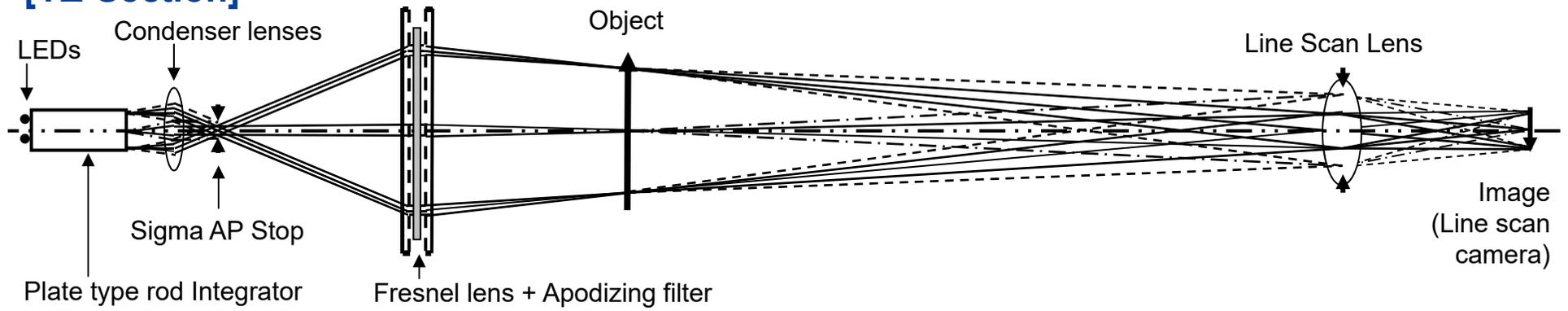


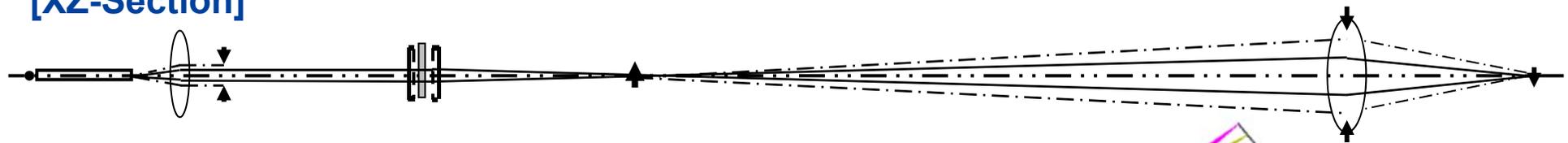
# Fresnel illumination system for line scan lens

