Single transit analysis: objectives

- Analyse single-epoch spectra to:
  - Perform a coarse characterization of the source/spectra:
    - Derive the RVS magnitude of the source
    - Detect lines in emission
  - Derive the epoch radial velocity (single & multiple lines spectra)
  - Derive the epoch rotational velocities (single & multiple lines spectra)

Derivation of radial and rotational velocities

- Several algorithms developed in parallel: e.g.
  - Cross-correlation in data space
  - Cross-correlation in Fourier space
  - Minimum distance method
- Same set of test data (covering “all” cases: hot stars, cold stars, high S/N, low S/N, ...) used to test all algorithms
- Merits and drawbacks of the algorithms assessed using this common data set
  - Cross-correlation might be better suited for cold stars (TBC)
  - Minimum distance method might be better suited for hot stars (TBC)

Optimising radial & rotational velocities algorithms

- Common set of test data “upgraded” every 6 months
  - More and more realistic modelling of the instrument
  - More and more realistic description of the stars
  - More and more realistic description of the sky

- Cycle of 6 months
  - Assess the performance of the algorithms (new data set)
  - Optimize the algorithms (new data set)

GWP-S-650-00000 Single transit analysis (1)

- GWP-S-650-00000 Single transit analysis
  - **Viala (Co)**
- GWP-C-650-01000 Management, configuration management & interfaces
  - **Viala (Co)**
- GWP-S-650-02000 Definition test campaigns & comp. of algorithms perform.
  - **Viala (Co), David, Gomboc, Prsa**
- GWP-D-650-03000 Detailed functional analysis of sing. transit sing. lines
  - **Viala (Co), Delle Luche, Royer, Frémat**
- GWP-S-650-04000 Overview of existing techniques for spectra analysis
  - **TBD**
- GWP-S-650-05000 Coarse characterization of sources
  - **Martayan (TBC)**
- GWP-S-650-06000 Radial & rot. velocity CC w. template/mask in data space
  - **Delle Luche (Co), Viala, Royer**

GWP-S-650-00000 Single transit analysis (2)

- GWP-S-650-07000 Radial velocity by CC in Fourier space
  - **Frémat (Co), Viala, Delle Luche, Royer**
- GWP-S-650-08000 Rotational velocity by Fourrier transform
  - **Frémat (Co), Viala, Delle Luche, Royer, Jankov (to be contacted)**
- GWP-S-650-09000 Radial and rotational velocity by minimum distance method
  - **Blomme**
- GWP-S-650-10000 Rotational velocities by Neural network
  - **Kaempf (TBC)**
- GWP-S-650-11000 Radial and rotational velocities for multi-l by TODCOR like method
  - **Gosset (Co), Rauw, Postdoc**
- GWP-S-650-12000 Radial and rot. velocities for multi-l by spectrum subtraction method
  - **TBD**
- Participation TBD:
  - **Bouchy, Siebert**

CU6-GWP-S-650
Single transit analysis : single and multiple lines spectra

GWP- S-650-06000&07000
Radial and rotational velocities by cross correlation methods

