FIGURE 1

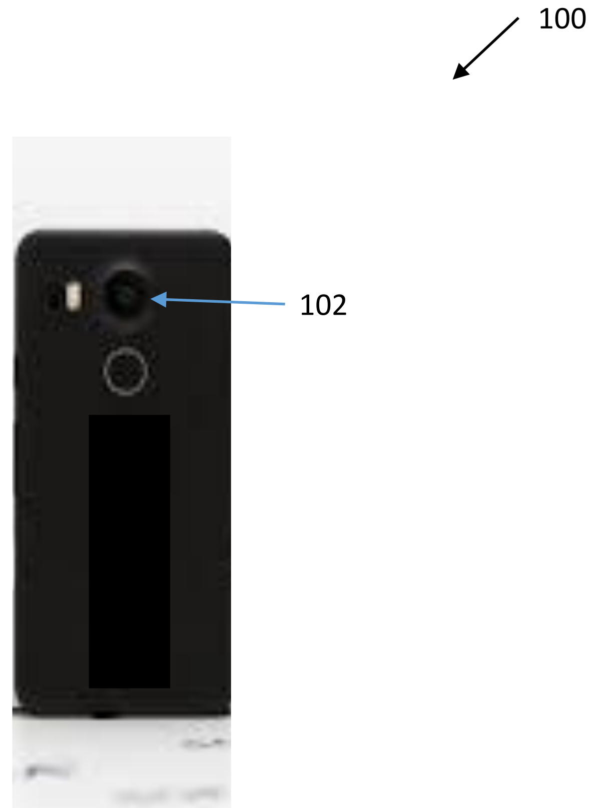


FIGURE 2A

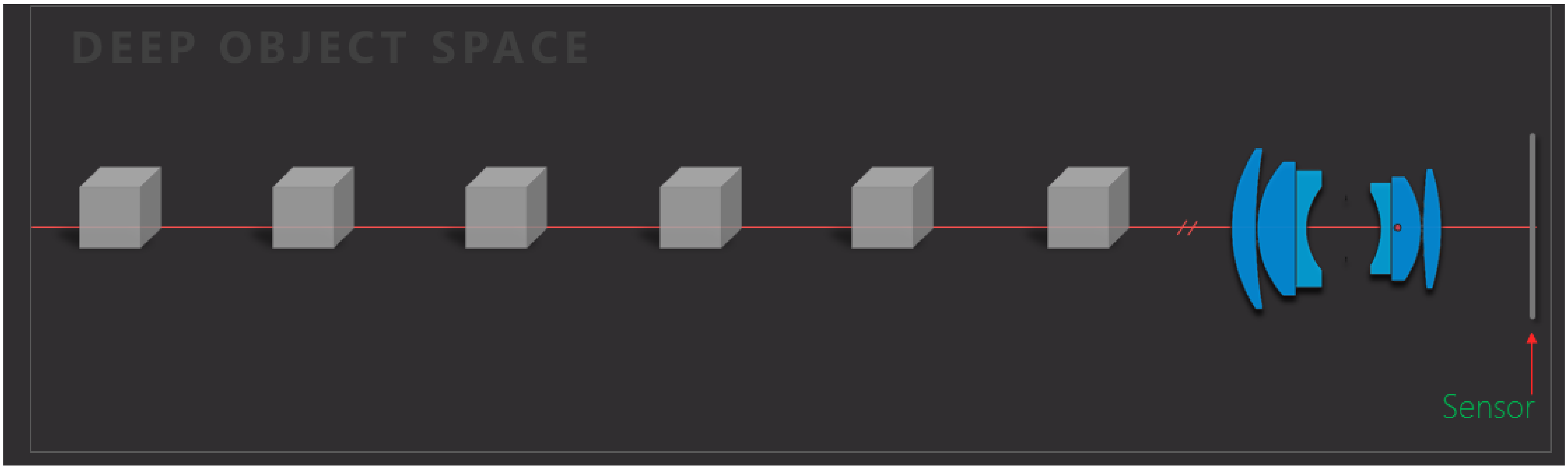


FIGURE 2B

