Solving Distortion

Pixel coordinates

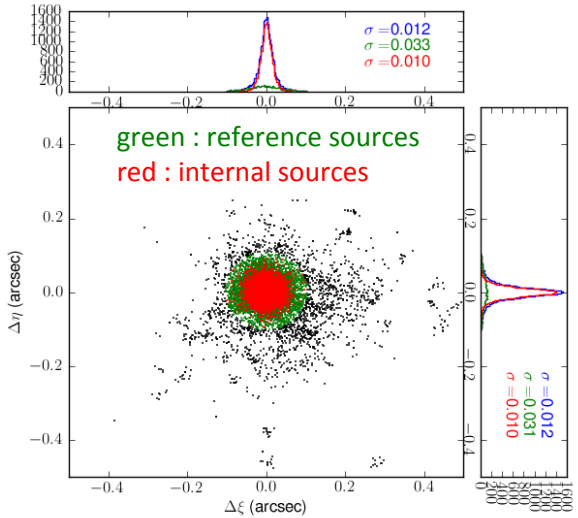
$$\begin{pmatrix} u^{s,e} \\ v^{s,e} \end{pmatrix} = \begin{pmatrix} \cos\theta_c & -\sin\theta_c \\ \sin\theta_c & \cos\theta_c \end{pmatrix} \begin{pmatrix} x^{s,e} \\ y^{s,e} \end{pmatrix} + \begin{pmatrix} X_c \\ Y_c \end{pmatrix} = \begin{pmatrix} x^s \cos\theta_c - y^s \sin\theta_c + X_c \\ x^s \sin\theta_c + y^s \cos\theta_c + Y_c \end{pmatrix}$$

Intermediate (Projected) coordinates

$$\begin{pmatrix} \xi^{s,e} \\ \eta^{s,e} \end{pmatrix} = \begin{pmatrix} \xi(\alpha^s, \delta^s, A^e, D^e) \\ \eta(\alpha^s, \delta^s, A^e, D^e) \end{pmatrix}$$

Minimize the difference using multiple objects on multiple exposures

$$\chi^2 = \sum_e \sum_s \left\{ \xi^{s,e} - \sum_k a_k (u^{s,e})^{i(k)} (v^{s,e})^{j(k)} \right\}^2 + \sum \left\{ \eta^{s,e} - \sum_k b_k (u^{s,e})^{i(k)} (v^{s,e})^{j(k)} \right\}^2$$



From the processing of Suprime-Cam data
we can achieve ~10mas (relative) and ~30mas (absolute) accuracy in astrometry

We can expand this to entire survey region
--> ubercalibration of astrometry