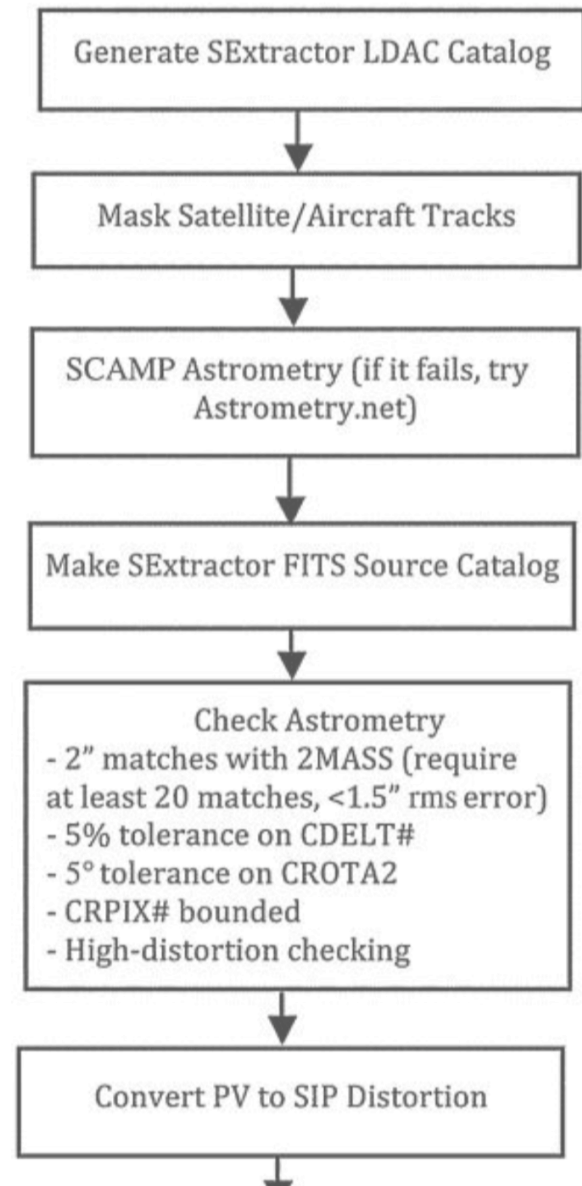


Astrometry for iPTF and ZTF

David Shupe + PTF working group

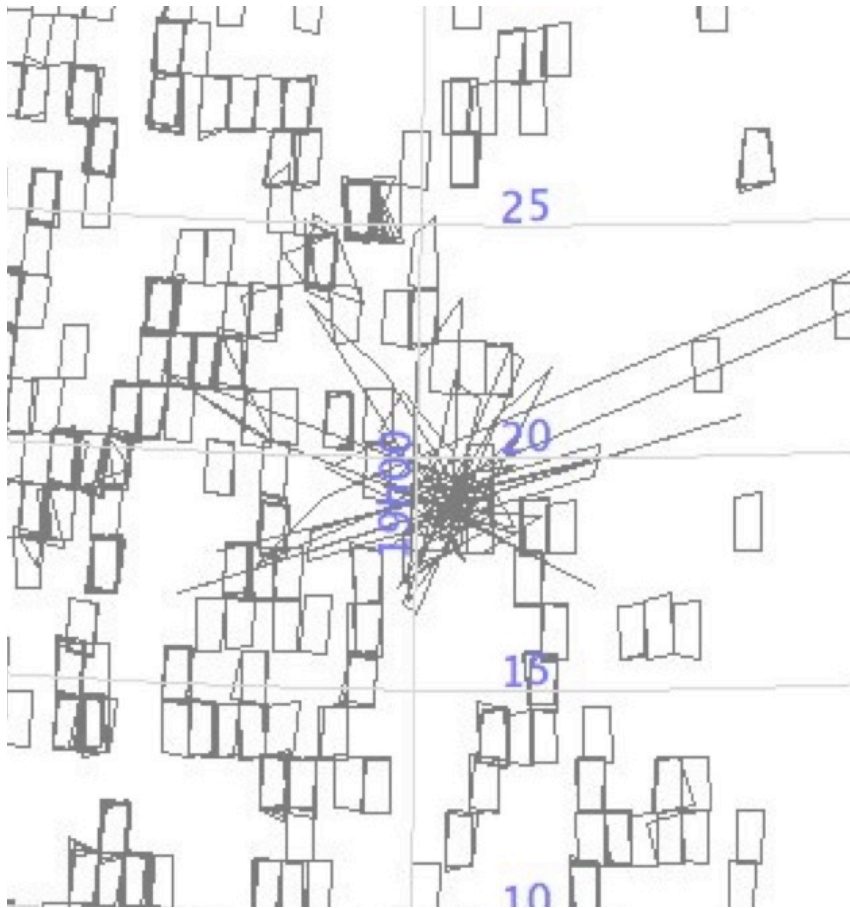
Current iPTF astrometry procedure

- Files are split by ccdid
- Astrometry.net is called for initial WCS
- SCAMP (v1.7.0) is the main solver
 - Combined SDSS DR9 + UCAC4 catalog is the reference
- If SCAMP error or timeout, fall back to Astrometry.net
- A WCS checker uses 2MASS sources



