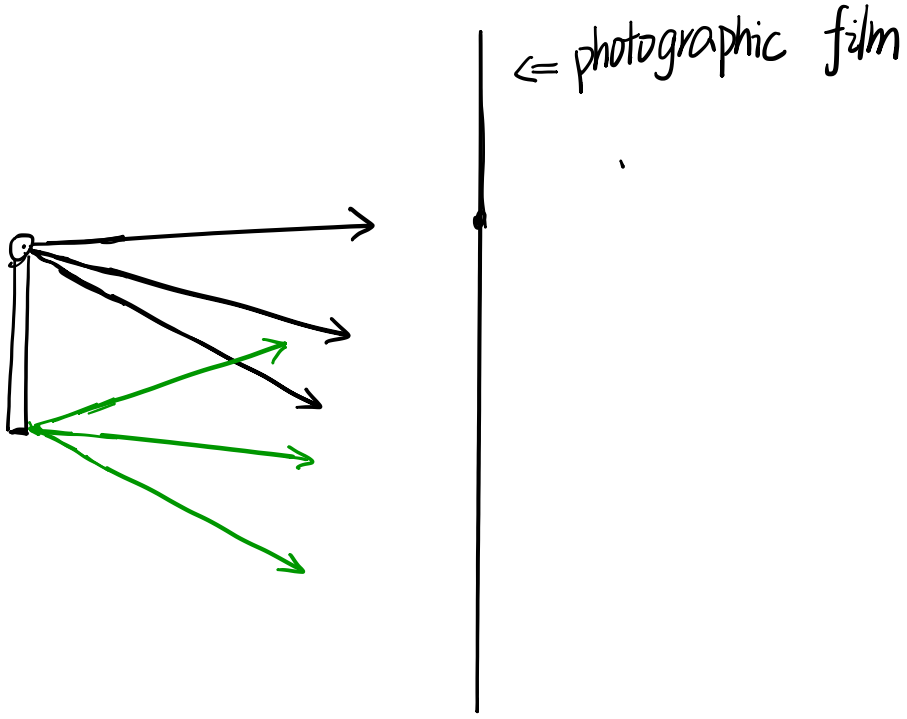
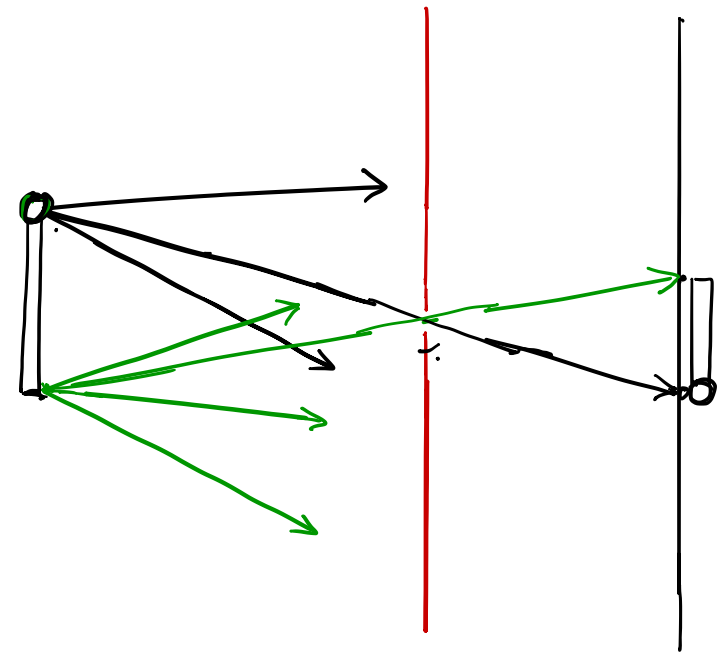
