High-resolution spectroscopy with UVES within the Gaia-ESO Survey

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The Gaia-ESO Survey

- Homogeneous spectroscopic survey of 10^5 stars in the Galaxy
- FLAMES@VLT: simultaneous GIRAFFE + UVES observations
- 2 GIRAFFE spectral settings for 10^5 stars
- Unbiased sample of 10^4 G-type stars within 2 kpc
- Target selection based on VISTA (JHK) photometry
- Stars in the field and in ~ 100 clusters

The field stars

- Mid-resolution GIRAFFE spectra (R~12,000) for 10^5 stars to V < 20 (mostly in the Gaia RVS *gap*)
- GIRAFFE HR21 (Ca II IR triplet) + HR10 (~540 nm) with 10<S/N<30 to yield atmospheric param., radial velocities, limited chemistry
- UVES spectra: ~5,000 (+2,000 in clusters) G-type stars to V<15 with S/N>50 to yield accurate atmospheric parameters and radial velocities, and 11+ elemental abundances

Observations and Calibration

- Visitor mode observations -- start December 2011
  - P88 A,B, C: three observing runs done of 5 nights
  - P89 has 35 nights in runs of 5/6 nights per run
- 300 nights over 5 years (~1500 pointings)
- Target selection will be largely based on VISTA VHS photometry + additional information for clusters

Data reduction/analysis

- Data reduction performed at Cambridge (GIRAFFE) and Arcetri (UVES) likely based on ESO pipeline: **WG7**
- Radial velocity derivation: **WG8**
- Object classification: **WG9**
- Spectral analysis: atmospheric parameters and abundances: **WG10,11,12,13,14**
- Parameter homogenization: **WG15,5**
- Gaia-ESO archive: **WG16.17**

Spectral analysis

- **GIRAFFE spectra of *normal* FGK stars:WG10**
- **UVES spectra of *normal* FGK stars: WG11**
- Pre-MS and cool stars: WG12
- Hot (OBA-type) stars: WG13
- Funny things: WG14
- Survey parameter homogenization: WG15

WG substructure: **WG 10, 11**

- WG10 coordination: Alejandra Recio Blanco & Carlos Allende Prieto
- WG11 coordination: Andreas Korn & Rodolfo Smiljanic
- Joint WG10,11 committee: + Vanessa Hill & Luca Pasquini
- Auxiliary Data sub work packages:
  - Stellar atmospheres: B. Edvardsson
  - Line list compilation: S. Mikolaitis
  - Synthetic spectra grids: Patrick de Laverny
  - Benchmark stars: Caroline Soubiran

Normal FGK stars: **WG 10, 11**

- GIRAFFE data: R~20,000 and several setups
- UVES data: R~45,000 with #580 setup
- 1 single set of 1D model atmospheres (MARCS)
- Atmospheric parameters from WG9: Nelder-Mead, MATISSE and DEGAS
- Final set of Aps: SME, MyGIsFos and **MOOG (EWs)**
- EWs in UVES using DAOSPEC, SPECTRE & **ARES**

TESTs: **WG 10, 11**

- **First Test:** Selected observed CD#3 UVES spectra of ~145 well-studied FGK stars selected by C. Soubiran
  - Results presented in Nice meeting on June 2011
- **Second Test:** 50 synthetic spectra computed by Patrick de Laverny with 3 noise levels (S/N~40, 70, 100) for [X/Fe] from –2 to +0.5
  - Results presented in Garching meeting on Sep 2011
- **Third Test:** 4 benchmark stars: MPG, MRG, MPD, MRD
  -Results will be presente in Nice meeting on April 2012

TESTs: **WG11** Node UCM-IAC

- Node UCM-IAC:

  Hugo Tabernero, David Montes & Jonay I. González Hernández

- Deriving stellar parameters:

  - EW-based method: ARES code (Sousa et al. 2007)

  - Linelist from Sousa et al. (2008)

