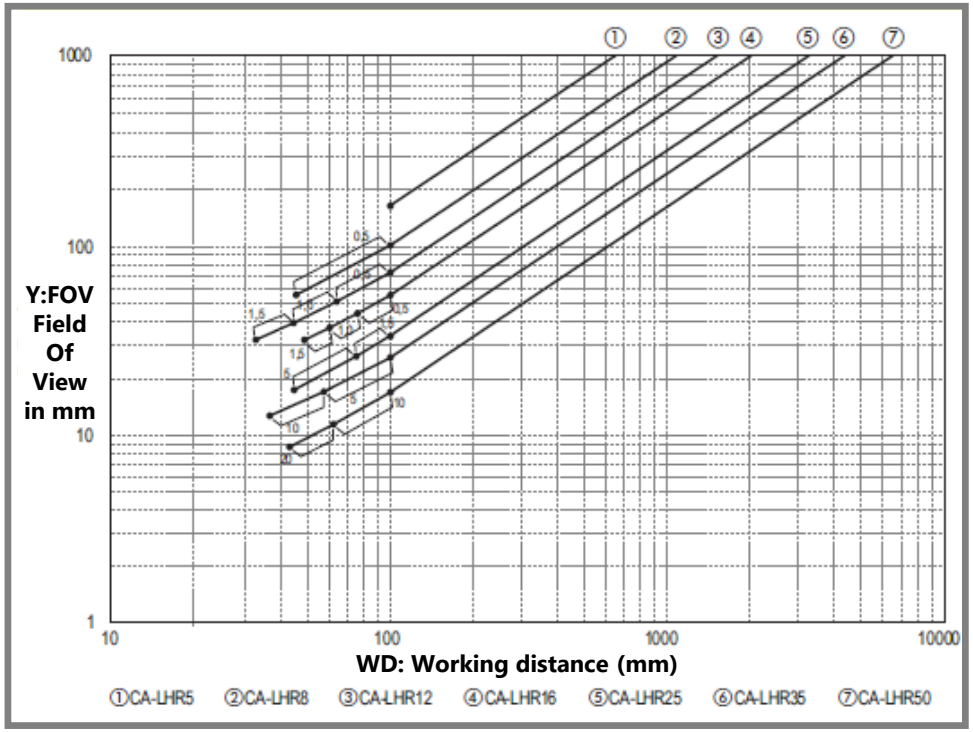
Lenses: Focal distance





Lenses: Focal distance

- Logarithmic diagram
- Based on CCD-Size
- Based on Lens type



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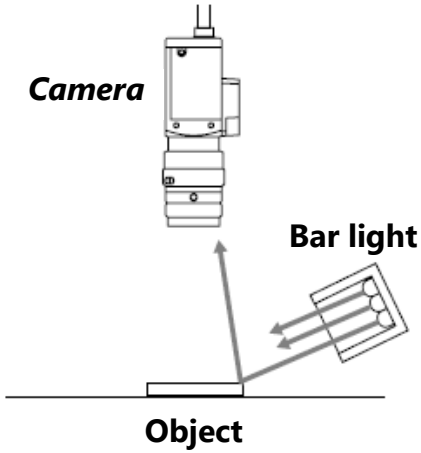
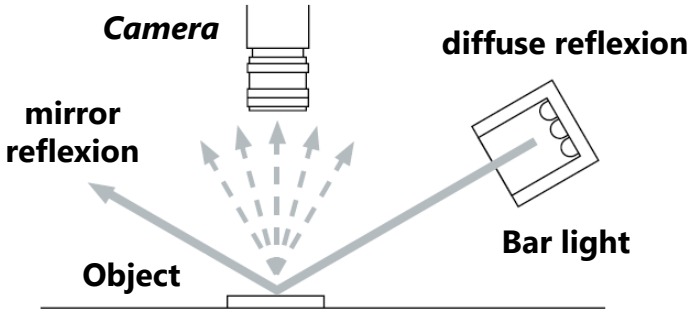
Bar Lights


Bar Light
CA-DB


Camera
Bar light
Object


Camera
diffuse reflexion
mirror
reflexion
Bar light
Object

Line Cameras

- Introduction
- Image Capture
- Encoder

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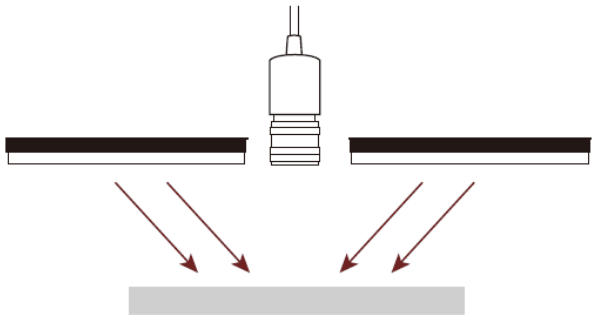
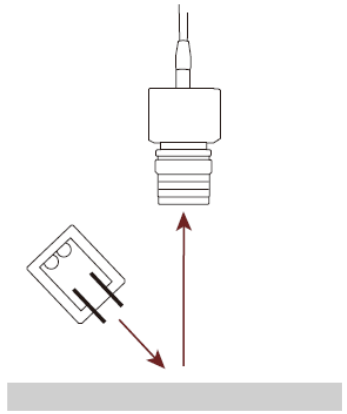
Line Cameras - Introduction

Difference between area cameras and line scan cameras:
Size and cost reduction

An area camera will capture an entire 2D image area in one operation while the line scan camera will build a 2D image by capturing one line at a time.

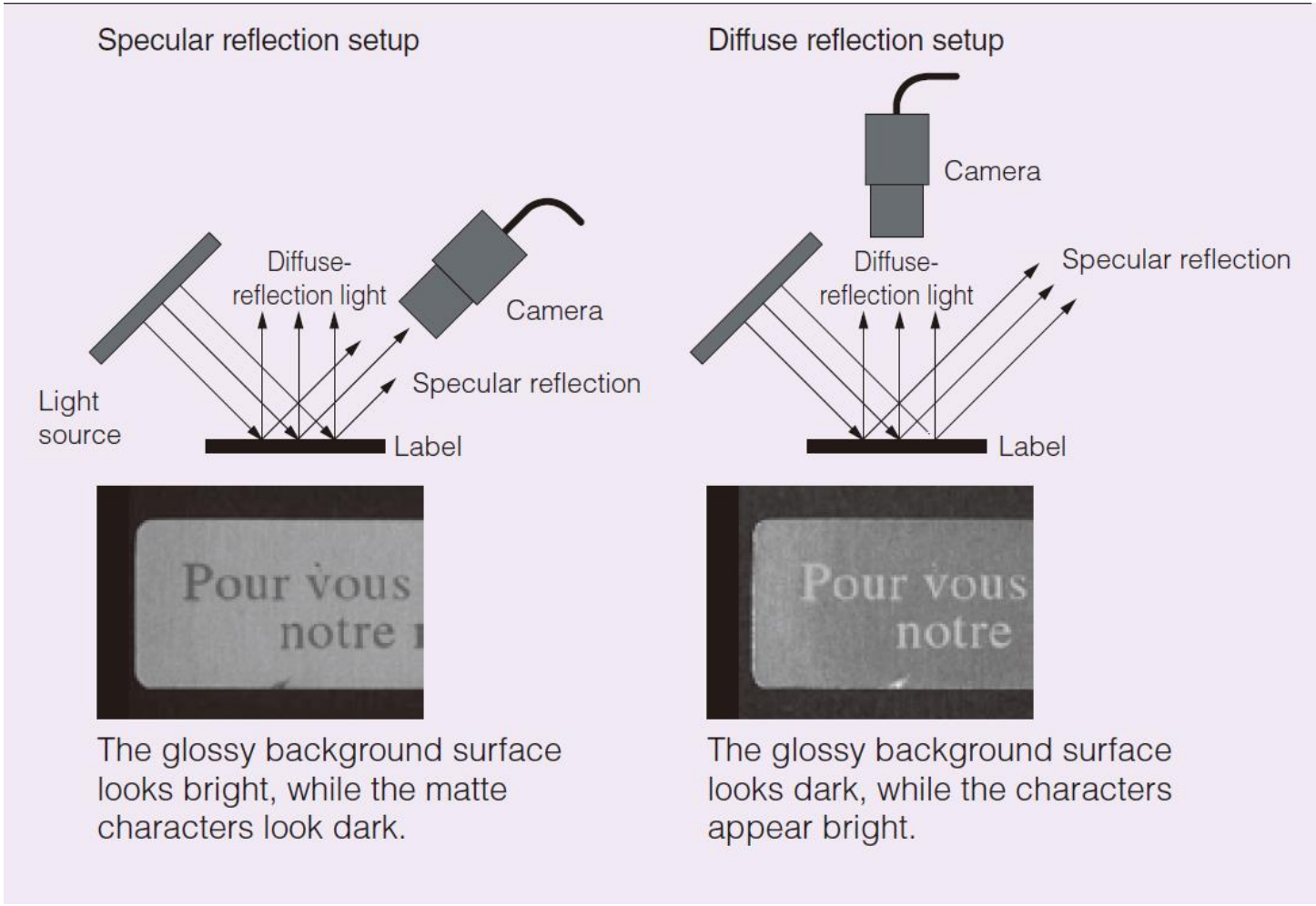


Larger sized lighting requires more costs and greater installation space.

