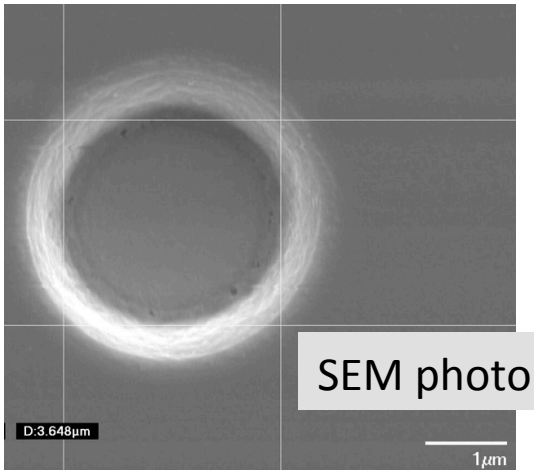
CCD Warping studies with pinholes

Andrei, 13 January 2015

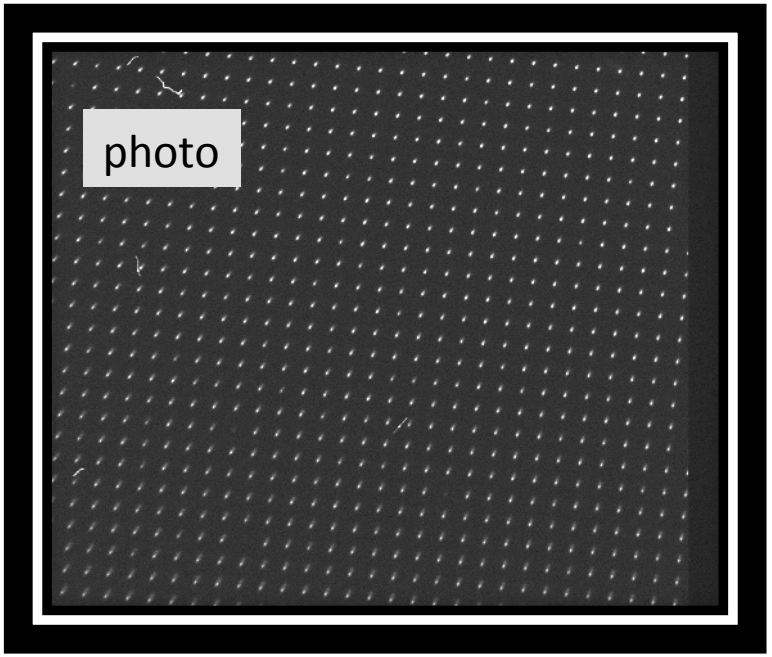
Data by Ivan, Justine & Paul, pinhole plate by John Warren

Spots: grid of pinholes

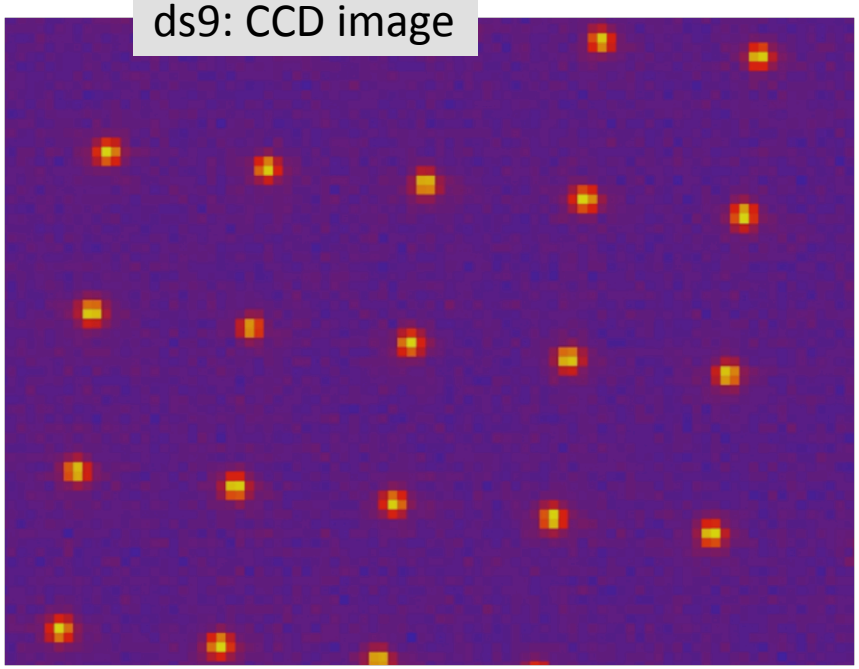
- Used multi-hole target to probe astrometric biases
  - 150 nm thick chromium on silica, produced at BNL by J.Warren
  - 46,656 pinholes
  - 3.6 micron diameter, 200 micron spacing



