

Radial and rotational velocity by cross-correlation with template and mask in data space (GWP-S-650-07000)

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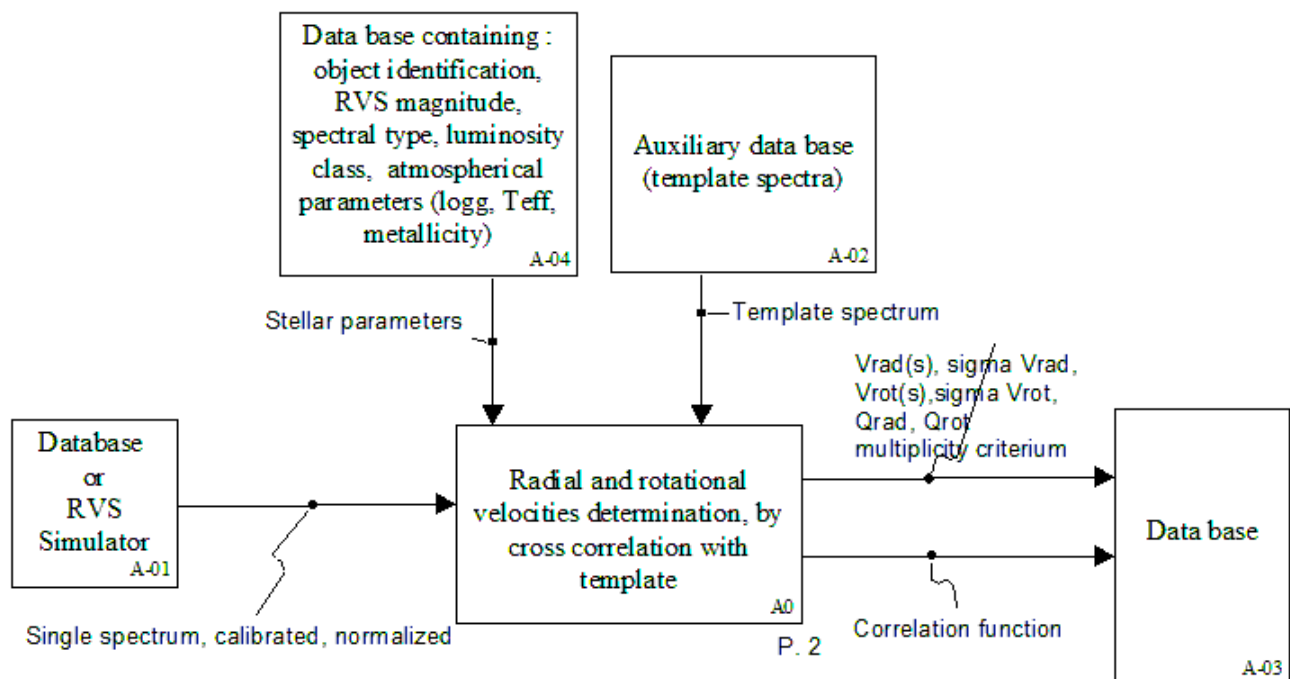
Outline

- Goal of GWP-S-650-07000
- Data flow model (functional analysis)
- Data model (UML diagram)
- A few examples of radial velocity determination
- Agenda

