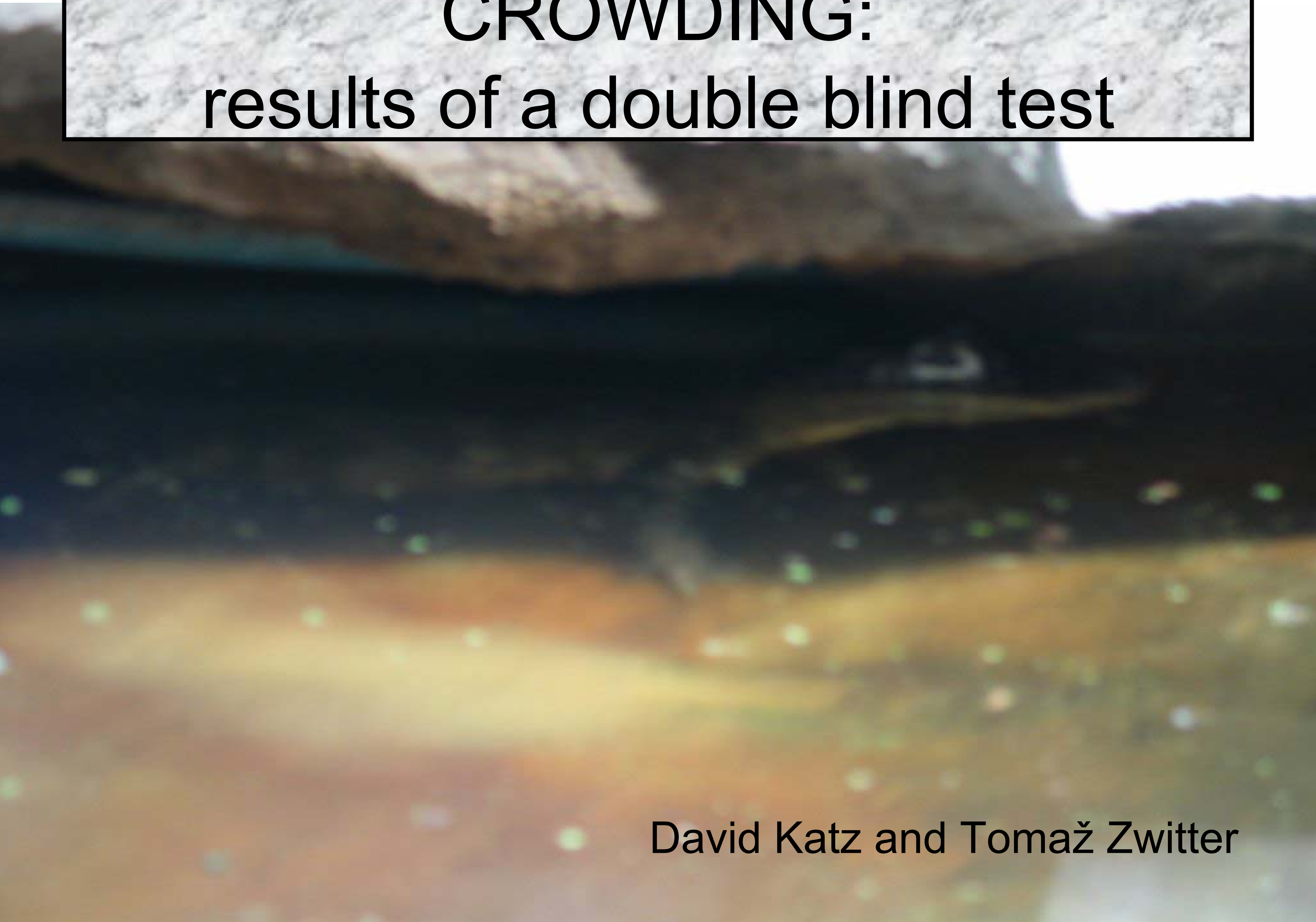
CROWDING:
results of a double blind test



David Katz and Tomaž Zwitter

Define stellar contents of the reference field of view

- Number of sources and magnitude distribution
  - GSC II.2
- Coordinates in the reference FoV
  - Random
- Stellar parameters (atmospheric parameters, radial velocities)
  - Galaxy model **(M . Haywood)**

  For each source in the field of view, stars are randomly chosen in the galaxy model until the difference between the magnitude of the source and the magnitude of the star from the Galaxy model is smaller than 0.15 dex. (slow process – to be optimized)

Single spectrum plus neighbouring star spectra

Compute the spectrum of a single star plus the spectral contribution from the neighbouring stars (and RVSM/GDAAS “diagnostics”).

