

Thirty Fourth Meeting of the Hipparcos Science Team

Lund Observatory, 14–15 April 1994

Attendance:

HST: Dr U. Bastian, Prof. P.L. Bernacca, Dr M. Crézé, Prof. F. Donati, Dr M. Grenon, Prof. M. Grewing, Prof. E. Høg, Prof. J. Kovalevsky, Dr F. van Leeuwen, Dr L. Lindegren, Dr H. van der Marel, Dr F. Mignard, Mr C.A. Murray, Mr R.S. Le Poole, Dr H. Schrijver, Dr C. Turon

ESTEC: M.A.C. Perryman

Consortia: D.W. Evans, V. Makarov, C. Petersen, S. Söderhjelm

The agenda attached was adopted.

Actions agreed at the meeting are included at the end of the Minutes.

1. General Project Status

Perryman gave an overview of the overall project status (Annex I). Data analysis progress was excellent, although there was much work remaining to be done. Perryman outlined the status of the main mission reductions, referring to the excellent progress of the photometry, double star and reference frame working groups. The main schedule difficulties now arose from the activities associated with the catalogue publication (printed and CD-ROM versions) and associated documentation.

Schedule: the consortia are continuing to target completion of all mission products (or necessary preparatory work) by end 1995, with availability of these mission products at end 1996, thus: main catalogue (merged), annexes, TBD per cent of double stars, epoch photometry, definition of data products and data formats, catalogue introduction, 3-volume technical accompanying volumes, concepts for printed version, CD-ROM, inclusion within CDS data base. The revised schedule for TDAC involves catalogue finalisation 6 months after the main mission, i.e. mid 1996, with general data release mid-1997. This schedule should permit coordination of the data values appearing on the Tycho and HIP CD-ROMs, and preparation (but not distribution) of both data volumes on the time scales.

Further details of the recommendations of the Documentation Working Group, which met

on 13 April, are given under Item 12.

2. TDAC Progress

Høg reported on the overall TDAC status and schedule (see Item 1). Results of the T14-H30 astrometric comparison were presented and appeared satisfactory (Annex II). The comparison T30-H30 might be available within 2- 3 months. Makarov presented the status of the double star processing within TDAC (Annex II). There was no foreseen requirement for a double star annex to the Tycho Catalogue, in analogy with that of the main mission, since the double star components should each appear as entries in the final catalogue. The appearance of phantom doubles had been identified in the processing, and it seemed likely that these arose because of the presence of two corresponding components in prediction. Bastian presented the photometric status, and noted that the calibrated transits now exist in a chronological form ready for recalibration. Høg indicated that it was CUO's intention to provide a 3σ flag from astrometry within the photometric catalogue. The partitioning of data on the Tycho CD-ROM's was discussed, and the question of whether the faint star epoch photometry should eventually be published on CD-ROM, or (e.g., via Exabyte) at data centres (see Item 12).

Grenon presented his revised calibration of the Tycho standard, including considerations of the count rate correction, correction for binaries, and chromatic and reddening corrections. The faint standards would be available by end April. Grossmann was due to visit Geneva shortly in order to discuss the details of the implementation. A report would be issued by Grenon (Action 1).

Grenon outlined the importance of obtaining an estimate of a DC Tycho magnitude, in order that double stars (observed at different orientations) would not be confused as photometric variables. Høg would investigate the consequences of this proposal (Action 2).

3. NDAC Report

Van Leeuwen reported on the work at RGO. The final 6 months of satellite data was awaiting processing at RGO. Much effort had been devoted to the question of a better attitude modelling, leading to a better torque modelling (by a factor of two or so) due to proper treatment of the off-diagonal terms of the gravity gradient torques. Tapes should start being despatched to CUO by early May, with completion by end June. The NDAC 37-month solution could therefore be expected by the end of the summer. The CHF production for double stars would start subsequently.

Lindegren presented results of various studies conducted on the 30-month solution, especially: (i) a rejection of outliers had been introduced (now that the grid-step uncertainties had been eliminated), leading to some 4000 additional stars solved for; (ii) further studies

of the chromatic displacement versus $(V - I)$ led to a transformation versus $(V - I)$ which mirrored that expected from the photometric calibration (by Grenon), and future solutions could introduce effective wavelength as the dependent variable (where the chromatic displacement effect would then be expected to be linear); (iii) output summaries of the observation equations for each star could now be produced, leading to the facility of off-line interrogation and analysis (e.g. introduction of acceleration terms). These output summaries could be a starting point for the archiving of intermediate data quantities; (iv) the introduction of secular acceleration for stars with known and significant radial velocities; (v) the implementation of a new weighting scheme for the estimation of the abscissa errors as a function of H_p and time. This gave a much improved behaviour of the t_1 statistic.

4. FAST Report

Kovalevsky reported results of the FAST 37-month solution. Perryman noted that the completion of the first iteration of the full data solution took place less than one year after the final useful satellite data had been acquired, less than 8 months after the satellite operations had been terminated, and only some three months after the final data had been received from ESOC. Perryman and the HST congratulated the FAST consortium on this remarkable achievement, and asked that this message be conveyed to the other members of FAST.

Mignard reported on some details of the sphere solution. The 37-month solution consisted of 115 000 solved stars, 2252 RGCs, 3700871 observations, and 41721 primary stars. The revised 37-month photometry was expected between May-June, the preparation of the iterated 37-month solution would take place between April-June, and the first iteration could be expected by end September. Work had been carried out on the characterisation of the chromatic evolution, on the global unknowns, and on the abscissa error evaluation, giving a dependence of the form $\sigma_0 = (a + b * H)/(c + d * H)$.

5. Sphere Comparisons, etc

No further results on the sphere comparisons were available. FAST did not foresee inclusion of the radial velocity terms in the astrometric parameter determination (Action 3). The revised TDAC SSRF's were considered to have no impact on the main mission processing (attitude, etc). Perryman reported on the investigations into the FK5-HIP proper motion differences carried out by R. Wielen at ARI. There seemed good reason to consider that the comparisons might be influenced by the presence of undetected astrometric binaries. Further investigations were being carried out in FAST (Action 4).

Kovalevsky gave a summary of the preliminary results of the NDAC and FAST sphere solution differences, which were being investigated by M. Lattanzi.

6. Main Astrometric Catalogue Merging

Apart from the progress in both NDAC and FAST in characterising the abscissae errors more rigorously, no further intercomparisons had been carried out. Lindegren, Mignard and Murray would carry out further tests on the 30-month solutions, with preparations being made for a full comparison of the covariance matrices once the two 37-month sphere solutions become available in September (Action 5).

7. Global Sphere Solutions

Bernacca reported that, because of the lack of financial support, Globus was no longer being considered within Italy.

Kovalevsky reported that B. Bucciarelli would be carrying out tests in FAST later in the year using adjustment of the RGC poles during the sphere solution.

C. Petersen reported on the progress of an alternative sphere solution being studied in NDAC (see Annex III). A corresponding sphere solution may be available in June. HST were strongly supportive of this initiative, it being understood that even if no changes were found in the resulting errors, this would be further excellent confirmation of the behaviour of the present solutions. As proposed by C. Petersen, the attitude is adjusted frame-by-frame, independent of the RGC poles. Lindegren noted that this was more analogous to a plate-overlap solution, as originally advocated by Lacroute. By iterating between the star coordinates and the attitude, the approach should approximate to a global solution, and it may be expected that the systematic errors resulting from a correlation between the projections onto the RGCs may be reduced.

8. Double Star Working Group Report

Mignard reported on the results from the Double Star Working Group Meeting on 11 March in Bruxelles. The format for the printed catalogue had been discussed in detail, and numerous suggestions made. A first proposal for the format of the double star annex (printed and machine-readable) had been prepared by Lindegren. Söderhjelm gave some results of his investigations into double star photometry and stressed the importance of solving for the photometry within the double star task (Annex IV).

9. Photometry Working Group Report

D. Evans reported on the status after the fourth meeting held on 10 March in Bruxelles (Annex V). The main problem perceived was the merging of the epoch photometry from

FAST and NDAC. Grenon outlined the present status of the plans for a photometric annex to the final printed catalogue (Annex VI), and a more definitive proposal would be made before the next PWG meeting (Action 6).

10. Report from Reference Frame Working Group

Kovalevsky reported on the status of the activities following the meeting of the group in Hamburg on 30 March (Annex VII). The meeting had been very positive. Kovalevsky proposed that activities in all identified areas should be continued. The use of the H30 parameters for the various groups was agreed in principle, and should be made available shortly (via C. Turon) so that the next tests could be carried out before the end of the year, in time for the next meeting (Grasse, 15 February 1995).

Concerning data distribution, Perryman noted that all data distribution should be made by C. Turon, who was keeping a record of which data are distributed to whom. NDAC and FAST data should not be made available separately, although this policy may require that Lindegren or Kovalevsky make available additional information on double star data, particularly to the VLBI group. Before any future data distribution to the RFWG participants, the data lists should be approved by Turon, Kovalevsky & Perryman. For the record, Perryman recalled that all RFWG participants had received only the 18-month solutions. However, the VLBI and Lick groups had received the 30-month data, in addition, by virtue of their approved A& A papers.

Kovalevsky expressed concern that the second epoch VLA observations had not been approved (Perryman to investigate what might be done, Action 7). Kovalevsky also expressed concern that the preliminary VLBI results had not been passed to the Hipparcos project, at the same time that the preliminary Hipparcos results had been communicated to the VLBI group; he had no explanation for this, even though he had firmly requested these data (Perryman to investigate, Action 8).

Specifically, 30-month data should go to all groups in the table in Annex VII, with the following exceptions: (i) the Kiev data will not be distributed until recommended by Kovalevsky (i.e., until we have visibility that proper use may be made of the data); (ii) data for the HST link will be provided once the Hipparcos team has adequate visibility of the FGS observation list, and FGS reduction and calibration status (in particular, until the scale calibration is performed later this year, the Hipparcos data cannot be used by the link programme); (iii) no further information will be distributed to the VLBI group (in particular, double star data) until clarification of the data exchange policy of the VLBI group had been received.

A further point of concern related to the list of stars submitted by Hemenway for access to early Hipparcos data. Turon noted that some objects on this list were contained neither in the VLBI list, nor in the HST-FGS list (Perryman & Turon to investigate, Action 9).

L. Morrison had requested certain data related to the EGO link programme. Kovalevsky would contact Morrison, and establish what data were required, and authorise if appropriate (Action 10).

11. Results Data Base

Schrijver reported on the progress of the results data base. The disc had only been available for about two weeks, but the following data had already been implemented (and the software was working well): HIC (complete, including Annex 1, but excluding cross-identifications); ground-based parallaxes (USNO and Allegheny); Mk III; FAST (single stars from 18 and 30 month solutions); NDAC (ditto); merged solution (ditto).

Items awaited included: cross-identifications (awaiting some clarifications from INCA); VLBI results (see above); definitions and agreements on the type of data to be included in the area of double stars and photometry.

The definition document was evolving, and available to those requesting it. A User Manual was in preparation. User interface was via SQL.

The following items were discussed, and would be reflected on before the next meeting (Action 11):

(i) notes: the results data base was the obvious location to accumulate notes on objects for eventual publication. e.g. incorrect star observed. Should include name and date of person.

(ii) cross-identification updates: these should be maintained in the data base. Grenon recommended a periodic (not continuous update), and the HIC number, previous id, new id, and other details should be included. Turon and Schrijver to reflect on the mechanism needed for these updates, and whether a coherent policy with respect to the CDS was needed.

(iii) Tycho: Høg would communicate the forthcoming astrometric solution which would include all five astrometric parameters per star.

