The Hipparcos Input Catalogue: I. Star selection

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Abstract. The Hipparcos Input Catalogue has been compiled, over the period 1982-1991, as the definitive observing catalogue for the European Space Agency's Hipparcos satellite, launched on 8 August 1989. It contains the most up-to-date, comprehensive and homogeneous information on the 118 000 stars being observed by Hipparcos. Its stellar and data content is described in a series of three papers. Details of the astrometric data are presented in Paper II, and of the photometric data (including photoelectric standards stars) in Paper III. The present paper deals with the stellar content of the catalogue and the way it was constructed.

Key words: Hipparcos – Stellar Catalogues

1. Introduction

The Hipparcos Input Catalogue has been compiled, over the period 1982-1991, as the definitive observing programme for the Hipparcos satellite, launched on 8 August 1989. It contains the most up-to-date, comprehensive and homogeneous information on the 118 000 stars being observed by Hipparcos.

This observing programme has been defined on the basis of scientific proposals submitted to the European Space Agency, while taking into account the observing possiblities of the satellite. Because Hipparcos operates by a continuous and systematic scanning of the celestial sphere, it is not possible to observe particular objects or regions of the celestial sphere in preference to others. However, some targets can be privileged with respect to their immediate neighbours in the field by the adjustment of the observing strategy parameters (Perryman & Vaghi 1989). Since the available observing time during each field crossing is limited, it is furthermore not possible to observe all stars down to the limit of observability of the satellite, and stars to be retained in the observing list – the Input Catalogue – had to be selected in advance.

Some compromise had to be searched for between the optimal choice of targets in terms of scientific outcome and the optimal use of observing time throughout the mission.

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The present description of the Hipparcos Input Catalogue will allow the future users to understand how, and under what constraints, this catalogue was actually compiled.

2. Scientific objectives of the Hipparcos mission

The Hipparcos mission has been primarily designed to provide a uniform whole-sky catalogue of stellar positions, proper motions and parallaxes. However, it was, from the very begining, recognized that a major enhancement of the scientific return might result from selecting stars also on the basis of their relevance to major astrophysical questions. Such a catalogue will have enormous value for a wide variety of detailed astrometric and astrophysical studies. Compared with existing stellar catalogues, the Hipparcos Catalogue will offer a significant improvement on the errors of these quantities, absolute rather than relative parallaxes and proper motions, a relatively dense reference network, and homogeneous sky coverage. Some of the most spectacular advances to be expected from the mission are likely to come from the five-fold increase in precision of measurements of trigonometric parallaxes compared with typical earth-based observations, and from the very much larger number and the very much wider variety of stars which will be measurable (Lacroute 1975; Kovalevsky 1975; Turon 1975; Høg & Fogh Olsen 1977; Høg 1979; Perryman 1986; Perryman & Turon 1989).

2.1. From scientific proposals to tentative Input Catalogues

In answer to an Invitation for Proposals issued by ESA in 1982 to the scientific community, 214 proposals were submitted, including suggestions for the observation of both stars and minor planets. Amongst the scientific proposals submitted, programmes to determine distances, motions, luminosities, masses, radii, and ages of a wide range of stellar types including white dwarfs, giants, radio and X-ray stars, variables and binary stars are well represented. Studies of star cluster dynamics and distances, stellar physics (including studies of atmospheric convection and mass-transfer phenomena) and studies of the interstellar medium have been proposed. Determination of the optical reference frame and its relationship to the radio and infrared reference frames has been proposed, and major collaborative projects between Hubble Space Telescope, VLBI and other important ground-based astrometric and astrophysical programmes have been initiated. Proposals also cover studies of solar system dynamics, including the dynamics, structures and masses of asteroids, the major planets and certain planetary satellites; earth rotation, polar motion and continental drift; lunar occultation phenomena. Galactic dynamics and evolution, dynamics of the Magellanic Clouds; determination of the extragalactic distance scale from Cepheids; and investigations of the validity of general relativity are other examples of the broad scientific interest generated by the Hipparcos mission.