# Principal of Fresnel Illumination System

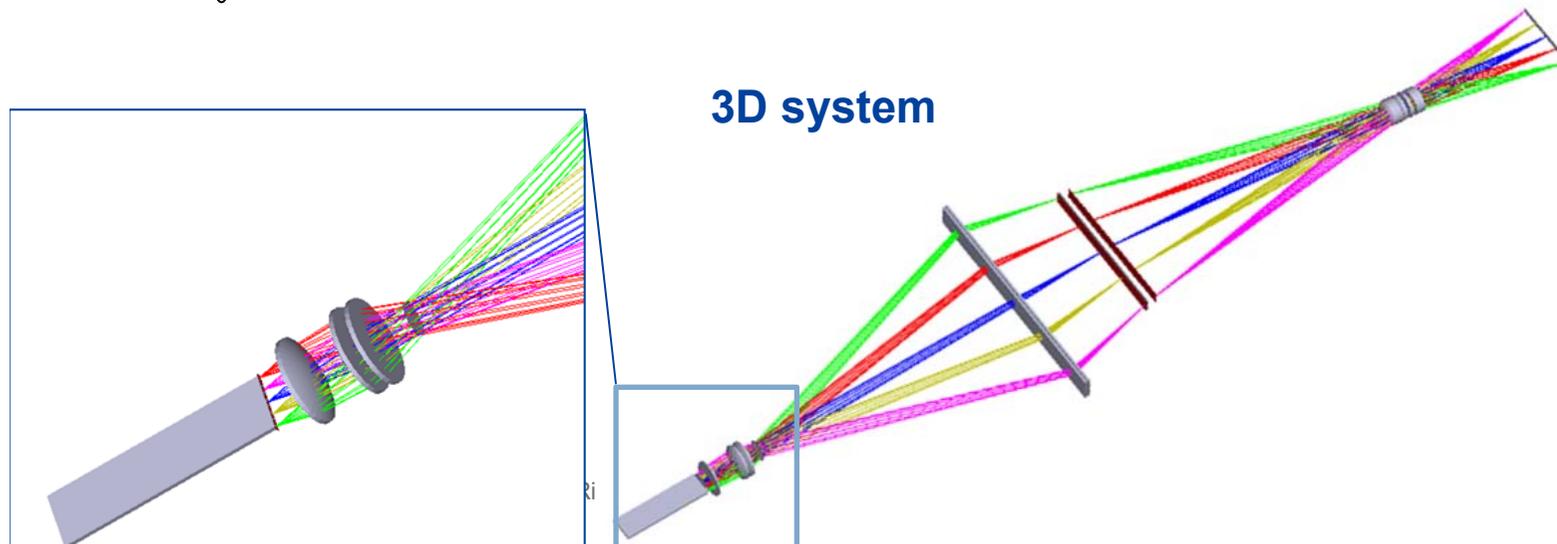
## [YZ-Section]



## [XZ-Section]