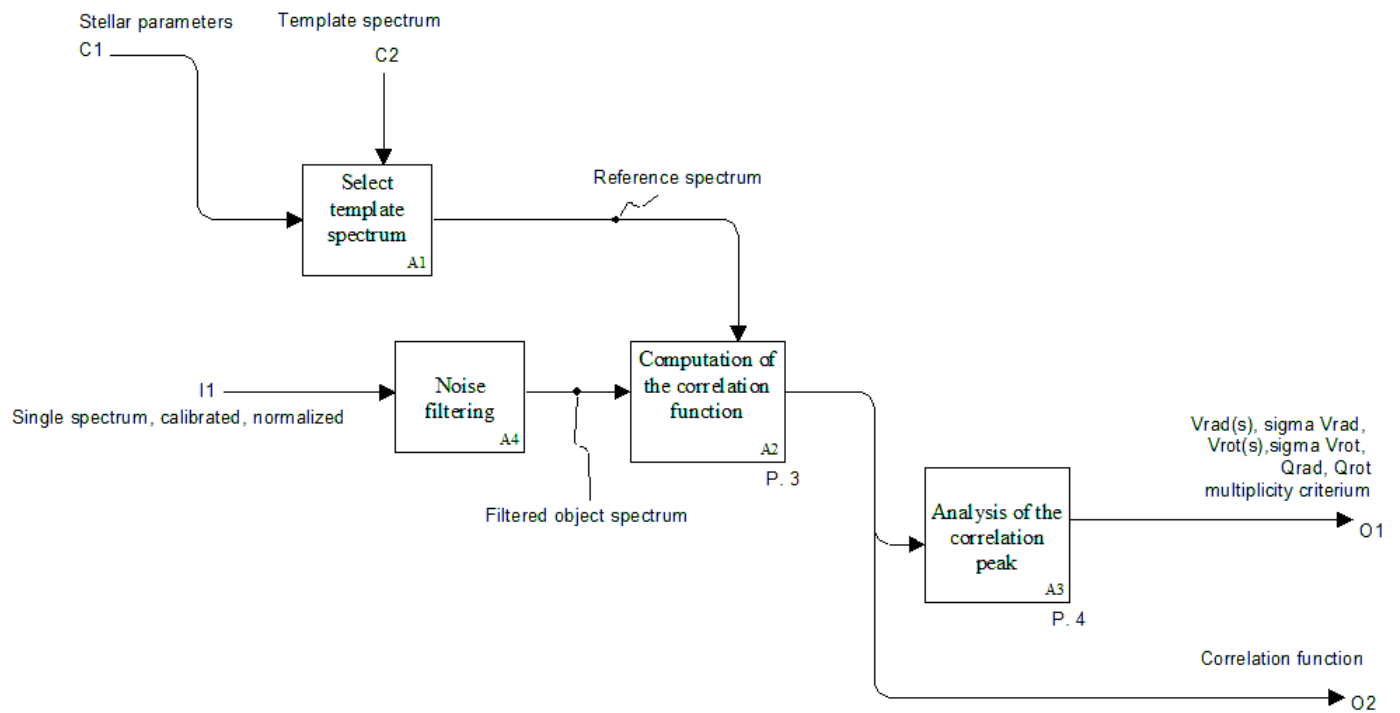
Goal of this WP

- develop a cross-correlation algorithm in data space to determine the radial and rotational velocity
- single transit
- using template spectra and synthetic masks
- outputs : vrad and vrot, errors, correlation function

