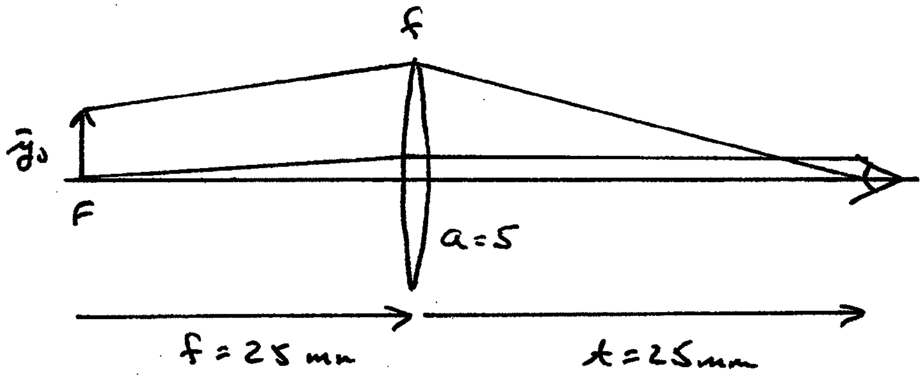
Magnifier FOV

$$MP = 10X = \frac{250\,mm}{f} \qquad f = 25\,mm$$

- The object must be at the front focal point of the magnifier to produce an image at infinity
- The marginal ray is collimated between the lens and the eye.
- The system stop is at the eye since the eye pupil is smaller than the lens diameter
- For half-vignetted: $a = |\bar{y}|$

  and only the chief ray matters.

a) 25mm Magnifier - Eye Separation



		Obj		Mag		Stop Eye				
	Surface	0		1		2		3		
	f			25						
	$-\phi$			-.04						
	t		25		25					
Chief Ray	$\bar{y}$	5		5		0				
	$\bar{u}$		0		-.200					
	y									
	u									

$\bar{y} = 5$ at the Magnifier Lens - Half vignetting

$\bar{y}_o = 5$

FOV = ±5 mm = 10 mm

b) 250 mm Magnifier - Eye Separation

All of the conditions are the same except $t = 250$ mm

		Obj		Mag		Stop Eye				
	Surface	0		1		2		3		
	f			25						
	$-\phi$			-.04						
	t		25		250					
Chief Ray	$\bar{y}$	0.5		5		0				
	$\bar{u}$		.18		-.02					
	y									
	u									

$\bar{y} = 5$ at the magnifier Lens - Half Vignetting

$\bar{y}_o = 0.5$ mm

FOV = ± 0.5 mm = 1 mm

The FOV is greatly reduced from the situation of the eye loupe.

c) The magnifying glass problem is easy to observe when the magnifying glass is pulled away from the object to place it at F, the observed FOV becomes very small. The image is at infinity with infinite magnification. Only a small portion of the image/object is seen through the "window" of magnifying glass lens. Vignetting by the magnifying glass aperture limits the FOV.

- As a result, a magnifying glass must be used with the object well inside F. A finite-conjugate virtual image results and a usable FOV is obtained. The viewer's eye must now accomodate.
- This situation also limits the power of the magnifying glass.

When the magnifier is placed close to the eye (eye loupe), the FOV is greatly increased. The angular subtense of the vignetting aperture (the magnifier lens) is much larger and more of the virtual image at infinity can be seen.