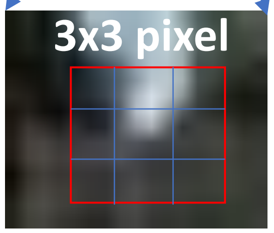
❑ MATCHING FEATURE NEED ~3PIXELS



The most common size of a sweep window to recognize a corner feature is **3x3** pixel

❑ **FORMULA**: depth, focal length(f), baseline(B) and target position on camera sensor (x1-x2) has the following relationship:

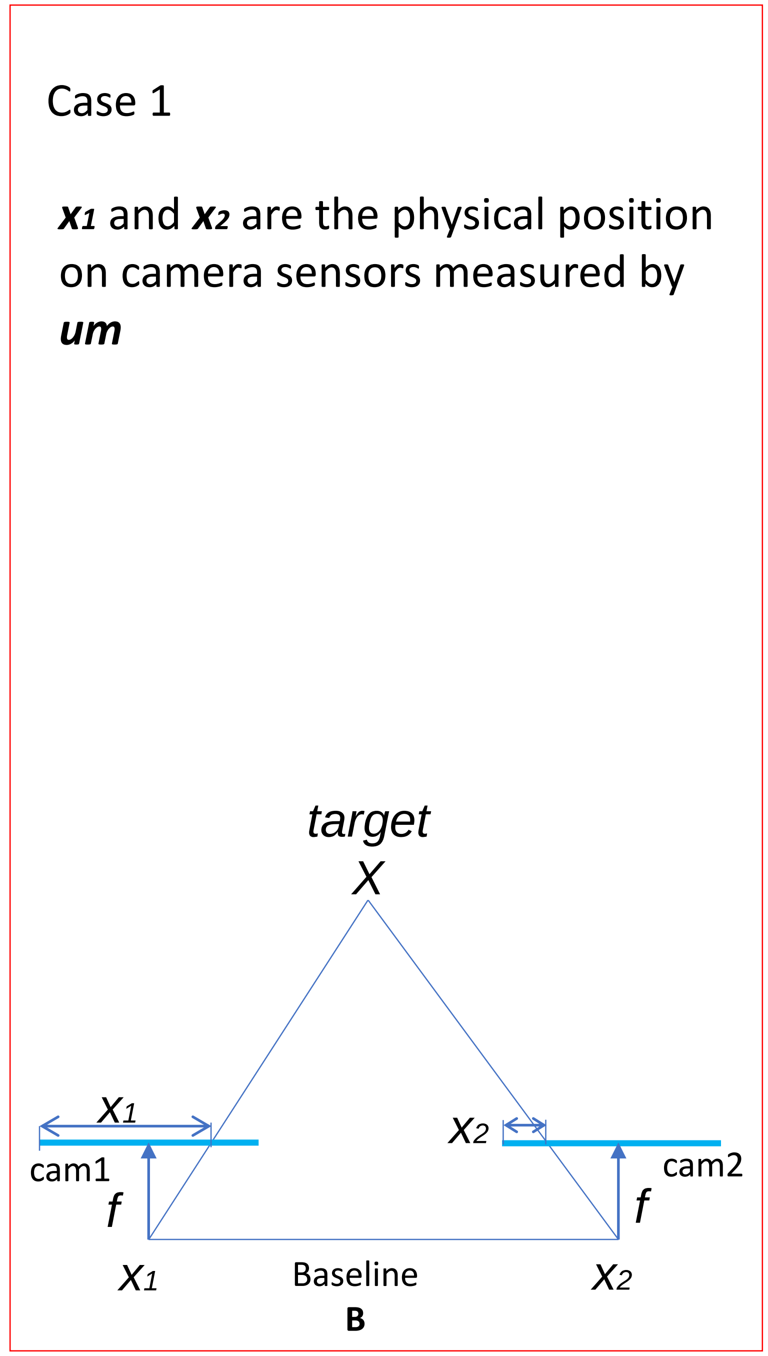
$$depth = \frac{fB}{x_1 - x_2} \Rightarrow depth_{\max} = \frac{fB}{3 \times (pixel\ size)}$$

