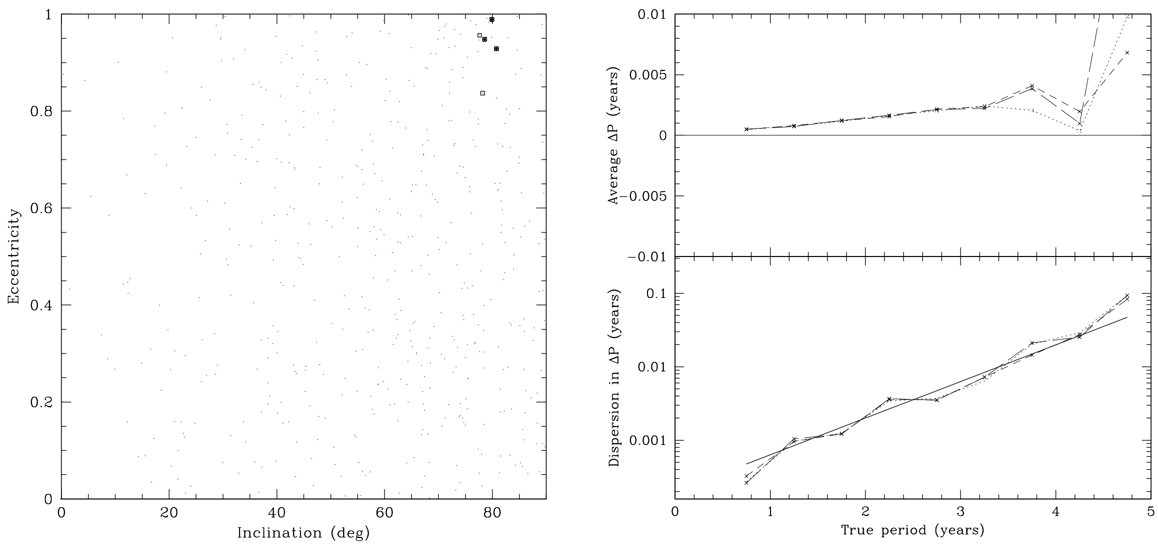

Figure 1: *Left: eccentricity e and inclination i of planets in the T0 experiment. Only 0.5% of the sample, with very high e and i, goes undetected (asterisks and open boxes). Right: Mean and dispersion of the difference between true and measured orbital period P. The dispersion roughly scales with* $10^{0.5P}$*, and is still of order of 1% for periods approaching the 5-yr nominal Gaia mission duration*

The ability of simultaneously and systematically determining the frequency and distribution of orbital parameters of extra-solar planetary systems for the stellar mix in the solar neighborhood (an estimated reservoir of $\sim 10^5$ objects) stems out as a fundamental contribution that Gaia will uniquely provide to planetary science. The main challenge will be not only to be able to deal with such a large database, but also to fully understand the limitations intrinsic to the mission, i.e., the actual sensitivity of the Gaia measurements to planetary perturbations. The main objectives of the Planetary Systems working group can thus be summarized as follows: *a*) to evaluate the astrometric detection capabilities of planetary systems with Gaia, *b*) to refine models of the expected number of systems which may be discovered, and to assess the physical diagnostics that may be expected (orbital elements, co-planarity, masses, etc.) in connection with payload developments, *c*) to develop the software tools necessary for the data analysis, and *d*) to consider ground-based facilities and networks that will eventually be required for their follow-up observations.

The first three objectives have so far been given the highest priority. To this end, a software code for astrometric planet detection and orbit reconstruction has been delivered to the Gaia Data Access and Analysis Study (GDAAS). The algorithm is composed of two steps. First, it performs statistical hypothesis testing and periodogram analysis of the observation residuals, to highlight significant deviations from the single-star solution and to identify one or multiple significant periodic signals. Then, the full set of Keplerian elements and mass for each detected planet are determined by minimization of the objective function (in the sense of robust least squares fitting procedures), where astrometric as well as orbital elements are re-estimated together.

In order to test the data analysis algorithm performance and refine the science case, detailed simulations must be conducted. In light of this, the PS working group has begun an extensive program of double-blind tests devised to assess Gaia's capability in detecting and measuring single and multiple-planet systems in the solar neighborhood. At the end of the program, it will be possible: 1) to compute planet detection probabilities—including completeness and false positives—and accuracy in orbital parameters and planet masses that can be achieved within the mission; 2) to assess to what extent, and with what reliability, coplanarity of multiple-planet systems can be determined, and how the presence of a planet can degrade the orbital solution for another. In other words, Gaia's ability to detect and measure planets will be gauged under realistic analysis procedures of data produced by a nominal satellite. The double-blind test program is currently underway, and a preliminary assessment (T0 phase) of the robustness of statistical tests for planet detection and of different strategies to search for good starting guesses for the orbital parameters in the astrometric orbit reconstruction has been made (see figure above). Ultimately, Gaia's scientific and technical capabilities will be established globally in light of the dominant open questions in exoplanet research, and it will possible to identify the areas in which Gaia can be expected to have a prominent impact.

For more detailed information about the group see the web site: http://wwwhip.obspm.fr/gaia/ps/