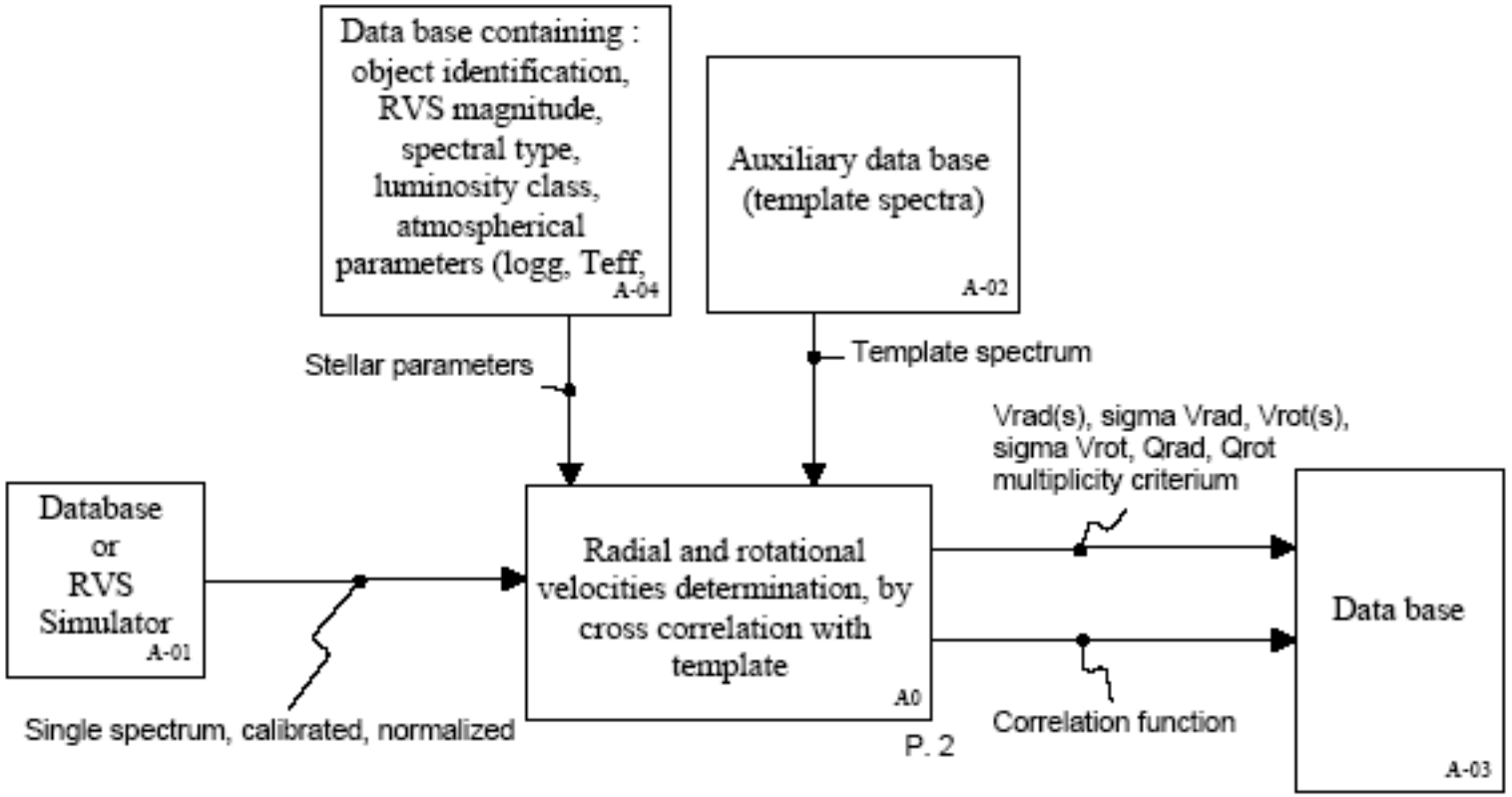
- Objective : Vrad(s) and Vrot(s) determination from one single (calibrated) object spectra (simple or multiple)
- 3 methods :
  - Cross correlation in data space of the object spectrum (simulator) and a template spectrum (auxilliary data)

    Delle Luche, Viala (Observatoire de Paris - GEPI)
  - Cross correlation in data space of the object spectrum (simulator) and a mask (auxilliary data ?) containing the main spectral features

    Royer (Observatoire de Paris - GEPI)
  - Cross correlation in Fourier space of the object spectrum (simulator) and a template spectrum (auxilliary data)

    Frémat (Observatoire Royal de Belgique)

USED AT:	AUTHOR: Viala Y., Delle Luche C.	DATE: 10/02/06				CONTEXT:
	PROJECT: Extraction of radial velocities	REV:		WORKING	READER DATE	
			x	DRAFT		Top
	NOTES: 1 2 3 4 5 6 7 8 9 10			RECOMMENDED		
				PUBLICATION		