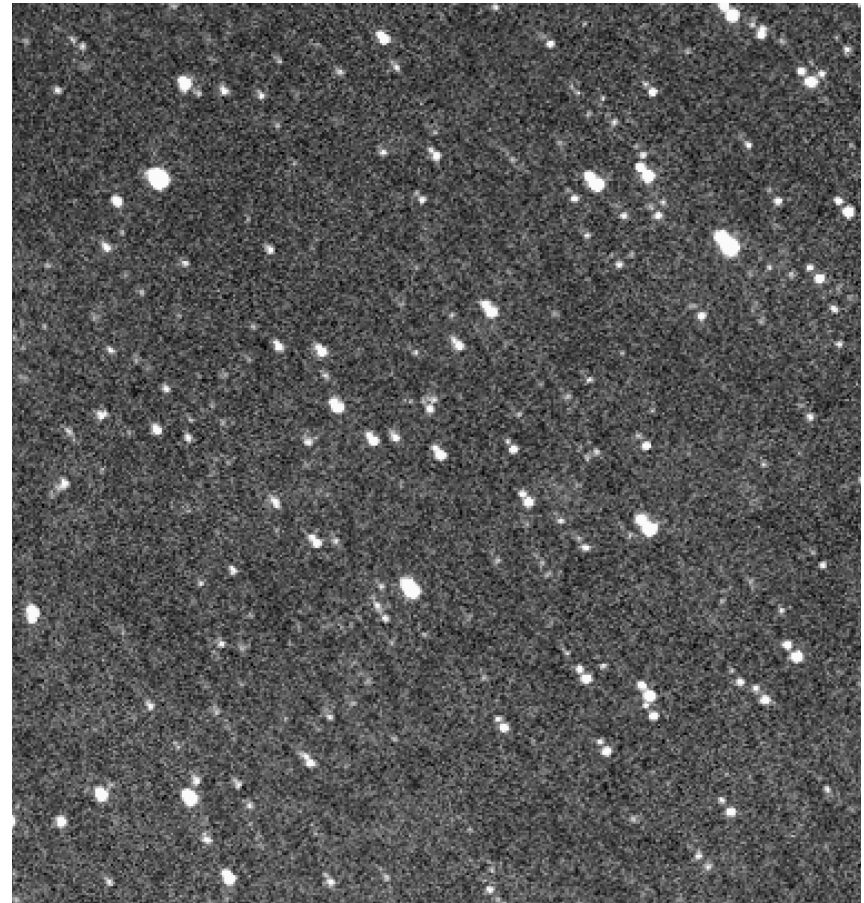
Some problems in distortion solutions

Chip corners varying by $\pm 5\%$



Shupe+ 2016 AAS poster

Double stars in refim corners

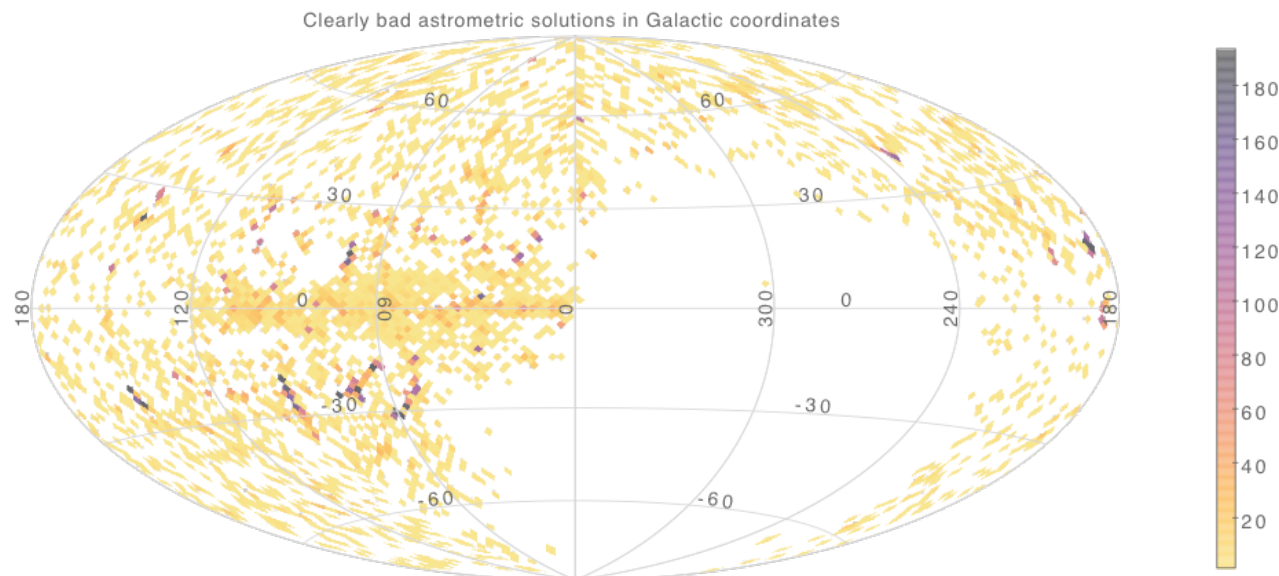


c. Adam Miller. Field 22568, chip 6

Statistics
for PTF and
iPTF

5% threshold
for bad
corner
positions

<i>Image Subset</i>	<i>Number</i>	<i>Percentage</i>
All images	4,722,125	100%
Ran Astrometry.net	226,884	4.8%
Images with Solutions	4,617,276	97.8%
Clearly bad corner positions	12,687	0.3%
Failed WCS checker	35,110	0.7%
Bad corners missed by WCS checker	5,734	0.12%

