NPOI Observations with Short Baselines: Big Fluffy Stars and Geosats

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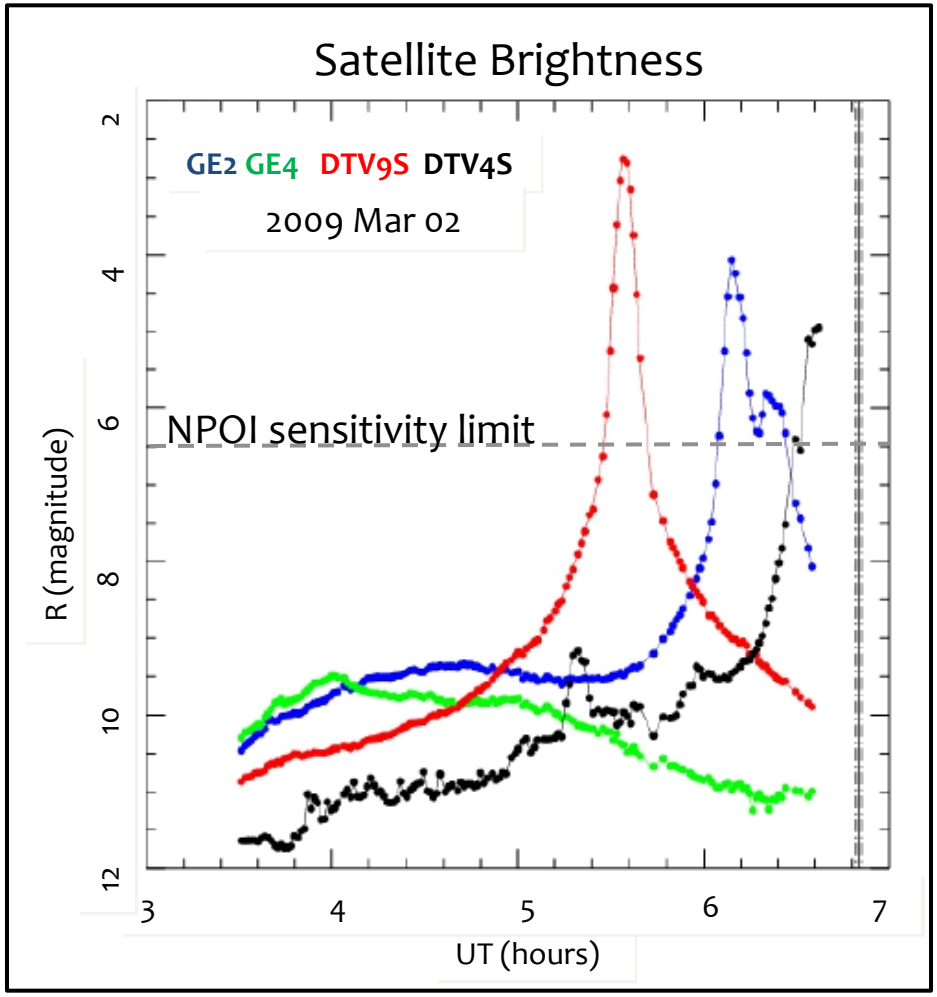
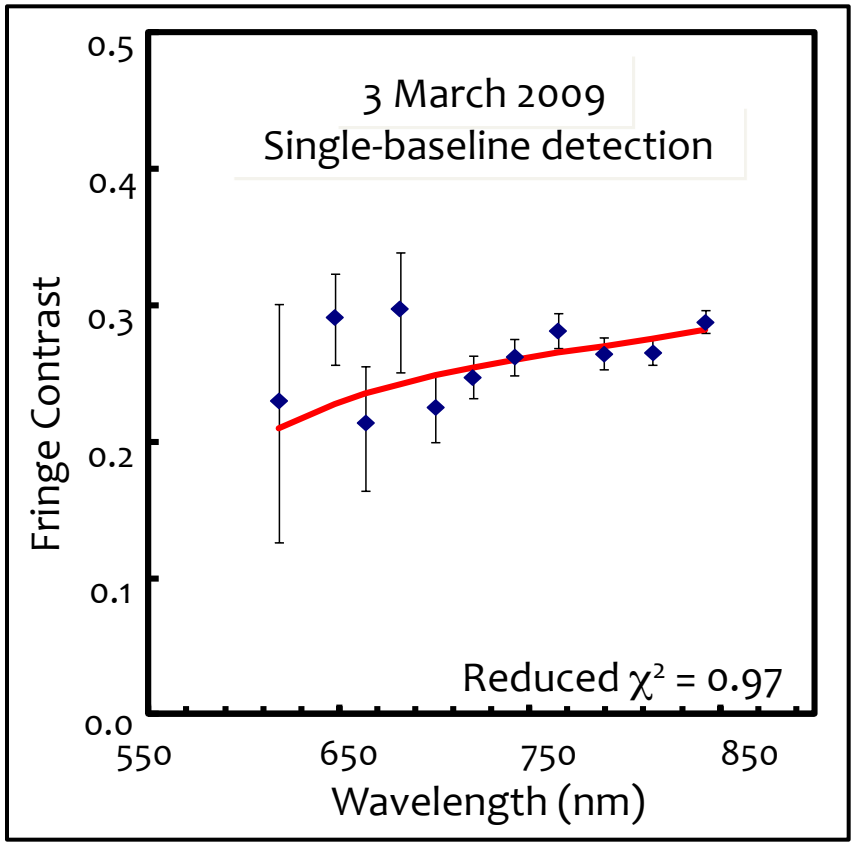
NPOI Proof of Concept for GEOsat Imaging