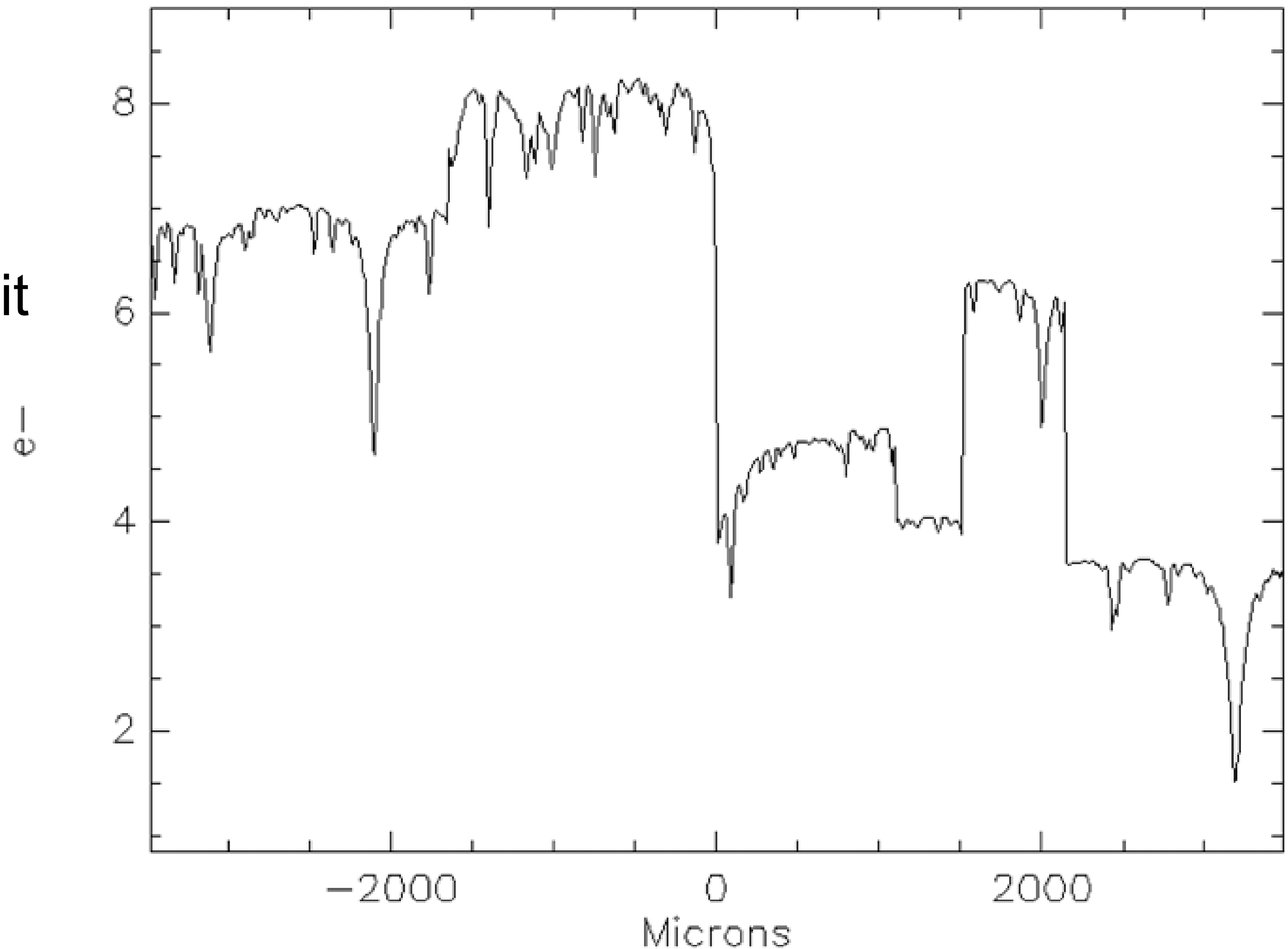
Method:

- Define the stellar contents of a reference field of view
  - Number of stars, stars characteristics (positions, magnitudes, atmospheric parameters, radial velocities, …)
- Compute the projection of the ref. FoV on the focal plane
  - Rotate the FoV according to the orientation of the scan
- For each transit: compute and sum the spectral contribution of the neighbouring stars at the location of the central spectrum.
  - According to its position, apparent magnitude and atmospheric parameters and according to the PSF width AC (assumed gaussian)
- Add the spectrum of the central star

Stellar background spectrum (single transit)

