GAIA RADIAL VELOCITIES: FIRST COMPARISONS WITH GROUND VALUES

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Abstract. After several months of Gaia-RVS observations, many radial velocities are now available and can be compared to existing ground values. An extended catalogue of 10227 reliable ground-based RV has been compiled from different sources including our own observations of standard star candidates, and objects with good archive spectra.

First conclusions are:

Some 4000 comparison stars already observed several times during the 3 first months of operation show a gaussian dispersion around the ground-based value on the order of 1.1km/s; some stars show a slight evolution of their RVS measurements and are probably binaries; some RVS observations show "irregularities" now explored in details.

It is particularly important to note that our 2798 primary standard star candidates (extended list), are very stable over the Gaia mission. For the others, the last ground-based campaign anticipated 10 years ago to assess their stability, should be now started.

Keywords: stars, radial velocities, sb2, Gaia

1 Introduction

The Gaia satellite with its Radial Velocity Spectrometer (RVS) has been working regularly since July 2014. Many radial velocities have already been acquired. In order to enlarge the number of standard stars, an extended catalogue of reliable ground-based RV has been already compiled from different sources including both our own observations of standard stars candidates, and other objects with good archive or literature measurements. This catalogue is used for calibration and evaluation of accuracy of the instrument. It contains 10227 objects and its description is for the moment restricted inside the DPAC Consortium; 2798 of these stars are called "primary standards" (highest quality).

It should be noted that the "RVS values" presented in this paper are not yet provided by the general reduction pipeline, but by the simplified pipeline developed at Meudon for the commissioning. They are therefore not "final".

2 General results

Within the RVS observations, those concerning the stars in our extended catalogue (primary and secondary stars) have been extracted, and compared to the ground values. The result is shown on the histogram of Fig. 1 left; it contains 11787 observations made between july and october 2014, and concerning 3783 objects with more than 3 observations each. In x, the quantity $(RV_{RVS} - RV_{ground})$. The standard deviation is 1.14 km/s. (Expected values at end of mission: 1 km/s for such bright objects).

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3 Some examples

3.1 A nice double star

The star HIP 70674 shown on Fig. 1 right is listed as double star in the SB9 catalogue (Pourbaix et al. (2004), Halbwachs et al. (2014)). Each calcium line shows a double peak. The distance between the two peaks varies with time.
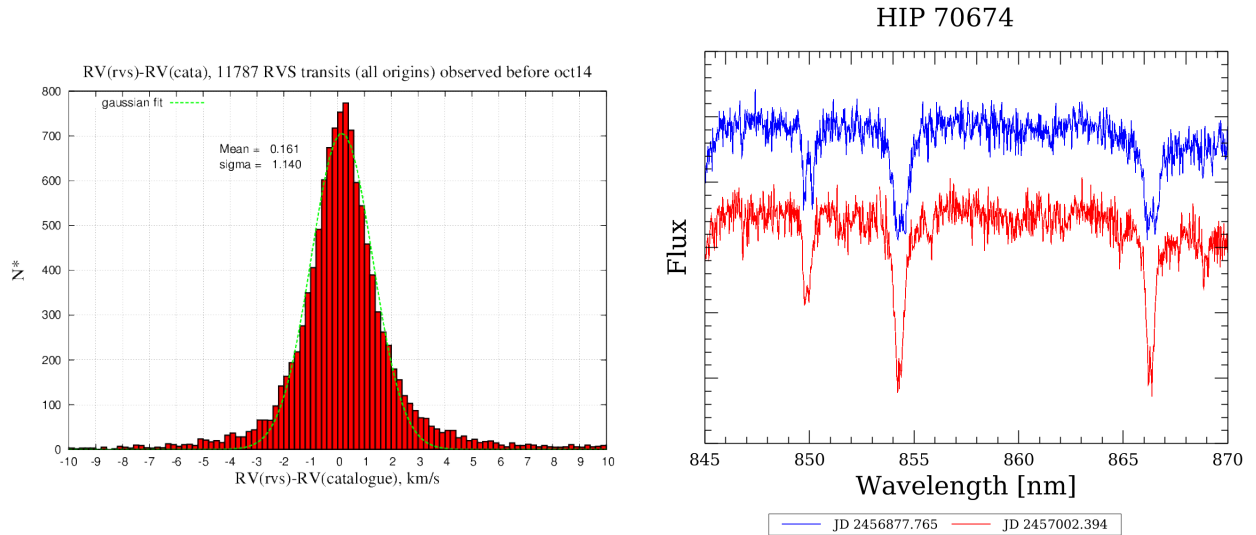