Proposals altogether amounted to about 500 000 stars. It was eventually recognized by the INCA Consortium, through an extensive automated use of the SIMBAD database (Egret et al. 1991) and manual cross-identifications (Turon, Gómez & Crifo 1989), that there was a lot of redundancy in the stars proposed: actually about 210 000 individual objects were contained in the 214 proposals submitted.

In addition to stars, 68 minor planets and two satellites of major planets were proposed for observation with Hipparcos, mainly for improving the definition of the dynamical reference system and for linking it to the Hipparcos reference sytem. 48 minor planets were retained, taking into account their observability by the satellite. The work developed within the frame of the INCA Consortium for their best observability with the satellite is described by Bec-Borsenberger (1989, 1990, 1991).

The steps to be taken to arrive at the final Input Catalogue composition were not at all obvious at the outset of the project, and even at the end of the work it must be acknowledged that the inclusion or rejection of some objects is rather arbitrary. The main steps taken were as follows:

(a) a Selection Committee appointed by ESA ranked the proposal, or subsets of the proposals, in 5 priority classes, from objects with a high scientific interest which should be included in the Input Catalogue if at all possible (priority 1), through to objects which should not be retained in the Input Catalogue selection process unless there were no other competing stars in the relevant area of sky (priority 5). Different priorities were often awarded for a given proposal for different magnitude ranges, since it was known that the observation of fainter objects would be expensive in terms of observing time, and that only a decreasing percentage of all stars in the sky at fainter magnitudes could be included.

(b) based on these recommendations, the INCA Consortium constructed distributions of the proposed objects as a function of priority, magnitude and position on the sky. After the first round of priority allocations, it was immediately obvious that a large amount of work was needed to achieve a sky and magnitude distribution better suited to the satellite's capabilities.

(c) methods were developed within the INCA Consortium to numerically simulate the observation with Hipparcos, and control the observing time allocated to each star throughout the mission. This allowed the Consortium to establish the feasibility of observations of any given star, according to its magnitude and the detailed properties of its surroundings, as well as the expected precision of the astrometric parameters. Different algorithms prescribing the allocation of observing time as a function of magnitude were studied at the start of the work, allowing a decision to be made on the total number of stars to be retained in the Input Catalogue as a function of magnitude, based on the final expected accuracies implied by these distributions.

Nine successive selections were thus submitted to a chain of numerical simulations (Crézé 1985; Crézé & Chareton 1988; Crézé et al. 1989), allowing the statistical representation of the various proposed programmes and the expected precision on the astrometric parameters to be assessed.

(d) the proposers were given the opportunity to express their comments, first on the priorities allocated to their proposed programmes, and later, once a close-to-final star selection was obtained, on the very stars retained out of their proposal. This dialogue, albeit unusual, was felt desirable for two important reasons: (1) the first round of recommendations from the ESA Selection Committee and the corresponding treatment of the data by the INCA Consortium was necessarily somewhat statistical in nature. It was realised that such a coarse treatment might be satisfactory for many proposals, but quite unsuitable for others, and (2) since the observing programme of Hipparcos will remain fixed throughout the satellite lifetime (it will not be possible to add new objects to the observing list throughout the mission, nor to undertake new rounds of proposals) it was important to satisfy the scientific requirements of each proposal from the very outset, and to check further on, that the final star selection would not exclude one specifically important object in the opinion of the proposer.

(e) the INCA Consortium presented the results of its work, in the form of detailed statistics and performances for each proposal, to the Scientific Selection Committee. This presentation, which took place four years after the commencement of the INCA Consortium's work, allowed the Selection Committee to verify that their original recommendations, and other scientific goals that were identified during the course of the INCA Consortium's work, had been satisfactorily implemented.

2.2. The INCA 'Survey'

The 'Survey' is a basic list of bright stars, largely complete to a given magnitude limit, resulting from a compromise between various, possibly conflicting, requirements: (i) the satellite operations and the data reductions require a list of about 50 000 – 60 000 stars with $V \leq 9$ mag and with good positions (to better than about 1 arcsec), uniformly distributed over the celestial sphere; (ii) from a purely scientific point of view, it was considered highly desirable to have a sample over the whole celestial sphere, complete to the faintest possible magnitude limit, in order to enhance future statistical uses of the whole catalogue.