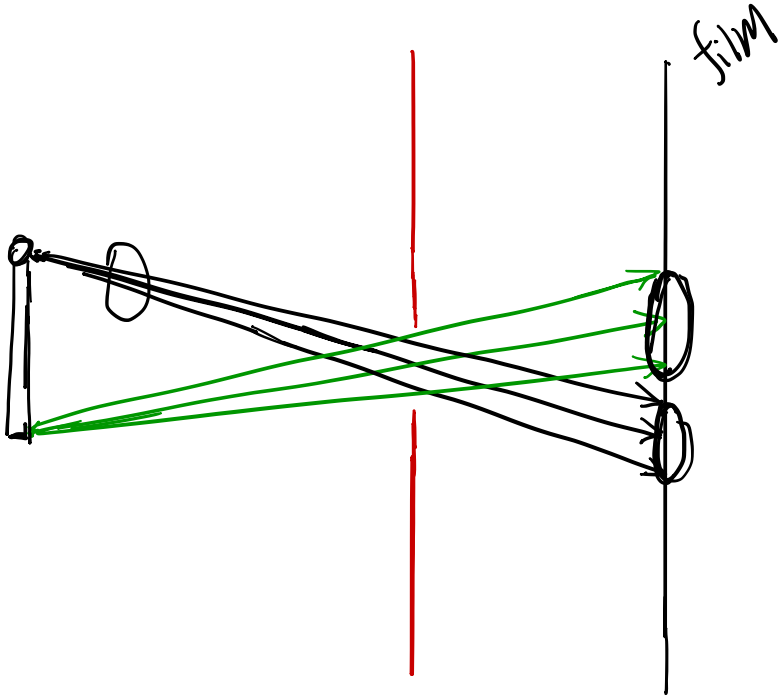
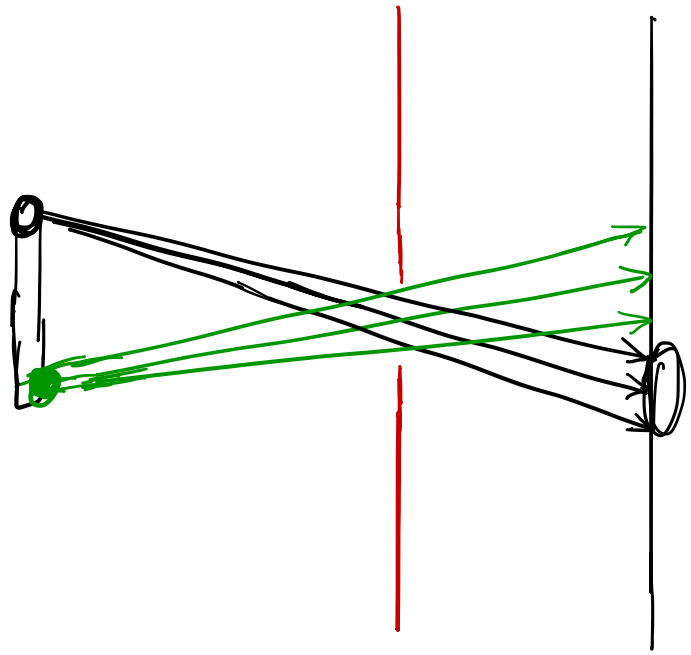