(iv) HIC/IC numbers; the situation had not been entirely clarified (Morin, Schrijver, and Lindegren all having different assessments). At the end, Schrijver would have to filter the final NDAC and FAST data to ensure that no redundancies remain, and that all data pertaining to the same star (.e.g in the case of different IC numbers for those objects where the magnitude was revised) are taken together.

(v) facilities for sphere plots (NDAC-FAST differences, etc) were being investigated by Schrijver.

(vi) backup and security was discussed and considered satisfactory. Access to *bona fide*

authorised users (e.g. the three consortia leaders) could be considered. Only Schrijver would have authority to write to the data base.

(vii) relevant persons should reflect on whether the full epoch photometry is to be contained (and validated) within the results data base (Action 12).

12. Documentation Working Group Activities

There was extensive discussion of the printed catalogue format (including annexes), the CD-ROM preparation, data subdivision, and statement of work, and the final project documentation, both during the Documentation Working Group meeting, and also during the HST meeting itself. Numerous ideas had been forthcoming, and the present approach is summarised in Annex VIII. Perryman underlined his perception of the importance and urgency of getting these formats under control. Advice on the approach to be taken for the target CD-ROM software environment and target platforms was invited. Various related actions are collected under Action 13.

13. Minor Planet Status in NDAC/FAST

Mignard gave a report on the work being carried out in FAST, and on the publication options (Annex IX). Lindegren noted that a student had been working on these data in Lund, a report would be distributed in due course.

14. Miscellaneous

(a) A& A Papers: the status of the papers was reviewed. A revised schedule was adopted, and plans agreed for the reviewing and submission of the papers (Action 14, Action 15). Perryman would make a proposal for two reviewers for each paper. Individual HST members would inform Perryman if they wished to receive a draft of any given paper; in the absence of this information, only the identified reviewers would receive the draft paper.

(b) Feedback from Meudon DDRT meeting: two proposers had written to Perryman expressing their concerns at the outcome of the review of their proposals. After extensive discussion, it was agreed unanimously that Preston's proposal should be accepted in its reduced form, while Lattanzi's proposal could not be accepted because of overlap with the goals of the INCA Survey proposal. Perryman would write to each proposer accordingly (Action 16).

(c) Confirmation of data distribution policy: Perryman noted that the internally imposed schedule for catalogue completions was considered an important target to maintain. However, delays to the schedule would be considered if the scientific quality of the mission results would be compromised. In advance of final catalogue distribution, the HST remains

unanimously opposed to the distribution of preliminary data, because of the damage to the project which would be created by diffusing incorrect and misleading results into the scientific literature.

(d) Intermediate data file archiving: the requirements were discussed during the Documentation Working Group meeting. Proposals will be made independently by FAST and NDAC (Action 17).

(e) Key programmes: there was limited support for Perryman's proposal for the coordination of Key Programmes to exploit the final data, and considerable opposition on the grounds that it would be largely unworkable and excessively complex in practice. Although Perryman considered that such coordination would undoubtedly be in the best (at least short-term) interests of the project as a whole, this would be impossible in the absence of greater conviction on the part of other HST members that it was a valuable way to proceed. The idea of project-wide Key Programmes was therefore dropped, although the INCA Key Programmes would be unaffected by this. Grenon proposed, and there was no opposition to the idea, that individuals who wished could submit their names for inclusion in investigations that had been considered as possible Key Programmes at the Meudon DDRT meeting.

(f) IAU General Assembly plans: Kovalevsky presented the status of the organisation of IAU Symposium 166, devoted to milli-arcsec astrometry. The programme was close to finalisation

(g) Project completion conference/ceremony: Perryman outlined his ideas for a scientific conference to be held within 2-3 months after the final data release (see Annex I). If the Tycho data release was still 6 months after the main mission data release, this would still not be considered as a reason for delaying such a meeting. HST members were invited to reflect on the location of such a meeting (Action 18), and whether it should be an ESA ESLAB meeting (in which case, its location at ESTEC might be preferred by ESA).

(h) INCA CD-ROM: a prototype was demonstrated during the meeting by C. Turon. Perryman had used it for a day, and given comments. Final testing would be undertaken by Mignard.

(i) Convention for milli-arcsec: the wisdom of selecting a preferred convention for the abbreviation of this quantity was discussed, given the importance that it might assume in the future. Options available were milli- arcsec, mas, arc ms. Kovalevsky had proposed to the IAU that 'as' be a recommended abbreviation for arcsec, it following that 'mas' would be used. Bastian noted the awkwardness of the appearance of 'as' in English. HST would reflect on this (Action 19).

(j) Horizon 2000+: Perryman noted that the survey committee was in the process of producing a report. S. Beckwith had had contact with Lindegren, and the feeling was that astrometry might well be represented within the future ESA programme in some form.

(k) Data despatch from Meudon: Turon gave a summary of the data that had been distributed from Meudon (Annex X). Perryman stressed the importance of maintaining a formal distribution system for all data in the future, along these lines.

(l) Proxima Centauri: F. Benedict had proposed the exchange of data from FGS and Hipparcos on the parallax and p.m. of this object. HST agreed that any external check was valuable in principle, but there was some debate about the possible reliability of FGS parallaxes and p.m. (given the problem of relative measurements. Lindegren would investigate further, and if the data exchange seemed appropriate, HST would be satisfied to proceed with an exchange, it being understood that a discussion of any resulting publications would only be considered after results had been considered by the HST members (Action 20).

15. Next Meetings

HST: The 35th meeting of the HST will be held on ⁵⁻⁶~~6-7~~ October 1994, at CERGA, at the invitation of Mignard and Kovalevsky. A meeting of the documentation working group will be held on the previous day (⁵October). Perryman noted that all interested HST members were invited to participate in this meeting.

Dates arranged for other meetings were as follows: (i) DSWG Meeting, 7 July 1994, Geneva; (ii) PWG Meeting, 8 July, Geneva.

M.A.C. Perryman, 15 April 1994

Distribution: HST, DRC Participants, A. Wicenec, J.L. Halbwachs

Actions

- 34.1 Grenon to circulate report on updated Tycho photometric calibration.
- ✓ 34.2 Høg to investigate inclusion of Tycho dc magnitude. *Could not be done within work plan.*
- ✓ 34.3 Mignard to consider inclusion of radial velocities in FAST sphere solution.
- 34.4 Kovalevsky to report on FAST's continued investigations into astrometric binaries as cause of discrepancy between Hipparcos and FK5 proper motions.
- ✓ 34.5 Lindegren/Mignard/Murray to pursue investigations into catalogue merging through 30-month sphere solution tests, and 37-month sphere solution experiments.
- ✓ 34.6 Grenon to propose detailed form of printed photometric annex by next PWG.
- ✓ 34.7 Perryman to investigate possibility of further VLA link observations. *MAAD sent letter to Johnston*
- ✓ 34.8 Perryman to investigate availability of provisional VLBI data for link. *✓ with CT+JK*
- ✓ 34.9 Turon/Perryman to investigate detailed link list requested by Hemenway. *data sent*
- ✓ 34.10 Kovalevsky to recommend if preliminary data are needed by L. Morrison for the EGO selection. *data sent*
- ✓ 34.11 Schrijver to consider aspects of the Results Data Base discussed at the meeting (Item 11).
- ✓ 34.12 Schrijver/Evans/Perryman to reflect on whether results data base will also include the Hipparcos epoch photometry.
- ✓ 34.13 Related to Documentation Working Group: (i) van der Marel and Peterson to provide guidance on platform and s/w environment for the CD-ROM; (ii) Grenon to provide definition of the printed photometric annex (see also Action 6); (iii) Evans/Perryman to update proposal for photometric annex to machine-readable data base, and which of these data are to be included on the CD-ROM; (iv) Mignard/Linderen/Perryman to make proposal for intermediate astrometric data to be included within the Hipparcos archive (see also Action 17).
- ✓ 34.14 HST members to provide revised papers for A&A by end July.
- ✓ 34.15 Perryman to propose reviewers for A&A papers. HST members to communicate to Perryman which of the papers they wished to see in addition.
- ✓ 34.16 Perryman to communicate HST disposition on proposal recommendations to Preston and Lattanzi.

- / 34.17 Lindegren and Mignard to propose details of intermediate astrometric data archiving.
- / 34.18 All to reflect on location of the final Hipparcos symposium/ceremony.
- / 34.19 All to reflect on convention to be proposed for an abbreviation of milli- arcsec.
- / 34.20 Lindegren/Perryman to take up exchange of data on Proxima Centauri with F. Benedict.

From Previous Meeting

- ∫ 33.7 Grenon to provide λ_{eff} versus (V-I) index (15 November).
- 33.13 Bastian/Høg/Grewing/Grenon to consider applicability of the mass processing approach to variable star analysis for the Tycho data (as being proposed by Geneva for the main mission).

Thirty Fourth Meeting
of the
HIPPARCOS SCIENCE TEAM

Lund Observatory

14-15 April 1994

Start of meeting: 09.00 (14 April)

AGENDA

1. Overview of progress and problem areas (Perryman)
2. TDAC progress report and schedule (Hoeg/Makarov*)
 - Tycho astrometry, and comparison with NDAC sphere solution
 - light curves/double stars
3. NDAC final sphere solution, related studies, major problems (Lindegren)
4. FAST final sphere solution, related studies, major problems (Kovalevsky)
5. NDAC/FAST sphere comparisons (Lindegren/Mignard/Kovalevsky)
 - new SSRFs, radial velocities, astrometric binaries, chromaticity
6. Main astrometric catalogue merging: results and plans (Murray)
7. Report on the global sphere solution in NDAC (C. Petersen*)
8. Report from Double Star Working Group (Mignard)
 - progress in NDAC (Lindegren/Soderhjelm*) and FAST (Kovalevsky/Mignard)
 - results of comparison activities
 - status of ground-based preparatory programmes
 - problem areas and future plans
9. Report from Photometry Working Group (D. Evans*)
 - plans for Hipparcos/Tycho light curve analysis (Grenon/van Leeuwen)
 - problem areas and future plans
10. Report from Reference Frame Working Group and future schedule (Kovalevsky)
11. Results data base activities (Schrijver)
12. Report of Documentation Working Group (Perryman)
 - printed catalogue contents/formats for main catalogue (Perryman)
 - printed double star annex (Lindegren)
 - printed variable stars annex (Grenon)
 - status of CD-ROM preparations (HIC - Turon/HIP - Perryman)
 - status of final documentation: Volumes I-III
13. Minor planet status in FAST/NDAC (Mignard/Lindegren)
14. Miscellaneous:
 - status and review of papers for A&A 1994 issue
 - feedback from Meudon DDRT meeting
 - status of ad hoc/Form B/TDAC internal proposals***
 - confirmation of policy on data distribution
 - intermediate data file archiving (Mignard)
 - Key Programmes**
 - IAU General Assembly plans
 - ESLAB Symposium, February 1997: and project completion ceremony
 - next HST meeting: date and place

