

# Time-Variable Systematics

Jessica Krick

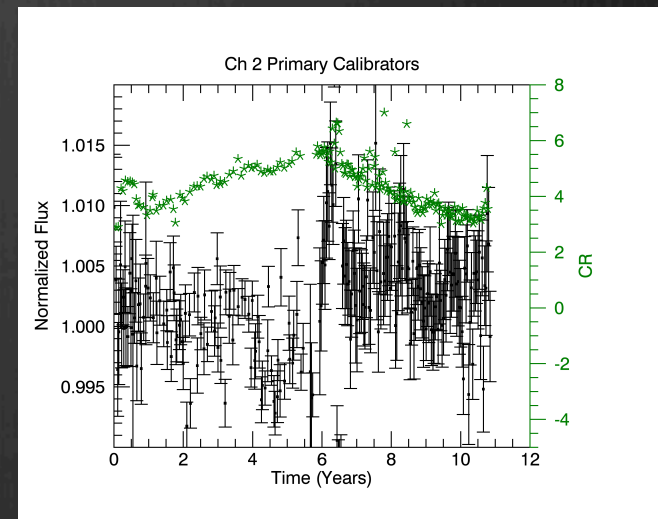
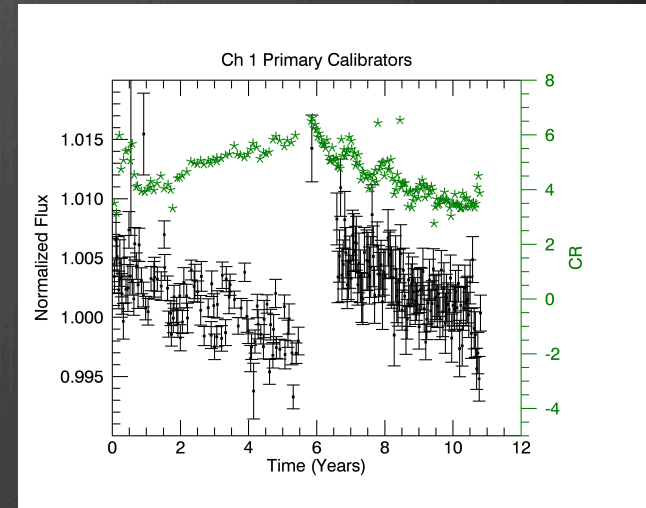
Jim Ingalls, Sean Carey, Bill Glaccum, Patrick Lowrance,  
Jason Surace, Carl Grillmair, Seppo Laine, Peter Capak

# Repeatability

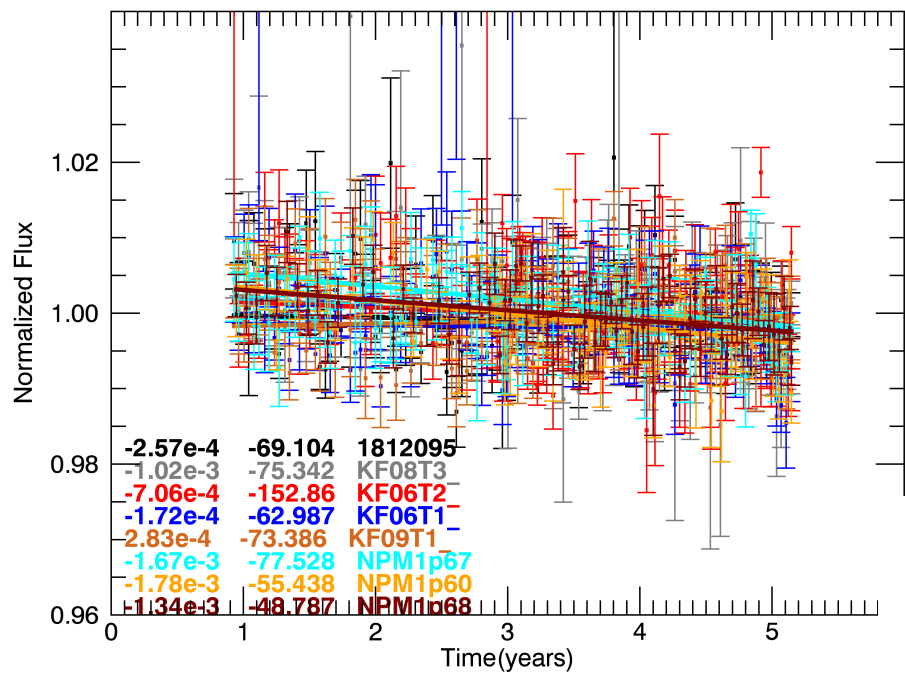
- ⊗ Instrumental Sources of non-repeatability
  - ⊗ Photometric stability over the mission is excellent
  - ⊗ Snapshots as evidence that RMS vs. Binsize changes slightly with each AOR.
  - ⊗ Persistent images change on short and long timescales
- ⊗ Astrophysical sources
  - ⊗ The star or the planet
  - ⊗ Are there observations we could make to rule out one or the other?