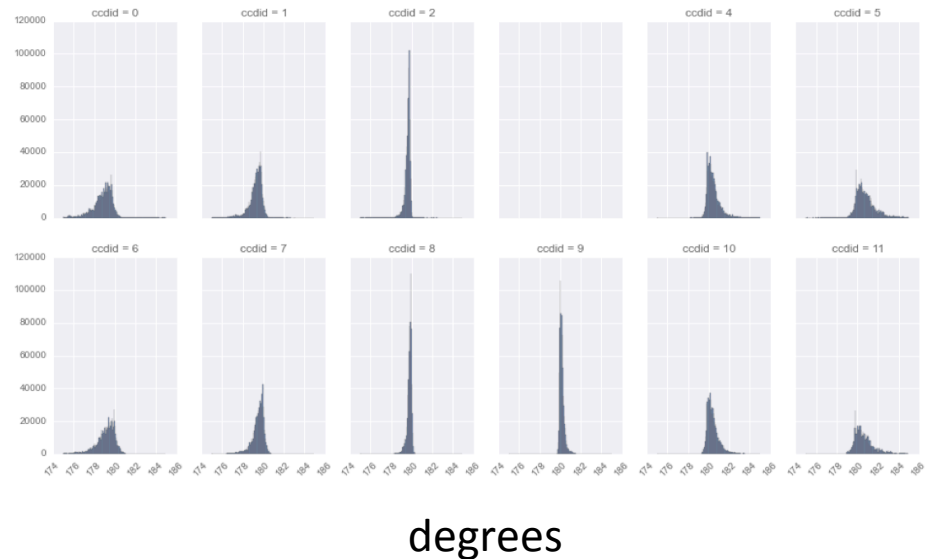
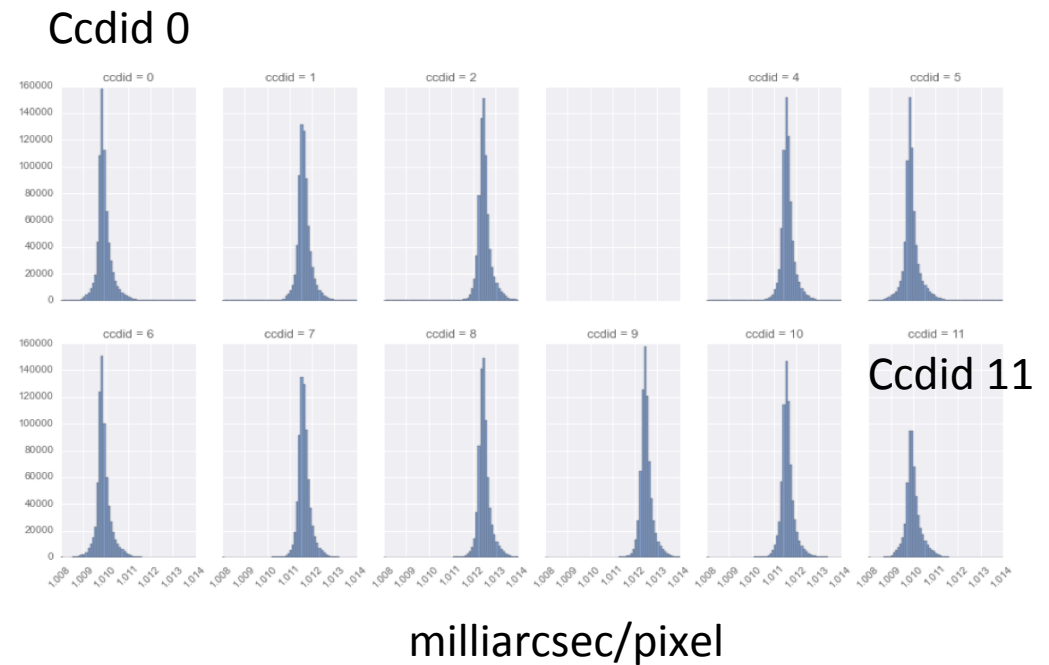