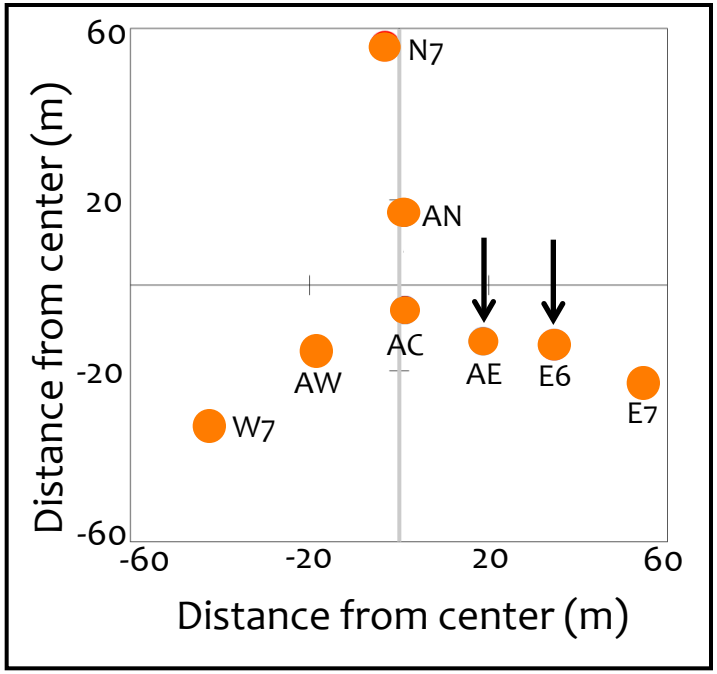
During glint:

- GEOsats brighten from 10-14th magnitude up to 1st
- Occurs twice a year
- Lasts ~10 minutes each night for a week