Single transit

b = -15

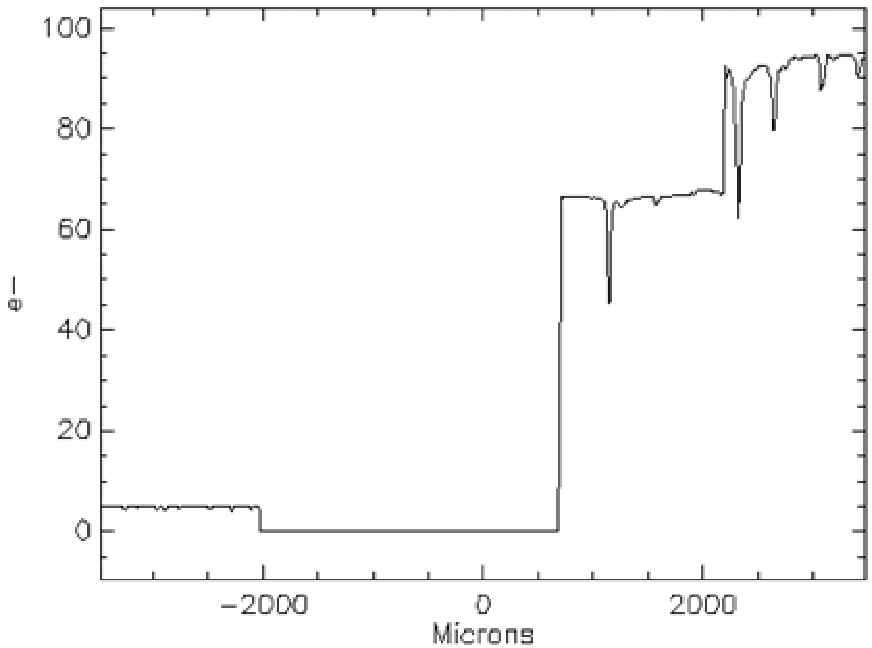


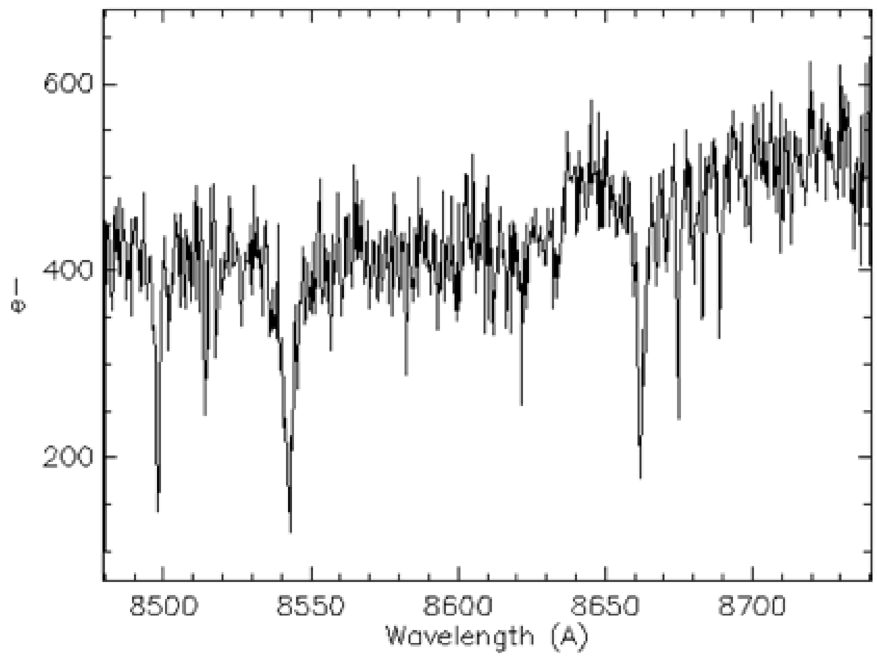
Combined spectrum (single transit)

