# Section 1.4

# Double and Multiple Systems

# 1.4. Double and Multiple Systems

This section provides the information necessary to interpret and use the results appearing under the header 'Multiplicity Data' of the main Hipparcos Catalogue (Fields H55–67, see Section 2.1), and the contents of the Double and Multiple Systems Annex (see Section 2.3). More extensive details of the processing of double and multiple star data are given in Volume 3.

## 1.4.1. Complications Arising from the Observations

The presence of double systems severely complicated the entire Hipparcos Catalogue production. If all the stars observed by the satellite had been single, and centred in the detector's instantaneous field of view, the five astrometric parameters per star would have been well constrained by the global observations. A well-defined reference system, and well-behaved photometric results, would have been obtained by a relatively straightforward process. Double or multiple systems, however, resulted in one-dimensional positions on the reference great circles which changed according to the satellite's scanning direction and the measurement epoch. These instantaneous positions had no well-defined common physical meaning for double star systems, except for close pairs (with separations less than about 0.30 arcsec) where the photocentre of the system was a good approximation to the Hipparcos observations. Careful screening of the observations and dedicated processing were necessary to avoid this having an effect on the resulting reference system at the level of the reference great circles, or at the level of the sphere solution.

In cases of detected duplicity the observation model had to be extended from the standard single-star model, essentially on a case-by-case basis, to account for resolved systems, systems with moving components, astrometric binaries, and multiple systems. Similar complications appeared when the magnitudes of individual components were derived from the combined detector signal. An additional difficulty was caused by the finite size of the detector's instantaneous field of view, of around 30 arcsec diameter. This meant that many double systems with separations comparable to this size had their astrometry and photometry affected by the resulting attenuation in the detector's response (Figure 1.4.1).

Systems with separations $< 0.1 - 0.15$ arcsec or magnitude differences $> 3.5 - 4$ mag were at the limit of what could be recognised as non-single and measured. The sensitivity of the detection and the quality of the solutions were also dependent on the ecliptic latitude of the star, as a consequence of the variation of sky coverage and scanning geometry resulting from the ecliptic-based scanning law. Although considerable attention was given to the optimised design of the modulating grid of the Hipparcos satellite to the detection of double stars, there are 'grey areas' in the parameter space where the astrometry and photometry of double and multiple systems must be considered as poorly defined. An additional problem was in trying to reconcile the Hipparcos results with relevant information (for example, system and component designation) already available from ground-based observations.