Stars were selected automatically from the SIMBAD Database of the Centre de Données Astronomiques de Strasbourg, considered to be essentially complete down to about $m_V = 9.0$ mag (Egret et al. 1991), using the following criteria:

$V \leq 7.9 + 1.1 \sin |b|$ for spectral types earlier or equal to G5

$V \leq 7.3 + 1.1 \sin |b|$ for spectral types later than G5

When no spectral type was available, the break was taken at $B - V = 0.8$ mag. Special attention was subsequently given to variable stars, for which the SIMBAD magnitude is usually the one at maximum brightness.

As a result, about 55 000 objects were selected (after revisions performed several times throughout the work, when newly collected photometric or spectral type data became available in the INCA database). This sample of stars was then processed during the numerical simulations of the mission like any other proposal. However, special care was taken to maintain its statistical properties as much as possible.

The choice of the above limits was made after the study of the statistical properties of various possible selections obtained from SIMBAD (Crifo et al. 1985; Crifo 1988; Turon et al. 1989). A 'one-component' survey, defined by the same magnitude limits whatever the spectral type, would have led to a very high contribution of red giant stars (43 per cent, mostly situated between 300 and 500 pc). In order to reduce this contribution in favour of A, F, and early G-type stars, statistically closer to the sun, and for which the ages may be better predicted, a brighter limiting magnitude was chosen for late-type stars than for early-type stars, leading to the concept of a 'two-component' survey. The magnitude difference is a constant, adjusted in order to have the main bulk of giant stars within 200 pc in the galactic plane, thereby avoiding the most disturbing interstellar clouds.

Due to uncertainties in the knowledge of magnitudes and spectral types, stars will inevitably be erroneously included or rejected from the selected sample. The effect of these errors can be estimated to be about 1 000 missed stars and 2 500 incorrectly included. The sample finally retained contains 52 000 stars, 95 per cent of them being closer than 500 pc. Less than 6 per cent of the complete sample failed to be retained after the selection process, due to operational constraint on the satellite (Gómez et al. 1989).

2.3. Additional INCA proposals

In addition to the 214 proposals submitted to ESA by the worldwide astronomical community, five additional proposals were defined during the course of the work of the INCA Consortium. In particular, it was necessary to make a global and dedicated study of all proposals submitted on some specific topics in order to optimise their observation by Hipparcos. This was done for programmes dealing with stars in the Magellanic Clouds and in galactic open clusters, for stars used for the geometrical calibration for the Hubble Space Telescope (NGC 188), for programmes for linking the Hipparcos system to an extragalactic reference system: radio stars and stars around compact extragalactic radio sources (Argue 1985, 1986a and b, 1988, 1989; Argue et al. 1984).

These proposals were made in close cooperation with members of the data analysis consortia, and after detailed studies on proximity effects, and on the requirements of the link to an extragalactic reference system (Froeschlé & Kovalevsky 1982; Froeschlé et al. 1985, 1987; Kovalevsky 1987, 1988; Lindegren 1987, 1988; Söderhjelm 1987, 1988, Turon et al. 1989).

2.4. Complementary ground-based observations

In order to take full advantage of the unprecedented amount of very precise astrometric data expected from Hipparcos, complementary ground-based observations, not mandatory for the satellite observations, but valuable for the eventual scientific exploitation of the Hipparcos Catalogue, have been organised in parallel with the work of preparation of the Input Catalogue. They mainly deal with radial velocity programmes: for early-type stars in the northern (Fehrenbach et al. 1985; Grenier 1988; Burnage et al. 1988) and southern (Gerbaldi et al. 1989) hemispheres, and for late-type stars in the southern hemisphere (Mayor et al. 1989).

It is expected that a large proportion of the stars included in the survey-type part of the Input Catalogue (see Sect. 3) and in most large proposals designed for galactic studies will be measured by the time of availability of the Hipparcos Catalogue within the frame of one of these two complementary programmes.

2.5. Comparison with antecedents: the SAO Catalogue

Some striking resemblances between the construction of the SAO Catalogue and of the Hipparcos Input Catalogue may be pointed out: both are compilation catalogues set up for space research purposes, over similar time intervals, with some similar constraints. The Hipparcos Input Catalogue might therefore have been envisaged as a subset of the SAO Catalogue, possibly with some additional measurements.