⇐ photographic film

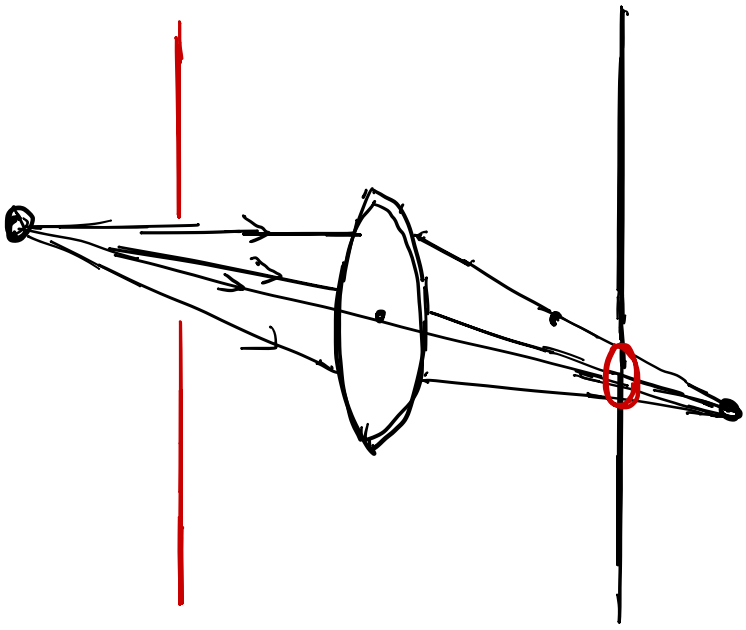
pinhole camera



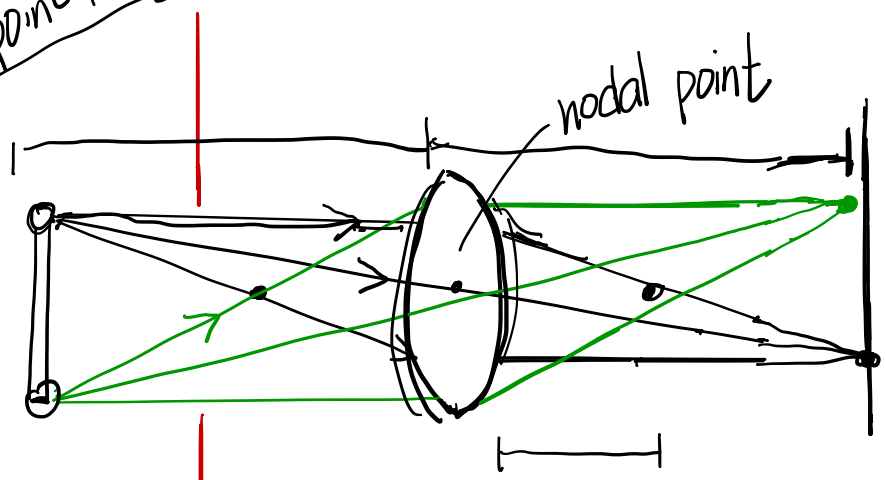


lens:
point source → point image



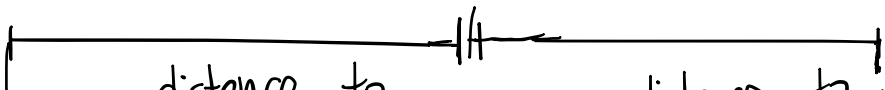


lens:
point source → point image



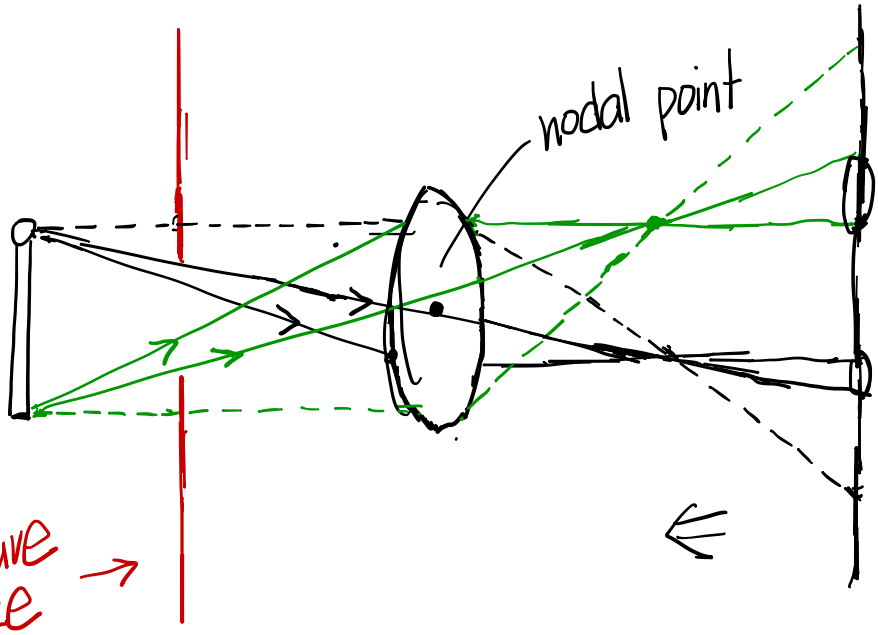
aperture size →

focal length
(power of the length)