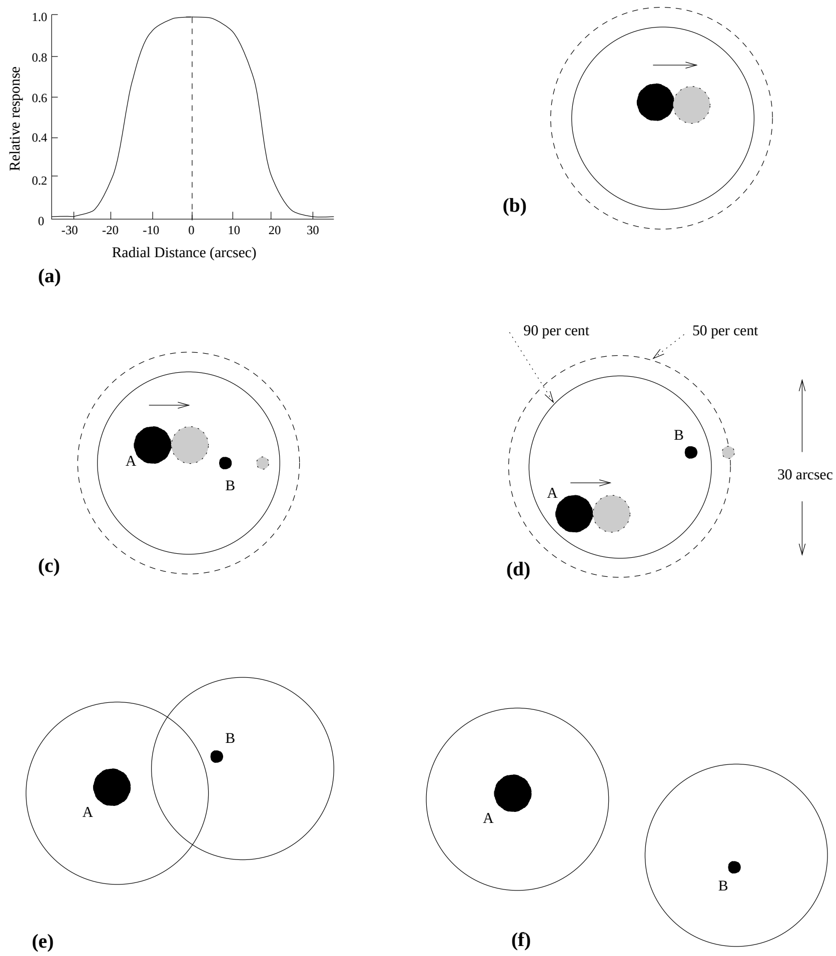


***Figure 1.4.1.*** *(a) the (schematic) form of the detector's response profile in intensity, or the instantaneous field of view (IFOV). The geometric configuration of the double or multiple star affects the way in which reliable astrometric and photometric data could be acquired by the satellite. In (b) a single star has an a priori position such that it is well-centred within the detector's IFOV. Satellite attitude uncertainties (of less than a few arcsec) and discrete stepping of the IFOV during the star's transit across the instrument's focal plane (indicated by the solid and shaded images) leave the image well within the central part of the detector's response. In (c) a double star system, of a few arcsec separation, is still well-centred for the majority of observations, leading to reproducible and therefore reliable astrometric and photometric data. As the double star separation becomes comparable to or larger than the IFOV (d), attitude uncertainties lead to variations in the response as one or other of the components falls on the steep part of the detector's sensitivity profile—in such cases the resulting astrometry and/or photometry may be perturbed. In (e) the separation of the two components is too large for them to be observed within a single pointing of the IFOV, but small enough that consecutive pointings of the IFOV nevertheless 'interfere'. Such consecutive observations were reduced together, taking into account their mutual interference—the system is referred to as a two-pointing double. In (f) the component separation is large enough that they can be observed with two consecutive non-interfering IFOV pointings. Such components may or may not be part of a physically associated system: for Hipparcos such cases were treated no differently (for the observations, the reductions, and the presentation of astrometric and photometric results) to any other distinct catalogue entries.*

One major difficulty in the double star processing was a consequence of the large number of categories of double and multiple systems that had to be treated by distinctly different methods. While the majority of non-single systems are physical binaries, with either fixed relative positions over the mission duration or with an orbital motion that could be approximated by a linear function of time, some three thousand more complex systems were already included in the Hipparcos Input Catalogue, and many more were discovered by the satellite observations. Some such systems comprised more than two components, or had a significant orbital curvature over the time-scale of the satellite observations, or one or more of the components was found to be variable. Finally, the published results of the satellite observations may or may not be consistent with previously available ground-based observations.

Double and multiple systems therefore provided not only a challenge to the observations and data reductions, but also to the publication and presentation of the derived parameters. Any attempt to present information on previously known or newly discovered double or multiple systems in a simple and uniform manner was complicated by the large variety of configurations that exist: double or multiple stars may be contained within a single Hipparcos Catalogue 'entry', which means that the detector was always (nominally) pointed at the same point in the system, or they may appear as separate entries (because of the large component separation), or with one or more previously known components unobserved by the satellite (because of its faint magnitude, or due to its lack of high-priority scientific interest).

Catalogue users should thus be aware that the reliability of the published results for double and multiple systems depends on a variety of factors, some of which are not readily quantified in the form of standard errors and goodness-of-fit statistics. A particular difficulty, very specific to the Hipparcos mission, is the possible occurrence of 'grid-step' errors, where the derived position of a component may be displaced by a multiple of the main grid period, or about 1.2 arcsec. While this problem was readily soluble for single stars, some double or multiple systems with limited coverage in scanning directions may be quite susceptible to this kind of error, which then also affects the determination of the proper motion and parallax. Fortunately, the parallax is usually much less affected by this problem than the other parameters, and since the majority of objects received good observational coverage, their solutions are not likely to be affected by grid-step errors.

Although a quality rating of the component solutions according to their expected reliability has been attempted, based on factors such as the detection rate, rejection rate, and the level of agreement between the FAST and NDAC Consortia parameters, some caution must always be exercised in the interpretation of the double and multiple star results.

