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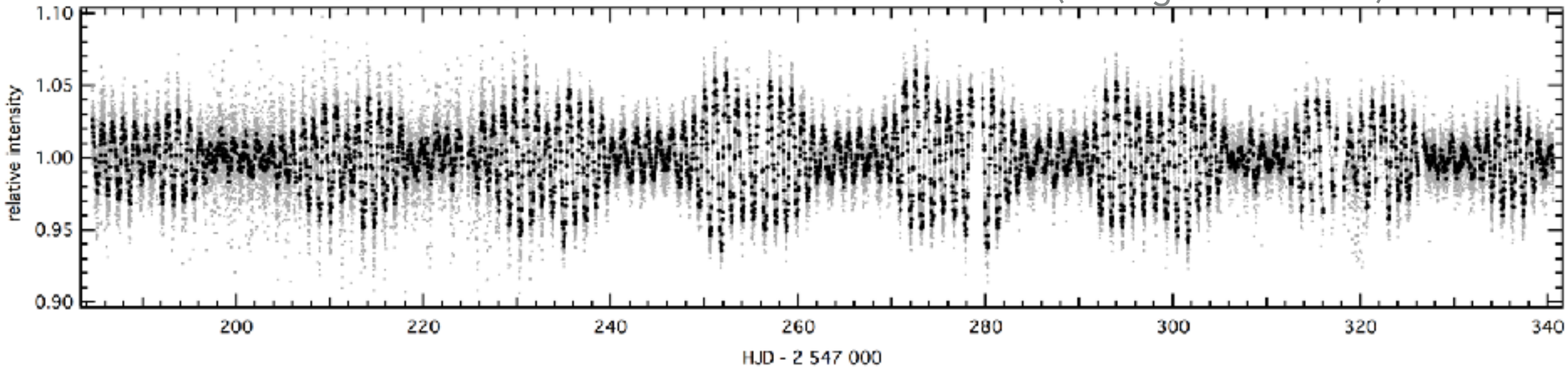
TESTING THE PHOTOMETRIC STABILITY OF BRITE-CONSTELLATION

FFG
universität wien

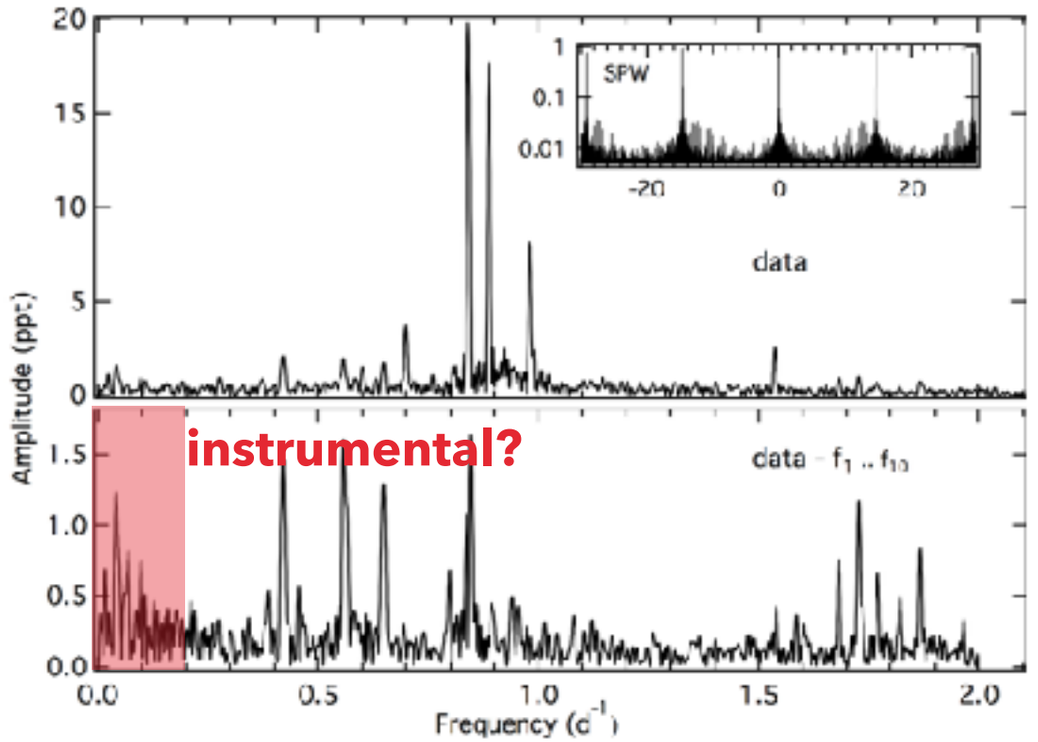
ABSOLUTE PHOTOMETRY

156d of BRITE-Toronto observations of the SPB star HD201433 (Kallinger et al. 2017)



BRITE satellites deliver high-precision photometry, but…

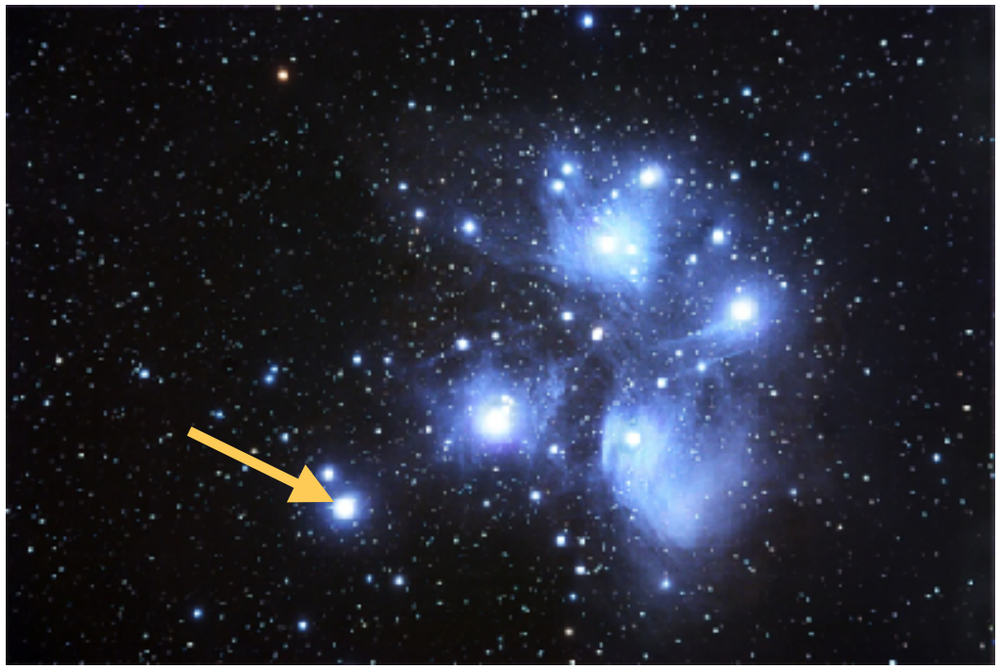
… there are various instrumental effects that potentially affect the (long-term) stability of the photometry



HOW TO TEST?