Fig. 1. Left: 11787 transits for 3783 primary and secondary standard stars already observed. **Right:** A double star at 2 different epochs.

3.2 Ground and space measurements

Data from both ground and space are available for the observed standard stars. On Fig. 2 they all are plotted on a common graph for HIP 32769. The zero-shift between the histogram centre (see fig. 1) and the ground values has not yet been removed. A slight drift in time is possible: therefore this object will be remeasured in our ground-based observing programme, phase 2 (during mission). It might be an unknown long-period double star.

4 Ground observations, phase 2

For the RVS calibration, 1420 candidate standard stars had been selected several years ago (see Crifo et al. (2010), Soubiran et al. (2013) and intensively observed from the ground between 2006 and 2013; 1300 more have been recently selected within the archive data from Elodie, Sophie and Harps: a total of 24865 individual measurements. Most objects proved to be quite stable in RV; but some are less: figure 3 shows the variability found within the basic list of 1420; the maximum acceptable value for variability being set at 0.3 km/s.

For slightly more than 1000 of these stars, the long-term stability (until end of mission: 2019?) has to be assessed. Therefore it is now time to start the Phase 2 of our observing programme, on the SOPHIE (north) and CORALIE (south) spectrographs. Figure 4 shows the fraction of stars to be reobserved in the North: those with only few measurements; or a short time basis; or quite old data; or a possible small drift.

