

HORIZONTAL FOCUS: OFF-AXIS TRANSMISSION HOLOGRAPHY

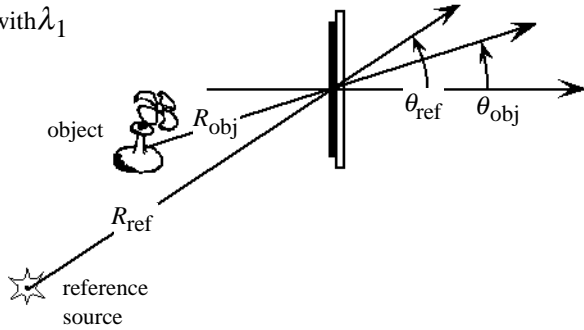
“Direct” or “Forward” Reconstruction:

Illumination angle \approx reference angle, usually $m=+1$, producing a virtual image.

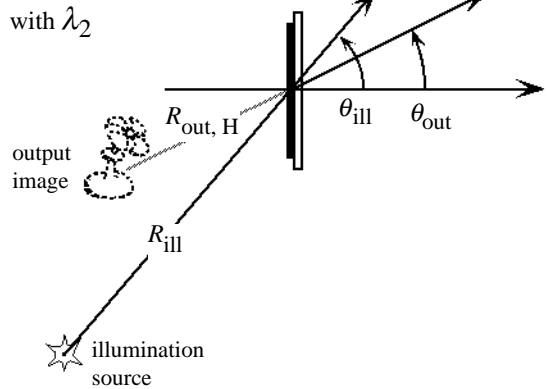
Horizontal focus:

Marginal rays are coming out of the page. Also known as: the “y-focus,” the “parallax focus,” and the “sagittal astigmatic focus.”

EXPOSURE
with λ_1



RECONSTRUCTION
with λ_2



$$\frac{\sin \theta_{out} - \sin \theta_{ill}}{\lambda_2} = m \frac{\sin \theta_{obj} - \sin \theta_{ref}}{\lambda_1}, \quad m = 0, \pm 1, \pm 2, \dots$$

$$\frac{1}{\lambda_2} \left(\frac{1}{R_{out,H}} - \frac{1}{R_{ill}} \right) = m \frac{1}{\lambda_1} \left(\frac{1}{R_{obj}} - \frac{1}{R_{ref}} \right)$$

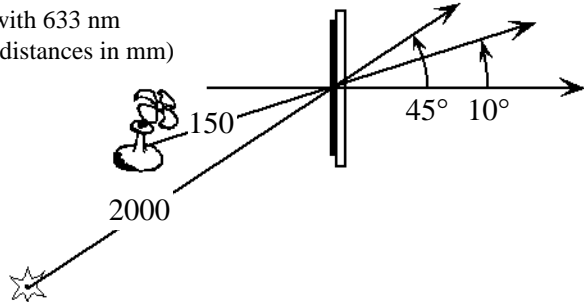
Magnification (usually a virtual image)

$$MAG_{lateral,H} = \frac{width_{image}}{width_{object}} = m \frac{R_{out,H}}{R_{obj}} \frac{\lambda_2}{\lambda_1}$$

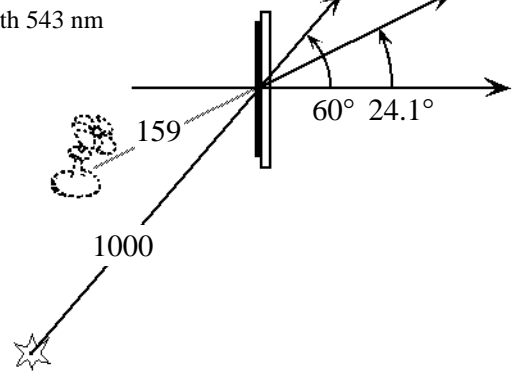
$$MAG_{longitudinal,H} = \frac{depth_{image}}{depth_{object}} = m \frac{\lambda_2}{\lambda_1} \left(\frac{R_{out,H}}{R_{obj}} \right)^2 = \frac{1}{m} \frac{\lambda_1}{\lambda_2} MAG_{lateral,H}^2$$

example:

EXPOSURE
with 633 nm
(distances in mm)



