**GWP-T-513-00000 (DU13): Instrument absolute response characterization, ground-based preparation** – **Pancino**, Altavilla, Bellazzini, Bragaglia, Cocozza, Galleti, Marinoni, Ragaini

**Management.** All OABO DU13 contracts expired between Dec 31 2015 and Feb 29 2016 but Cocozza and Galleti’s AR contracts have been renewed until Dec 31, while Ragaini’s position, that could not be extended any more, was advertised again and a new AR assigned to Ragaini, until Dec 31. Altavilla’s TD contract was also renewed for 5 months, until July 31. Bellazini took over the management of Gaia-DPAC funds for OABO because of Pancino’s relocation in Arcetri, nevertheless Pancino continues managing DU13 as usual. Regular weekly meetings were held (2-3 times per month) and will be regularly held in the future among DU13 members.

**Interfaces.** Altavilla collaborated with polish observers within the Gaia science alerts verification programme.

**Observations.** Our observational campaign was formally concluded in July 2015.

**Data reductions.** Data pre-reductions (image de-trending and spectra extraction and wavelength calibration) were formally completed recently. New procedures for reducing fringing and for differential light loss correction are now routinely applied. Technical Notes documenting these further steps are in preparation. The goal is to increase the data quality of the SPSS flux tables already delivered (V1, Summer 2015) and to add a few SPSS of spectral types A and M to the next release (V2, expected in Autumn 2016), to improve the Gaia calibration model.

**Data Analysis.** The short-term constancy monitoring analysis was completed, and a paper draft was circulated among co-authors for comments. Only 12 SPSS were rejected because of variability, including some stars that were widely used as flux standards in the literature like BD+174708, SA 105-448, 17403468, and HD 37725. The absolute magnitudes of SPSS observed in photometric conditions were measured, we are now assessing the internal and external uncertainties, and collecting the relevant literature measurements for the quality control.

**GWP-T-514-00000 (DU14): Instrument absolute response characterization, definition and application** – **Cacciari** (1.05 MM), Bellazzini (0.35 MM), Montegriffo (5.45 MM), Ragaini (0.10 MM)

In view of the first release of Gaia data (Gaia-DR1) planned for late summer 2016, which will contain only the integrated G photometry, work focussed initially on the calibration of the G zeropoint in the AB system using the OR5S3 mean internally calibrated data, and the code was optimized to this purpose. Following the decision that the absolute calibration of the G integrated photometry shall be based on the nominal passband and in the VEGAMG system, the code was refactored and optimized accordingly, to produce the zeropoint in the VEGAMAG system for the absolute calibration of the instrumental data. To this purpose, the most updated (DR1) mean internally calibrated data for 56 SPSS were used. For the sake of completeness, also the zeropoint in the AB system was calculated, as well as the BP/RP zeropoints, all based on the nominal passbands. These values were then delivered to the MDB (BP/RP for DPAC use only).

This work and results were presented in the internal technical note GAIA-C5-TN-OABO-PMN-010 and discussed at the CU5 Plenary Meeting \#16 in Bologna (19-21 April), and are described in the corresponding papers (A\&A monographic issue) and online documentation that will accompany the data release.

Preliminary tests to derive the true instrument response using DR1 data showed that the G/BP/RP passband

true shapes can be obtained with a good degree of accuracy. A new version of the BP/RP response model was developed, and several tests were made to find the best way to model the passband cutoffs and hence obtain the best fit of the passbands. A solver based on a differential evolution algorithm was developed to find the best fit set of model parameters independently from the values of the initial conditions. This work is in progress, and the results are relevant for the next data release DR2 planned for late 2017.

The internally calibrated (DR1 quality) mean and epoch spectra of the above mentioned 56 SPSS were made available to us by DPCI in March 2016, along with spectra of emission line objects. These data are used to define and produce the external calibration model, which is of interest for CU5 to calibrate the spectra for future data releases, and also for other CUs to fine-tune their procedures, e.g. CU4 (characterization of SSO), CU8 (estimate of astrophysical parameters) etc.

Regular monthly meetings with the CU5 Management Team were held via teleconference by Cacciari, as well as working meetings with the collaborating teams at the University of Barcelona and Cambridge. Internal meetings were held regularly to discuss, plan, organize and coordinate all aspects of the work to be done.

**GWP-T-517-00000 (DU17): Science Alerts – Altavilla**

A joint proposal (Bologna-Warsaw) for the Feb-July 2016 semester was submitted on Dec 10

and accepted on Jan 14, 2016 (P.I. G. Altavilla) to continue using the Loiano telescope in a follow-up observing campaign of transient objects detected by the GSA.

**GWP-M-511-00000 (DU11): BP/RP flux extraction and initial data treatment –** Brown, Busso; **Pulone**, **Giuffrida, Castellani, De Luise, Piersimoni**

**Sub WPs: DU11-N-11: PhotPipe: Crowding Evaluation**

With regard to the implementation of the *Scene*, that is the input of the crowding evaluation procedure, several aspects have been discussed (for instance, to include SSOs, spurious sources and, in case, how to handle them, etc..) with Busso and Holland of the IoA. Possible changes to the Scene in case of more crowded regions have been discussed, to evaluate the crowding not for single transits but for groups of transits. Together with that, the possibility to improve the Scene creation, including transits to the Scene instead of just sources from externals catalogues (IGSL) or already observed by Gaia, as the present structure.

