Constraining the Milky Way thick disk formation: chemical characterization of the thick disk outside of the solar neighborhood

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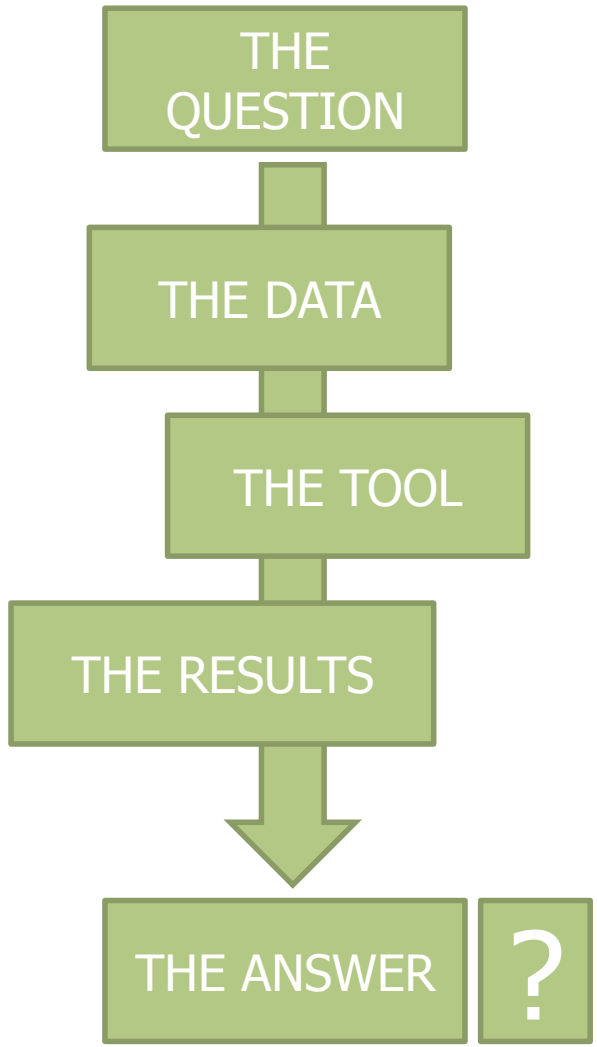

THE QUESTION
THE DATA
THE TOOL
THE RESULTS
THE ANSWER
?

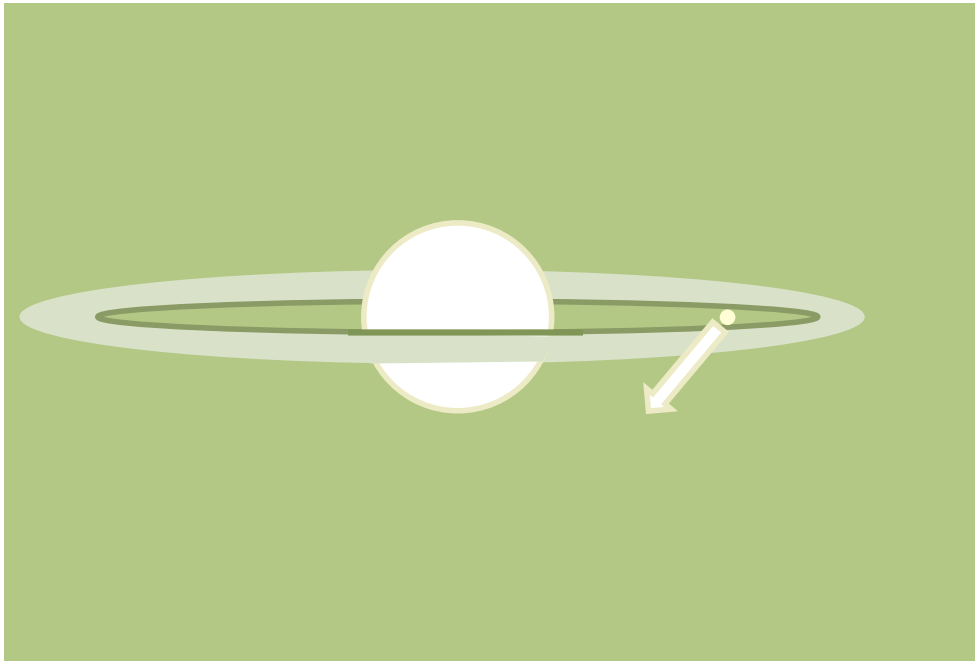
The question

- How was the thick disc formed?
  - heating by mergers
  - accretion of satellites
  - early, clumpy rapid star formation
  - migration etc…