The (long-term) photometric stability is tested best with independent observations of a “quiet” star

A rare example for such a test is the Pleiades star *27 Tau: B8III star; 3.6mag in V*



Kepler/K2

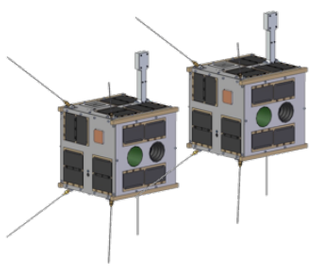
- C4 (early 2015)
- Long cadence (29min)
- ~3,400 data points
  29 x 1min
- ~71d

BRITE-Austria (b)

- 2014/15
- ~25,500 data points
  2 sec
- ~130d

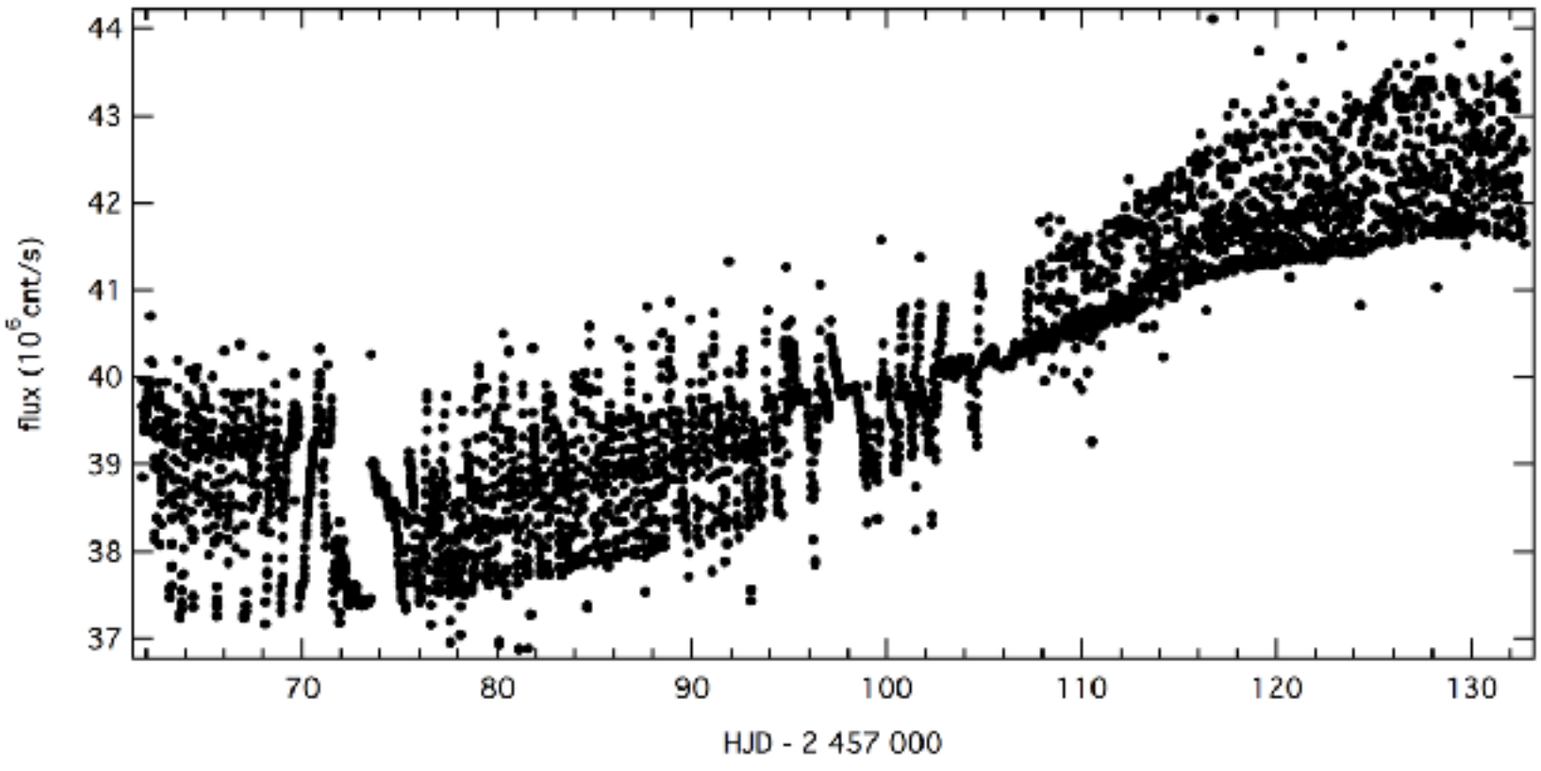
UniBRITE (r)