Successful Feasibility Study



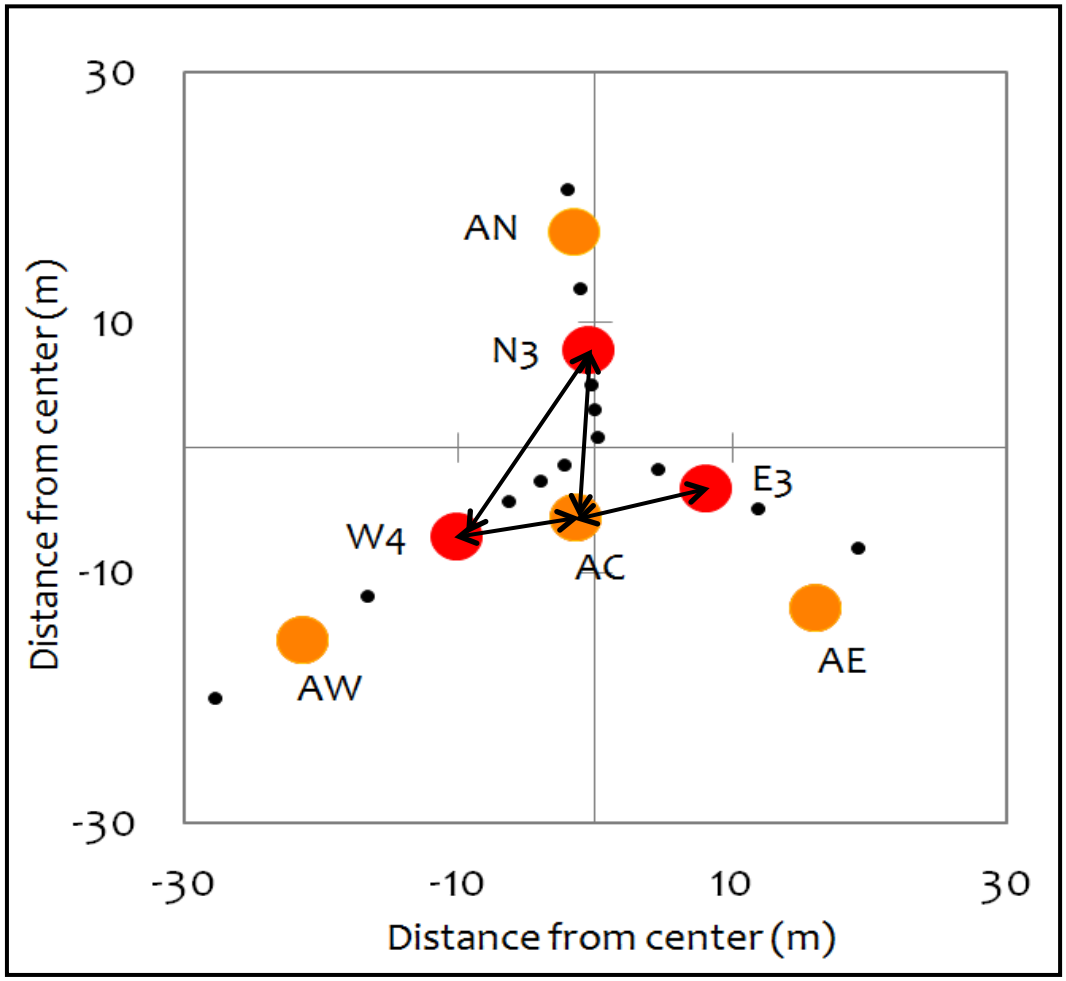


Two-component model

- small, bright element (1 m)
- large, diffuse element (≥3 m)