Single transit

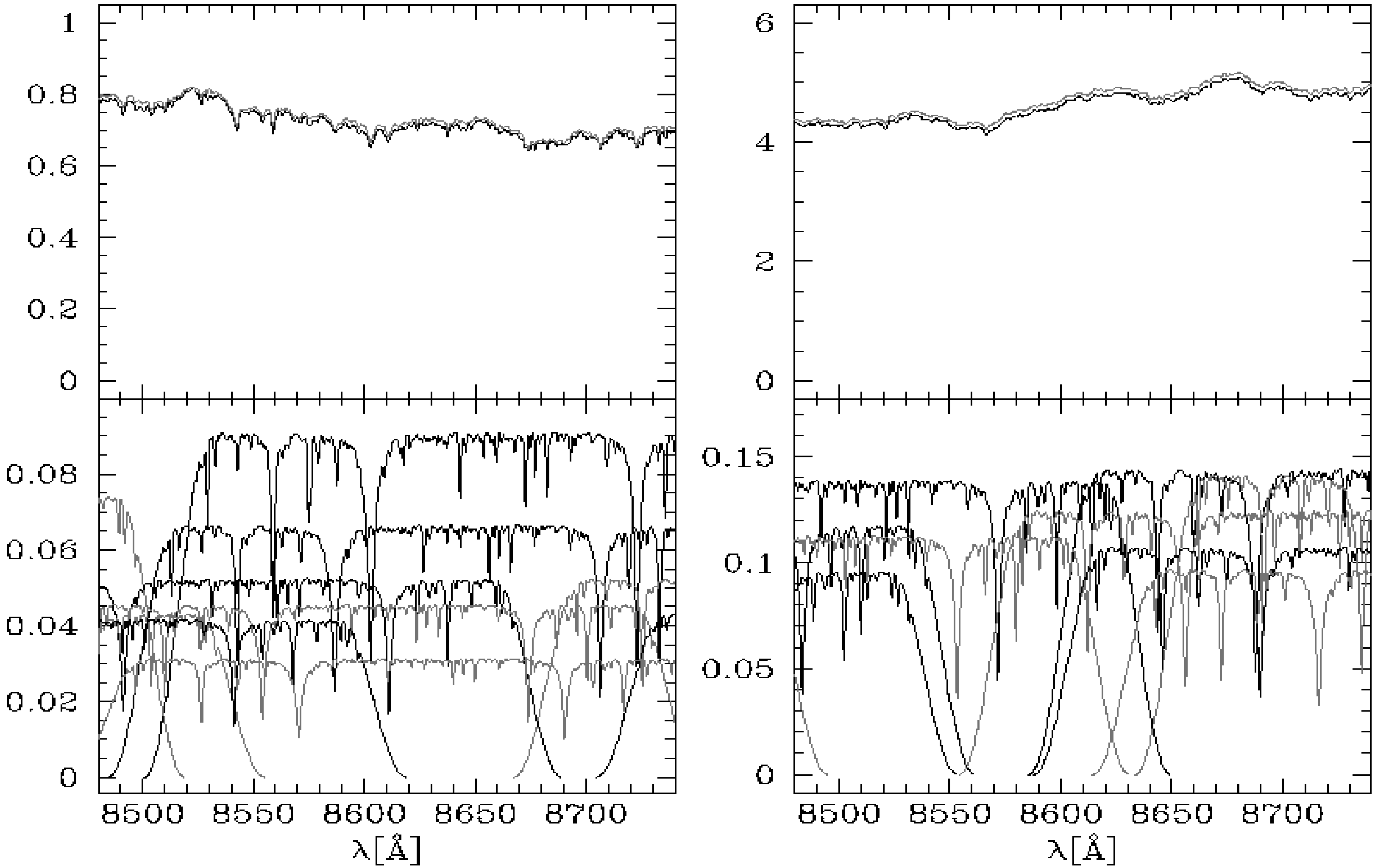
b = -15