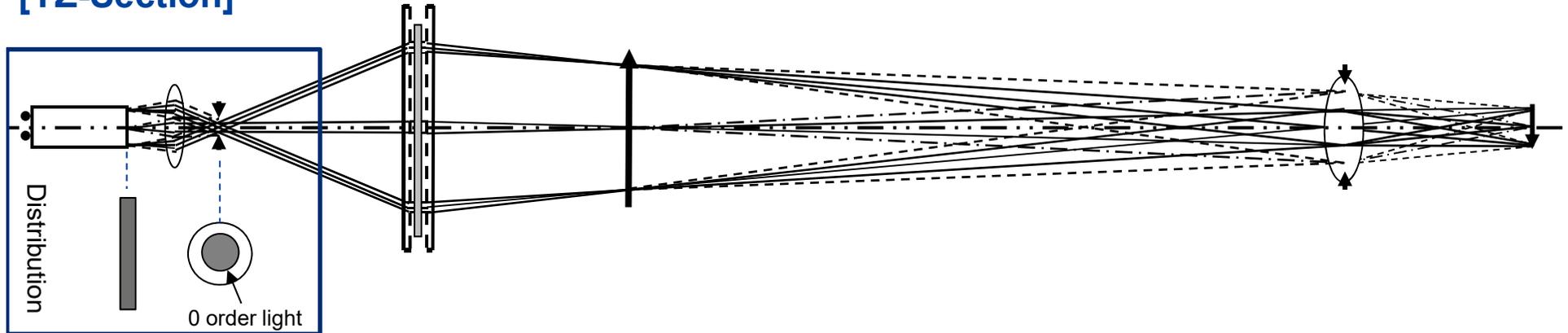


## 3D system



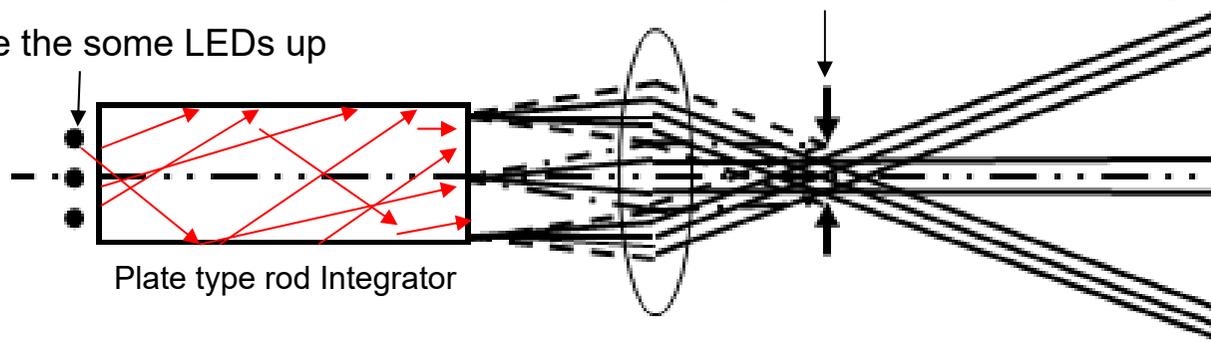
# Principal of Fresnel Illumination System

