Minutes of the splinter meetings at the 6^{th} CU8 meeting

Held in Brussels on December 24 2008

prepared by: Antonella Vallenari, Rosanna Sordo, Ulrike Heiter, Anne-Marie Janotto, Caroline Soubiran

approved by:
reference: GAIA-C8-MN-OAPD-AV-008-03
issue: 3
revision: 2
date: 2008-12-05
status: Issued

Document History

Issue	Revision	Date	Author	Comment
1	0	2008-12-02	AV, RS	Creation
2	1	2008-12-04		Added sections on Observed templates by U.Heiter and on Java coding by A.-M. Janotto
3	2	2008-12-05		Added sections on Calibration by C. Soubiran

Contents

1 Splinter meeting on stellar libraries **3**

1.1 Synthetic stellar libraries status 3

1.1.1 Large grids 3

1.1.2 Cool stars 3

1.1.3 Hot stars 4

1.1.4 Emission line stars 4

1.1.5 Chromospherically active stars 4

1.2 Open questions on synthetic libraries 4

1.3 Observed stellar libraries status 5

1.3.1 Calibration activities 6

2 Software Development and Java Coding Splinter **8**

2.1 Participants 8

2.2 Presentation Contents 8

2.3 Discussions 9

1 Splinter meeting on stellar libraries

The goal of the meeting is to discuss the present status and future implementation of the source spectral libraries.
The participant list will be found at
http://www.rssd.esa.int/wikiSI/index.php?title=CU8:_Meeting_06:_participants.
The agenda of the Splinter Meeting can be found at
http://www.rssd.esa.int/wikiSI/index.php?title=CU8:_Meeting_06:_Topics

1.1 Synthetic stellar libraries status

1.1.1 Large grids

PHOENIX
For Cycle 5, a wrong spectral coverage was delivered and the library was not used. Ines Brott finalized the computation up to 10000 K, with a small format problem. AK agreed on reformatting the library and delivery it to AV in a few months. An extension of the grid to metal poor stars with alpha-enhancement is foreseen

MARCS
An extension of the sample photospheres to lower temperature (2500 K) was calculated. Computation of the library for BP/RP range will be soon available, AK will investigate the possibility to have the library in the RVS range.
In the current version, $\sim$ 10-20 spectra are missing in order to have a more uniform AP coverage for [Fe/H]$>$ -3 and logg $<$ 3. AV will produce a list of the missing spectra to be calculated.

1.1.2 Cool stars

Ultracool (low Main Sequence, by France Allard)
The library is on the way to be recomputed but is not expected in the next cycle. The spectral range and the resolution are not exactly following the requirements. For the RVS range the computation started a few weeks ago.

Supergiants (by E. Josselin)
the calculation is going on and the data delivery is expected on December/early January.
ACTION on FT: mail to E. Josselin to request libraries

C stars (by E. Josselin)
- in the T_{eff} range 4000-8000 K: recalculated and delivered for Cycle 5;
- cooler C stars are still missing. ACTION on FT: ask for cooler C stars

1.1.3 Hot stars

Fast rotators were calculated for Cycle 5.

A stars
- the library calculated by J.-C. Bouret present a flux level completely different from other libraries.
- the library calculated by O. Kochukhov is available only for solar metallicities.
ACTION on AV to ask about different metal contents.
- A stars with different He abundances are requested and can be calculated by O. Kochukhov.
ACTION on YF: ask Kochukhov about them.
- Different metallicities for B, O stars are missing and need to be calculated.
ACTION on AV: ask J.-C. Bouret about different metal contents.

1.1.4 Emission line stars

Be stars
A new code is under testing and will be ready at the end of the year. The new spectral library is expected early next year.

KS asks for more emission lines objects for comparison with QSOs for GSC-phot. Those objects are difficult to model and it will be more significant to use observed spectra. A proposal was already submitted by CM and collaborators but it was rejected.
In any case a new library is expected for next cycle.

1.1.5 Chromospherically active stars

An effort is ongoing to implement NLTE calculations in MARCS codes, but problems were encountered. It might be useful to contact Hauschildt to use instead the PHOENIX models.
These models needs to be complemented with observations. Terranegra already made a search in the literature, but often the spectra have too low resolution. New observations are planned.

1.2 Open questions on synthetic libraries

1. Efforts need to be done to verify whether the uncertainties by the interpolation in the random libraries are significant. In that case it might be necessary to recalculate source libraries at finer steps, since the error introduced by the interpolation depends on the grid steps.

2. There is a large overlap in the HRD. While overlapping simulated libraries are requested to test algorithm performances, it is unclear at which extent a grid homogenization is needed for classification purposes.

3. Source spectra from different libraries (same APs) can have differences up to 60% mainly at $\lambda < 450$ nm for cool stars. These differences, after GOG simulations, are or the order of 8-10%. It is unclear how important those differences are for the classification.