Chemical caracterization of the Thick disc

Determine the elemental abundance of the Thick disc at high latitude: Z > 1kpc

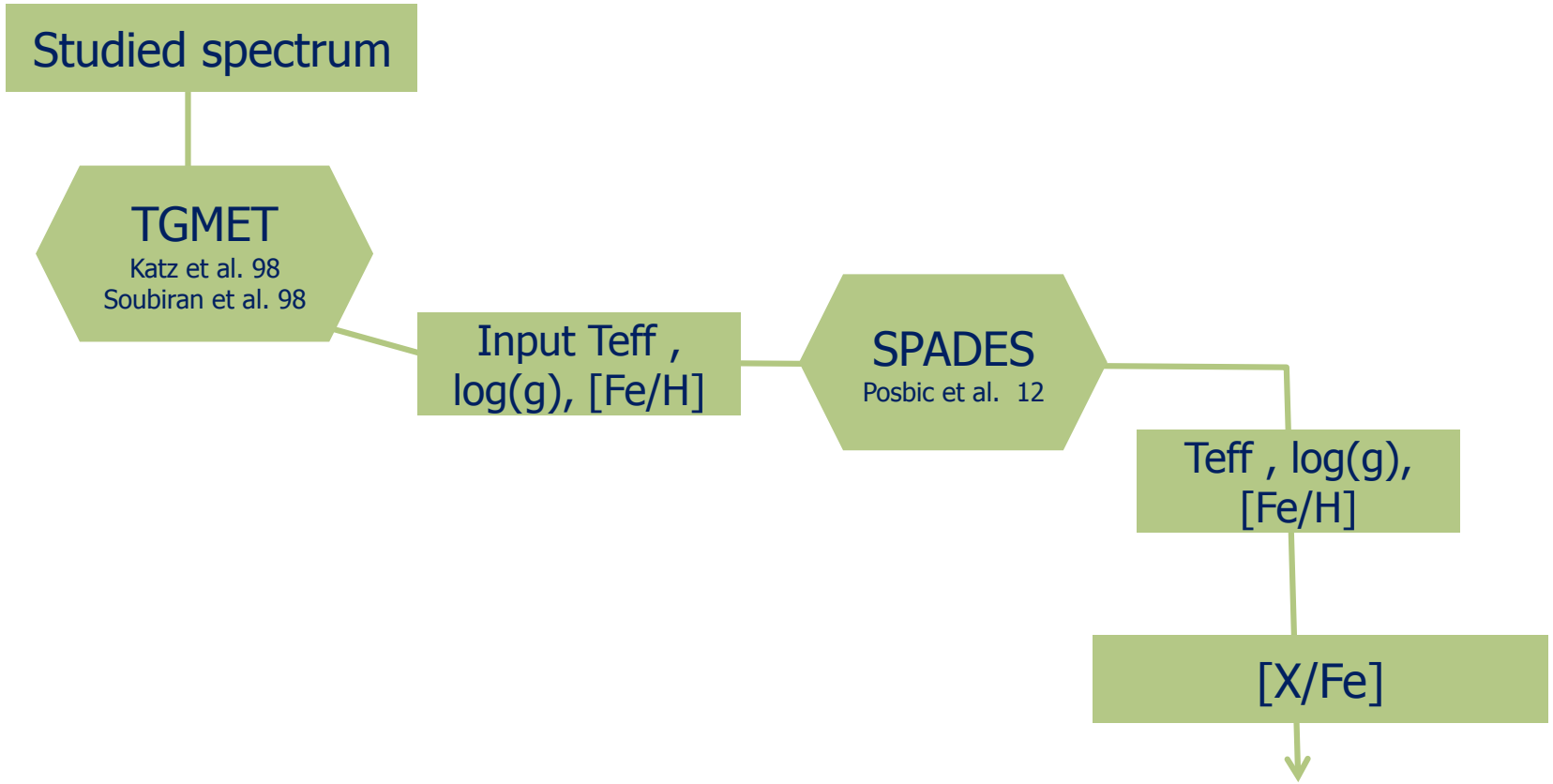
The data



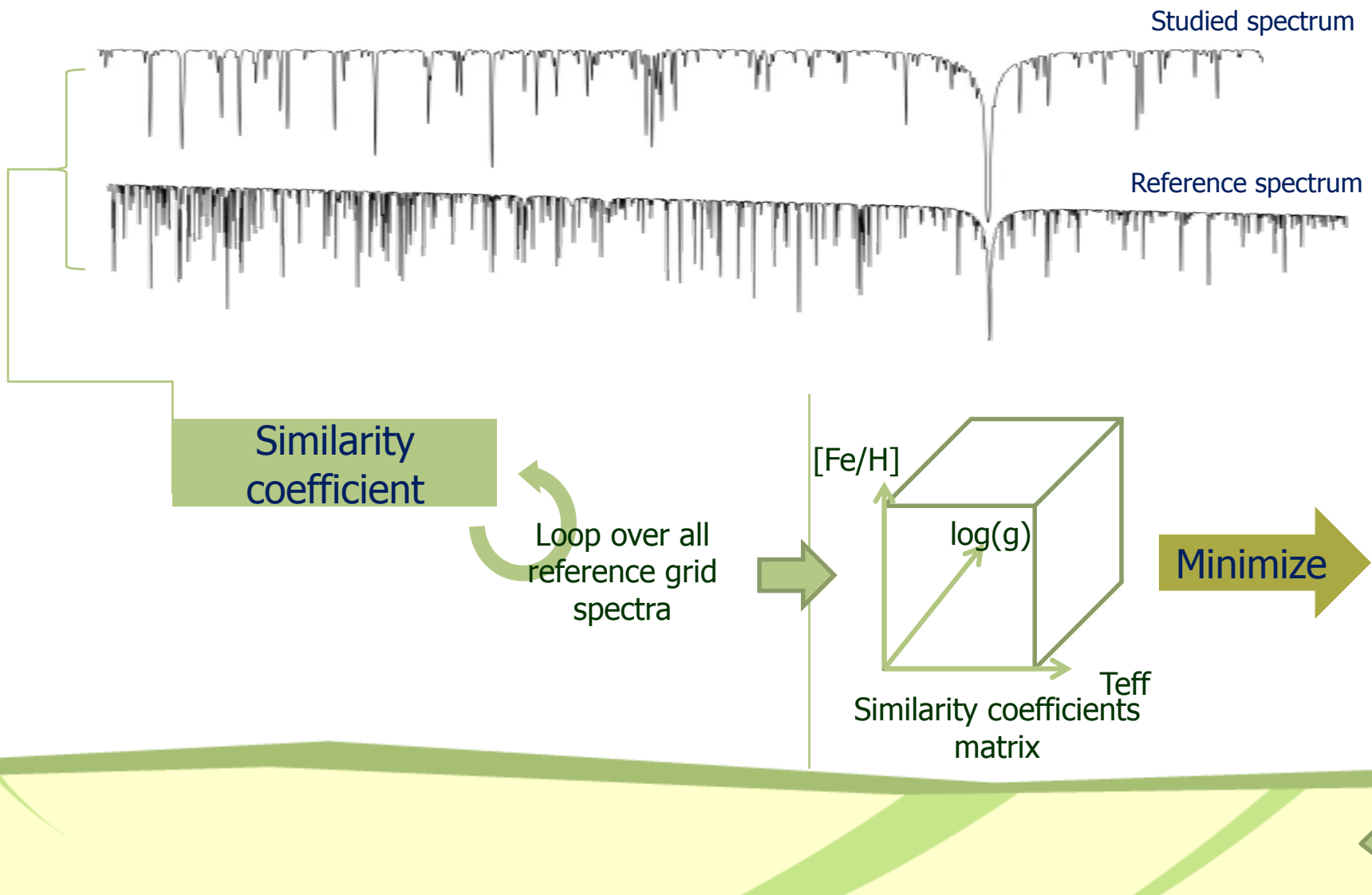
-Spectroscopic
- l = 357°, b = -39°
- ~ 200 stars
- Giraffe/VLT
- High resolution (R ~ 25000)
-High altitude: reaching more than 1kpc above the Galactic plane
-Mostly F and G stars of the Thick Disk