  - Local continuum fitting and automatic EW determination

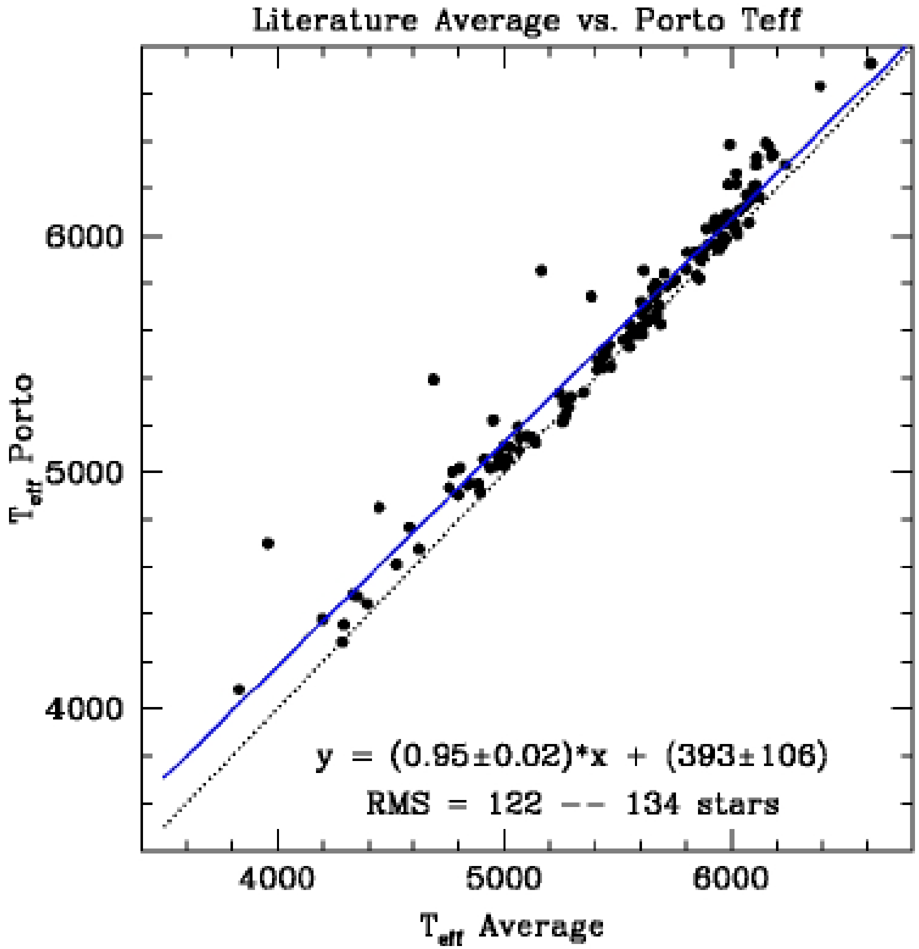
  (StePar: Tabernero et al. 2011)