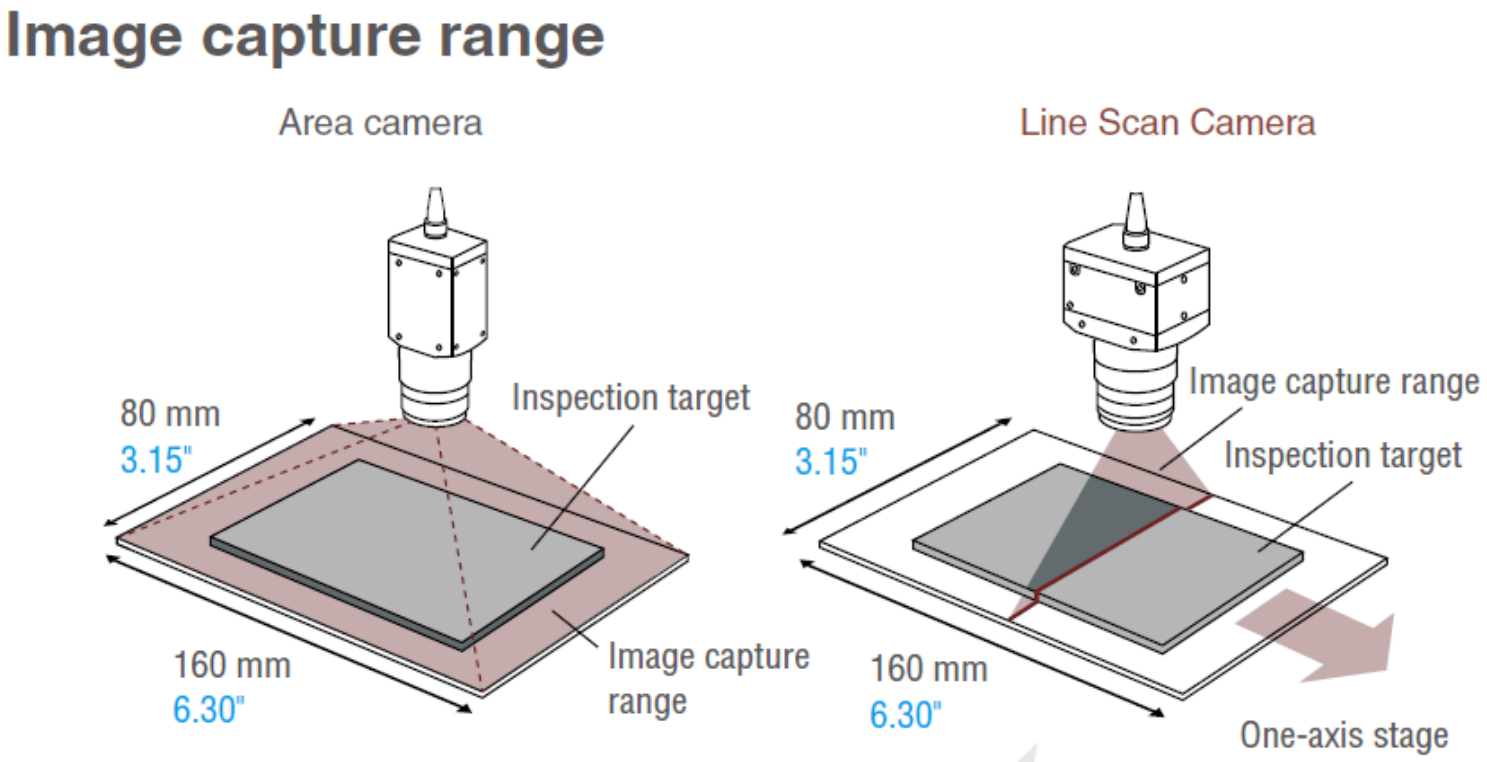


A bar light can be used to perform the inspection, which reduces installation space requirements and cost.

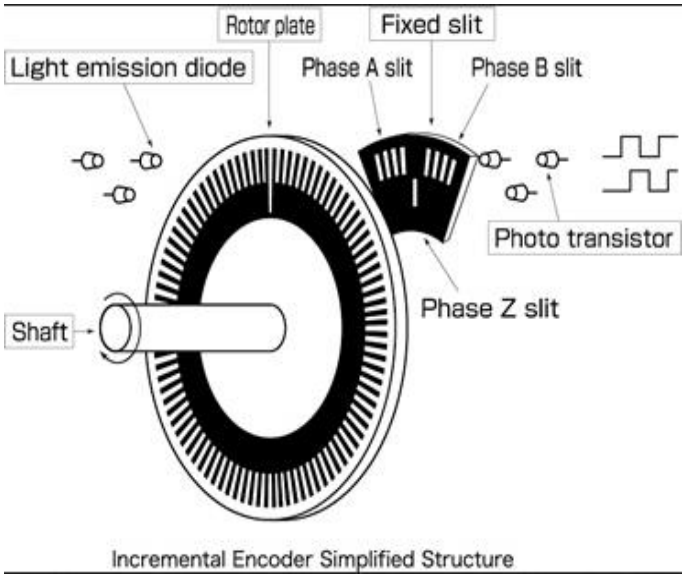
Line Cameras – Image Capture



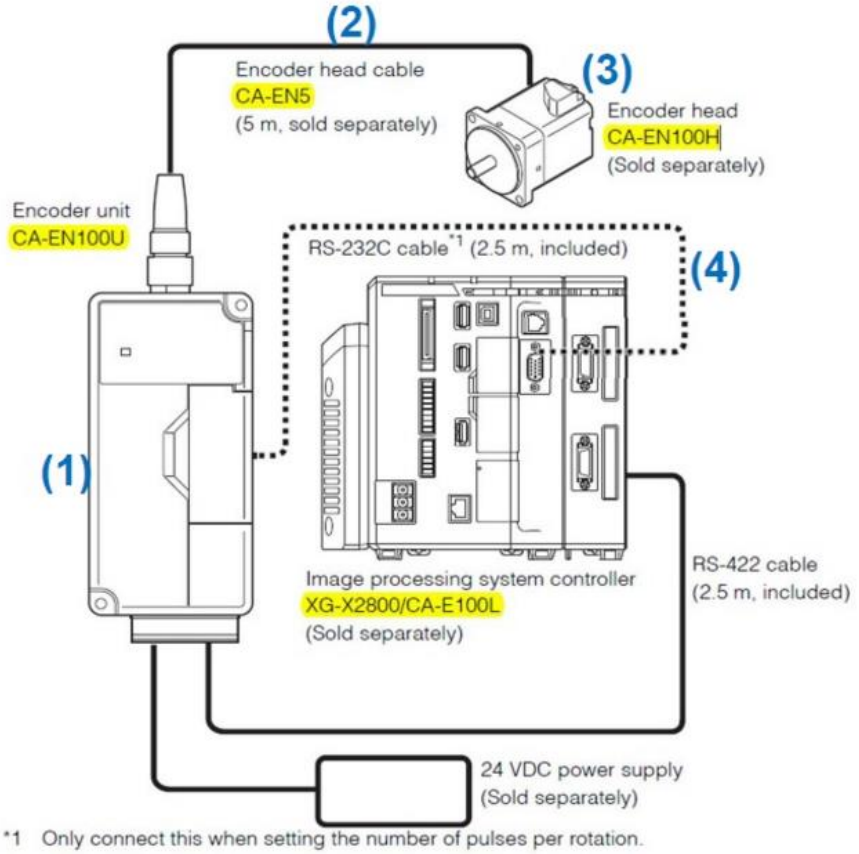
Line Cameras – Image Capture



Encoder



Incremental Encoder Simplified Structure



*1 Only connect this when setting the number of pulses per rotation.