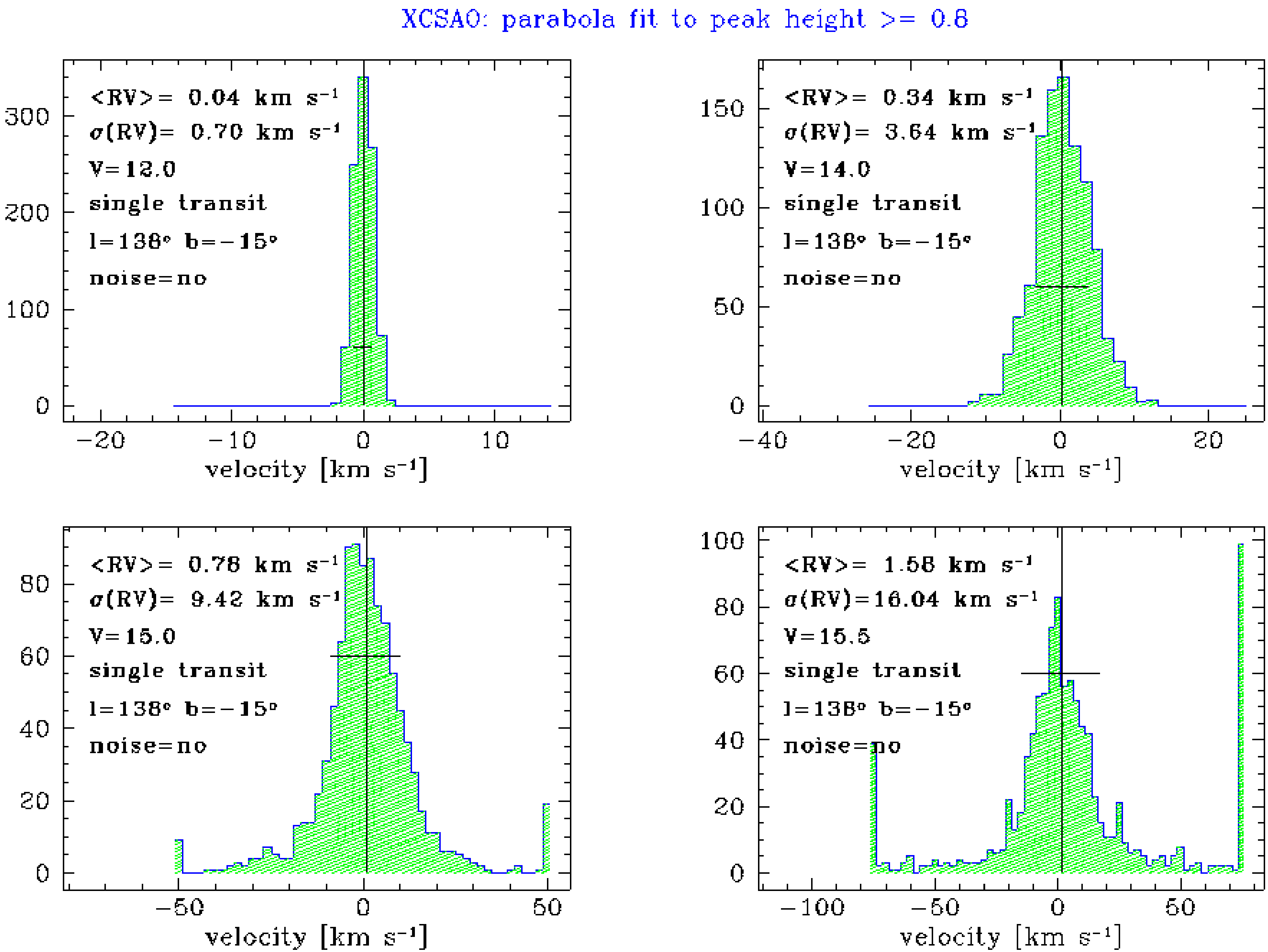
K1III V = 12

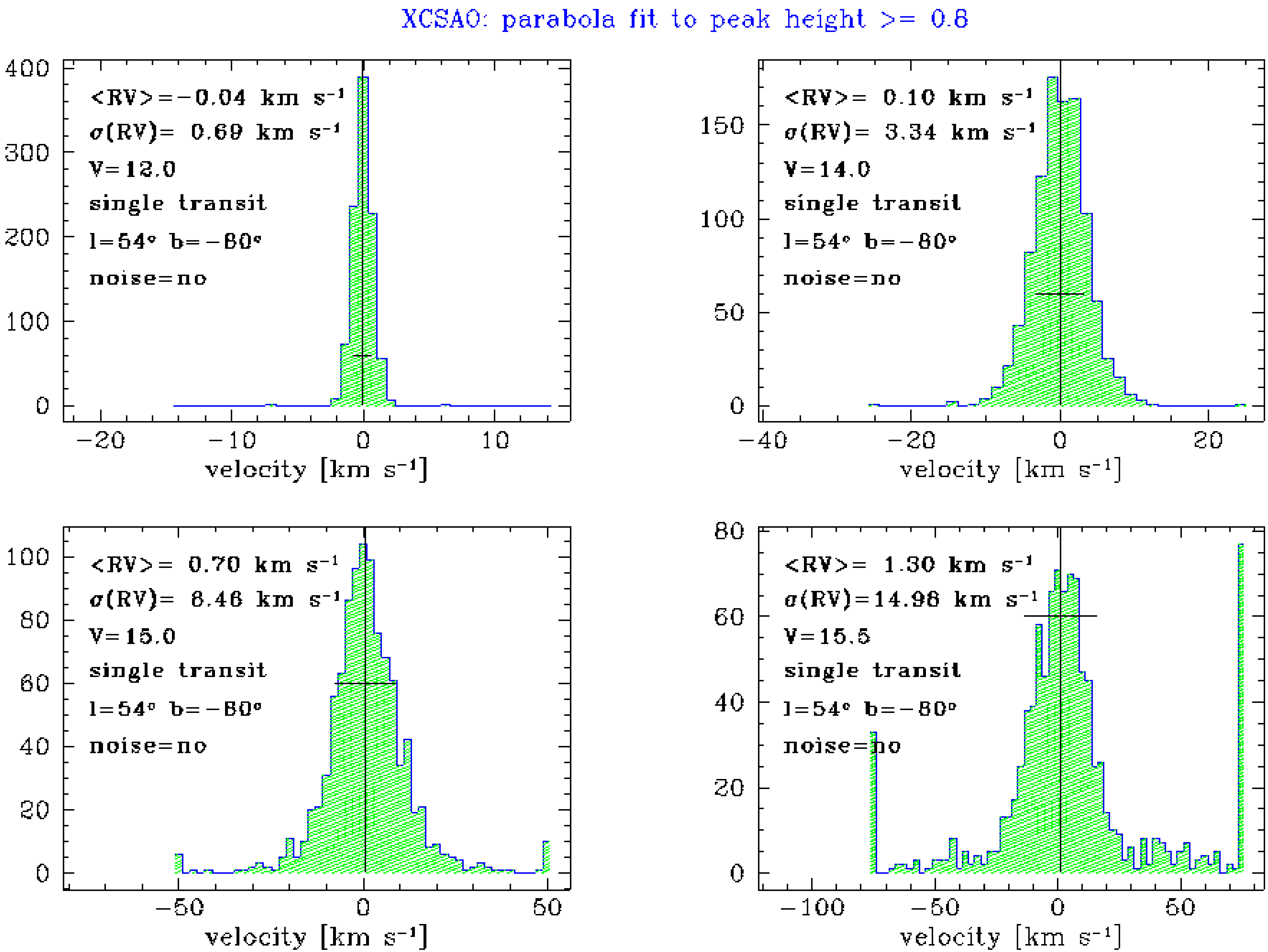




