GAIA: PRESENT STATUS AND PREPARATION OF DATA ANALYSIS

F. Crifo, for the french GAIA team[1]

Abstract. The GAIA mission of ESA is expect for launch in december 2011. Since March 2006 the preparation is in Phase B, with EADS-Astrium as prime industrial contractant. The european community is now organized in a consortium representing the different tasks of the data analysis preparation.

We shall present here the finally adopted design for the scientific instruments, its specifications, the new organization for data analysis, and the french contribution.

1 Introduction

The period 2005-2006 was a major step for the GAIA project. In february 2006 the ESA-SPC approved the final proposal of EADS-Astrium, which is a compromise between scientific objectives, weight constraints and cost. The B2 phase started immediately.

2 The scientific payload

2.1 Basic characteristics

- The main so successful Hipparcos features are kept: two directions observed simultaneously on the sky, separated by a (wide) basic angle of 106.5 degrees; common focal plane, now extended to the other instruments; continuous scanning of the sky with a slow precession of satellite axis on a cone at 45 degrees from the Sun.

  Launch is expected in december 2011 from Kourou, on a Soy-ouz launcher; the spacecraft will be placed at the L2 Lagrange point (small orbit around, in order to avoid eclipses), for 5 years.

- 3 instruments are available:

  - main astrometric instrument: very wide band (300-1000 nm); expected accuracies for parallaxes:

  $V \leq 11 : 7\mu as; V = 15 : 24\mu as; V \sim 20 : 300\mu as$.

  - 2 spectrophotometers with dispersed images, allowing photometry in many bands, from 300 to 1000 nm;

  - radial velocity spectrometer (RVS): spectral interval [847- 874]nm; expected accuracies on RV:

  $V \leq 11 : 1km/s; V \leq 17 : 30km/s$.

- The 2 entrance mirrors are 145x50 cm^2 each, and the total focal length is 35 m; there is now only ONE focal plane; the 2 photometers and the RVS are fed by a small fraction of the main recombined beam.

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3 Scientific Organization for Data Reduction

The scientific community is in charge of data reduction, and defined a new organization for this aim. In january 2005 the GAIA Science Team asked the scientists to answer a "Letter of Intent", in order to organize and share the various tasks and responsabilities: some 170 answers from individuals, groups and institutes were received. A "Data Analysis Coordination Consortium" (DACC) was setteled, and the work was distributed into "Coordination Units" (CU):

- CU 1, Overall system architecture : O'Mullane
- CU 2, Data simulations: X. Luri + Babusiaux/Mignard
- CU 3, Core processing: U. Bastian + Torra/Lattanzi
- CU 4, Object processing: D. Pourbaix + Tanga
- CU 5, Photometric reduction: F. van Leeuwen + Brown/Jordi
- CU 6, Spectroscopic reduction: D. Katz + Cropper/Munari
- CU 7, Variability: L. Eyer + DW Evans
- CU 8, Classification: C. Bailer-Jones + Thévenin

President of the DACC: F. Mignard

There are still many smaller working groups.

The french scientific community is deeply involved, and the CNES at Toulouse will provide strong support on many technical and computational aspects.

4 Need for complementary ground-based observations

There is an important need for ground-based observations for standard stars: radial velocities, spectrophotometric standards, variable stars, peculiar objects... Most observing projects are still in elaboration phase.

- Radial velocity standards: the RVS has NO calibration unit onboard and will use as references ground-based objects with well-known RV (error $\leq$ 300 m/s) and no drift until 2017. Some 2500 objects are needed, the IAU references are not numerous enough. Bright asteroids and stars ($6 \leq V \leq 10$) will be observed , mainly at OHP-Sophie and TBL-Narval for the north, Coralie and possibly ESO-FEROS in the south, according to carefully selected lists. They will provide wavelength calibration and zero-point. This program has begun already and is in a trial phase.

- Spectrophotometric standards for many types of objects are needed, in the range $10 \leq V \leq 14$.

- Specific high-resolution spectra are needed for adapting the grids of models.

5 Tentative (and incomplete) list of french participants:

- Besançon: A. Robin, C. Reyle;
- Bordeaux: P. Charlot, C. Ducourant, C. Soubiran;
- GRAAL Montpellier: G. Jasniewicz, B. Plez;
- Institut d'Astrophysique de Paris: A. Lecavelier, G. Hebrard, A. Vidal-Madjar, F. Bouchy;
- Obs. de Paris - GEPI: F. Arenou, C. Babusiaux, F. Chereau, F. Crifo, C. Delle Luce, M. Floquet, A. Guerrier, A. Gomez, M. Haywood, A.M. Hubert, D. Katz, Y. Lebreton, N. Leclerc, C. Macabiau, C. Martayan, S. Mignot, C. Neiner, F. Royer, N. Robichon, P. Sartoretti, C. Turon, Y. Viala;
- Obs. de Paris - IMCCE: J.E. Arlot, J. Berthier, A. Fienga, D. Hestroffer, S. Mouret, W. Thuillot;
- Obs. de Paris - LESIA: A. Doressoundiram;
- OCA - Nice: L. Bigot, P. de Laverny, F. Mignard, A. Recio-Blanco, B. Pichon, P. Tanga, F. Thévenin;
- Strasbourg: J. L. Halbwachs;
- CNES - Toulouse: C. Huc, A. Jean-Antoine, T. Levoir.

6 Literature citations

Here are some websites where more details can be found:

- Official ESA site: http://www.rssd.esa.int/index.php?project=Gaia

- RVS/CU6 site at Meudon: http://wwwhip.obspm.fr/gaia/cu6/