A SPECTRO-ASTROMETRIC STUDY OF BRACKETT GAMMA EMISSION IN THE HAeBe STAR HD100546

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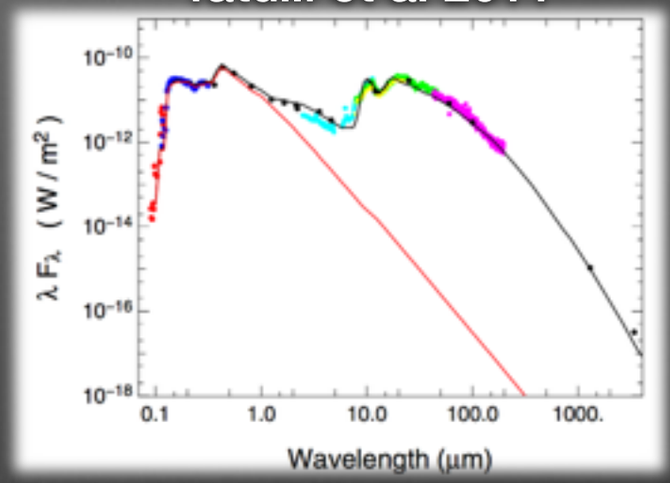
Why Study Bracket Gamma

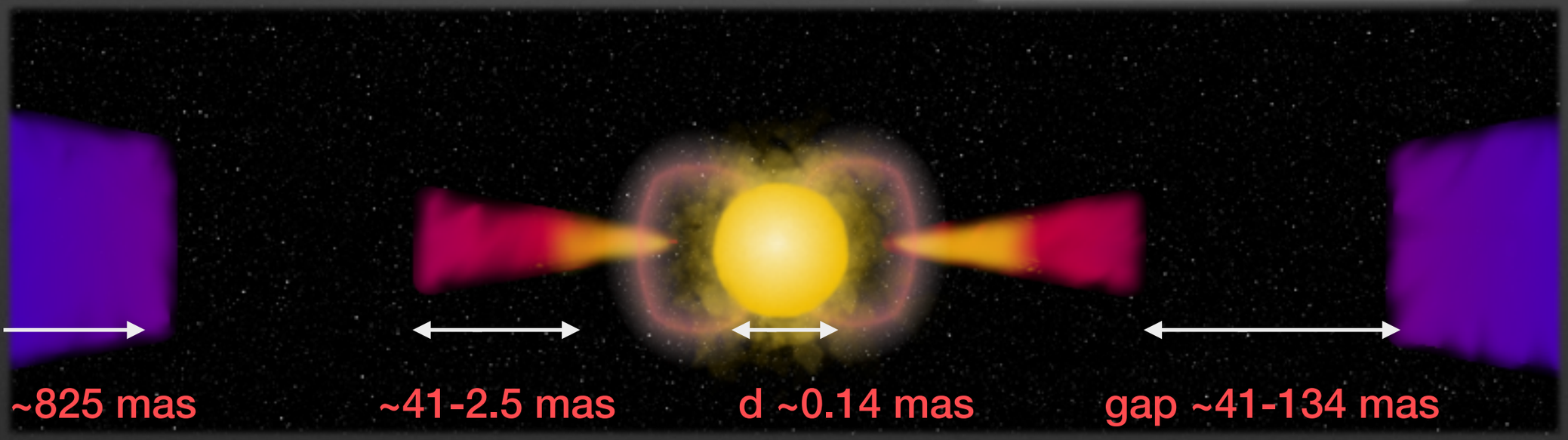
- Bracket gamma is related to the accretion process
- The accretion process is not well understood in Herbig star
- Using the spectro-astrometric technique we wish to constrain the size of the Bracket gamma line emitting region.

HD 100546

- It is a B9 Ve Herbig Ae/Be star and has been classified as transitional disk
- It has a transition SED.
- It has a gap and a inner disk

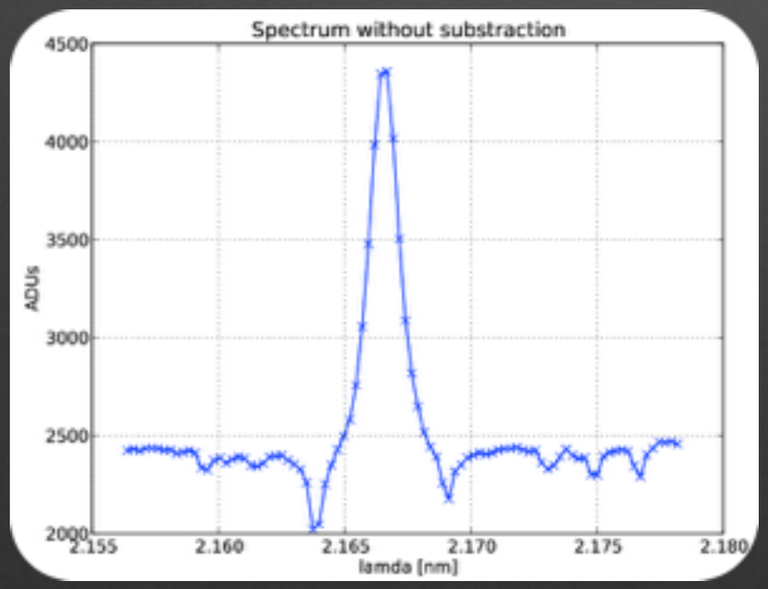
Tatulli et al 2011

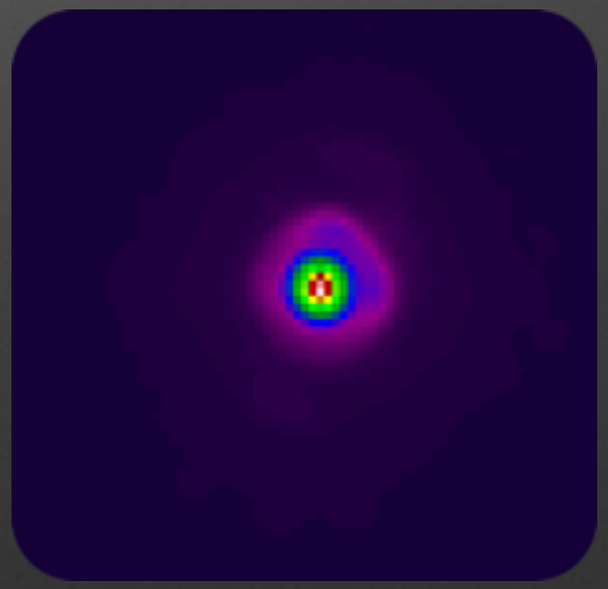




DATA

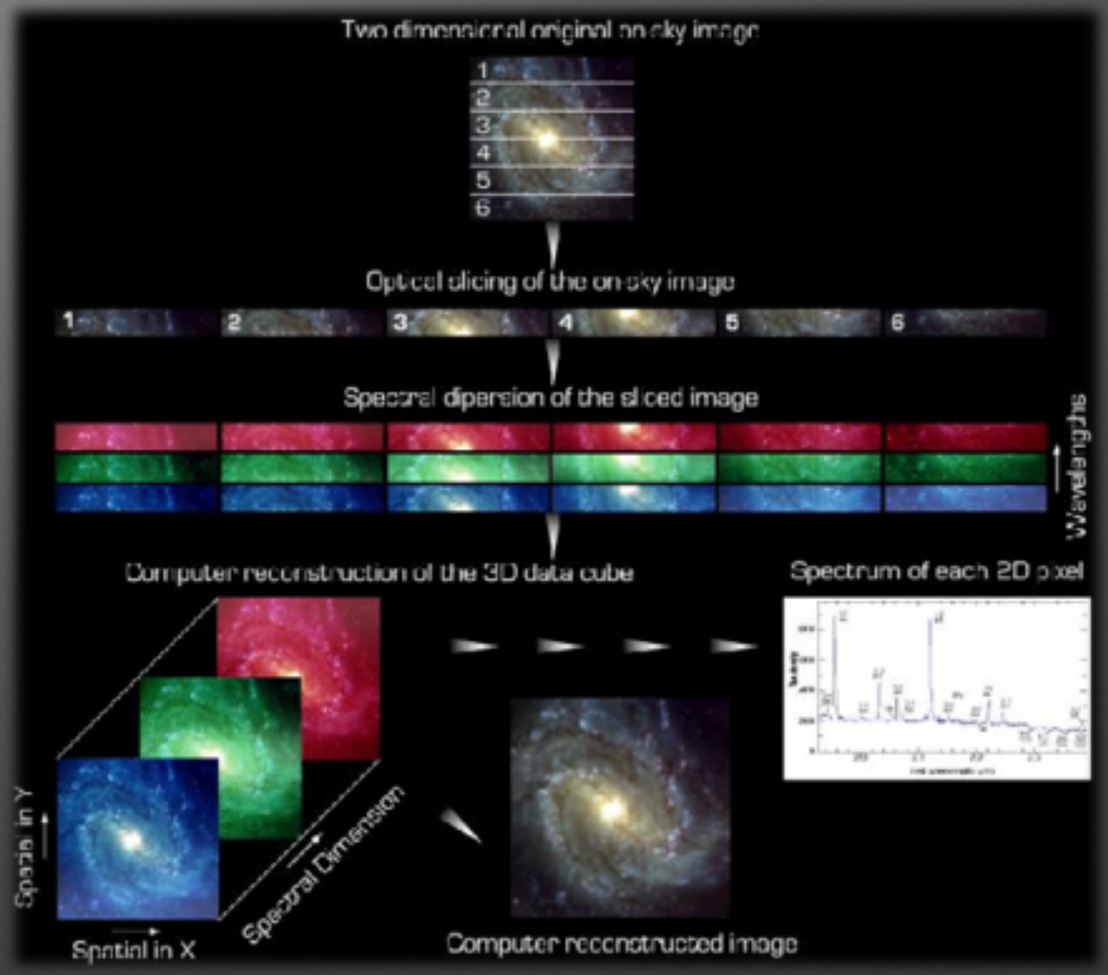
- We have used SINFONI in K band with a resolution around 4000.
- The FOV is of 800 x 800 mas
- The data is a set of 9 tiles or datacube of 32x64 spaxels in space (12.5 x 25 mas) and 2048 en wavelength (0.245 nm)