* invited participants

** I propose to drop this concept due to lack of support

*** to carry forward to next meeting

Documentation Working Group Meeting

Lund Observatory

Wednesday 13 ~~March~~, 09:00 - 17:00

~~Ap.1~~

Agenda

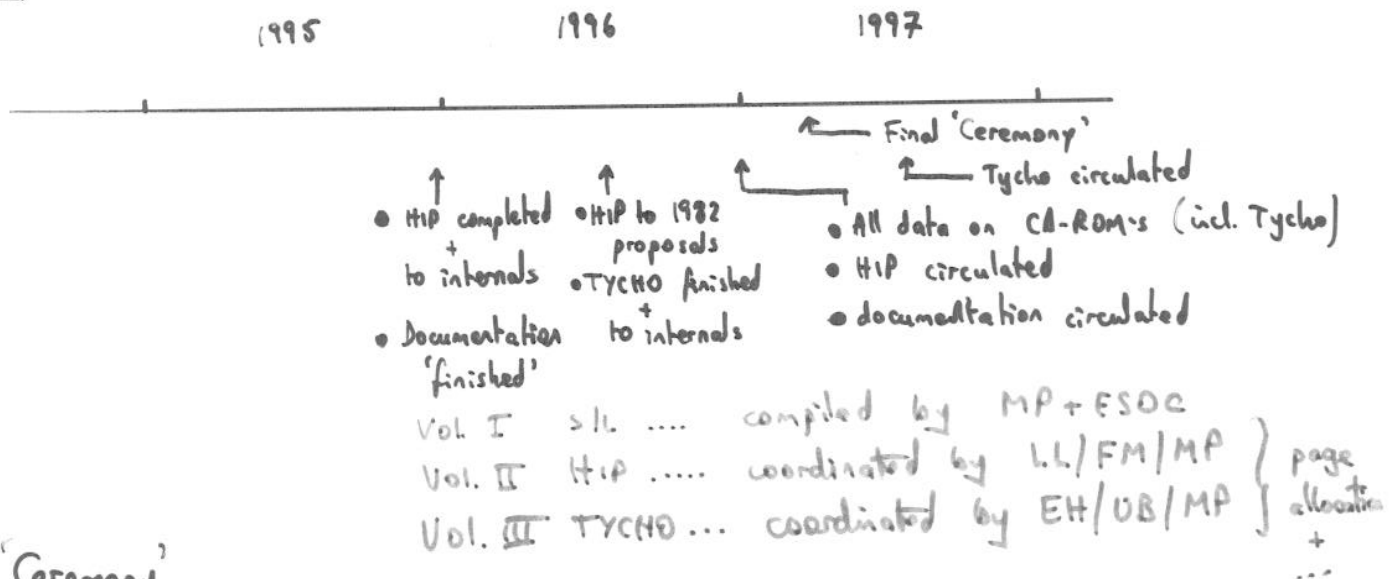
1. The CD-ROM development:
 - statement of work (Version 3 is available from MP)
 - proposed data content
 - progress
 - documentation
 - schedule
 - logistics of mastering, production, distribution
 - inter-relationship of HIP and TYCHO CD-ROMS:
 - relative schedule
 - definitive BT, BT, BT-VT
 - inclusion of BT, VT, lightcurves on HIP CD-ROM
2. The printed Hipparcos Catalogue:
 - present status of the main catalogue, problems, future drafts (Version 4 has been distributed by MP)
 - draft of the double star annex (LL)
 - draft contents of variable star catalogue (MG)
 - policy for finding charts (cf INCA, and clusters, LMC/SMC)
 - logistics of production and distribution, and schedule
 - cover design
 - distribution policy and address lists
3. The machine-readable versions of Hipparcos and Tycho Catalogues:
 - contents, formats and specifications
 - specification of main catalogue data
 - specification of covariance data
 - specification of double star data
 - specification of photometric data
 - relationship between printed, magnetic tape and CD-ROM versions:
 - inclusion of INCA data
 - inclusion of radial velocities
 - inclusion of ecliptic/galactic coordinates
 - logistics of production, packaging, documentation
 - distribution policy and address lists
4. The status of the SP documentation (Volumes I-III):
 - contents
 - overall schedule
 - cover design
 - distribution policy and address lists

Goals: The goals of the DWG Meeting are to review the status of all documentation planned for the project, and ensure its proper completion by 31 December 1995.

Attendance: Perryman, Bernacca, van Leeuwen, Lindegren, Mignard, Schrijver, Turon, Hoeg (TBC), Kovalevsky (TBC).

34th HST, LUNDInternal Proposals, etc

- Results circulated to PI's early January
- two cases to be re-considered today
- ad hoc, Tycho + Form B's ... to next meeting

ScheduleFinal 'Ceremony'

- Combine scientific conference (internal + 1982 results)
- + Presentation of data / databases to community
- + Release of data + documentation - " -
- + Project completion ceremony (industry, consortia, ESA, ESOC, ...)

Time: March 1997 ?

Location: TBC

Data Analysis

14-15 April
1994

Final sphere solutions : ongoing in NOAC and FAST

(new SSRFs from TOAC?
global sphere solution studies in NOAC)

Sphere comparisons:

- includes new analyses by M. Lattanzi
- FK5 proper motions studied wrt Hipparcos by ARI (Wielen) \Rightarrow differences may indicate a significant fraction of undetected binaries

Excellent progress in:

- Tycho processing (astrometry & photometry)
- double stars working group
- photometry working group
- reference frame working group
- results data base starting up.

One outstanding problem area:

DEFINITION OF CONTENTS & FORMATS OF
FINAL DATA PRODUCTS

(and consequences for printed catalogues & introductions
+
CD-ROM and interrogation software).

Tycho double stars

Sep. > 3 arcsec

Normally should be resolved by Recognition
 ⇒ separate entries in TICR,
 independent solution in the main
 processing

Sep. < 3 arcsec

Not resolved by Recognition
 ⇒ single entries in TICR
 ⇒ specific problems in
 Detection, Astrometry, and
 Photometry

Special treatment of close double stars:

Known double stars: 14 237
 stars in TICU correspond to
 ~ 13 234 double stars,
 provided by J.-L. Halbwachs
 with $0.35 < \text{Sep.} < 3.0 \text{ arcsec}$

Suspected new double stars

- 1) 797 selected astrometry outliers
 from T17b, with abnormally large
 normalized residuals
 ~ 400 of them could be new doubles
- 2) Double-peaked stars in Detection
 (a special processing by K. Wagner,
 Tuebingen)

TICU, Reprocessing

TDsolve: treatment in astrometry, based on identified transits
 after Reprocessing

– within the time schedule?

output: separations (in the range $1.0 \div 3.0 \text{ arcsec}$ only)

PA – for use in Tycho Photometry

T_a – astrometry magnitudes for both components

new entries in TC

Two-peak astrometry analysis, based on raw counts

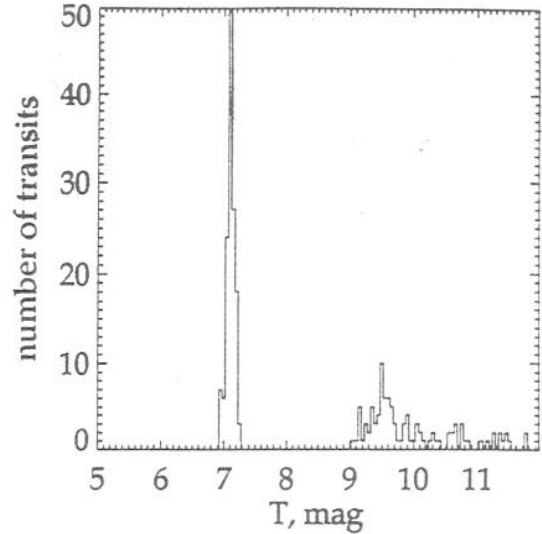
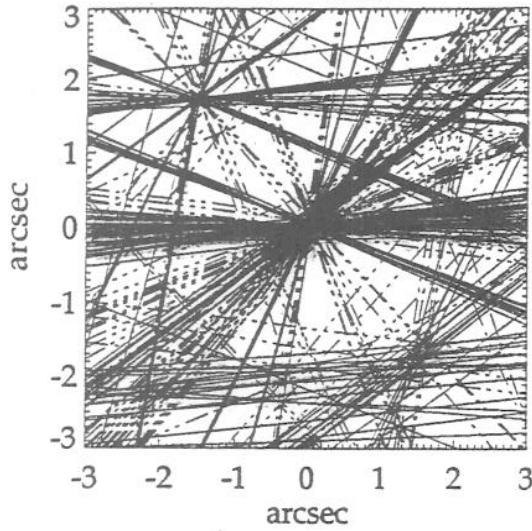
– out of the time schedule

output: relative positions

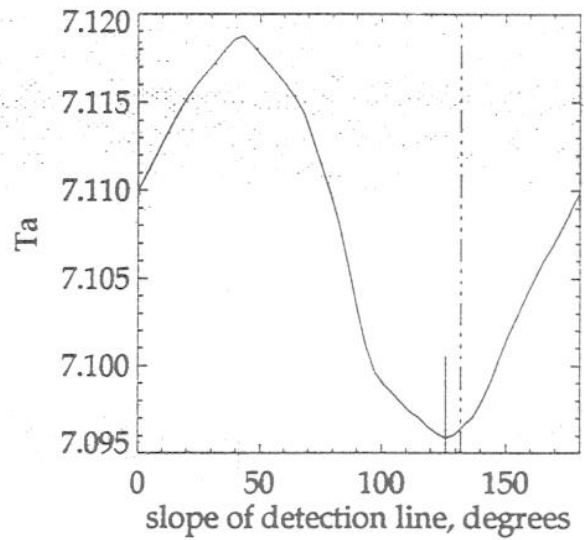
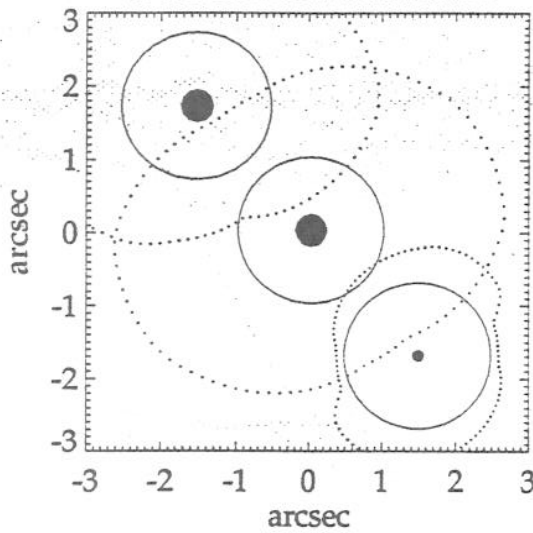
selection of transits for different components, for use
 in Photometry

Verification

Star 1333



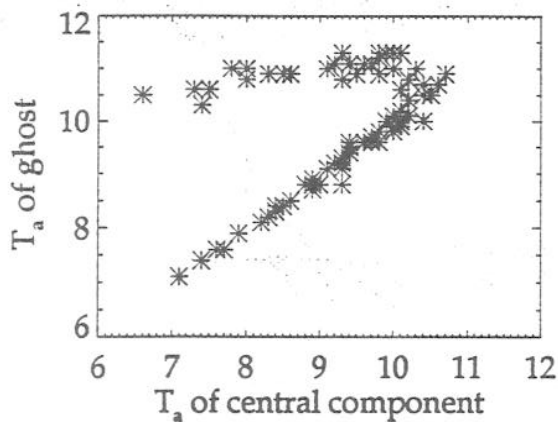
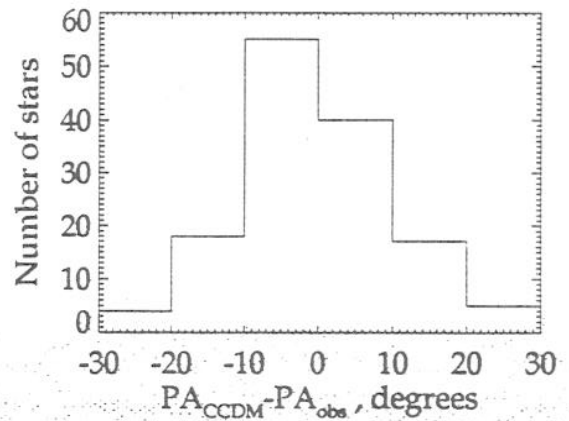
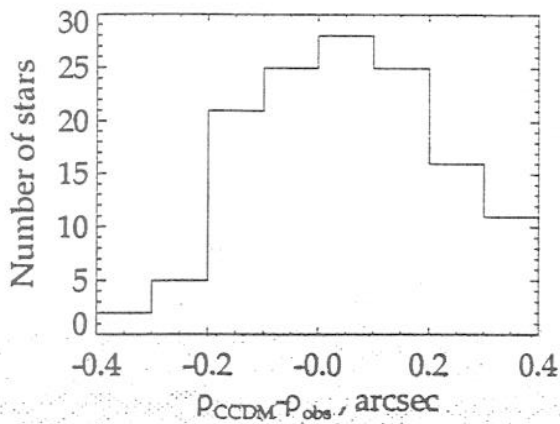
Normalized residuals



TDSolve

Hipparcos star 1333

- 1) upper left: map of detection lines on the sky
- 2) upper right: distribution of identified transits on T magnitude
- 3) lower left: position of resolved components, their brightness, and projected normalized residuals
- 4) lower right: mean projected T magnitude as function of PA. ± 6 error bar is shown at the minimum, that indicates the initial estimated PA. Dashed line indicates the true PA.