5 Conclusion

From these very first data it appears that the RVS gives good, accurate spectra; and that the agreement with ground-based data is good too. The second phase of ground observations for the candidate standards can now be started.
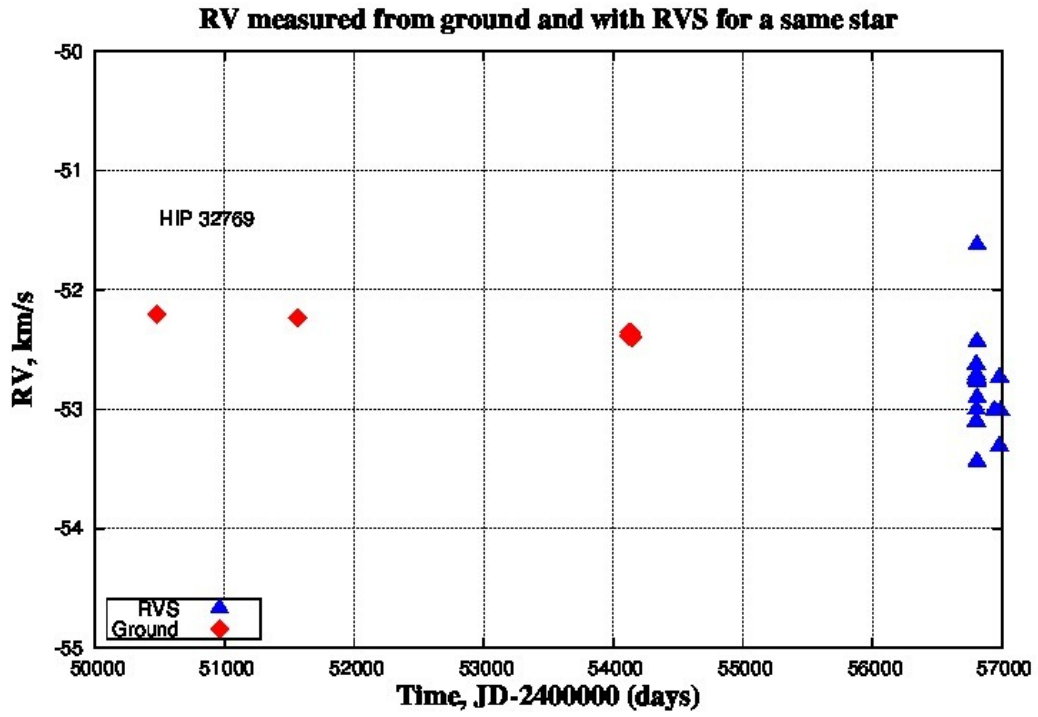
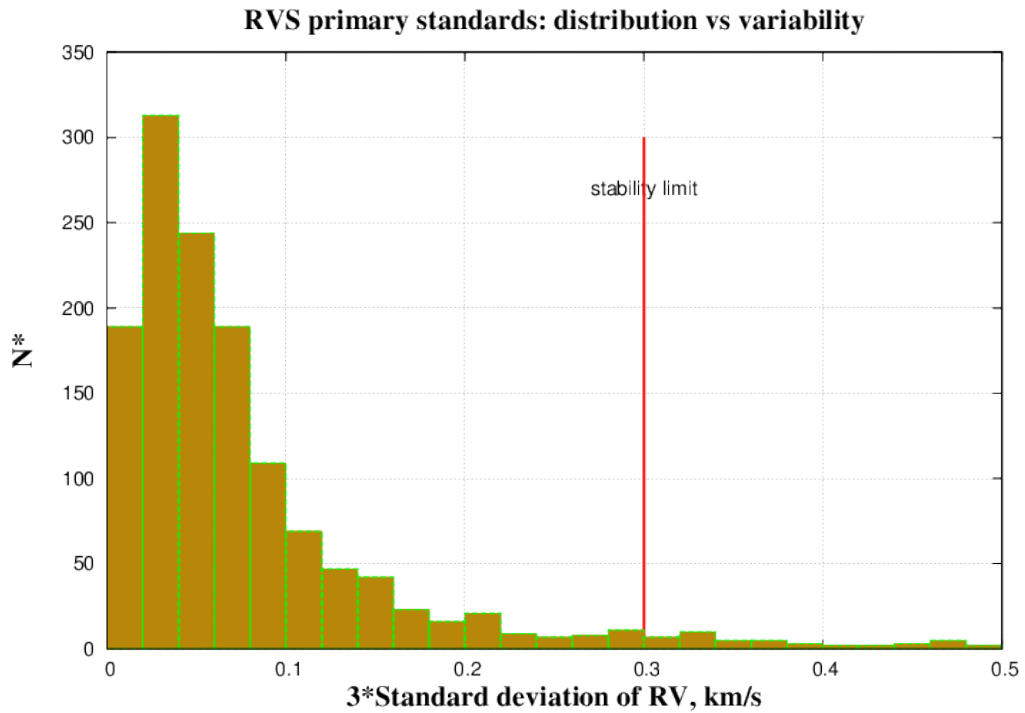**Fig. 2.** Ground and space observations for a same star: possible drift?