RECONSTRUCTION
with 543 nm



$$MAG_{lateral} = 91\%, \quad MAG_{longitudinal} = 96\%$$

VERTICAL FOCUS: OFF-AXIS TRANSMISSION HOLOGRAPHY

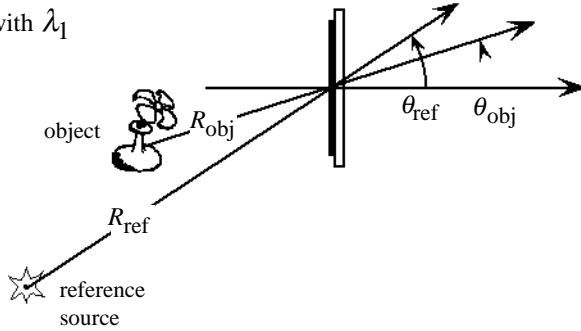
“Direct” or “Forward” Reconstruction:

Illumination angle \approx reference angle, usually $m=+1$, producing a virtual image.

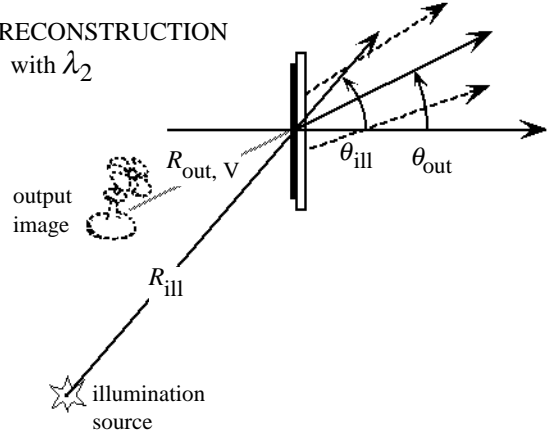
Vertical focus:

Marginal rays are in the plane of the page. Also known as: the “x-focus,” the “color focus,” and the “tangential (or meridional) astigmatic focus.”

EXPOSURE
with λ_1



RECONSTRUCTION
with λ_2



$$\frac{\sin \theta_{out} - \sin \theta_{ill}}{\lambda_2} = m \frac{\sin \theta_{obj} - \sin \theta_{ref}}{\lambda_1}, \quad m = 0, \pm 1, \pm 2, \dots$$

$$\frac{1}{\lambda_2} \left(\frac{\cos^2 \theta_{out}}{R_{out,V}} - \frac{\cos^2 \theta_{ill}}{R_{ill}} \right) = m \frac{1}{\lambda_1} \left(\frac{\cos^2 \theta_{obj}}{R_{obj}} - \frac{\cos^2 \theta_{ref}}{R_{ref}} \right)$$

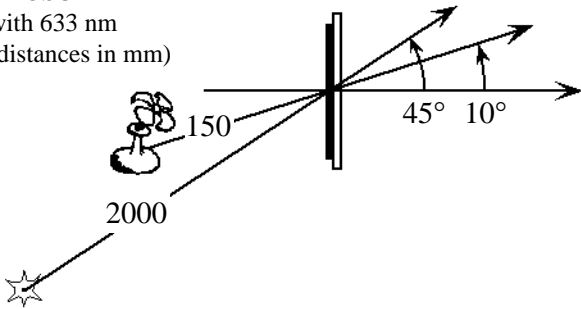
Magnification (usually a virtual image)

$$MAG_{lateral,V} = \frac{width_{image}}{width_{object}} = m \frac{\lambda_2}{\lambda_1} \frac{\cos \theta_{obj}}{\cos \theta_{out}} \frac{R_{out,V}}{R_{obj}}$$

$$MAG_{longitudinal,V} = \frac{depth_{image}}{depth_{object}} = m \frac{\lambda_2}{\lambda_1} \left(\frac{\cos \theta_{obj}}{\cos \theta_{out}} \right)^2 \left(\frac{R_{out,V}}{R_{obj}} \right)^2 = \frac{1}{m} \frac{\lambda_1}{\lambda_2} MAG_{lateral,V}^2$$

example:

EXPOSURE
with 633 nm
(distances in mm)



RECONSTRUCTION
with 543 nm