Figure 1.4.1 illustrates schematically the form of the detector's response profile (referred to as the instantaneous field of view), and the interplay between the geometric configuration of the double or multiple star and the reliability of the astrometric and photometric data acquired by the satellite. The numerical values of the instantaneous field of view profile used by both data reduction consortia are given in Table 1.4.1, and the corresponding profile in Figure 1.4.2. This function was used to correct the photometric data for systematic effects caused by components falling in the wings of the instantaneous field of view profile.

**Table 1.4.1.** The detector's response profile ($\Delta Hp$, in magnitudes) as a function of the distance to the centre of the instantaneous field of view ($\varrho$, in arcsec). The table gives the intensity attenuation for non-centred stars as adopted in the data reductions.

| $\varrho$ | $\Delta Hp$ | $\varrho$ | $\Delta Hp$ | $\varrho$ | $\Delta Hp$ | $\varrho$ | $\Delta Hp$ | $\varrho$ | $\Delta Hp$ |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0000 | 7.0 | 0.0223 | 14.0 | 0.3148 | 21.0 | 1.5960 | 28.0 | 4.9226 |
| 0.5 | 0.0000 | 7.5 | 0.0279 | 14.5 | 0.3638 | 21.5 | 1.7629 | 28.5 | 5.1868 |
| 1.0 | 0.0001 | 8.0 | 0.0347 | 15.0 | 0.4180 | 22.0 | 1.9445 | 29.0 | 5.4431 |
| 1.5 | 0.0002 | 8.5 | 0.0430 | 15.5 | 0.4776 | 22.5 | 2.1402 | 29.5 | 5.6884 |
| 2.0 | 0.0005 | 9.0 | 0.0530 | 16.0 | 0.5429 | 23.0 | 2.3493 | 30.0 | 5.9194 |
| 2.5 | 0.0010 | 9.5 | 0.0650 | 16.5 | 0.6140 | 23.5 | 2.5713 | 30.5 | 6.1330 |
| 3.0 | 0.0017 | 10.0 | 0.0793 | 17.0 | 0.6912 | 24.0 | 2.8056 | 31.0 | 6.3262 |
| 3.5 | 0.0028 | 10.5 | 0.0961 | 17.5 | 0.7746 | 24.5 | 3.0512 | 31.5 | 6.4962 |
| 4.0 | 0.0041 | 11.0 | 0.1159 | 18.0 | 0.8645 | 25.0 | 3.3063 | 32.0 | 6.6400 |
| 4.5 | 0.0059 | 11.5 | 0.1391 | 18.5 | 0.9613 | 25.5 | 3.5690 | 32.5 | 6.7559 |
| 5.0 | 0.0081 | 12.0 | 0.1658 | 19.0 | 1.0662 | 26.0 | 3.8371 | 33.0 | 6.8465 |
| 5.5 | 0.0107 | 12.5 | 0.1965 | 19.5 | 1.1807 | 26.5 | 4.1085 | 33.5 | 6.9153 |
| 6.0 | 0.0139 | 13.0 | 0.2314 | 20.0 | 1.3062 | 27.0 | 4.3813 | 34.0 | 6.9660 |
| 6.5 | 0.0177 | 13.5 | 0.2708 | 20.5 | 1.4442 | 27.5 | 4.6534 | 34.5 | 7.0022 |