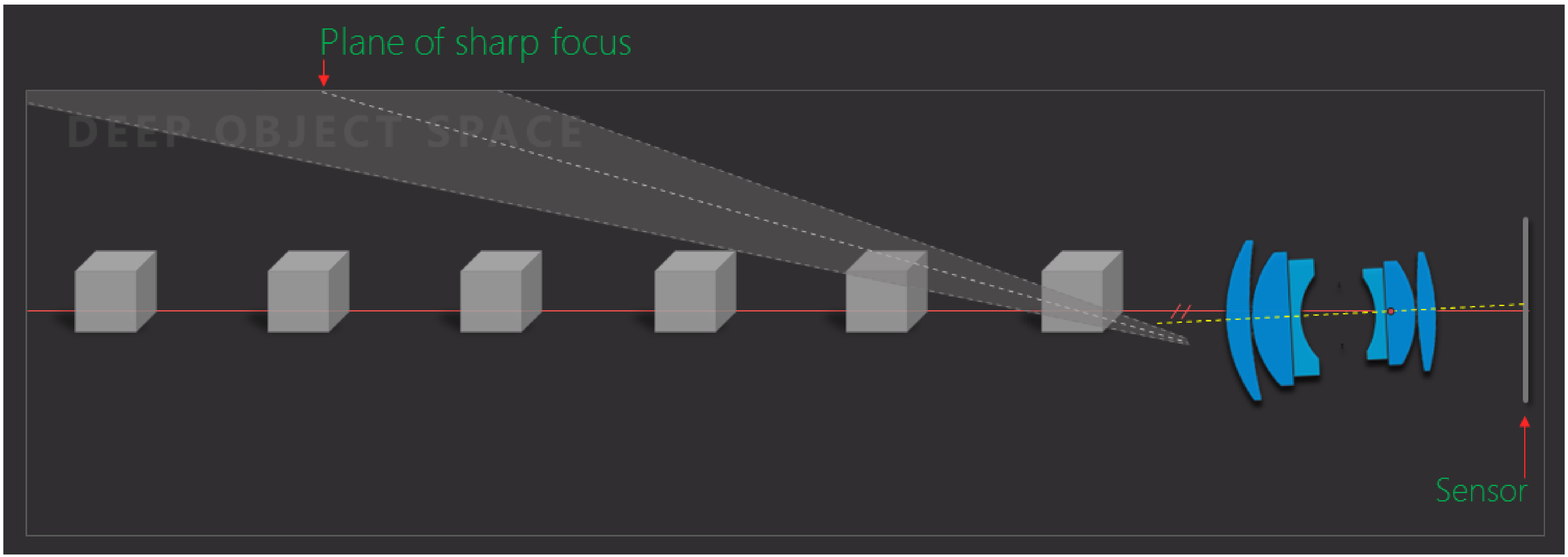


FIGURE 2C

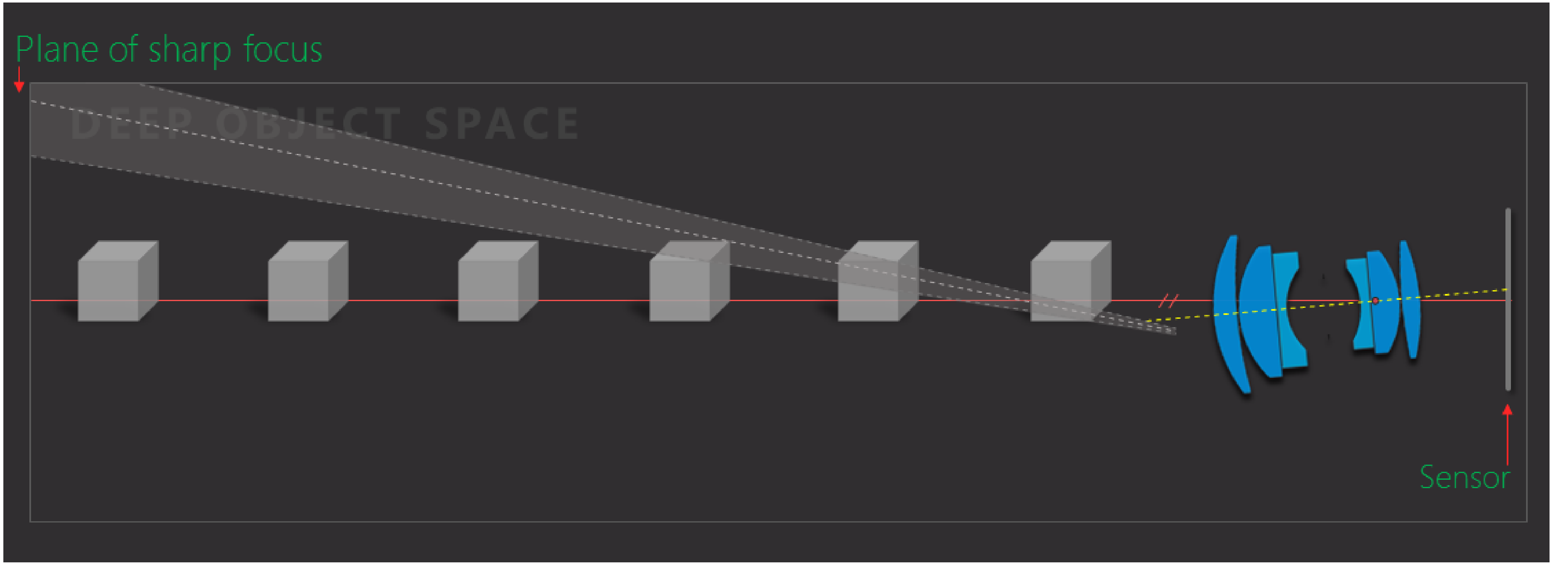


FIGURE 2D