USED AT:	AUTHOR: Viala Y., Delle Luche C.	DATE: 10/02/06		WORKING	READER	DATE	CONTEXT:
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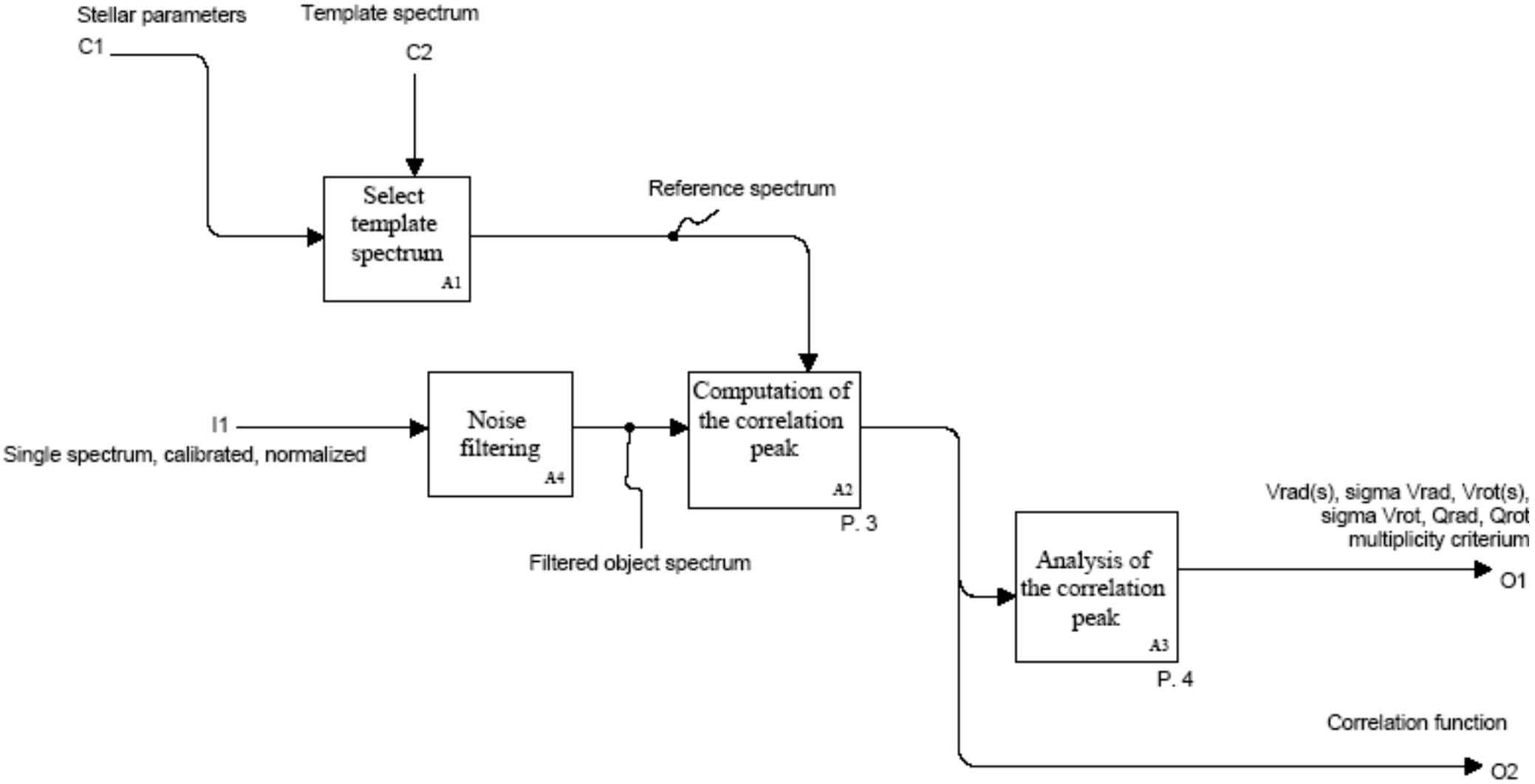
				RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10			PUBLICATION			