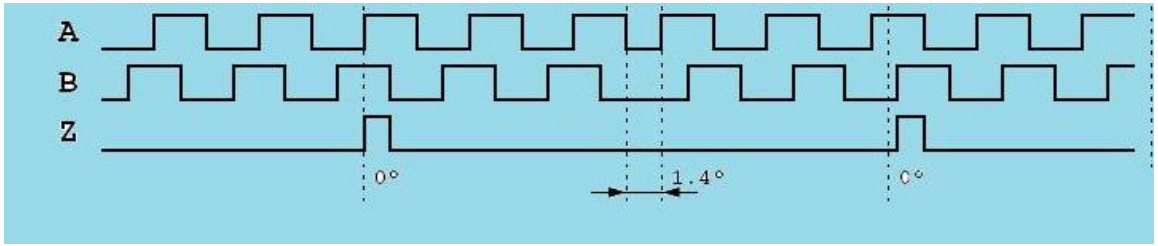


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Image Filters

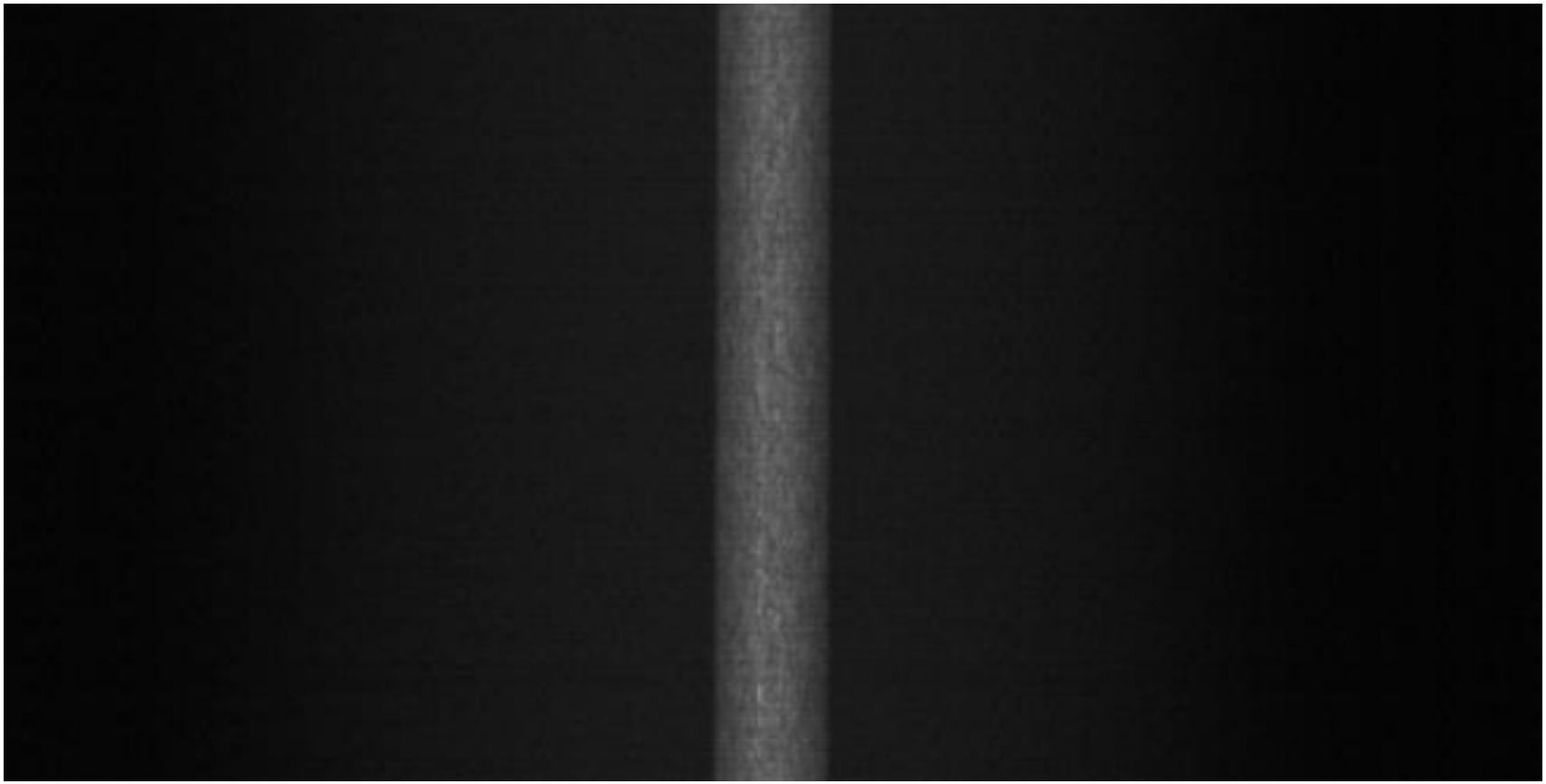


Image Filters – Shading Correction

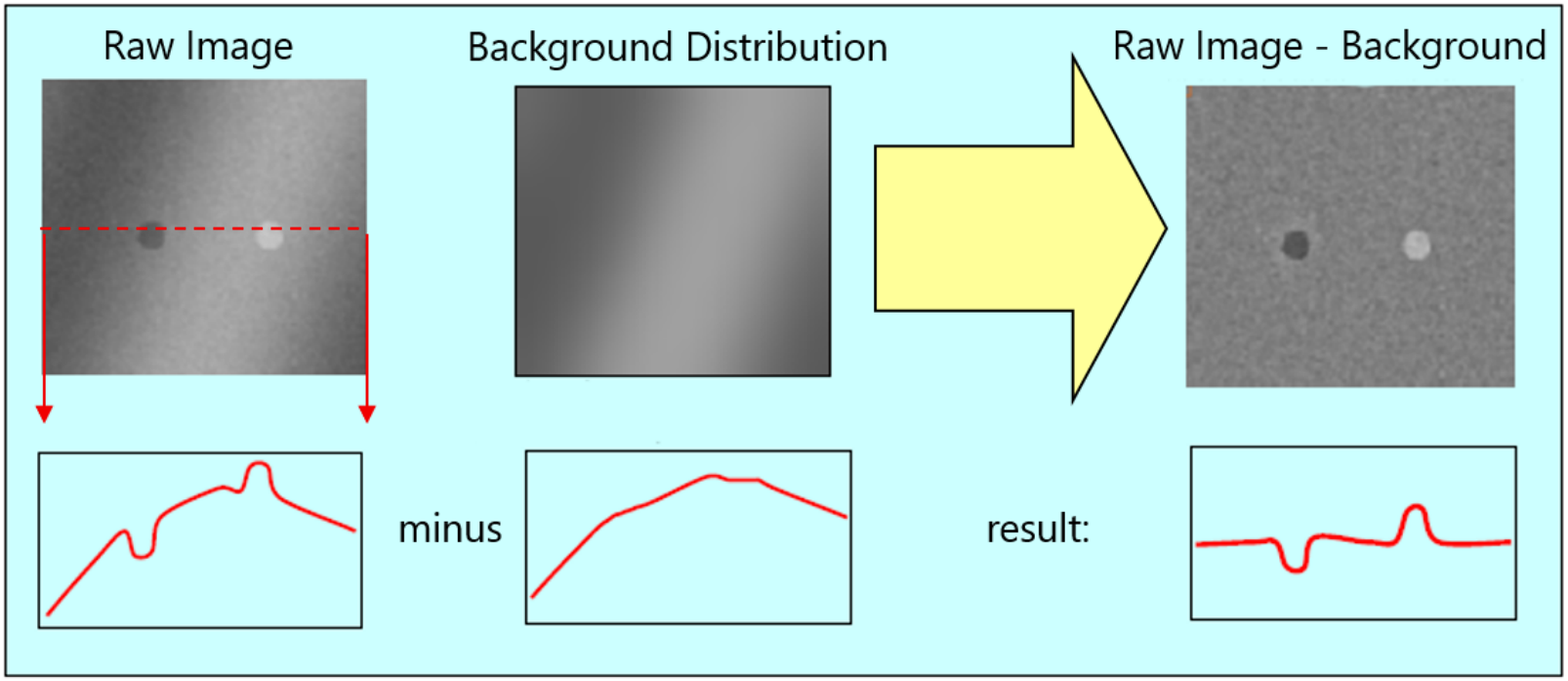