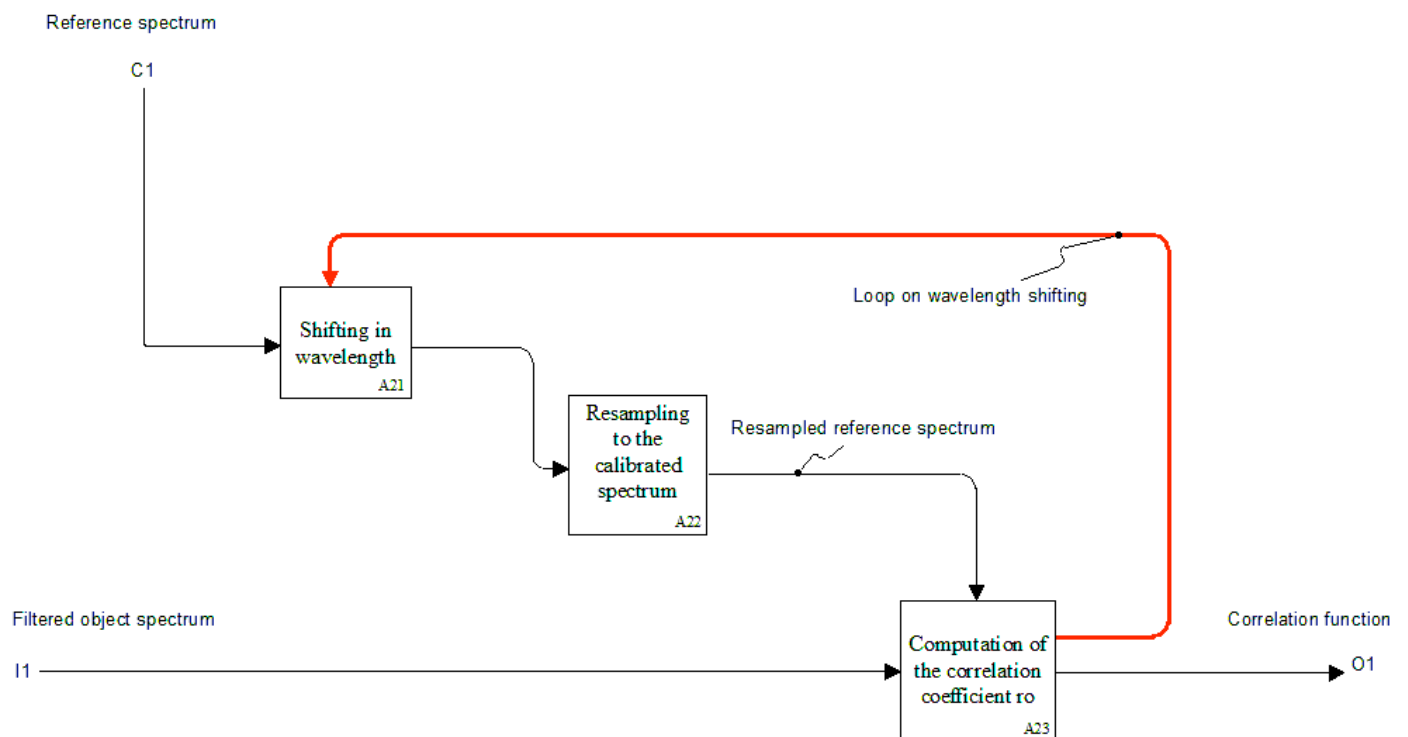
Functional analysis



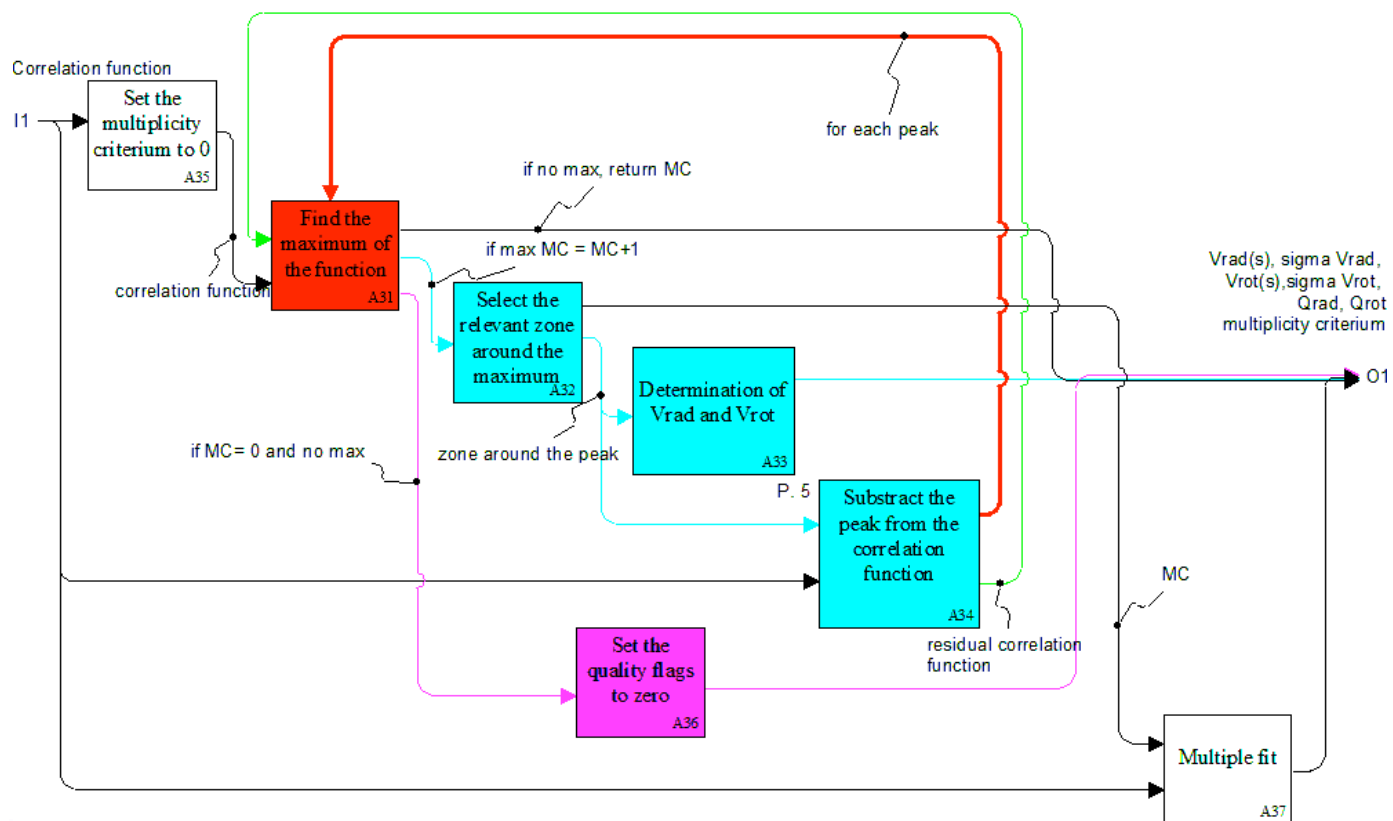
Level A0



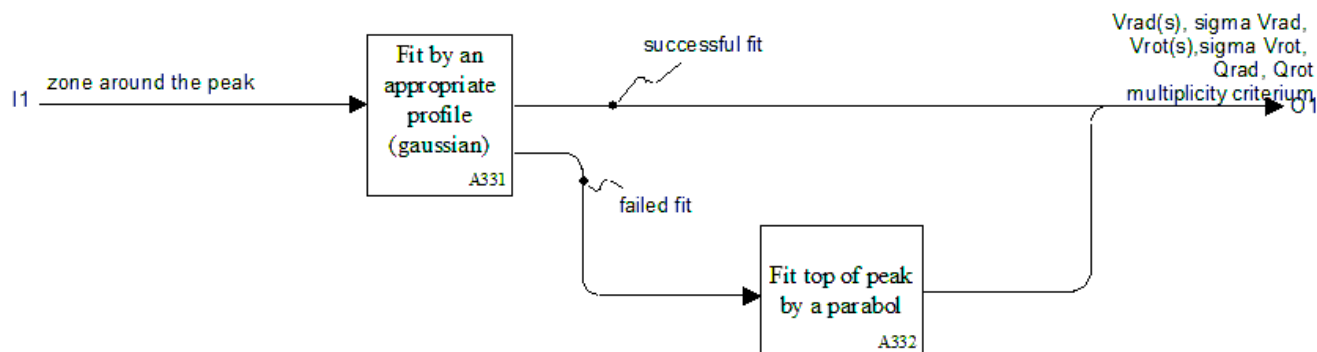
Level A2