However, fundamental differences led to a completely different catalogue construction philosophy. The SAO Catalogue was intended mainly for the general purpose of stellar field identification and artificial satellite tracking. SAO stars were selected on the basis of pre-existing reliable positions, not at all on scientific grounds. By contrast, Hipparcos stars were first proposed by the worldwide astronomical community on scientific grounds, then selected according to the expected satellite capabilities, irrespective of the accuracy of existing positions or magnitudes.

As a consequence, many star identifications had to be confirmed, and extended ground-based astrometric and photometric preliminary compilations as well as observation progammes had to be organised (Réquième 1985, 1986, 1988a and b, 1989; Bastian & Lederle 1985 ; Jahreiß 1988, 1989; Grenon 1985, 1986, 1988a and b, 1989; Egret 1985; Crifo et al. 1991; Jahreiß et al. 1991; Grenon et al. 1991). All these data, along with the identification of each star in each proposal and the results of the successive mission simulation (Sect. 3.3) were included in a new database, the INCA database, created from SIMBAD, but proper to the INCA Consortium (Morin & Arenou 1985; Turon et al. 1987; Arenou & Morin 1987; Gómez 1988a; Turon et al. 1991a). The Input Catalogue includes, for each star, the best data available in the INCA database.

In addition, due to the characteristics of the Hipparcos detector, specific selection and other preparations had to be carried out for variable stars (Sect. 3.2; Mennessier 1985, 1988; Mennessier & Baglin 1988; Mennessier & Figueras 1989) and stars in very dense areas of the sky (Sect. 3.1; Turon 1988b; Turon et al. 1989), and particularly for double and multiple systems (Dommanget 1985, 1988, 1989), stars in galactic open clusters (Mermilliod 1985; Mermilliod & Turon 1988, 1989) and in the Magellanic Clouds (Prévot 1985, 1988, 1989).

The resulting Hipparcos Input Catalogue should therefore be used in the future, keeping in mind its specific purpose and constraints, and the way it was defined.

3. Tuning the Input Catalogue to Hipparcos technical capabilities

The specific scanning mode and detection system of Hipparcos, added to requirements induced from satellite operations and data reduction, result in some characteristics of the Hipparcos Input Catalogue.

3.1. Proximity effects between adjacent stars

The fact that the response profile of the main Hipparcos detector is not perfectly sharp-edged implies that the observations of a given star may be perturbed, or even made impossible, by the modulated signal of other stars further out in the wings of the response profile. The closer and the brighter the perturbing star, the larger will be the perturbation. This effect is evidently most severe in densely crowded regions, such as star clusters and the Magellanic Clouds, and for certain double and multiple star systems.

The various observing strategies were derived taking into account the diameter of the instantaneous field of view of the image dissector tube, which is about 38 arcsec, and its non-zero profile even at large distance from its centre. Numerical studies were carried out by the data analysis consortia in order to derive the optimum methods for the observation of such stars by Hipparcos, according to their magnitude differences and separations (Froeschlé et al. 1985; Kovalevsky 1987, 1988; Lindegren 1987; Söderhjelm 1987, 1988). These methods were implemented, albeit with some simplifications, in the mission simulation runs performed by the INCA Consortium, and the consequences of the proposed specific processings investigated in detail (Turon 1988c; Turon et al. 1989). Several iterations were necessary to arrive at the rules finally adopted:

- for star separations smaller than 10 arcsec, a unique entry is retained for Hipparcos observation. It may be either the primary star, or the geometric centre, or the photocentre of the system, depending on the relative positions and magnitudes of the components.

- for star separations larger than 10 arcsec up to a maximum of 45 arcsec, and for some given range of magnitude difference between the two components, a precise determination of the astrometric parameters of the brightest component from the Hipparcos observations requires the alternating observation of the two components. As a consequence, some additional components had to be forced into the Input Catalogue, even though they were not requested by any proposer nor by the survey.

About 1400 systems required the use of the alternating observing strategy, and about 70 'bright' stars had to be added to the original selection for further correction of this effect on high-priority fainter target stars.