Image Filters – Shading Correction

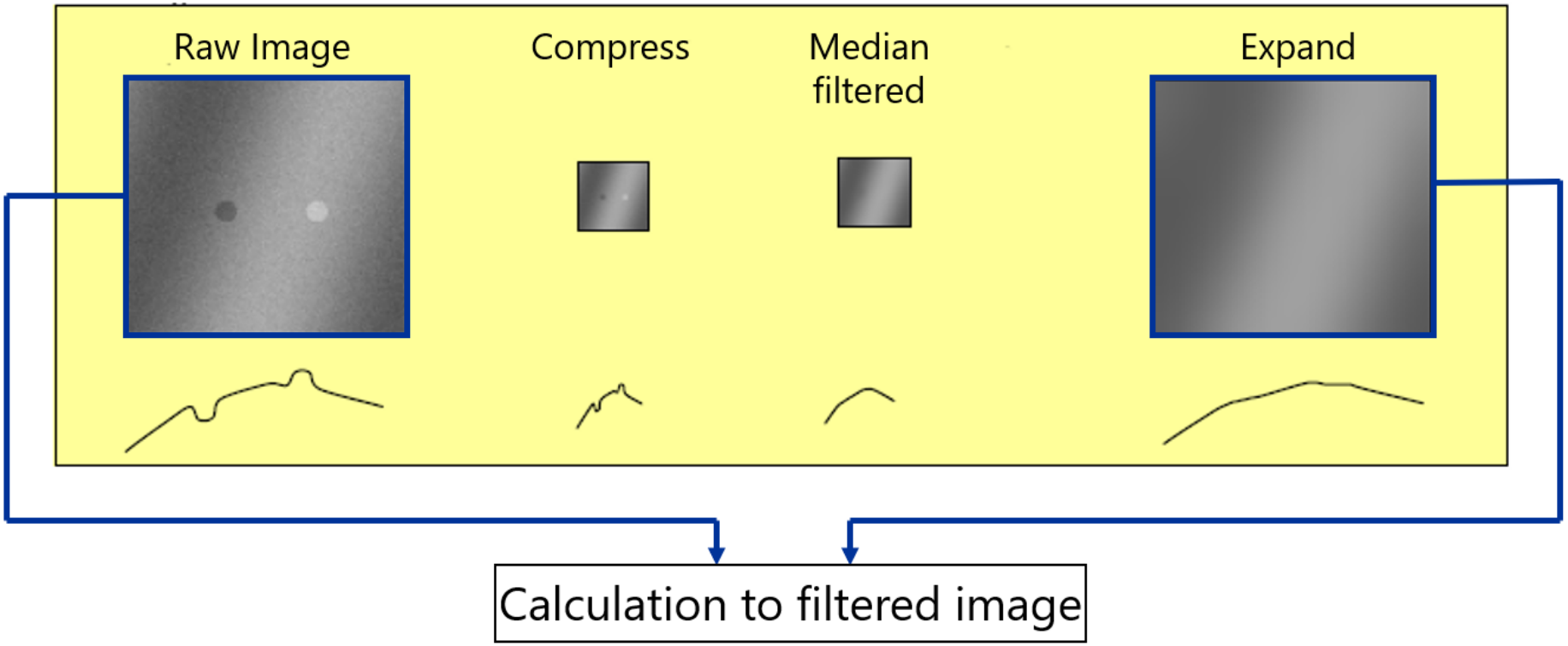


Image Filters – Shading Correction

- Target orientated extraction (bright or dark)

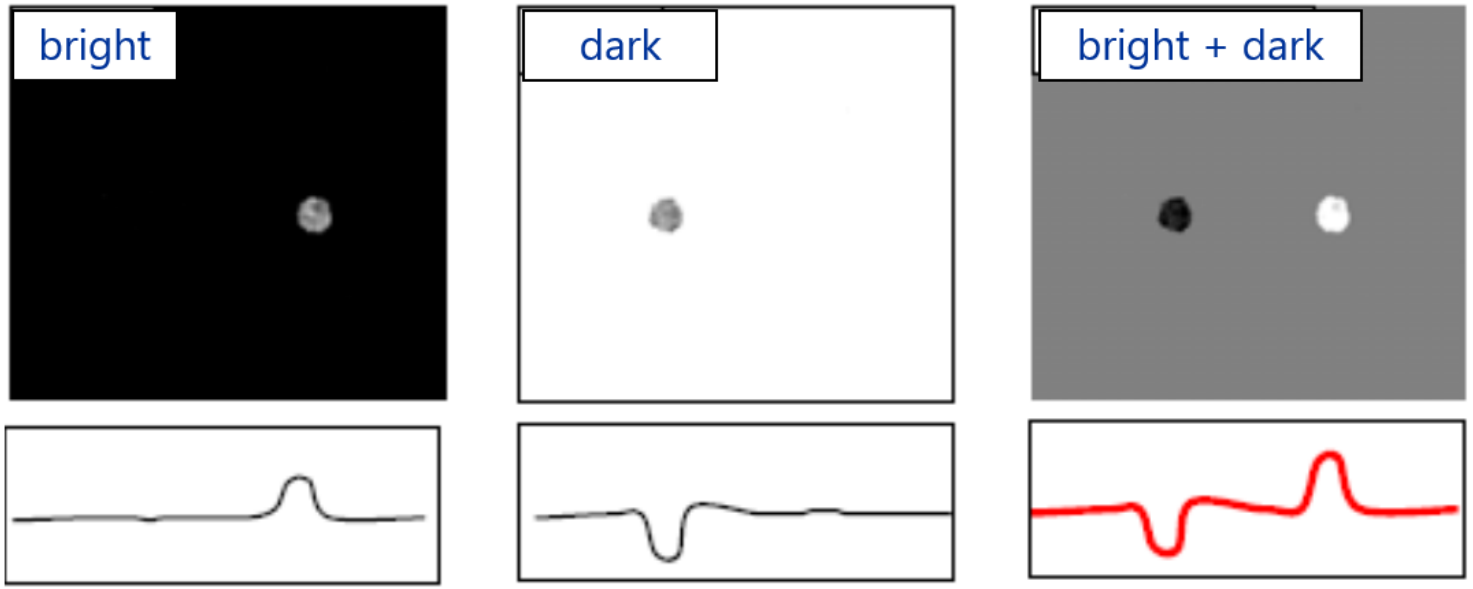
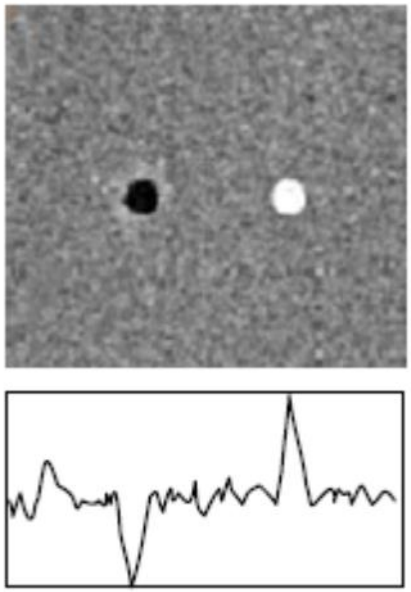