  - Rejecting lines with wrong fitted FWHM

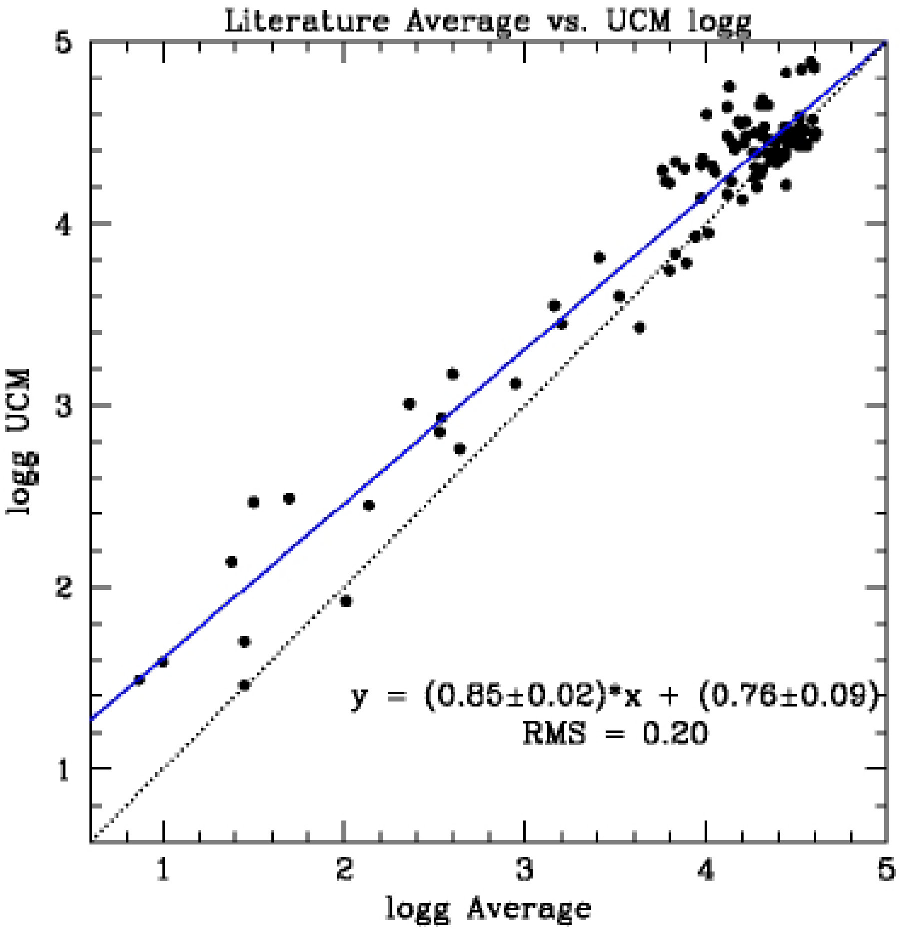
  - Automatic code to derive the stellar parameters from excitation and ionization equilibria of FeI-II line strengths