4. Observational spectra are requested for the algorithm calibration and for the correction of synthetic spectra. However, to plan observations it is important to know exactly how observed spectra will be used by classification algorithms.

1.3 Observed stellar libraries status

A discussion on observational calibration of stellar libraries was held on 24 Nov 2008, 14.30 – 17.30. Participants: R. Blomme, R. Sordo, P. Tsalmantza, J.-Ch. Mauduit (CU2), A. Recio-Blanco, A. Korn, U. Heiter, C. Soubiran, Ch. Martayan, A. Lanzafame.

The discussion revolved around the two questions

- How will observations be used?
- Which observations do we need?

Various related webpages were presented:

- The wiki page for the GBOG working group (Ground based observations for Gaia), to be easily accessed via the menu to the left on the Gaia wiki. It contains a list of "observing programmes", i.e. compilations of observing proposals which have a common objective, from several CUs. For CU8, there are currently two observing programmes listed, "reference stars for stellar parametrisation" and "spectral energy distributions at low and medium resolution across the HR diagram". Each of them comprises several submitted and/or accepted proposals. The individual proposals are tabulated on a separate wiki page[1].
- The wiki page for GBOG activities within CU8[2], which contains among others a list of people involved in GBOG activities. The most important section is that of "planned proposals". Please enter your planned proposals there and "watch" the

[1] http://www.rssd.esa.int/wikiSI/index.php?title=GBOG:Proposals
[2] http://www.rssd.esa.int/wikiSI/index.php?title=CU8:_GBOG

page (using the "watch" function and e-mail notification) to keep updated on proposals. Currently, there are two work packages dedicated to GBOG within CU8: one for GSP (GWP-S-811-20500, U. Heiter) and one for ESP (GWP-M-835-01000, Y. Frémat). Several algorithmic workpackages include GBOG activities (see below).

- The wiki page on benchmark stars[3] – a list and available data for testing stellar atmosphere models and synthetic spectra. For reference, the GWST benchmark stars published in 2007 (at a calibration workshop) were mentioned. ACTION on UH: check those stars.
- The CU6/CU8 stellar spectra database[4]. All spectra observed for CU6 and CU8 are stored here. Access is restricted – ask Caroline Soubiran for username and password.

1.3.1 Calibration activities

Work package GWP-S-811-20000 (C. Soubiran) deals with calibration of the GSP algorithms which requires observations of normal single stars.

One has to distinguish the calibration of the algorithms from the calibration of synthetic grids. Algorithms are calibrated by comparing the APs obtained from high resolution spectra to those obtained by the algorithms from Gaia data for a set of reference stars. This can only start when Gaia data will be available albeit the selection of suitable AP reference stars has already started (see GAIA-C8-TN-UAO-UH-001). The calibration of synthetic grids is intended to correct computed spectra which do not reproduce real spectra perfectly. It is done by a direct comparison of real and computed spectra over a wide range of APs. Another way to improve synthetic spectra is improve the underlying physics, focussing on a limited number of benchmark stars, with the best known APs, which strongly constrain model atmospheres. The later two activities are taken in charge by U. Heiter through in GWP-S-811-20200: Empirical testing of synthetic spectra. It is worth noting that such an overall validation of synthetic spectra over a wide AP range has never been organized before, although stellar grids are widely used as reference for a number of projects.

Testing algorithms is another task. Although it is desirable to test GSP on real spectra, it is would be a hard task to build libraries of BP/RP-like and RVS-like spectra for a sufficient number of AP reference stars for this unique purpose. GSP can be tested with other sets of spectra, for instance RAVE spectra of stars also observed with ELODIE, or SDSS spectra of 500 stars observed at R$>$ 25000 (see Allende Prieto et al., 2008 AJ 136, 2070). This is not done by GWP-S-811-20000 and GSP providers should organize themselves to test their algorithms on real data if needed.

[3] http://www.rssd.esa.int/wikiSI/index.php?title=CU8:_Benchmark_Stars
[4] http://gaia.aip.de/cu6a8/

A. Recio Blanco has shown results obtained by C. Allende Prieto for real stars, with AP known from high resolution spectra, processed with a minimum distance algorithm (arXiv:0810.4100). Residuals are larger than expected but it is difficult to separate what comes from the method itself (degeneracies), from the synthetic grid, from the reference spectra (normalisation), or from the parameters of the reference stars (AK notes that CAP's determination of APs for both Alpha Cen components diverges from other authors).

Ideally, the grid size of the observed library built to correct synthetic spectra, should be comparable to that of the synthetic library. The feasibility of this was questioned. For example, for GSP-spec, the nominal grid used for training MATISSE contains about 7500 spectra (of which about 3000 are FGK stars). Step sizes are 250 K in $T_{\rm eff}$, 0.5 dex in $\log g$ and for metallicity 0.25 dex around 0, 0.5 dex around -1 and 1 from -1 to -5. It was noted for comparison that for the calibration of the SEGUE Stellar Parameter Pipeline, 500 calibration stars with $V < 14$ are used. For considerations on AP reference stars for GSP see GAIA-C8-TN-UAO-UH-001.