3.2. Processing Specific to Variable Stars

With the exception of the 245 large-amplitude variable stars, mainly Miras, for which ephemerides predicting the luminosity variations are used for allocating the target observing time with Hipparcos (Mennessier et al. 1991), a single magnitude is retained for each star. It may be the magnitude at maximum, minimum or mean (mean or weighted mean) luminosity, depending on the type of variability.

3.3. Star selection optimization: simulating the observation process

Over the entire sky, there are some 2 000 000 stars down to the limit of observability of the Hipparcos satellite. A number of stars of about 100 000 – 120 000 objects appeared to represent the scientific optimum, given the specified satellite performance, as well as the processing capabilities of the data analysis consortia.

One of the main tasks of the INCA Consortium has therefore been to define precisely which subset of the more than 214 000 proposed objects should be retained in the final Input Catalogue, and to determine whether the proposed objects properly reflected a comprehensive scientific programme of observations out of all possible stars that could be observed (Crézé 1985; Turon et al. 1985; Crézé & Chareton 1988; Turon 1988b; Crézé et al. 1989; Turon 1989). The sky distribution of the 214 000 proposed candidate objects is shown in Fig. 1, and it is immediately apparent that these candidate stars are far from being uniformly distributed over the sky, in contrast to the strong constraints imposed by the scanning law of the satellite and by the operating mode of the detector.

Due to the specific scanning mode of Hipparcos the distribution of observing time between selected stars cannot be arbitrary. The observing time to be devoted to stars in the two combined fields of view is limited by the fixed scanning velocity, with a full field of view passage of $0\overset{\circ}{.}9$ taking just 19.2 s. On the other hand, the accuracy of observations is limited by the total number of photons received by the satellite from one star throughout the mission. This number of photons should be sufficient to make sure that the expected statistical accuracy is met. Then, from the Hipparcos point of view, candidate stars should be rather evenly distributed over the sky, although the star density may be larger at high ecliptic latitudes. The local number density depends on the local magnitude distribution.

The two fields of view of Hipparcos make the actual situation more intricate. Stars compete for observing time not only with other stars in the same field of view. All along the mission, depending on the position of the satellite spin axis, a given field will be superimposed with a number of other ones, all separated by angular distances on the sky equal to the 'basic' angle of about 58°.

For this work, a three-step iterative procedure was developed, reflecting the observational considerations (scanning law and field superposition), as well as the scientific requirements.

The first and simplest simulation package aims at achieving a star selection compatible with the scanning density, and involves the introduction of the concept of 'pressure' (Nicolet 1985; Nicolet & Crézé 1988). This 'pressure' is a local measure of the degree of competition for observing time around each candidate star. It is defined as the ratio of the observing time required by stars with a higher (or equal) scientific priority as compared with the priority of the candidate star over the total observing time available in the considered field of the sky. A tentative selection is then obtained by retaining all stars up to a given pressure. Stars with the highest scientific priority were retained up to a higher limiting pressure.

Once a tentative selection was made, it had to be checked that the Hipparcos observing capabilities were used in an optimum way: no waste of observing time, and nominal accuracy on the astrometric parameters achieved for most of the stars retained in this selection. This was done in two ways:

(a) a simulation taking into account the succession of field superpositions and the nominal satellite scanning law, but using a simplified 'star observing strategy' (actual choice of the stars to be observed at a given epoch, in one or the other field of view, and respective observing time allocation), simple enough to be run over the whole catalogue and covering a large part of the mission duration at reasonable computing cost. A 400-day simulation period was chosen, as large enough for the slow precession of the spin axis to produce suitable sampling of the diversity of field superpositions along the whole mission.

This second simulation package (Feaugas 1985; Crézé 1989) indicates, for each star from a given tentative Input Catalogue, the ratio of the total observing time devoted to the star during the 400-day period of the simulation to the target observing time of this same star during this period. This ratio, called the 'yield', gives a measure of the 'quality' of the tentative selection with respect to the observing capabilities of Hipparcos. A zone where the mean yield is significantly larger than 1 is an indication that some observing time was inefficiently distributed amongst the stars present in the zone, and that more stars could, in principle, be introduced into the programme. On the contrary, a zone where the mean yield is significantly smaller than 1 indicates that too many stars, or too many faint stars, were retained in the selection under test, and that a new selection was mandatory.