Image Filters – Shading Correction

- Noise elimination



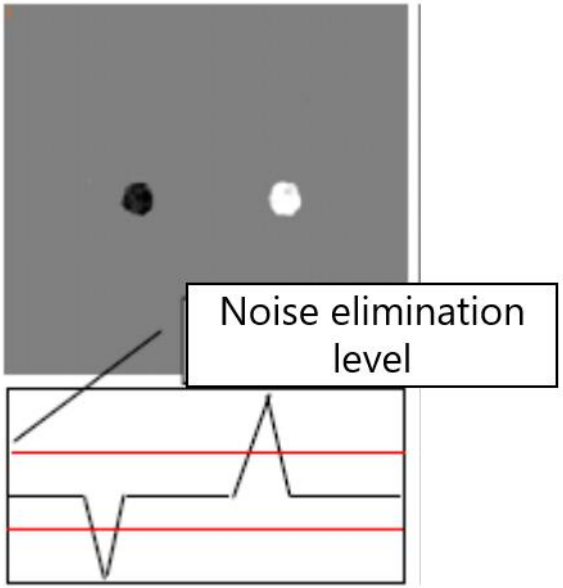


Image Filters – Shading Correction

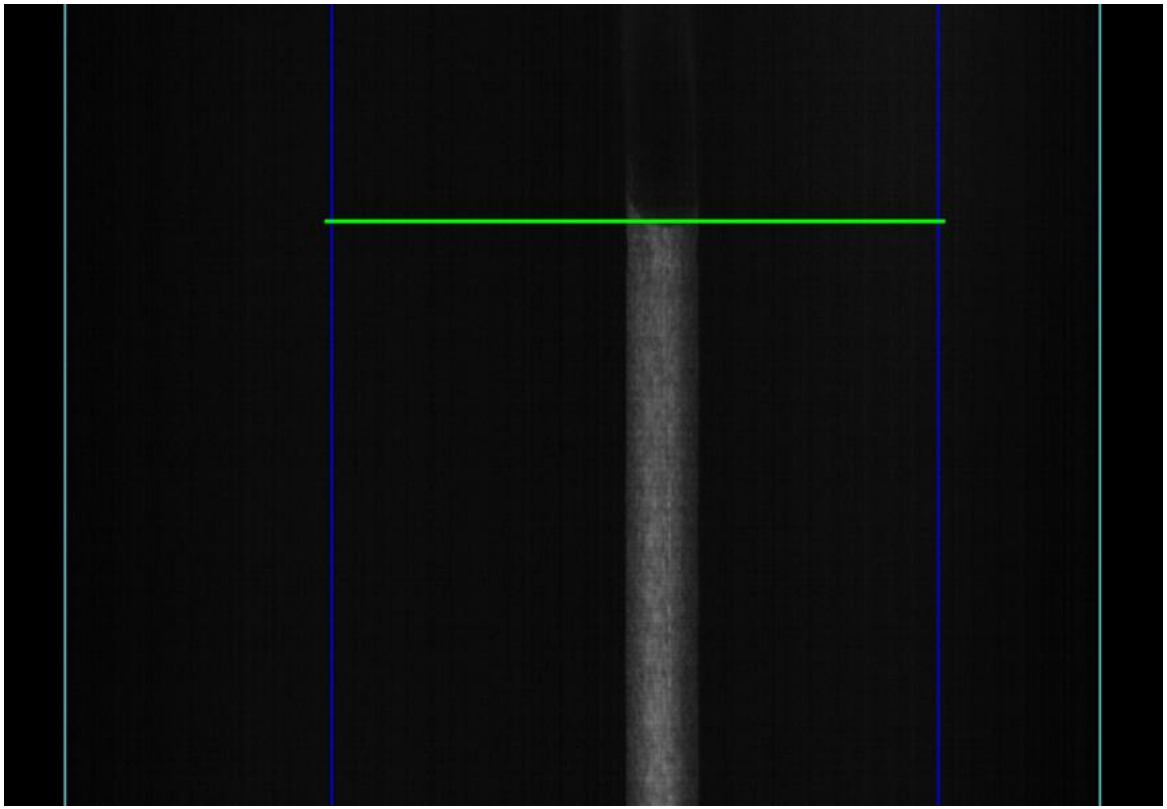
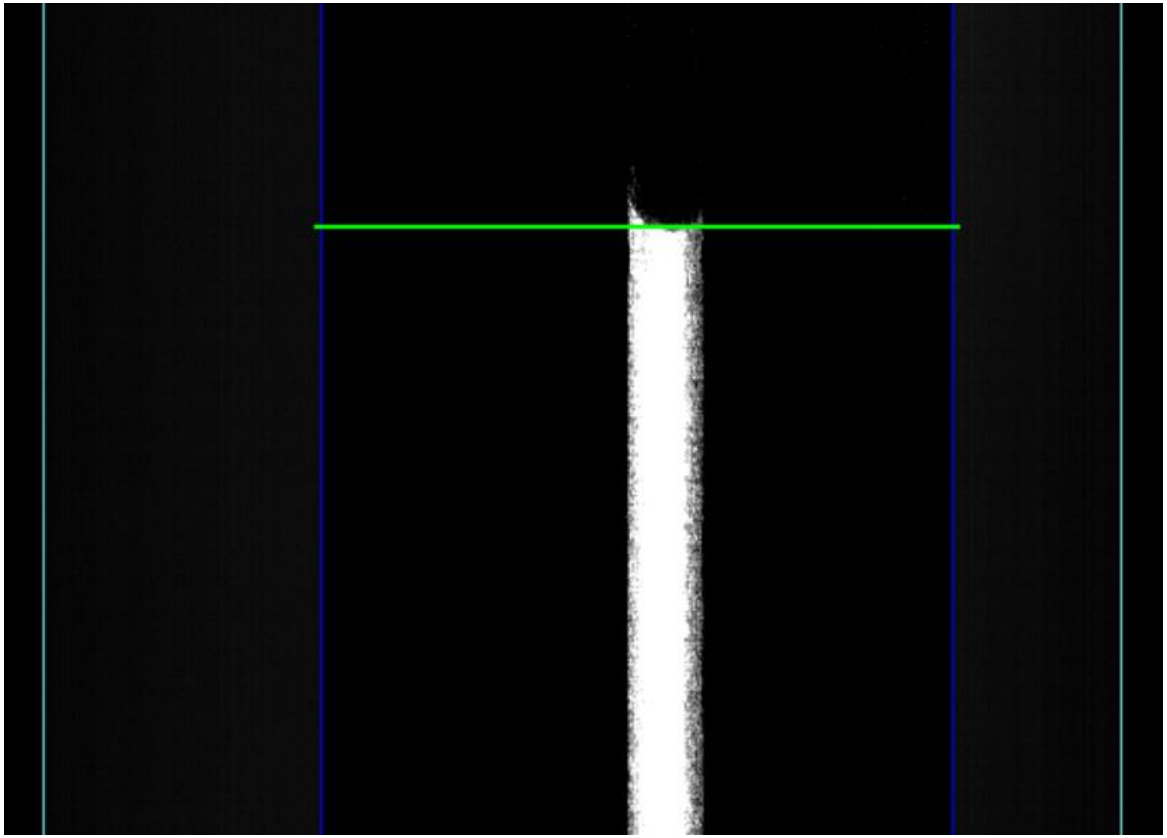


Image Filters – Shading Correction



Median Correction – Bright – High Gain

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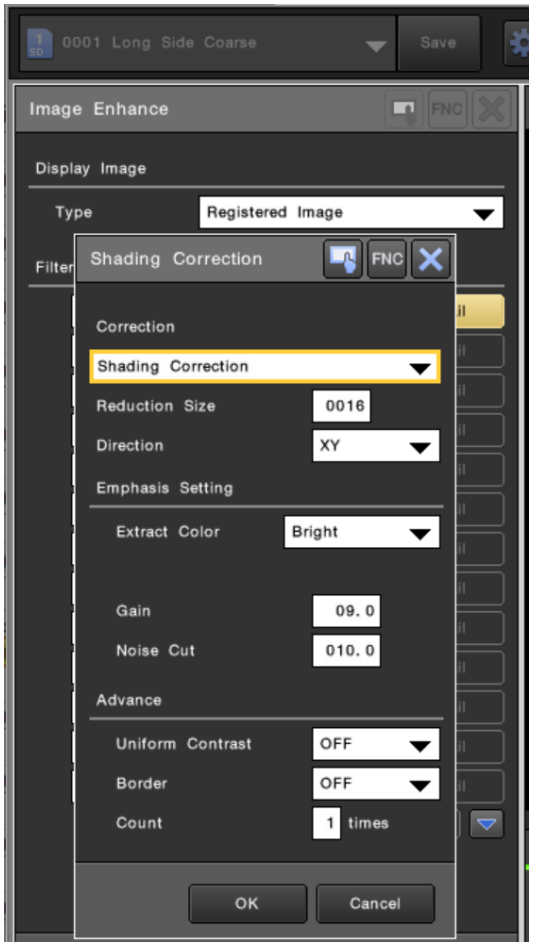
Image Filters – Shading Correction



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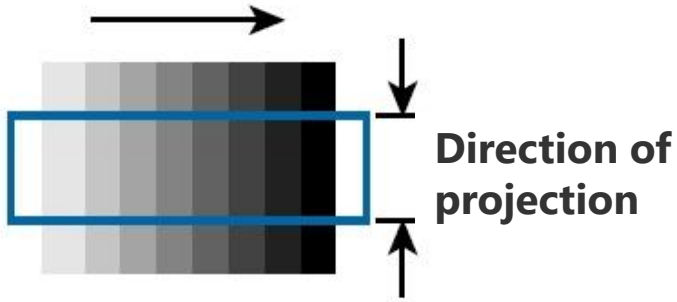
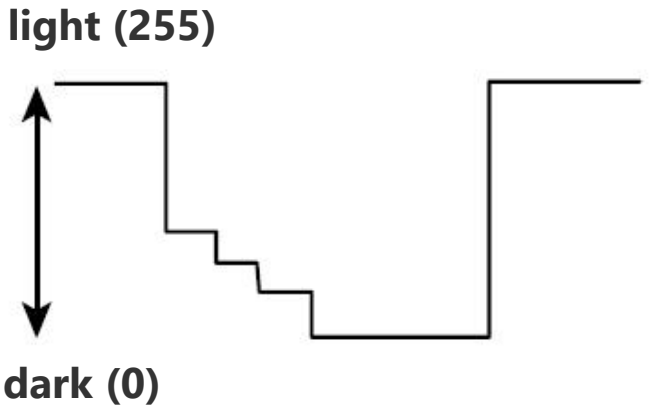
Edge Detection

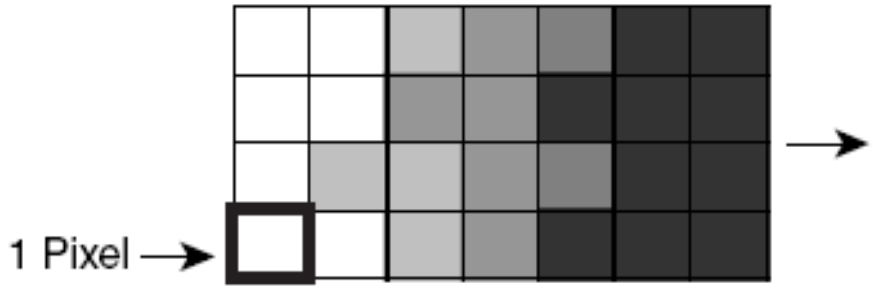
Direction of
edge detection



Projection waveform



Edge Detection



255	255	135	90	70	10	0
255	255	95	70	50	0	0
255	120	120	85	70	10	0
255	255	130	95	50	0	0
255	221	120	85	60	5	0