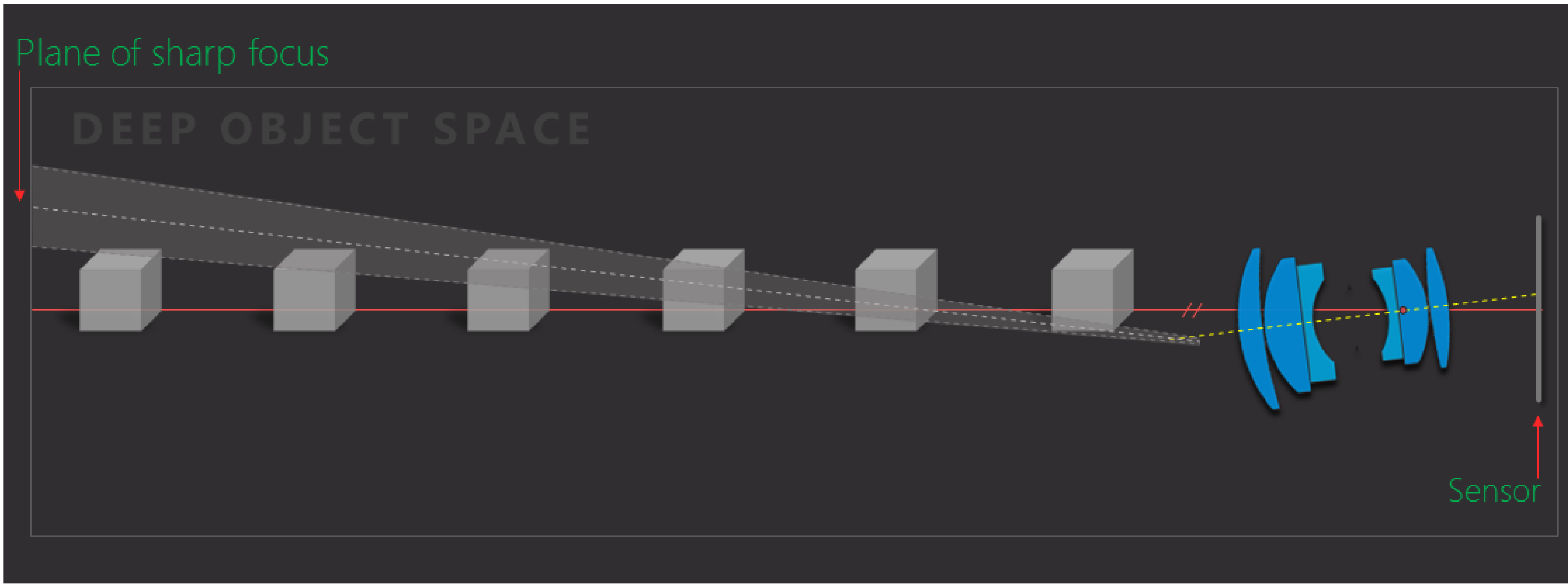


FIGURE 2E

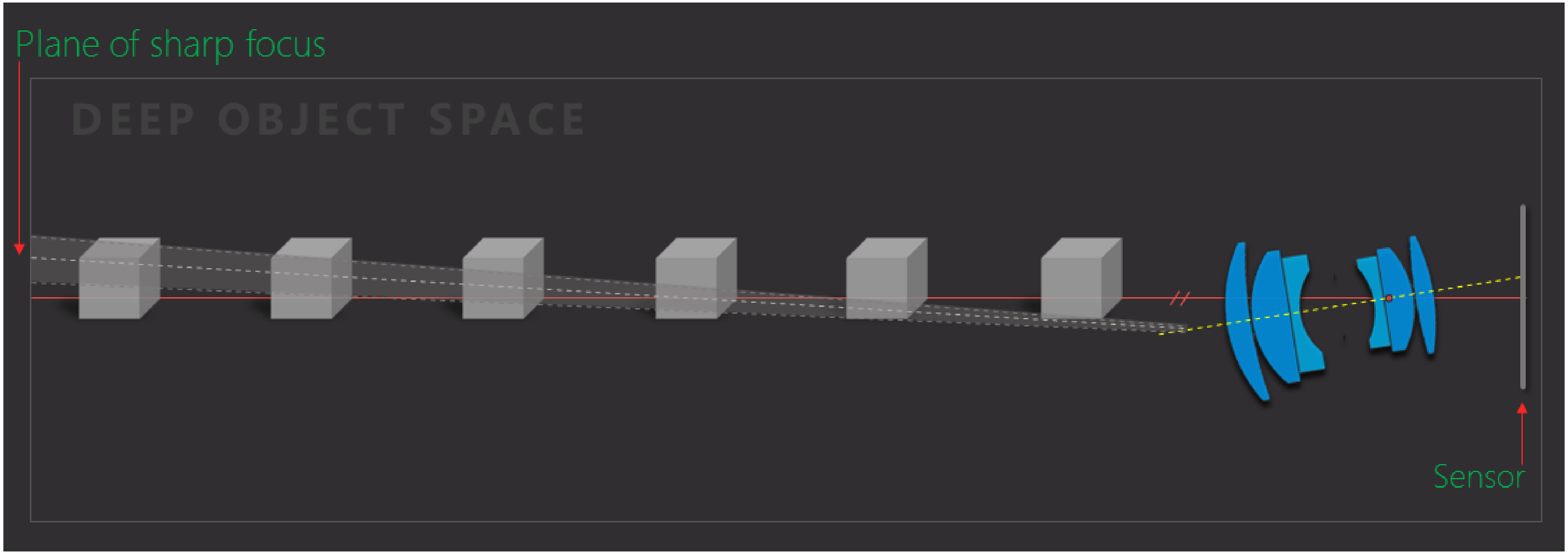


FIGURE 2F