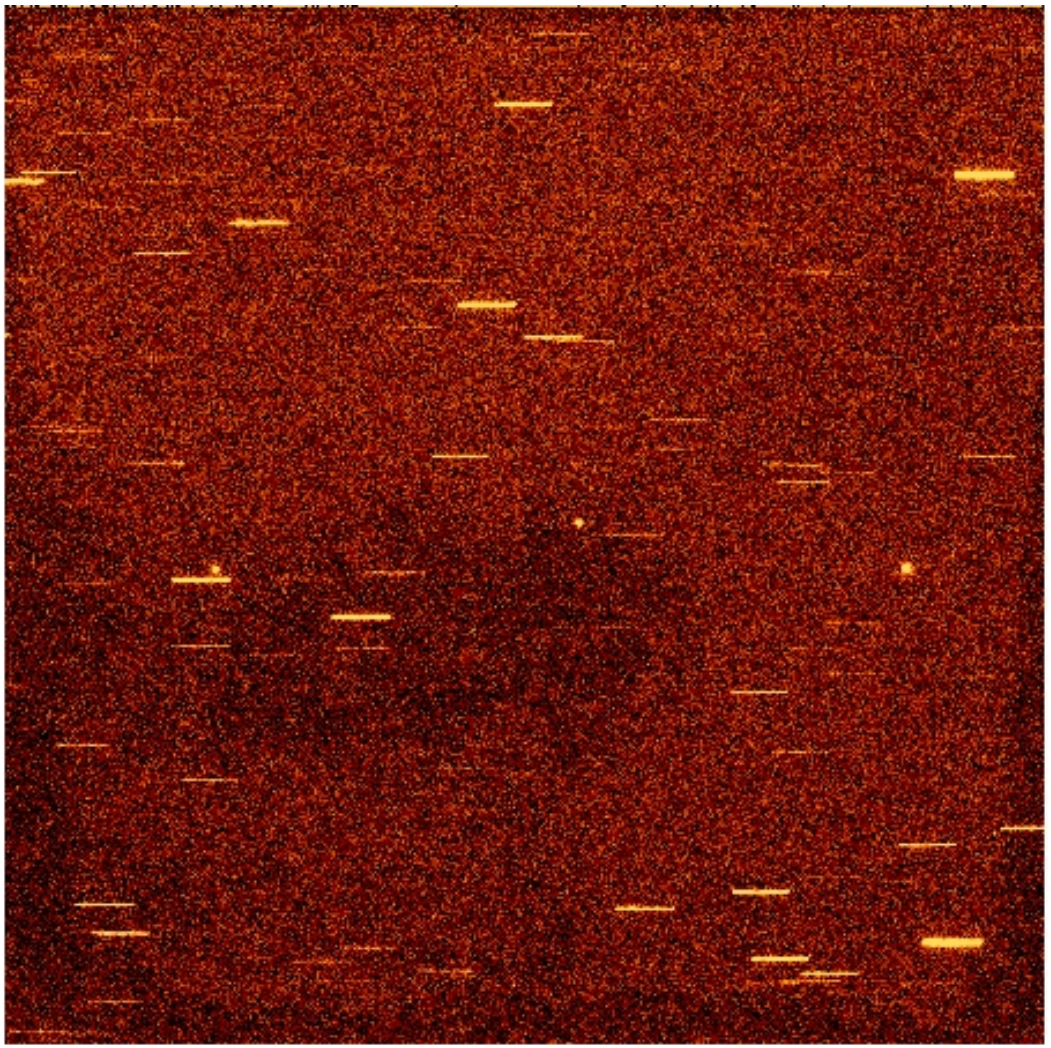
Array Configuration

AC-W4 = 8.9m
AC-E3 = 9.6m
E3-W4 = 18.1m

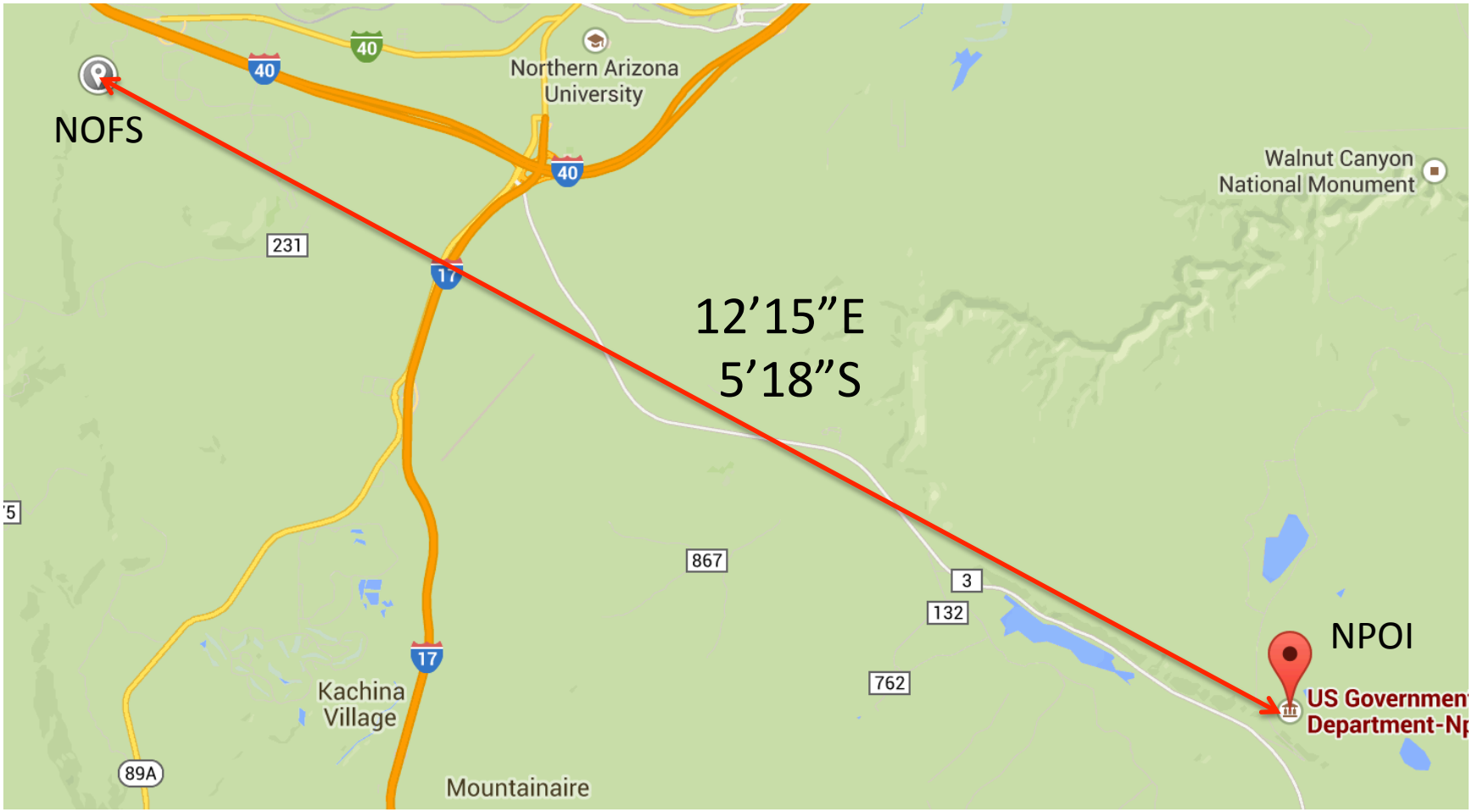


Determine the satellite position

- Rough satellite positions can be obtained from TLEs (Two Line Elements).
- TLEs are notoriously unreliable, with uncertainties of 20” to 2’. In some cases they miss-tag satellites.
- An uncertainty of 1’ on a 9m baseline corresponds to a delay uncertainty of 2.6mm.
- Depending on the fringe search mode we can search 25um per second, which makes the detection of the fringes hard during the glint.
- We need better astrometry.
- Used NOFS 40” telescope to obtained 1” precision astrometry.