Tentative double star analysis from 14 months data:

1276 CCDM stars were examined with $\rho < 3$ arcsec

441 of them had a priori $\rho > 1.1''$

533 obtained solutions of duplicity

143 of the 533 were successful, i.e. $|\Delta\rho| \leq 0.4$ arcsec,
 $|\Delta PA| \leq 30^\circ$,

see upper diagrams

88 of the 143 showed ghosts, see Lower diagram

390 = 533 - 143 false components

Percentage of successful resolutions among stars with $\rho \geq 1.5''$ - 41%

$\rho = 1.5$ arcsec is a practical limit for the astrometry double star treatment

~s TDAC time schedule
To TDAC on 25 Oct, and (Creze, Turon, Genou, Le Poole

TDAC time schedule

TD227

E. Hoeg 27 Aug 1993 Issue #1, agreed with UB VG AW VM
25 Oct 1993 Issue #2, agreed by TDAC on 7 Sep 93
and slightly revised at *.

A schedule is given as required for completing the TC by end of 1995.
All explanations may be found in the task description TD226.

The invisible problems are that time will be needed to verify
results and to redo something, and also the unexpected events
which are likely to happen in any period of a few years.

The schedules given for Transit Identification and Photometry assume
that only the present computer resources are available at AIT
furtheron, which run at 3 times the real speed of observations.
A system running 10 times faster than real speed is desirable and has
been available for a test period.

The schedule for astrometry makes the (realistic*) assumption that a
faster AIT computer becomes available quite soon (in fact Oct.93*)
so that Transit Identification can be finished by June 1994.

Sep - Dec 1993

Prediction:

Redo first 3* months of Nominal Mission
Run the remaining about 6 months of mission

Detection:

Redo first 3* months of Nominal Mission
Run the remaining about 6 months of mission

Attitude:

Run the remaining about 6 months of mission

Updating:

Run the remaining about 6 months of mission

Transit Identification:

in the best case up to NM month no. 12

Photometry:

Preliminary and Final Photometric Calibration
Photometric Reduction: SSSC generation

Astrometry:

- ✓ Implement Ta magnitude in SCC;
- ✓ Magnitude calibration - get parameters from AIT
- Tests with 6 months of data from DSH+DSI:
- Calibration,
- ✓ SCCs with hexagon points

} - June 94 ?

} May 94 ?

SSSC = Standard and Selected Star Catalogue

SCC = Star Constants Cat

----- End of semester -----

Jan - Jun 1994

Prediction:

First Reprocessing

Detection:

First Reprocessing, perhaps not full completion by June

} - Aug 94 ?

Updating:

Run the remaining part of mission

Transit Identification:

in the best case up to NM month no. 30

April 94

Photometry:

Preliminary and Final Photometric Calibration
(including reprocessed stars)

*PSTC = Photometric
Star and Transit Cat.*

Photometric Reduction: SSSC generation
start of PSTC generation

Astrometry - supposing a faster computer at AIT than the present:

SCC of TIGR and analysis of component significance

Tycho Catalogue Generation, including TPMC from AIT

*TPMC = Tycho Photometric
Mean value Cat.*

Get cross-ids to TIGR from CDS

----- End of semester -----

Jul - Dec 1994

Transit Identification:

Run the remaining part of mission

Photometry:

Final Photometric Calibration (including reprocessed stars)

Photometric Reduction : finish SSSC
PSTC generation

- send a first TPMC (mean values) to CUO

- Dec 94 ?

Astrometry:

SCC of TICU and analysis of component significance

Tycho Catalogue Generation, including TPMC from AIT

Solar system objects

----- End of semester -----

Jan - Jun 1995

Photometry:

Photometric Reduction: remaining PSTC generation

Astrometry:

Tycho Catalogue Generation, including TPMC from AIT

Merging of TC.R and TC.U, including cross-id to TIGR from CDS

TC = Tycho Cat.

----- End of semester -----

Jul - Dec 1995

Photometry:

Generation of TPOC of individual observations, including solar system
Verifications

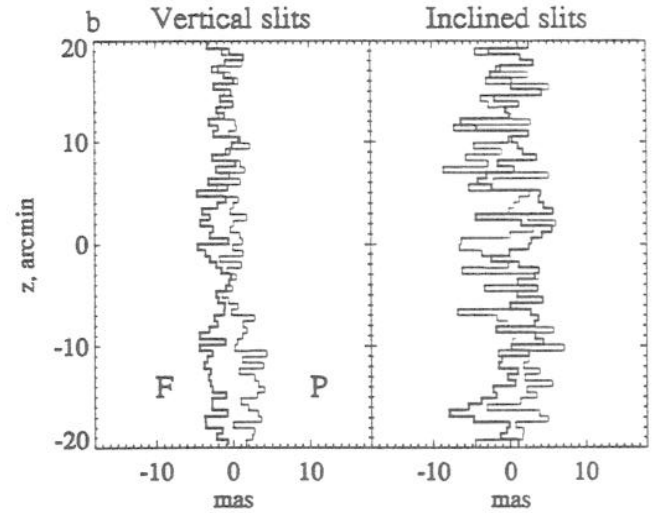
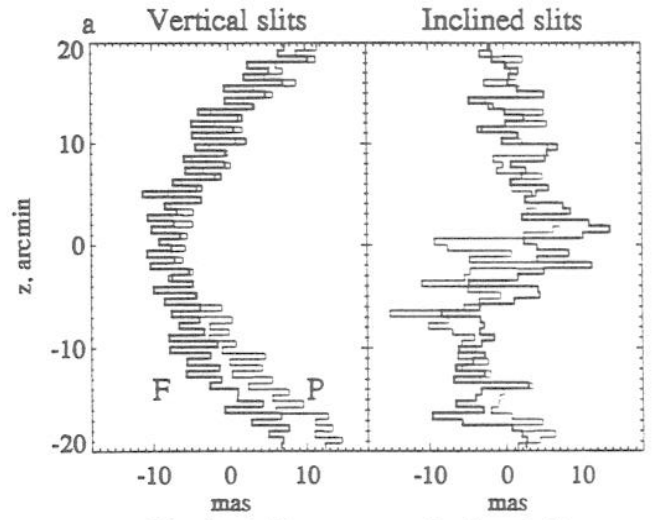
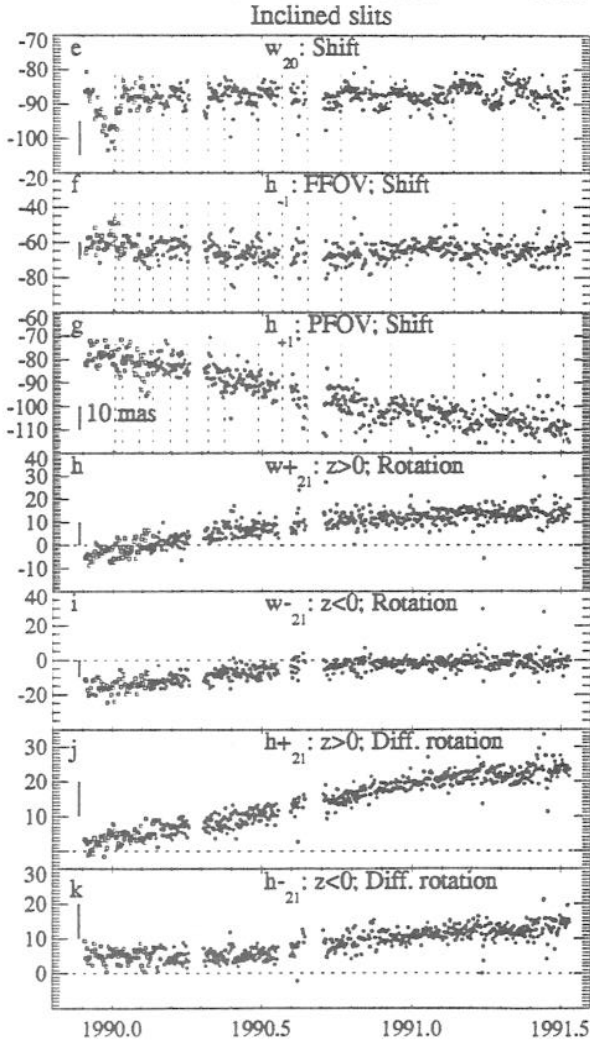
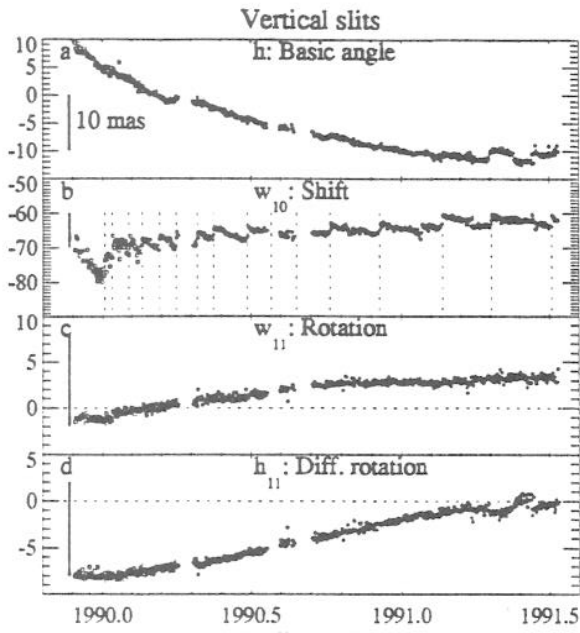
*TPOC = Tycho Photometric
Observation Cat. for ESA*

Astrometry:

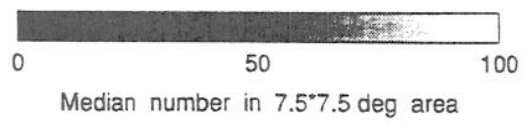
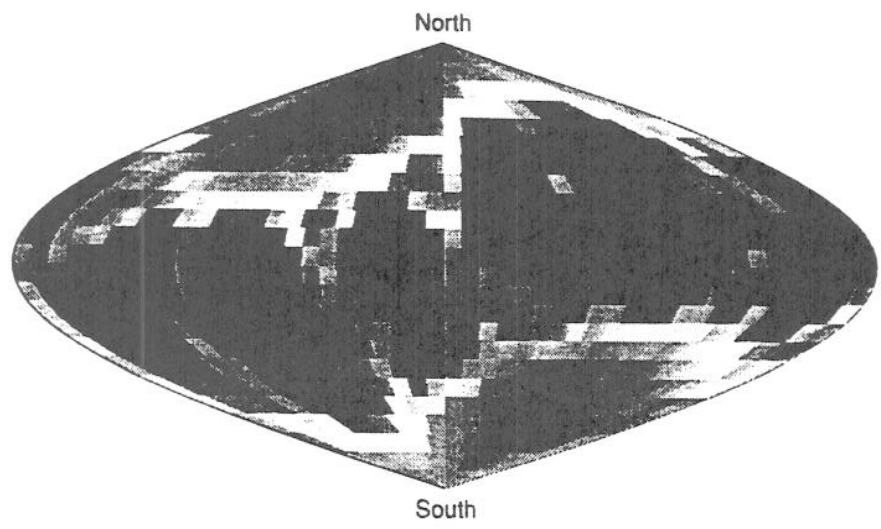
Rotation to the final Hipparcos reference system