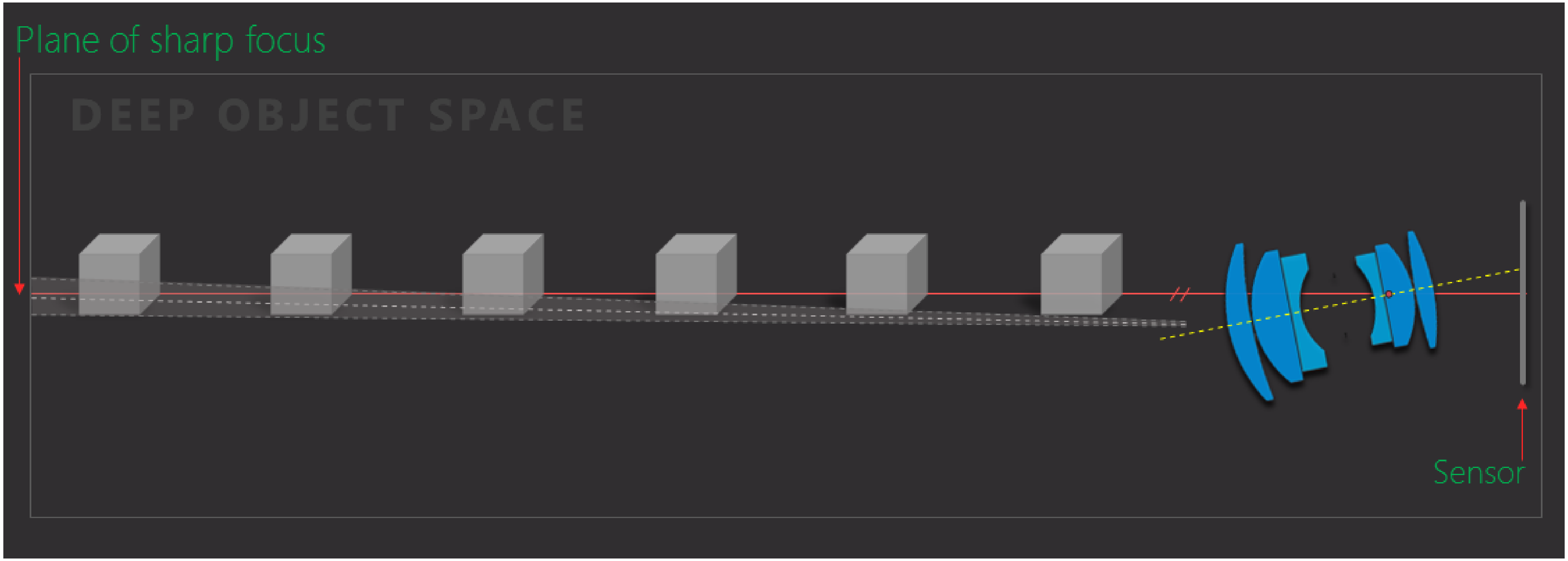
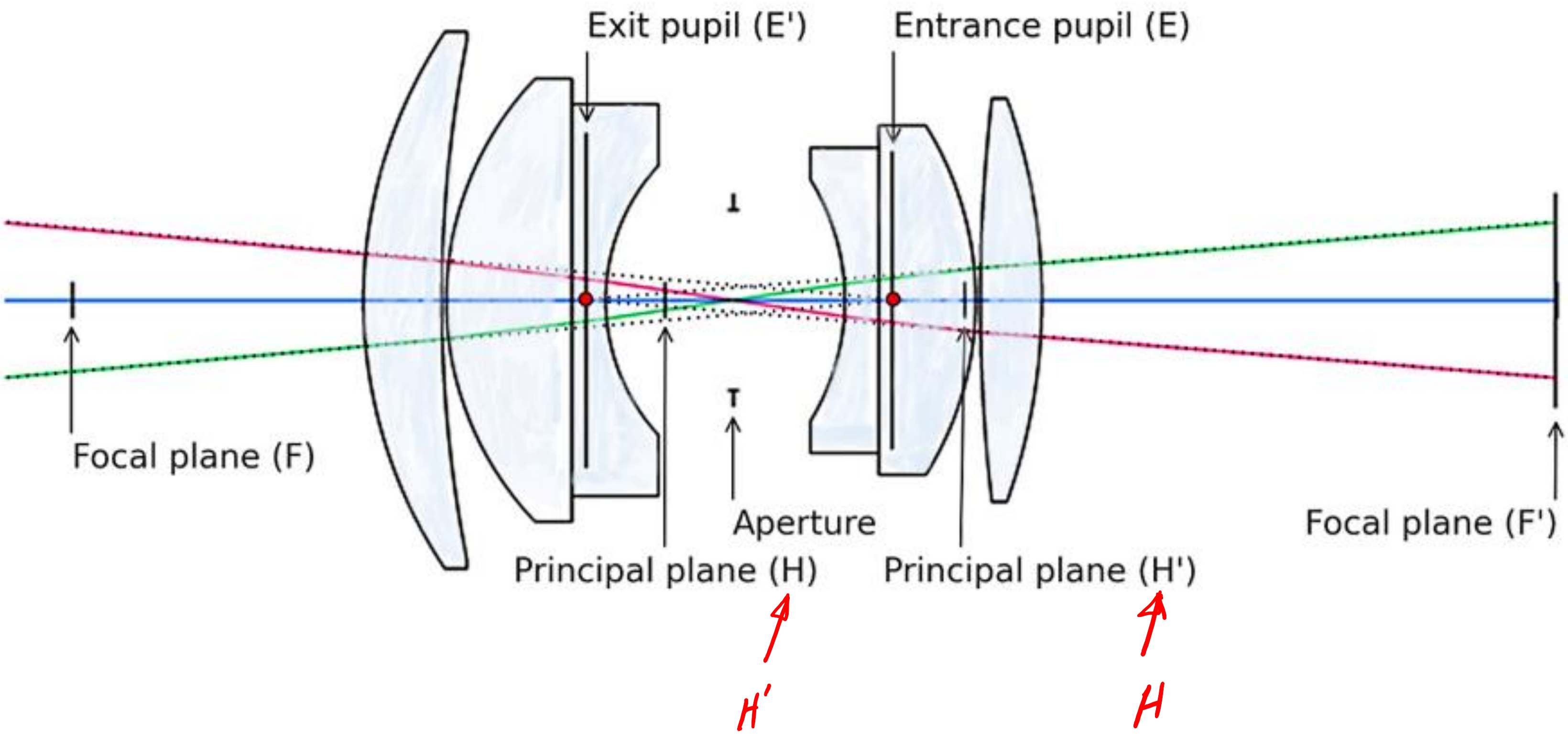
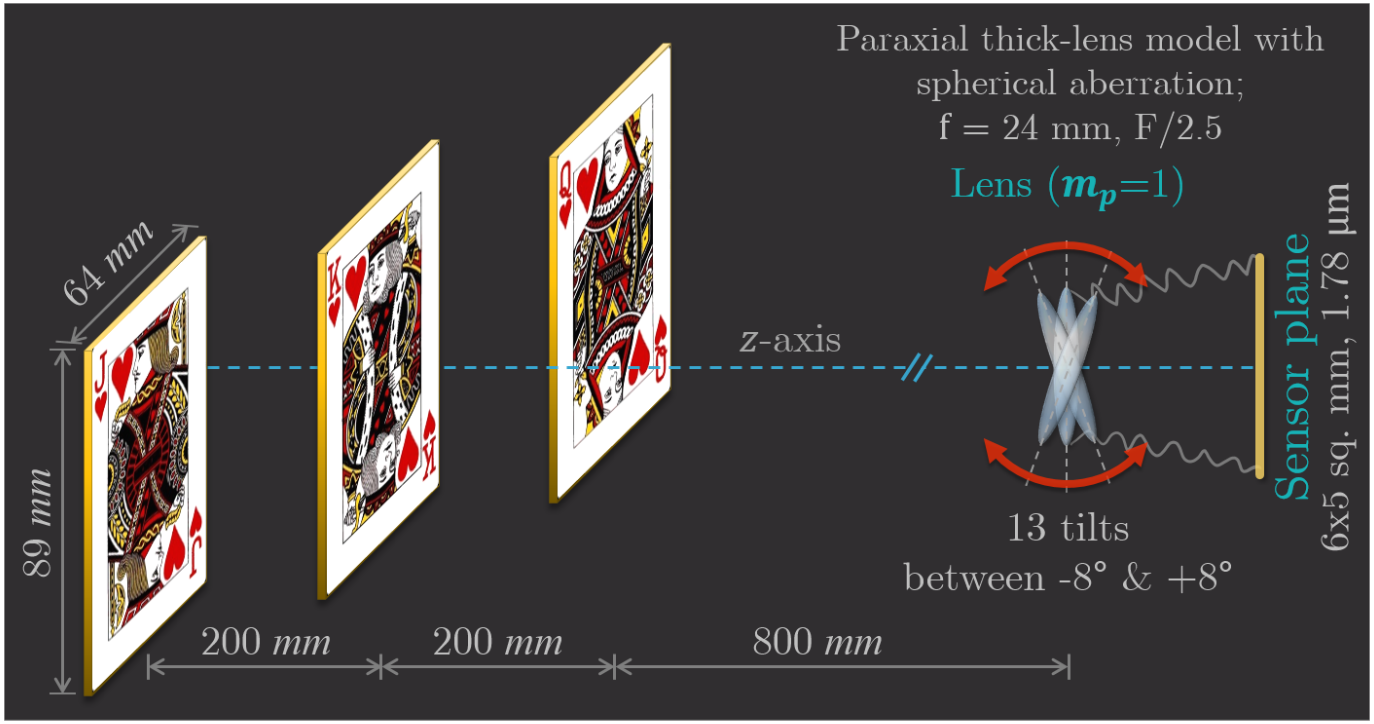