# Photometric Stability on Year-Long Timescales

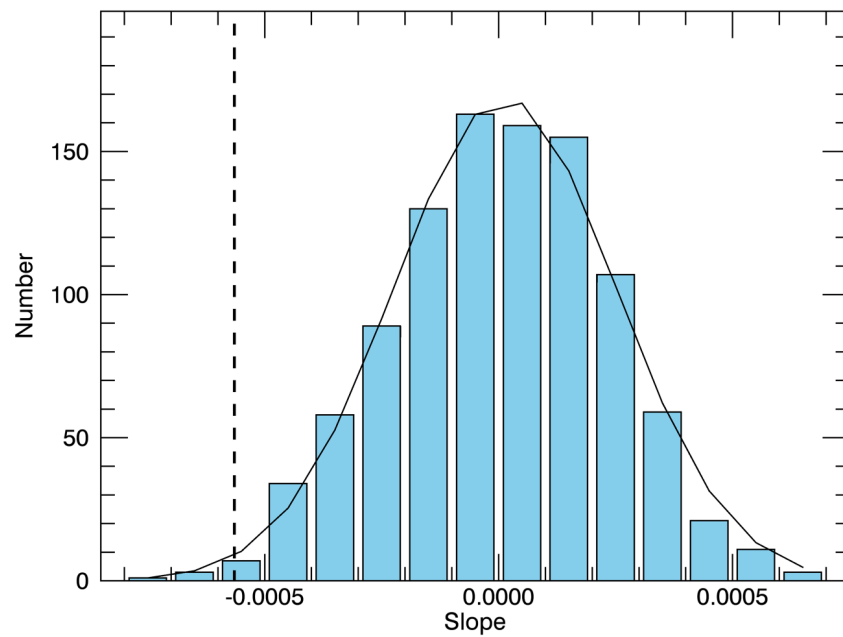
- 7 calibration stars binned to 2 weeks
- Calstars are dithered – main source of scatter
- Error bars are  $1\sigma$  stddev on the mean
- Statistically significant decrease in sensitivity
  - 0.1% per year in ch1 and 0.05% per year in ch2
  - Likely caused by degradation in the system, maybe radiation damage to the optics
- Will not effect eclipse depth measurements since those are measured relative to out of eclipse times