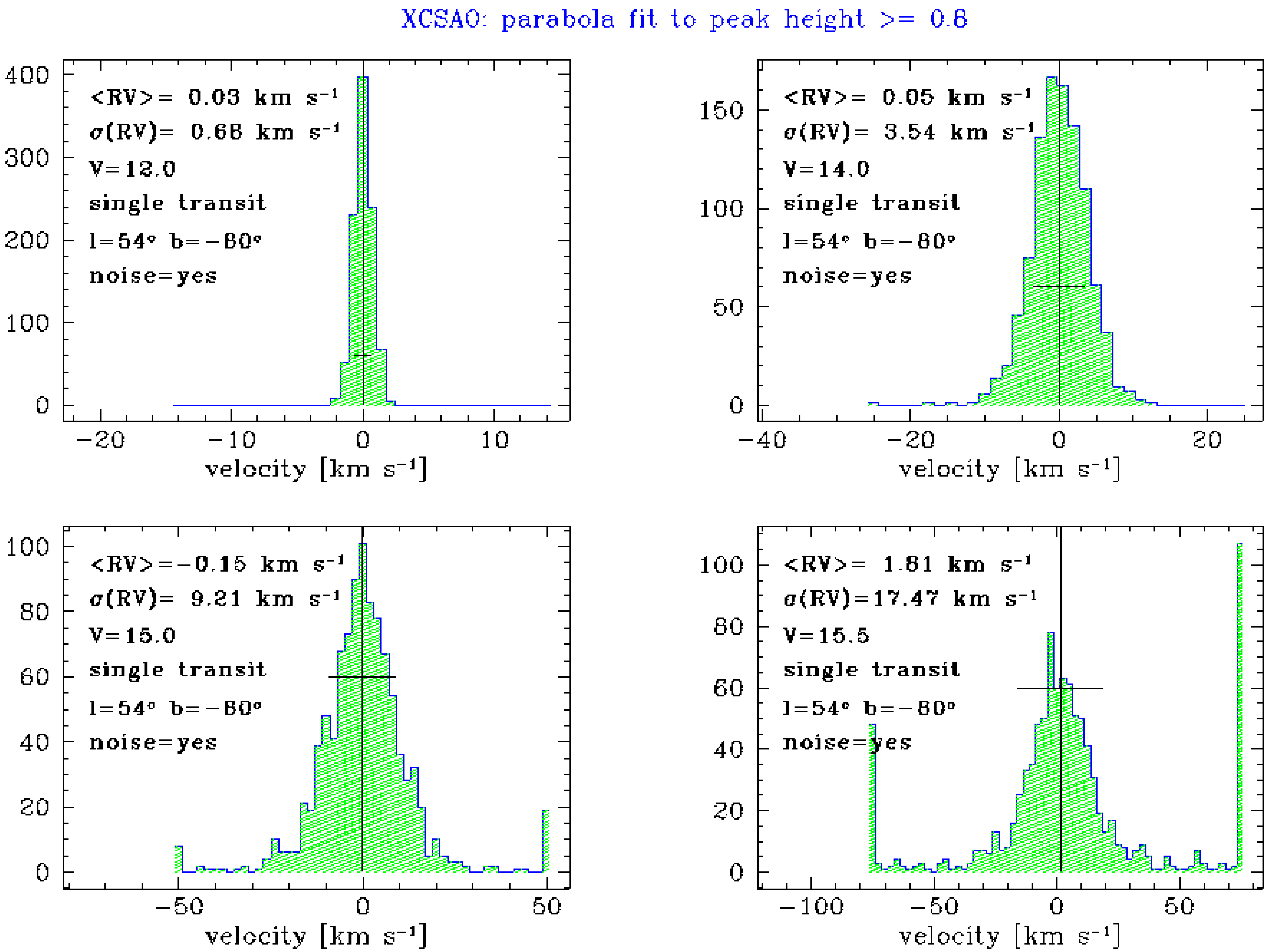
Stellar background (mission sum)



