

HIPPARCOS - PREPARATION OF THE MISSION: EARTH-BASED ASTROMETRY

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ABSTRACT. The proper and efficient operation of the Hipparcos satellite requires positions within 1.5 arcsec at the 1989 epoch for the 100-120 000 programme stars. The first steps of the preparation have been the identification of the proposed stars in the well-known astrometric catalogues and the output of successive lists of 'non-astrometric' stars not belonging to these catalogues. Ground-based observations needed to supplement the presently available data, which are now under way, are also described.

1. 'NON-ASTROMETRIC' STARS: THE OBSERVING TASK

The last version of the Hipparcos 'non-astrometric' list contains 21 544 stars out of the 209 772 stars found in 219 proposals. All these stars are not included in classical astrometric catalogues: FK4, IRS, NPZT74, N30, GC, AGK3, SAOC, CPC, CPC2. Although the latter catalogue CPC2 has not yet been completed, cross-identification has been achieved and positions will be available in due time from Hamburg and Herstmonceux.

The resulting list has to be observed by meridian circles or measured on photographic plates during the next two years since the deadline of delivery of the Input Catalogue to ESA is July 1987, one year before the satellite launch.

The actual number of stars which have a high probability of being included in the Hipparcos catalogue is drastically reduced if we eliminate stars with high 'pressure', i.e. with no chance of belonging to the final Hipparcos list (e.g. bright companion in the field, nearby bright star giving disastrous effect of 'veiling glare', magnitude H greater than 12.4, neighbouring stars with higher priorities, etc.).

1.1. Northern Hemisphere

The number of 'non-astrometric' northern stars ($\text{dec} \leq 82$ deg), to be measured by the Bordeaux automatic meridian circle, is about 5 500 if we consider only stars of Priority 1-3 with pressure ≤ 4 , and stars of Priority 4-5 with pressure ≤ 1.5 . The polar zone has already been

measured on astrographic plates at the Hamburg Observatory (Chr. de Vejt). Positions of northern cluster stars will be also supplied by this institute.

1.2. Southern Hemisphere

From 0 to -25 deg, about 2 500 non-astrometric stars are currently being observed by the Carlsberg Automatic Meridian Circle (CAMC) at La Palma. From -17 deg to the south pole, glass copies of the ESO Schmidt blue Survey are being measured by teams at Bordeaux, Marseille and Leiden. C.A. Murray at Herstmonceux will undertake measurements for all Hipparcos stars on the CPC2 plates in the zone -40 to -52 deg.

Tests with the CAMC have confirmed the existence of position errors greater than 2 arcsec for a non-negligible number of SAOC stars. About 45 000 southern SAOC stars are in the list of proposed Hipparcos stars. Fortunately 80-90 per cent appear in the CPC2, while the others have to be considered again as non-astrometric stars. From 0 to -40 deg, 932 SAOC stars will thus be observed by the CAMC. Between -40 and -52 deg, 1 253 SAOC stars will be measured at Herstmonceux on CPC2 plates. The other southern SAOC stars not included in the CPC2 will be obtained on ESO plates simultaneously with the non-astrometric stars.

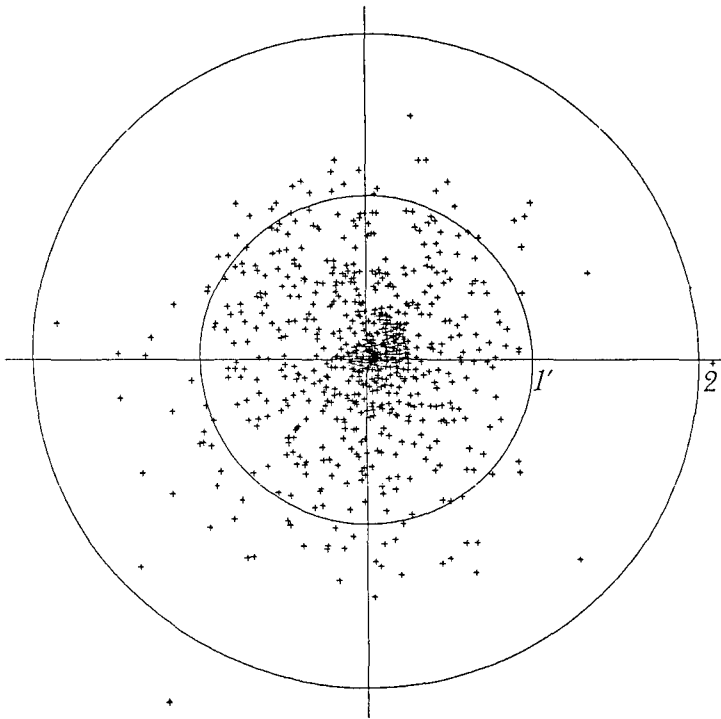


Figure 1. The figure shows the difference between the INCA-provided and CAMC positions for 'non-astrometric' stars in the range 0 to -25 deg. (Courtesy of L.V. Morrison, RGO).

2. MEASURING AND OBSERVING PROBLEM

The Input Catalogue Consortium has carried out extensive and time-consuming work in order to identify each proposed star and retrieve the best positions and magnitudes for them, especially from the Strasbourg Data Centre. But 'non-astrometric' stars are generally stars forgotten, deliberately or otherwise, by the astrometrists.

Photometrists are used to refer the telescope setting to identification charts, and the positions of many stars of well-known magnitude are therefore given only within 1 arcmin or worse. Furthermore positions of high velocity stars are very often poorly known. But the greatest difficulty for the astrometric observers arises with high astrophysical interest stars found in the Kukarkin variable star catalogue, where positions and/or magnitudes are doubtful in many cases (Fig. 1).

The automatic meridian circles at La Palma and Bordeaux, and also the Leiden measuring machine (Astroscan), work in a 'blind' mode inside a given radius, and measurements of an overcrowded field can sometimes give bad identifications. Magnitude measurements available on these instruments fortunately enable observers to check if the observed star was the proposed star. Since about 15 per cent of the Hipparcos non-astrometric stars are not found inside a radius of 1 arcmin around the proposed position, the only way is to determine very quickly by hand the approximate positions from Palomar, CPC2 or ESO surveys before observing with meridian circles. After that, the failure rate of the La Palma and Bordeaux meridian circles is expected to be less than 5 per cent (due mainly to variable stars).

Observation of components of multiple stars is also hazardous. The huge work carried out at the Observatoire Royal de Belgique on the CCDM (Catalogue of Components of Double and Multiple Stars) gives confidence of minimising the risk of identification errors to an acceptable rate.

3. CONCLUSION

The Hipparcos mission has the great merit to be a project where astrometrists and astrophysicists meet together and realize that too often they have been working in parallel without sufficient link. For galactic researches, which need proper motions, the fact that a lot of attractive stars are unknown by the astrometrists is most unfortunate. We take the opportunity of this meeting to ask the Data Centres for pointing out the gaps to the astrometrists and we urge the astrophysicists to express in a more explicit manner their needs in astrometric data. The difficulties encountered for the preparation of the Hipparcos mission should be felt as a useful 'alarm' for the benefit of all the astronomical community.