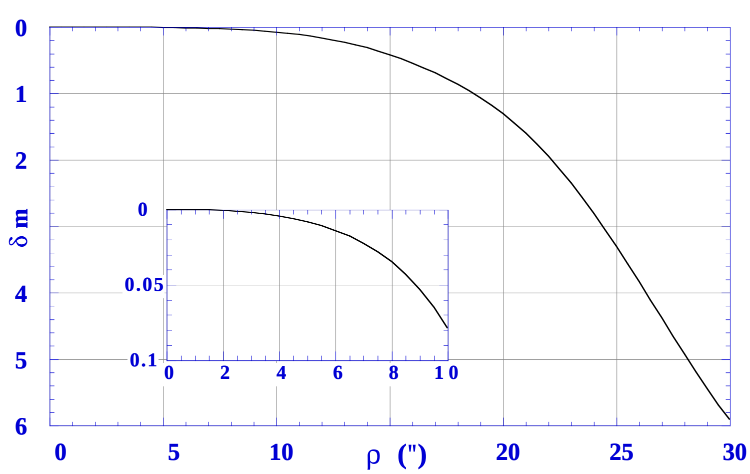


***Figure 1.4.2.*** *The form of the detector's intensity response profile, or instantaneous field of view.*

### 1.4.2. Categorisation of Hipparcos Double Stars

When a Hipparcos Catalogue entry refers to a single object, the astrometric and photometric data are largely unambiguous. In the case of non-single objects, the situation is more complex in a number of ways, although not all combinations of separations and magnitude differences were observably non-single for Hipparcos. For the ones that were observably non single, and also for some non-resolved systems, the interpretation of the catalogue data requires some care. The following classification of the objects in terms of their separation ($\varrho$), magnitude difference ($\Delta Hp$), and orbital period ($P$) illustrates the categories of double and multiple systems that had to be accounted for:

(1) Effectively single systems:

(a) Close binaries with a maximum separation $\varrho$ below 1–2 mas, corresponding to the final astrometric precision, showed no detectable photocentre offsets, and the observations effectively yielded the position, proper motion and parallax of the system's barycentre, plus the combined magnitude of the system. Such systems, being undetectable as binaries, appear simply as unresolved single entries in the main catalogue.

(b) Wide pairs with a minimum $\varrho$ above some 30 arcsec, where only one component (at a time) was included in the instantaneous field of view. The separation is such that the components could be considered as 'non-interfering' (cf. the two-pointing doubles, 4b) and gave data for each target component as if it were a single object. Associated data do not appear in the Double and Multiple Systems Annex.

(2) Unresolved systems (separation $\varrho \sim$ 2–100 mas):

(a) Short-period binaries ($P <$ few months) presented the next lowest degree of complexity. The whole photocentric orbit was sampled, and the parallax and proper motions can be taken as referring to the barycentre of the system. (With a non-zero orbital eccentricity the position is however biased towards the apastron of the photocentric orbit). With increasing size of the photocentre orbit, there was an increasing departure between the observations and the single-star model, and many such cases fall within the 'stochastic' solution (see below).

(b) Intermediate-period binaries ($P \simeq$ 0.1 to 20 years), with $\varrho \geq$ 10 mas, may have a significantly non-linear motion of the photocentre. In the upper range of this interval a non-linear proper motion could sometimes be fitted, but the separation of the (curved) orbital from the (rectilinear) barycentric motion was generally impossible, except in the relatively few cases where a full Keplerian orbit could be determined for the photocentre. The parallax was usually correctly estimated, unless the orbital period happened to be close to one year.

(c) Long-period binaries ($P >$ 10 years), at a distance where the projected separation was below 0.1 arcsec, presented a more complex situation. The parallax could still be correctly determined, but the proper motion reflects a combination of the barycentric motion and an approximately linear orbital component, being therefore indistinguishable from a normal single-star solution. If the object was not known from an external source to be non-single, the Hipparcos proper motion is thus slightly biased, and this effect has to be taken into account when comparing classical 'long-term' proper motions with the 'short-term' Hipparcos values (S. Söderhjelm, 1985, *Astrophys. Space Sci.*, 110, 77).

(3) Systems with large magnitude difference ($\Delta Hp \geq 4$ mag):

When the secondary component was sufficiently faint that effectively only the primary component was observed, the situation is analogous to categories 2(a–c) above, depending on the period of the system.

(4) Resolved systems ($0.1 < \varrho < 30$ arcsec *and* $\Delta Hp < 4$ mag):

(a) When the separation was below some 10 arcsec, both components fell well within the sensitive area of the instantaneous field of view, and they were observed simultaneously. There was usually little problem in analysing the combined signal as the sum of two point-like components. To determine correct photometry, it was only necessary to know if the instantaneous field of view of the image dissector tube was pointed at the primary, at the geometric centre, or at the photocentre of the system. More than 90 per cent of the resolved double-star solutions belong to this category.

(b) When $10 < \varrho < 30$ arcsec, the two components were sometimes included as separate entries in the Hipparcos Input Catalogue. Such 'two-pointing doubles' were observed through sequential pointings of the image dissector tube instantaneous field of view at the two distinct component positions, but using normally the data from both pointings in a combined solution for the astrometric parameters. With one of the components always in the steep wing of the instantaneous field of view profile some degradation of the precision was inevitable in these solutions, especially for the photometry, but for most systems the results are nevertheless reliable.