Verifications

----- End of report -----



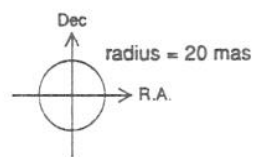
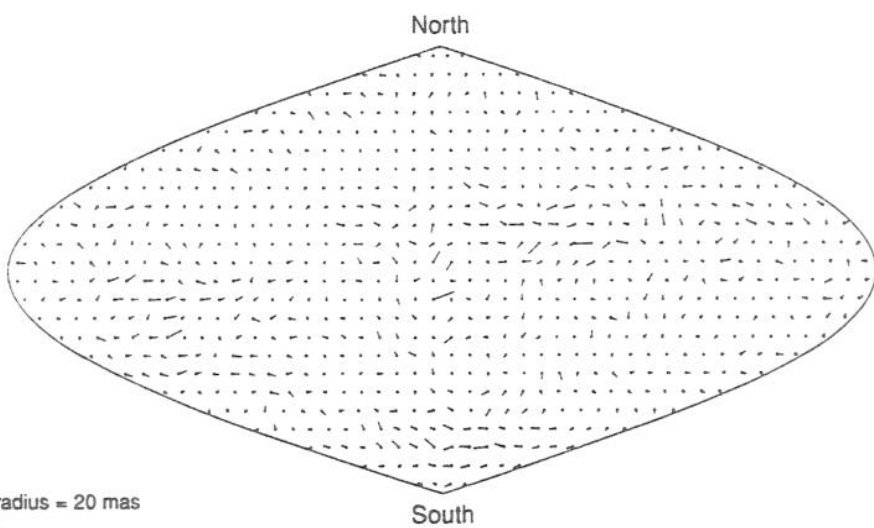
Number of ~~stars~~ ^{per star} per observation (in T14)



ndac

1994 Feb 28

Position Differences T14 - H30 (1990.6)



Equatorial projection; R.A. = -180 to 180 left to right

ndac

Median values in 7.5*7.5 deg areas

1994 Feb 17

T14-H30 positions

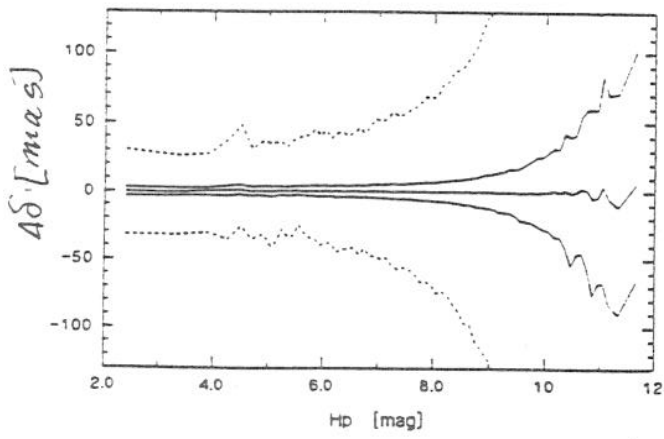
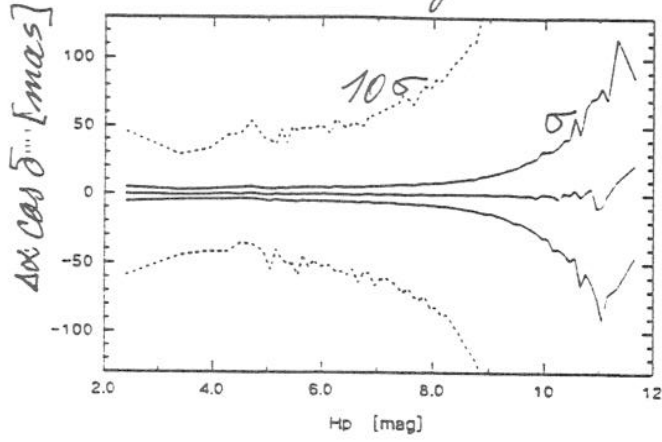


Fig. 6

Normalized
T14-H30/σ

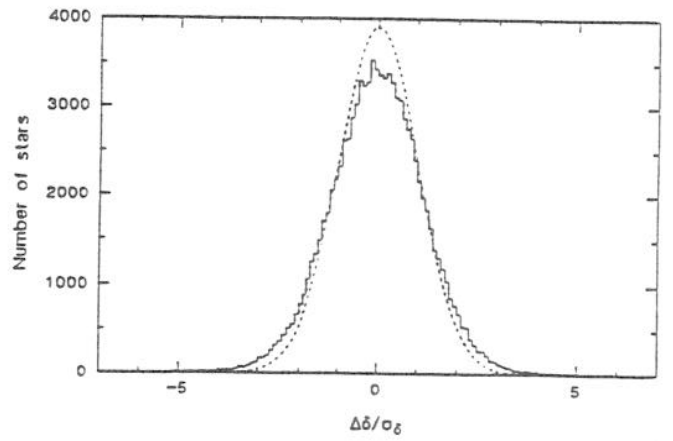
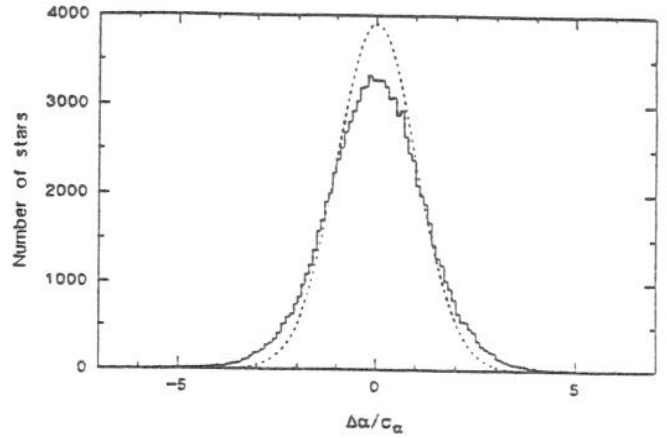
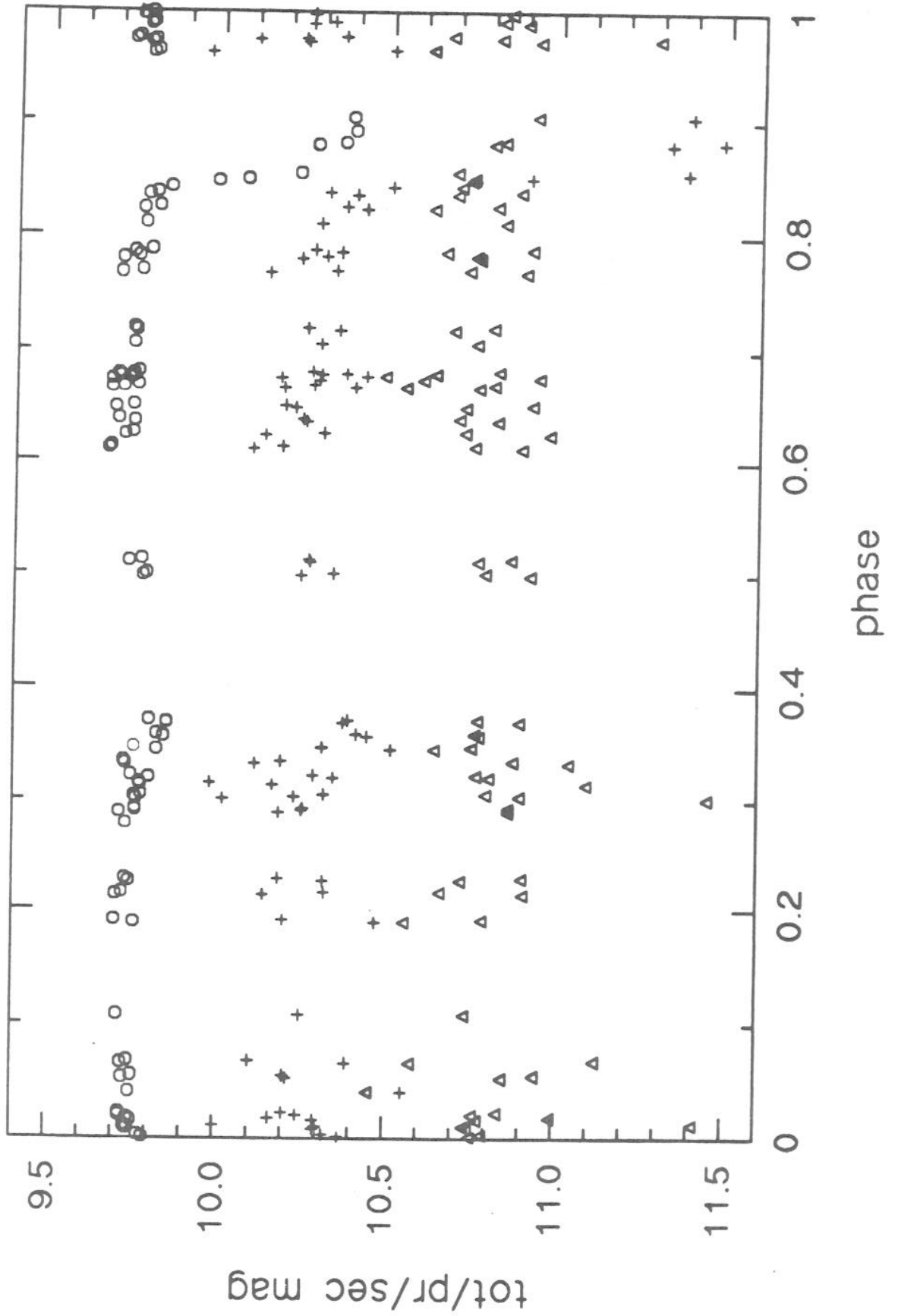
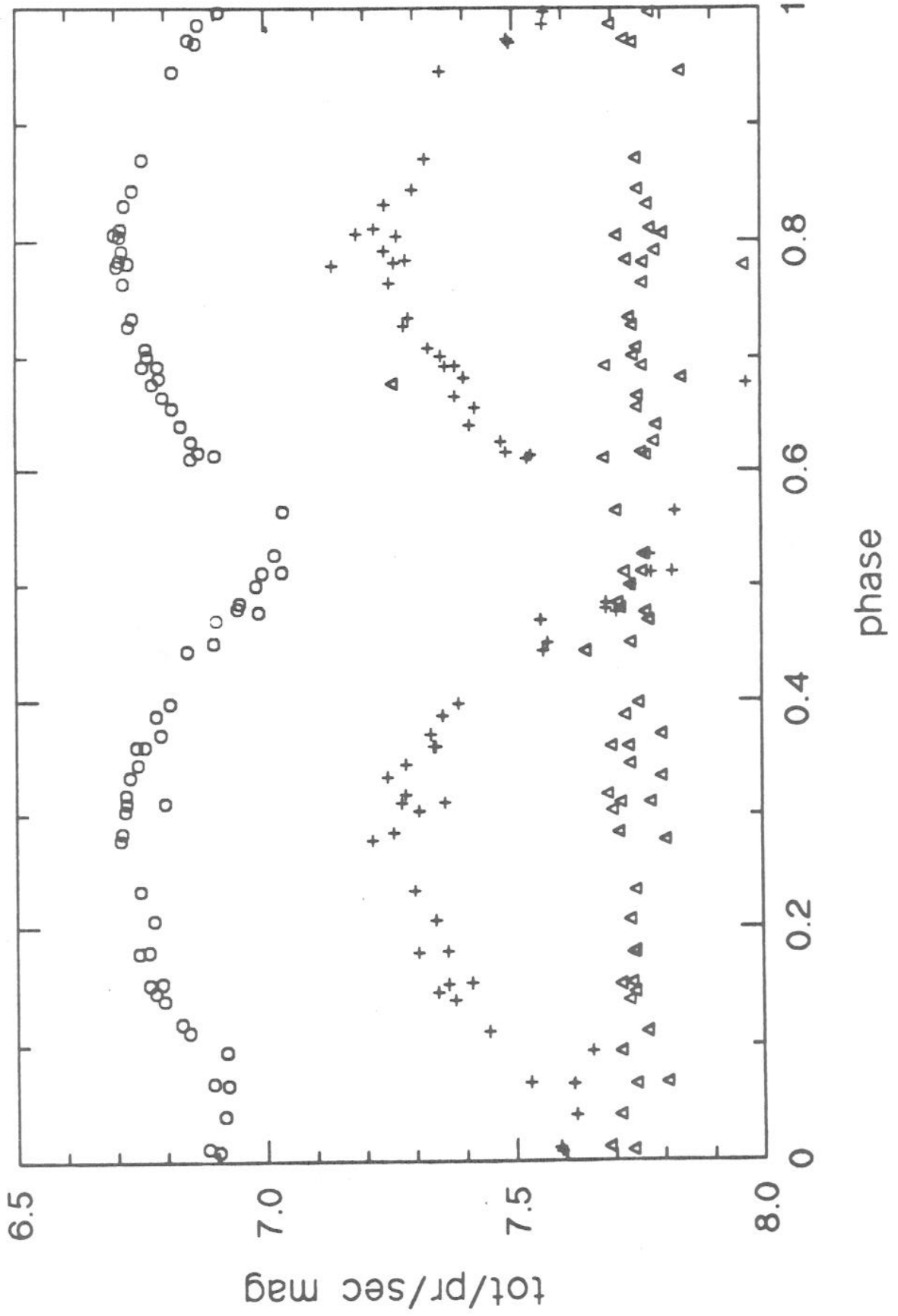