SEM photo of one pinhole

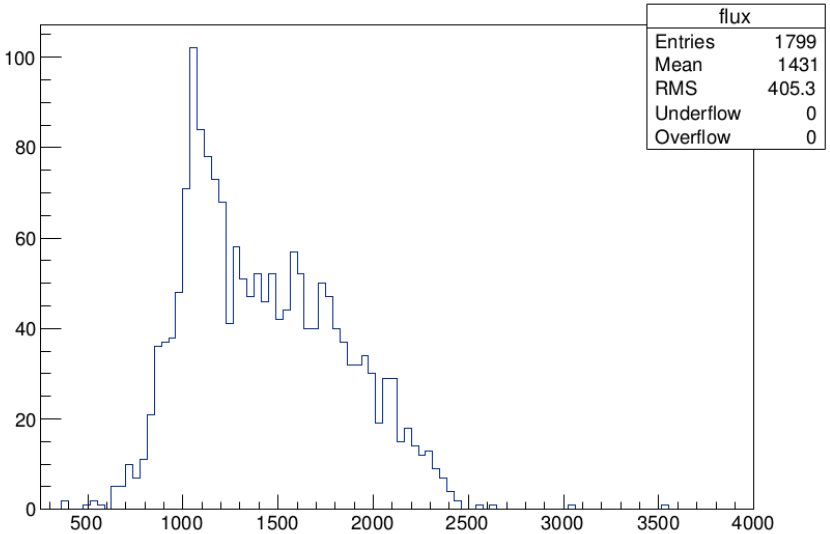


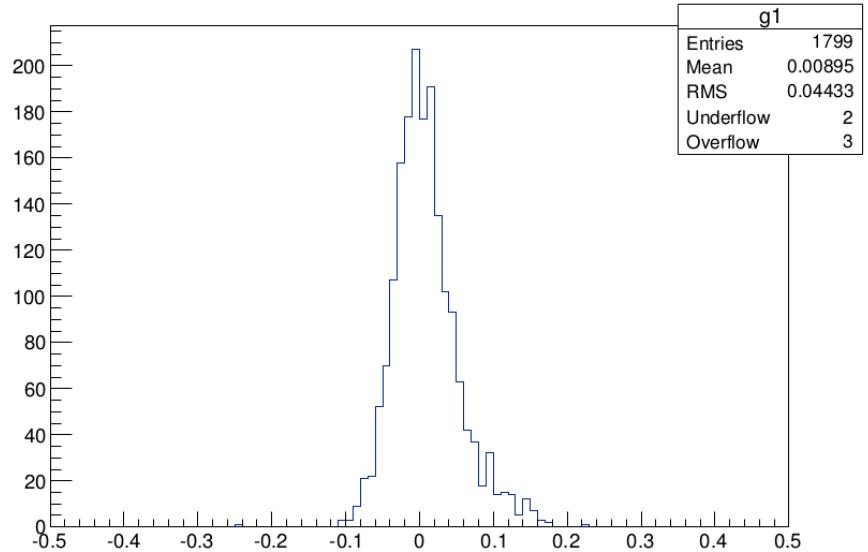
photo

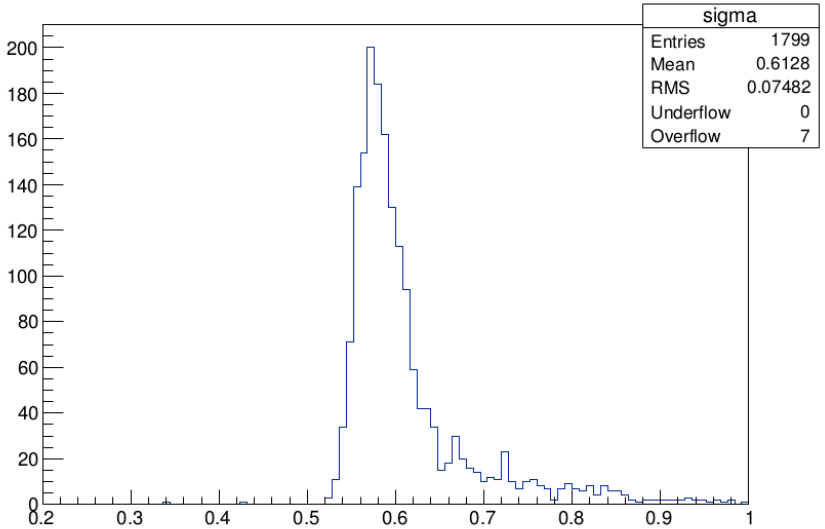


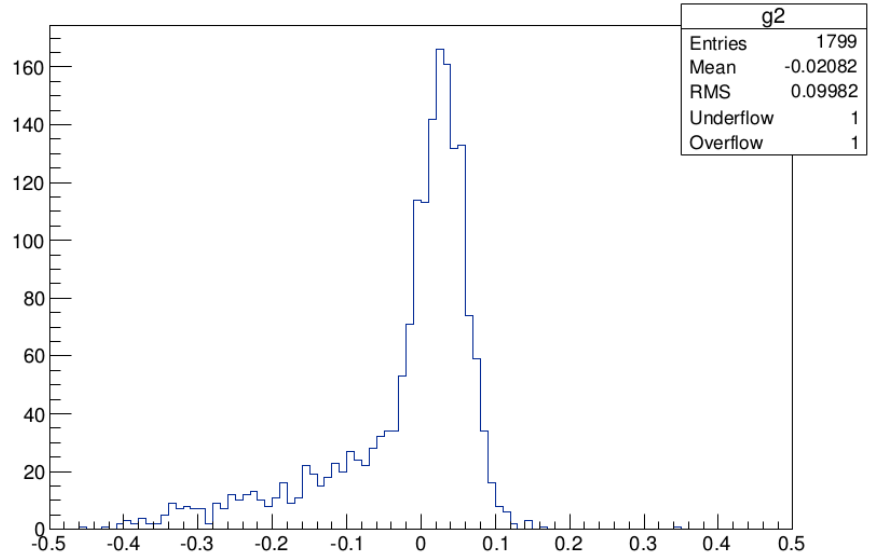
ds9: CCD image

Flux, sigma, shear



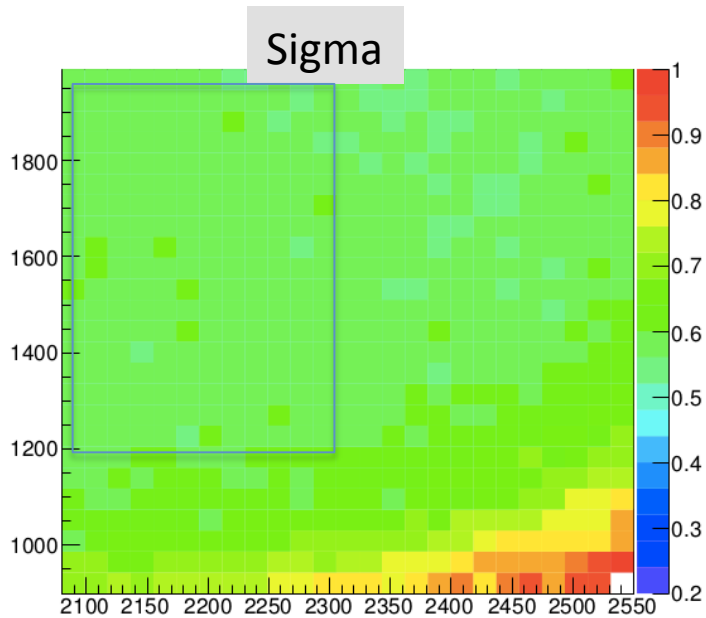