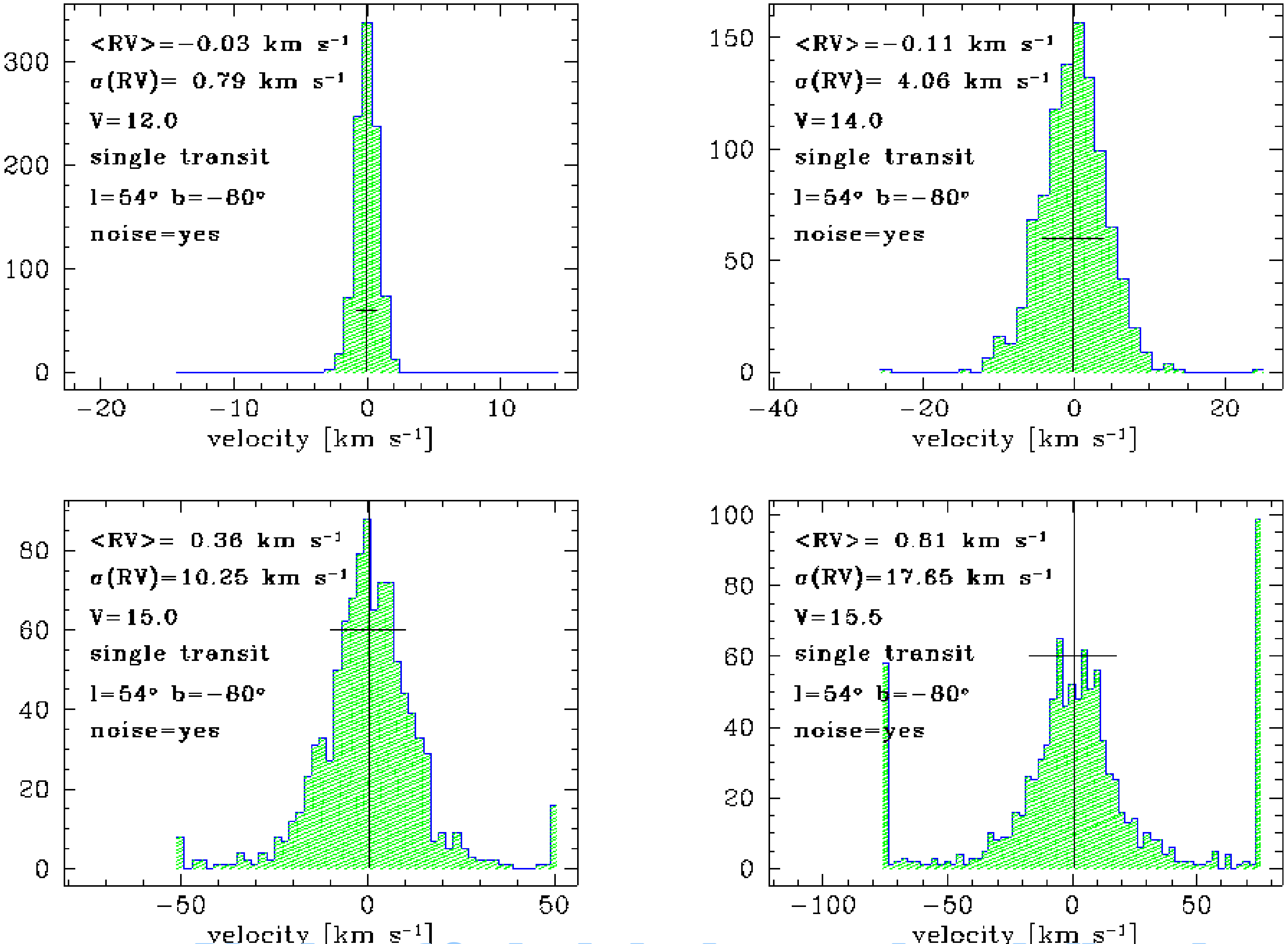

XCSAO: parabola fit to peak height >= 0.8
<RV>= 0.04 km s-1
σ(RV)= 0.70 km s-1
V=12.0
single transit
l=138° b=-15°
noise=no
velocity [km s-1]
<RV>= 0.34 km s-1
σ(RV)= 3.64 km s-1
V=14.0
single transit
l=138° b=-15°
noise=no
velocity [km s-1]
<RV>= 0.78 km s-1
σ(RV)= 9.42 km s-1
V=15.0
single transit
l=138° b=-15°
noise=no
velocity [km s-1]
<RV>= 1.58 km s-1
σ(RV)=16.04 km s-1
V=15.5
single transit
l=138° b=-15°
noise=no
velocity [km s-1]