FIGURE 3



(please use the new figure)

FIGURE 4



Paraxial thick-lens model with
spherical aberration;
f = 24 mm, F/2.5
Lens (m_p=1)
64 mm
89 mm
z-axis
Sensor plane
6x5 sq. mm, 1.78 μm
13 tilts
between -8° & +8°
200 mm
200 mm
800 mm

FIGURE 5

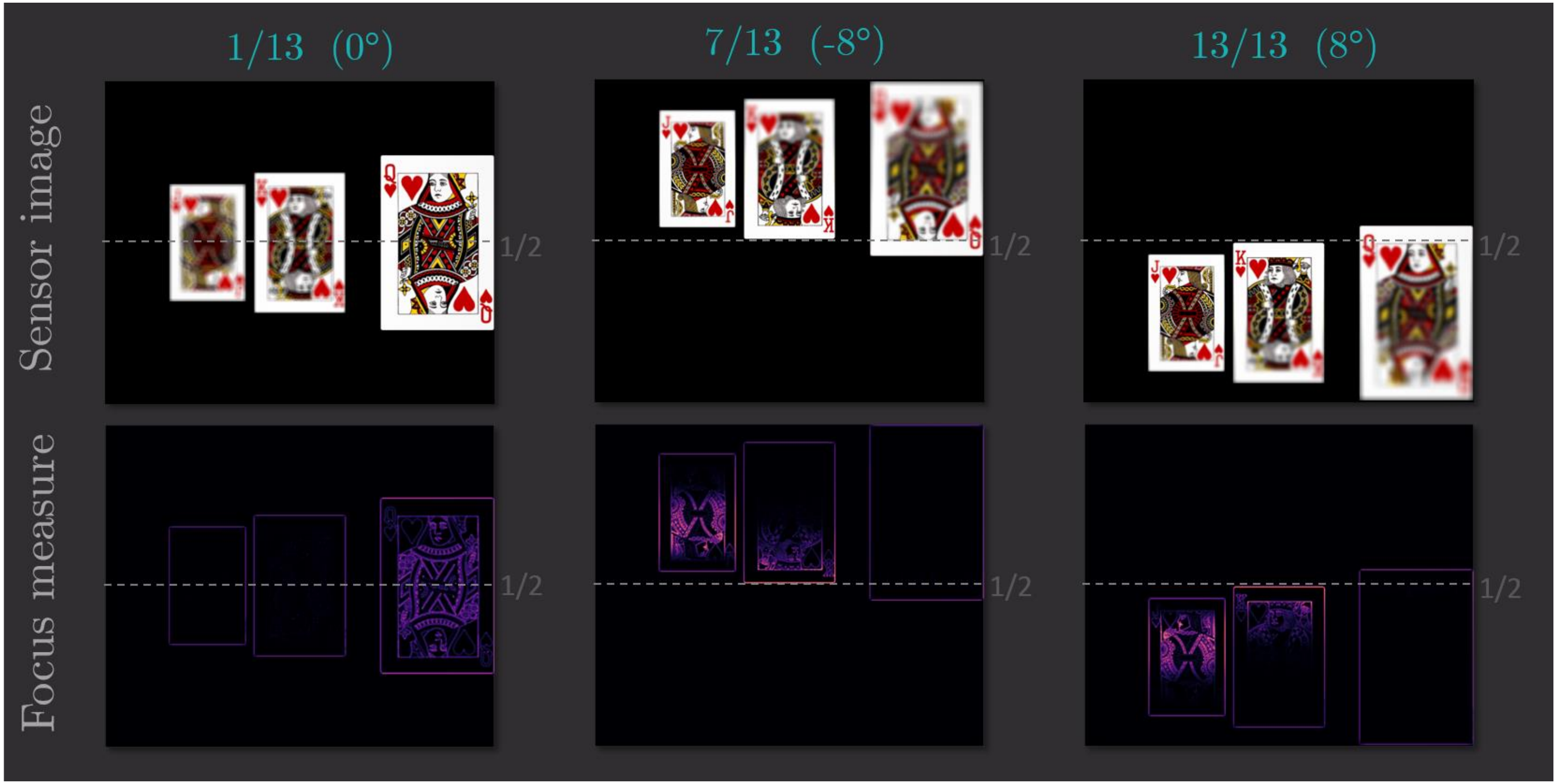
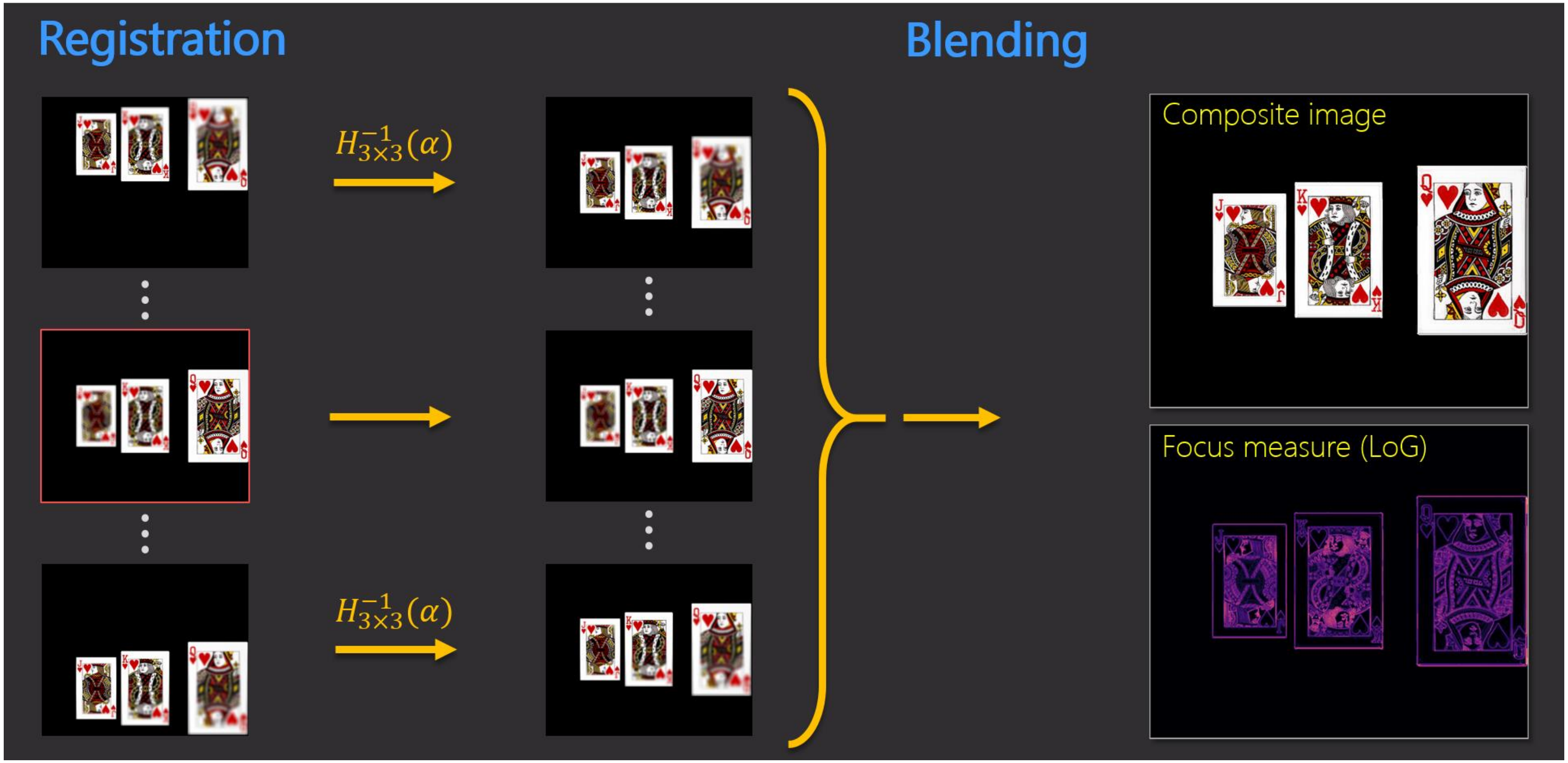


FIGURE 6

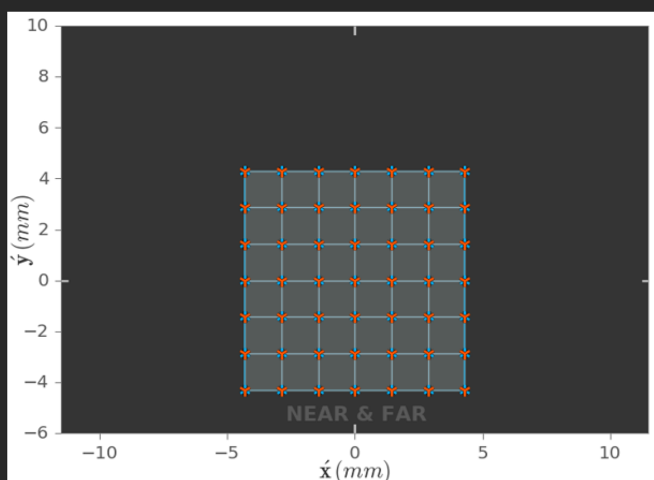


Registration
Blending
$H_{3\times3}^{-1}(\alpha)$
$H_{3\times3}^{-1}(\alpha)$
Composite image
Focus measure (LoG)