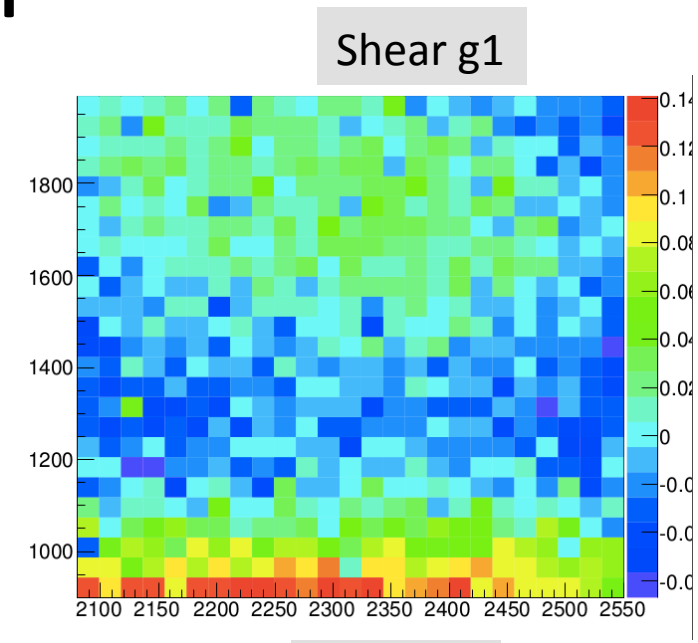


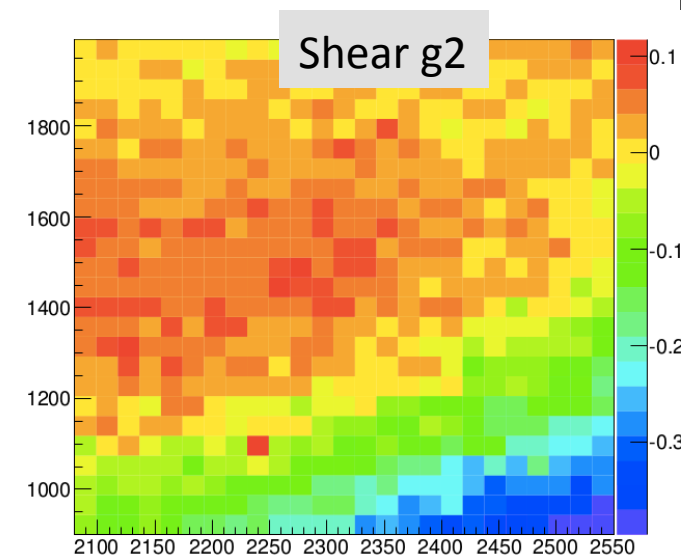


Maps of shapes

- Same procedure to fit spot shape as for Fe55 x-rays
  - Wider sigma: 6-7 um
- Some peripheral distortions due to optics
- Selected uniformly illuminated region for further analysis