## [YZ-Section]



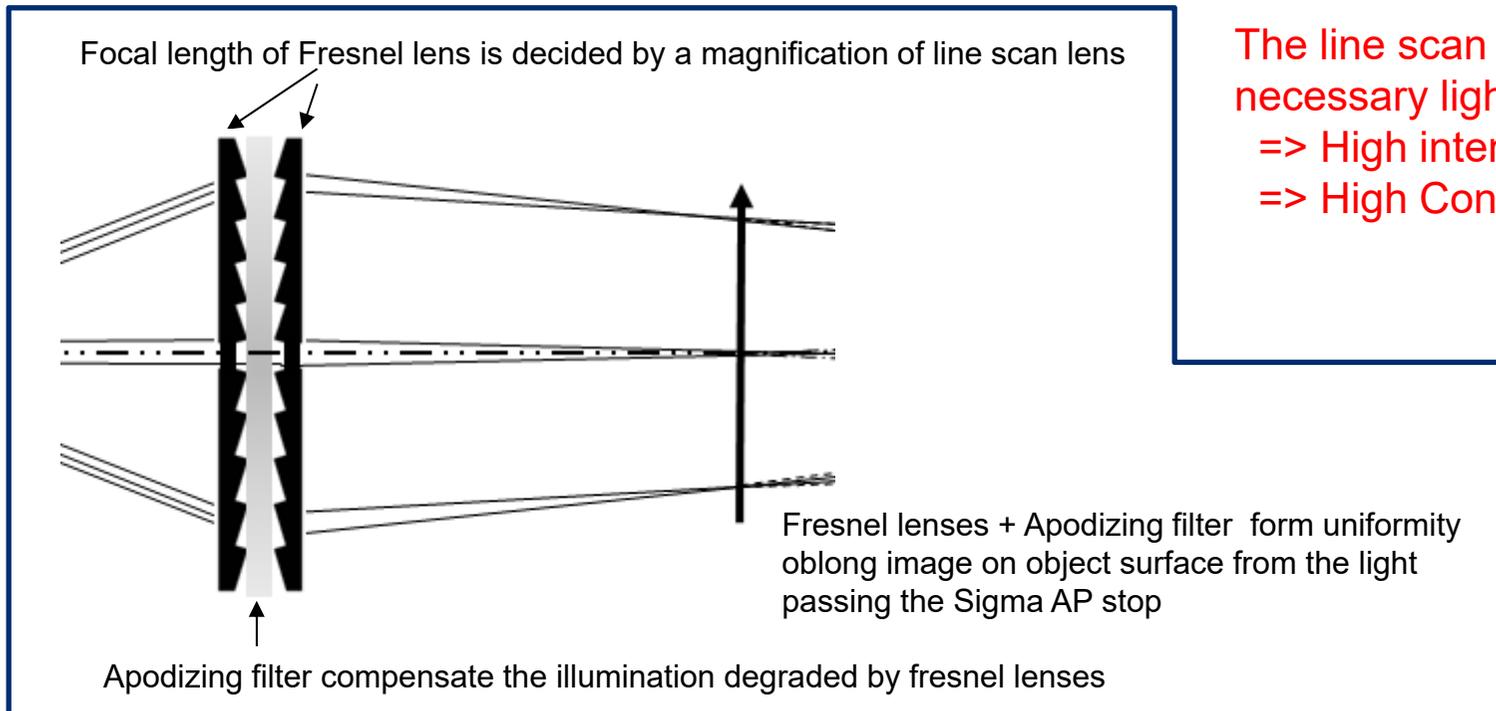
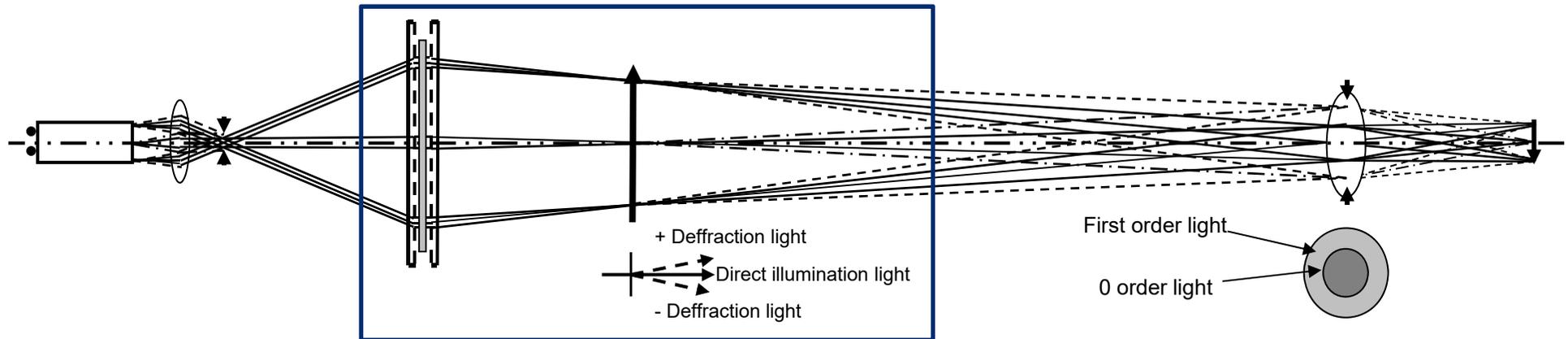
Oblong output light become uniform circle distribution by condenser lenses at **Sigma AP Stop**. -> Control light NA input to master lens