The software : general

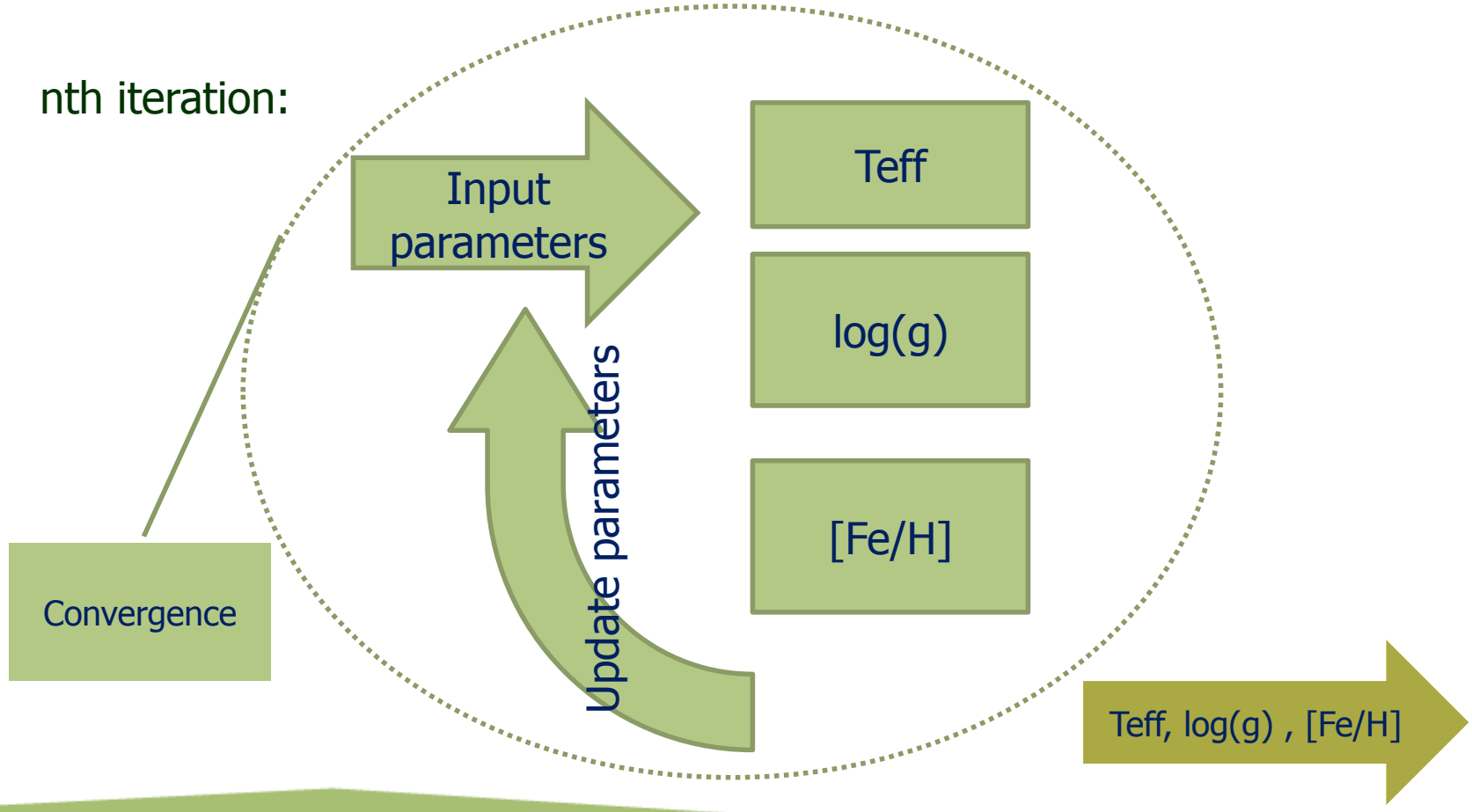
- SPADES: a Stellar PArameters DEtermination Software



