

$$\hat{\mathbf{p}} = \tilde{\mathbf{K}} \tilde{\mathbf{p}} = \begin{bmatrix} f & 0 & c_x \\ 0 & f & c_y \end{bmatrix} \begin{bmatrix} \tilde{u} \\ \tilde{v} \\ 1 \end{bmatrix} = \begin{bmatrix} f\tilde{u} + c_x \\ f\tilde{v} + c_y \end{bmatrix} = \begin{bmatrix} u \\ v \end{bmatrix}$$