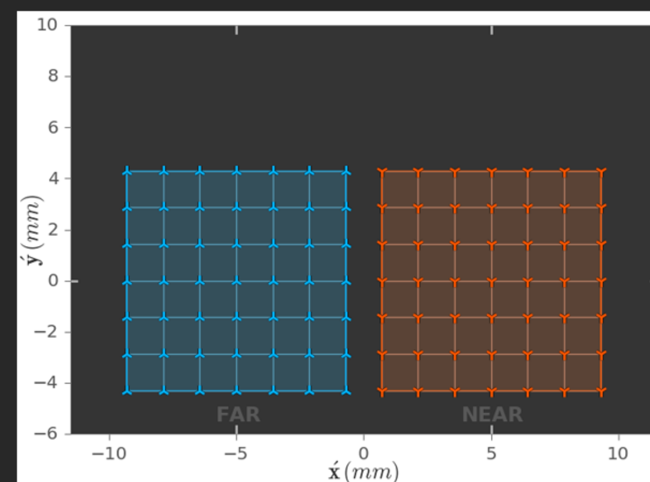
FIGURE 7

Two planes in the object space, such that projected images are of equal size in frontoparallel configuration:

- Near plane dimension: 88.15 *mm*, each side
- Far plane dimension: 178.30 *mm*, each side (Far plane sides are twice the near plane sides)
- Near plane distance ($z_e{}^*$): - 535.6 *mm* (m_p=0.55), - 516.0 mm (m_p=1.0), - 504.0 mm (m_p=2)
- Far plane dimension ($z_e{}^*$): -1071.3 *mm* (m_p=0.55), -1032.0 mm (m_p=1.0), -1008.0 mm (m_p=2)



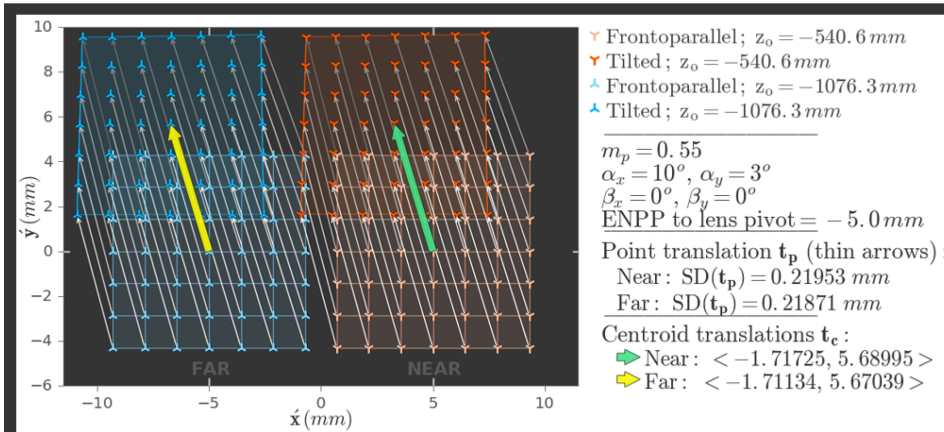
Coincident images of the two planes in frontoparallel configuration.



The images separated horizontally for visual clarity.

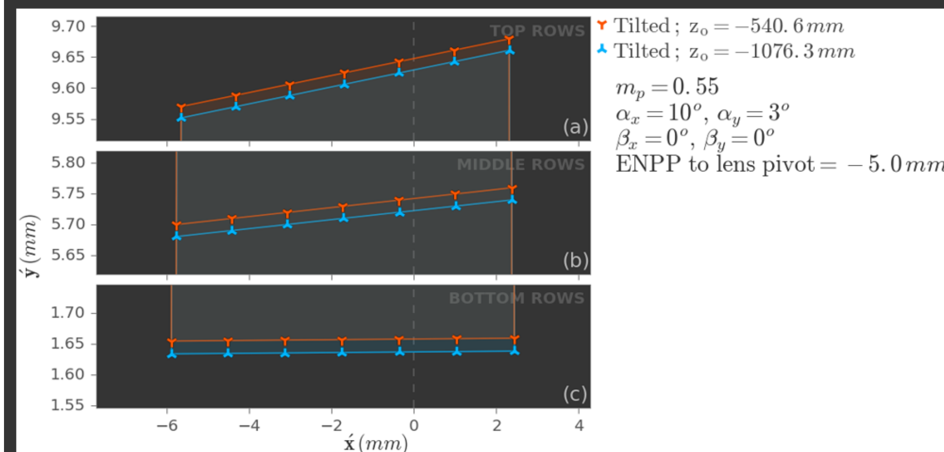
* z_e is the object distance from the ENPP; $z_o = z_e + d_e$

FIGURE 8



Shift of image field under lens rotation with pivot away from the ENPP; $m_p = 0.55$

The amount of shift of the image field depends on object distance z_o. The standard deviation of the translation vector lengths for the two sets of points from the two planes are different. Also, the centroid of group of points from the two planes shift by different amounts.

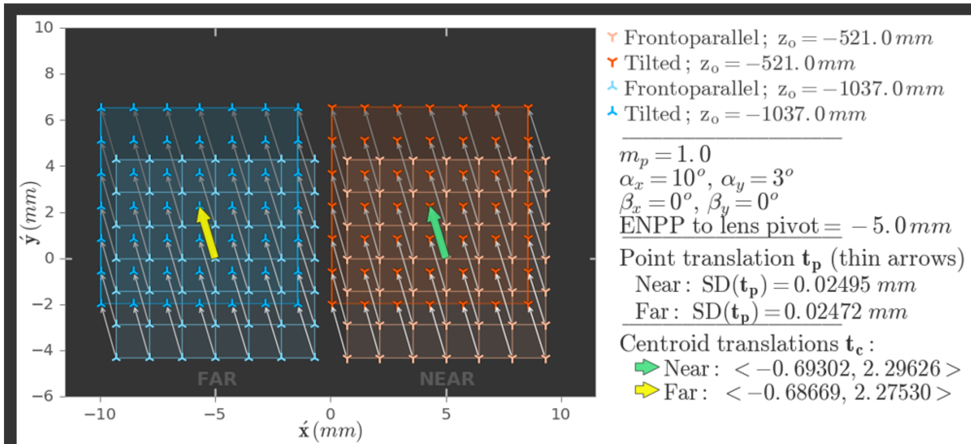


The top, middle and bottom rows of the grid of dots images of the two planes. The difference in the shift of the three rows implies that the distortion is NOT independent of object distance. i.e. lens rotation away from the ENPP introduces parallax.