XCSAO: parabola fit to peak height >= 0.8
<RV>=−0.04 km s−1
σ(RV)= 0.69 km s−1
V=12.0
single transit
l=54° b=−80°
noise=no
<RV>= 0.10 km s−1
σ(RV)= 3.34 km s−1
V=14.0
single transit
l=54° b=−80°
noise=no
<RV>= 0.70 km s−1
σ(RV)= 8.46 km s−1
V=15.0
single transit
l=54° b=−80°
noise=no
<RV>= 1.30 km s−1
σ(RV)=14.98 km s−1
V=15.5
single transit
l=54° b=−80°
noise=no
velocity [km s−1]


XCSAO: parabola fit to peak height >= 0.8
<RV>= 0.03 km s-1
σ(RV)= 0.68 km s-1
V=12.0
single transit
l=54° b=-80°
noise=yes
velocity [km s-1]
<RV>= 0.05 km s-1
σ(RV)= 3.54 km s-1
V=14.0
single transit
l=54° b=-80°
noise=yes
velocity [km s-1]
<RV>=-0.15 km s-1
σ(RV)= 9.21 km s-1
V=15.0
single transit
l=54° b=-80°
noise=yes
velocity [km s-1]
<RV>= 1.81 km s-1
σ(RV)=17.47 km s-1
V=15.5
single transit
l=54° b=-80°
noise=yes
velocity [km s-1]

XCSAO: parabola fit to peak height >= 0.8



Binning of 2 pixels in the wavelength direction.

Summary

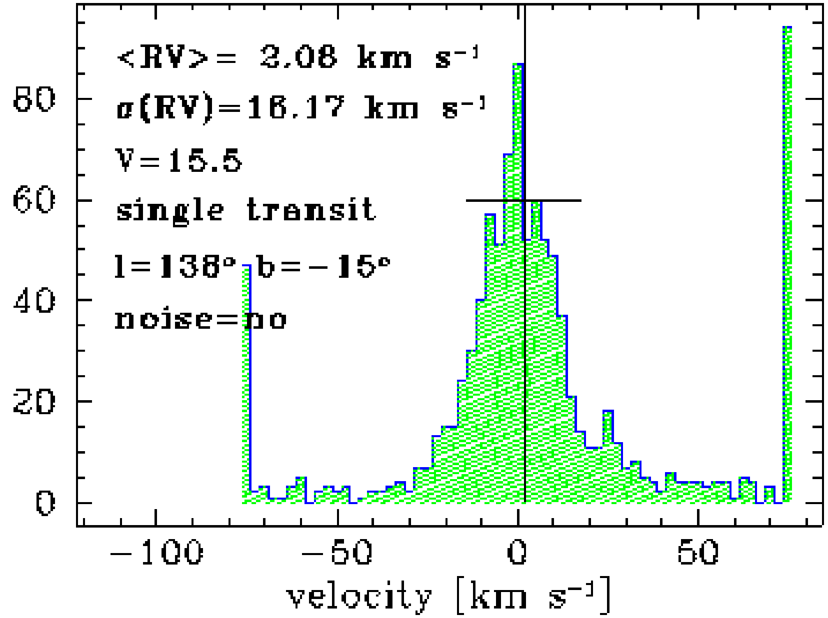
RV error standard deviations in km s^{-1} (with repeated 3-sigma clipping) for a single transit for a K1 III star:

V	Katz et al. (2004)	l=138 b= -15	l=54 b= -80	w/noise
12.0	1.1	0.7 (100%)	0.7 (99%)	0.7 (100%)
14.0	4.7	3.6 (99%)	3.3 (99%)	3.5 (99%)
15.0	11.5	9.4 (95%)	8.5 (96%)	9.2 (96%)
15.5	34.9	16.0 (83%)	15.0 (84%)	17.5 (83%)

(*) fraction of velocities within ± 3 σ(RV)

So the results we put in the paper are realistic,
but all these simulations are still somewhat simplistic.

What about if no background recovery ?



... similar results,
so we should go
denser and dimmer.