Line the some LEDs up



Get uniformity distribution on oblong output of the prism by reflecting and mixing the light launched from LEDs

# Principal of Fresnel Illumination System



The line scan lens is Input only necessary light for the lens.  
 => High intensity  
 => High Contrast

## Advantages of Fresnel Illumination system

1. Get high intensity light on a line sensor.
  - => Most lights from light source contribute to forming the image of line scan
  - => It is enough to illuminate a system with LED of several Watt.

### **[Comparison with Traditional method]**

Line illumination of fiber diffused light have been used to need high intensity light source as a metal halide lamp of several hundreds Watt.

2. There is no deterioration of the image contrast affected by a flare of illumination because the light coming from object to line lens exist only the lights which contribute to forming the image on line scan camera.

### **[Comparison with Traditional method]**

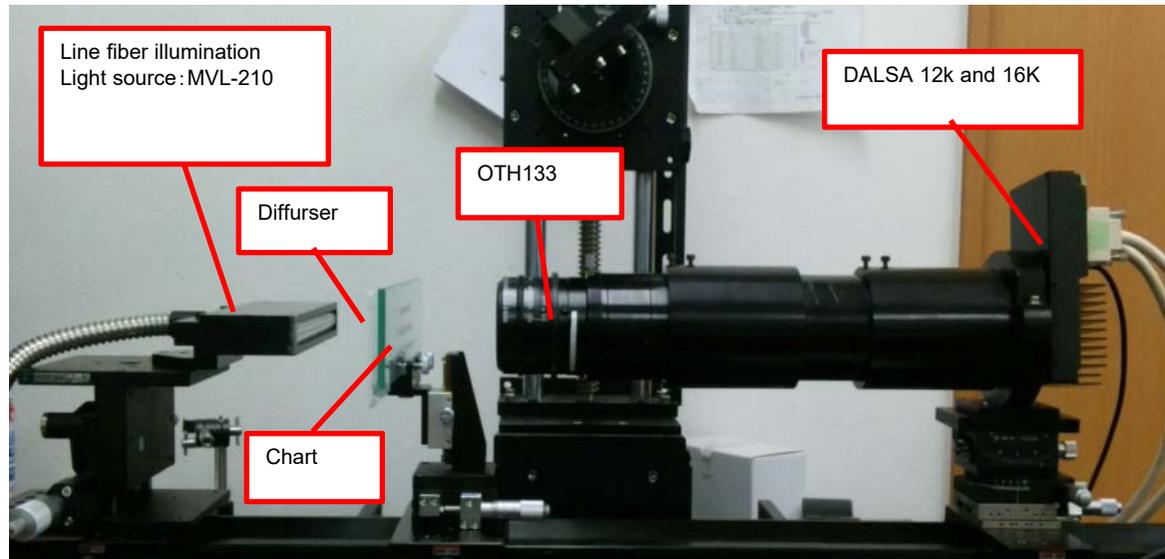
When using Line illumination of fiber diffused light having large NA , there is much flare light which is reflected from housing or lens surface.

3. It's realize the partial coherent illumination in order to conjugate relation between Sigma AP stop and stop of line lens. For example, if Sigma stop is set to small aperture and the center area of the stop of line lens is only illuminated by direct illumination light, it would be partial coherent illumination. The partial coherent illumination have sometimes improvement of about 1.5 times higher resolution and 2.0 times longer depth of focus. This has been used in the illumination of stepper in lithography technology

