Automatic determination of

Stellar Atmospheric Parameters of GAIA-RVS spectra

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1. The method**S**

Two approaches to derive the individual abundances from the RVS spectrum

1. *All the atmospheric parameters and the individual abundances are derived from the RVS spectra (**ONLY** !)*
2. *Atmospheric parameters from astrometry and photometry*

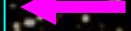
+

Individual abundances from RVS spectra

1. The methods – case A

Observed GAIA spectrum

Automatic procedure



Grid of synthetic spectra

Atmospheric parameters and individual abundances of the star

1. The method**S** - *Alternative*

Observed GAIA spectrum + *Inputs from Photometry & Astrometry*

Automatic procedure

Grid of synthetic spectra

Individual abundances of the star

Alternative to be tested in the coming 6 months

1. The method

Grid of synthetic spectra

- *Grid of synthetic MARCS spectra in the GAIA domain.*

λ range = 8475 – 8745 Å, in steps of dλ = 0.02 Å

- Effective Temperature range : 4000 K – 7500 K, step = 250 K

- Gravity (log g) range : 0.0 – 5.0, step = 0.5

- Metallicity ([M/H]) : - 4.0, -3.0, -2.0, -1.0, -0.5, 0.0, +0.5 (α enhanced)

- *Convolved to dλ = 0.24 Å => 3 points / RVS resolution element*

- *Convolved with a Gaussian noise*

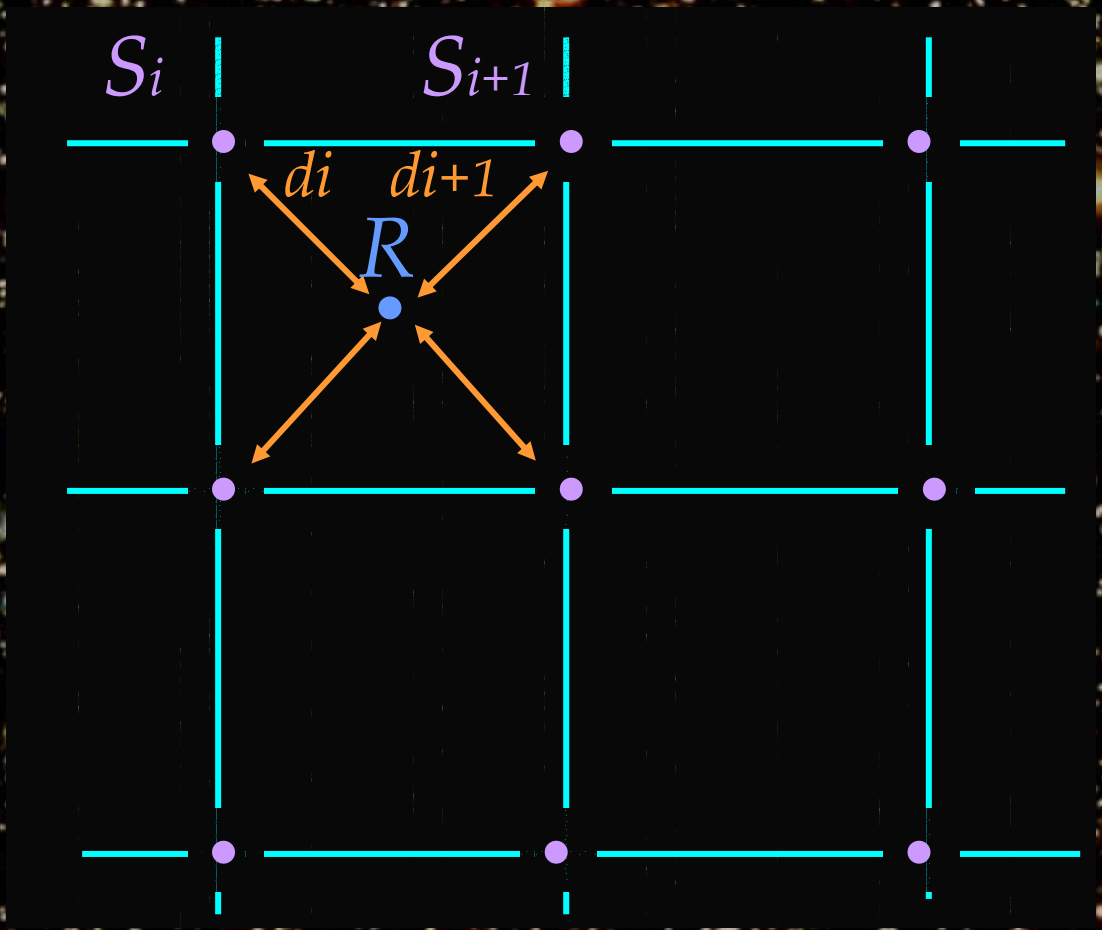
- ***New dimension added to the grid:***