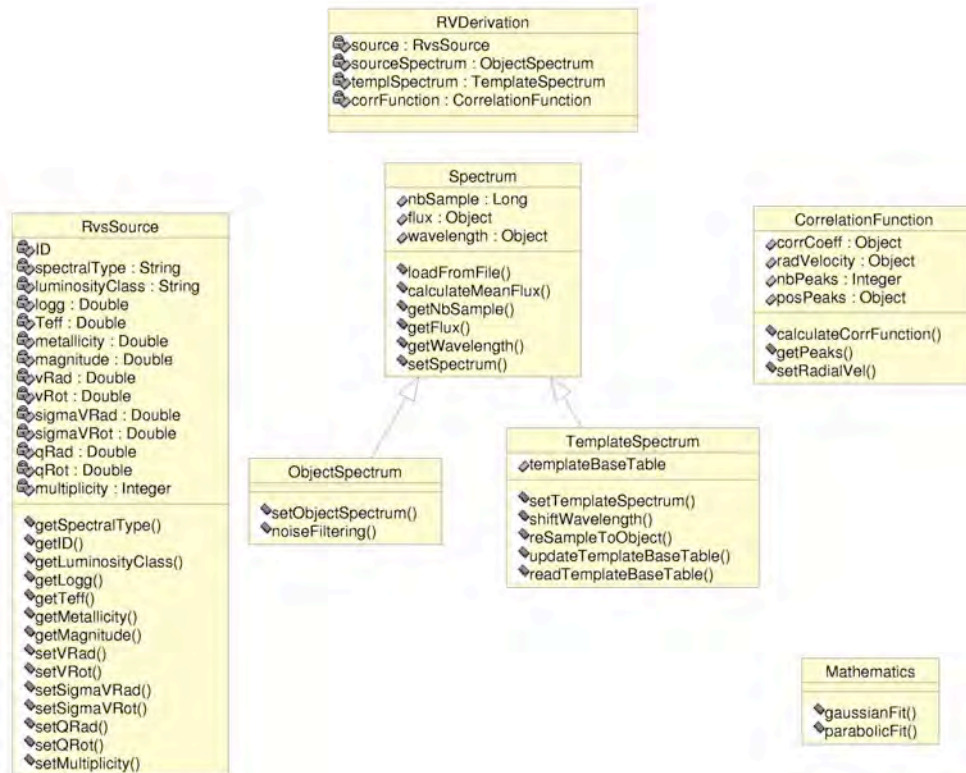
Level A3



Level A33



UML diagram



Status

- functional analysis : done, refinement if necessary
- UML : done, to be improved
- code : under development, first program deliverable in a few weeks
- tests : waiting for a template database
- done so far : one spectral type spectrum (solar) and the corresponding template