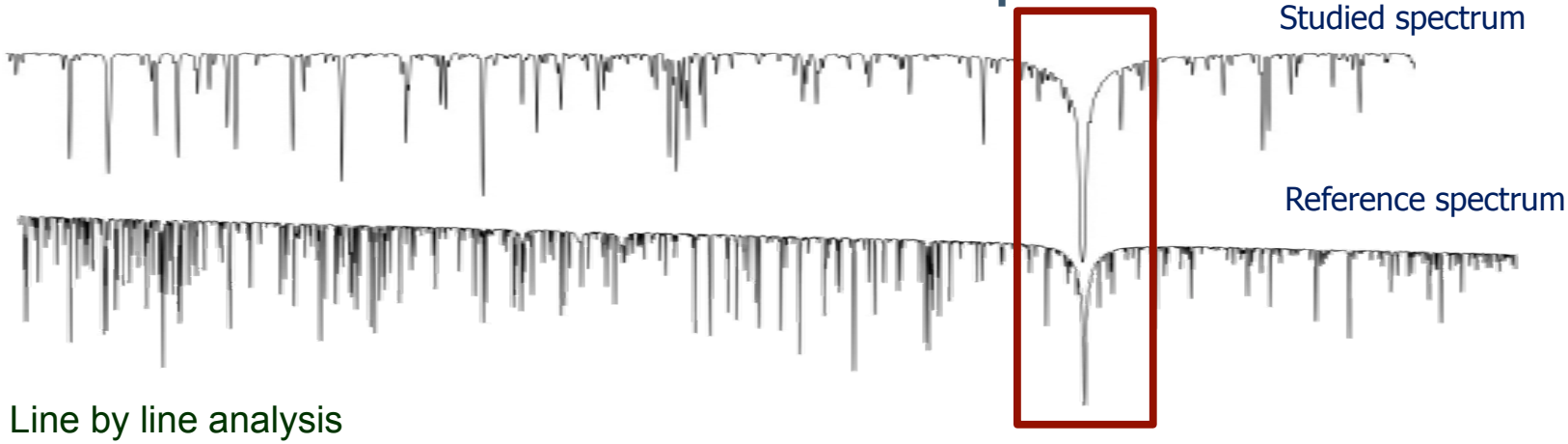
The software: TGMET



SPADES : Teff, log(g), [Fe/H]