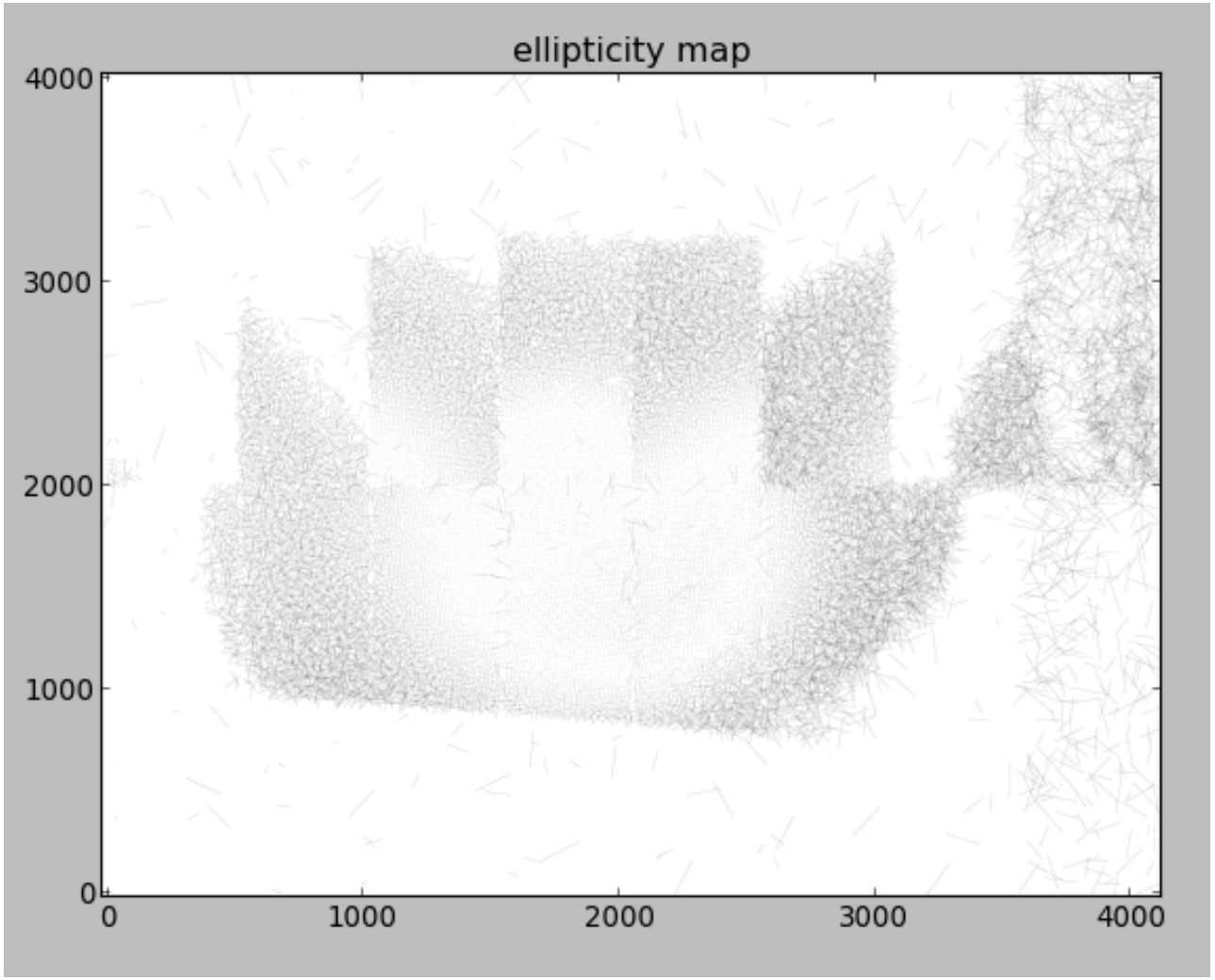






Ellipticity map

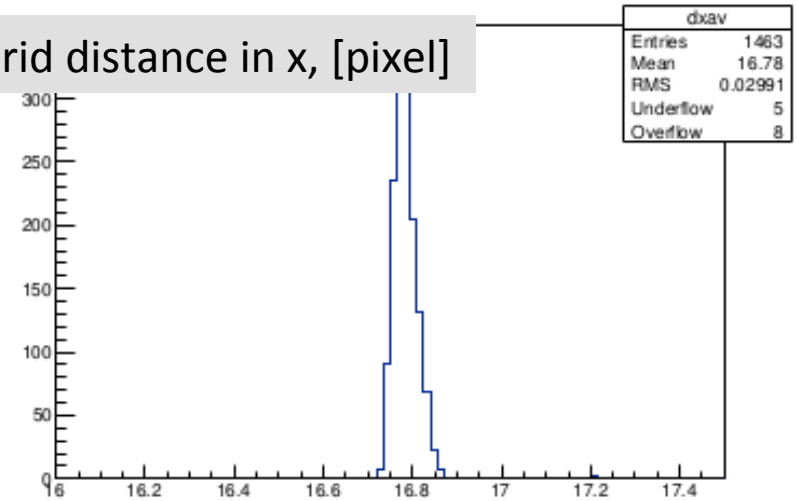
- Problem with image assembly – ITL sensor



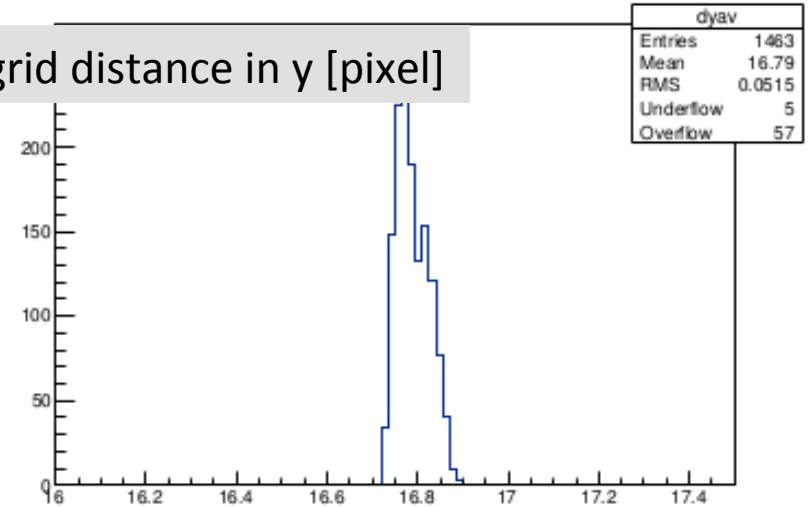
Distance to neighbors

- Along two grid directions “x” and “y”:
  - Average distance to two immediate neighbors

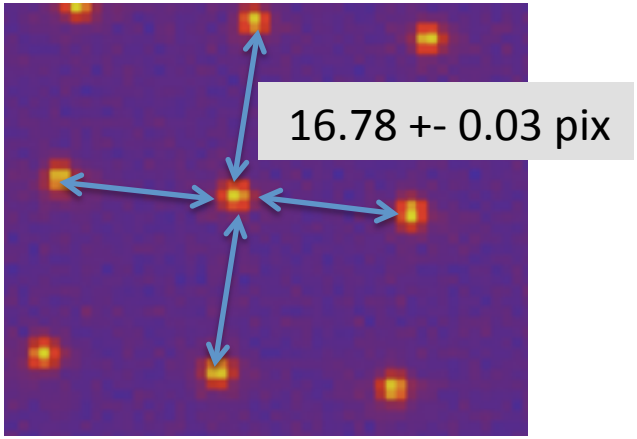
grid distance in x, [pixel]



grid distance in y [pixel]