← **Average Intensity**

Edge Detection

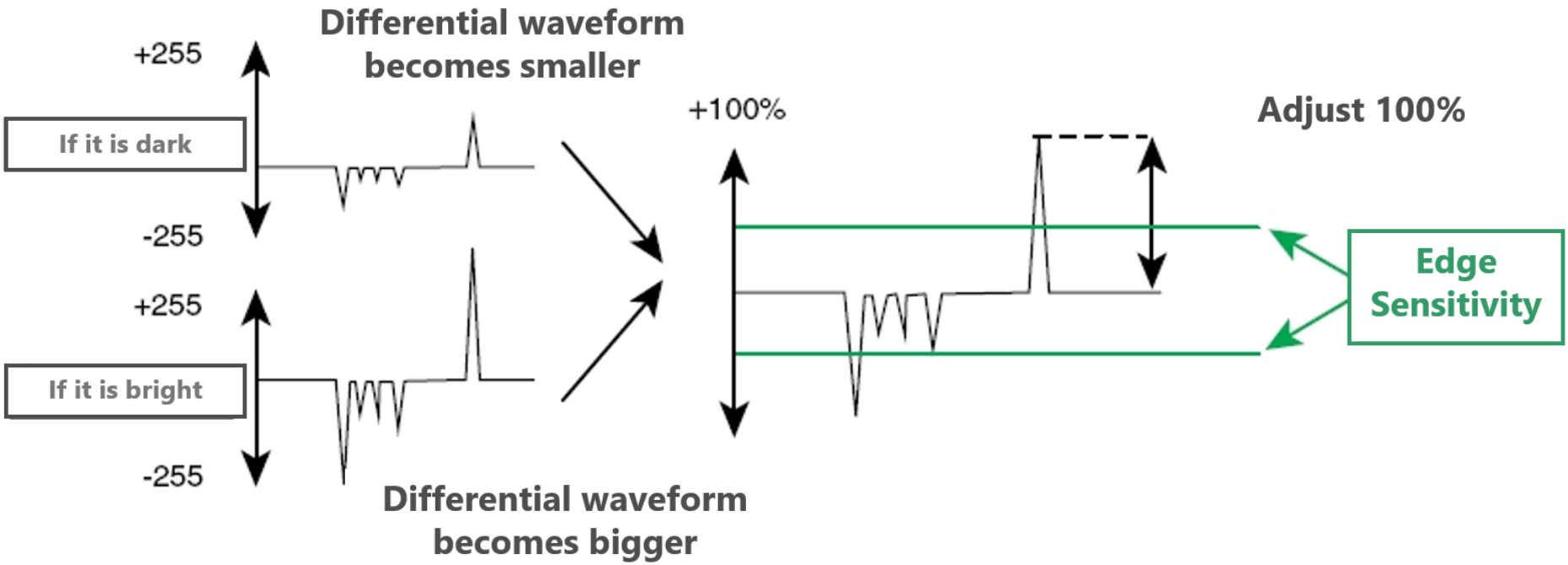
255	255	135	90	70	10	0
255	255	95	70	50	0	0
255	120	120	85	70	10	0
255	255	130	95	50	0	0