Fig. 7

HIC 16920 (AB Per)



HIC 9258 (AA Cet)



Current Photometric Status

RGO: 31 months reduced using latest standards

Accumulation in progress

CERGA: About to start reducing 37 months
of data (final run)

Geneva: Working on new Tycho system (&
faint standards)

Development of variable star processing

AIT: Waiting for new Tycho system

Ready to process all photometry
using new SSRFs

Future Work

CERGA to reduce 37 months of data (6 weeks)

Accumulate/collate data, 31/37(?) months (2 days)

Accumulated data comparison RGO/CERGA (4 weeks)

PWG5 8 July 1994

RGO to reduce remaining 6 months

Merging

Tycho Standards (if not already done)

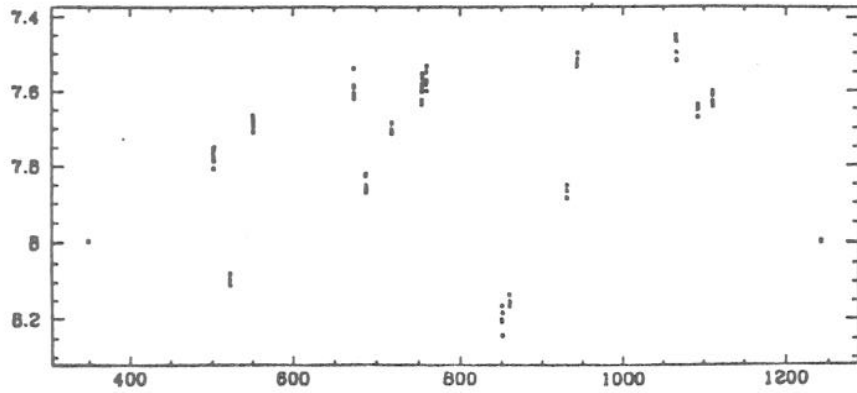
Variable star analysis of main mission data

Incorporate new Tycho photometric system

Reduce Tycho bright sample } 2-3 months
Reduce Tycho Faint sample }

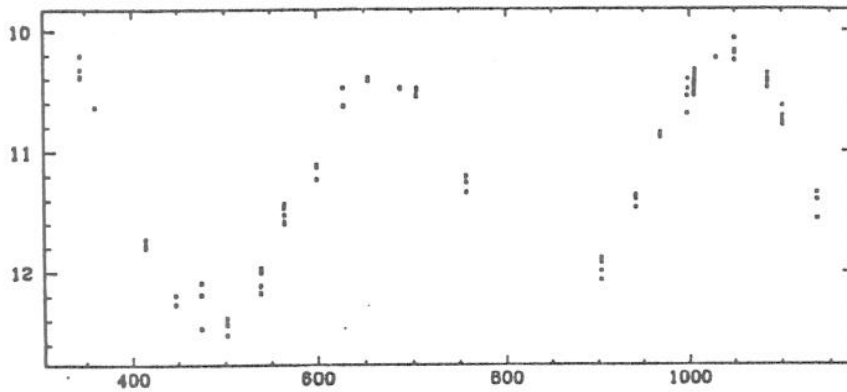
Provisional Statistics on
the variability of 1000 *

- 5% : no variability, - no outliers
- 14% : constant after rejection of few outliers
- 3% : linear drift only
- 35% : microvariances with A/noise too small for investigation using Fourier or Stekijewerf methods
- 33% : Search for P e-S A
- asymmetric light curve \rightarrow Stekijewerf 16%
 - symmetric light curve \rightarrow Fourier 17%
- Among them :
- 5% Residuals compressed by a factor > 2.0
 - 10% by a factor > 1.8
 - 14% by a factor > 1.6
- Double mode processing not yet implemented
- 8% : Not processed because varying glare or dust.2ity perturbation
- 2% : Not processed (too few data etc..)