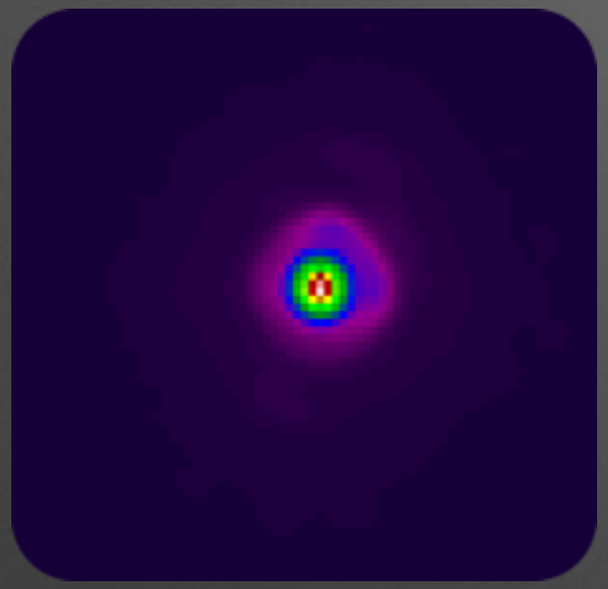
Spectro Astrometry

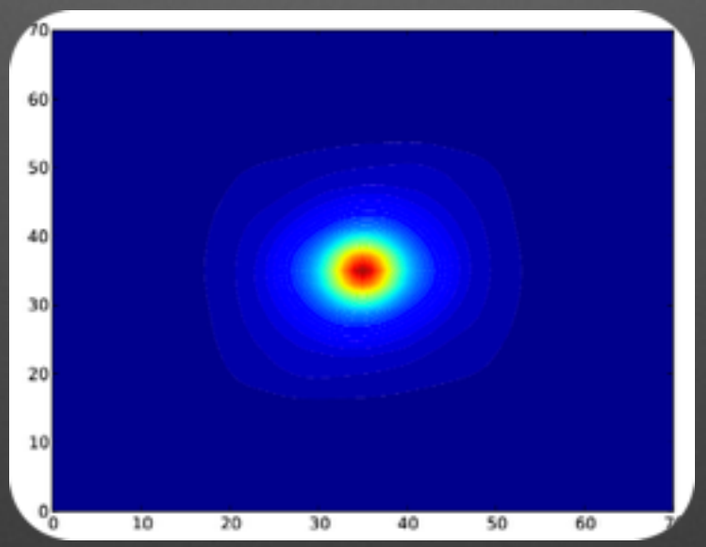
- This method involves carefully measuring the center of light in each wavelength channel of the datacube.
- With the combination of AO and this brighter star the positional accuracy can reach low values.
- Previous studies have been hable to extract meaningful spatial information an angular scales down to 0.1 mas.

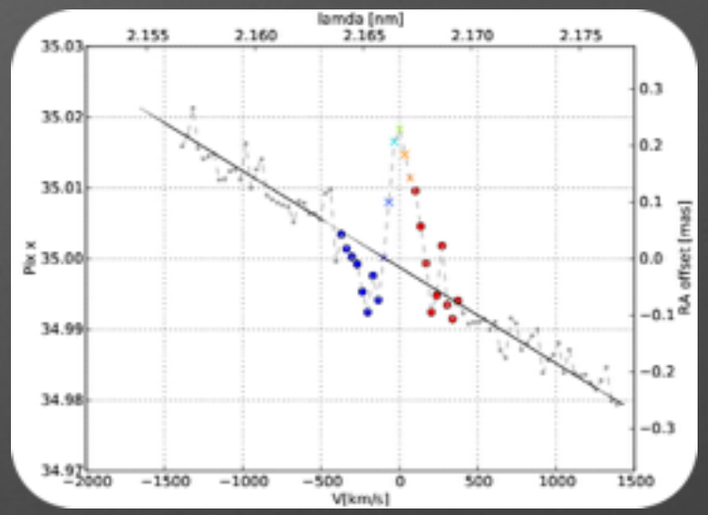


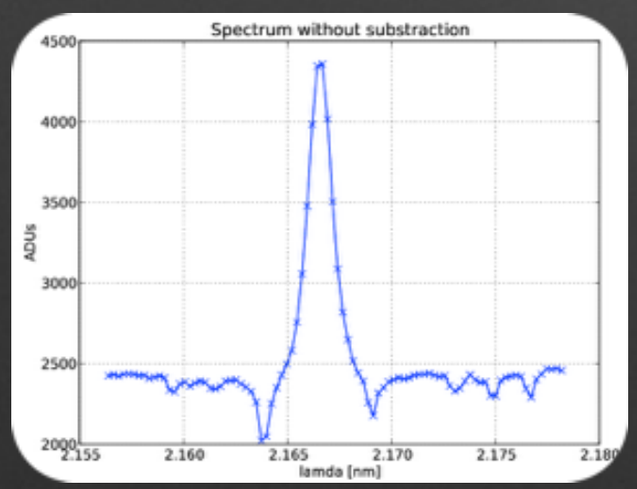
$$rms = \frac{FWHM}{2.35 * SNR}$$

Cross Correlation



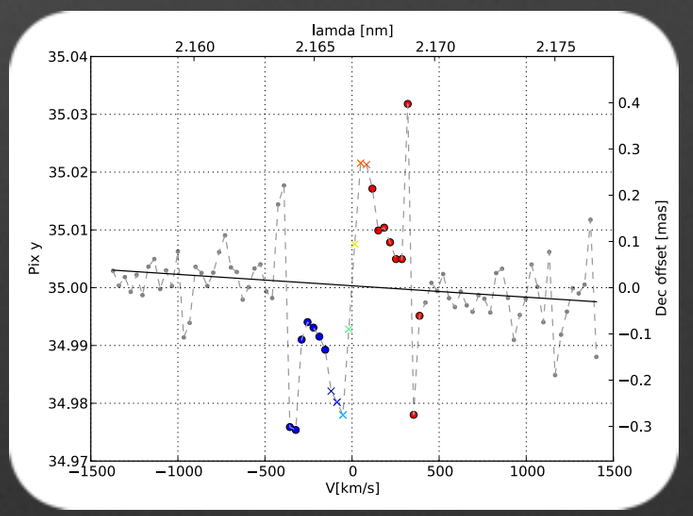






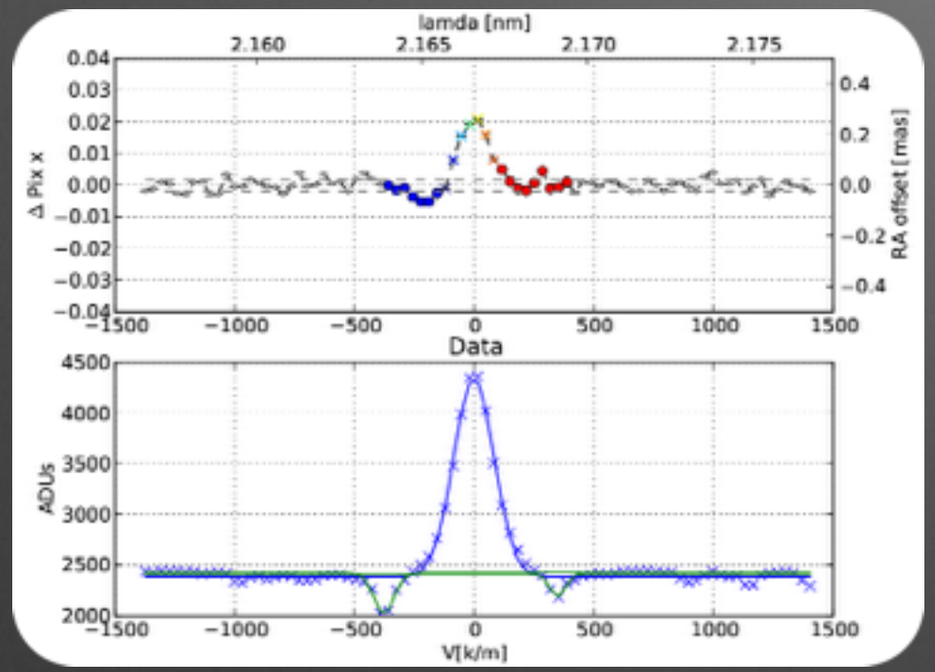
Data

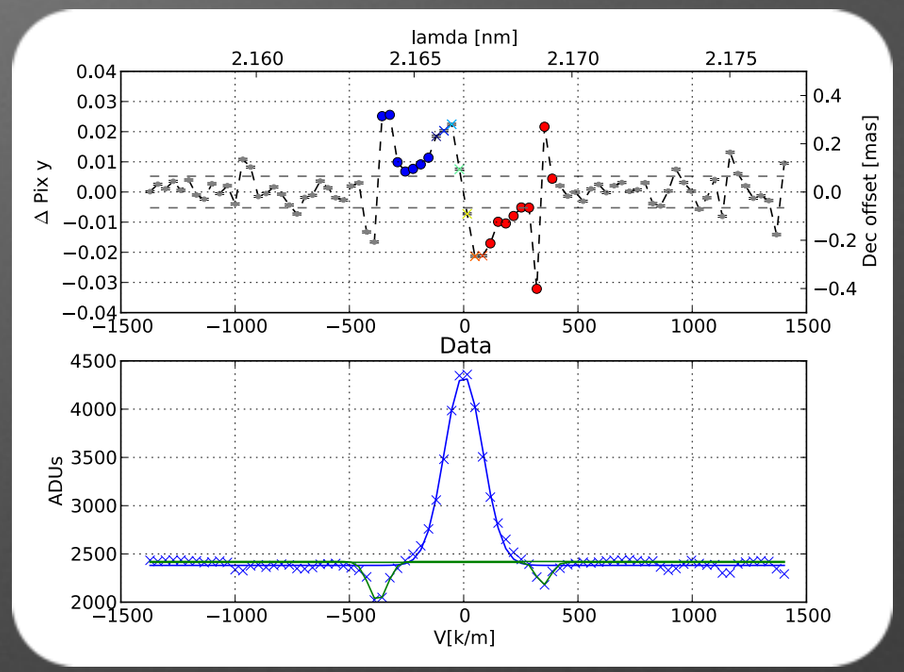
Cross Correlation



Spectro Astrometry

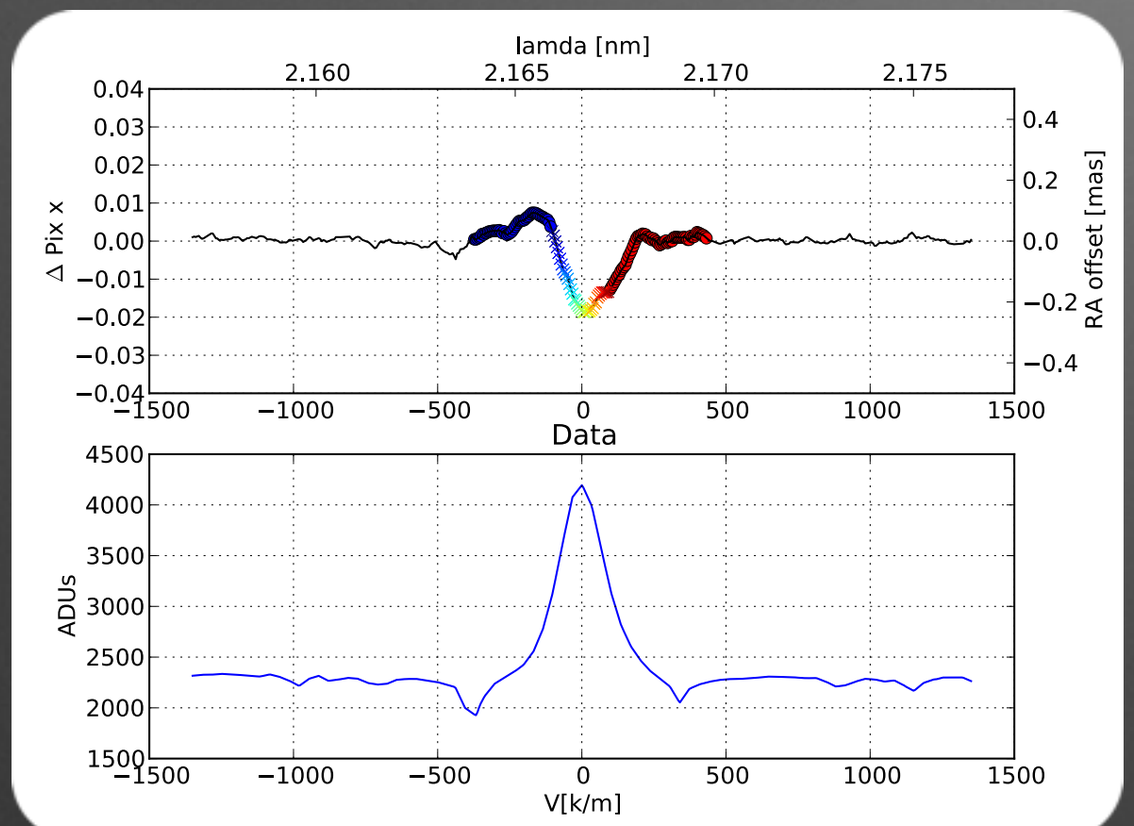
First Results

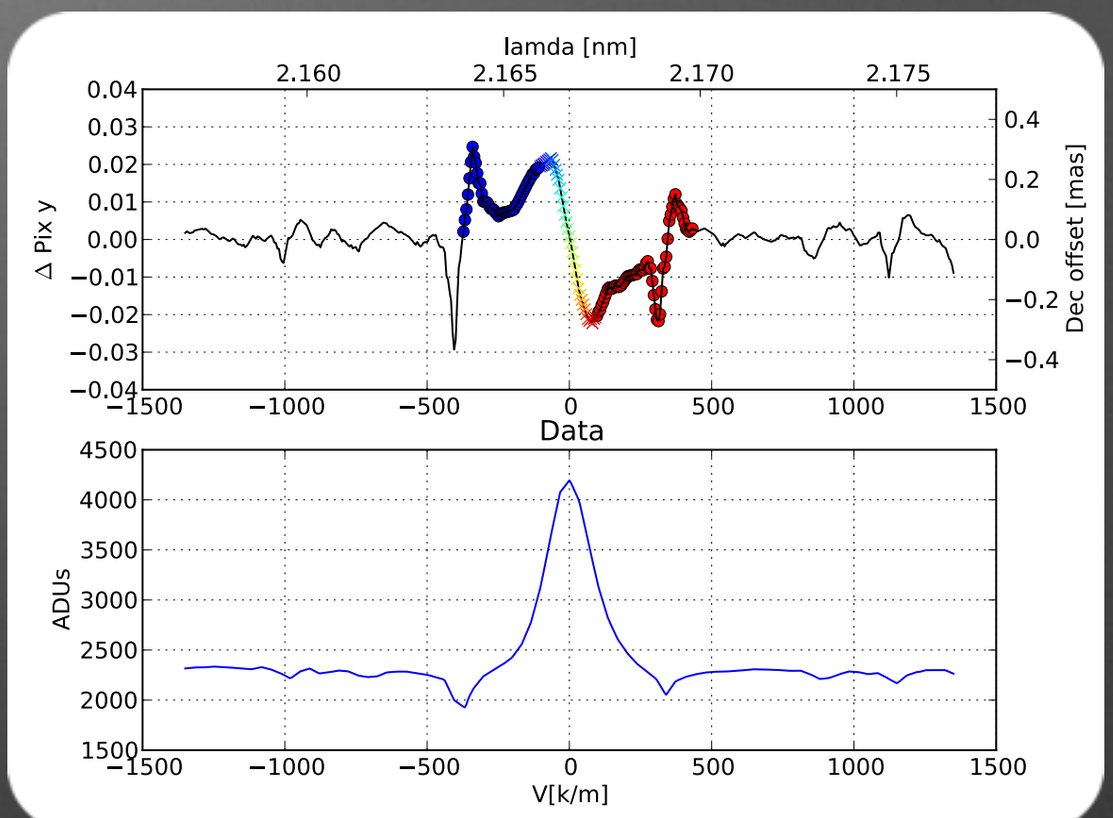




RMS	1 TILE	MEDIAN
X	0.03 mas	0.01 mas
Y	0.08 mas	0.03 mas

First Results





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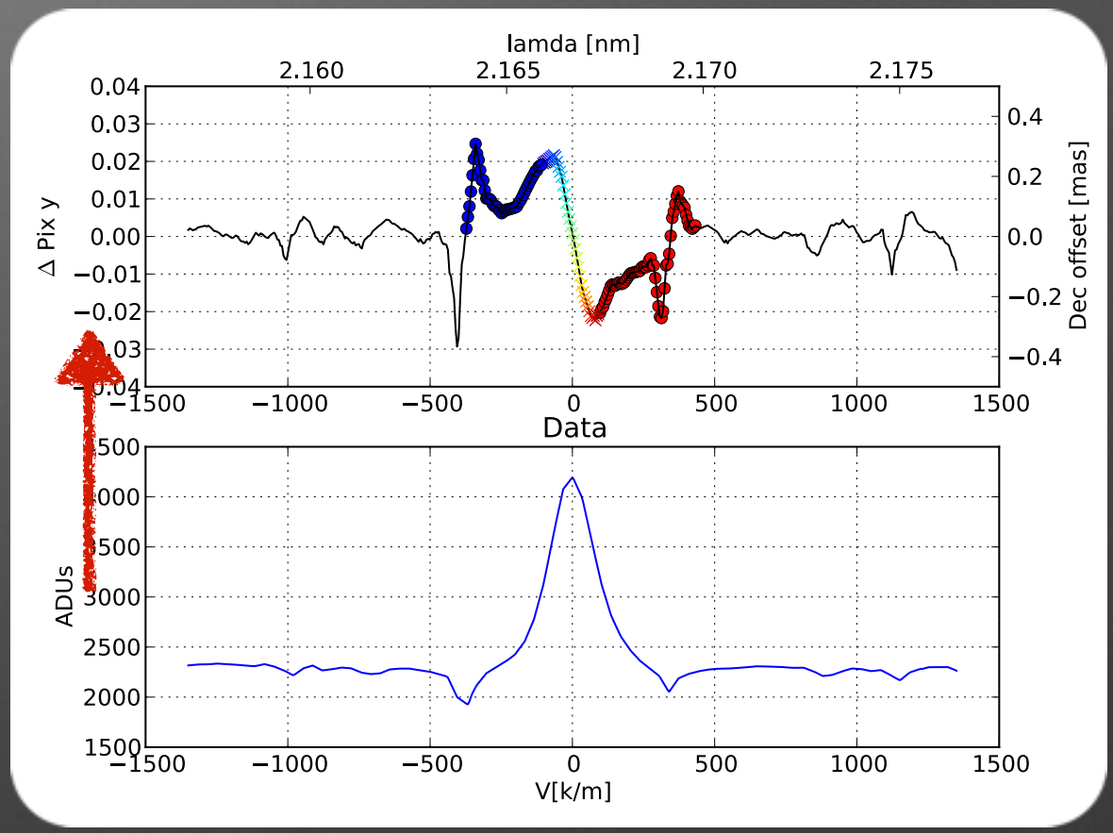
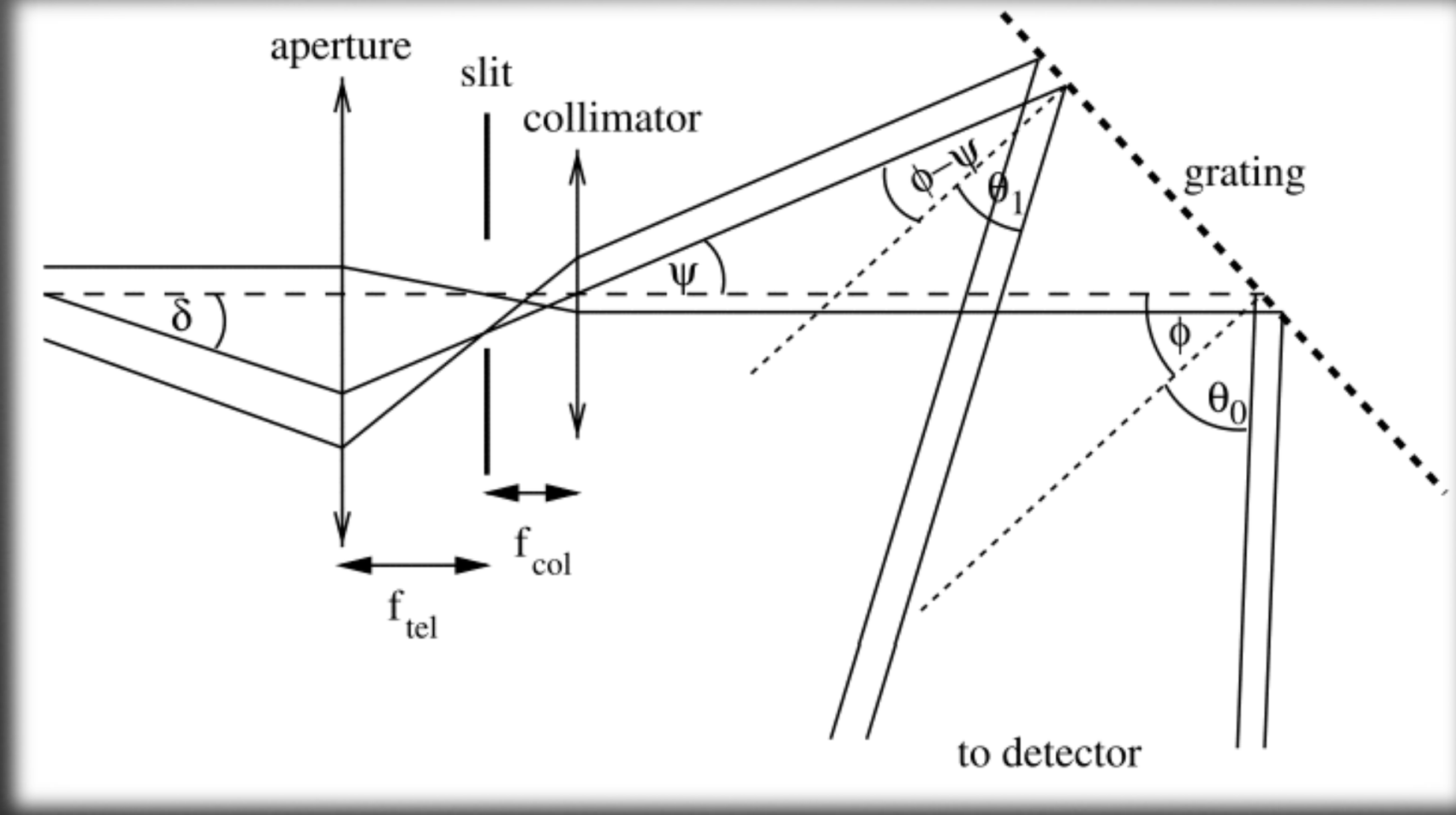
Artefacts



- We have found artefacts in the tellurics absorption lines: produced by slit illumination effect

Uneven Slit Illumination Effect

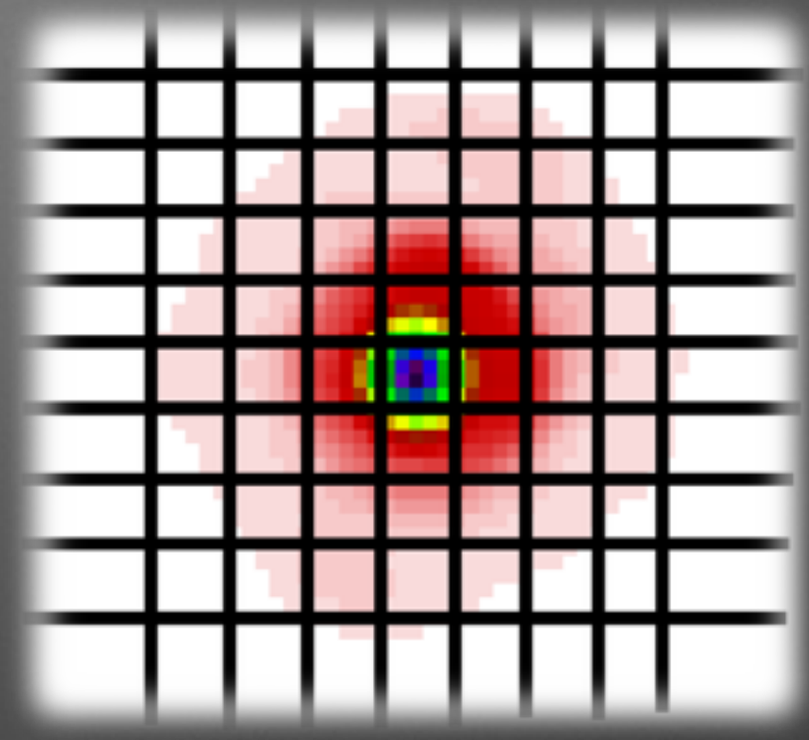


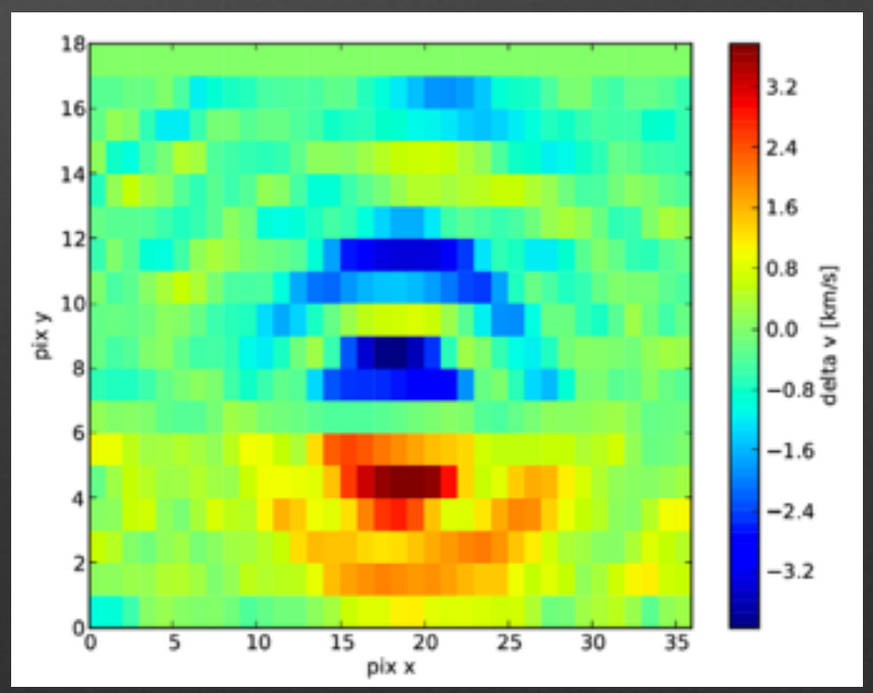
Correction

- We assume that the intensity in every channel is dominated by the psf *(estimated from the continuum)*

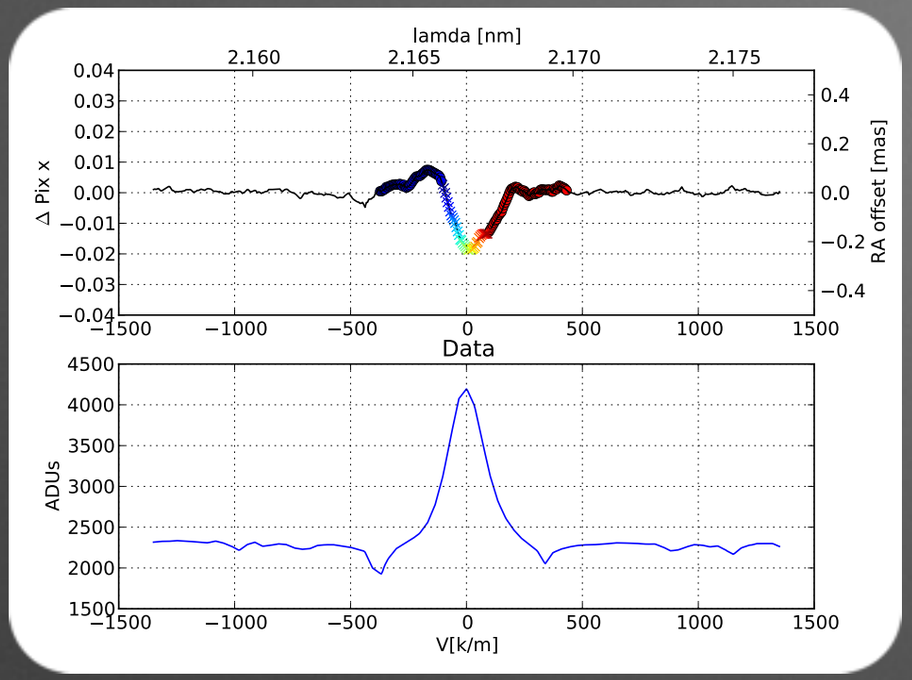
- An intensity-weighted displacement from the slit center was computed inside each (oversampled) spaxel. The wavelength shift was then estimated using the pixel scale an dispersion law

- This shift velocity (inverse) is then applied to each channel as a correction

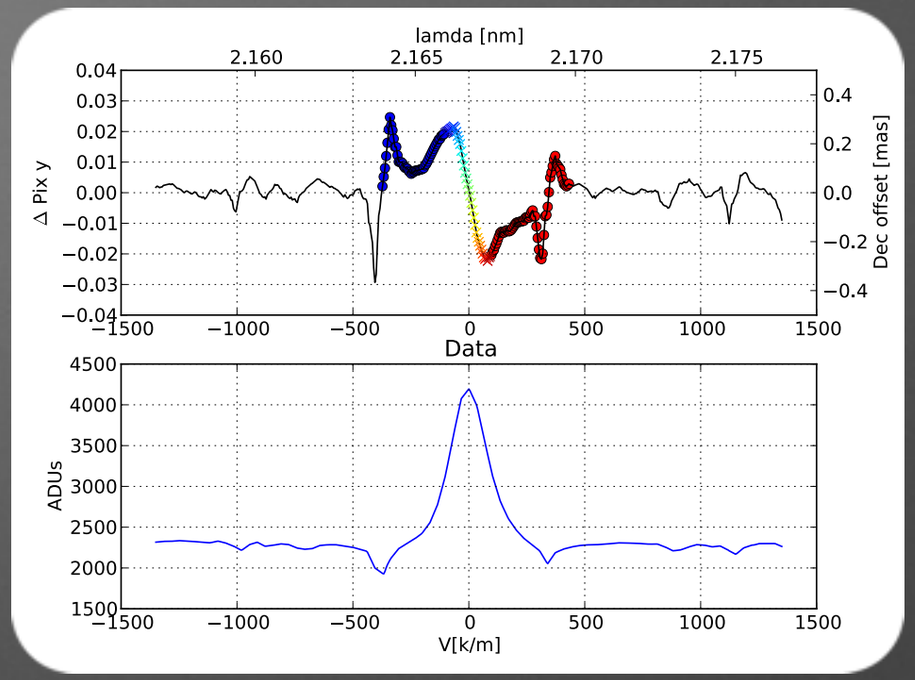




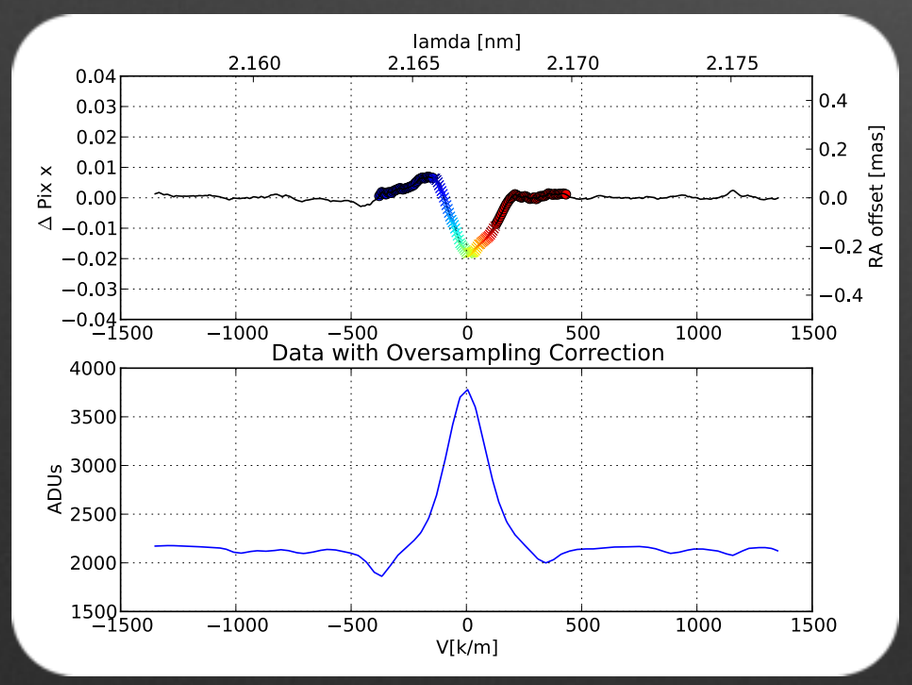
Comparison

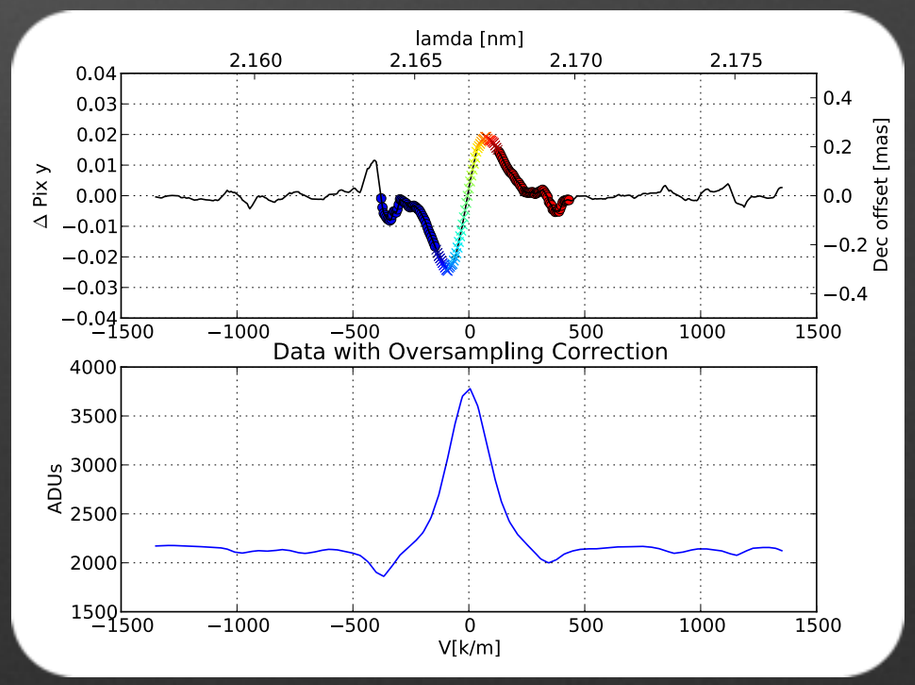


Before



After





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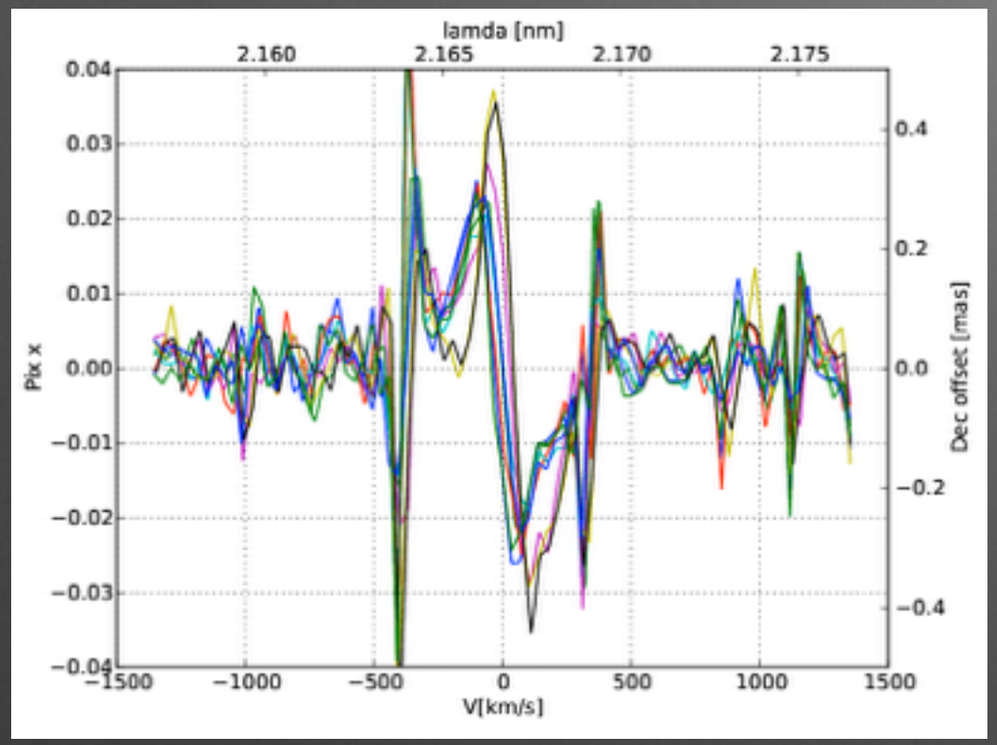
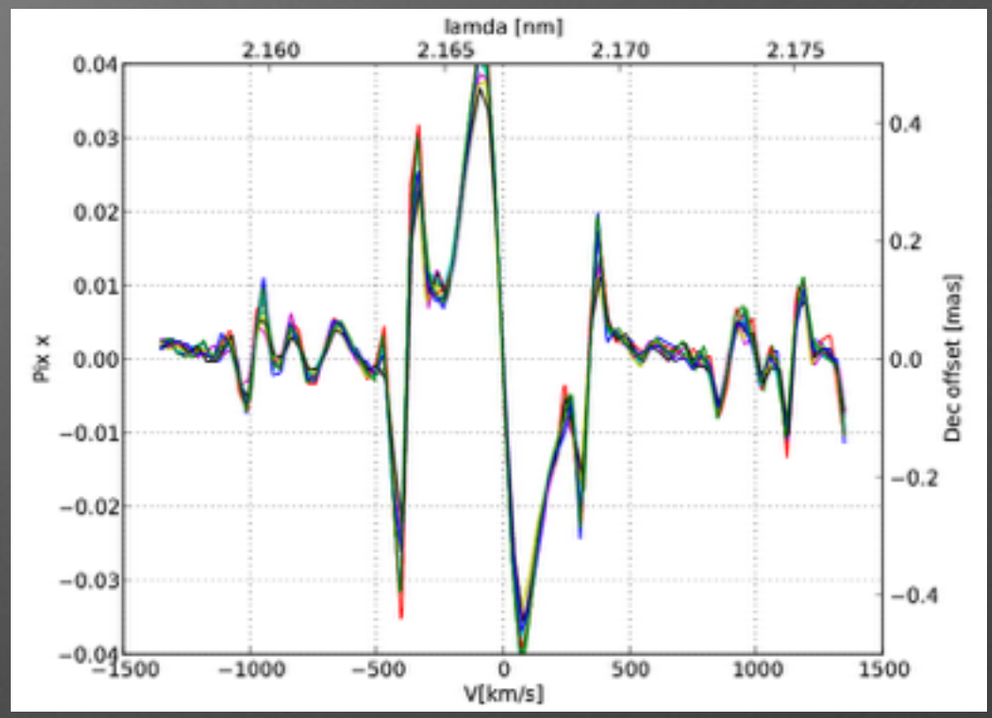