Homography (dependent on Z):

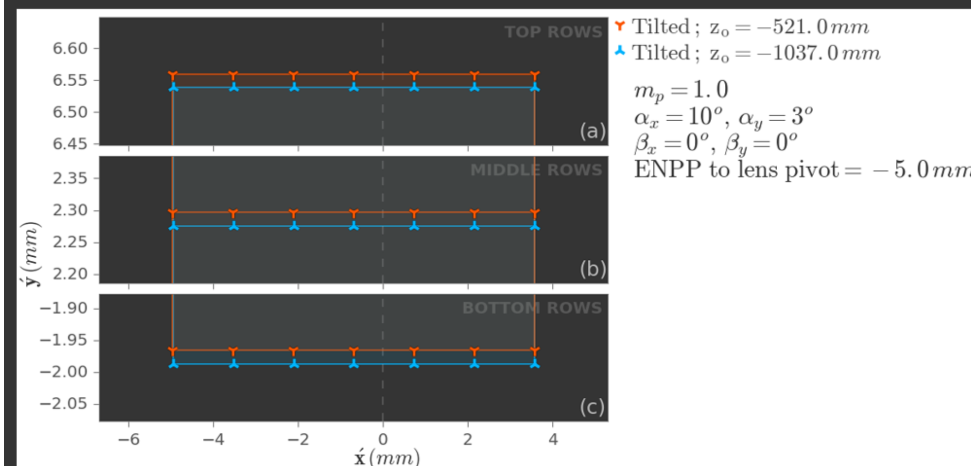
$$H(near) = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & 1 \end{bmatrix} \qquad H(far) = \begin{bmatrix} j & k & l \\ m & n & o \\ p & q & 1 \end{bmatrix}$$

FIGURE 9



Shift of image field under lens rotation with pivot away from the ENPP; $m_p = 1.0$

The amount of shift of the image field depends on object distance z_o.

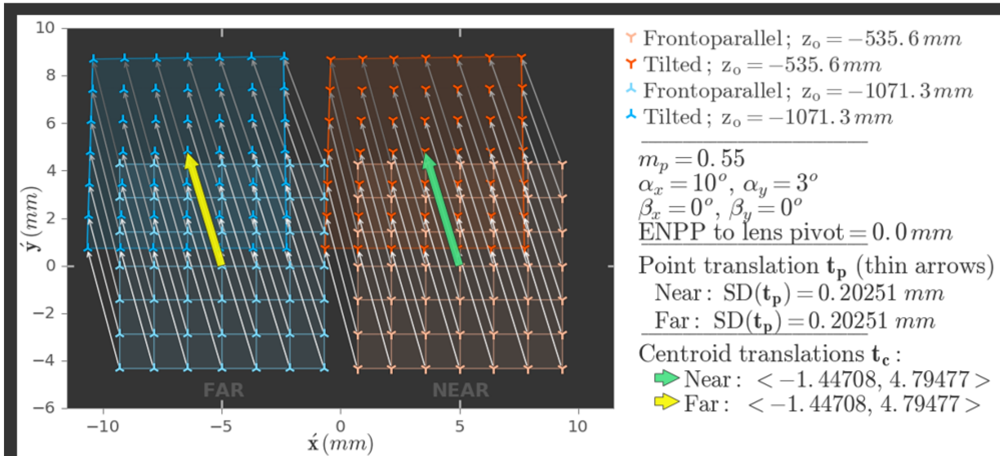


The top, middle and bottom rows of the grid of dots images. The difference in the shift of the three rows implies that the distortion is NOT independent of object distance. i.e. lens rotation away from the ENPP introduces parallax.

Homography (dependent on Z):

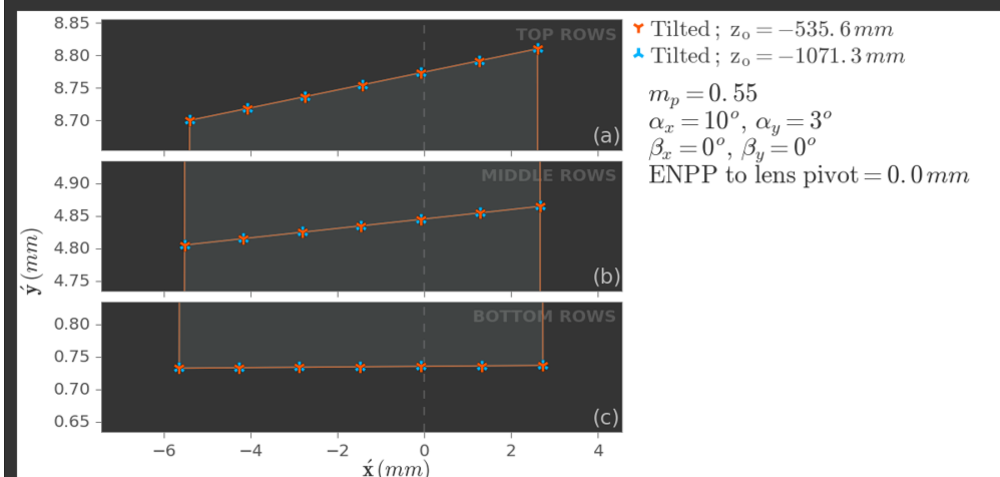
$$H(near) = \begin{bmatrix} a & 0 & c \\ 0 & a & f \\ 0 & 0 & 1 \end{bmatrix} \qquad H(far) = \begin{bmatrix} j & 0 & l \\ 0 & j & o \\ 0 & 0 & 1 \end{bmatrix}$$

FIGURE 10



Shift of image field under lens rotation about the ENPP; $m_p = 0.55$

The amount of shift of the image field is independent of object distance z_o. The standard deviation of the translation vector lengths for the two sets of points from the two planes are same. Also, the centroid of group of points from the two planes shift by the same amount.