(5) Multiple systems:

All the above cases can be generalised to more than two components. Apart from the relatively easy cases with three or more bright components within 10 arcsec, there were many borderline cases where more than one model could fit the data. Many known triple stars were assigned a reasonably good double-star solution by neglecting the faintest component or by treating two close components as one for simplicity, although a full triple-star model might have fitted the data even better. The interpretation of the astrometric results in such cases must be done on a case-by-case basis, but in most cases the system parallax is quite reliable and unambiguous.

(6) Variable double stars:

A small-amplitude variability of one or the other component is not uncommon, and has normally rather little influence on the derived astrometric parameters. At least within the NDAC Consortium, however, the double star detection and solution methods turned out to be unexpectedly sensitive to photometric variability, in the sense that a single variable star could sometimes result in a double star solution with large $\Delta Hp$. Many hundreds of such solutions were rejected when they were not confirmed by the FAST Consortium solutions. For large-amplitude variable doubles, very few solutions could be obtained with standard methods, and a re-analysis of the data using more elaborate methods may be worthwhile for some systems.

### 1.4.3. Presentation of Double and Multiple Star Data

The results on double and multiple stars have been collected into the Double and Multiple Systems Annex (Volume 10), which comprises five separate parts:

- Part C giving solutions for systems resolved into distinct components (categories 4 or 5 in the preceding section);
- Part G for unresolved systems (probably astrometric binaries) where more than five parameters were needed to characterise the non-linear motion of the photocentre (category 2b, with periods above some 5 years);
- Part O for the orbital systems, when the Hipparcos observations could be used to determine some or all of the Keplerian elements of the absolute orbit of the photocentre (category 2b);
- Part V for a small number of objects where the duplicity has been inferred by a photocentric motion caused by the variability of one of the components ('Variability-Induced Movers', category 6);
- Part X, 'stochastic solutions' for objects where none of the other models, nor a single-star solution, could be found consistent with the observations (any category).

Detailed descriptions of these parts are found in Section 2.3. The main Hipparcos Catalogue (Volumes 5–9) provides a concise summary of the general properties of double and multiple systems for each relevant entry (Fields H55–67), with more extensive details of the solutions provided in the printed annex (Volume 10), and in the machine-readable files.

Of the five parts of the Double and Multiple Systems Annex, Part C contains the largest number of solutions and also the largest variety of configurations and problem cases. This part provides the magnitude, position, proper motion, and parallax for each of the resolved components in a system (in the case of the two-pointing doubles the two components were considered as independent single stars, although the solution took into account the mutual disturbance of their signals due to the size of the instantaneous field of view). For a double star, this involved the simultaneous determination of 12 parameters. However in many cases, a better solution may have been derived when constrained to give equal parallaxes for the two components, in an 11-parameter solution. In other cases, all internal motions were neglected, resulting in a 9-parameter solution.

Considering the many possible configurations of resolved double and multiple stars, involving one or more entries in the main catalogue, it is unavoidable that the multiplicity information given in the main catalogue will in many cases be incomplete. A summary of the multiplicity status is in all cases given in Fields H55–61. In particular Field H59 contains a pointer to the relevant part of the Double and Multiple Systems Annex, where the complete data are found. Whether more detailed information is given in the main catalogue depends on the actual configuration of the resolved system.

If the entry itself was resolved by the satellite observations into *precisely* two components, a summary of the system geometry and photometry is included in Fields H62–67. Where the entry was resolved into three or more components, no attempt has been made to summarise the geometric or photometric information in the main printed catalogue and, for details of the system, reference to the annexes must be made.

Irrespective of whether or not an entry may have been resolved by the satellite observations, the entry itself may also be associated with one or more distinct, more widely separated components. Each such associated component may, or may not, have been observed separately by the satellite, and each may itself be double or multiple. No attempt was made to provide a summary of the geometric or photometric parameters of such a system in the main printed catalogue; but systems identified by their CCDM identifier (see Section 1.4.4), and whose components were observed by the satellite and jointly treated in the double-star reductions, are summarised in the Double and Multiple Systems Annex.