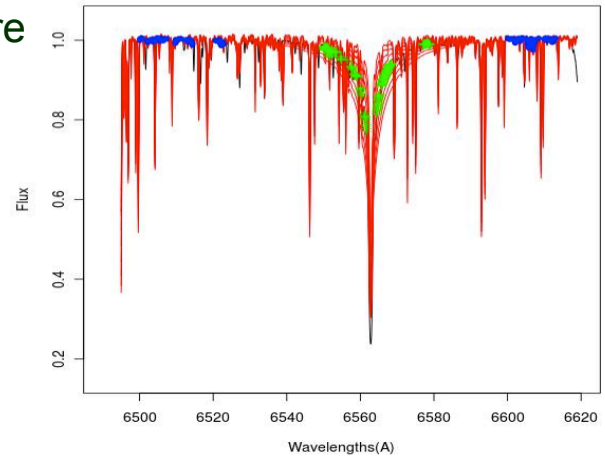
SPADES: an example

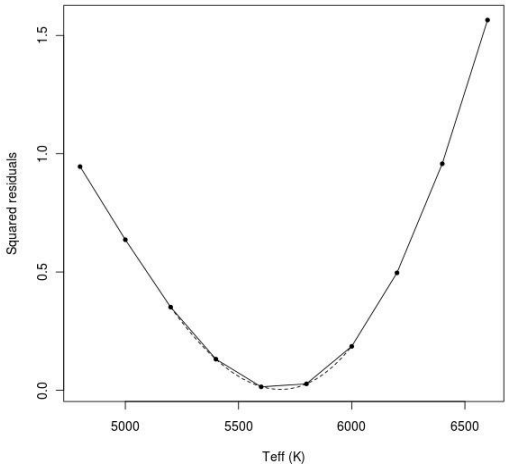


Line by line analysis

Example: determining the effective temperature using the Hα line wings

Measure

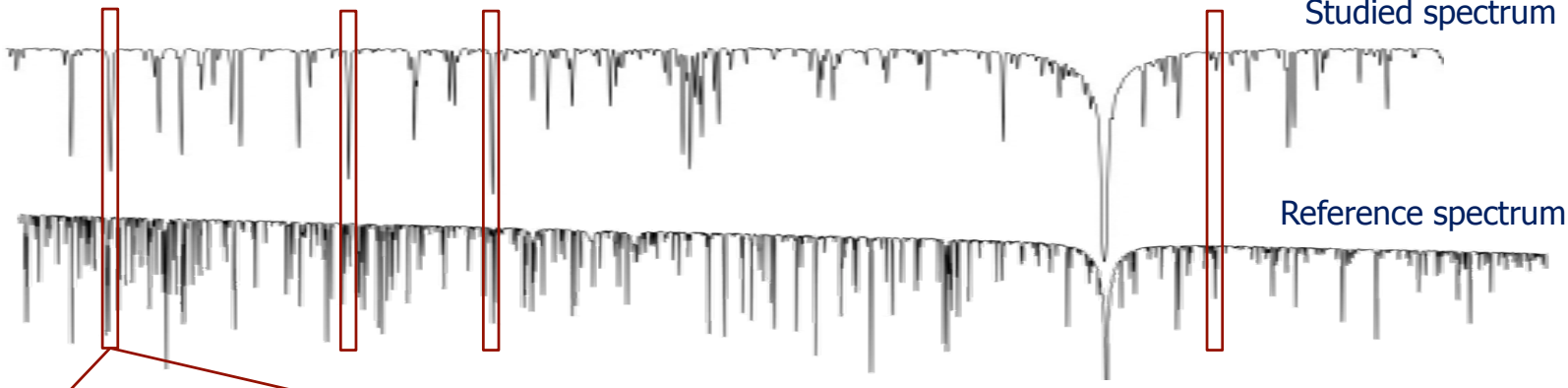


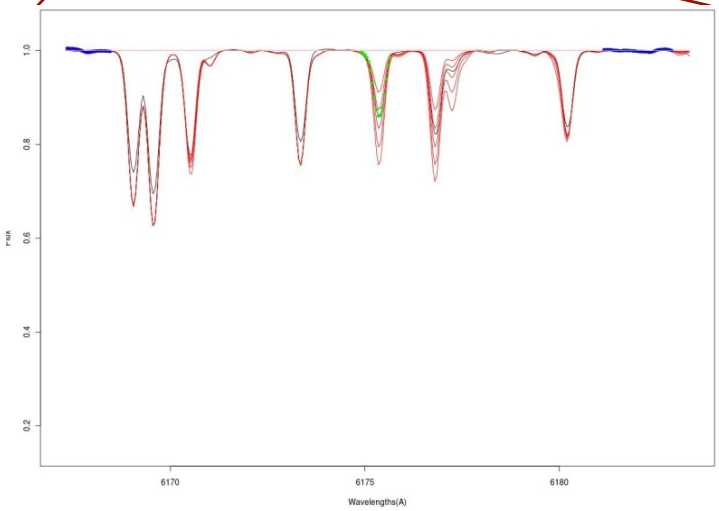


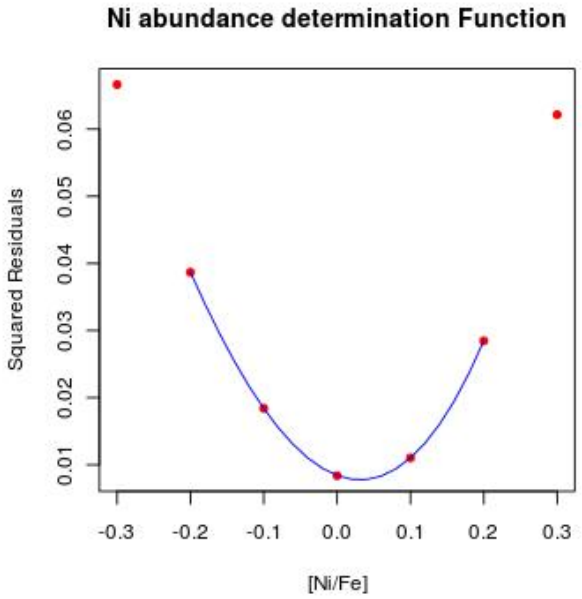
Diagnostic

Teff

SPADES : [X/Fe]







[X/Fe]

SPADES performances:

200 synthetic spectra with Teff = 5800 K, log(g) = 4.5, [Fe/H] = 0.0 dex, [Ti/Fe] = 0.0 dex, [Ni/Fe]= 0.0 dex.

		S/N=100	S/N=50	S/N=30
med($T_{\rm eff\ res}$)	(K)	0	0	0
σ $T_{\rm eff\ res}$	(K)	8	16	27
med(log $g_{\ res}$)		0.00	0.00	0.00
σ log $g_{\ res}$		0.05	0.09	0.15
med([Fe/H] $_{res}$)	(dex)	0.002	-0.001	-0.003
σ [Fe/H] $_{res}$	(dex)	0.009	0.020	0.030
med([Ti/Fe] $_{res}$)	(dex)	0.004	0.005	0.005
σ [Ti/Fe] $_{res}$	(dex)	0.003	0.040	0.060
med([Ni/Fe] $_{res}$)	(dex)	-0.004	0.002	0.010
σ [Ni/Fe] $_{res}$	(dex)	0.010	0.030	0.050