[Ca/Fe] = -0.5, 0, +0.5

1. The method

The automatic procedure

- Based on the Objective Analysis method



$S_i(\lambda)$

spectrum of the grid :

Teff_i, log(g)_i, [M/H]_i

$R(\lambda)$

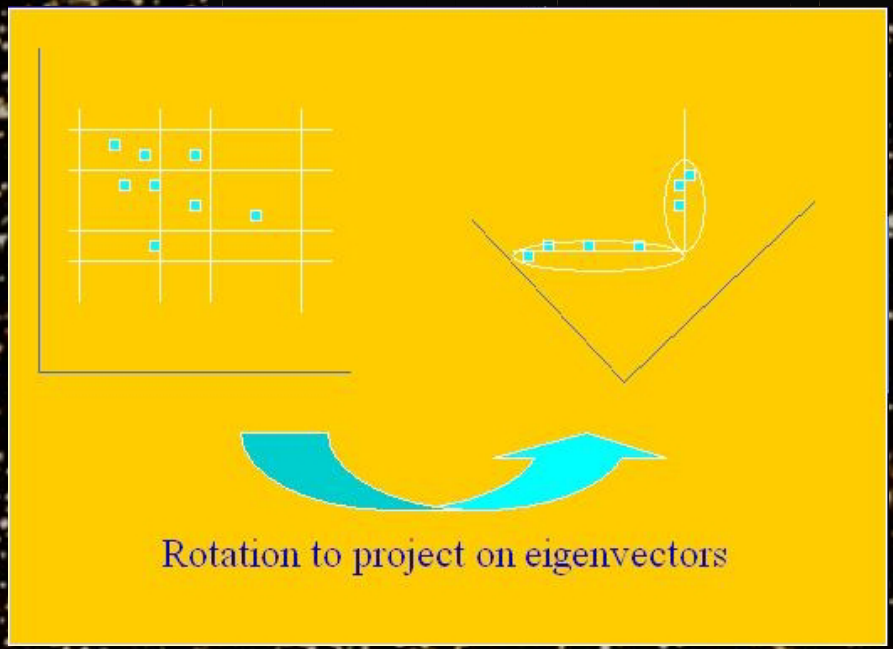
Observed input spectrum :

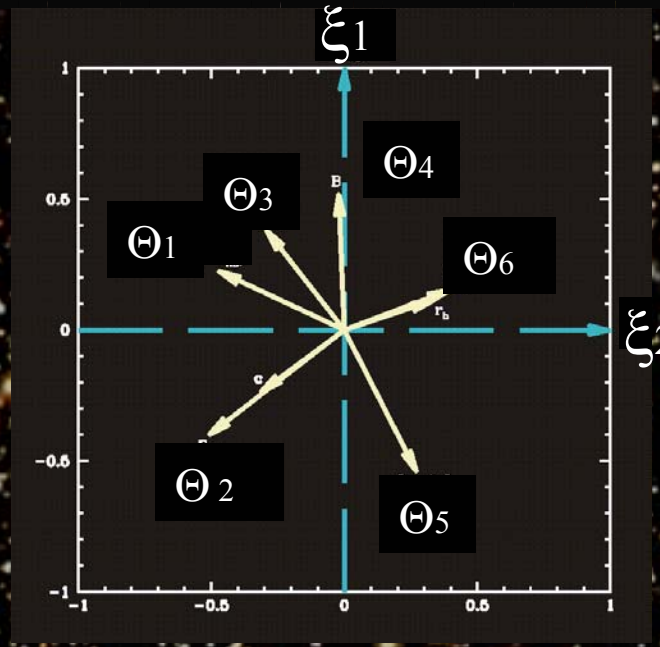
Teff, log(g)*, [M/H]**

1. The method

The automatic procedure - Alternative

- *Tests with the Principal Component Analysis*





Diagonalization of the correlation matrix => new system of the eigenvectors

i	e_i	V_i	C_i
1	1.72	57.3	57.3
2	0.99	33.0	90.3
3	0.29	9.7	100.0

ei = Eigenvector´s value

Vi = Associated variance

Ci = Cumulative variance

1. The method

The input GAIA spectra

- *Grid of synthetic spectra + Gaussian noise*

  "The Grid looks for itself !"