(b) a simulation taking into account the succession of field superpositions, the nominal satellite scanning law, and a realistic implementation of the Hipparcos star observing strategy. This package involves a detailed simulation of the observing process and checks that the distribution of selected stars (sky and magnitude distributions) allows the observing strategy to work efficiently. The contribution of each observation to the final accuracy of the astrometric unknowns can be recovered. In this way the standard error of each astrometric unknown relative to the target standard error (i.e. the standard error which would have been obtained if the target observing time had been obtained at each field crossing) can be derived.

This has been achieved through a set of test areas at various ecliptic latitudes and longitudes and with various star densities (and their associated 'superimposed' fields, separated by 58° from the centre of each area).

The three simulation packages described above have been run several times. These successive iterations were designed to test the efficiency of the whole procedure in a preliminary phase, to identify the quality and limitations of each step, and to calibrate the selection criteria (limits of acceptable pressure versus priority), and the warning criteria (lower acceptable limit for the yield). Different ways of processing proximity effects were also implemented in cooperation with the data analysis consortia.

Other goals of the iterations were to test the results of actions trying to improve the observation of high-priority faint stars, to take advantage of the many improvements brought to the basic material by the other groups in the INCA Consortium (such as newly-collected magnitudes and positions, corrections to identifications or cross-identifications of candidate stars), and to take into account the instrumental characteristics of the Hipparcos payload as they became available from ESA (such as the calibration of the Hipparcos magnitude H_p versus B and V, and the instantaneous field of view profile).

Finally, pressure and yield results were included in the INCA Database, and the results evaluated in terms of star selection, achievable accuracy and coverage of scientific proposals, and use of the observing capabilities of the satellite, thus producing criteria for the next selection run.

A by-product of the Input Catalogue oriented simulations of the Hipparcos observations has been the demonstration that optimal use of the star observing strategy requires a proper evaluation of the observing difficulties encountered for each star throughout the mission. Based on this knowledge, it has been decided to modulate the observing strategy parameters uplinked to the on-board computer for each star through modifications of the programme star file. The modulation is driven by the results of previous observations, accumulated at the ESOC ground station. Performances of previous observations are evaluated with respect to the pre-defined nominal data acquisition.The implementation of the modulation strategy ensures that the accuracy remains close to its nominal value throughout the mission (Crézé et al. 1989).

4. Resulting catalogue content

4.1. Global content

The sky distribution of the final catalogue is shown in Fig. 2. Though much smoother than the distribution of proposed stars, the distribution of observed stars still show a concentration along the galactic plane. This is allowed by the fact that, in these regions, the only stars wich are observable are relatively bright, and their individual target observing time relatively small.

The global distribution of selected stars versus H_p magnitude (i.e. the magnitude in the Hipparcos band - this band has an effective wavelength close to that of the V band of the Johnson system, but much wider (Grenon 1988)) is given in Table 1, along with the percentage of success obtained for priority 1 stars and for all survey stars. The bulk of stars observed by Hipparcos are brighter than $H_p = 10$, and few of them are fainter than 12. The effect of the weight put on high priority stars is also clear from the comparison of columns 2 and 5.

Table 1. Final selection of stars in the Input Catalogue, and global percentage of success for priority 1 (P1) and survey stars, as a function of Hipparcos magnitude.

Magnitude (H_p)	Entries in INCA Database	Entries in Input Cat.	Global % of success	Succ.% of P1 stars	Succ.% Survey stars
< 6	4 200	4 200	100	100	100
$6 - 7$	8 540	8 510	99	99	99
$7 - 8$	24 160	22 250	92	98	93
$8 - 9$	55 290	41 100	74	96	93
$9 - 10$	70 970	29 410	41	91	91
$10 - 11$	36 270	9 330	26	83	-
$11 - 12$	10 190	2 930	29	86	-
≥ 12	5 140	650	12	44	-
Total	214 760	118 380	55	94	94
Retained				72 500	52 800