ATLAS OF LIGHT-CURVES

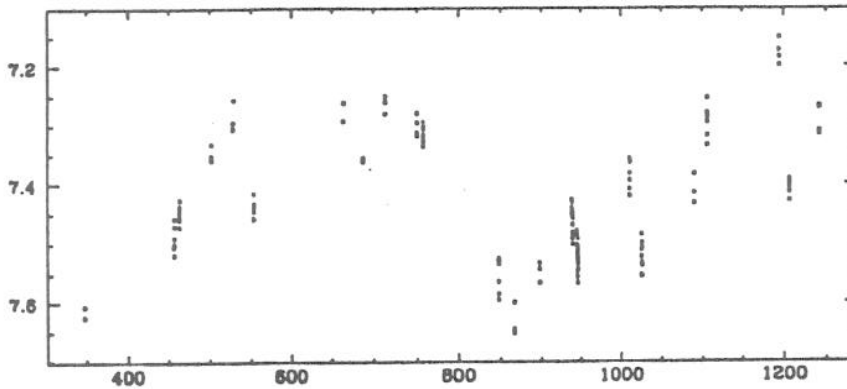
HC 893

Sp. Type : M3III
 Name : AC Cet
 Hp min,max 7.48 - 8.25
 V min,max 8.0 - 8.3



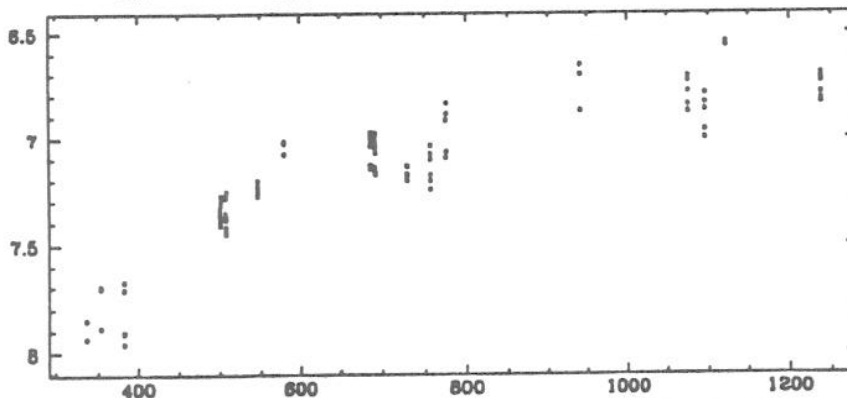
HC 703

Sp. Type : M
 Name : RU Oct



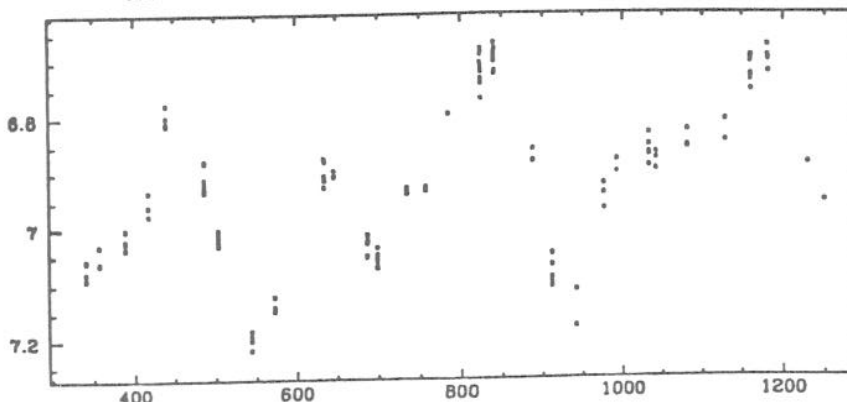
HC 457

Sp. Type : M3III



HC 852

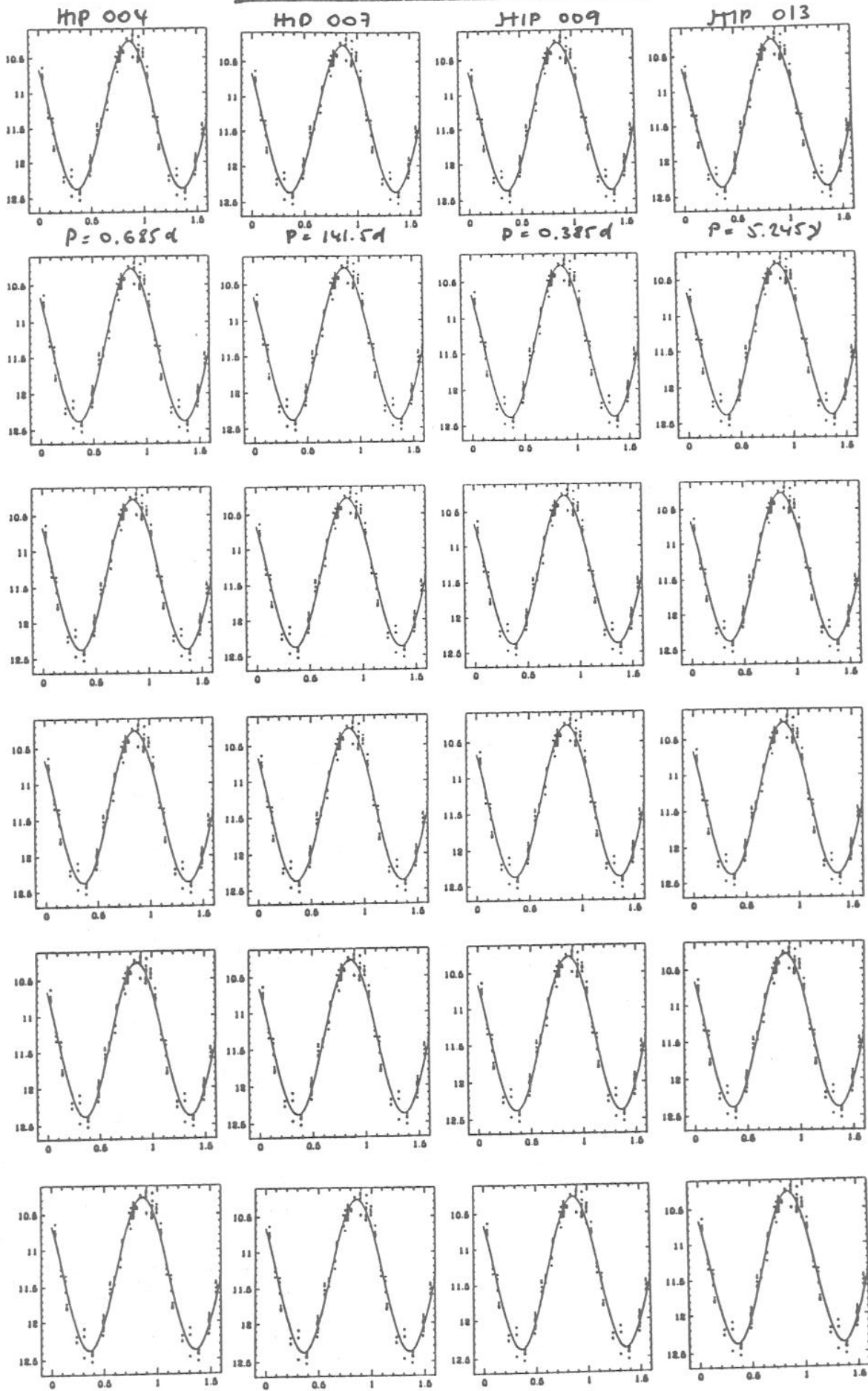
Sp. Type : M4III
 Hp min,max 6.51 - 7.95

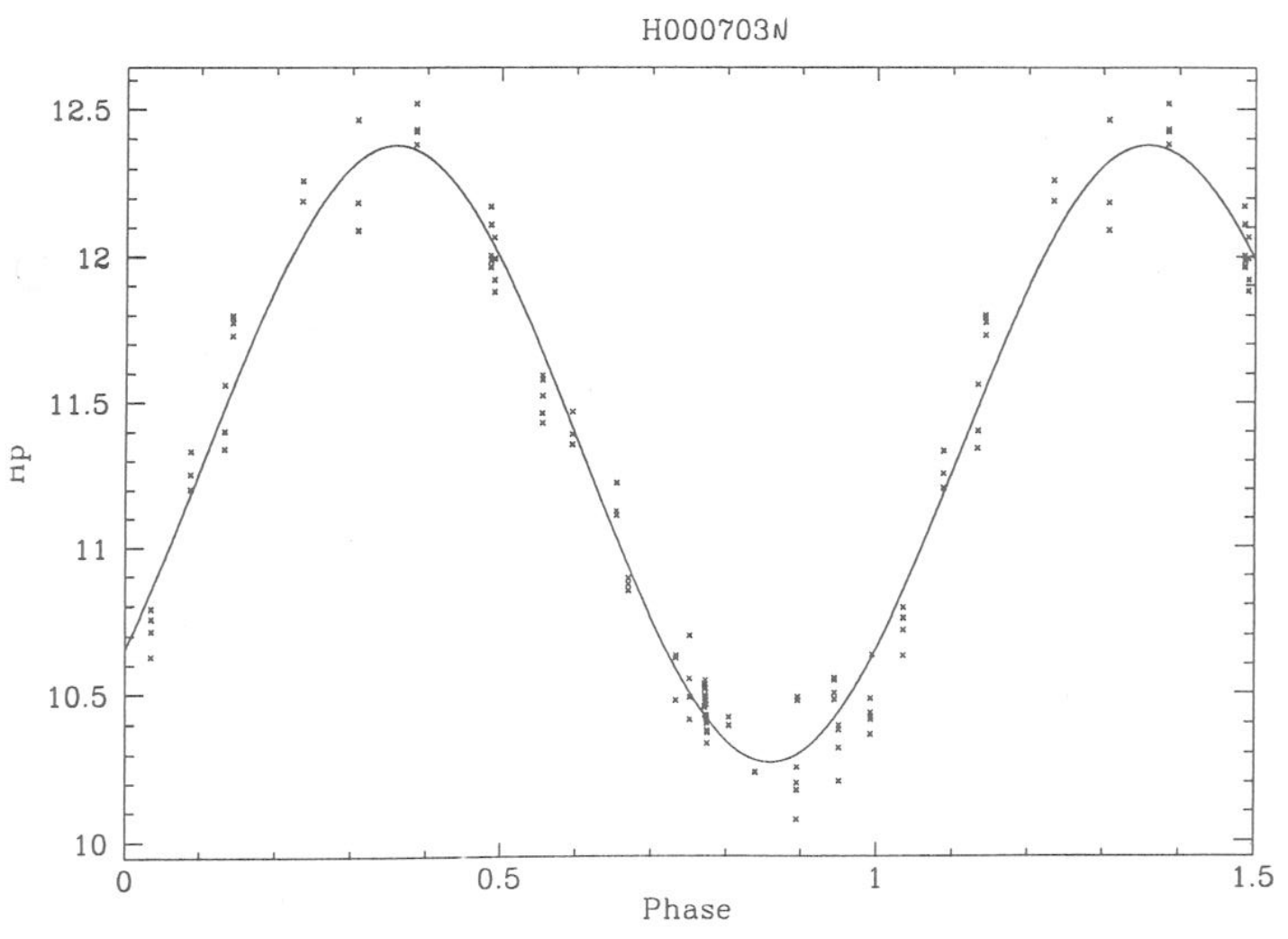
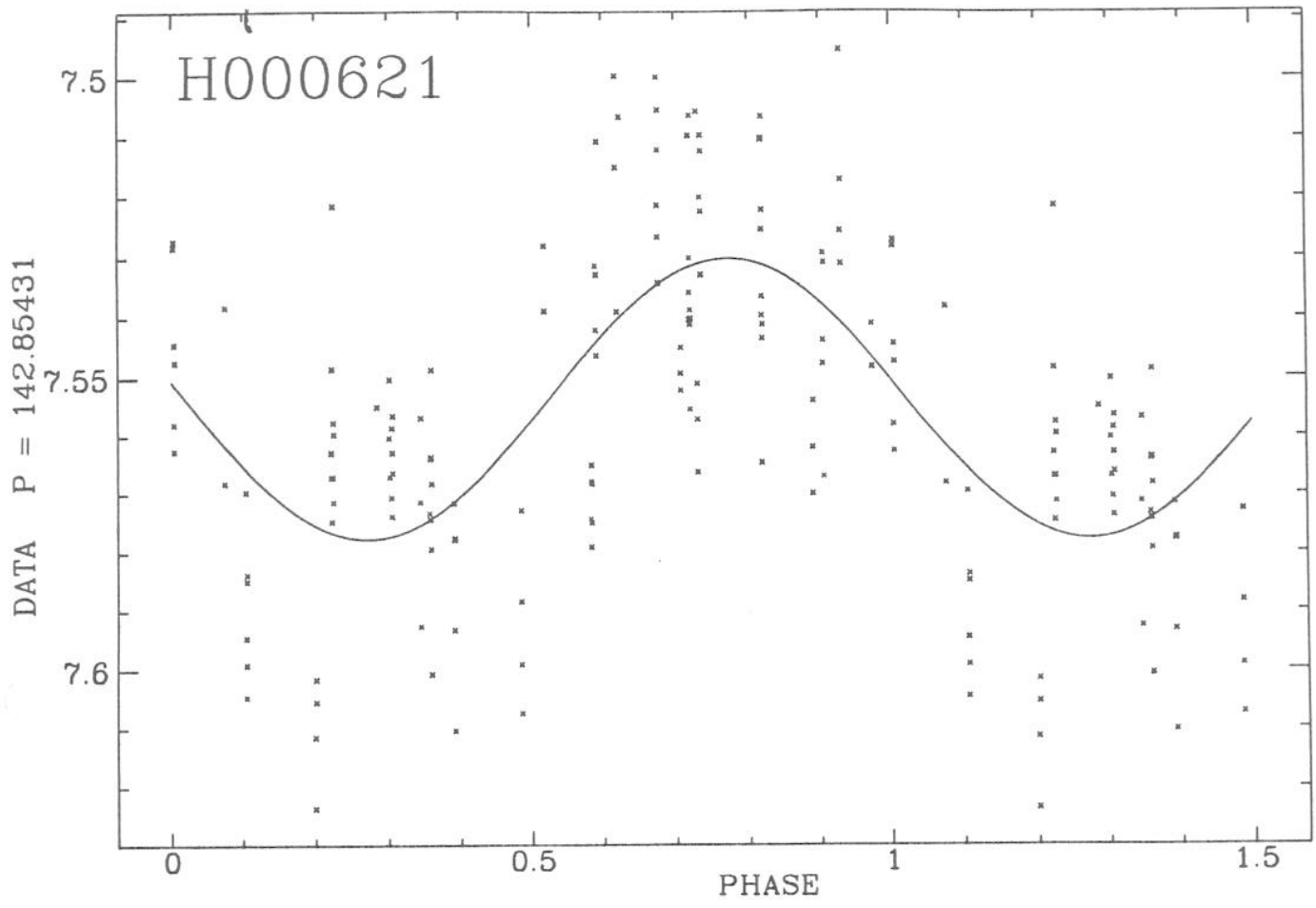