Cross-correlation results

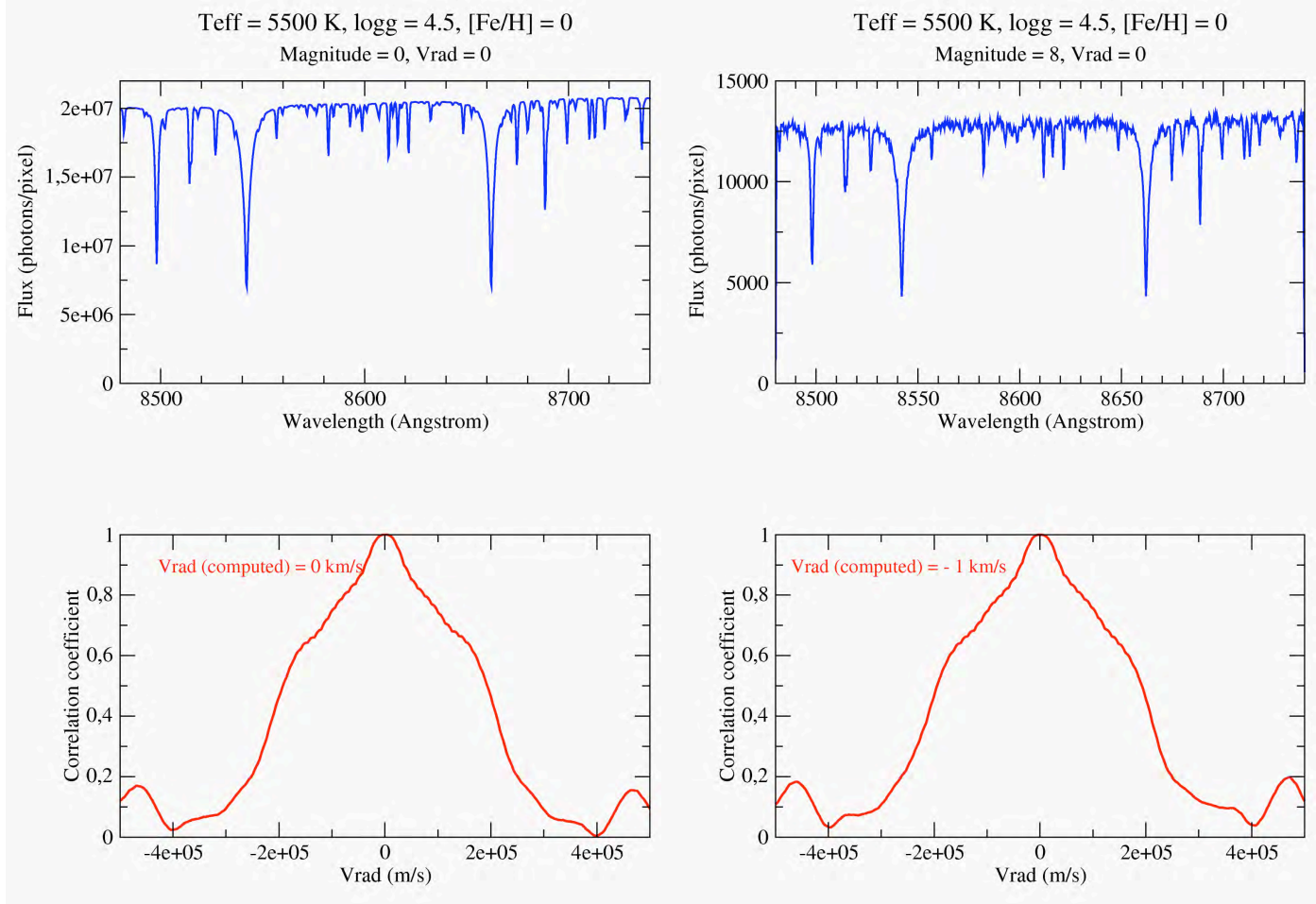
(very preliminary algorithm)

Data coming from RVS simulator (D. Katz) :

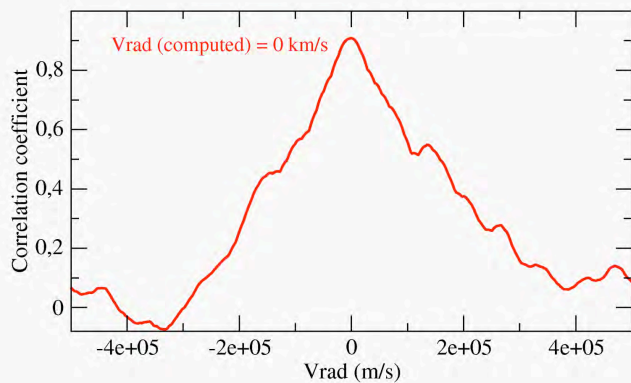
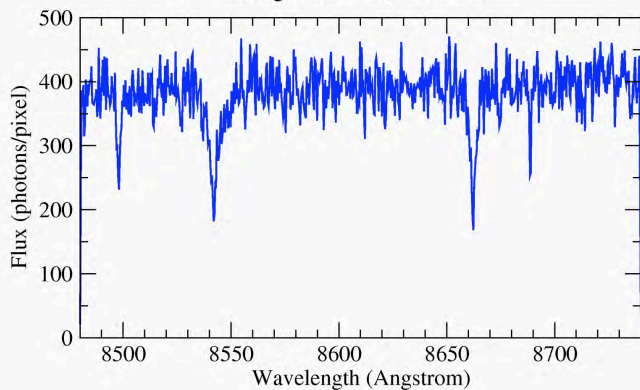
- object : solar type star
- template : same but without noise added and $M=0$