  - 2-σ rejection oflines with “wrong” EWs after 1st iteration

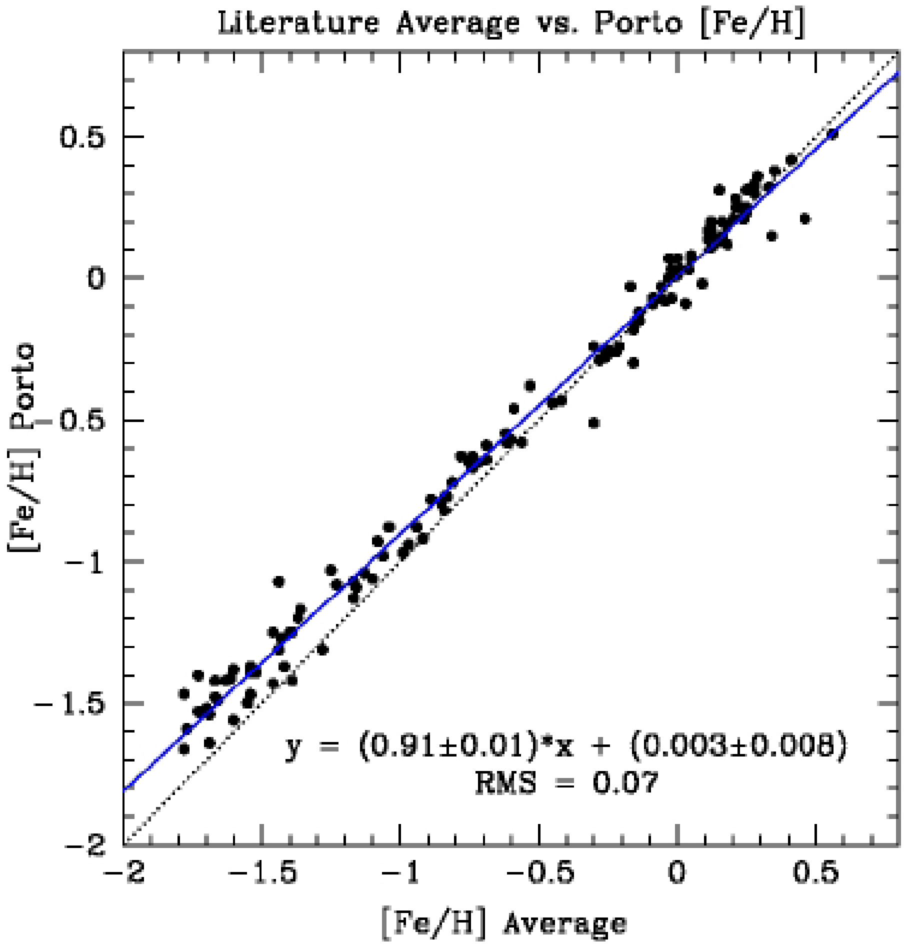
1st TEST: **WG 11**



1^{st} TEST: **WG 11**



1st TEST: **WG 11**



2nd TEST: **WG11** Node UCM-IAC

- Deriving stellar parameters:
  - We use ARES to obtain the EW of FeI-II spectral lines of the UVES solar spectrum of the MOON
  - We use the code MOOG (Sneden et al. 1973) with KURUCZ ATLAS9 models and MARCS models
  - We also use the code TurboSpectrum (B. Plez)
  - We perform some test using the log(gf) values from Sousa et al. (2008) and from VALD

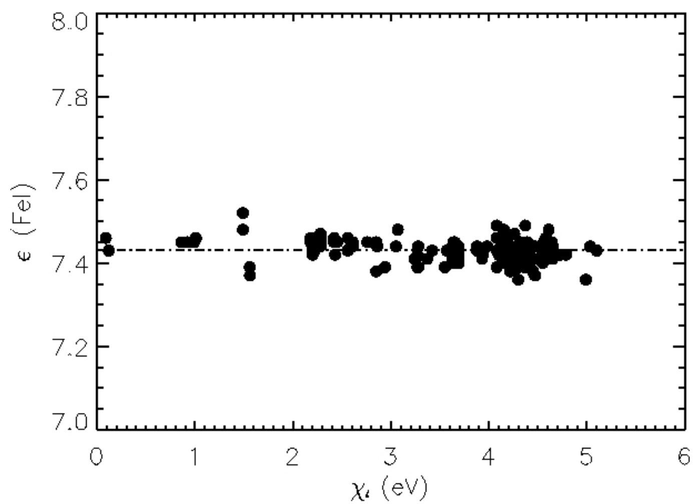
2^{nd} TEST: **WG 11**

UVES solar spectrum of the MOON:

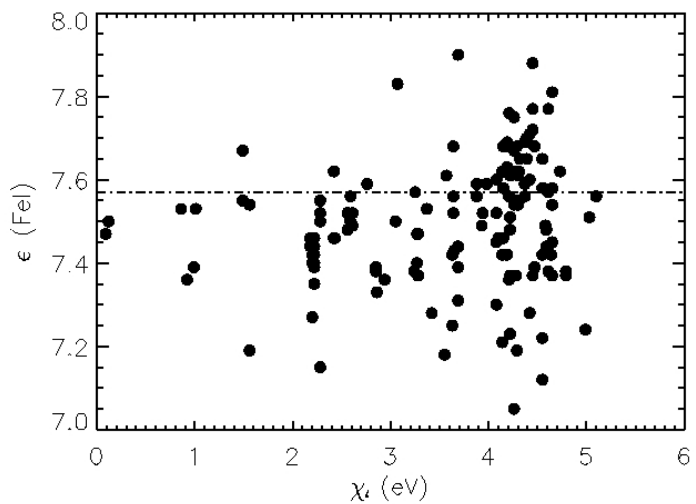
Code	Models	log*gf*	Teff	logg	[Fe/H]	Vmicro	NFeI-II
Turbospectrum	MARCS	Sousa et al.	5720	4.39	-0.05+-0.02	0.889	129-14
MOOG	MARCS	Sousa et al.	5678	4.31	-0.08+-0.02	0.878	125-12
MOOG	KURUCZ	Sousa et al.	5743	4.39	-0.01+-0.01	0.935	169-23
MOOG	KURUCZ	VALD	5764	4.52	0.15+-0.09	0.426	137-15

2^{nd} TEST: **WG 11**

FeI abundances of UVES solar spectrum of the MOON:

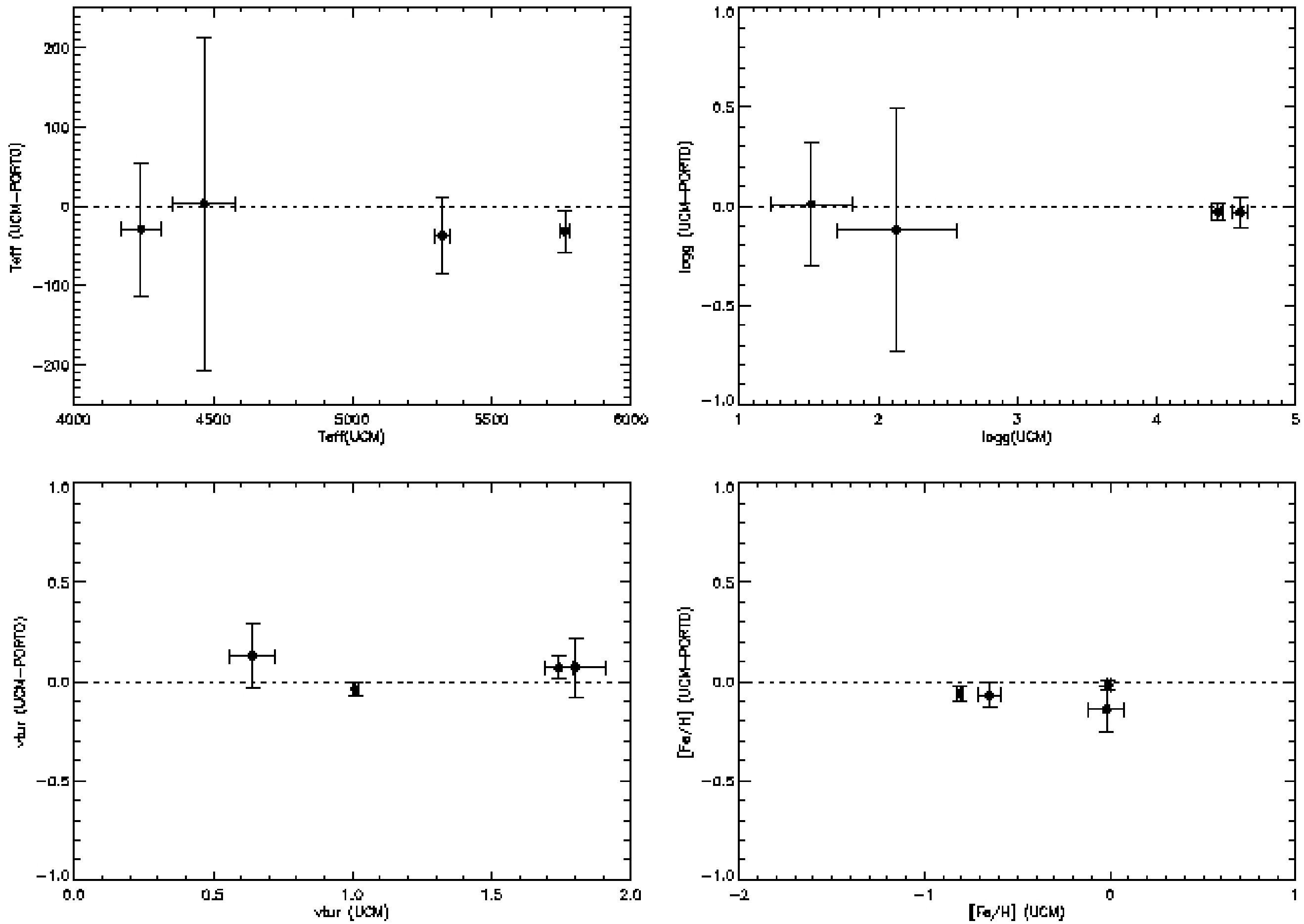


Log*gf* from Sousa et al. (2008)