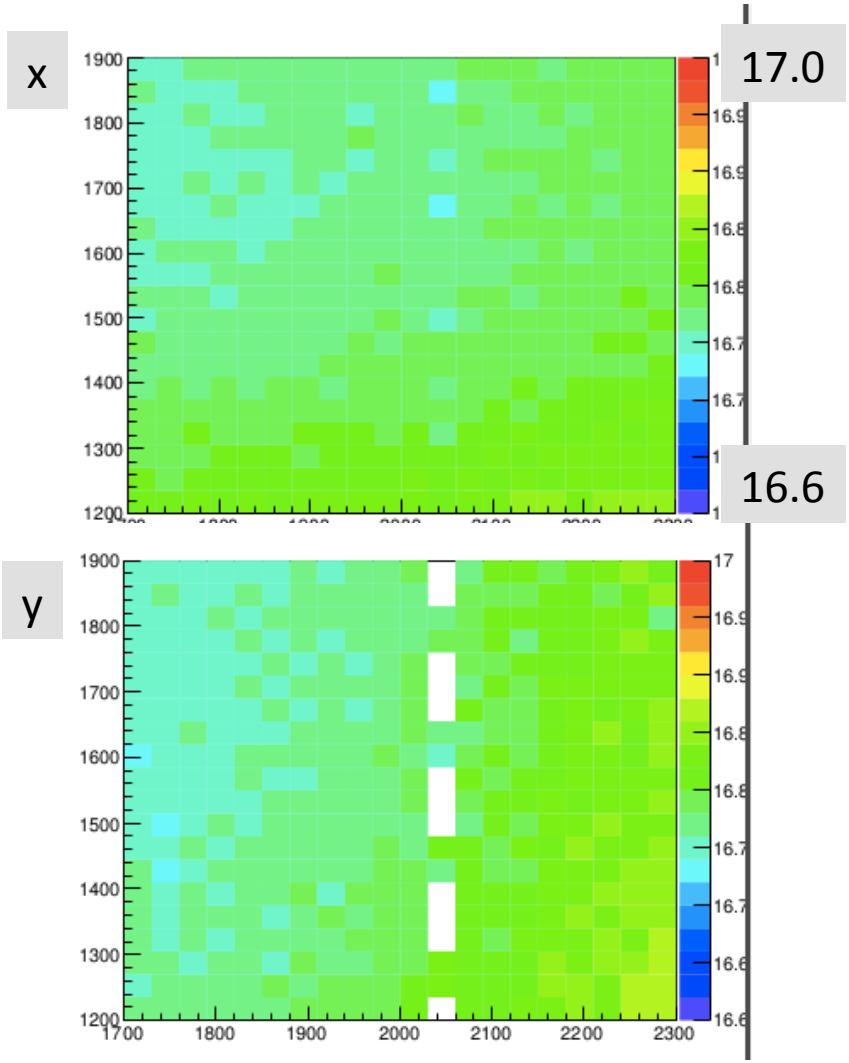


RMS 0.03 pixels = 0.3 micron



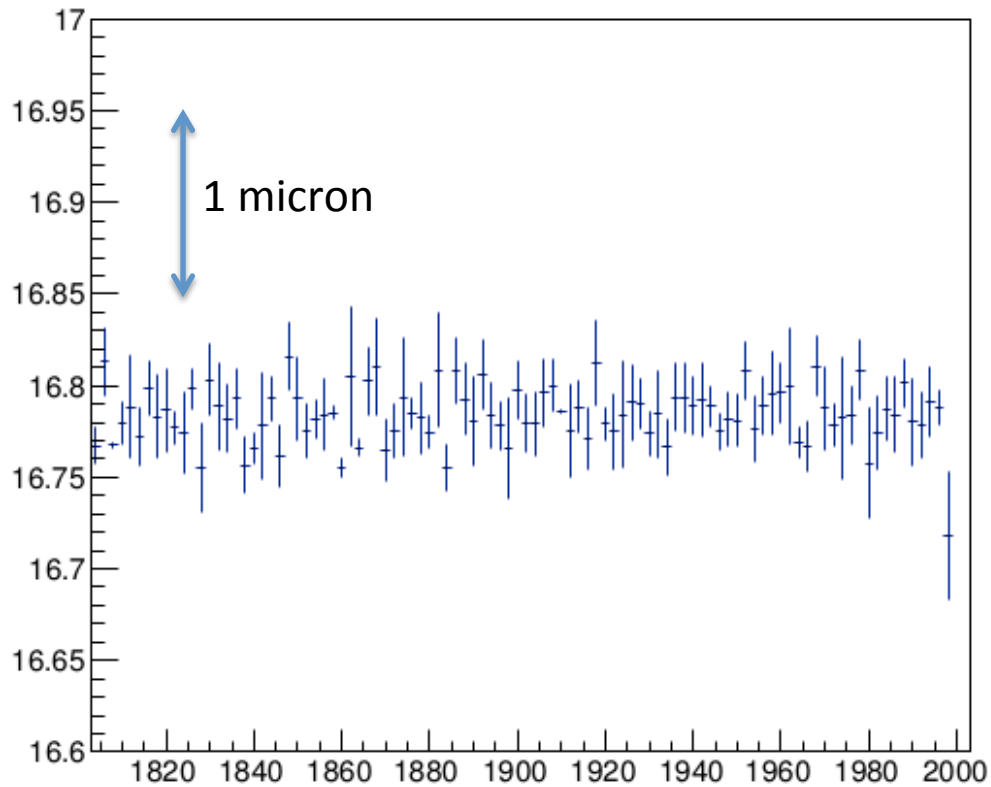
Maps of Distance to Neighbors

- Along two grid directions “x” and “y”:
  - Average distance to two neighbors
- Uniform to ~ 1 micron
  - Residual non-uniformity most likely due to optics



Midline in a grid of spots

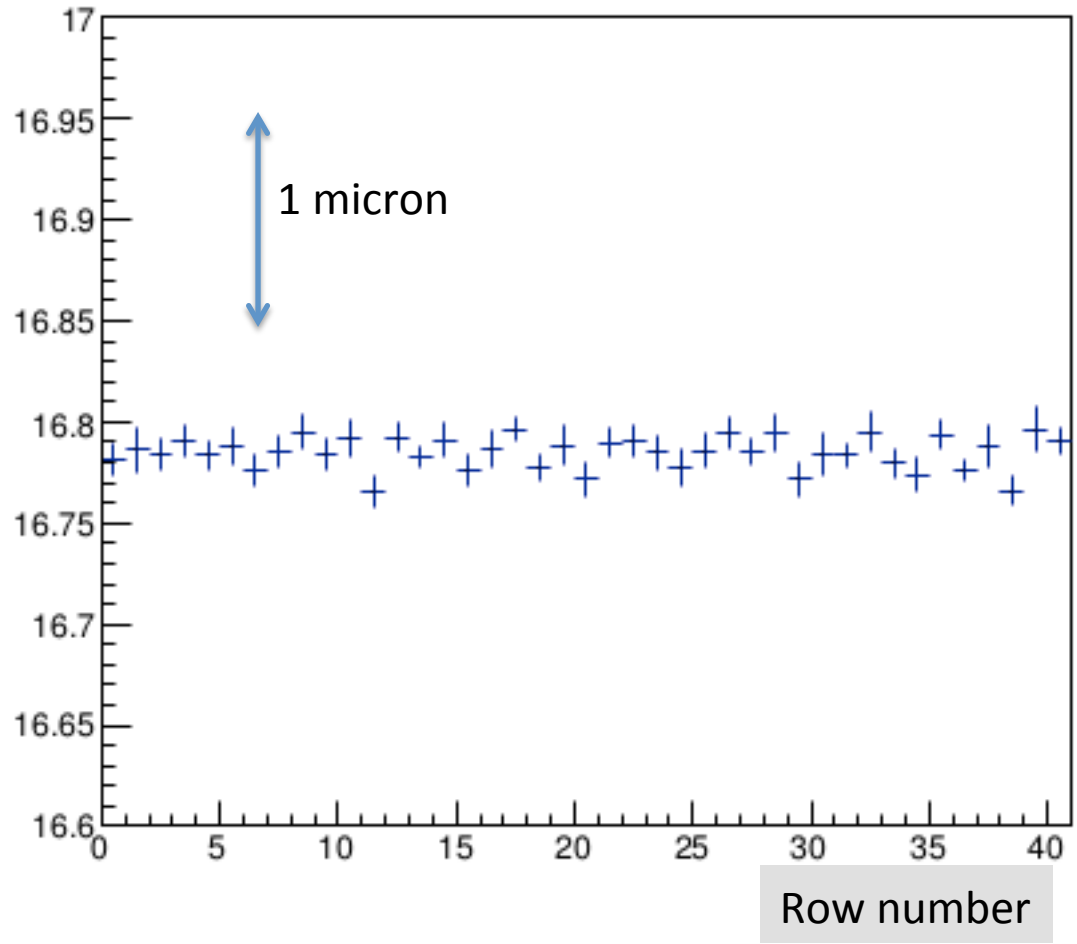
- Distance to neighbor vs row number
- Do not see the midline
  - Sensor did not have the anti-bloom stop implant
- Submicron sensitivity to astrometry
- Work in progress to propagate the technique to other sensor "features"