distance to object

distance to image plane



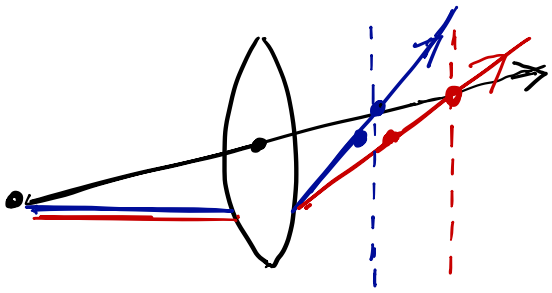
aperture size →

factors determine the quality of image

- Focus Error

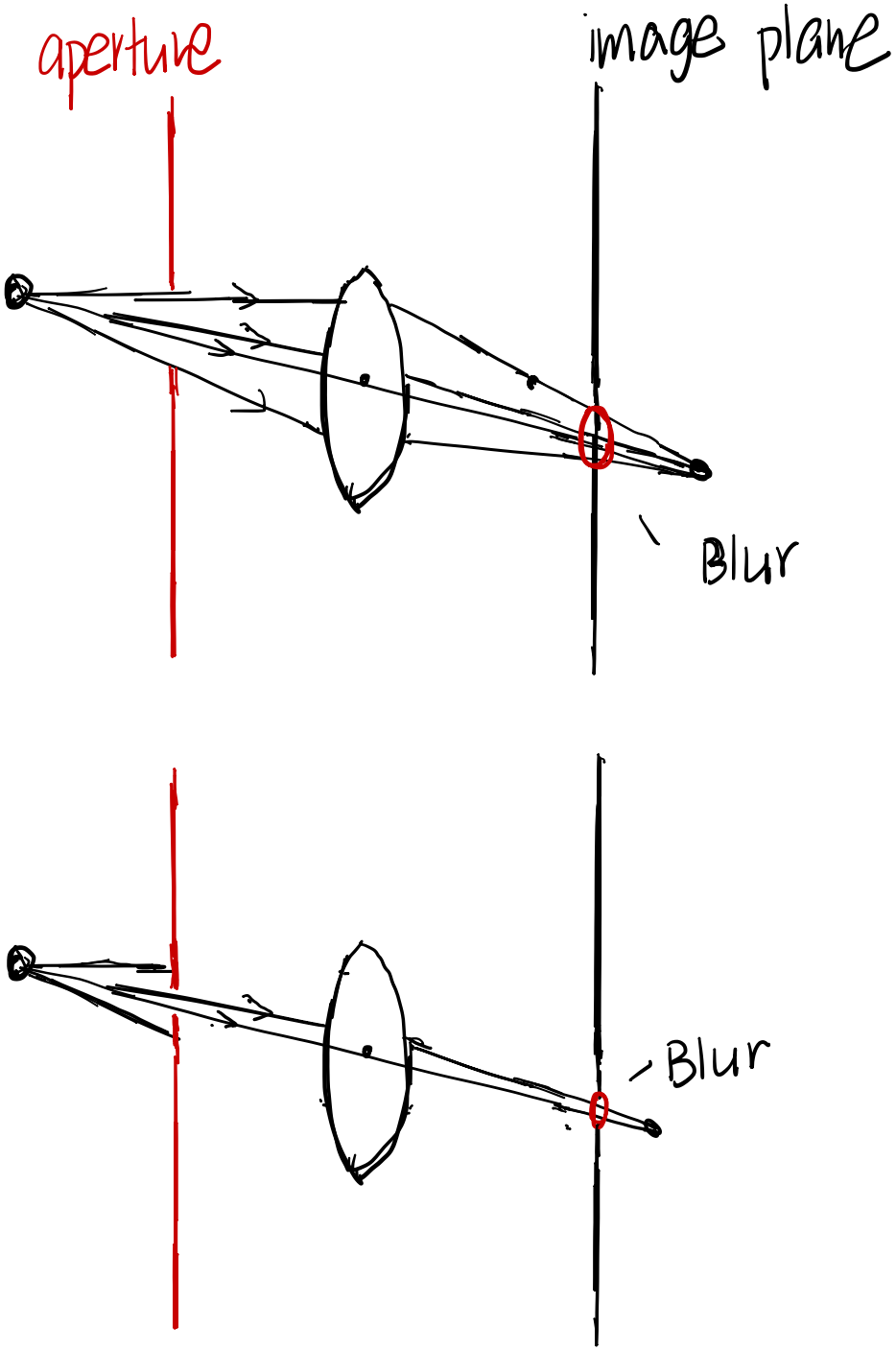
  myopic / hyperopic

- Chromatic Aberration