Galactic plane
is particularly
affected

Random WCS
can make
dozens of
matches and
1.42" RMS
per axis

Stability is great per chip

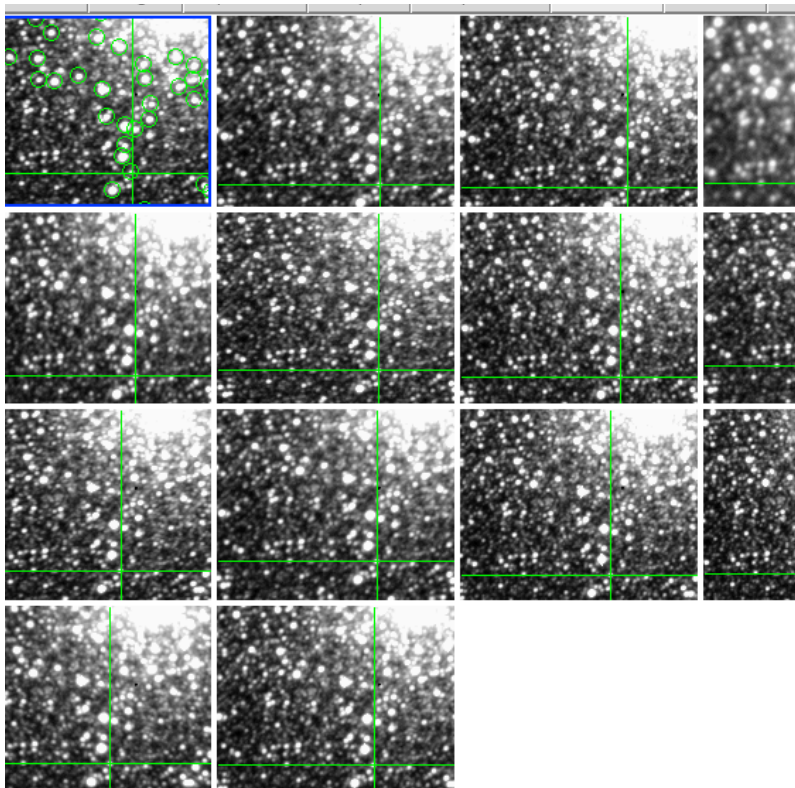
- Top: x-pixel scale in arcseconds
 - Trimmed std dev = 0.05%
- Bottom: CROTA2 (position angle)
 - 0.1 deg in center,
 - 0.3 deg on edges