- ~165,000 data points
  2 sec
- ~168d



KEPLER PHOTOMETRY

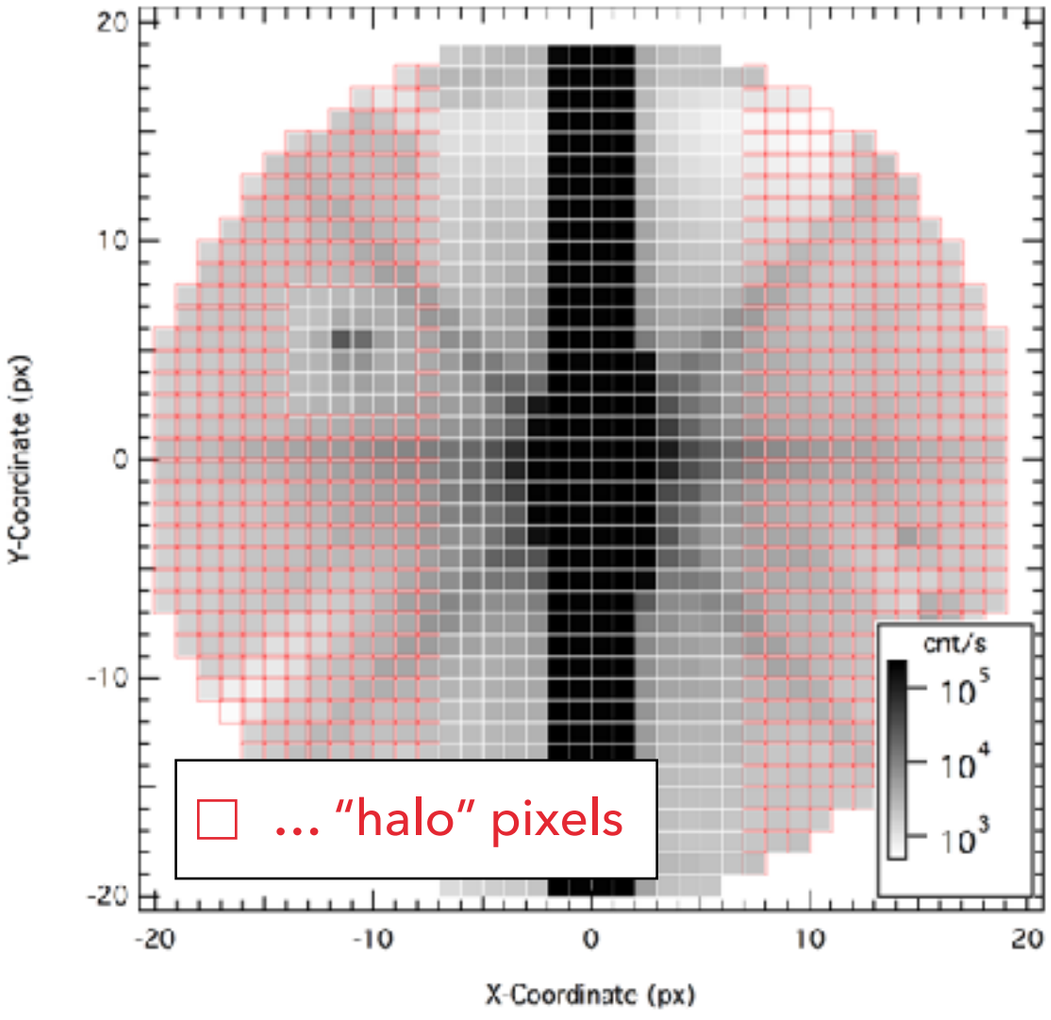
KEPLER – STANDARD APERTURE PHOTOMETRY

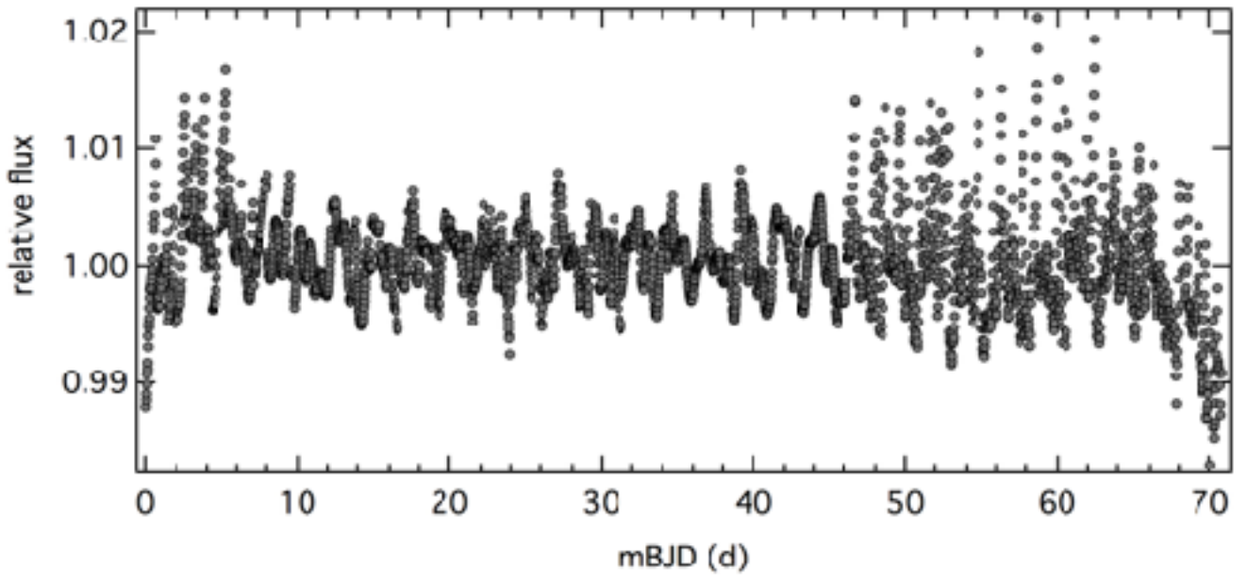


27 Tau is fully saturated on the Kepler CCD

➠ standard aperture photometry is therefore useless

KEPLER – HALO PHOTOMETRY