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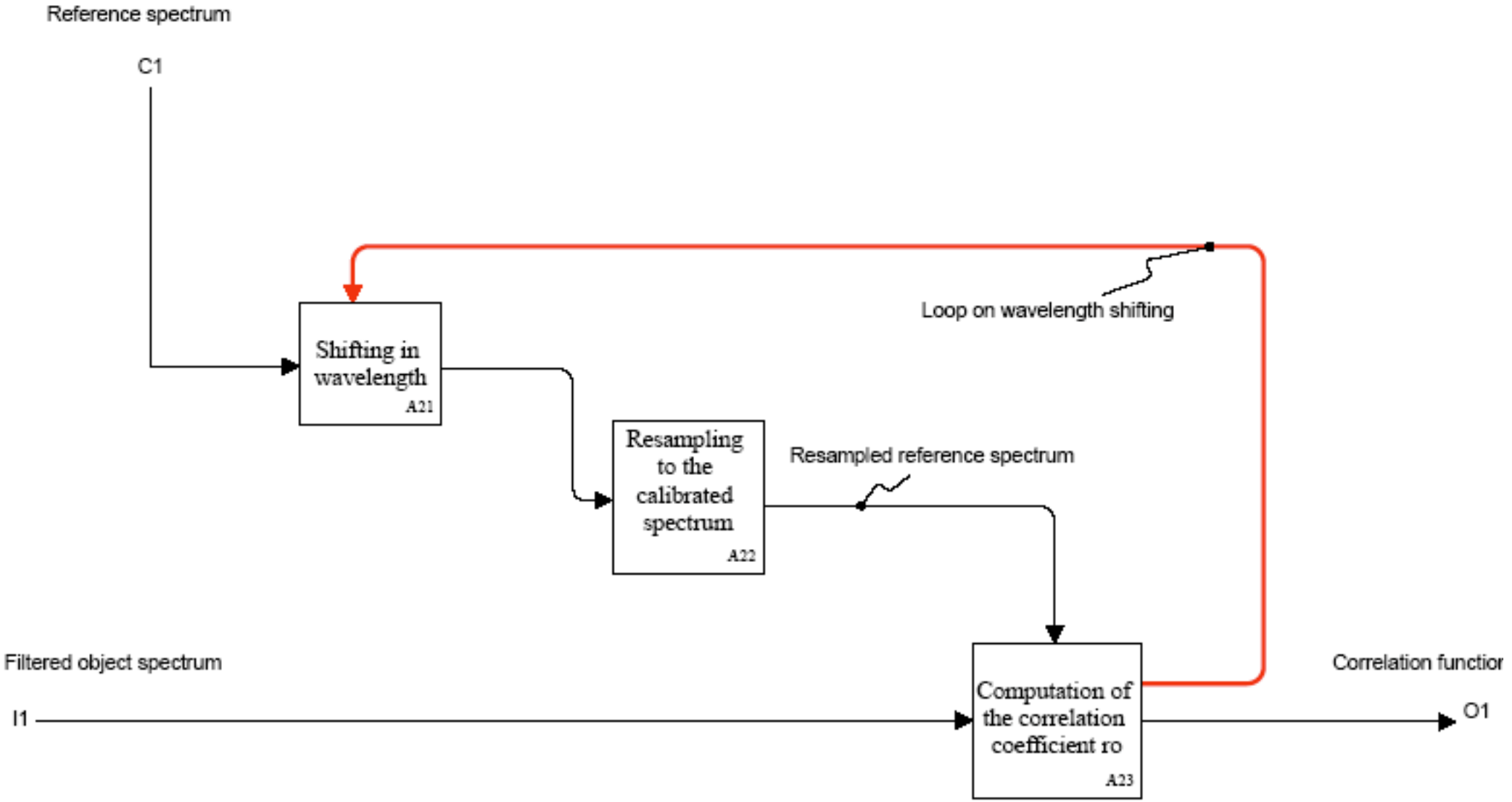