The possible consequences that this new approach will have on both crowding evaluation and, mainly, decontamination processes, and how to possibly change the data flow and the processing, have been examined during several telecons. A technical note by De Luise (INAF-OATeramo) on the crowding evaluation algorithm as a whole was prepared and circulated inside DU11 since last year, but postponed to wait for tests results from real data. Recently, because of several delays due to incoming DR1, together with DU11 Manager, Busso, the note has been resumed and is about to be issued.

**Sub WPs: DU11-N-12: PhotPipe: Template Library for Crowding Evaluation**

Piersimoni (INAF-OATeramo) continued the work on the Template Library. A set of CalSpecFovTransit data has been read and checked for using both calibrated fluxes and spectrum shape information. For this aim a class provided by DU15 for the conversion of an internally calibrated spectrum into a flux array in the system of the required FoV and CCD has been used. This work, was done with the aim to choose the best spectra to be used as template and is still in progress.

In the last period a discussion on the characteristics of the scene as required by the Crowding Evaluation, and described at the previous paragraph, mainly concerning the most efficient way to collect the data but also on possible edge cases or failures within the data, was done. In that respect, Piersimoni in order to give a ‘relevance radius’, depending on the magnitude, for the creation of the scene, computed the wings in AL and AC by fitting with analytical functions instead that with principal components.

Tests were done to compare the extrapolated analytical fit to the simulated big PSF with good results.

A technical note summarizing the findings concerning AC and AL expansion as based on different approaches (AP-002) is in progress.

**Sub WPs: DU11-N- 13 : PhotPipe: Decontamination**

De Luise (INAF-OATeramo) prepared a rough structure of decontamination, inherited from actual Crowding Evaluation and based on the present pipeline general structure. The algorithm behind, developed so far, is still under study, since several steps will be improved according to progresses for that part of PhotPipe related to decontamination processes. In that view, main data model, at least for main steps, have been prepared locally and waiting for DPCI approval.

**Sub WPs: DU11-D-02: PhotPipe: Per Transit Deblending**

Giuffrida (INAF-ASI ASDC), Castellani, and Pulone(INAF-OARome) continued the work on the deblending validation. Its now quite clear that validation criteria should properly evaluate the shapes of all the sources located on the given transit, i.e. not only the ”blended” sources but also the ”blending” ones. The problem is that such sources are often located partially outside the window, so that not all the sixty pixels are available for the validation. To deal with this problem, they have defined three different validation criteria: the first one analyze only the ”left” side of the spectrum, the second only the ”central” portion, while the third one evaluates only the ”right” side. The validation software will decide on case-by-case basis which criteria should be applied in order to obtain the best result.

Giuffrida, Castellani, and Pulone worked on the different strategies for the validation of deblending. Namely, they expanded previous attempt in evaluating a goodness of the fit by the computation of some integrals on the spectra, playing with the limits and the width of this selected area, allowing partial superposition of areas, etc. Some interesting results were obtained which can help in discriminating bad fits since it was realized that a fine tuning is certainly needed and this can be regarded as an unpleasant occurrence. To deal with this, an exploration of a new method based upon a neural network approach was started.

Different strategies for the validation of deblending have been explored Namely, they expanded previous attempt in evaluating a goodness of the fit by the computation of some integrals on the spectra, playing with the limits and the width of this selected area, allowing partial superposition of areas, etc. Some interesting results were obtained which can help in discriminating bad fits since it was realized that a fine tuning is certainly needed and this can be regarded as an unpleasant occurrence. To deal with this, an exploration of a new method based upon a neural network approach was started.

A careful investigation started about the possibility of validation through some selected ”index”, based upon the estimation of flux integrals in selected interval of band width (see also previous reports). This investigation has brought interesting results to help in discriminating ”good” solutions. In an attempt to overcome the limitations, another approach, based upon a dedicated neural network has started. A simple back propagation network has been built up and trained with a series of well known ”good” and ”bad” spectra, with the aim of teaching the net the quality of the fit. The open source software ENCOG (see http://www.heatonresearch.com/encog/) has been used to set up a neural network with a relative little effort. Experiments in tuning such network and in evaluating the outputs are going on. Encouraging results have been obtained.

They have built up ensembles of ”good” and ”bad” synthetic de-blended spectra in order to feed the network with a wide and comprehensive set of cases. Piersimoni provided the theoretical template spectra obtained via a simulator. Moreover, a procedure for building artificially ”bad” spectra has been designed and adopted. Much of the recent findings in this field has been reported by Castellani in his recent talk at the CU5 Plenary Meeting held in Bologna.

Lastly, part of the month has been allocated to rearrange their respective competences taking into account that Giuffrida underwent a significant change in his working career, anyway continuing to devote, till the end of the project, at least 0.2 FTE. The Rome team has started to explore other solutions for the

validation procedure. Following a comment made at the Bologna meeting, after Marco Castellani’s presentation, they started to evaluate Weka framework and the “random forest” procedure,

**Sub WPs: DU11 Other Tasks and Issues**

Since the contract of De Luise will expire next June 30, Piersimoni, with Pulone and Castellani, prepared the call for a new TD position devoted to the GAIA Project. The early duration of the contract is 3 months but renewable until the middle of 2018.

**Related activities**

Coordination Telecons have been organized/attended by all team members every two weeks.