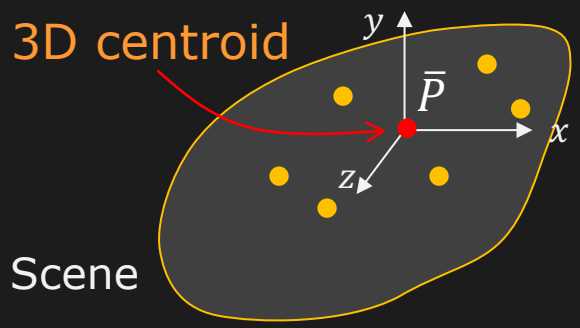
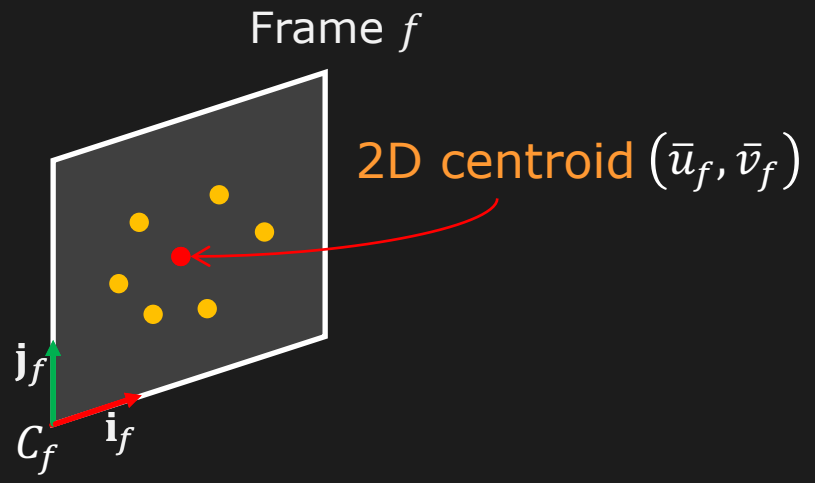
Centering Trick





Shift camera origin to the centroid $(\bar{u}_f, \bar{v}_f)$.

Image points w.r.t. $(\bar{u}_f, \bar{v}_f)$:

$$\tilde{u}_{f,p} = u_{f,p} - \bar{u}_f \qquad \tilde{v}_{f,p} = v_{f,p} - \bar{v}_f$$

$$= \mathbf{i}_f^T (P_p - C_f) + \mathbf{i}_f^T C_f \qquad = \mathbf{j}_f^T (P_p - C_f) + \mathbf{j}_f^T C_f$$

$$\boxed{\tilde{u}_{f,p} = \mathbf{i}_f^T P_p} \qquad \boxed{\tilde{v}_{f,p} = \mathbf{j}_f^T P_p}$$

Camera locations C_f now removed from equations.