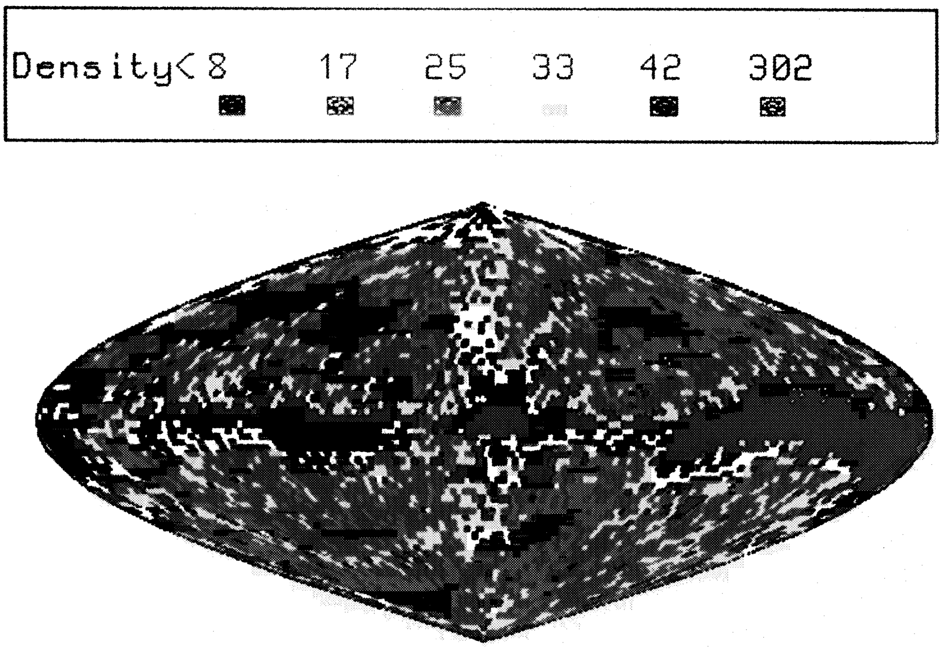

Fig. 1. Sky distribution of candidate stars shown as a function of galactic coordinates. The most prominent feature is the concentration of candidate stars along the galactic plane. Stellar densities refer to the number of stars in an area of 6.4° × 6.4°

