

# Cube - Gaussian Imagery

50 mm cube

a)  $f_F = -200$  mm       $f_R' = 300$  mm      (Positive Lens)

$z_0 = -500$  mm      ← center

$z_L = -525$  mm

$z_R = -475$  mm

$l_0 = l_L = l_R = 50$  mm

$$m = \frac{-f_F}{z - f_F}$$

$$z' = (1 - m) f_R'$$

$m_0 = -.667$

$z'_0 = 500$  mm

$l'_0 = 33.3$  mm

$m_L = -.615$

$z'_L = 485$  mm

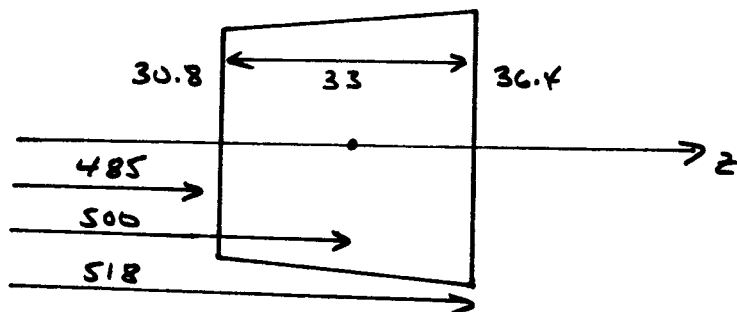
$l'_L = 30.8$  mm

$m_R = -.727$

$z'_R = 518$  mm

$l'_R = 36.4$  mm

A cross-section through the cube image is a trapezoid:



Note that the use of the average magnification  $m_0$  and the longitudinal mag  $\bar{m} = l_0 m_0^2$  is only an approximation. It would not show the distortion of the cube.

b)  $f_F = 300 \text{ mm}$  .  $f'_R = -200 \text{ mm}$  (Negative Lens)

$$z_0 = -500 \text{ mm}$$

$$z_L = -525 \text{ mm}$$

$$l_0 = l_L = l_R = 50 \text{ mm}$$

$$z_R = -475 \text{ mm}$$

$$m = \frac{-f_F}{z - f_F}$$

$$z' = (1-m)f'_R$$

$$m_0 = .375$$

$$z'_0 = -125 \text{ mm}$$

$$l'_0 = 18.75 \text{ mm}$$

$$m_L = .364$$

$$z'_L = -127 \text{ mm}$$

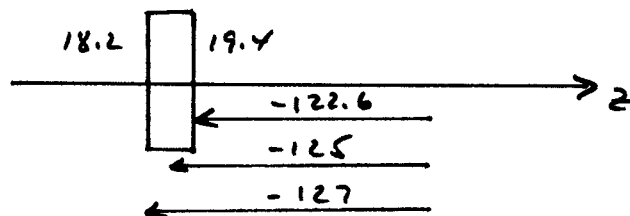
$$l'_L = 18.2 \text{ mm}$$

$$m_R = .387$$

$$z'_R = -122.6 \text{ mm}$$

$$l'_R = 19.4 \text{ mm}$$

A virtual image is produced:



Note that in parts a) and b) the lines representing the top and bottom of the cube image converge to the rear focal point of the system.

c) A focal system with  $m = -1/2$

$$m = -1/2$$

$$\bar{m} = b_1 b_2 m^2$$

Assume  $b_1, b_2 = 1$

$$\bar{m} = 1/4$$

The cross-section of the cube becomes a rectangle:

