

A Spectro-Astrometric study of bracket gamma emission in Young Stars

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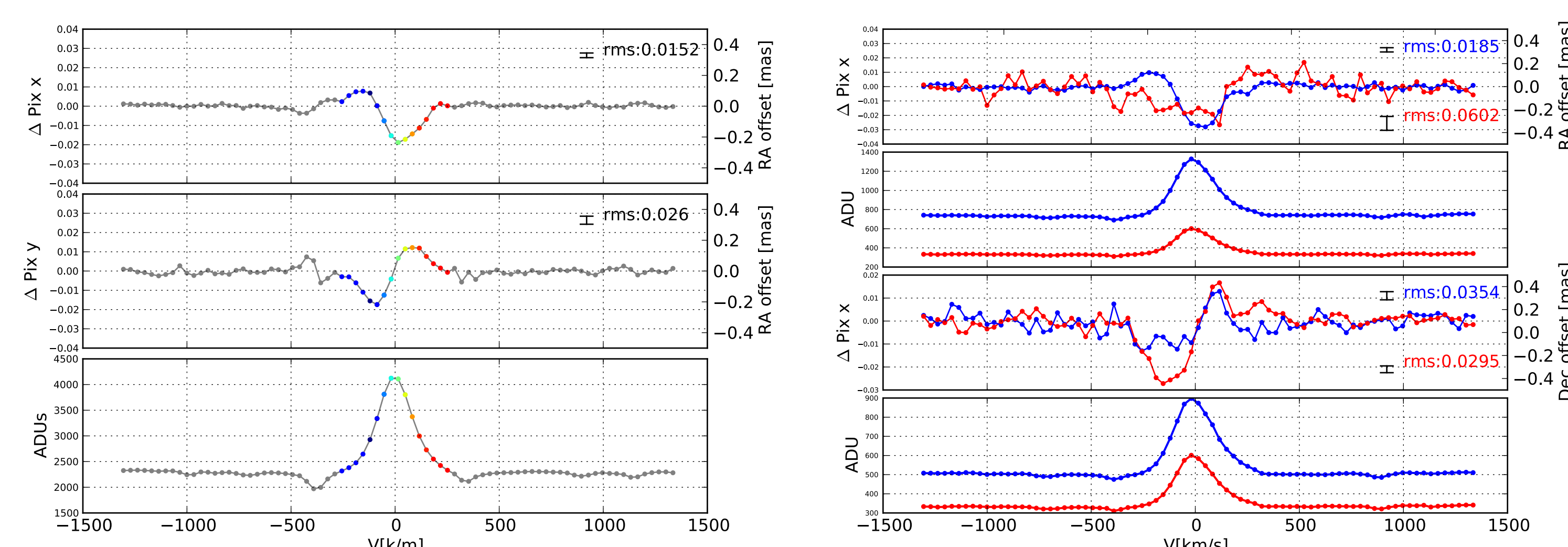
Background

Unlike the case of T Tauri stars, the mass accretion onto higher mass young stars (Herbig Ae/Be) and in particular the origin of the H I lines is not completely understood.

In T tauri stars H I lines are thought to form in the magnetic accretion funnels linking the star to the inner accretion disk. Whether this picture holds for the more massive Herbig stars is still an open question.

The H I bracket gamma line is well correlated with accretion luminosity in T Tauri stars, and while the same relation holds for Herbig Ae stars, in Herbig Be the bracket gamma line flux often overestimates the accretion luminosity.