- Blur miniaturization

  Sharpness Gigantification


aperture
image plane
Blur
Blur

① proportional change

② • focus error / point image

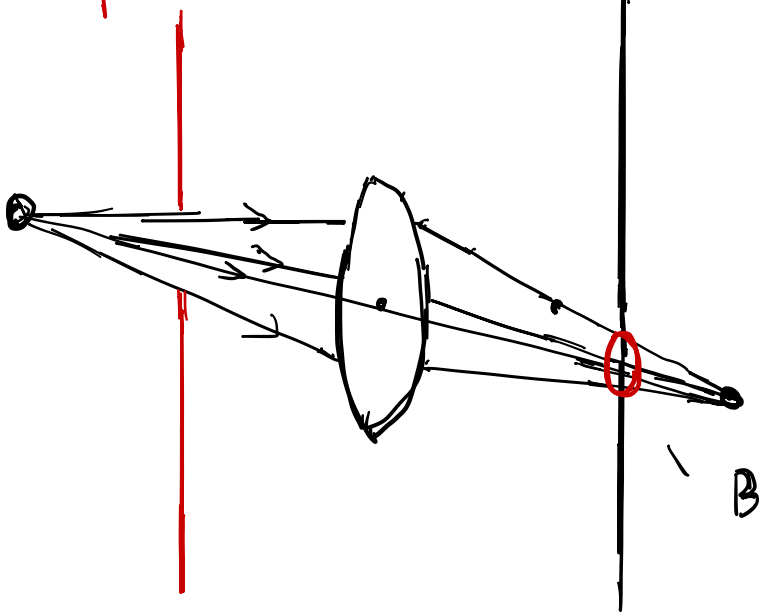
di, do, 1/f

↗ corrective lens

• image quality / "focus"