4. The fresnel illumination is available for a lens of any magnification by changing the focal length of fresnel lens.

# Comparison between Fresnel and Fiber line Illumination 1

Line Fiber illumination system



## Line Lens:

Magnification ; 1.33x

Fno ; 3.8

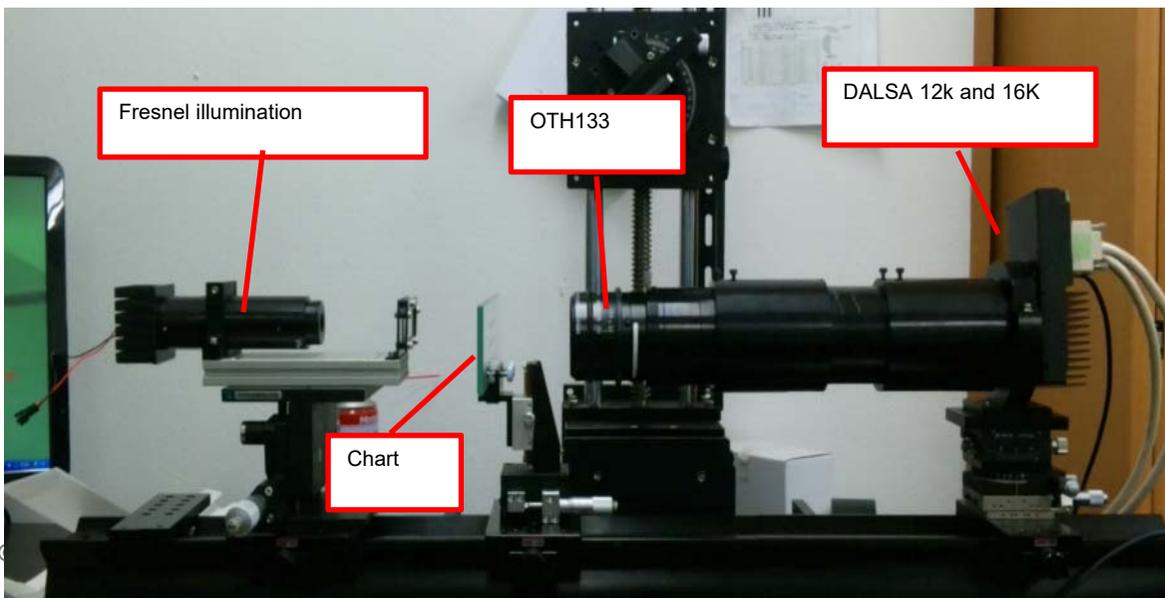
Object NA ; 0.079

Image field ; 62mm

Object field ; 46.6mm

WD ; 125.2mm

Fresnel illumination system



## Camera:

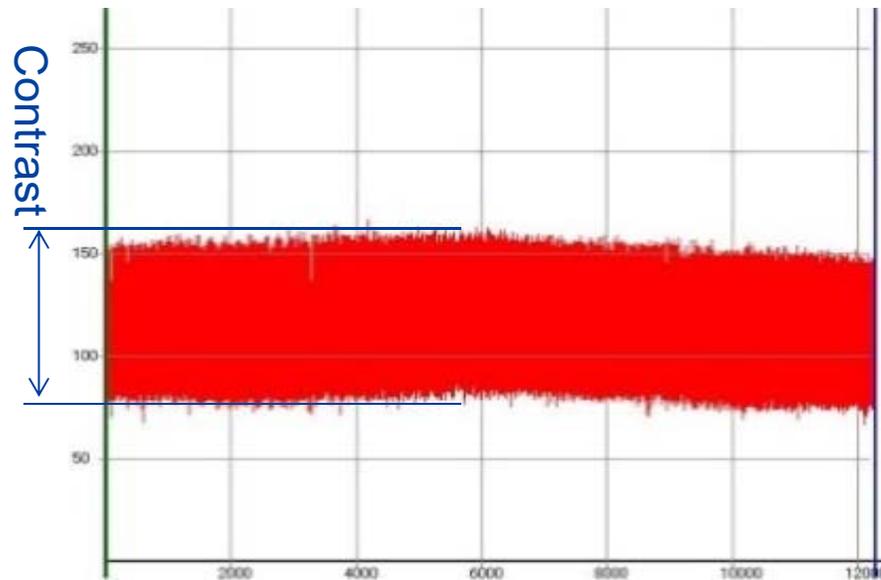
Dalsa 12K5 and 16K3.5

Chart ;