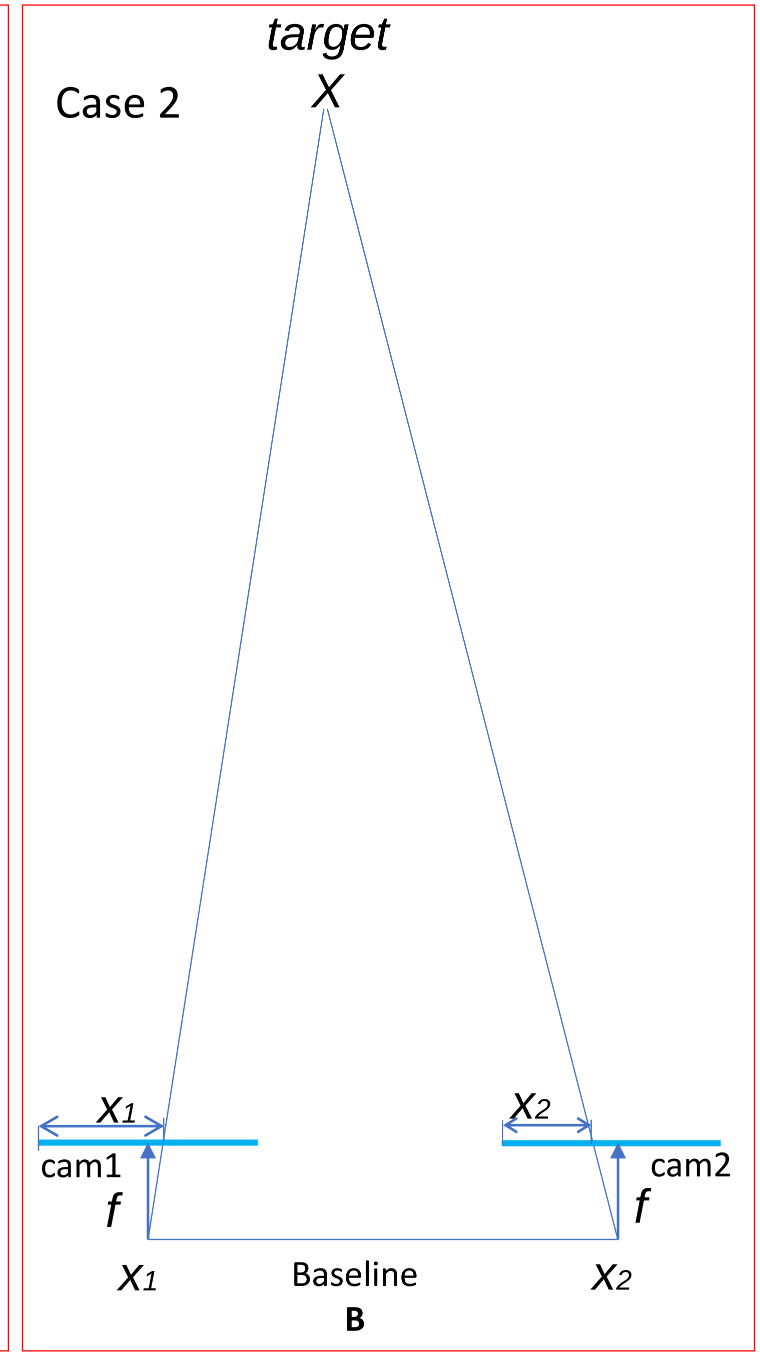
❑ **EXAMPLE**: for a camera with sensor pixel size of 5.4um, focal length 4mm, baseline(distance between two camera) is 100mm, we use 3x3 pixel window for feature matching, so the maximum depth to see a sharp point is:

$$\begin{aligned} depth &= \frac{fB}{x_1 - x_2} \\ &= \frac{4mm \times 100mm}{3pixel \times 5.4um\ /\ pixel} \\ &= \frac{4mm \times 100mm}{3pixel \times 5.4mm\ /\ pixel \times 10^{-3}} \\ &= 2.469 \times 10^4 mm = 24.69m \end{aligned}$$

❑ **PRACTICAL APPLICATION: f**or accurate measurement, I will use more pixels, like 6x6 for the feature matching, so the depth in the above is around 12.35m

❑ What depth means to the measurement?





Near target has bigger position different on sensor: $\left|x_1 - x_2\right|_{case1} > \left|x_1 - x_2\right|_{case2}$

Remark1: object textures determines the minimum target can be seen. Remember that matching feature between two image, need a pixel window, at least 3x3; sharper object, textures object need smaller pixel window; otherwise, we need to increase the window, maybe up to 50x50 pixel to cover an untextured target.

Remark2: the near object has large position difference on two camera sensor |x1-x2|, so it has more opportunity to be seen by trying using different pixel window size.

Remark3: larger pixel is better. Although larger camera pixel size reduce depth, it can receive more light information than a small pixel sensor. So for the same resolution, 5.4um pixel can see further than a 3.9um pixel sensor.

Remark4: You can manipulate baseline, focal length, resolution/pixel size to get the desired depth.