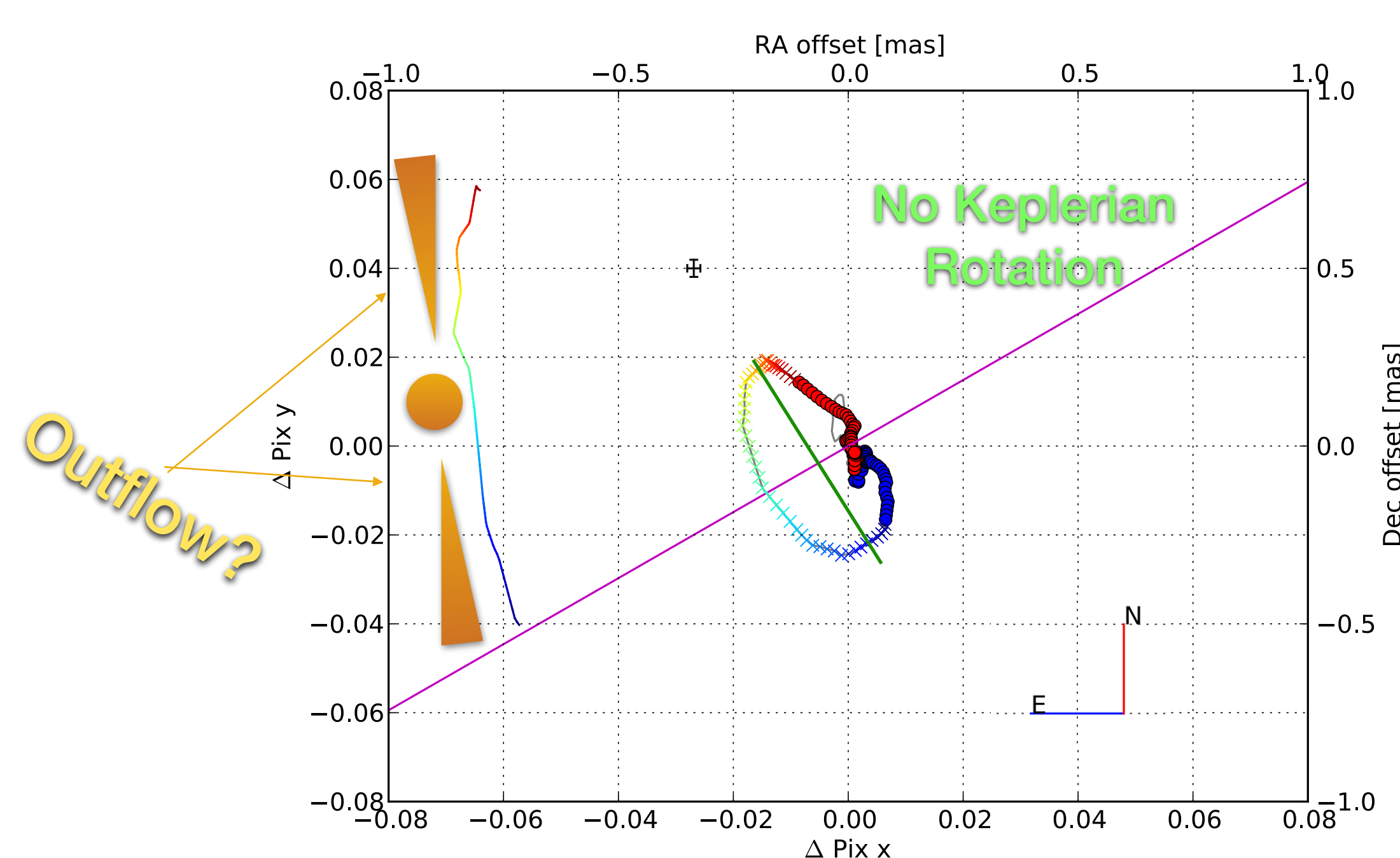
Results



Corrected median Spectro Astrometry in HD 100546

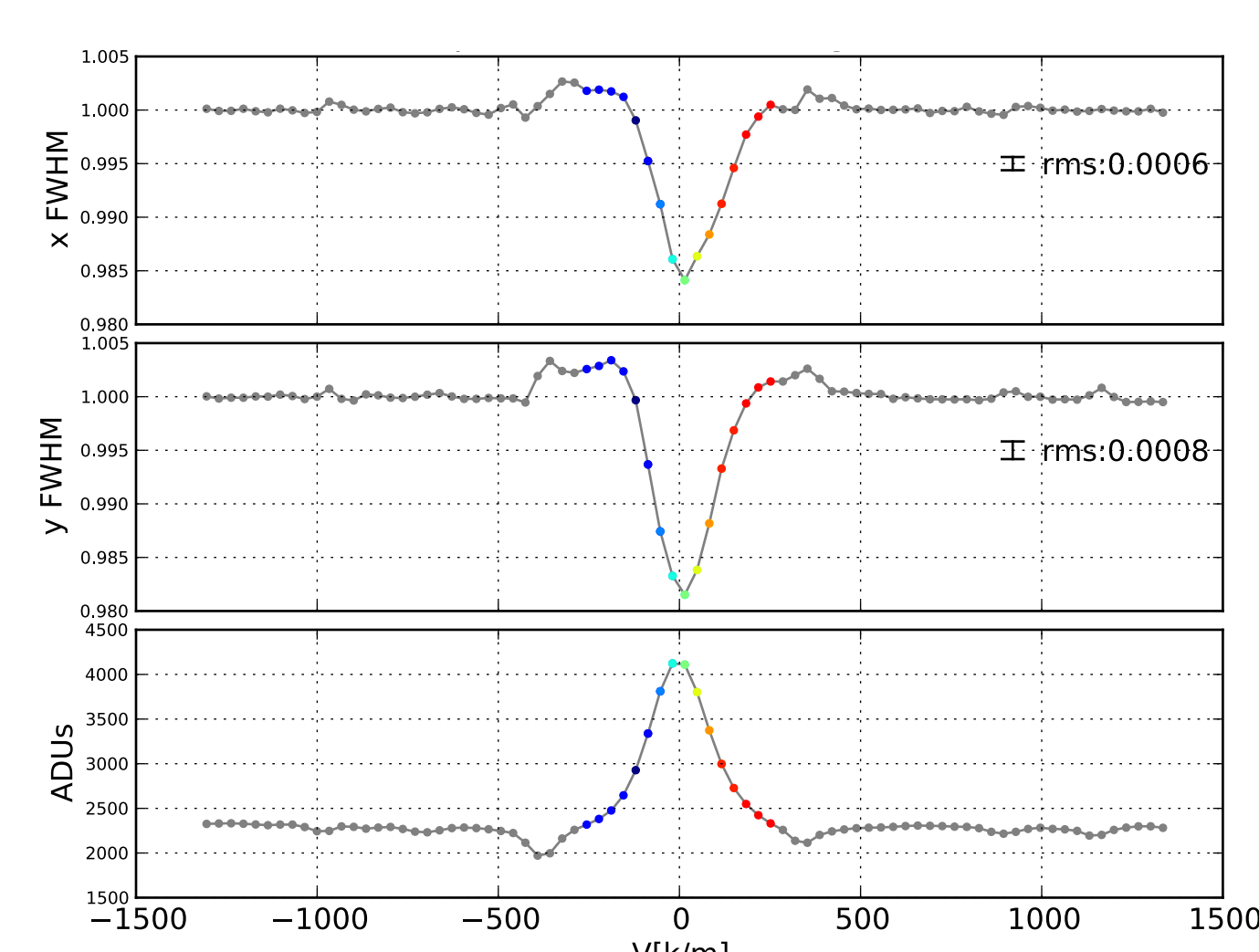
Left: signal with uneven slit illumination effect correction, the rms has been measured from the continuum (grey dots) and are in mas, top: signal in x (RA with direction to the West), middle: signal in y (Dec with direction to the North), bottom: Spectrum of the brighter spaxel.

Right: this plot represent the signal in Ra and Dec as the Left plot, in four different configuration with his respective spectrum, we only show the signal in x where we remark with a blue color the signal from the data which have better signal to noise respect to the other (red).