Fig. 3. Variability among the basic list of 1420 candidate standard stars
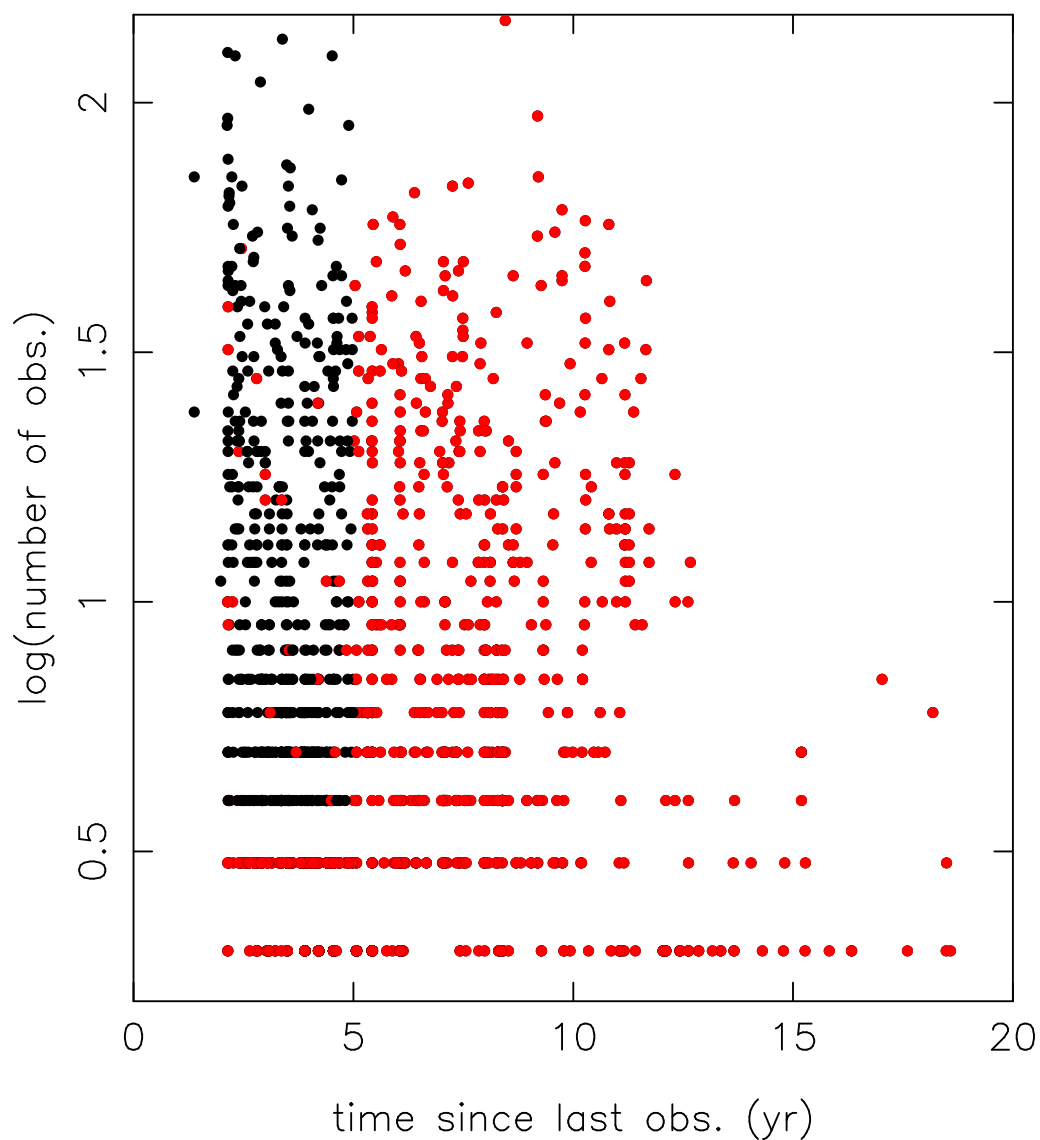
Fig. 4. Northern candidate standards: those in red should be remeasured.

References

Crifo, F., Jasniewicz, G., Soubiran, C., et al. 2010, A&A, 524, A10

Halbwachs, J.-L., Arenou, F., Pourbaix, D., et al. 2014, MNRAS, 445, 2371

Pourbaix, D., Tokovinin, A. A., Batten, A. H., et al. 2004, A&A, 424, 727

Soubiran, C., Jasniewicz, G., Chemin, L., et al. 2013, A&A, 552, A64