Row number

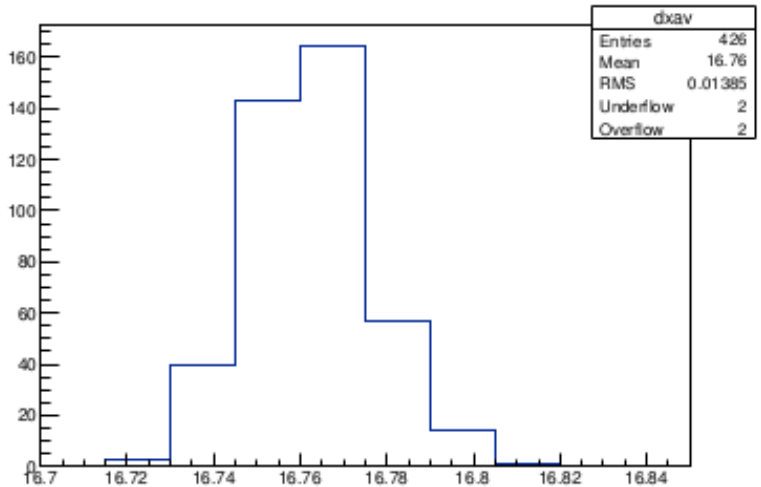
Bamboo may be? - no

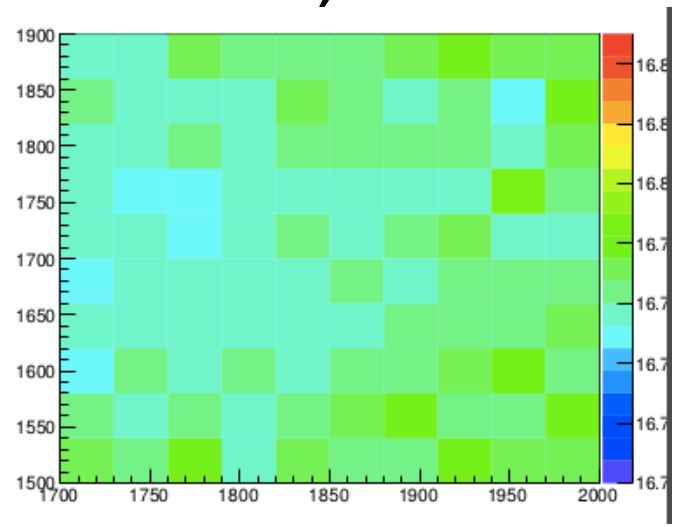
- Folded with 41 pixel period

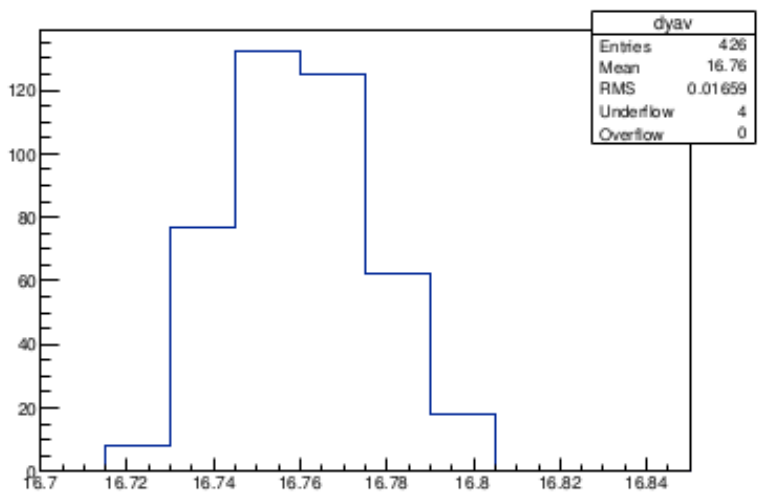


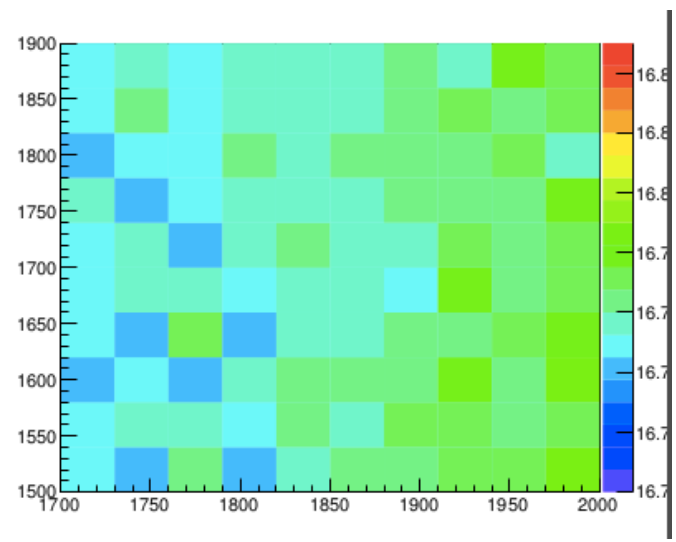
Smaller region

- Selecting smaller area (1700-2000, 1500-1900)