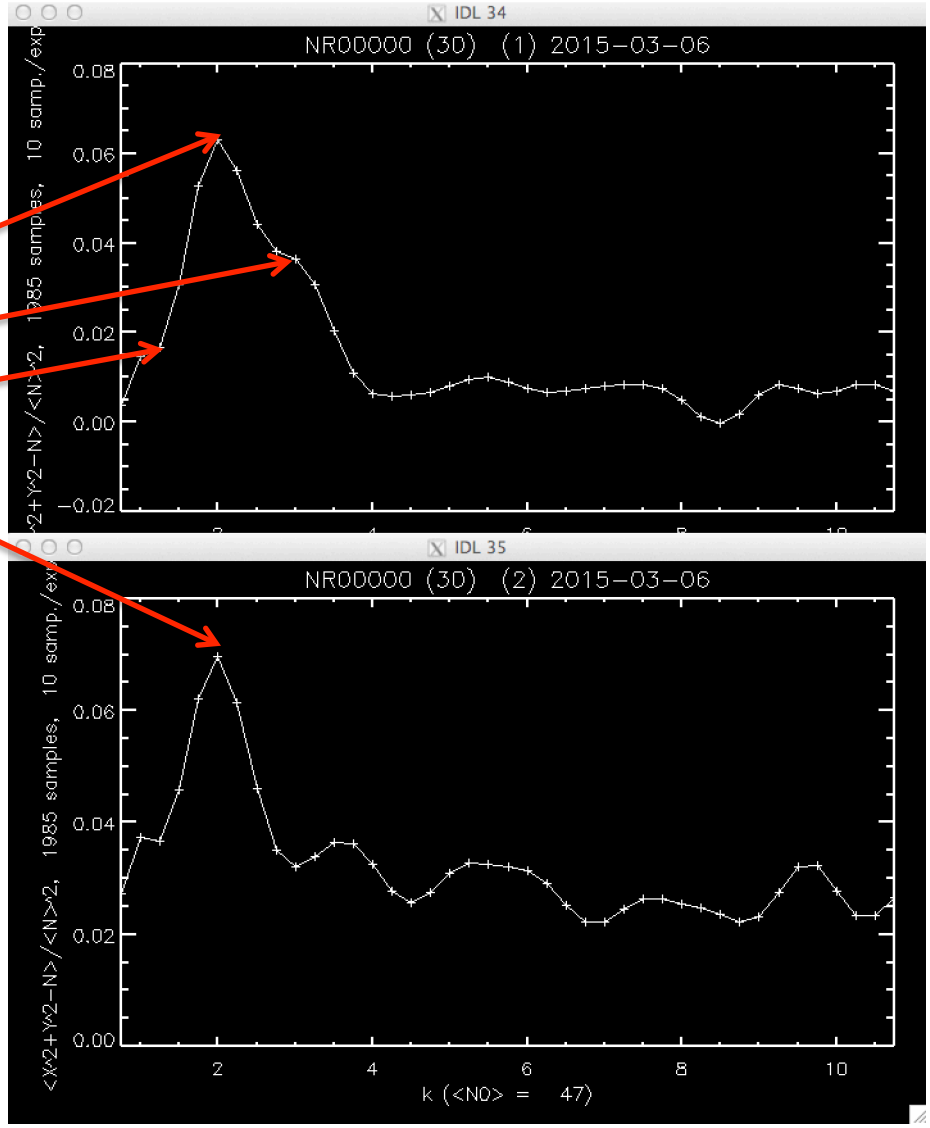


Parallax Correction

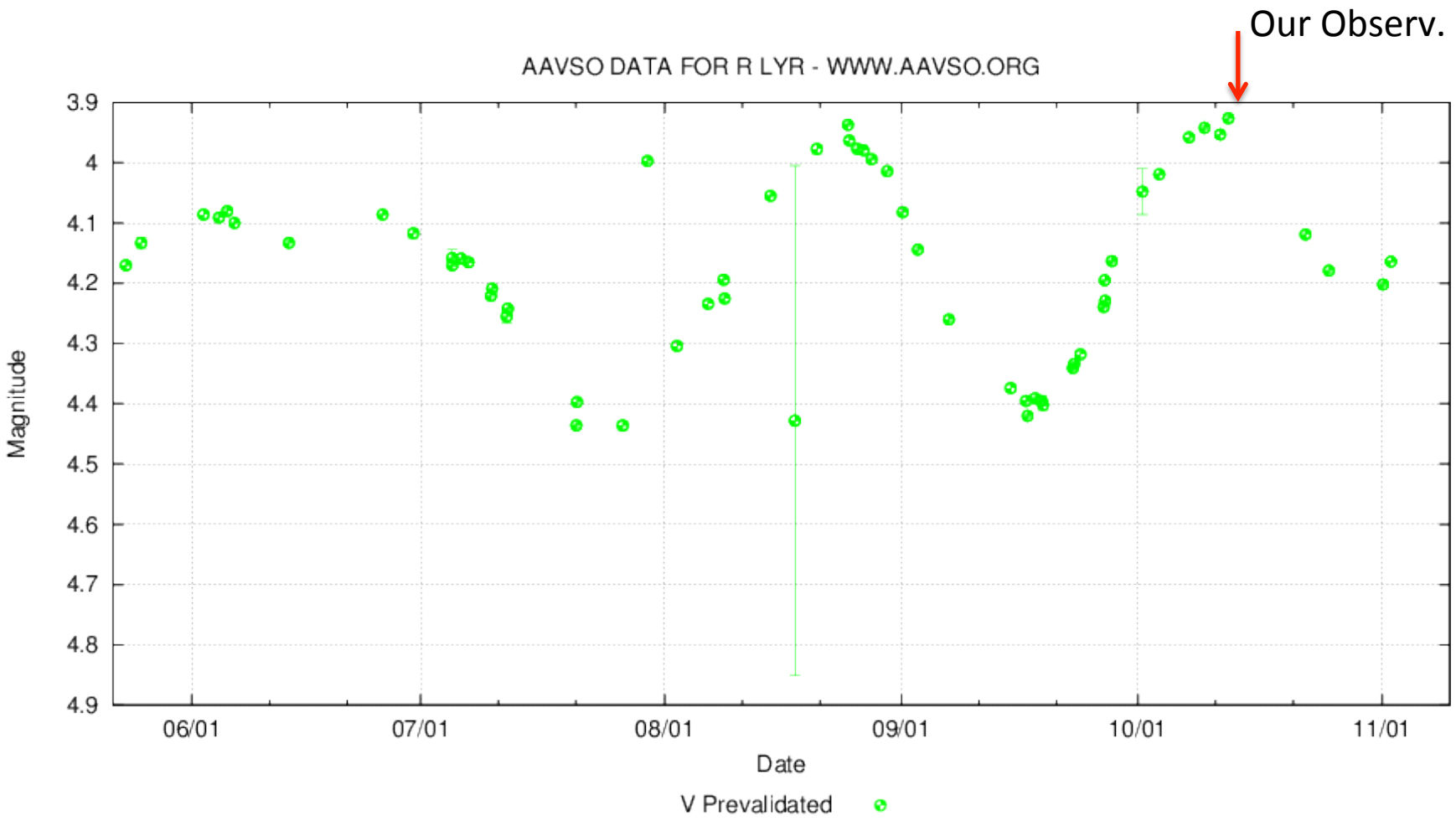


Detection of a Glinting Geosat with Multiple Baselines

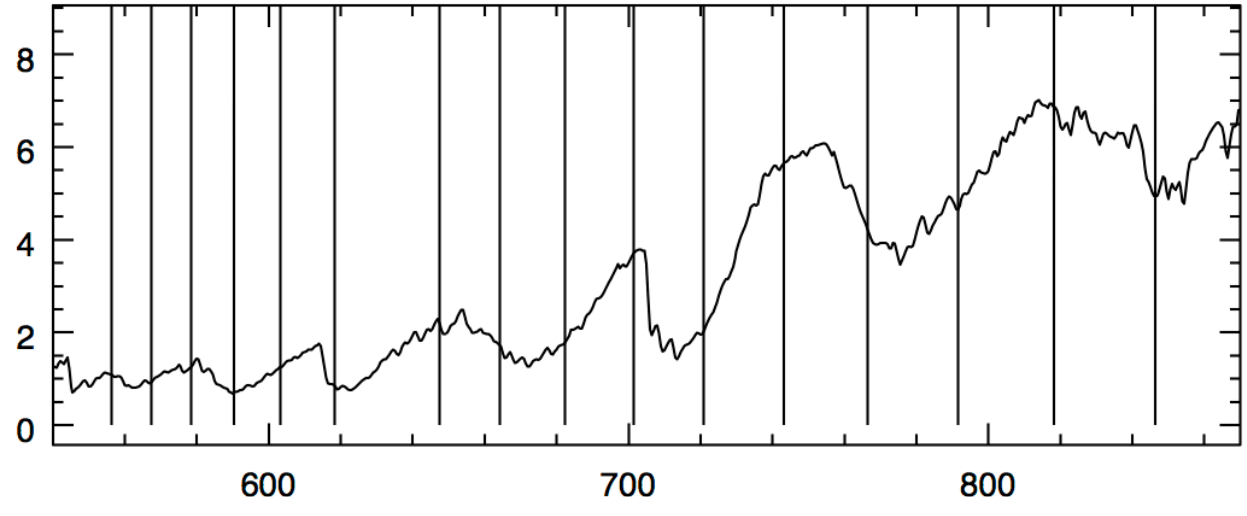
- Observations were done with stations AC, E3, N3 and W4, which correspond to baselines of 9 to 1m.
- Detected fringes on one glinting geosat with AC-W4 and AC-E3, and possibly detected E3-W4.
- AC-W4 was repeated in 2 spectrographs