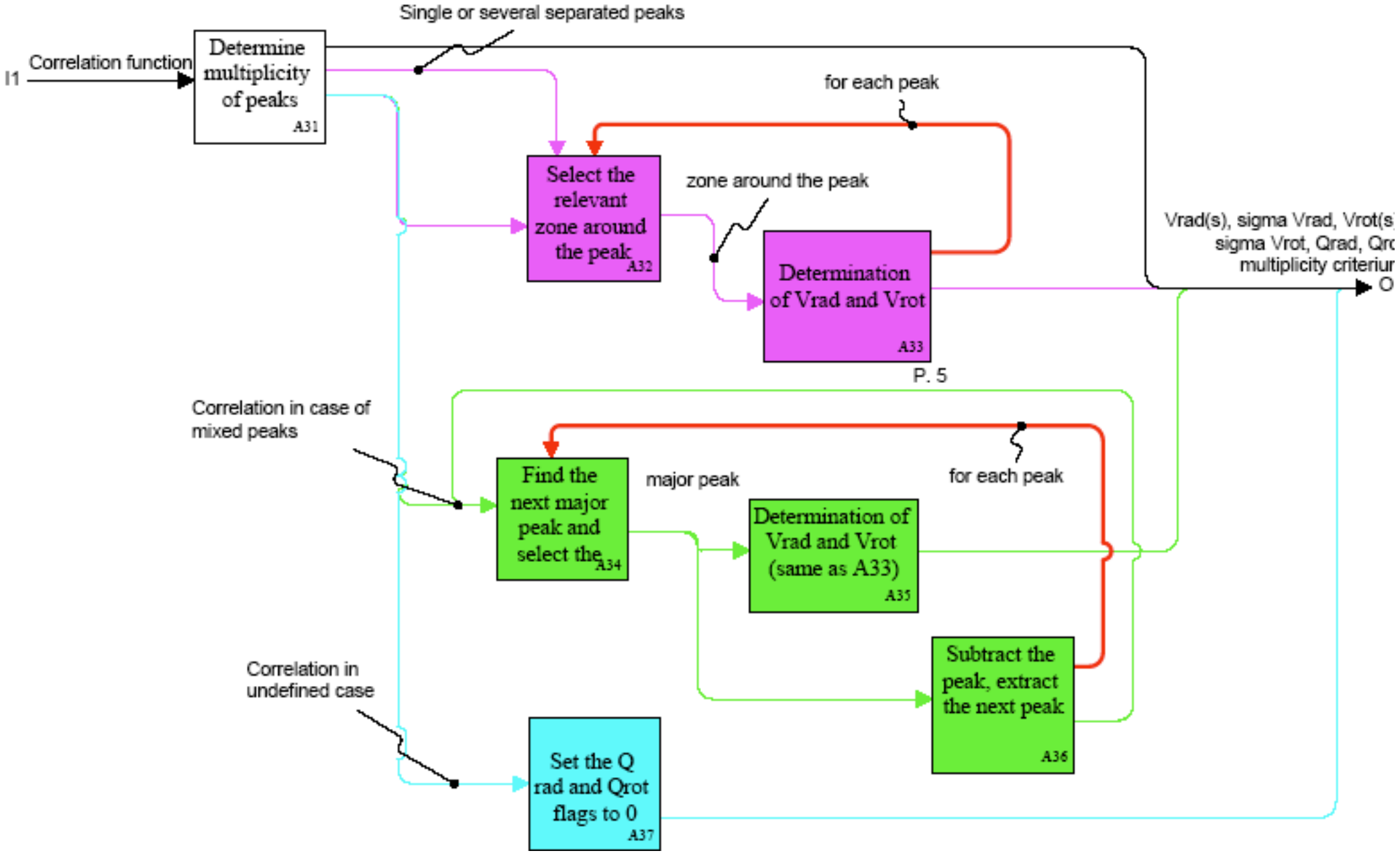
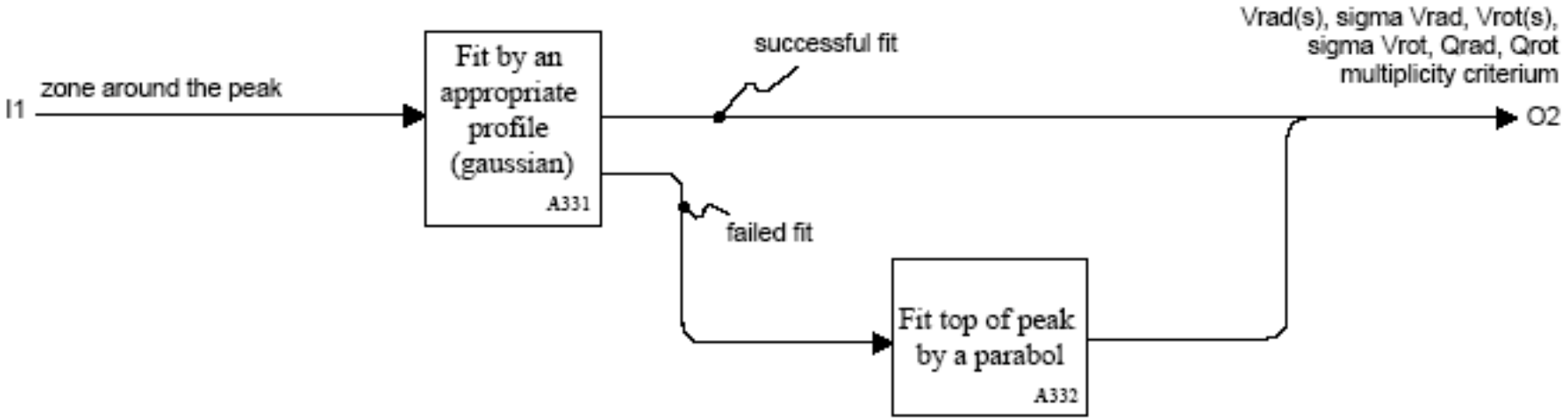
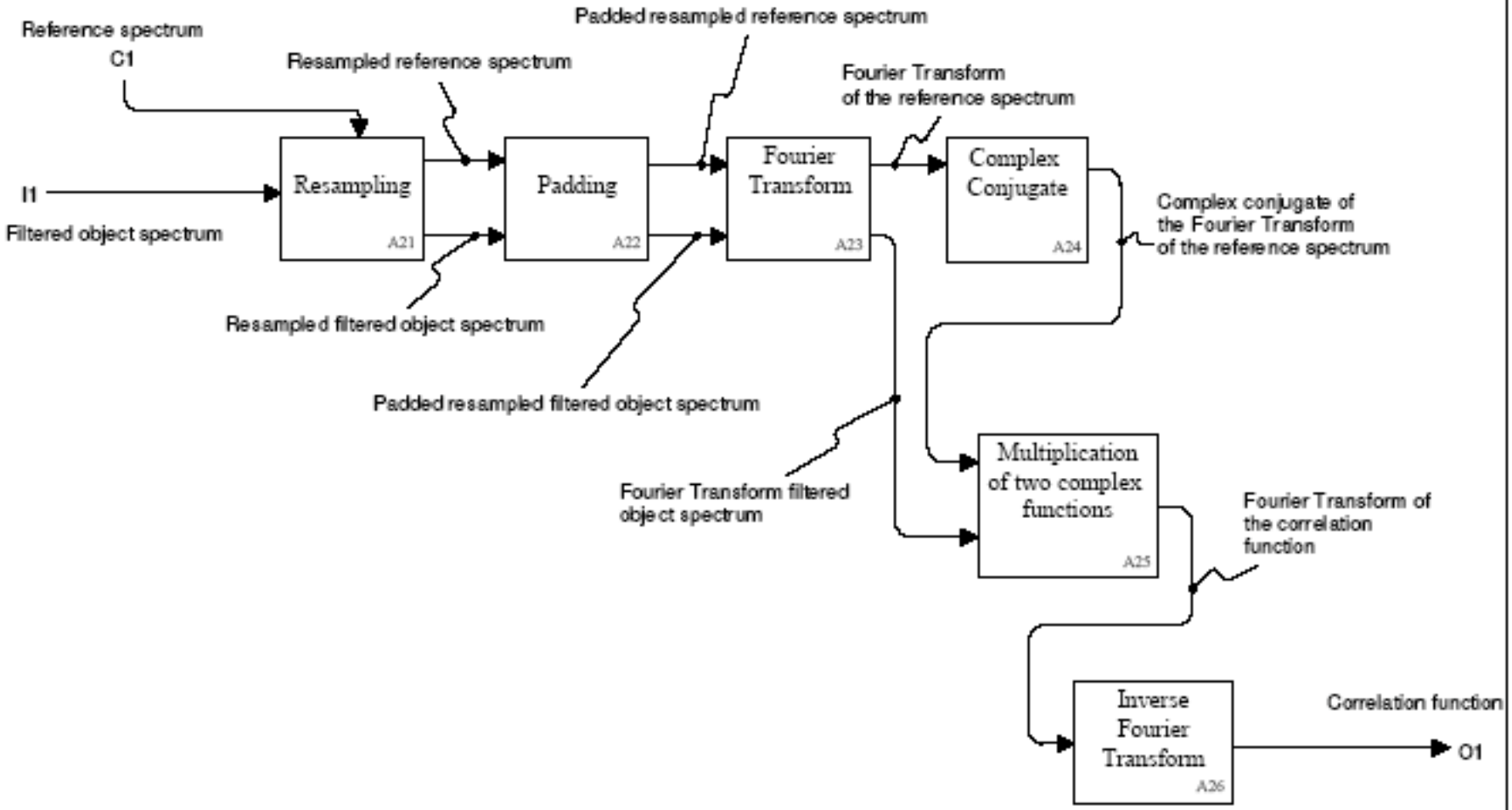
	PROJECT: Extraction of radial velocities	REV:	x	DRAFT		
				RECOMMENDED		
	NOTES: 1 2 3 4 5 6 7 8 9 10			PUBLICATION		