Sun

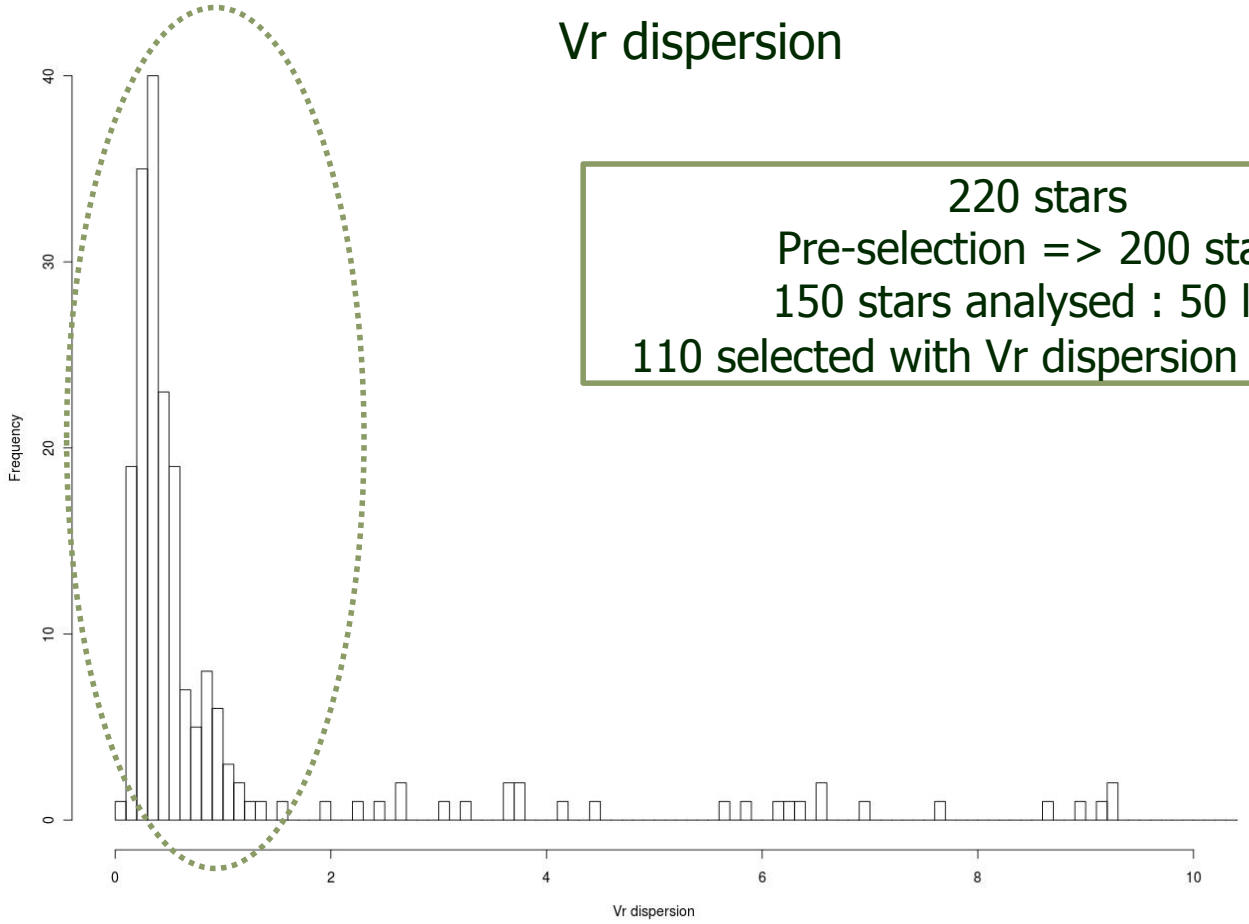
$T_{\rm eff}$ (K)	log g	[Fe/H] (dex)	[Ti/Fe] (dex)	[Ni/Fe] (dex)
5689	4.46	-0.18	-0.06	0.04