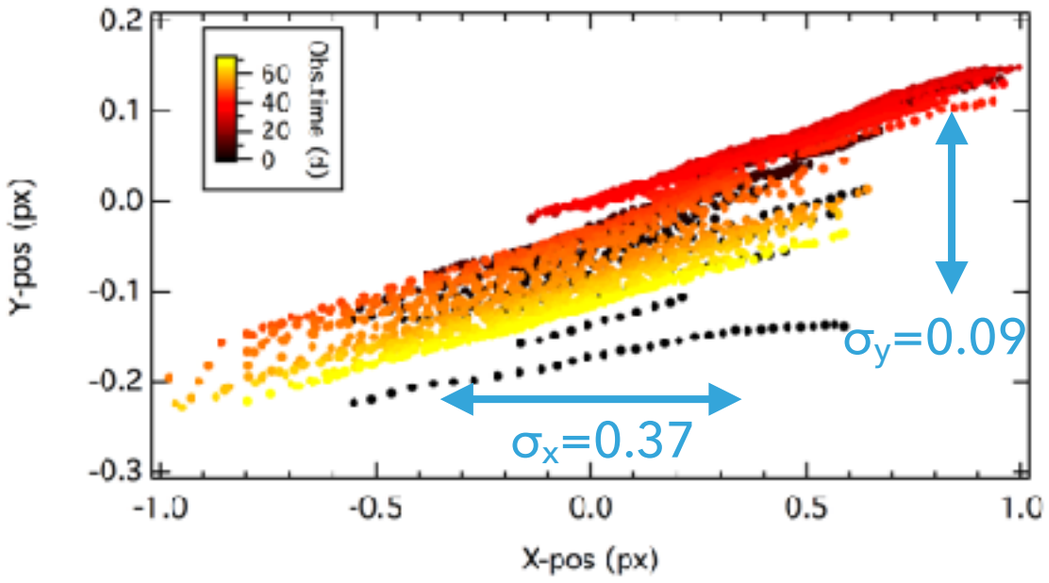


integrated flux of background-corrected "halo" pixels still give 1.7×10^6 cnt/s

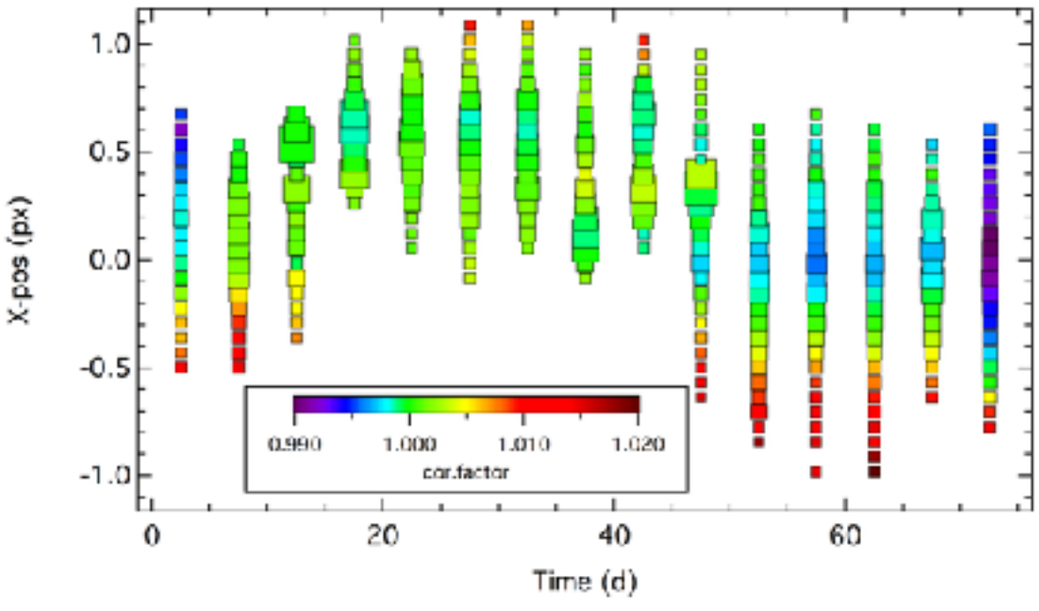
point-to-point scatter: ~0.13%

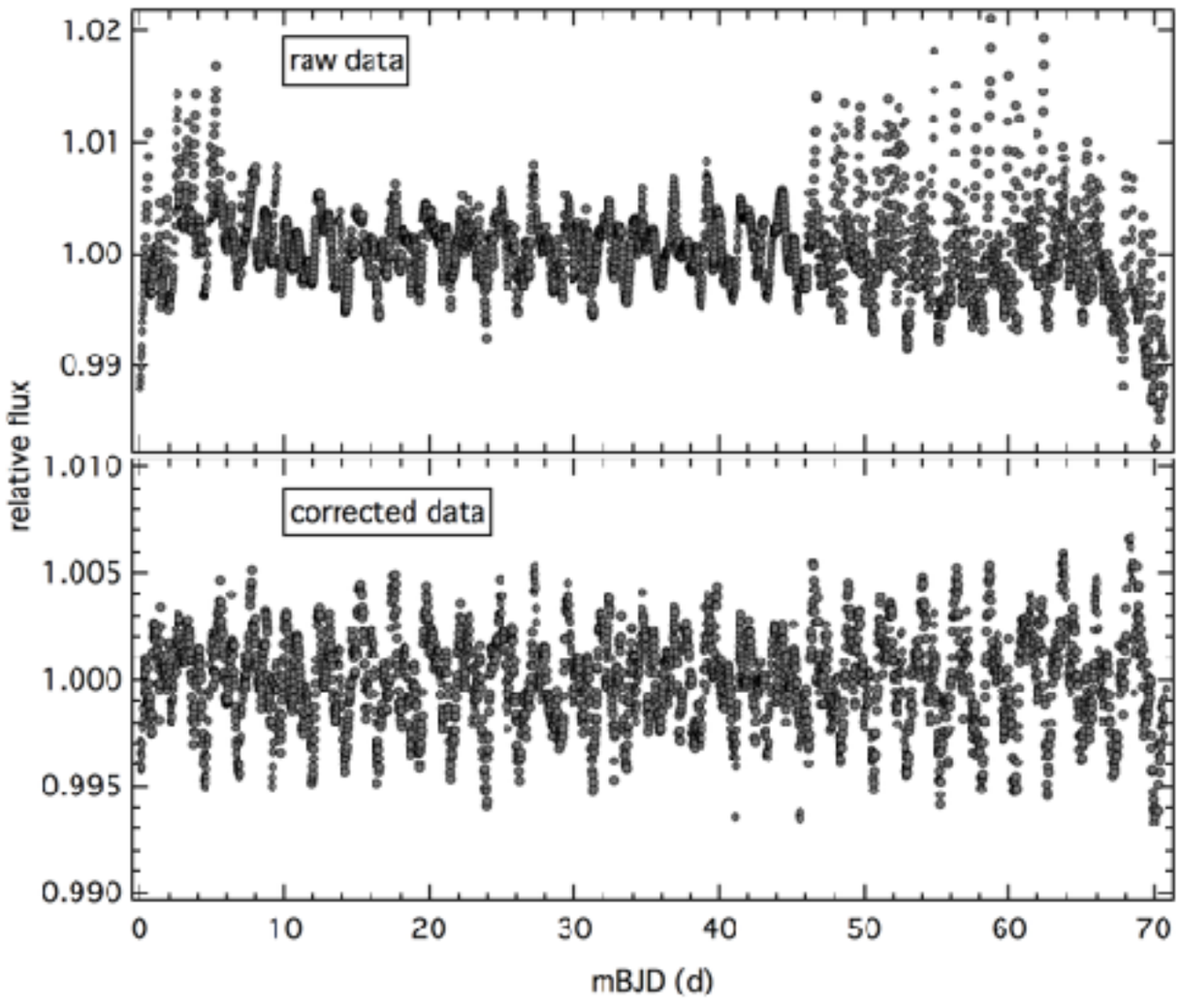
KEPLER – HALO PHOTOMETRY

time-dependent pointing drifts



correction map in x-pos and time