  Better results than in december

  - Errors in Teff, log g, [M/H] =0 for 100% of spectra

  if SNR>45 and [M/H]>= - 2

  - More metal-poor stars: larger errors for the gravity

- *Interpolated spectrum (outside the Grid) + Gaussian noise*

  - Stellar parameters not always well found

  - Effects of [Ca/Fe] variations can mimic Teff variations

  - To be more tested in the coming months

1. The method

Work in progress and future improvements

- *Results for input spectra "out of the grid" .*
- *Results for spectra with abundance anomalies (in [Ca/Fe], [α /Fe],…)*
- *Results for spectra with different values of microturbulence, macroturbulence and rotation…*
- *Individual abundances: Ca, Fe, Mg, Si, Ti.*
- *Other technique of parameter determination: Principal Component Analysis.*

2. Tests with real data in the RVS domain

- *Galactic Globular Cluster 47Tuc*

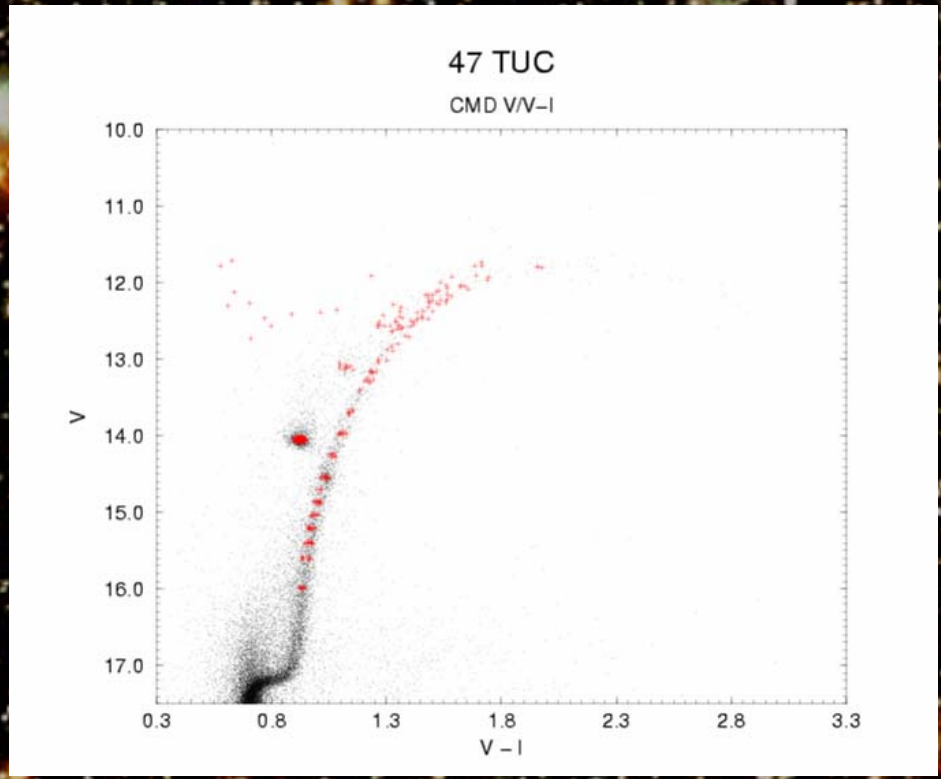
- *Galactic Open Cluster M67*

- *ESO/Flames application for 3 galactic fields to periodically check the procedure during the GAIA mission.*