New astrometric procedure

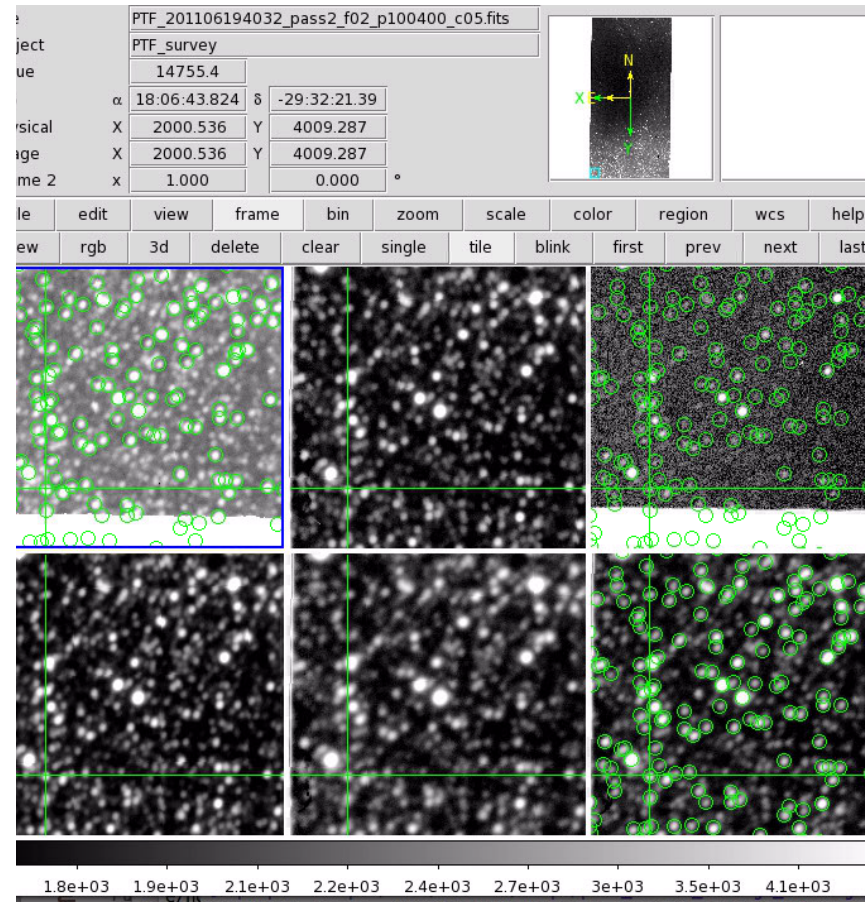
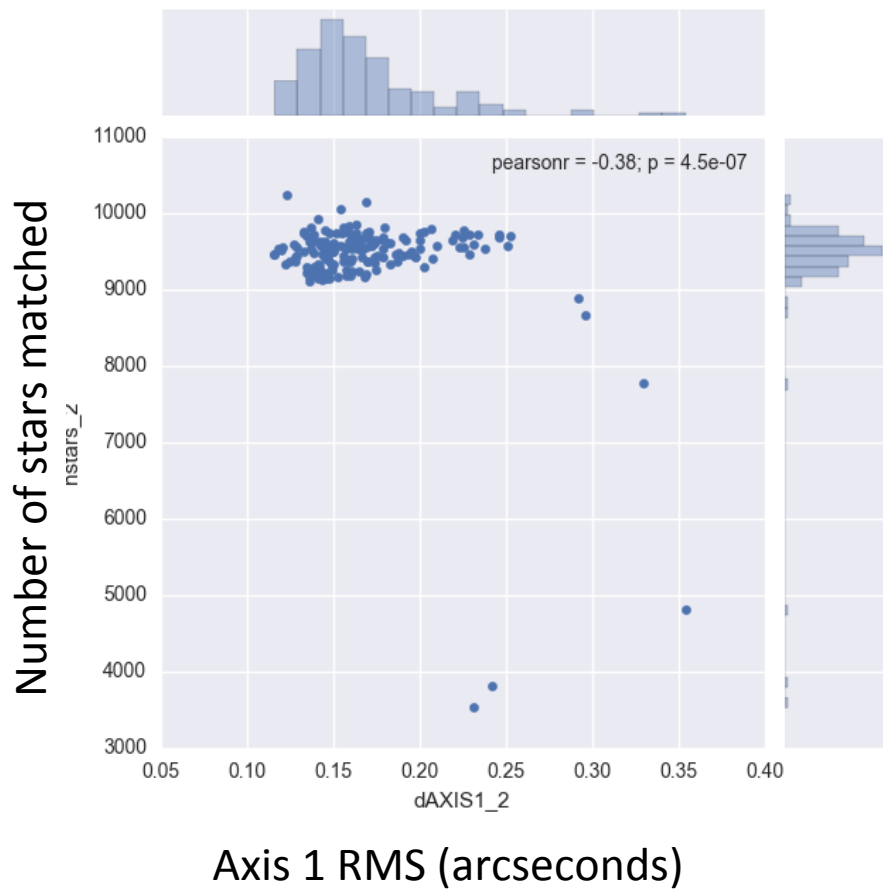
- Linear regression model on Field 4588 matches
- Pre-populate image headers
 - Per-chip CD matrix, CRPIX1/2
 - Global quadratic distortion terms
 - OBJRAD and OBJDECD as CRVAL1/2
- SCAMP run for shifts/scale/rotation
 - Tight constraints on scale and rotation
 - Shifts typically 30'' to a few arcminutes
- SCAMP run for distortion terms
 - Shift/pattern matching turned off
 - 2-arcsecond matching radius to reference catalog

New procedure has solved 1400+
challenging images correctly



- At left: “Challenge field”
1549, chip 5, with
globular cluster
- Of 1474 images only six
failed – 2 exposures w/
12 arcsecond “seeing”
(telescope out of focus)

Field 100400, chip 05, R filter outliers are due to seeing or clouds



Baseline plan for ZTF

- Use SCAMP as astrometry solver
 - Solve per quadrant
 - Gaia or PSI as reference catalog
- Check astrometry with e.g. 2MASS
- Improve astrometry checking
 - Number of stars matched relative to # in reference
 - Compare distortion surface to regression model