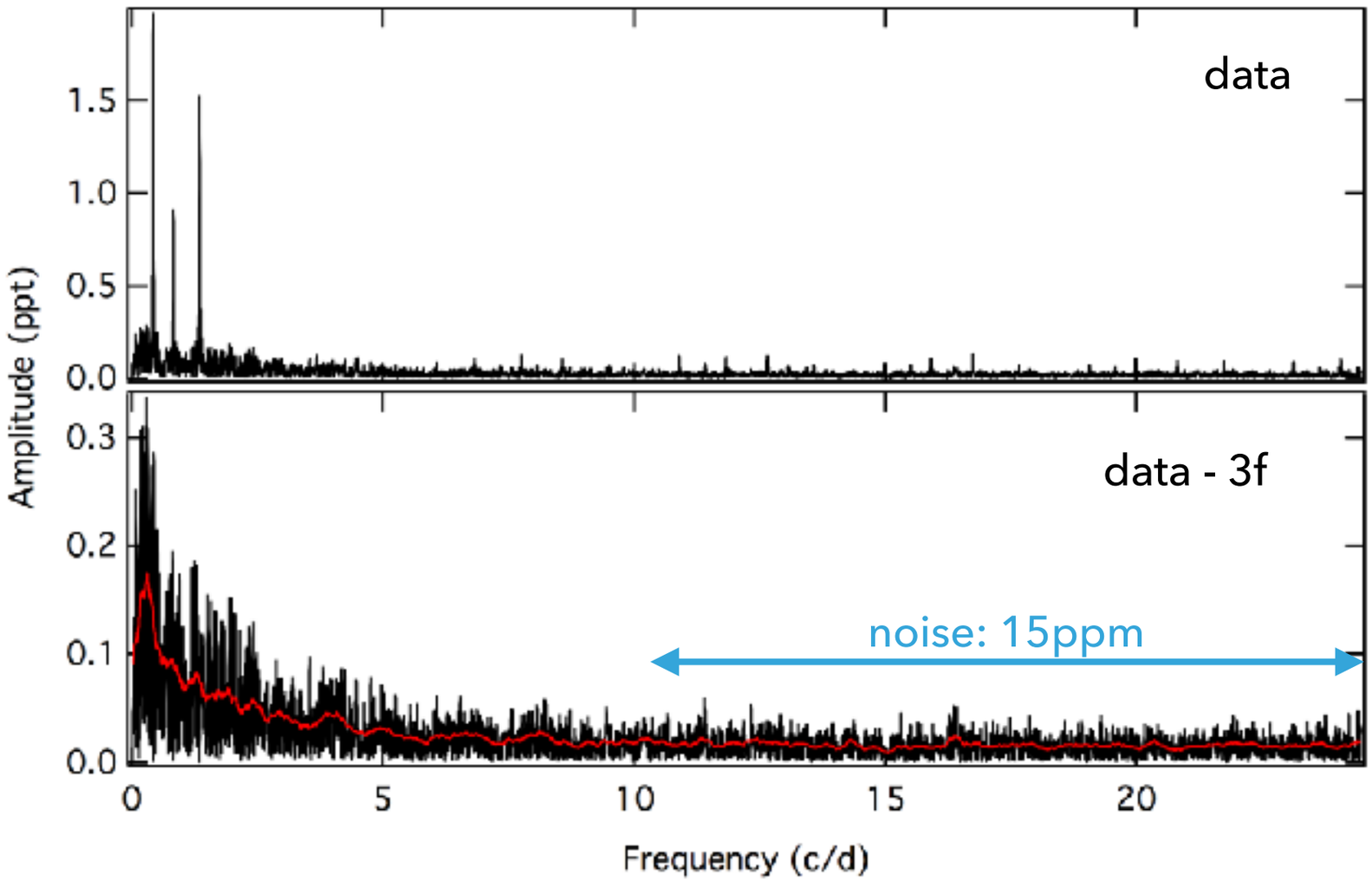




data after correcting for pointing drifts

point-to-point scatter: ~0.05%

KEPLER – HALO PHOTOMETRY

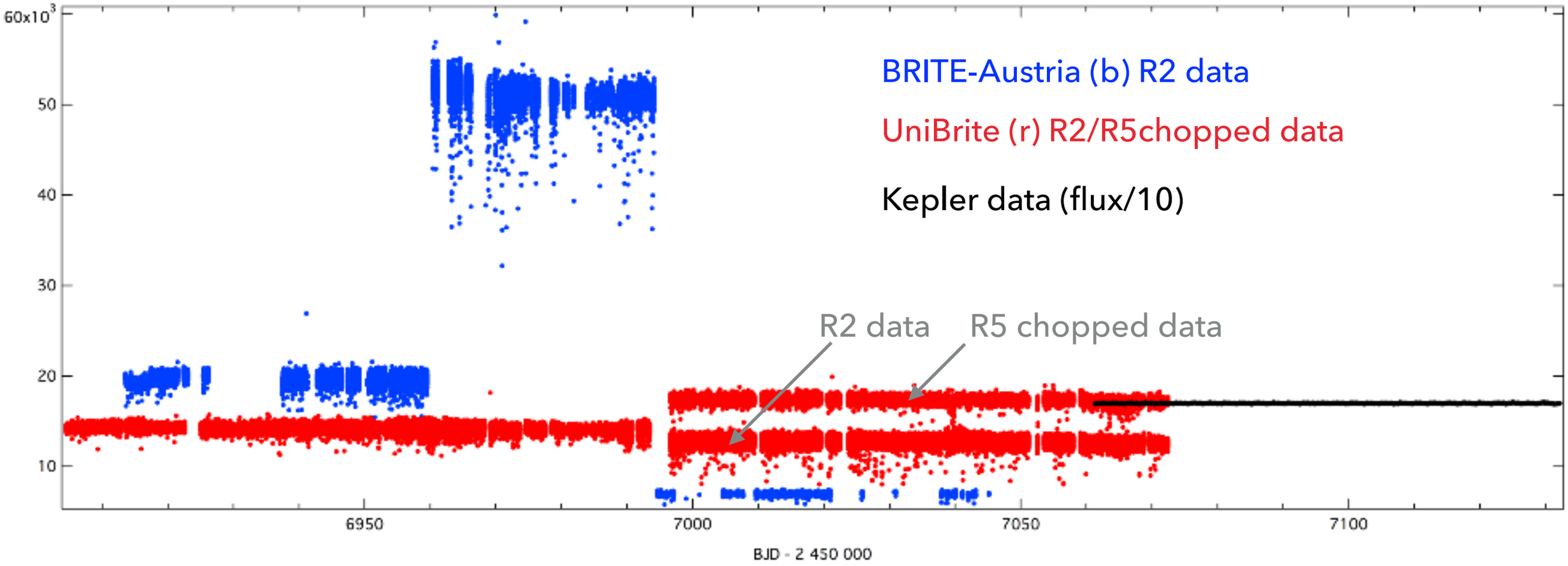


<u>significant signal</u>

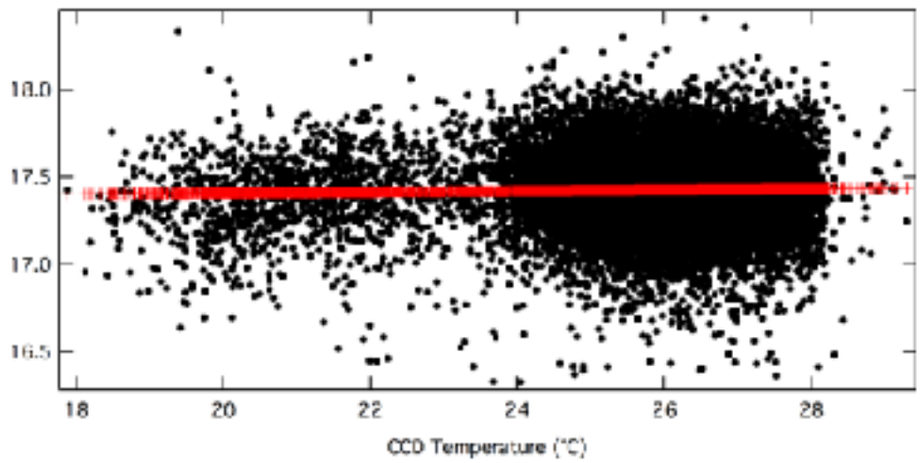
f (c/d)	A (ppt)
0.4122	2.00
0.8237	0.94
1.3409	1.54