Data



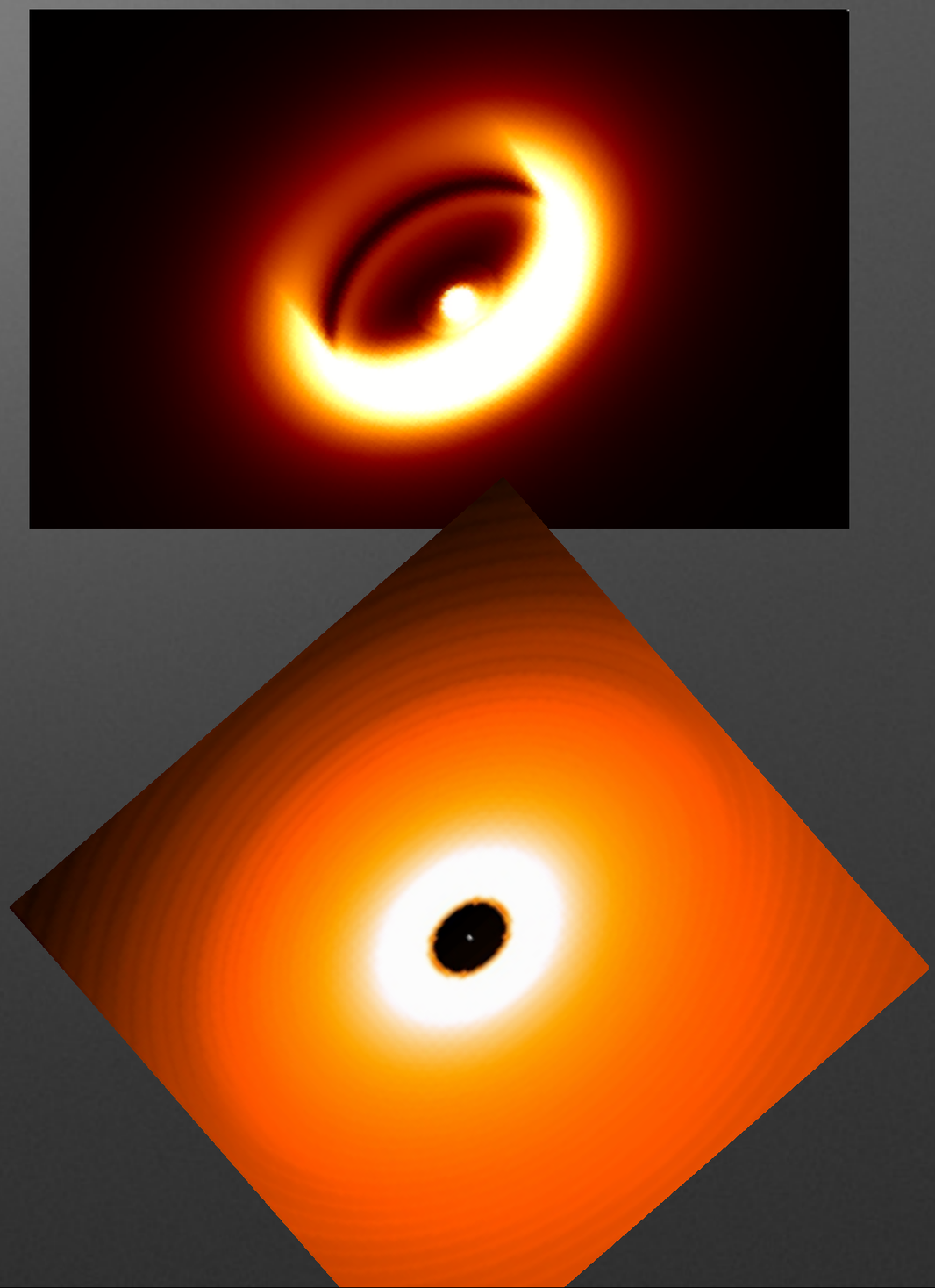
Prediction

- We created a fake data cube with a copy of the same central spectrum to all spaxels and then this are scaled to the original level of the continuum and we apply the velocity shift map.

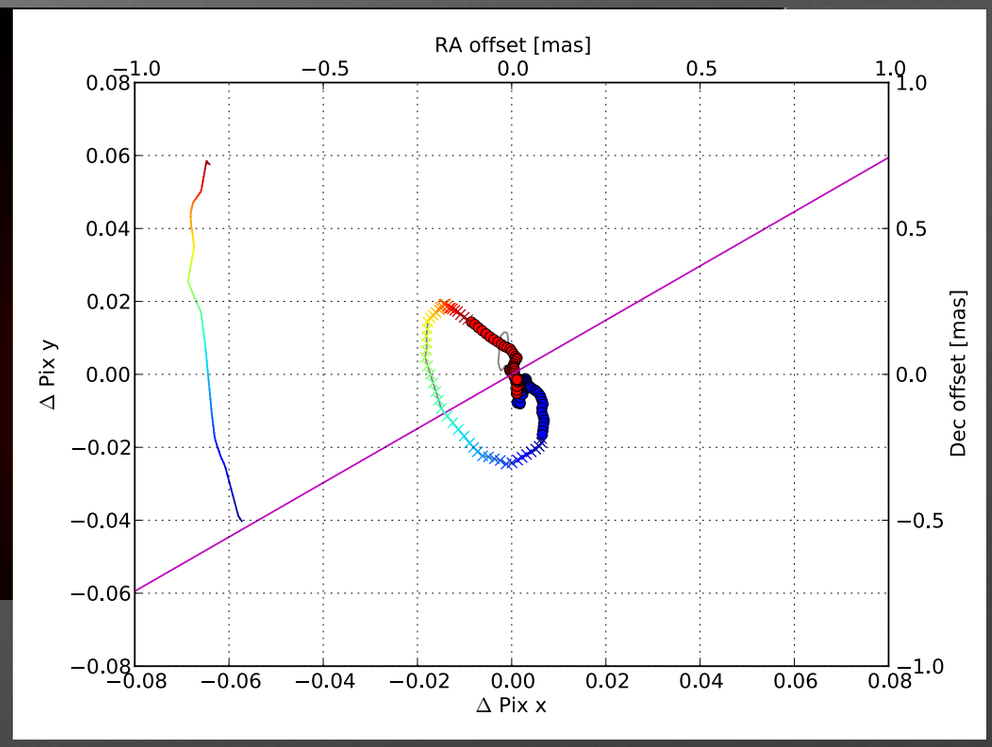
- The scale of the signal from uneven slit is comparable to the signal observed

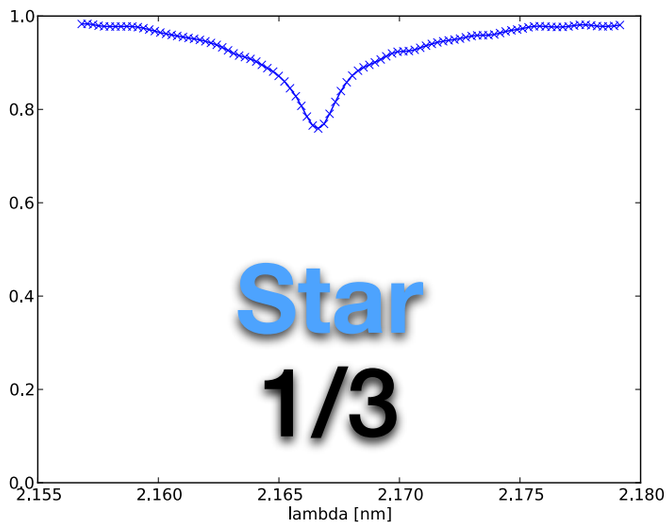
Continuum Subtraction

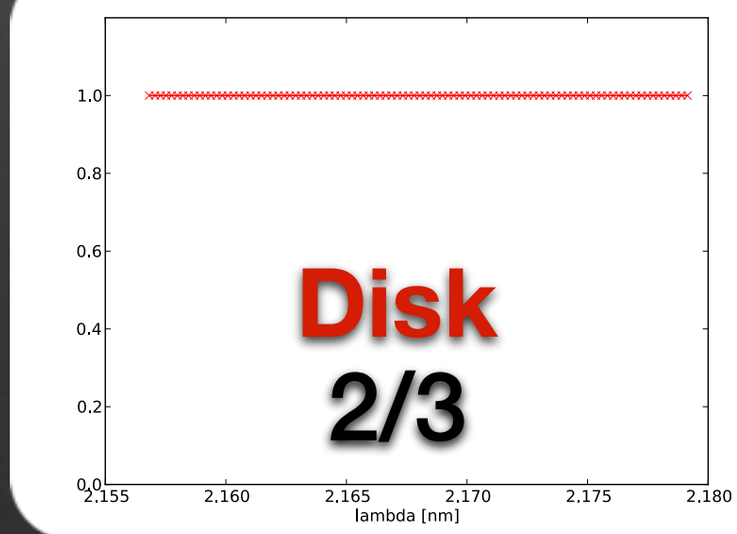
- This consists in subtracting the continuum part of the spectrum, as a linear function to identify the real shift in the bracket gamma.