⇒ aperture

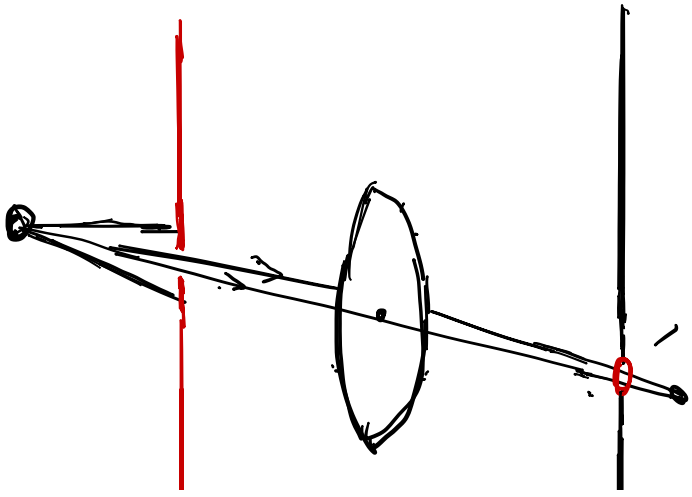
image plane



Blur

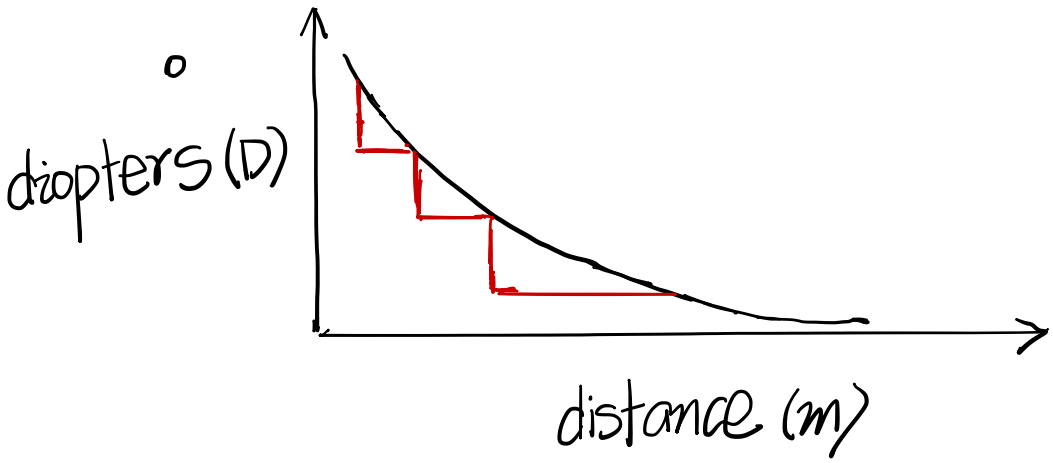
* noise

* diffraction



Blur

③ diopter



- measure defocus
- the power of the lens

④ broadband amplitude

⑤ ↓ aperture
{ amount of noise
diffraction

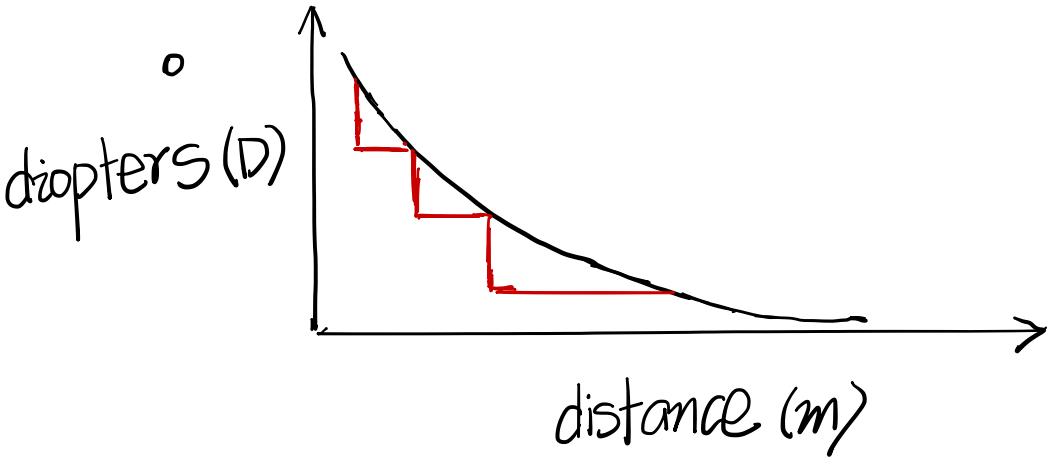
* amplitude spectrum

* combined example

optical blur, chromatic aberration, amplitude spectrum

defocus error (in diopter)

$$\left|\frac{1}{z_0} - \frac{1}{z_1}\right|$$



- optical blur

$$\beta = A\left|\frac{1}{z_0} - \frac{1}{z_1}\right|$$

↑ aperture size (pupil diameter)

↑ magnitude of defocus error