BRITE PHOTOMETRY

BRITE – RAW STELLAR FLUX

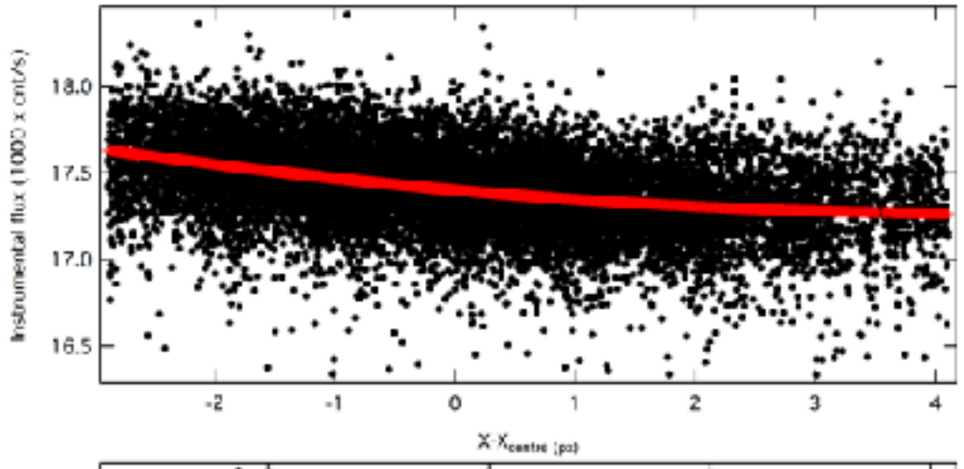


BRITE – DATA POSTPROCESSING



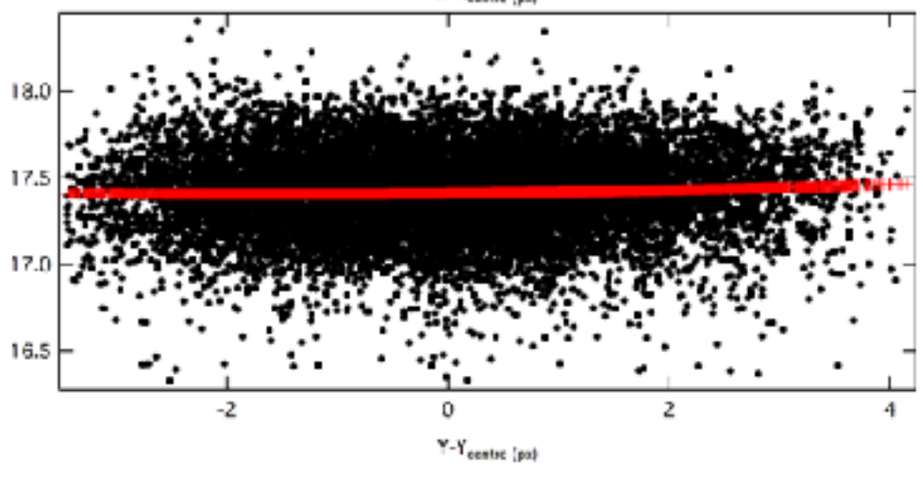
CCD Temperatur

~3cnt/K



centroid X position

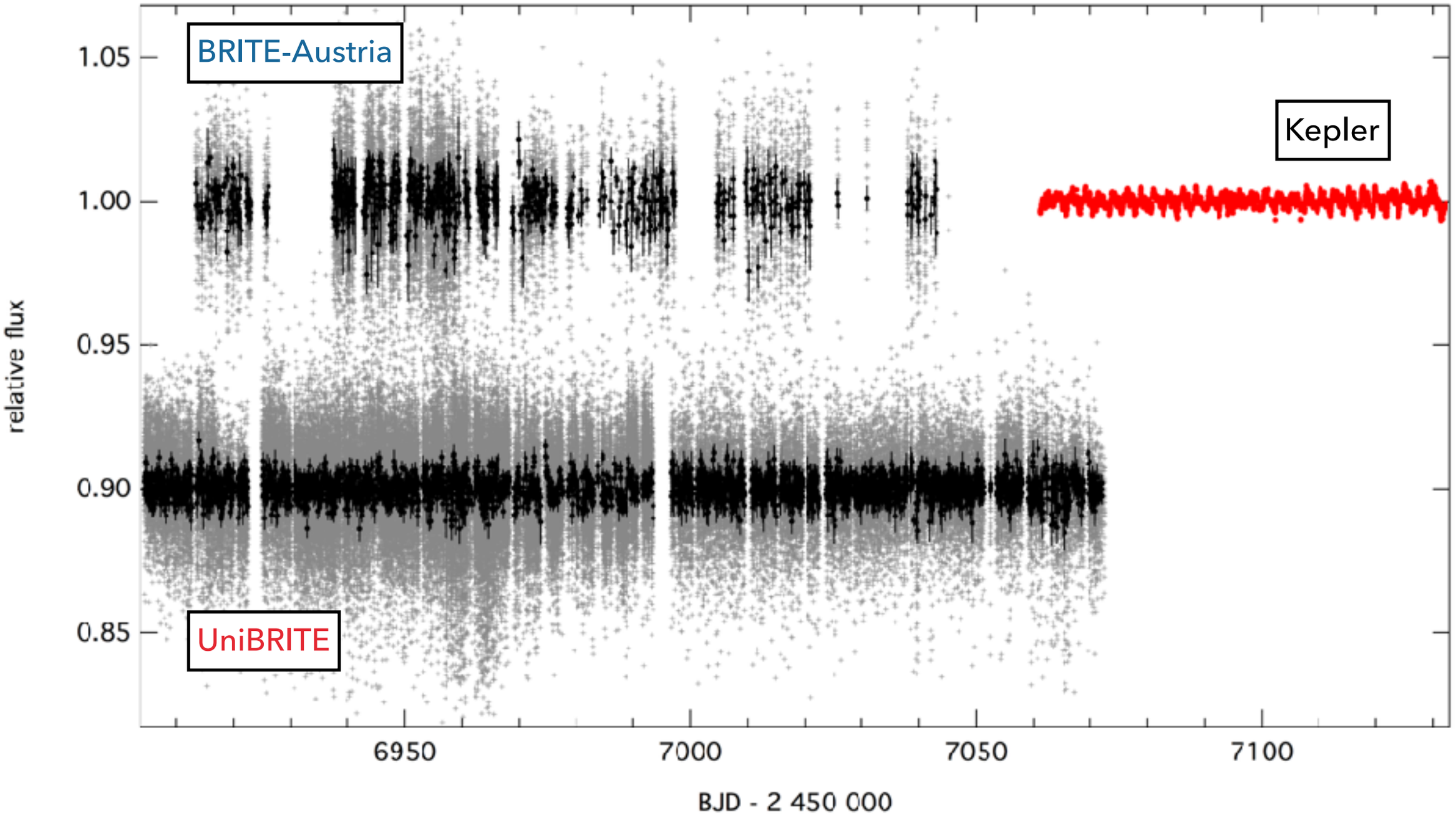
~60cnt/px



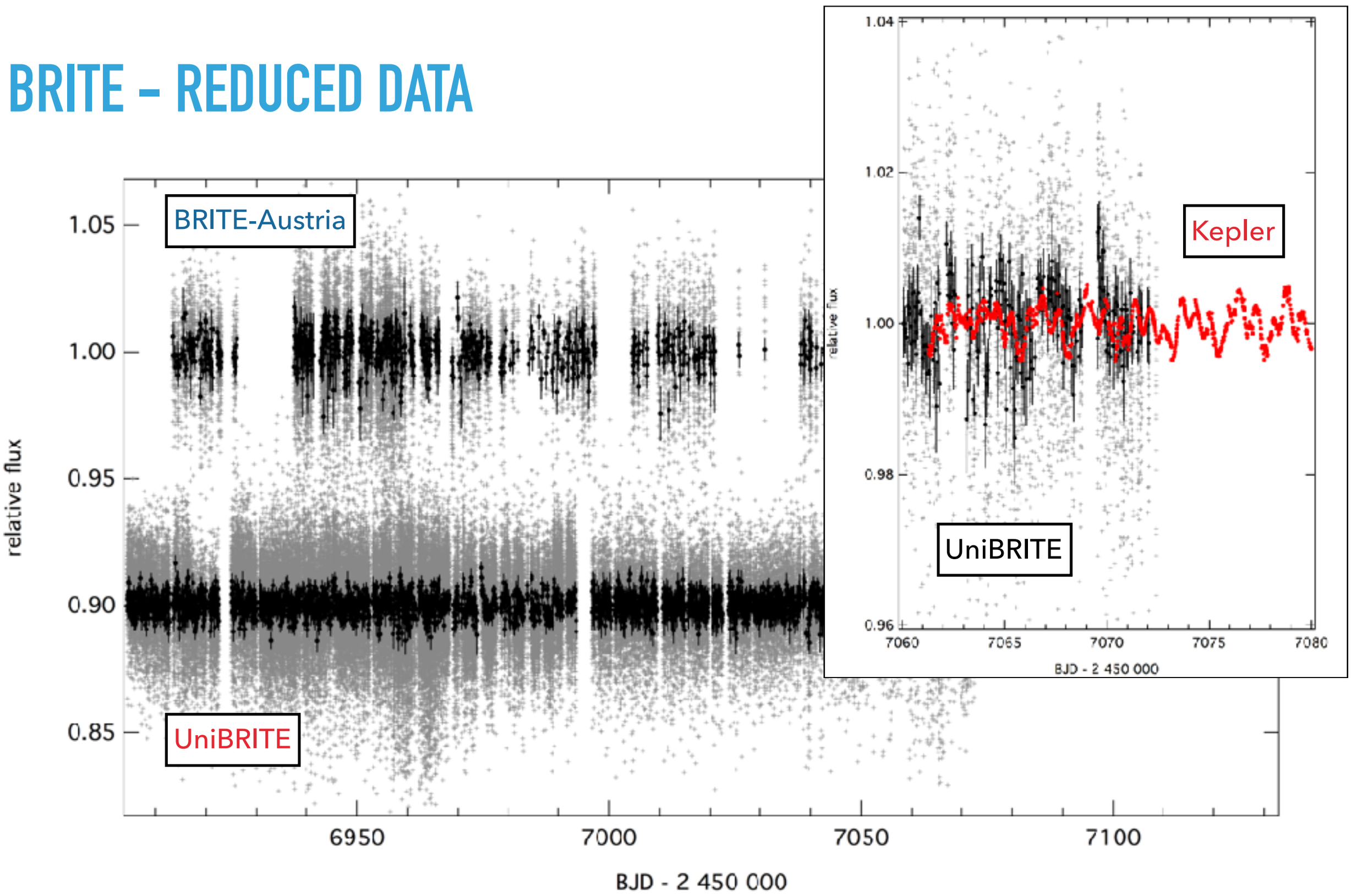
centroid Y position

~6cnt/px

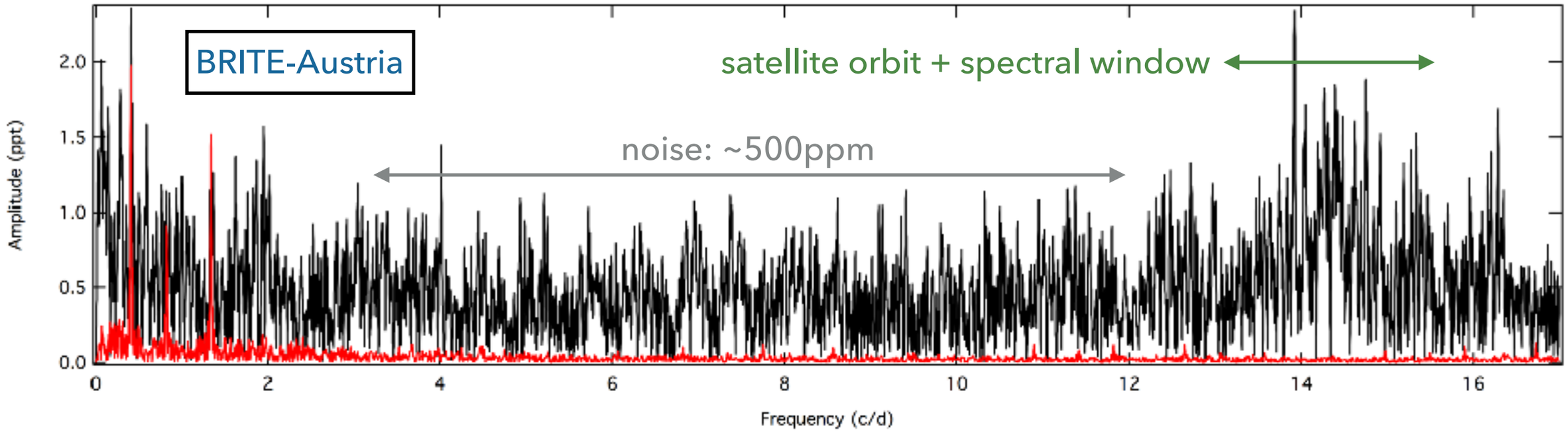
BRITE – REDUCED DATA



BRITE – REDUCED DATA