Galactic Globular Cluster 47 Tuc

[M/H] ~ -0.75

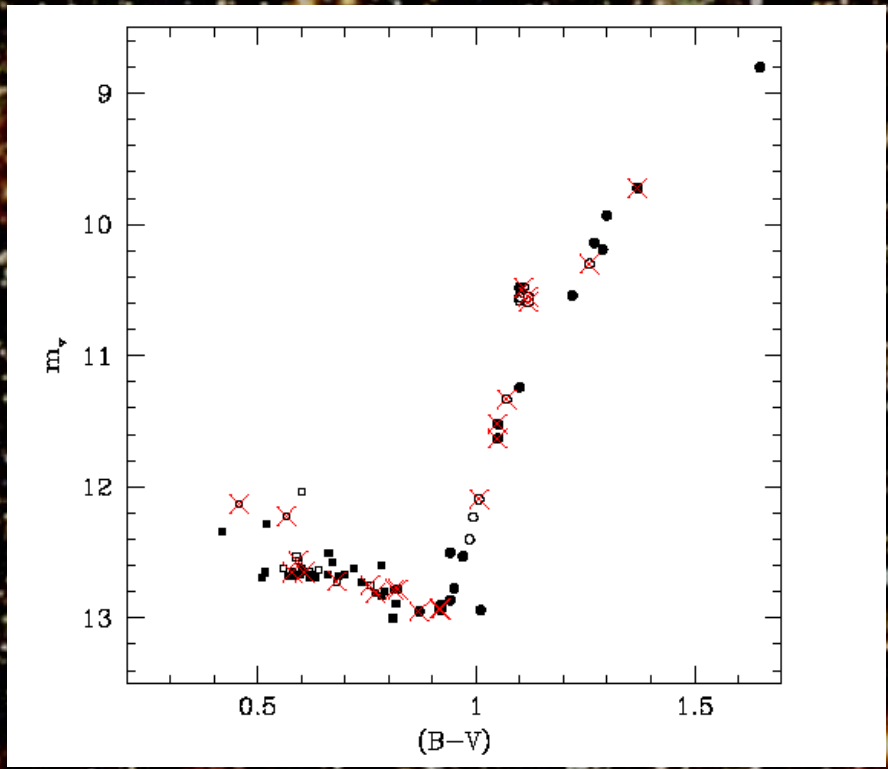
~220 RGB & HB stars observed with Flames (R~17000)



Old Galactic Open Cluster M67

4.5 Gy

~40 stars observed with UVES (R~50 000)



2. Tests with real data

The FLAMES proposal

- *About 500 stars in 3 fields with SNR=40-60 (for I < 16)*

GIRAFFE + UVES = 130 + 8 fibers

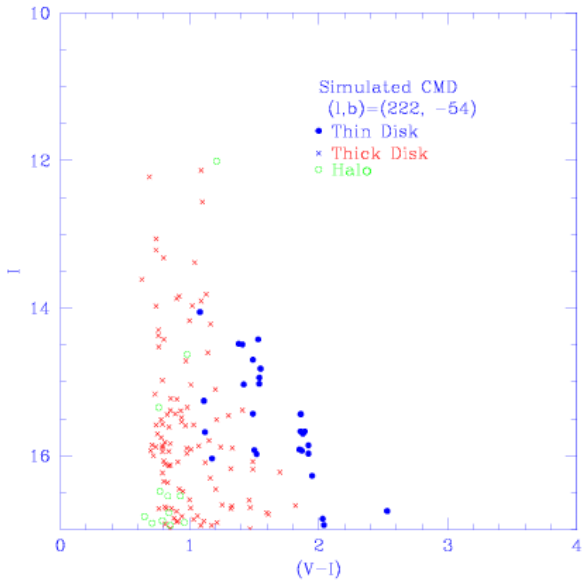
Field of view: diameter = 25 arcmin

Set up: Giraffe # 21 (8484 – 9000 Å) *R=16200*

UVES (4500-7500 + 6000-9000Å) *R=40000*

2. Tests with real data

The FLAMES proposal



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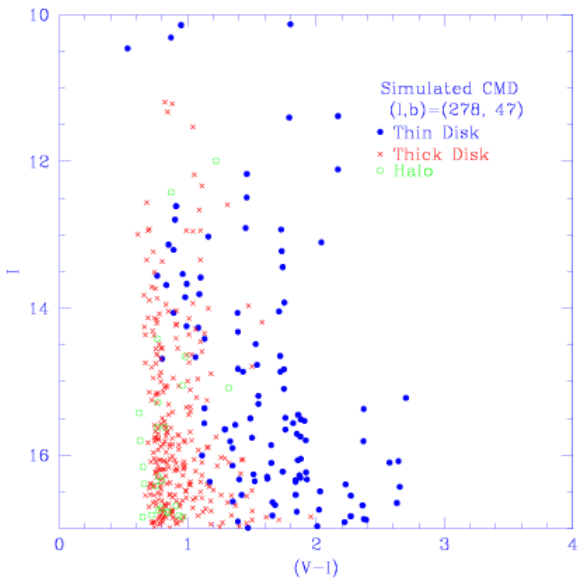

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