255 221 120 85 60 5 0

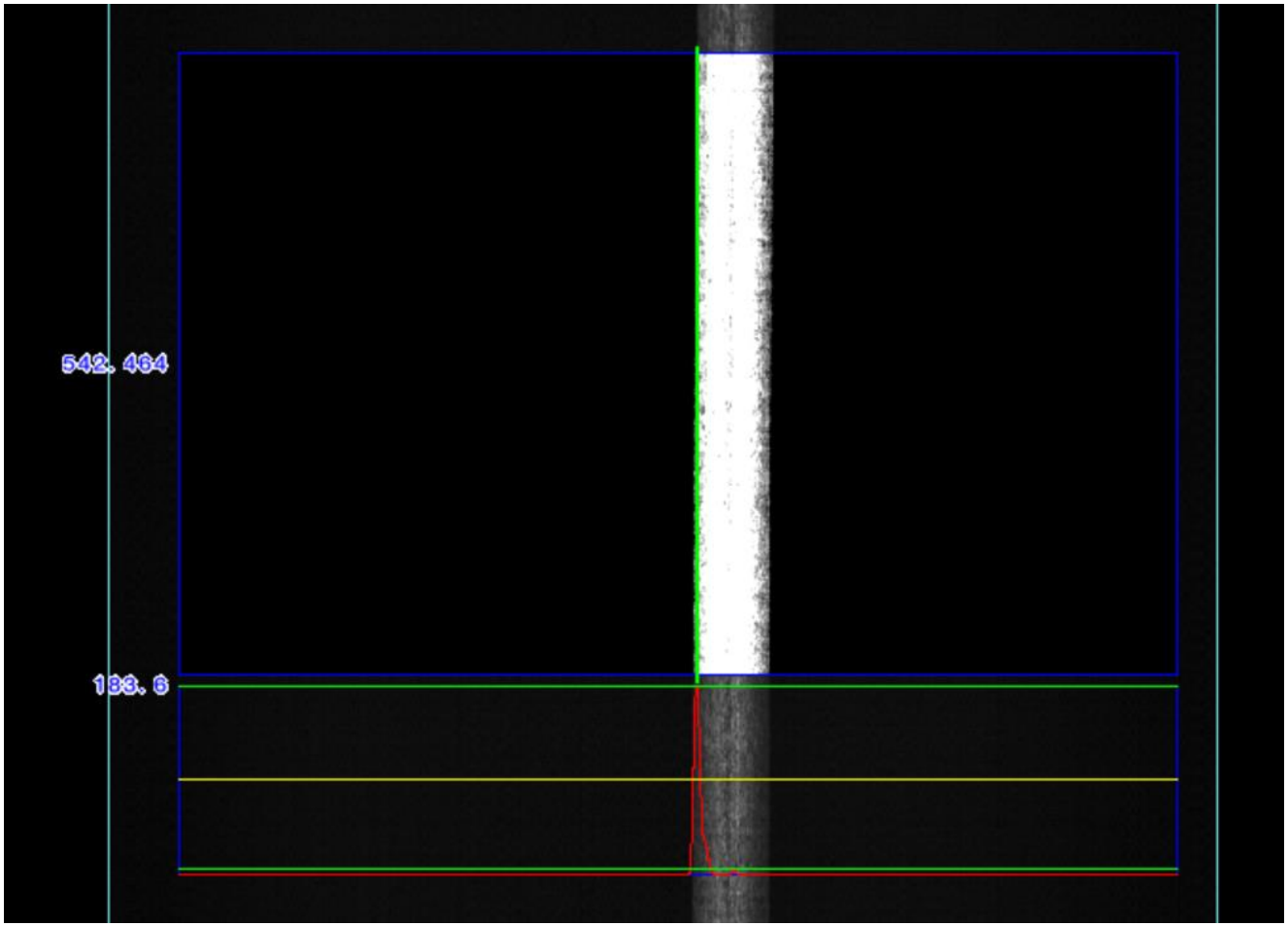
difference: 34 101 35 25 55 5

Edge Detection

Edge Detection

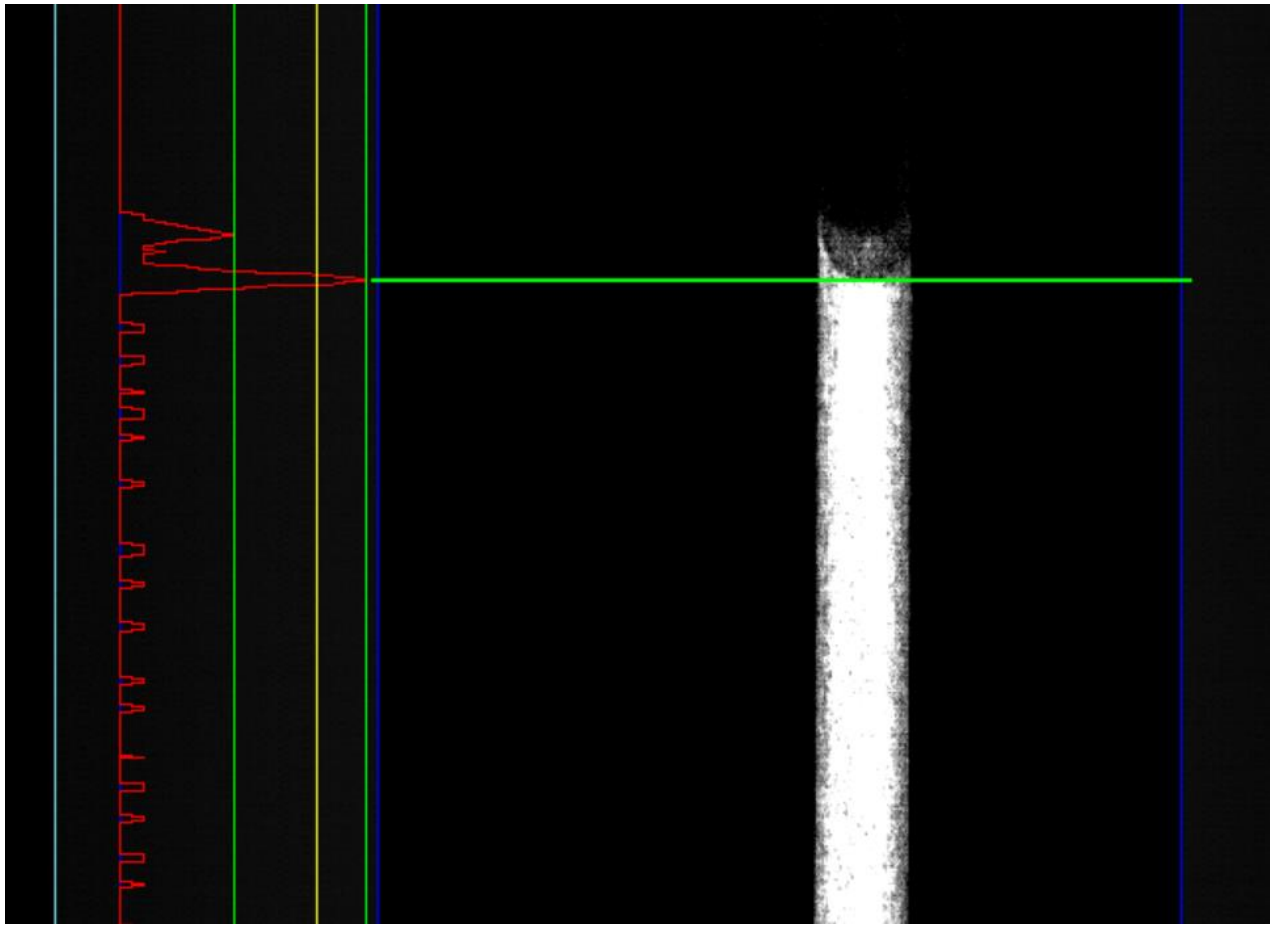


Edge Detection



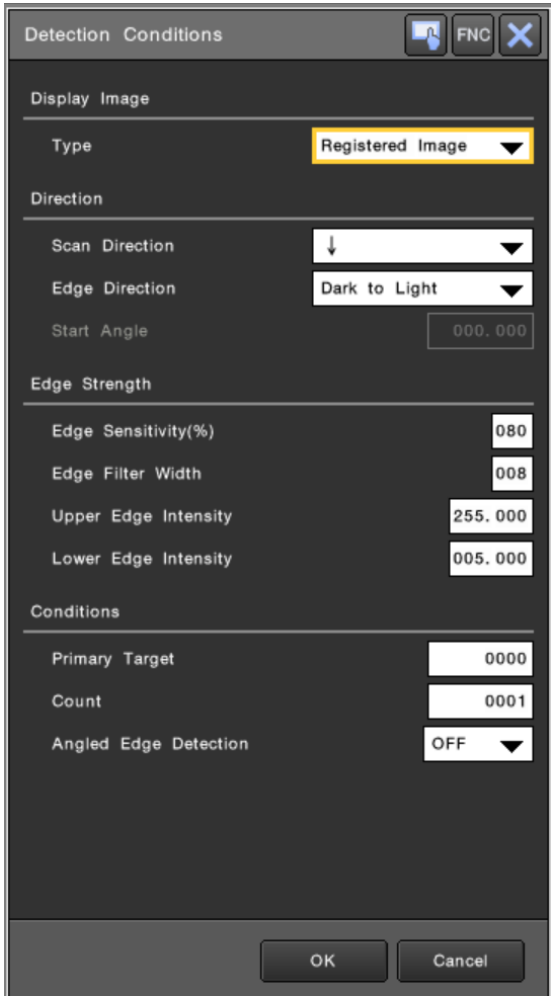
Sensitivity 50%

Edge Detection



Sensitivity 80%

Edge Detection



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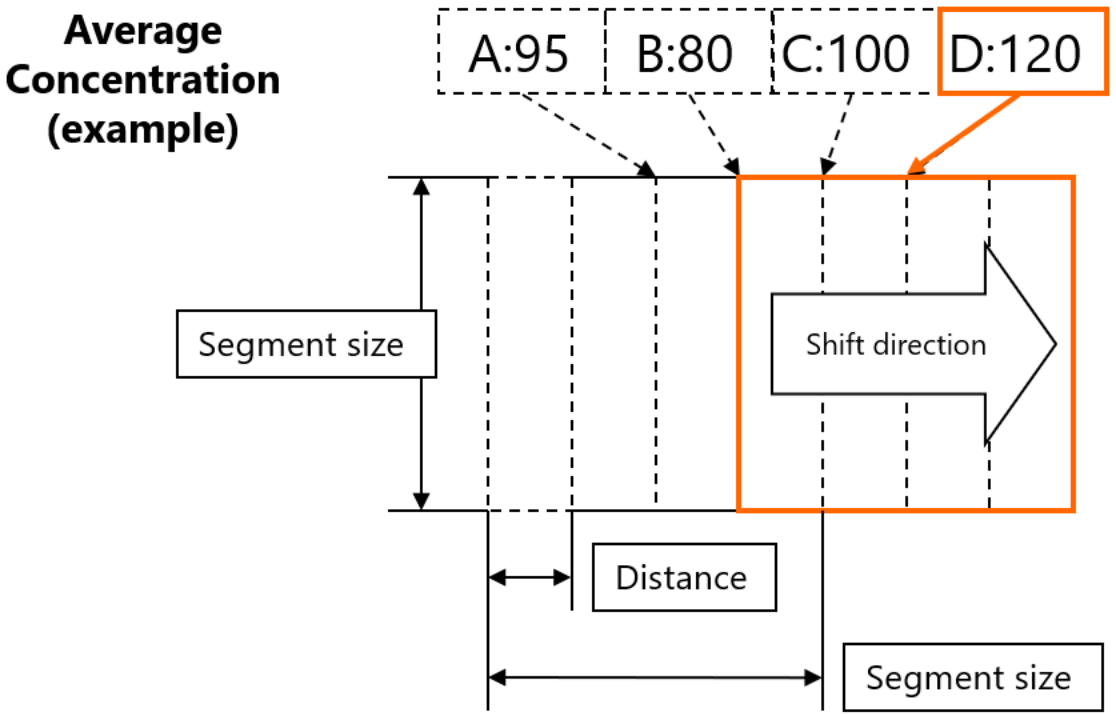
Stain Detection

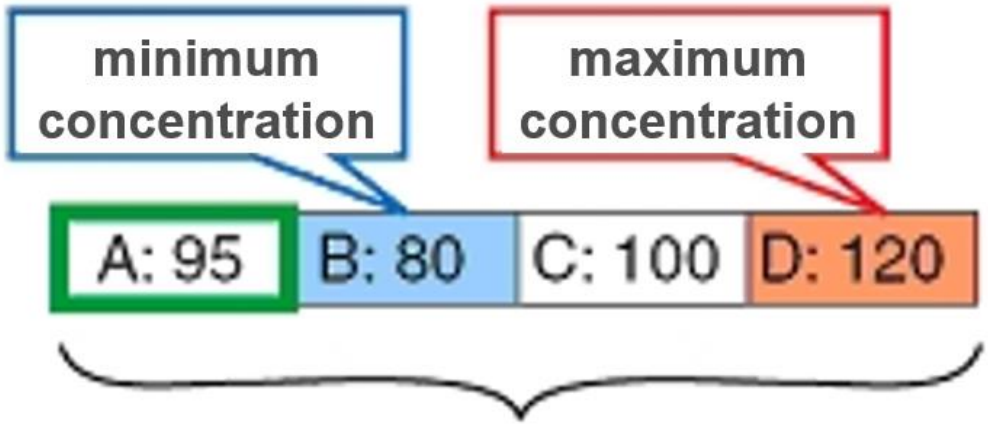
Intensity and segment shift:



Stain Detection

Difference maximum:

Average Concentration (example)