Depending on the precise geometry and photometry of the system, the astrometric and photometric data for an individual entry may be most meaningfully presented for a component of the system, or for the photocentre (or for one of the photocentres). This choice is found in Field H10 (for the astrometric data) and Field H48 (for the photometric data). Generally, for the astrometric data in the main catalogue, the photocentre is specified for component separations below about 0.30 arcsec (see Field H10), otherwise the primary is taken as the reference component. For the photometric data, photometry is presented according to the component separation as described in more detail under Field H48. Photometry is given for the combined system for objects with a single entry and with separations below 10 arcsec, for the primary component for separations larger than 10 arcsec, and for each component for all systems with two entries. For systems resolved into more than two components, the photometry in the main catalogue is not corrected for the detector's response profile, and the most complete information is contained in the Double and Multiple Systems Annex.

### 1.4.4. Hipparcos Catalogue Entries and Relationship to the CCDM

There are three levels of identification of a multiple system and its components in the Hipparcos Catalogue:

- the system identifier, based on the CCDM catalogue, which serves as the unique entry point to Part C of the Double and Multiple Systems Annex;
- the Hipparcos entry, according to which the main catalogue and all other annexes are organised;
- the component designation by upper-case letters (A, B, ...).

A system may be associated with one or several Hipparcos Catalogue entries, and each entry may correspond to one or several components according to the hierarchy of the system and to the separations between its components.

The definition of a Hipparcos Catalogue 'entry' depended on the separation of components, and has been influenced by the profile of the detector's instantaneous field of view. This is roughly 30 arcsec in diameter, with a flat central region, and more extended response wings (Figure 1.4.1). *A priori* known systems with components separated by less than 10 arcsec were considered as a single 'entry', or observing target, and the components were thus observed together. In terms of the pointing of the detector's sensitive area, either the photometric or geometric centre, or an individual component may have been targeted. For systems with components in the separation range 10–30 arcsec, observations were generally made by pointing the sensitive area of the detector to the various components individually, in order to adequately compensate for the rapidly changing response profile in its outer regions—these are referred to as two-pointing systems (see Figure 1.4.1).

The basis for much of the preparatory work associated with the observations and treatment of double and multiple systems was the CCDM, the Catalogue of Components of Double and Multiple Stars (J. Dommanget & O. Nys, 1994, *Comm. Obs. R. de Belg.*, Serie A No. 115; and available from the CDS, ref. I-211), including a subset of 34 031 definitely identified systems. The CCDM identifier is based upon the approximate equatorial coordinates of the system at epoch and equinox J2000.0. For previously known systems this identifier is taken from the CCDM catalogue. New systems identified from ground-based observations were updated until 1 January 1994 using, in particular, a pre-release version of the WDS (The Washington Catalogue of Visual Double Stars; C.E. Worley & G.G. Douglass, US Naval Observatory, Washington).

Newly-discovered double and multiple systems have been allocated new CCDM numbers as part of the continual updating of the CCDM catalogue, following the rules described in its introduction. The CCDM identifier plays a special role in the identification and cross-referencing of double and multiple systems, and also establishes a link between the components of systems not present in the Hipparcos Catalogue. It is therefore included within the main catalogue (Field H55) for all the systems with component solutions, irrespective of whether they were previously known or discovered from the Hipparcos observations, and for all the entries of double and multiple systems of the Hipparcos Input Catalogue for which no solution could be determined from the Hipparcos data.

Field H56 summarises the 'discovery status' of double and multiple systems, in the form of the three flags:

- H : double and multiple systems discovered by Hipparcos, and not identified in either the Hipparcos Input Catalogue, the CCDM, or the WDS;
- I : double and multiple systems identified using the CCDM during construction of the Hipparcos Input Catalogue, and recorded in its double and multiple star annex;
- M : systems identified between the preparation of the Input Catalogue and the completion of the Hipparcos observations. These are due either to the improvements of the CCDM (J. Dommanget & O. Nys, *Bulletin du CDS*, 46, 13 (1995) & 48, 19 (1996)), or to ground-based discoveries up to 1994.0, identified in more recently available catalogues and compilations, partially within the pre-release version of the WDS. The latter category also includes systems discovered by speckle interferometry, which were not included in the Hipparcos Input Catalogue.

Double or multiple systems, whether newly discovered by Hipparcos or not, should ideally have been allocated the component designations A, B, ... in order of decreasing brightness (increasing magnitude) or increasing angular separation from the primary. The differences in passbands, variability, rapid orbital motion with components of roughly equal magnitude, and errors, made such a scheme difficult to apply consistently. In any case, such a convention strictly applied to the Hipparcos double or multiple systems might be in conflict with systems previously measured by ground-based observers, not least because the component identification from ground-based observations depends on the angular separation as well as on the chronological order of discovery—hence one encounters complex designations reflecting the observing history of the system.