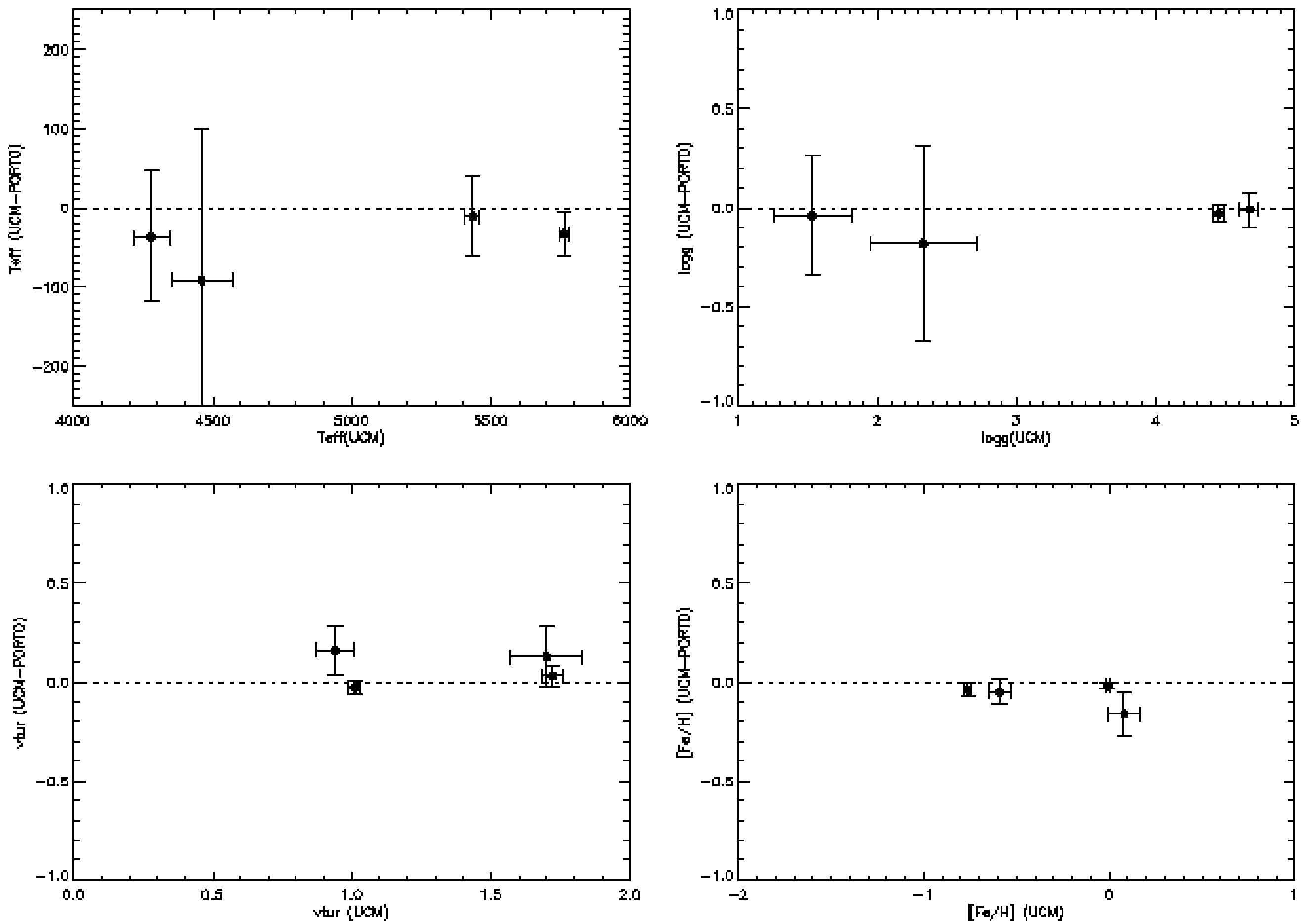


Log*gf* from VALD

3rd TEST: WG 11



3^{rd} TEST: **WG 11**



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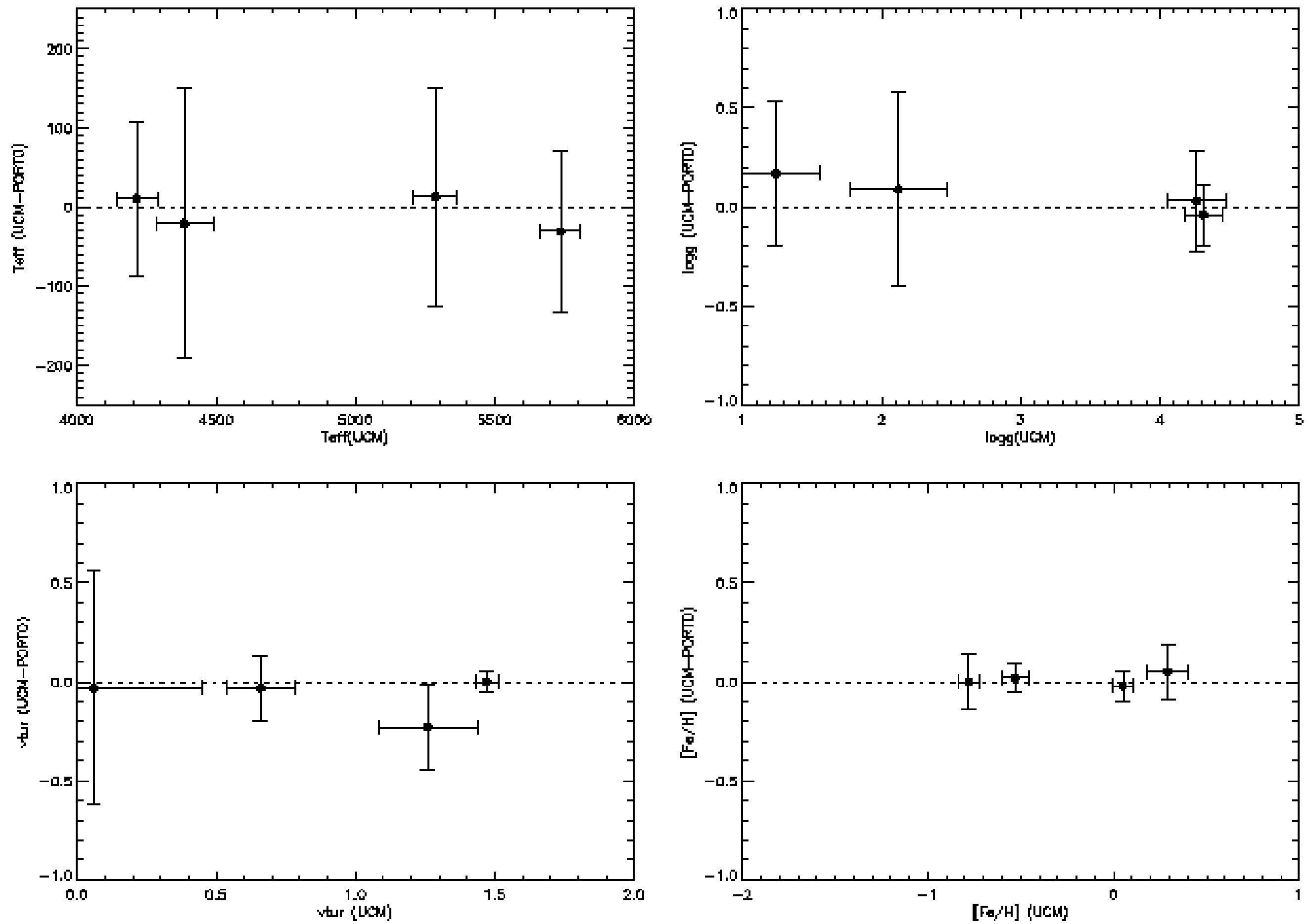

3rd TEST: **WG 11**

- We have built a routine to interpolate MARCS models
  - Both plane-parallel and spherical MARCS models
- We checked the inconsistency of using spherical models and MOOG (only for pp models) by also doing the consistent analysis with Turbospectrum

	Teff	**logg**	**[Fe/H]**	**Vmicro**
MPG star:				
MOOG:	4449	2.02	–0.47	1.81
TS:	4400	1.82	–0.46	1.78
MRG star:				
MOOG:	4752	2.77	0.28	1.65
TS:	4748	2.77	0.28	1.65