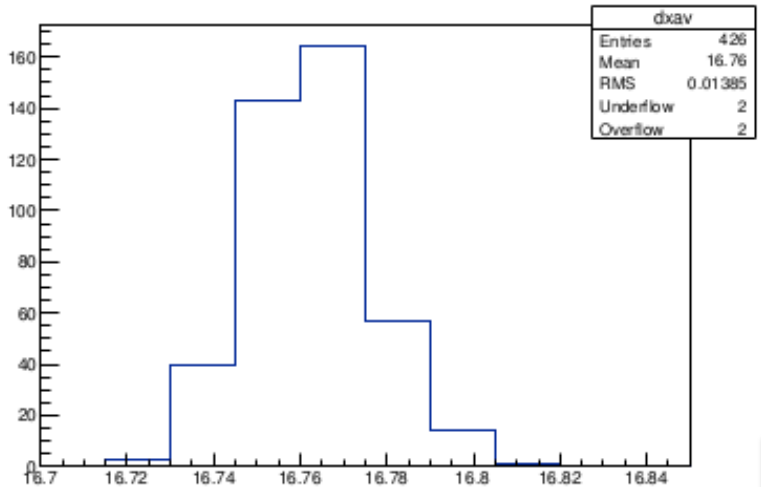


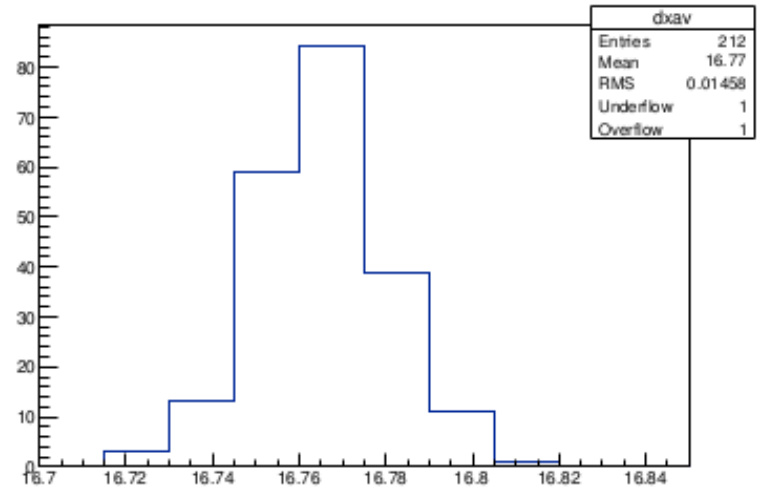


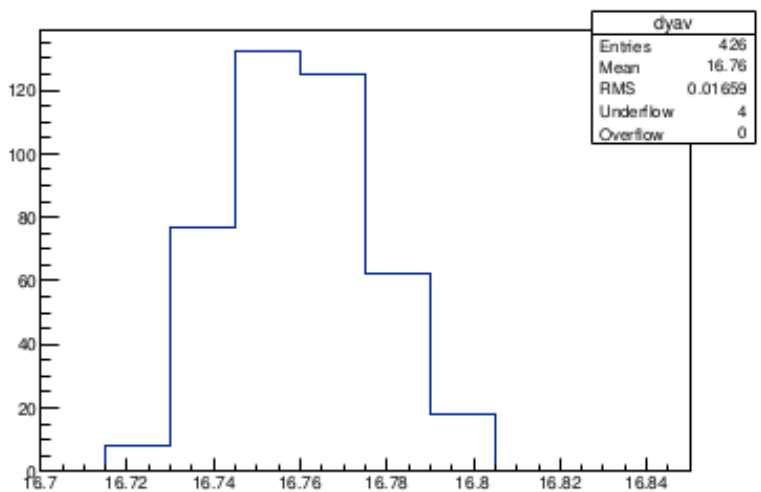


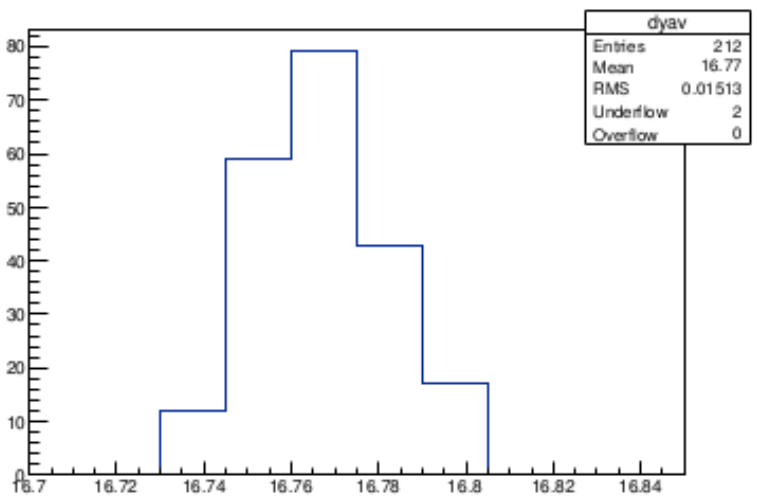
..and even smaller region

- Selecting smaller area (1850-2000, 1500-1900): no improvement
- So 0.15 micron is about the limit of this method