Work packages GWP-S-835-10000 (R. Blomme) and GWP-S-835-50000 (Ch. Martayan) deal with hot and emission-line stars, respectively. The temperature domain of "hot" stars was discussed to start around 15000–25000 K. Data in the RVS range from the GHOST team in Liège are used to test the algorithms. This is done by comparing AP determinations using those spectra with AP determinations from optical spectra. Experiments using simulations based on these spectra remain to be done. The question was raised if these "ESP data" could be used also to test the GSP algorithms. ACTION on CS: check the availability of the data with the GHOST team.

R. Blomme presented developments regarding parametrization of Wolf-Rayet stars. Model grids are not very realistic and not complete. There are about 300 known Galactic WR stars (i.e. almost complete to V=17). Not many new detections are expected from Gaia. Therefore, identification is considered more important than modelling. The training data will be based on a model grid from Hamann et al. (supplemented for the RVS range) for WN stars, supplemental observations for WN stars and only observations for WC stars (for which there are no models).

Work package GWP-S-835-20000 (A. Lanzafame) deals with cool, chromospherically-active stars. Observed spectra are needed for calibration ("comparison with benchmark stars"). Some data from SARG exist (in the RVS range, with gaps) for G- and K-dwarfs. Data for dM and dMe stars are missing, and a new proposal is planned. Action on UH and AL: look for synergies regarding M dwarfs (benchmark stars and observations for GSP and ESP calibration).

Work package GWP-S-832 – Unresolved galaxy classifier (M. Kontizas, represented by P. Tsalmantza) needs observed spectra of galaxies for testing synthetic libraries. SDSS data have been used up to now and there are no news of planned observations.

ACTION on all: watch the "CU8: GBOG" wiki page and send information on your observations and planned proposals to Ulrike and Yves.

2 Software Development and Java Coding Splinter

The splinter concerning Software Development and Java Coding was held on November, 26th from 14:00 to 16:30. Its main purposes were to give insights and details to WP leaders and Java developers about Gaia software framework as well as answering peculiar questions.

2.1 Participants

- Blomme, Ronny
- Chastel, Serge
- Damerdji, Yassine
- Fremat, Yves
- Janotto, Anne-Marie
- Jonckheere, Anthony
- Klement, Rainer
- Lanzafame, Alessandro
- Lindstroem, Hans
- Ordenovic, Christophe
- Poels, Joel
- Smith, Kester
- Sordo, Rosanna
- Tsalmantza, Paraskevi
- Vallenari, Antonella

2.2 Presentation Contents

Held by S. Chastel. Available at:

http://gaia.esac.esa.int/dpacsvn/DPAC/CU8/docs/meetings/CU8M06/6CU8_Chastel_Splinter.pdf

- DPCC IRD Constraints. Detailed explanations.

- Facade and TestBed Implementation through Example
- How will SAGA work?
- Flop Measurement through Example
- Where to get information for framework configuration?
- CU8 Software Support Group

2.3 Discussions

- **In a facade, why providing inputs one after the other (e.g. AstroSource) instead of a set (an array, a collection) to the *call()* method?** The purpose of SAGA is to process as many inputs as possible in expected time. Imagine that a set of 10000 inputs are provided as an input then the *call()* method as to loop over them. Imagine now that an error occurs (i.e. an exception is thrown), SAGA will likely catch that exception... but the whole computation will be considered invalid (unless particular management is made in the *call()* method). Imagine this occurs for the 10000th input... One hour computation lost. Sad! For that reason but also to ease development and to provide a common generic framework, this is the reason why we ask for providing inputs one after the other. Note however that algorithms that apply only on a collection of data as an input do not have to repsect that framework.
- **Dictionary Tool, Datamodel and data serialization**
  - Many users seem to have problems to handle data from gbin files and difficulties to use the Dictionary tool as well as the Data Explorer tool. Problems seem essentially to come from outdated files used with new configuration. Check for examples the following wiki page:
    http://www.rssd.esa.int/wikiSI/index.php?title=CU1:DalToolsExample
  - Need tools to convert from Gbin format to Ascii (at the moment we essentially have tools to convert Ascii to Gbin): requested by all!
  - Users don't understand well how the MDB and DPC DMs will work, how the other CUs will know about the CU8 output data, and so on. AMJ explains that other CUs get the CU8 output data as described in Dictionary MDB DM, the DPC/CU8 DM is local to CU8 and intended for SAGA and CU8 algorithms processing (not published externally). Some guidelines to understand better the Dictionary DMs would be helpful for the developers.
  - Discussion about how to deal with the new gbin format of training data in Cycle 6. It came out that we need to define the parameters of the training data such as noiseless parallaxes, magnitudes ecc. which are not already defined in the MDB. In practise we need to modify the AstroSourceLabel specific for CU8.