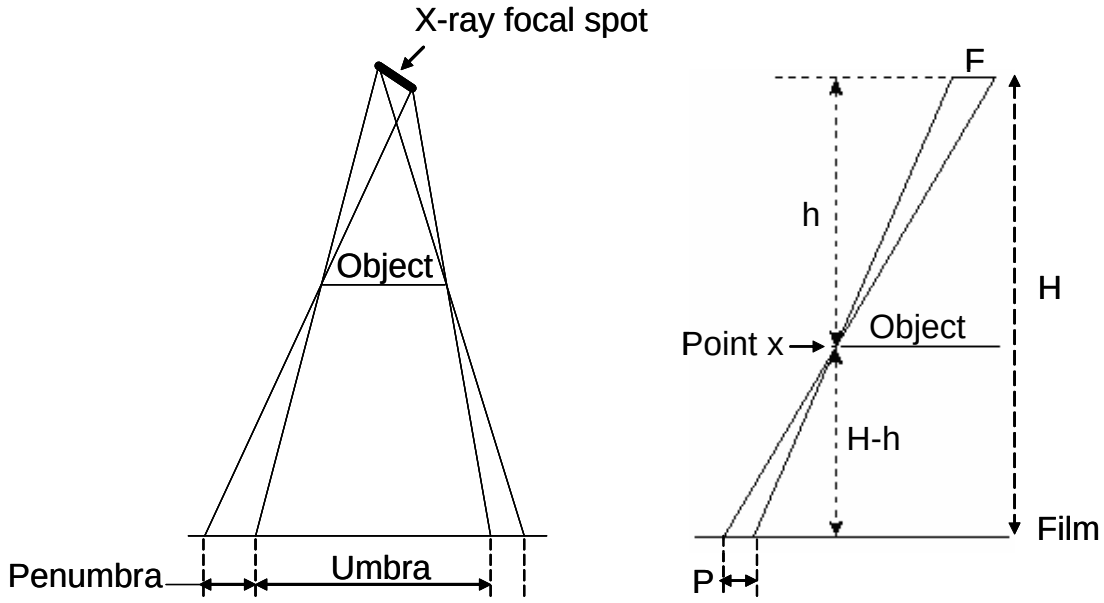
Homework # 3

1. What is a radiographic penumbra? (Draw a simple picture to illustrate), and what causes it?

Solution:

Radiographic penumbra, also called geometric unsharpness, or edge gradient, which is due to the fact that the x-ray source is not a perfect point source.

The width of penumbra: $$P = F\,\frac{H-h}{h}$$



2. What is the "intensification factor" of a screen?

Solution:

The intensification factor = (x-ray exposure required without screen) / (x-ray exposure required with screen)

3. Assume that 1000 x-ray photons, each with an energy of 100 keV, are incident on an intensifying screen with an absorption efficiency (quantum efficiency) of 50% and an intrinsic efficiency of 20%.

Solution:

a. How many x-rays photons will contribute to the image?

$$1000\,(\text{x - ray photons}) \times 50\% = 500\,(\text{x - ray photons})$$

b. Assuming the average energy of a blue light photon is 3eV, how many blue light photons will be produced for each x-ray photon absorbed?

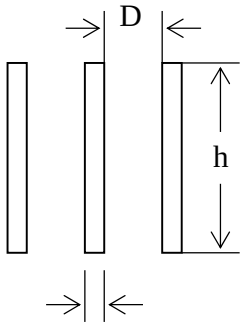
$$\frac{100KeV}{3eV} \times 20\% = 33333 \times 20\% \approx 6667\,(\text{light photons})$$

4. If a screen is made thicker, what happens to the spatial resolution?

Solution:

Spatial resolution will be less.

5. A linear scatter grid has dimensions shown here, where D is 0.10mm, h is 0.2mm. What is the grid ratio?



Solution:

$$Grid\ Ratio = \frac{h}{D} = \frac{0.2mm}{0.1mm} = 2:1$$

6. If the grid ratio is doubled, does the number of scattered x-rays contributing to the image increase or decrease? ___**decrease**____.