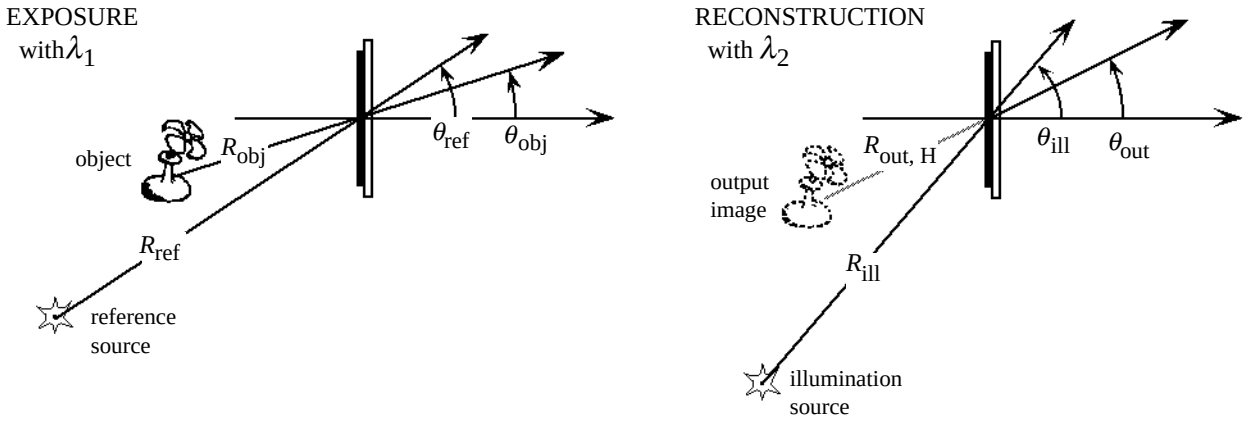
HORIZONTAL FOCUS: OFF-AXIS TRANSMISSION HOLOGRAPHY

"Direct" or "Forward" Reconstruction:

Illumination angle ≈ 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."



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

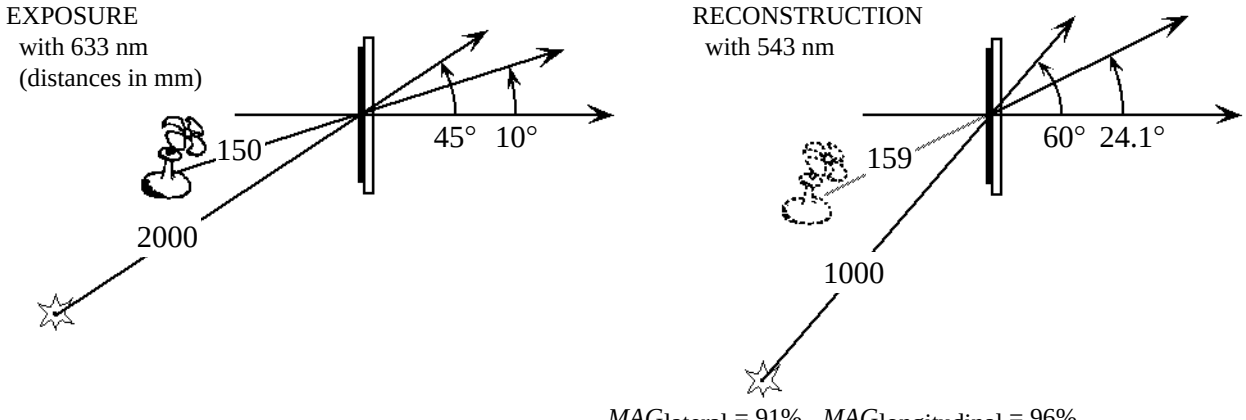
$$\frac{1}{\lambda_2}\left(\frac{1}{R_{out,H}} - \frac{1}{R_{ill}}\right) = m\frac{1}{\lambda_1}\left(\frac{1}{R_{obj}} - \frac{1}{R_{ref}}\right)$$

Magnification (usually a virtual image)

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

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

example:



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

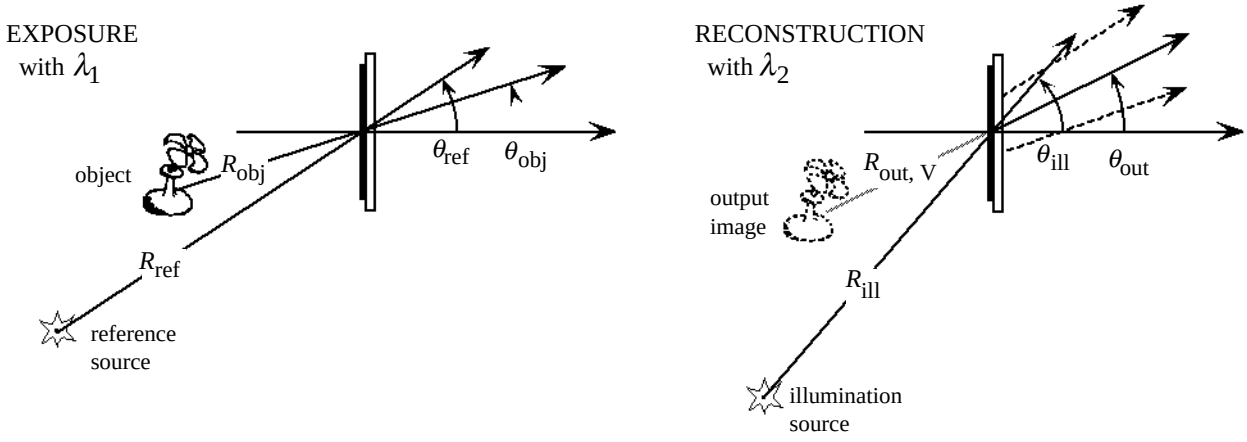
VERTICAL FOCUS: OFF-AXIS TRANSMISSION HOLOGRAPHY

"Direct" or "Forward" Reconstruction:

Illumination angle ≈ 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."



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

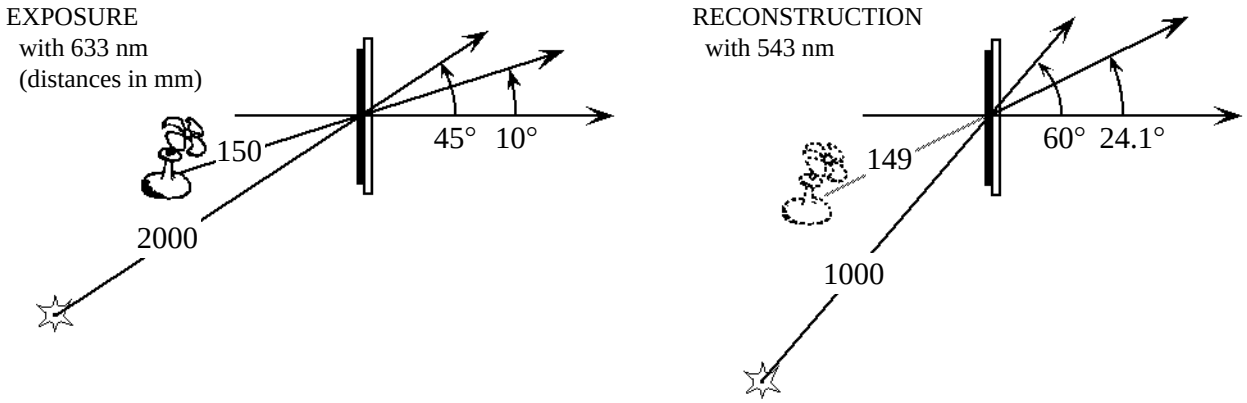
$$\frac{1}{\lambda_2}\left(\frac{\cos^2\theta_{out}}{R_{out,V}} - \frac{\cos^2\theta_{ill}}{R_{ill}}\right) = m\frac{1}{\lambda_1}\left(\frac{\cos^2\theta_{obj}}{R_{obj}} - \frac{\cos^2\theta_{ref}}{R_{ref}}\right)$$

Magnification (usually a virtual image)

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

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

example:



$MAG_{lateral}$ = 92%, $MAG_{longitudinal}$ = 99%