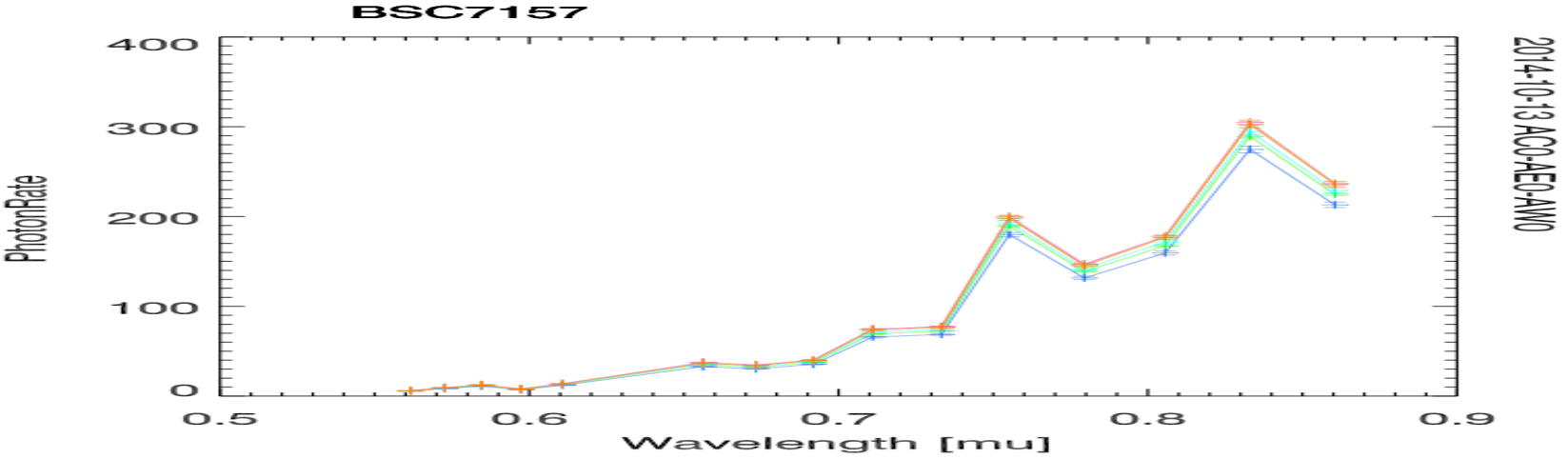


R Lyr - Variability



R Lyr - M5III – Semi regular pulsator
V=4.0 mag – θ~17 mas – strong TiO bands





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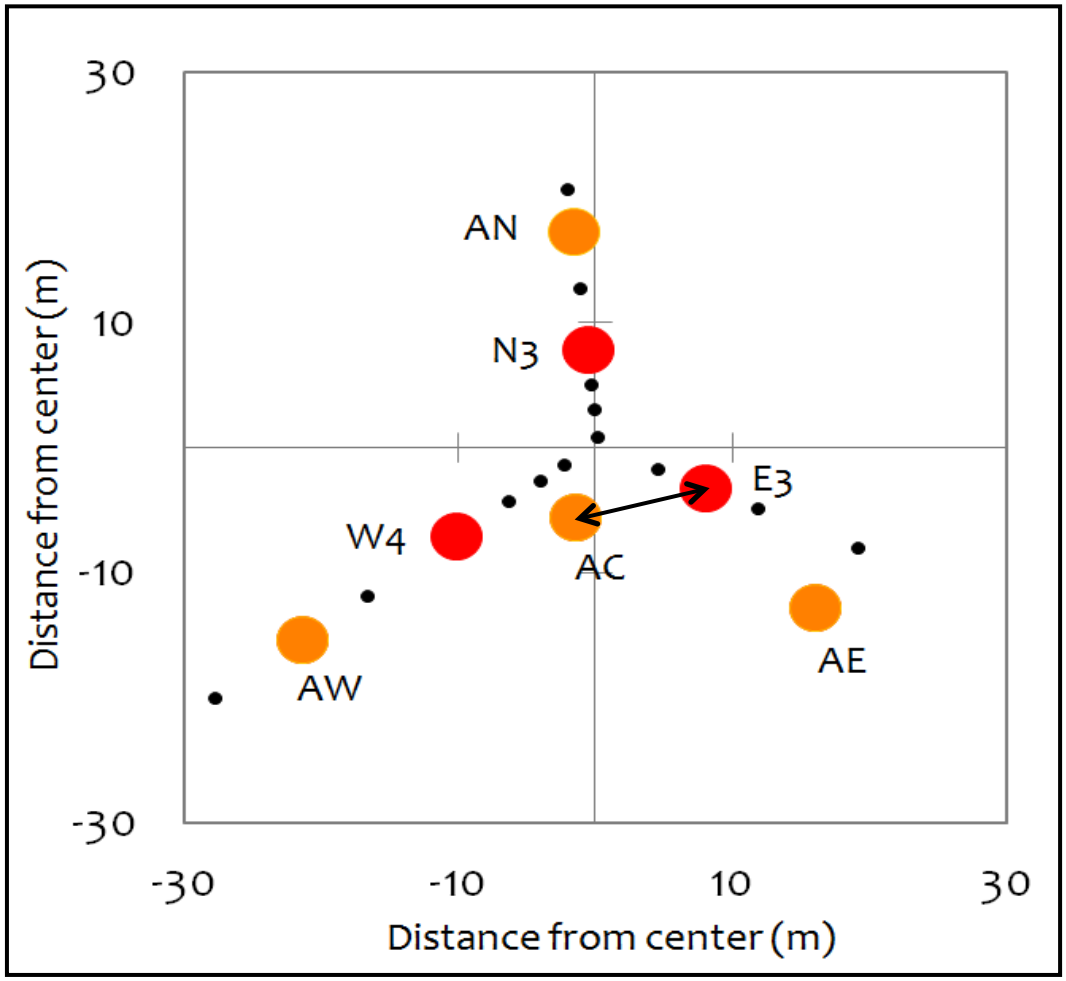
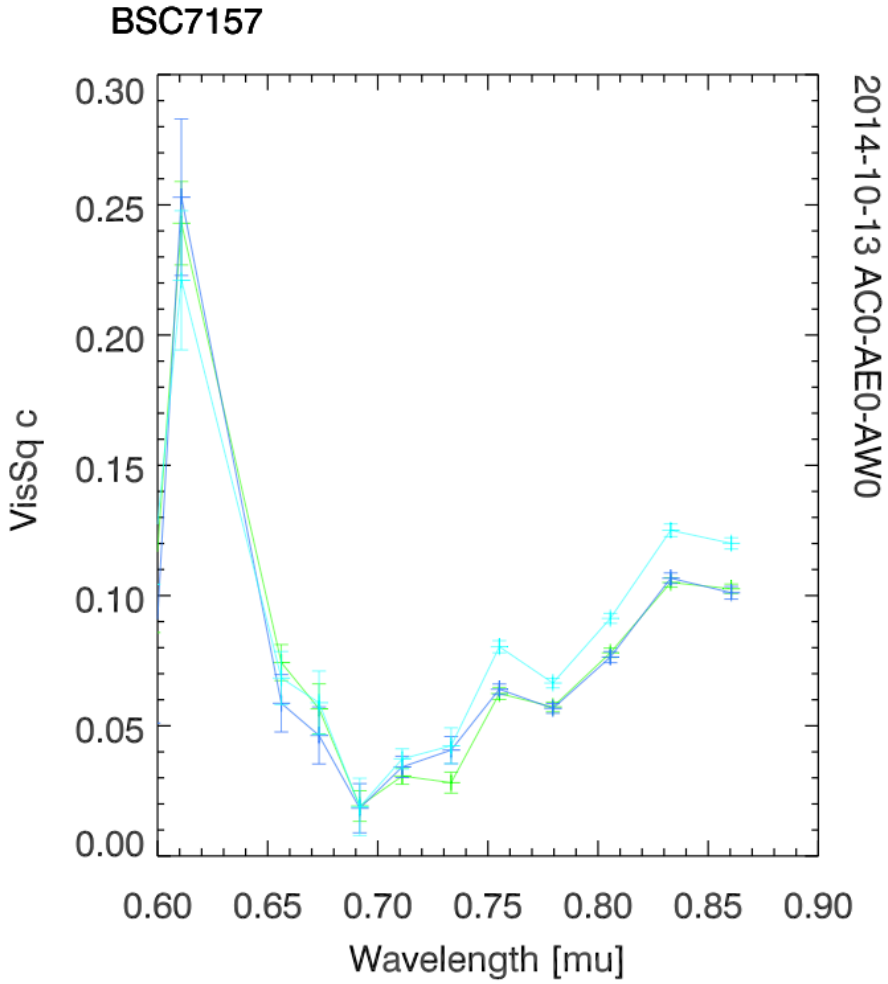


R Lyr – Visibilities on baseline AC-E3



R Lyr - Line and Continuum Diameters

- We find that the diameter of the star is 3.7% larger in the line than in the continuum.
- Quirrenbach et al. (1993) found that the diameter in the line was 12% larger than in the continuum.