**Table 1.4.2.** Approximate number of entries considered in the double star processing by the reduction consortia FAST and NDAC. For each consortium the entries are divided into solved systems, systems detected as non-single but without a good solution, and entries considered as single stars ('undetected') but solved or detected by the other consortium. The total number of entries considered, 21 360, corresponds to the entries in Parts C, O and V of the Double and Multiple Systems Annex, plus those flagged as suspected non-single ('S' in Field H61).

| | FAST solved | FAST detected | FAST undetected | Total |
|---|---|---|---|---|
| NDAC solved | 12710 | 1030 | 2250 | 15990 |
| NDAC detected | 500 | 210 | 2190 | 2900 |
| NDAC undetected | 2310 | 160 | – | 2470 |
| Total | 15520 | 1400 | 4440 | 21360 |

The general principle adopted was to adhere as closely as possible to the previous identifications listed in the CCDM or in the literature. As a consequence, a newly-discovered wide component to a close pair AB may have been called C, even if it was brighter than B. A newly-discovered close component to component A of a normal wide pair AB might be called C, a, or P. Where this resulted in component B (for example) of a Hipparcos system being brighter than component A, B has been used as the reference component for the astrometric data (Field H10), to ensure that the values of $\Delta Hp$ (Field H66) is always positive. Cases where the component designation adopted here differs from that given in previous catalogues are unavoidable. For newly discovered systems the components have always been designated as A, B, ... in order of increasing Hipparcos magnitude.

### 1.4.5. Statistics of Observed Double and Multiple Systems

On the basis of the double and multiple systems contained in the CCDM, the Hipparcos Input Catalogue contained 15 966 related entries. These entries, each assigned a specific HIC number, were part of the 14 162 systems (11 427 double, 2735 multiple) for which one or more targets were observed by the satellite. Of these 12 411 were systems with one target (or entry); 1703 were systems with two targets; 43 were systems with three targets; and 5 were systems with four targets (note that these *a priori* observational configurations do not correspond to the final catalogue classification of double or multiple systems).

Of these Hipparcos Input Catalogue CCDM-classified systems, some 11 000 were initially estimated to be observably non-single by the satellite, the precise number being highly dependent on the exact limits for plausible solutions, and on the quality of the $\Delta Hp$-data. Even with later updates of the CCDM and the inclusion of WDS data, the number of entries in known double systems was never more than about 11 500 in 'single-pointing' and 2000 in 'two-pointing' systems. To this would be added some 1000 entries in known multiple systems, resulting in a total of some 14 500 *a priori* known entries.

In constructing the final Hipparcos Catalogue, double or multiple star solutions were sought for all these known systems, and the detector signals were carefully screened for possible signatures of 'new' double stars to be added to this list. The uncertainties inherent in the detection of binaries and the subsequent determination of the system parameters are illustrated by Table 1.4.2. Depending on the criteria for accepting an object as double or multiple, the number of systems in the Hipparcos Catalogue could have ranged between 10 000 (accepting only solutions where the consortia were in good agreement) and 19 000 (accepting all cases where at least some solution existed).

In the end a fairly conservative publication policy has been adopted. The solutions for many of the 14 162 previously known non-single systems observed by Hipparcos turned out to be not significantly better than single-star solutions, and the final number of resolved, known doubles (category 'I' or 'M' in Section 1.4.3) listed in the Hipparcos Catalogue is 10 210. Similarly, although some 15 000 'suspected non-singles' were initially selected and treated with double-star reduction methods by either FAST or NDAC, only 3001 new resolved doubles were finally fully 'accepted', with the remaining objects flagged in Field H61 as suspected doubles.

Part C of the Double and Multiple Systems Annex contains a total of 12 195 solutions. 12 005 of these are double star solutions, 182 are triple star solutions, and 8 are quadruple star solutions; the number of components is therefore 24 588.

The number of distinct entries in each part of the Hipparcos Double and Multiple Systems Annex is as follows: Part C: 13 211 entries; Part G: 2622 entries; Part O: 235 entries; Part V: 288 entries; Part X: 1561 entries.