Single or several separated peaks
I1
Correlation function
Determine multiplicity of peaks
A31
for each peak
Select the relevant zone around the peak
A32
zone around the peak
Determination of Vrad and Vrot
A33
Vrad(s), sigma Vrad, Vrot(s
sigma Vrot, Qrad, Qrc
multiplicity criteriur
O
P. 5
Correlation in case of mixed peaks
Find the next major peak and select the
A34
major peak
for each peak
Determination of Vrad and Vrot (same as A33)
A35
Subtract the peak, extract the next peak
A36
Correlation in undefined case
Set the Q rad and Qrot flags to 0
A37


I1
zone around the peak
Fit by an appropriate profile (gaussian)
A331
successful fit
failed fit
Fit top of peak by a parabol
A332
Vrad(s), sigma Vrad, Vrot(s), sigma Vrot, Qrad, Qrot multiplicity criterium
O2

USED AT:	AUTHOR: Viala Y., Delle Luche C.	DATE: 03/02/06		WORKING	READER DATE	CONTEXT:
	PROJECT: Extraction of radial velocities	REV:	x	DRAFT		
				RECOMMENDED		
	NOTES: 1 2 3 4 5 6 7 8 9 10			PUBLICATION		



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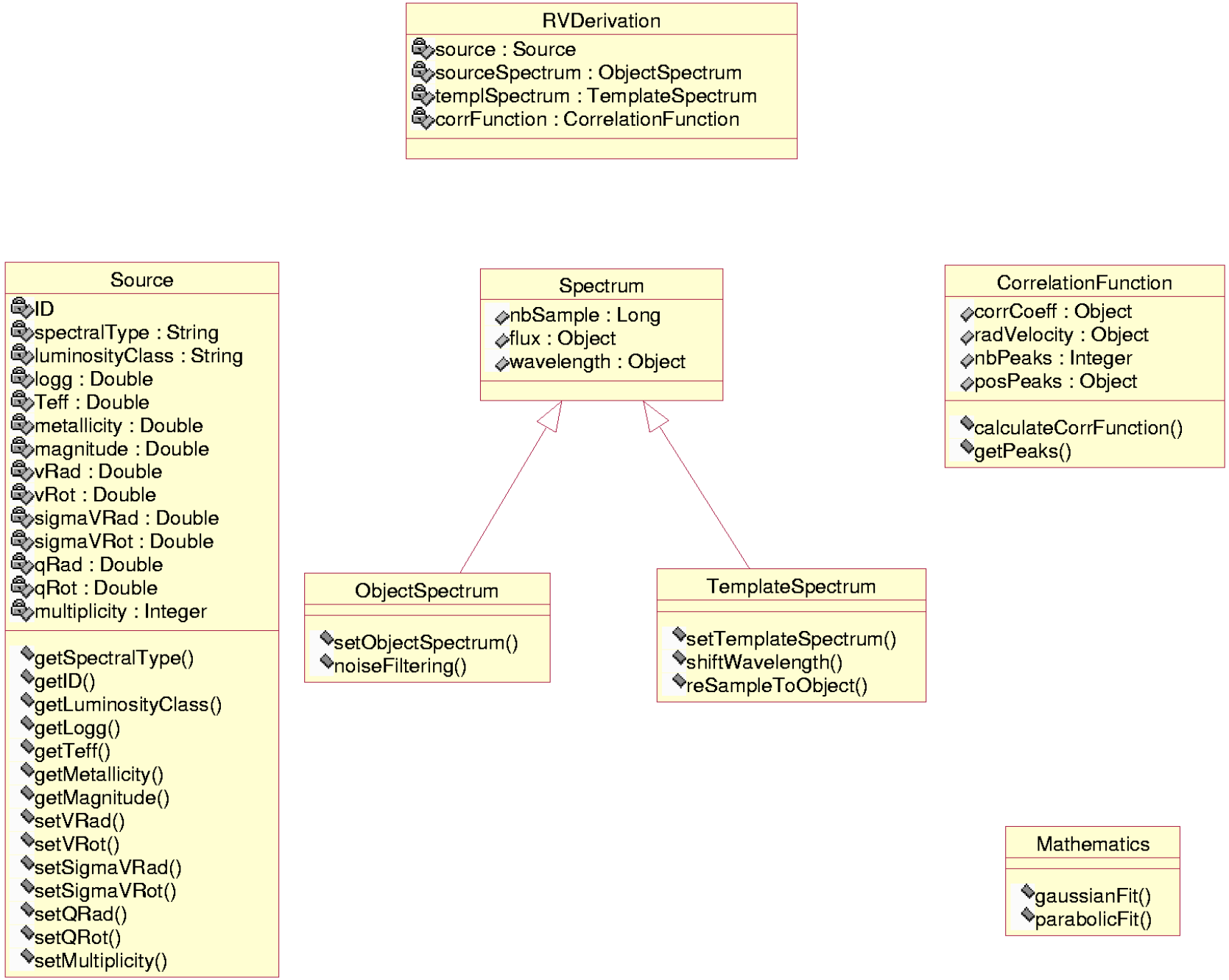
RVDerivation
source : Source
sourceSpectrum : ObjectSpectrum
templSpectrum : TemplateSpectrum
corrFunction : CorrelationFunction
Source
ID
spectralType : String
luminosityClass : String
logg : Double
Teff : Double
metallicity : Double
magnitude : Double
vRad : Double
vRot : Double
sigmaVRad : Double
sigmaVRot : Double
qRad : Double
qRot : Double
multiplicity : Integer
getSpectralType()
getID()
getLuminosityClass()
getLogg()
getTeff()
getMetallicity()
getMagnitude()
setVRad()
setVRot()
setSigmaVRad()
setSigmaVRot()
setQRad()
setQRot()
setMultiplicity()
Spectrum
nbSample : Long
flux : Object
wavelength : Object
ObjectSpectrum
setObjectSpectrum()
noiseFiltering()
TemplateSpectrum
setTemplateSpectrum()
shiftWavelength()
reSampleToObject()
CorrelationFunction
corrCoeff : Object
radVelocity : Object
nbPeaks : Integer
posPeaks : Object
calculateCorrFunction()
getPeaks()
Mathematics
gaussianFit()
parabolicFit()