Shifting the template in the range $[-500 \text{ km/s} - 500 \text{ km/s}]$ by steps of 1 km/s

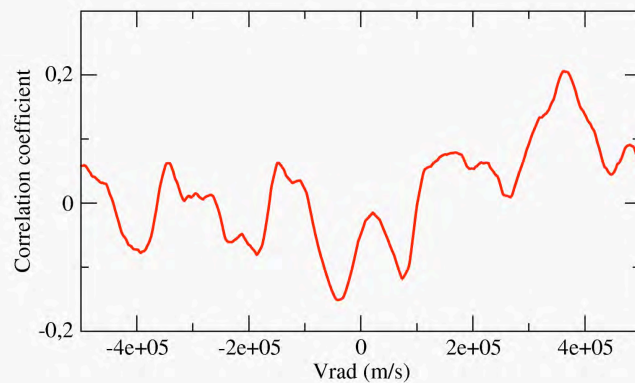
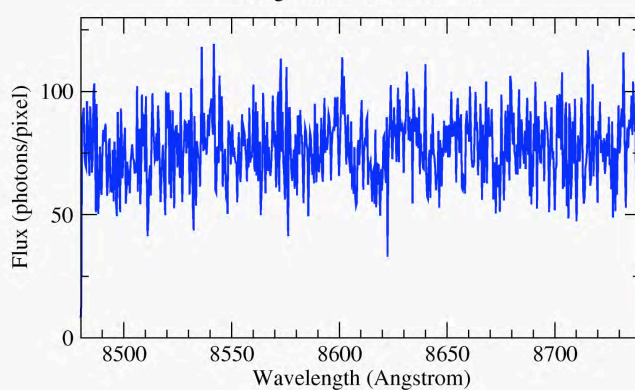
Time execution $\approx 0.3\text{s}$ (laptop)



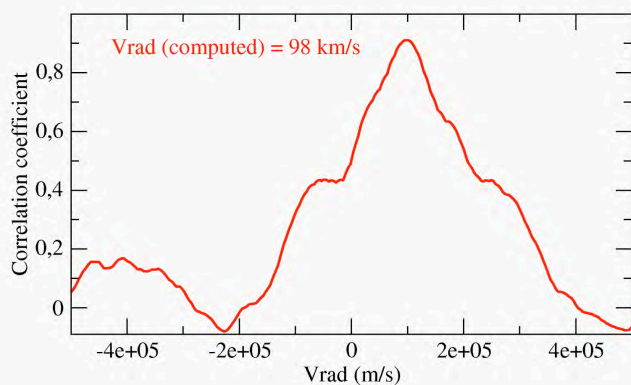
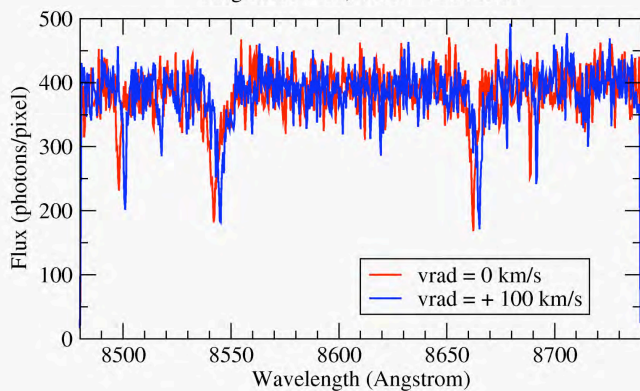
Teff = 5500 K, logg = 4.5, [Fe/H] = 0
Magnitude = 12, Vrad = 0