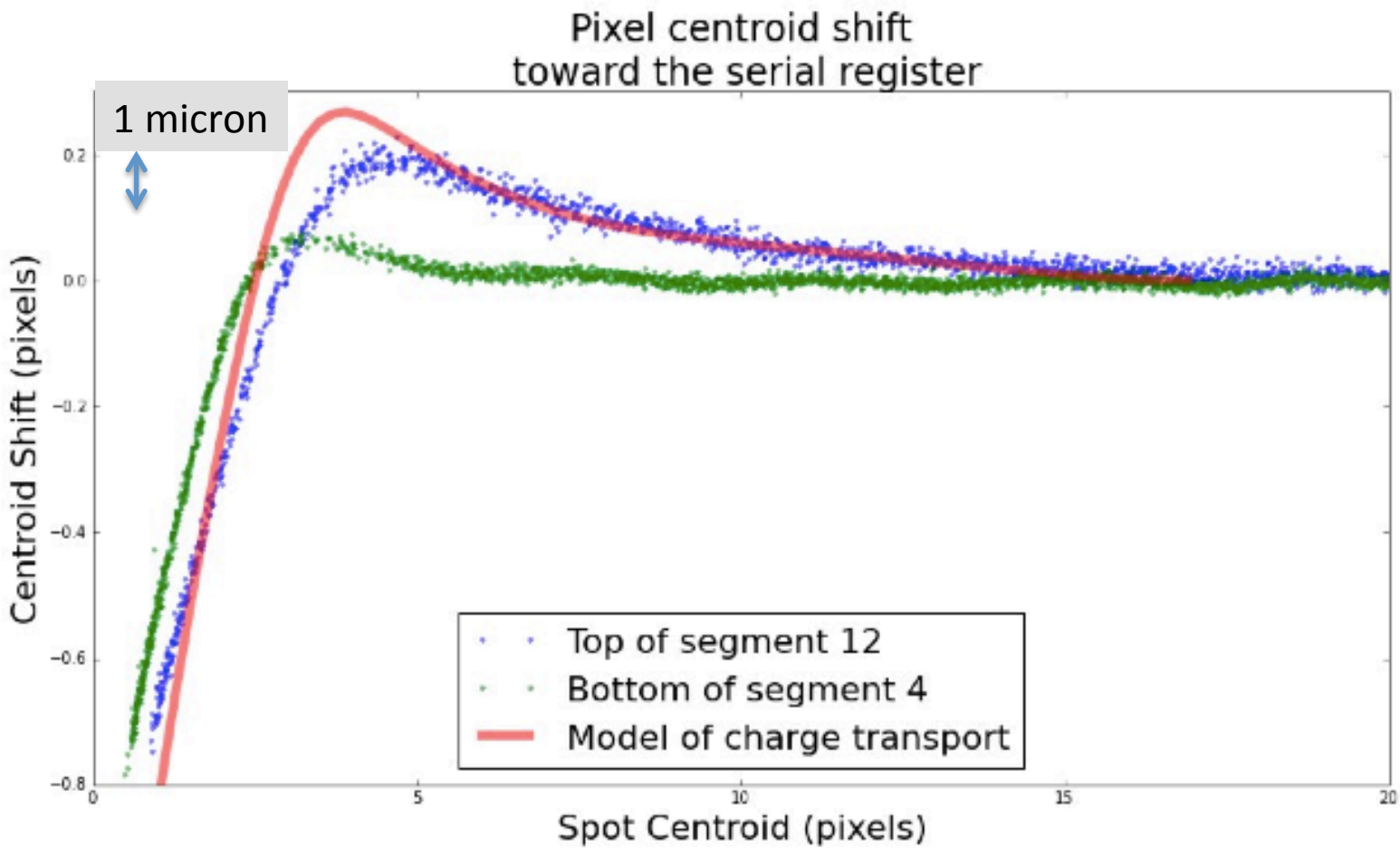






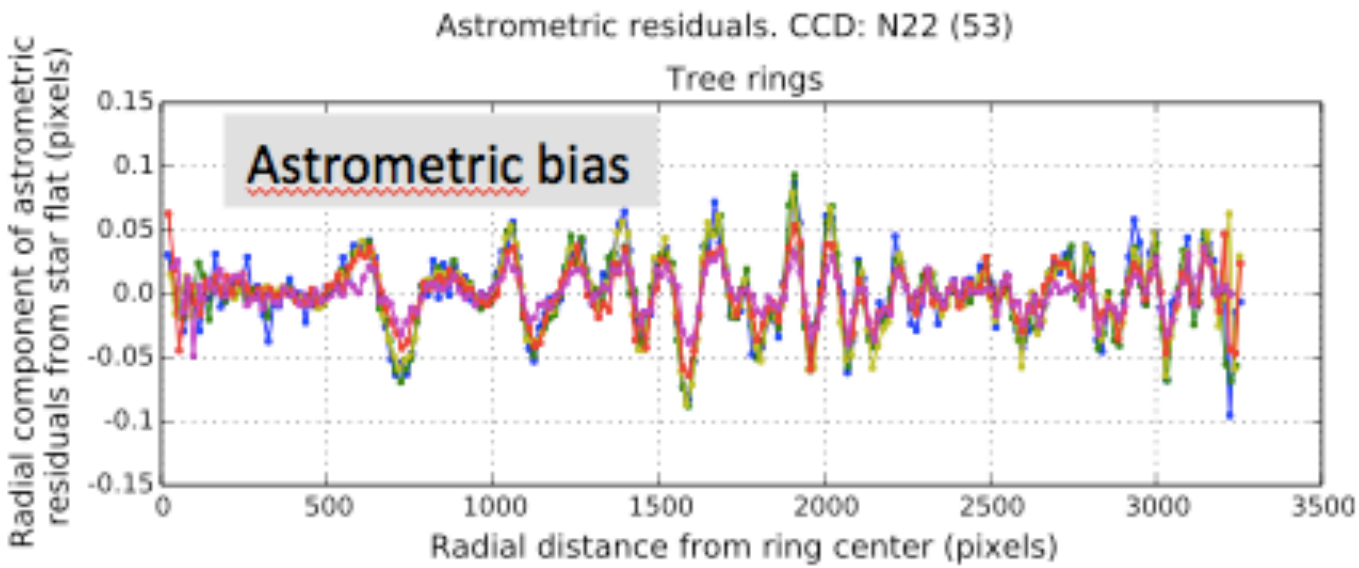
UC Davis results: Bradshaw, Tyson et al

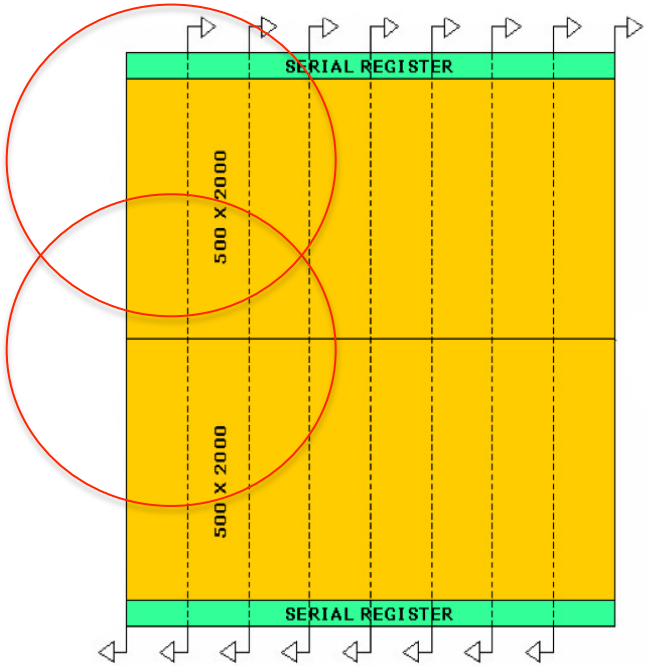
- Were moving the plate with pinholes and measuring the centroid shift for same holes. 300 exposures.
- Better technique? Vibrations?
- Ultimately the scatter of points is about the same (~0.2 micron?)



DES astrometric bias due to TR

- To be compared to ~ 0.5 micron shifts due to TR in DES



Next steps

- Measure pitch for pinholes at OGP
  - Now show the distance to the neighbor hence rely on stability of the pitch
- Produce absolute displacement graph (arrow plot) assuming regular grid
- Take more measurements with e2v sensor, cover the edges and midline, move the image around