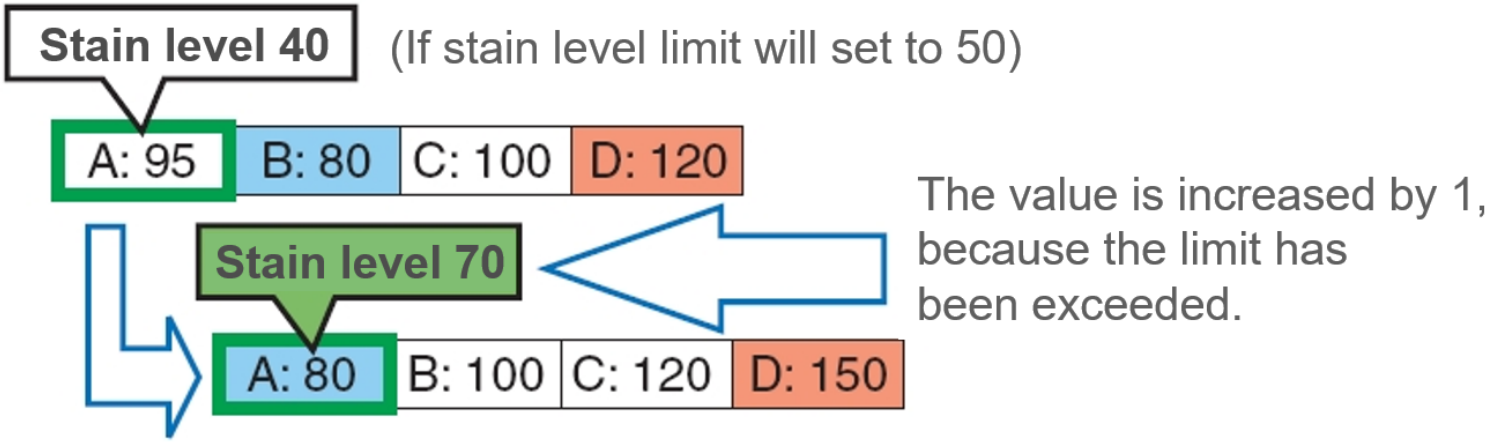


four segment area

120 – 80 =40 (stain level)

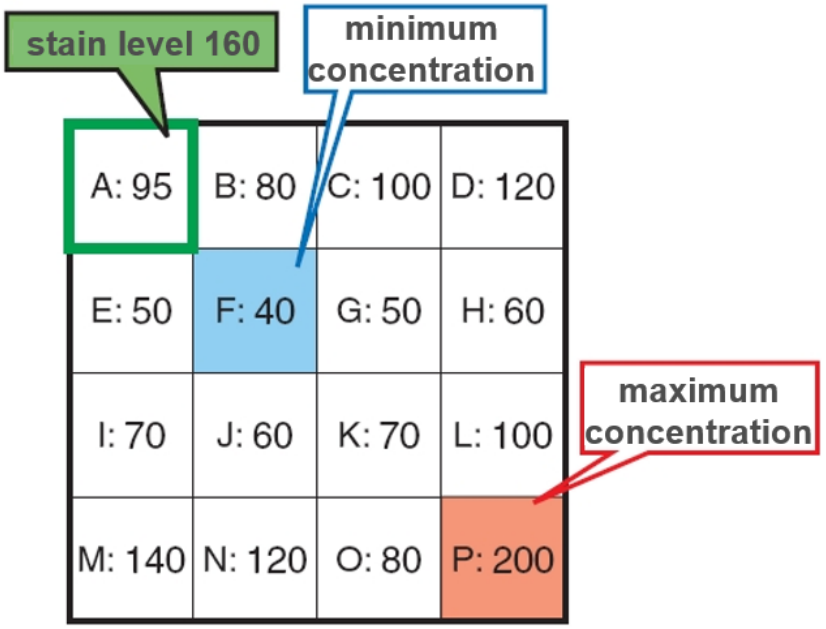
Stain Detection

Stain level evaluation:



Stain Detection

XY-direction detection:



4 x 4 =area with 16 segments
200 – 40 = 160 (stain level 160)

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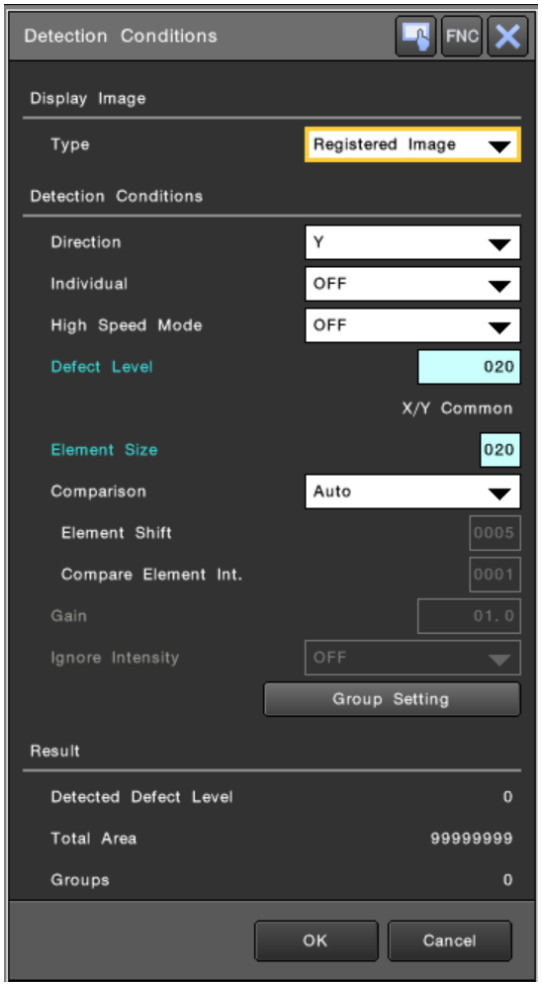
Stain Detection



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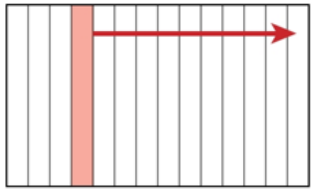
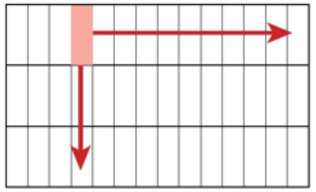
Stain Detection

Direction detection:

- X-direction

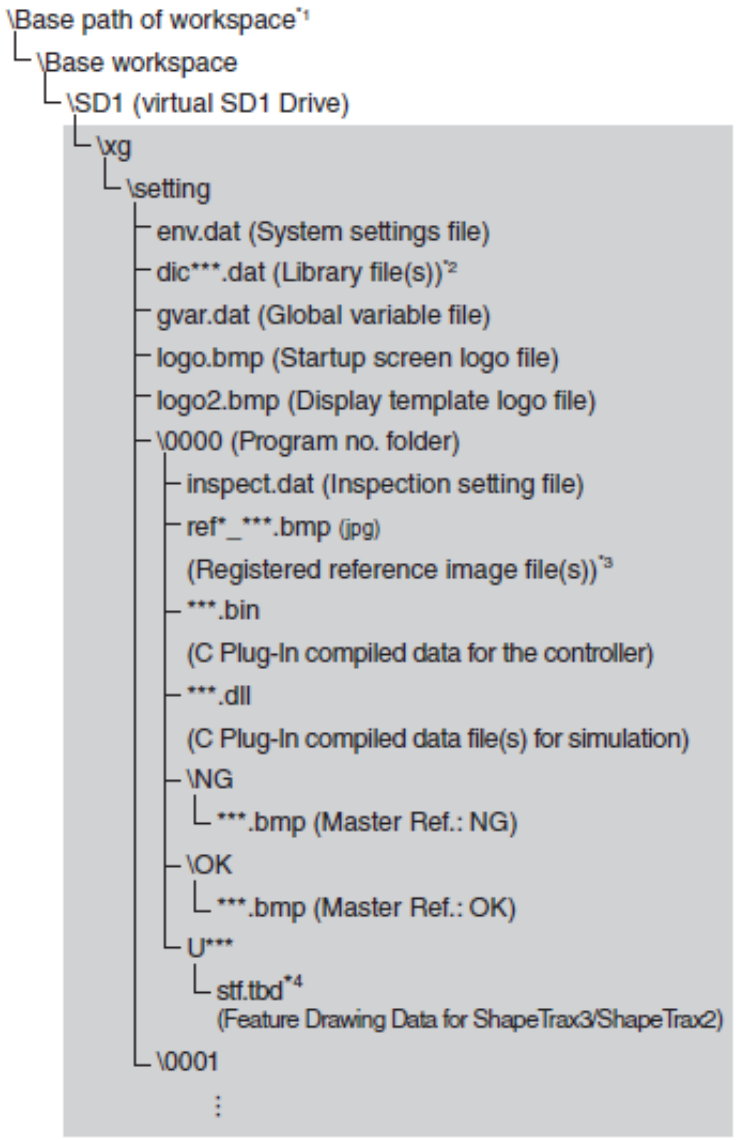


- XY-direction



Interface

- Connecting to the system
- Setup and Run Modes
- Managment data
- Saving/Loading Programs
- Flowchart



Management data in the controller

Any Questions?

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Thank you for your attention

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