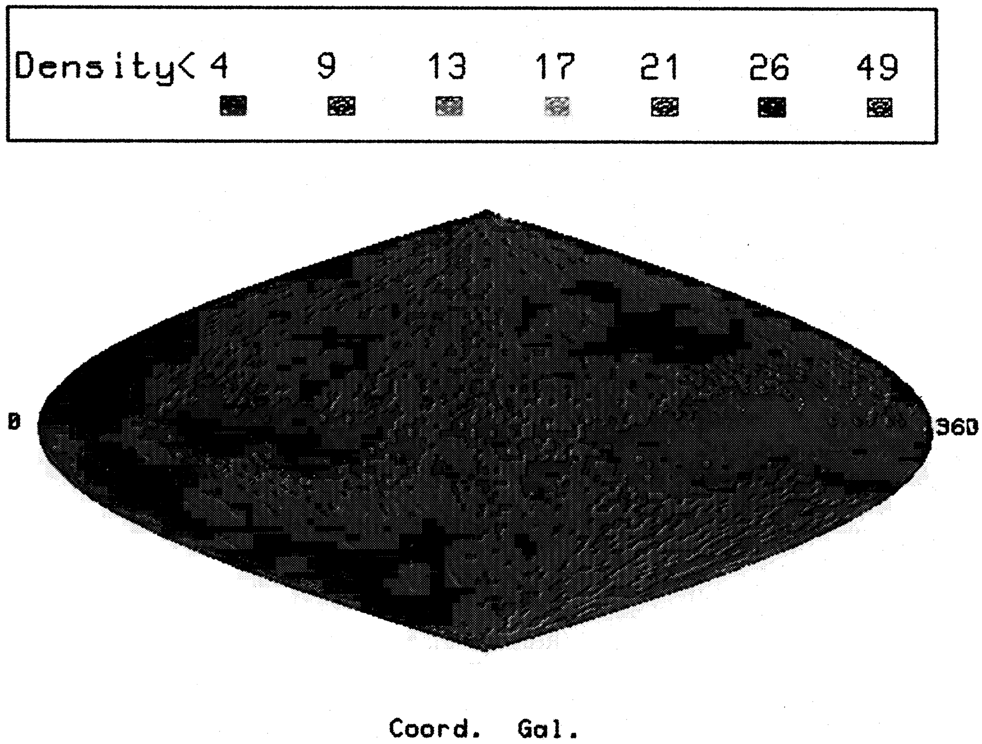

Fig. 2. Sky distribution, in galactic coordinates, of all selected stars. Stellar densities refer to the number of stars in an area of 6.4° × 6.4°

optimum way, in order to prepare the link of the Hipparcos reference frame to an extragalactic reference system, via VLBI and, if finally possible, Hubble Space Telescope observations.

4.3. Astrophysical programmes

As described in Sect. 2.1, a very large variety of astrophysical programmes was proposed for observation on Hipparcos. Table 3 shows the mean rate of inclusion for the main categories of programmes.

The Input Catalogue contains field stars of almost all spectral types and luminosity classes belonging to various stellar populations,

Table 2. Success of the main astrometric proposals in the Input Catalogue.

Catalogue or Proposal	Number of Proposed stars	Success (per cent)
FK5	1 535	100
FK5 extension	2 013	99.8
NPZT	1 718	99.4
AGK3R	21 499	98.2
SRS	20 495	96.8
IRS Supplement	1 900	95
GC	33 100	90
Selected radio stars	189	98
Selected link stars	175	95
Photographic link stars	1 000	42
Lunar occultations	15 300	50
Jupiter occultations	4 900	42
Uranus and Neptune occultations	23	39
Pluto occultations	290	41
Parallax standard stars	64	95

Table 3. Success rates of various categories of astrophysical programmes.

Type of Proposal	Success (per cent)
Luminosity calibration	>70
Stellar masses	>95
Stellar atmospheres	>90
Stellar structure	>90
Galactic structure[(1)]	>50
Galactic structure[(2)]	>80
Magellanic Clouds	>50

[1] If the number of proposed stars is $\geq$ 10 000
[2] If the number of proposed stars is $<$ 10 000

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The Input Catalogue contains field stars of almost all spectral types and luminosity classes belonging to various stellar populations, most types of binary and variable stars, very specific objects such as white dwarfs, central stars of planetary nebulae, and Wolf-Rayet stars, stars in about 280 open clusters, and stars in the Magellanic Clouds (Gómez 1988b; Gómez & Crifo 1988). In most cases, the closest stars of each category were retained. The result is that more than 85 per cent of the selected stars are closer than 500 pc. The distribution of the selected stars by spectral types, versus a rough estimate of the distance is given in Table 4.

Table 4. Distribution of the selected stars as a function of spectral types and distance estimates (the total number is not 118 000, as it was impossible to make an (even rough) estimate of the distance of some stars.

Spectral	Distance	(pc)			
Type	<100	100-500	500-1000	> 1000	Total
O-B	170	6 050	2 530	1 980	10 730
A0-A9	1 260	15 910	1 330	270	18 770
F0-F9	12 400	13 150	110	250	25 910
G0-K1.5	14 200	23 560	2 150	530	40 440
K2-M8	3 380	10 470	5 500	900	20 250
Total	31 410	69 140	11 620	3 930	116 100

5. Conclusion

The Hipparcos Input Catalogue is the result of a major cooperative effort aiming at preparing the best possible scientific return for this satellite which offers a unique opportunity of obtaining an homogeneous, very accurate, and very dense reference frame, accurate absolute parallaxes, and proper motions for a wide variety of stellar types.

The INCA Consortium, about 50 people in 20 Institutes, devoted 8 years to obtain a selection of stars which uses the observing capabilities of Hipparcos to a maximum considering the multifold possibilities of scientific applications expected from the basic data obtained from the satellite. A priori data for these selected stars, often originally very poor, were improved by extensive programmes of ground-based compilations and new observations of photometric and astrometric data. The best of these data is kept in the Input Catalogue (Turon et al. 1991b), and already used for operating the satellite and the Hipparcos data analysis.

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