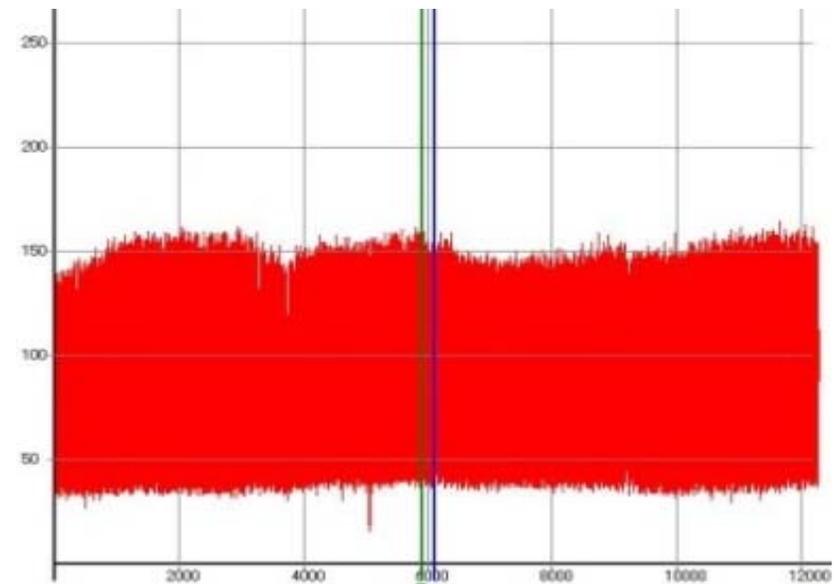
Resolution ; 5um

## Comparison Results (Camera 12K5)

### Fiber illumination



### Fresnel illumination

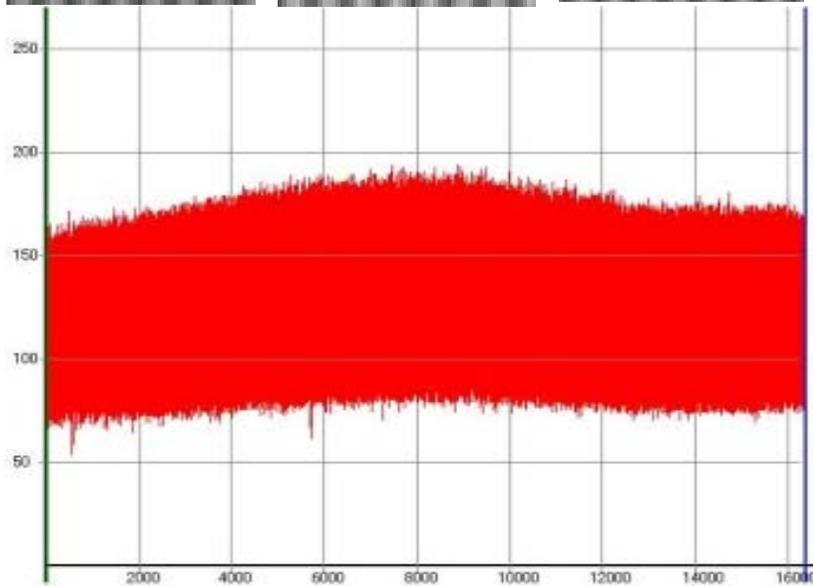


### Contrast

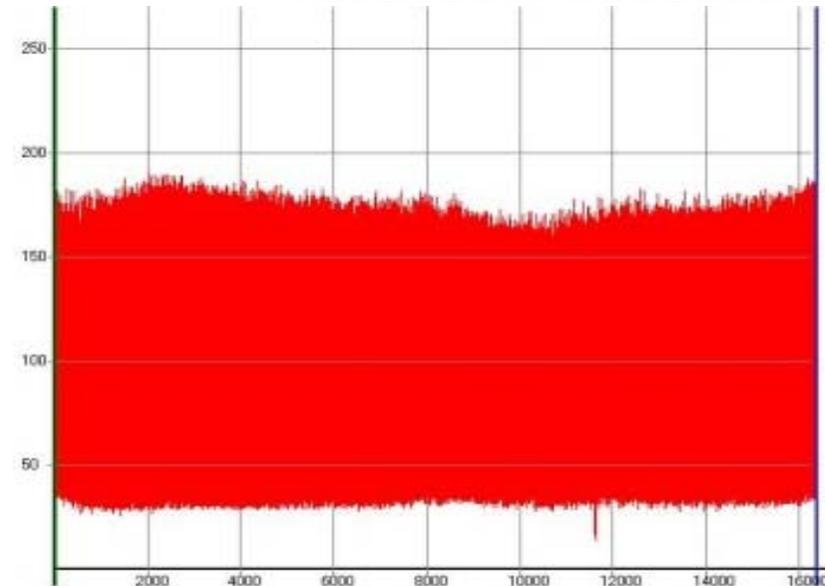
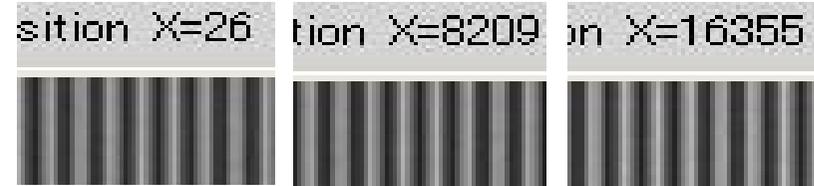
Object=5um (Chart)	L=-30mm	Center	R=+30mm
Fiber Illumination	25%	30%	29%
Fresnel Illumination	55%	56%	56%

## Comparison Results (Camera 16K3.5)

### Fiber illumination



### Fresnel illumination



### Contrast

Object=5um (Chart)	L=-30mm	Center	R=+30mm
Fiber Illumination	37%	37%	36%
Fresnel Illumination	65%	66%	67%