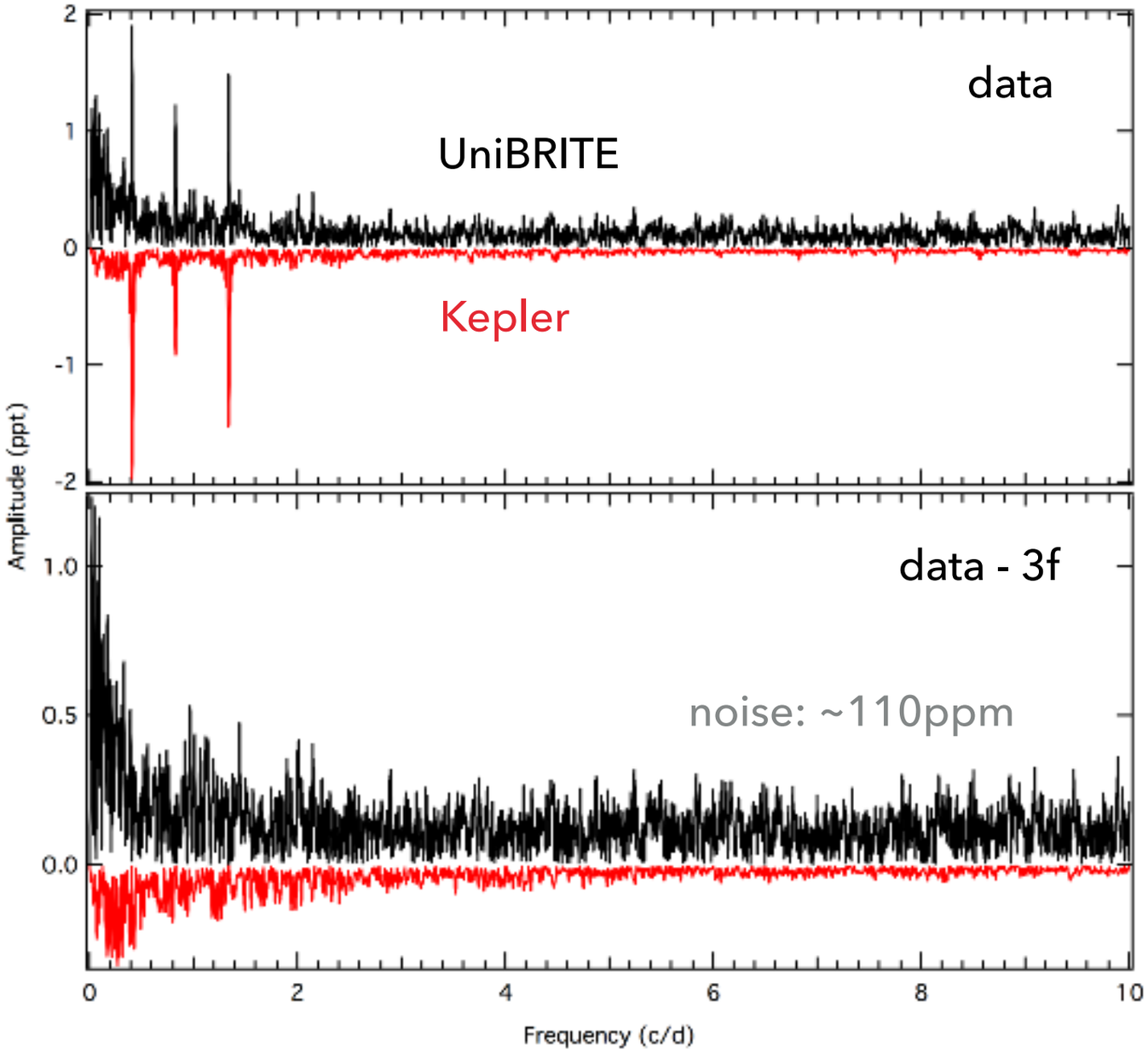


COMPARISON BRITE – KEPLER DATA



only 1 significant frequency (0.41c/d) in BRITE-Austria time series

COMPARISON BRITE – KEPLER DATA



significant signal

	f (c/d)		A (ppt)	
	Kepler	UBr		
	0.4122	0.4118	2.00	1.92
	0.8237	0.8234	0.94	1.25
	1.3409	1.3408	1.54	1.45

CONCLUSIONS

UniBRITE (red filter):

- can easily observe low-frequency signal (0.2-12c/d) with ~1ppt amplitude
- expected detection limit ~0.4ppt for a 3.6mag B-type star
- ~1ppt signal at periods of 5d and longer (but could well be stellar signal)
- in the frequency range 0.2-12c/d no instrumental signal (e.g., 1c/d) found

BRITE-AUSTRIA (blue filter):

- less good sensitivity: detection limit 1.5-2ppt for a 3.6mag star

outlook

- further comparisons of complementary BRITE/Kepler observations of other Pleiades stars