Primary Calibrators

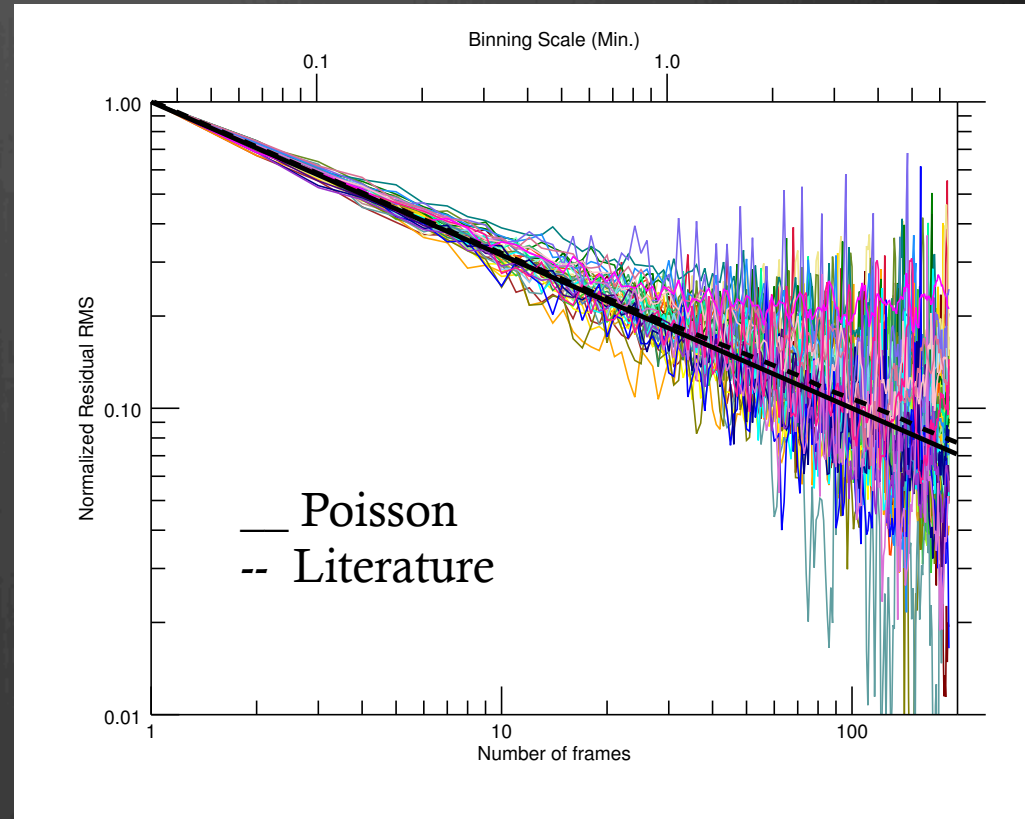


1000 Monte Carlo realizations



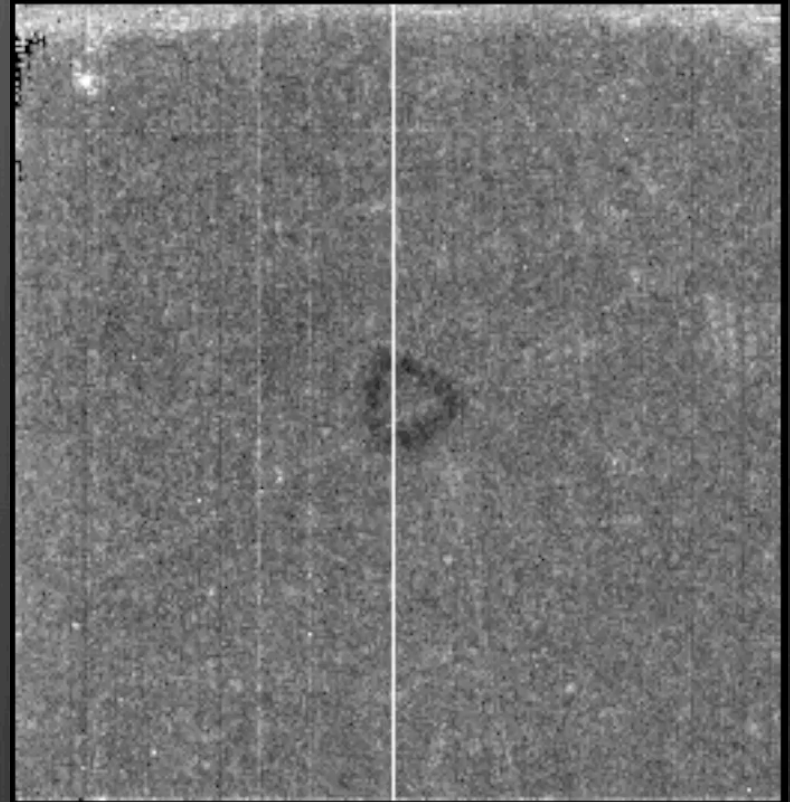
# Snapshots

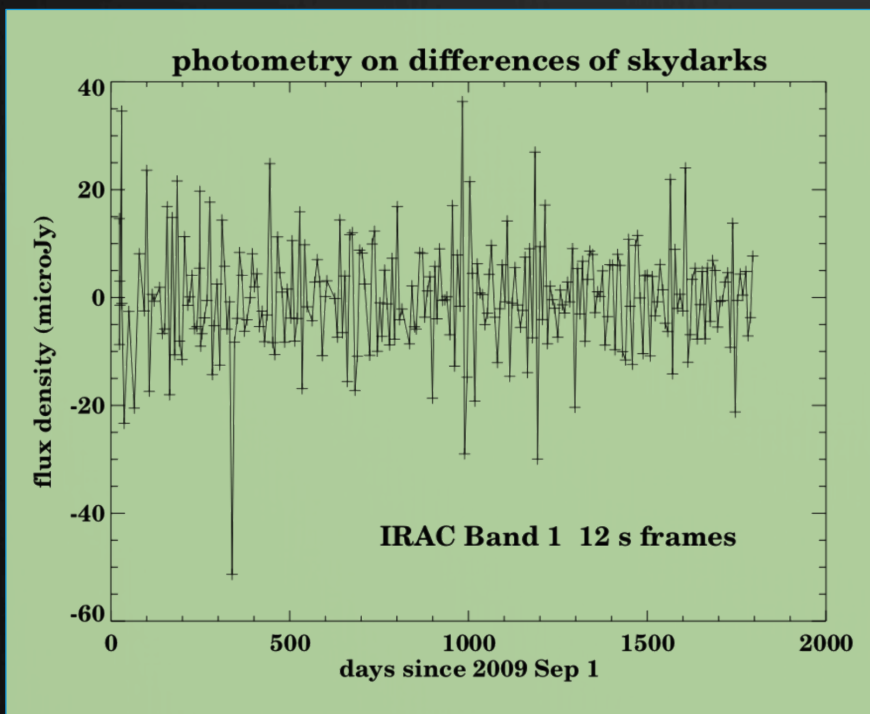
- 43 individual observations taken over two visibility windows 1 year apart.
- Scatter due to 30 minute observations
- No time-correlated noise above that seen in literature source for same star.



# Latents

- ⊗ Background pattern is changing underneath the targets due to latents at the 0.01 - 0.1% level.
- ⊗ Scheduling attempts to place exoplanets further than 4 hours from bright observations
- ⊗ 250 skydarks 12s full array from Sep 2009 - Aug 2014 with backgrounds removed.





Frame time	Ch1 sigma	Ch2 sigma
0.02 sub	0.03%	0.01%
0.1 sub	0.07%	0.01%
0.4 sub	0.1%	0.02%
2 sub	0.11%	0.03%
0.4 full	0.06%	0.05%
2 full	0.06%	0.04%
6 full	0.07%	0.03%
12 full	0.07%	0.04%

# Summary

- **Long term (years)** – instrument is very stable with a degradation of order 0.1% per year in ch1 and 0.05% per year in ch2 which can be removed from the data.
- **Short term (days)** – Latents exist and are changing.
- **Short term (minutes to hours)** – we know of nothing changing on these timescales – very difficult to disentangle from the position dependent gain changes. – we see no evidence for a “ramp” in ch1 or ch2 which is not a function of position.