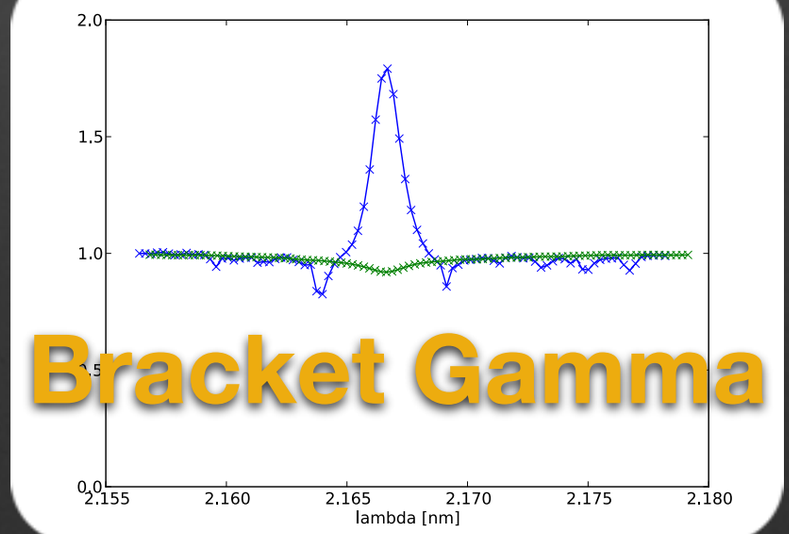


Continuum Subtraction

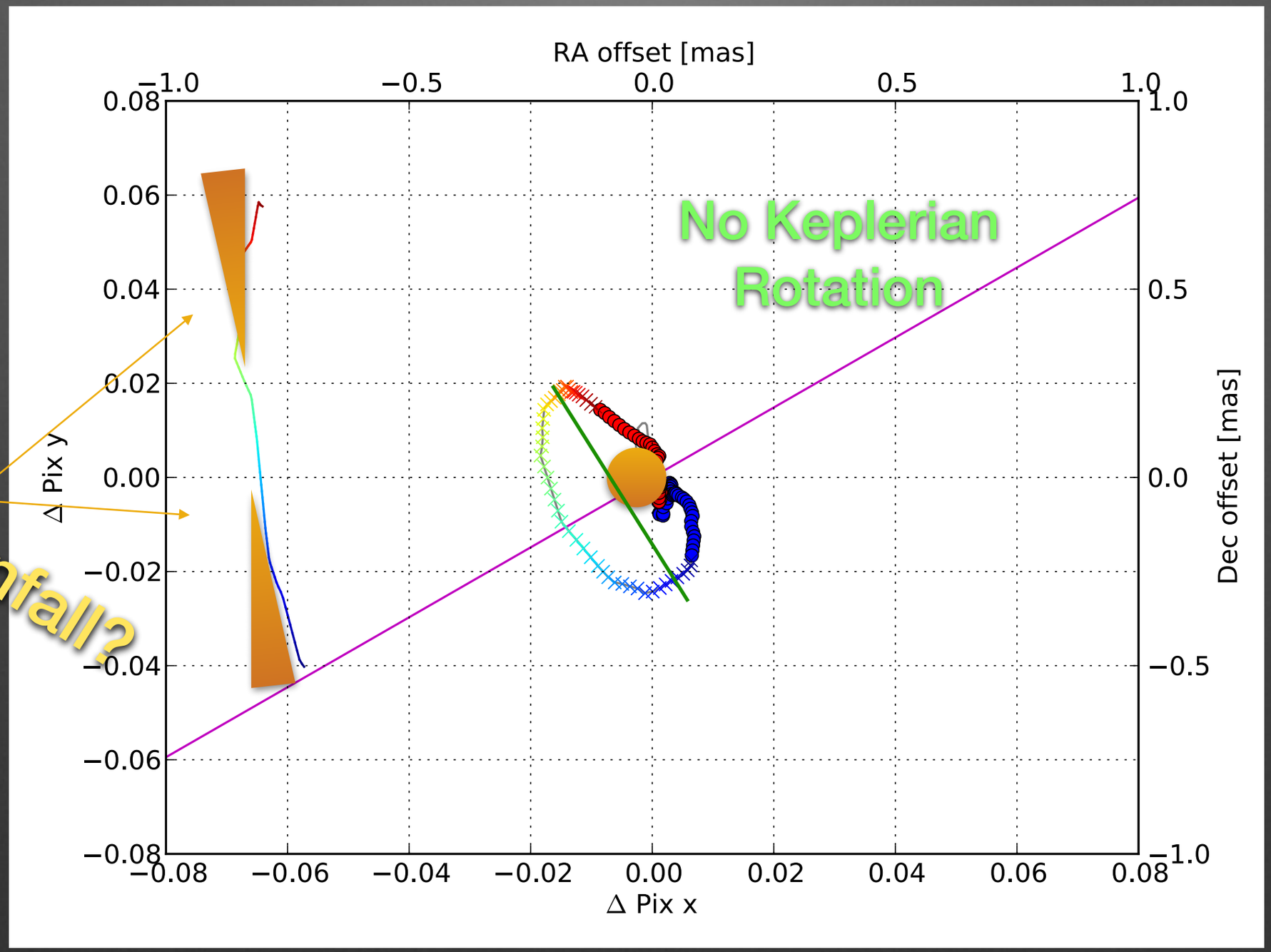






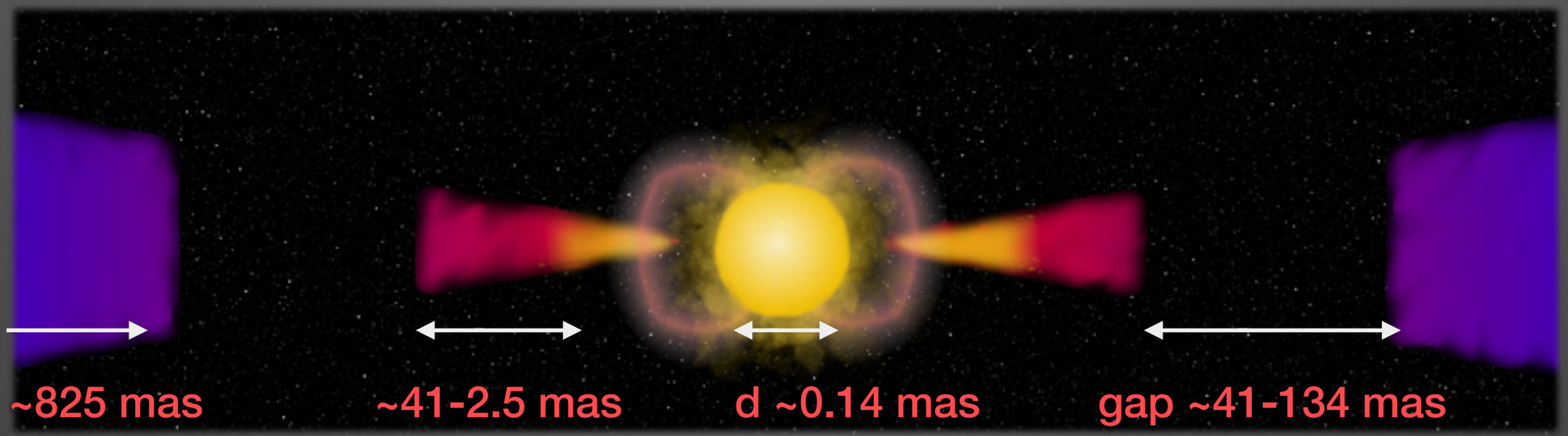


Interpretation



The Inner rim of the disk is around 2.5 mas

Conclusion



- There is an asymmetric shift in x and S-Shaped shift in y.
- The uneven slit effect introduces strong artefact.
- The SA Signal is not compatible with keplerian rotation with the same PA as the large scale disk (bipolar outflow/infall ?)
- The shift in RA between bracket gamma and the continuum could be explained by an asymetric K brightness in the disk. (Tatulli et al 2011)