M67-1194 : solar twin

Teff (K)	log g	[Fe/H] (dex)
5703	4.04	-0.048

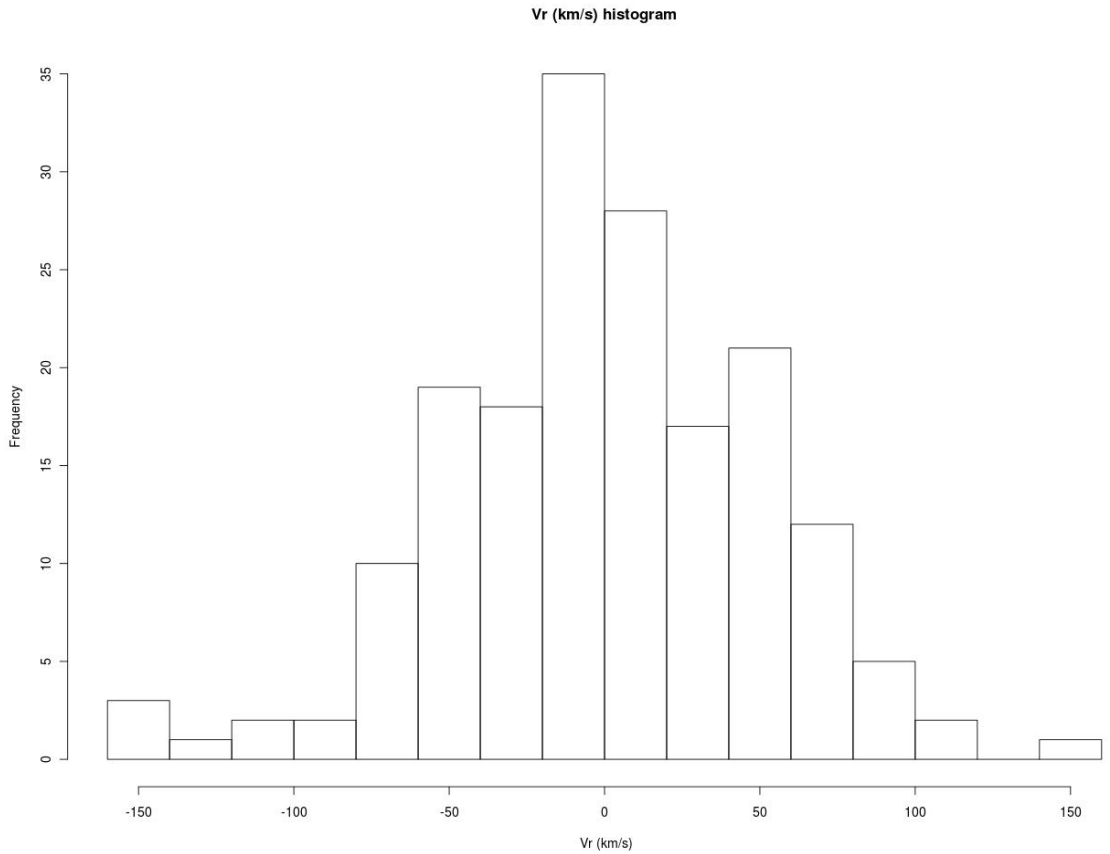
The results : radial velocities

Vr dispersion

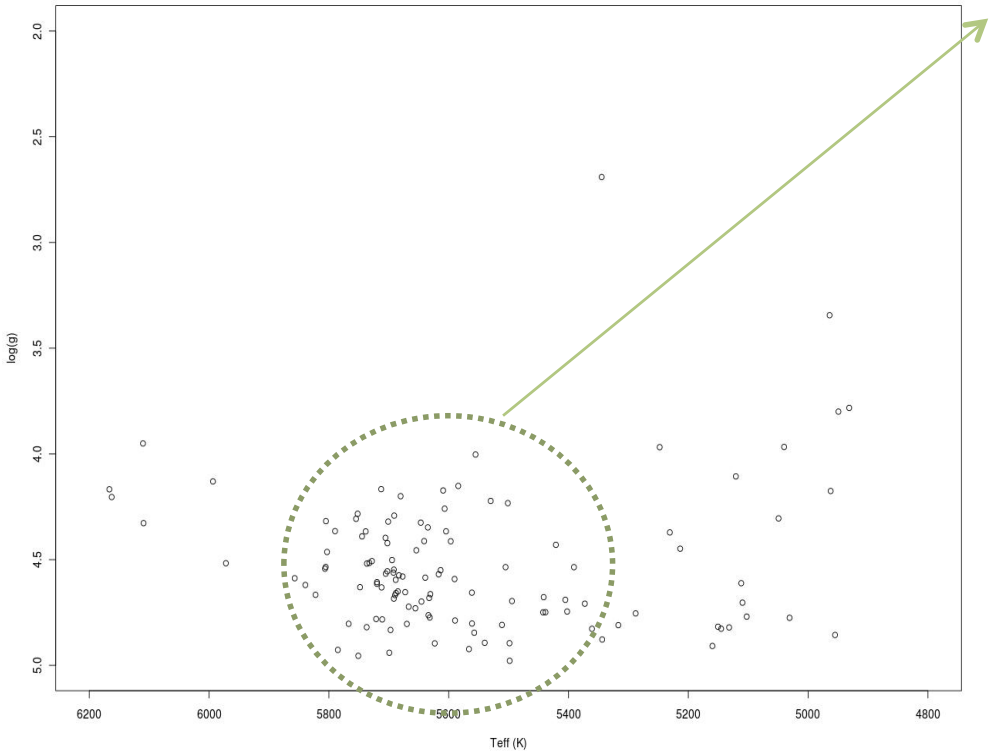


220 stars
Pre-selection => 200 stars
150 stars analysed : 50 left
110 selected with Vr dispersion < 2 km/s.