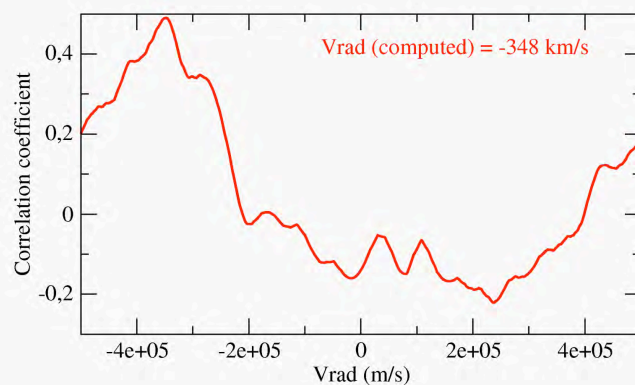
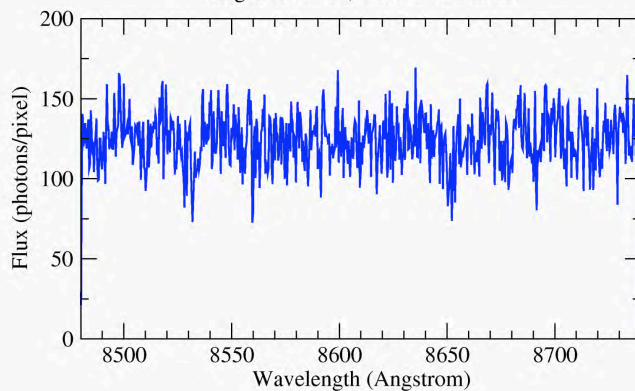
Teff = 5500 K, logg = 4.5, [Fe/H] = 0
Magnitude = 17, Vrad = 0



Teff = 5500 K, logg = 4.5, [Fe/H] = 0
Magnitude = 12, Vrad = +100 km/s

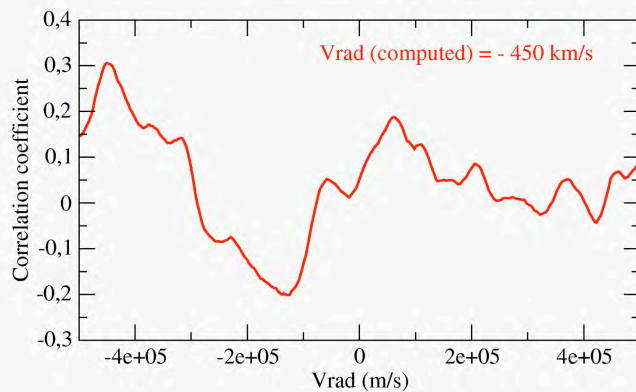
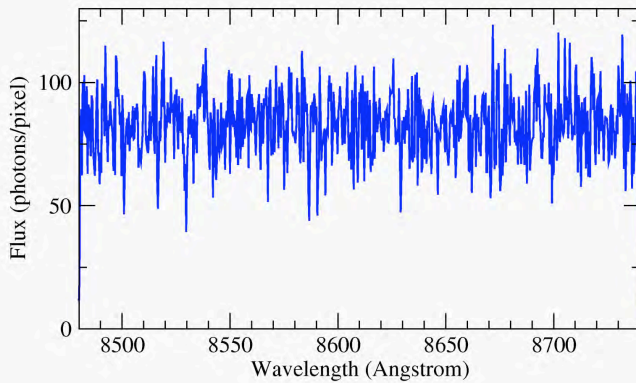


Teff = 5500 K, logg = 4.5, [Fe/H] = 0
Magnitude = 14, Vrad = -350 km/s



Teff = 5500 K, logg = 4.5, [Fe/H] = 0

Magnitude = 16, Vrad = + 50 km/s



Algorithm not efficient in case of faint objects ($M \geq 16$?)

Noise-filtering can improve the result

In any case : send correlation function to multi transits analysis (GWP-660)

CU6 workshop 2: Brussels 12-13 October 2006

Agenda for future work

Cycle 2 :

- first draft of the complete algorithm : refined search of the maximum of the correlation function (parabolic fit or gaussian fit needed to obtain vrot), automatic search of the template
- application to the set of data (object and template) provided by CU2
- estimation of the precision on vrad and vrot

Cycle 3 :

improvement of the performance and robustness (noise filtering), estimation of the errors