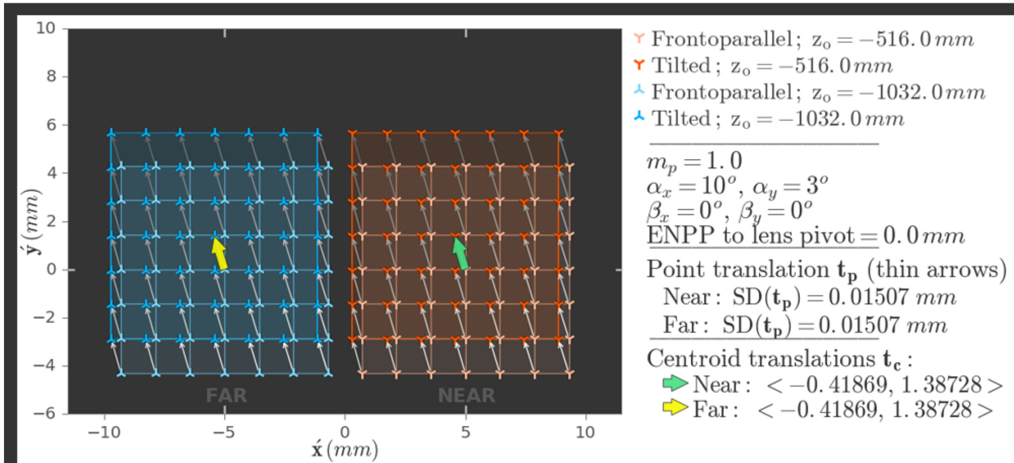


The top, middle and bottom rows of the grid of dots images of the two planes. The three rows shift exactly by the same amount in each direction implying that the distortion is independent of object distance.

Homography (independent of Z):

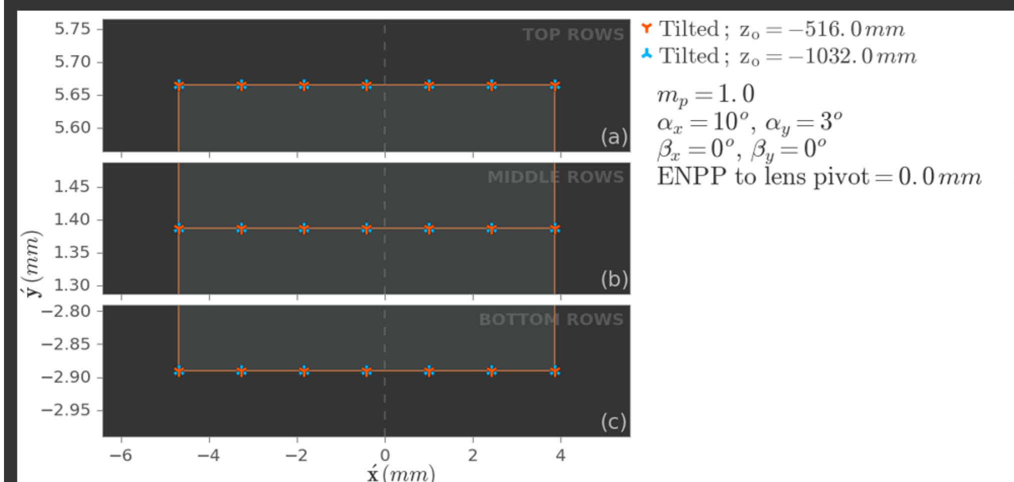
$$H = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & 1 \end{bmatrix}$$

FIGURE 11



Shift of image field under lens rotation about the ENPP; $m_p = 1.0$

The amount of shift of the image field is independent of object distance z_o. The standard deviation of the translation vector lengths for the two sets of points from the two planes are same. Also, the centroid of group of points from the two planes shift by the same amount.



The top, middle and bottom rows of the grid of dots images of the two planes. The three rows shift exactly by the same amount in each direction implying that the distortion is independent of object distance.

Homography (in dependent of Z):

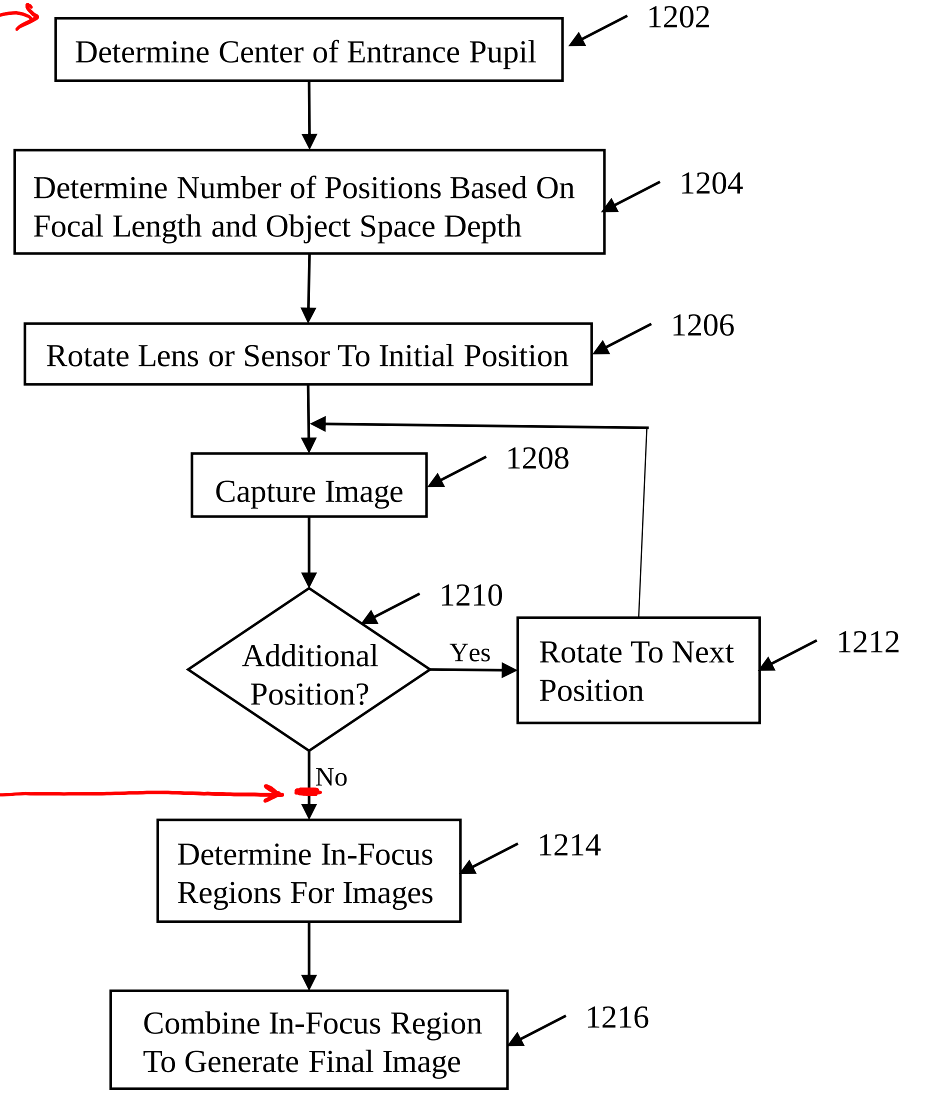
$$H = \begin{bmatrix} a & 0 & c \\ 0 & a & f \\ 0 & 0 & 1 \end{bmatrix}$$

Note:

The center of the entrance pupil is fixed for a fixed focal length lens. Therefore we only need to do this once if we are not using a zoom lens.

FIGURE 12

1200



Missing block

Register images in the stack