The results : radial velocities

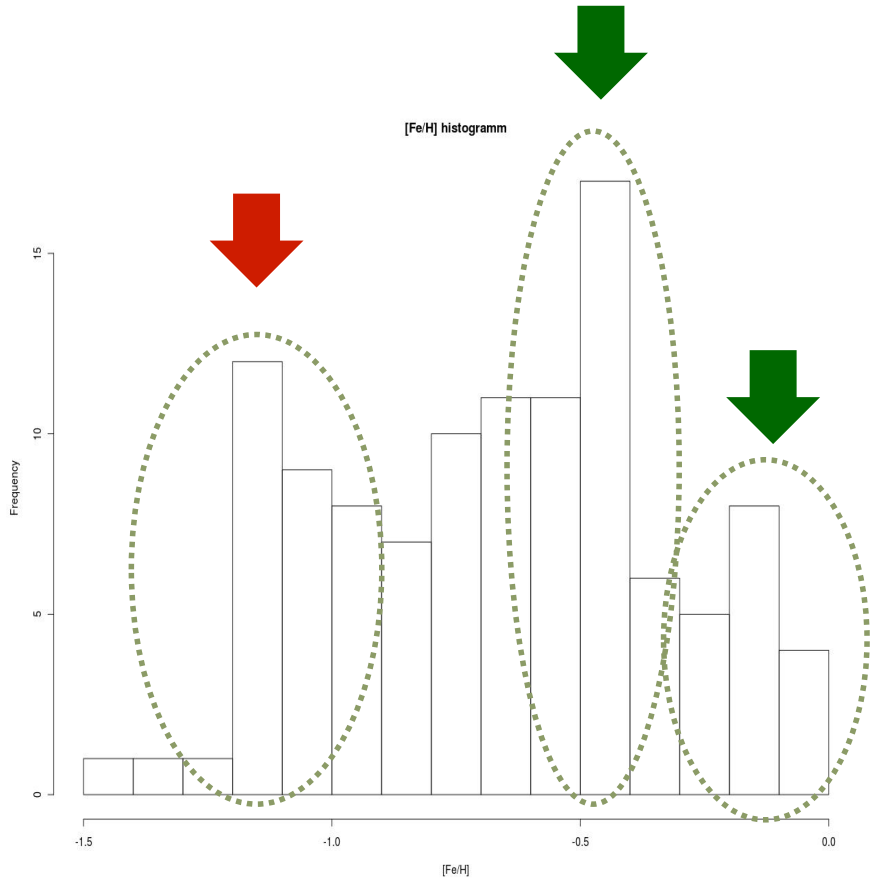


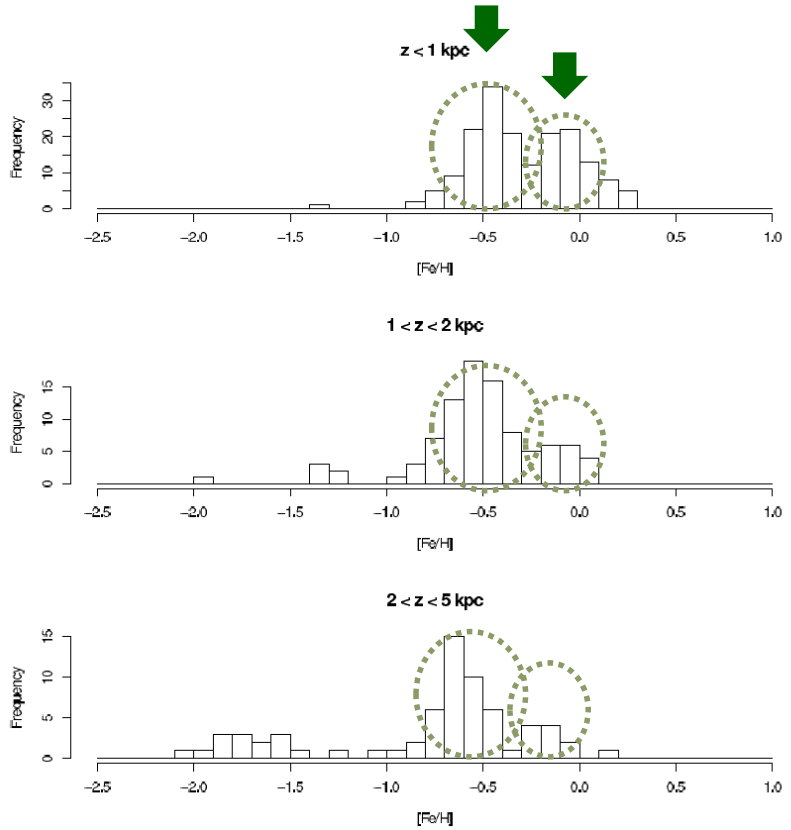
The results : distances



Rough estimate of the mean distance:
Mv ~ 5
Mean V :15
=> Mean D ~1 kpc

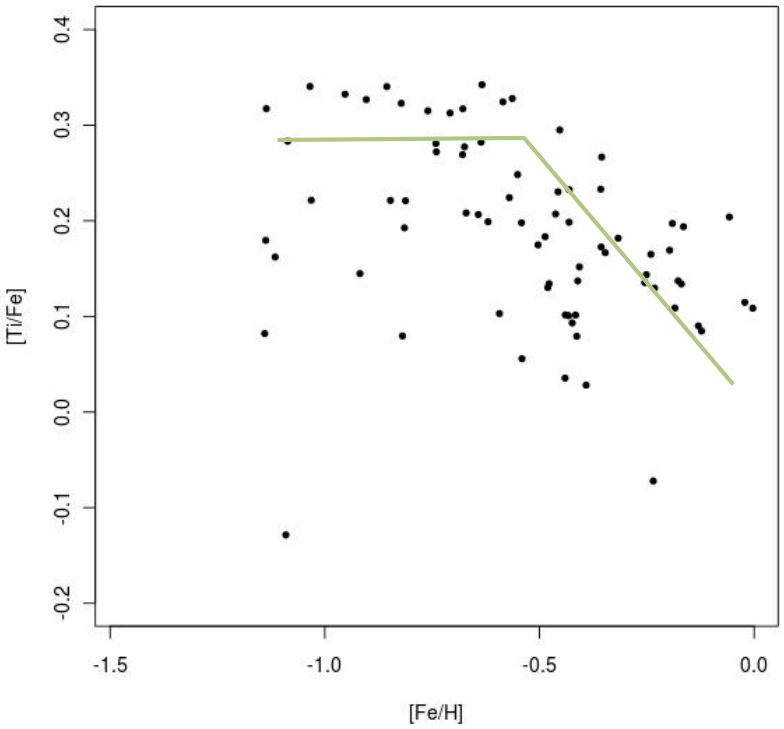
The results : metallicity

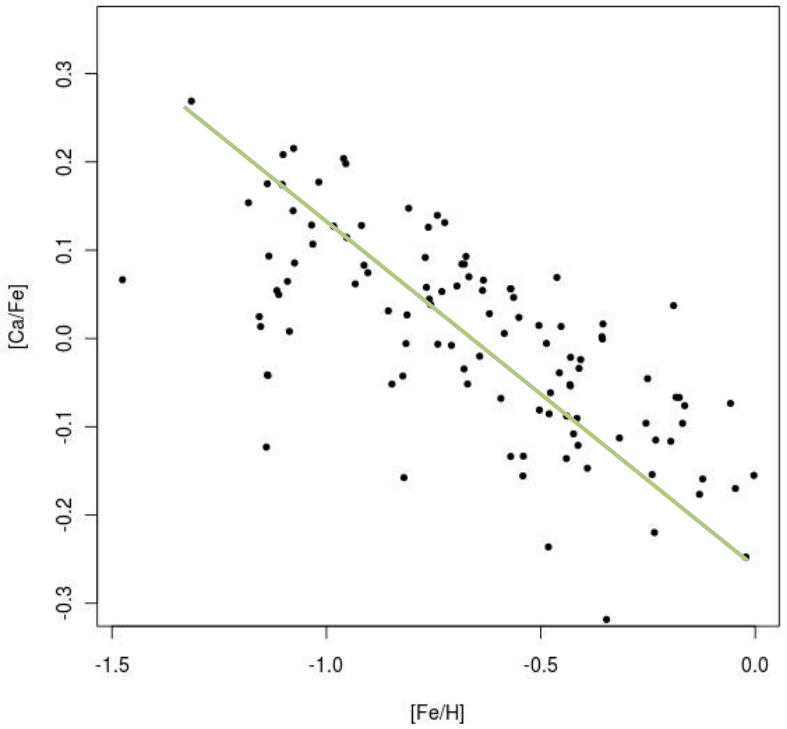




Katz et al. 2011

The results : abundance trends





Summary and Conclusion

- SPADES developped and tested:
  - H. Posbic et al. 2012 soon to be published
- Preliminary results:
  - Vr
  - Metallicity
  - Abundance trends
- 0 point issues:
  - Teff
  - [Fe/H] et [X/Fe] : log(gf) not astrophysic
- Scientific interpretation to come.