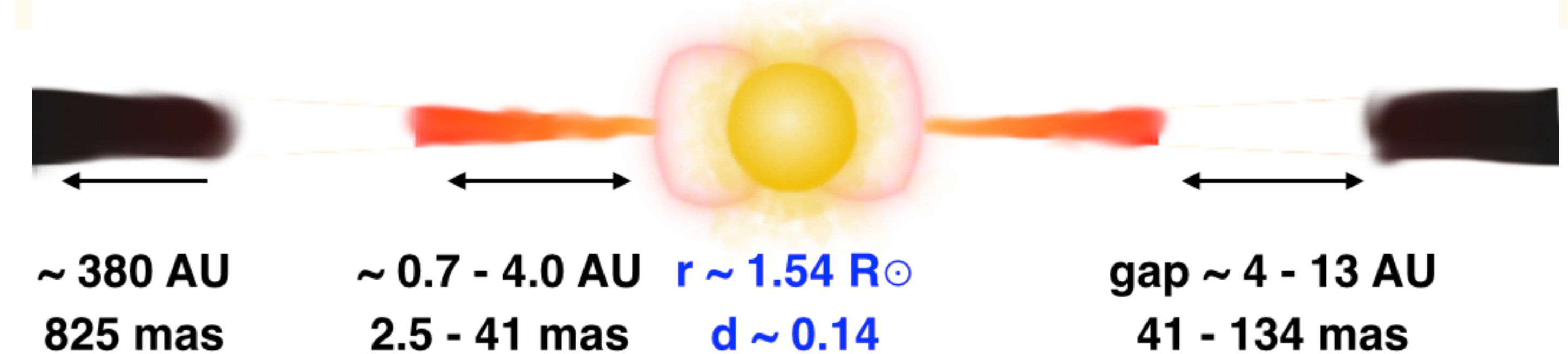
Corrected median Spectro Astrometry in HD 100546, where we plot x and y signal in a 2D figure, the violet line represent the PA of the star (138°), the rms has been plot in the upper left corner which has been measured from the continuum. Left colored Line is the signal with the continuum subtracted, which don't show a signal from a keplerian disk. We could interpret it as outflow. The orange circle represent the size of the star.

FWHM from de 2D gauss fit in HD 100546, in x and y, this shows a reduction in around 1.5 % on bracket gamma signal and the increase around 0.2 % over the wings with respect to the value in the continuum.



Data

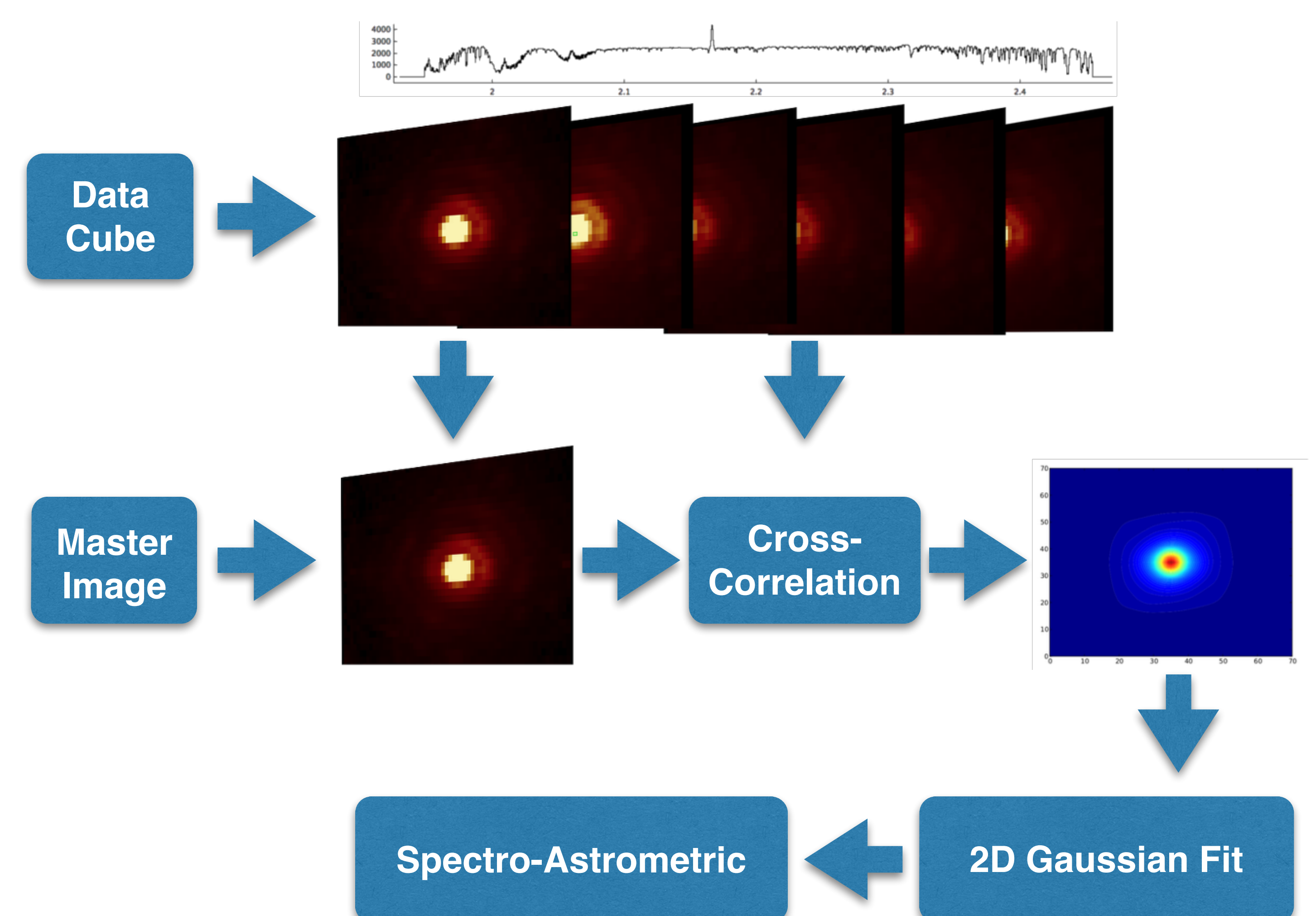
HD 100546 is an Herbig Be star with a transitional disk. We observed it with the VLT/SINFONI integral field spectrograph in K band.



Spectrum-Astrometry

Spectro-Astrometry is a technic that mesure the astrometry position as wavelength function (Whelan & Garcia 2008 LNP) This method has been applied traditionally to long-slit spectroscopic observations (Takami et al. 2003) with accuracies of 10 mas, but more recently extended to integral field spectroscopy data coupled with AO (Goto et al. 2012, Davis et al) allowing to reach much better accuracy on order of 0.1 mas.

We have applied the spectro-astrometric technique to the SINFONI observations of the H I bracket gamma emission line in this source, with the aim to constrain the origin of the line emitting region.



Pipeline scheme to measure Spectrum-Astrometric; using the measurement of the 2D gaussian fit from the cross-correlation between a master image from the continuum part of the spectrum and the data.

Conclusion

We have reached a positional accuracy (rms) of 10-30 micro arcseconds (0.01-0.03 milli-arcseconds), corresponding to the size scale of the stellar radius.

In HD 100546 we find an asymmetric signal in RA and a S pattern in Dec of amplitude around 0.2 mas.

We also detect small (less than 1%) variations in the size scale (FWHM) of the emission across the line profile.

The detected spectro-astrometric signal in H I Brg doesn't follow the expectations from a keplerian accretion disk with the same PA as the large scale disk around this source, and suggest the contribution from a compact emitting region at low velocities and large scale high-velocity bipolar outflow or accretion funnels. Detailed modelling will be required to fully interpret these results.

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