HC 99

Sp. Type : Cp
 Name : W2 Cas
 Var. Type : SR
 Period Lit. : 186 d

Formul for folded curves

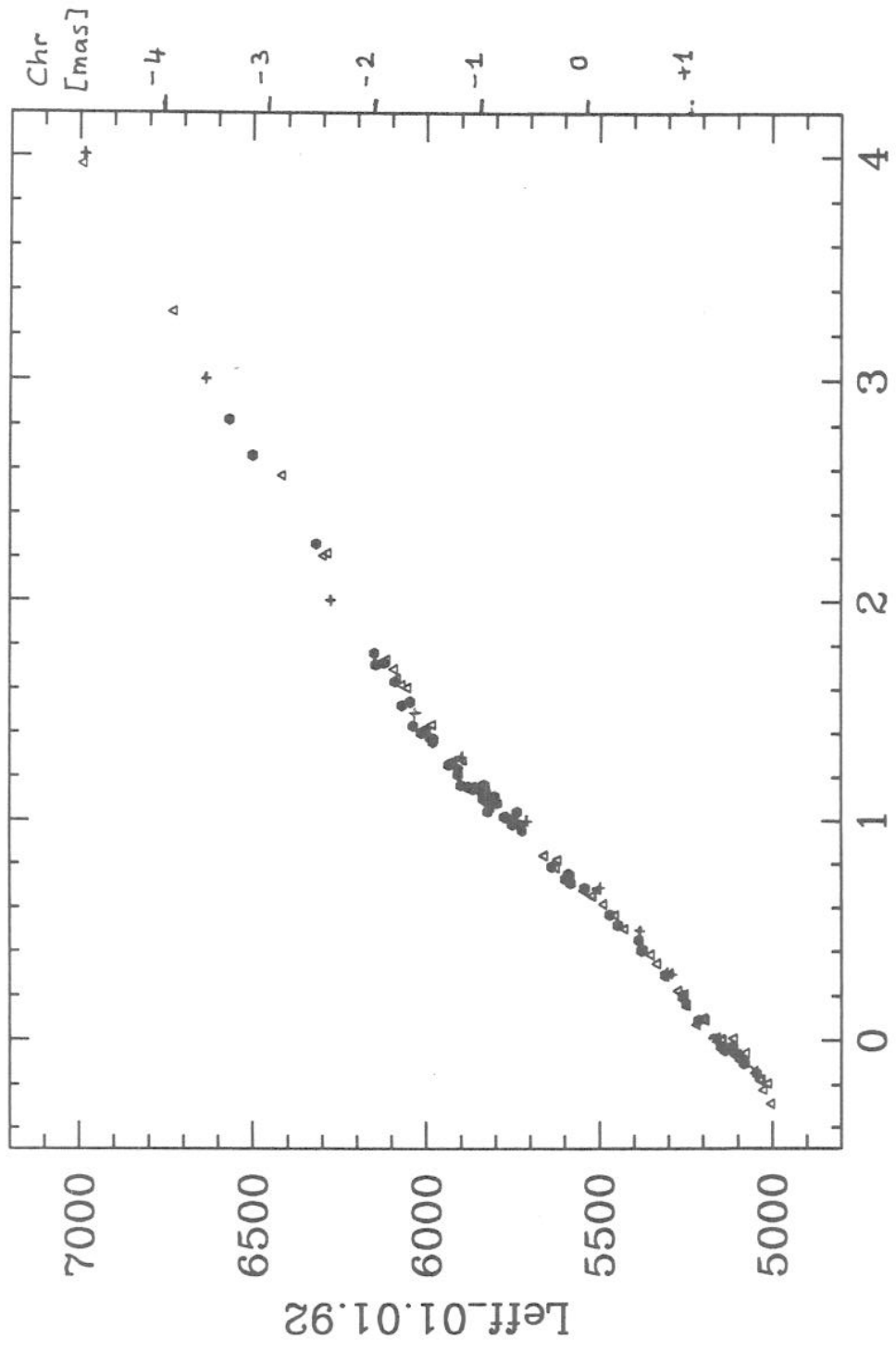




Prediction of chromaticity

A pure function of effective λ

Leff/(V-I) at mid-mission (01.01.1992)

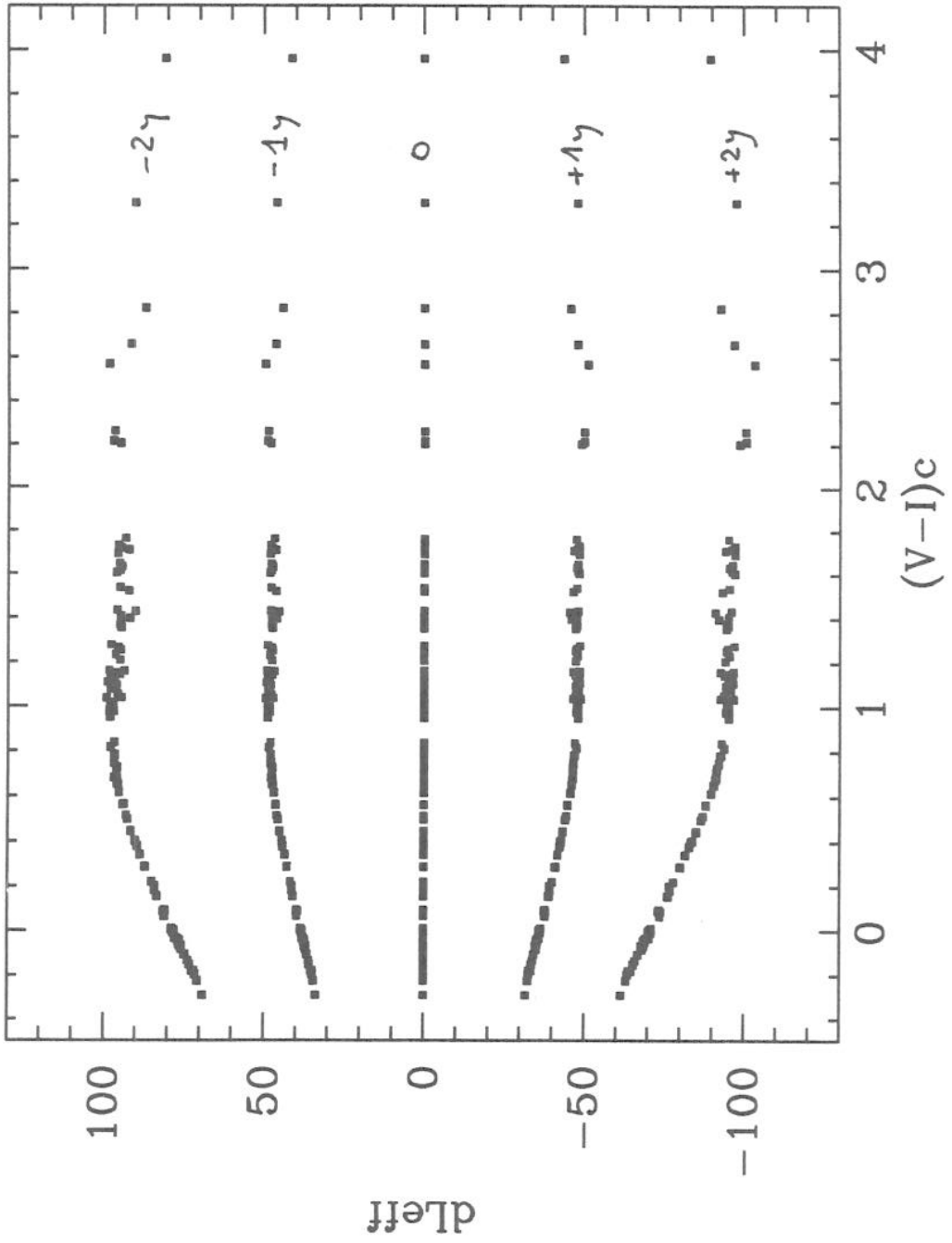


(V-I)c

+ : Henderson's estimate for 18 month solution

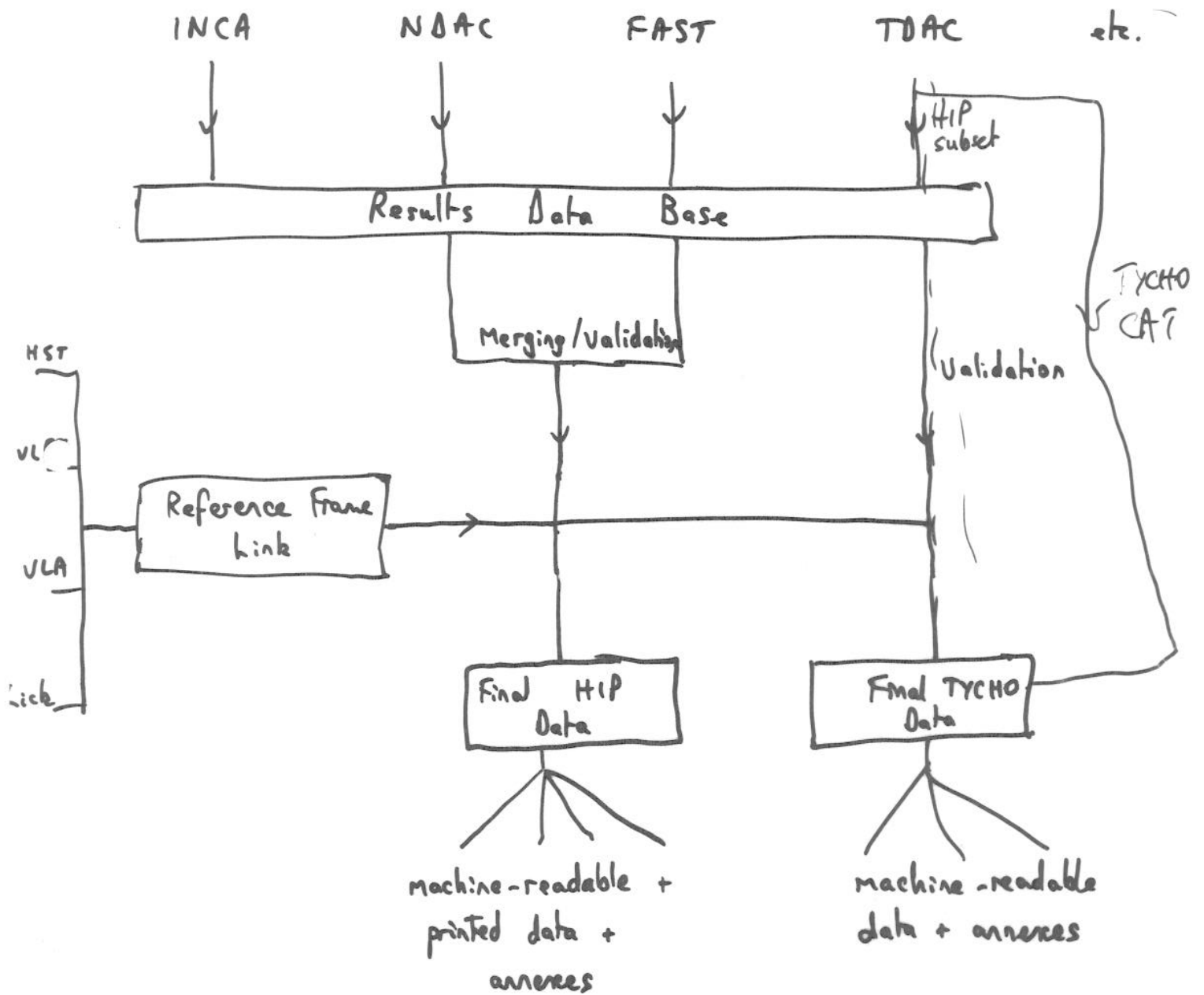
Aging effect

Relative change of L_{eff}



DATA FLOW

ANNEX VIII



PRINTED CATALOGUE

- VOLS 1 - 5 Catalogue (Version 4 \rightarrow 5)
+ introduction
+ notes (at end)
(suppress near obs. epoch)
add $\rho_{\alpha}^{\mu k}$, $\rho_{\delta}^{\mu k}$) [ERF 2000?]
- VOL 6 Double Star Annex
(format in prepⁿ by LL
Version 2 \rightarrow 3)
- VOL 7 Photometric Annex (folded light curves)
(format TBC by MG)
- VOL 8 Finding charts:
- individual charts (as SP1136)
+ corrections
- open clusters (TBC by CT)
- LMC / SMC

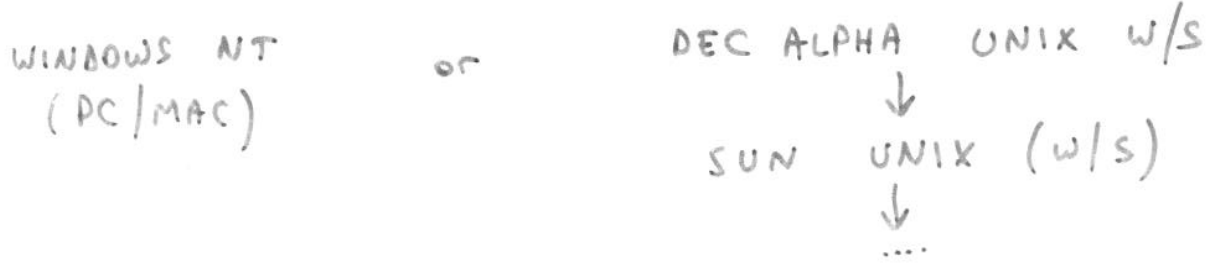
+ Full congruence between printed and machine versions

Notes:

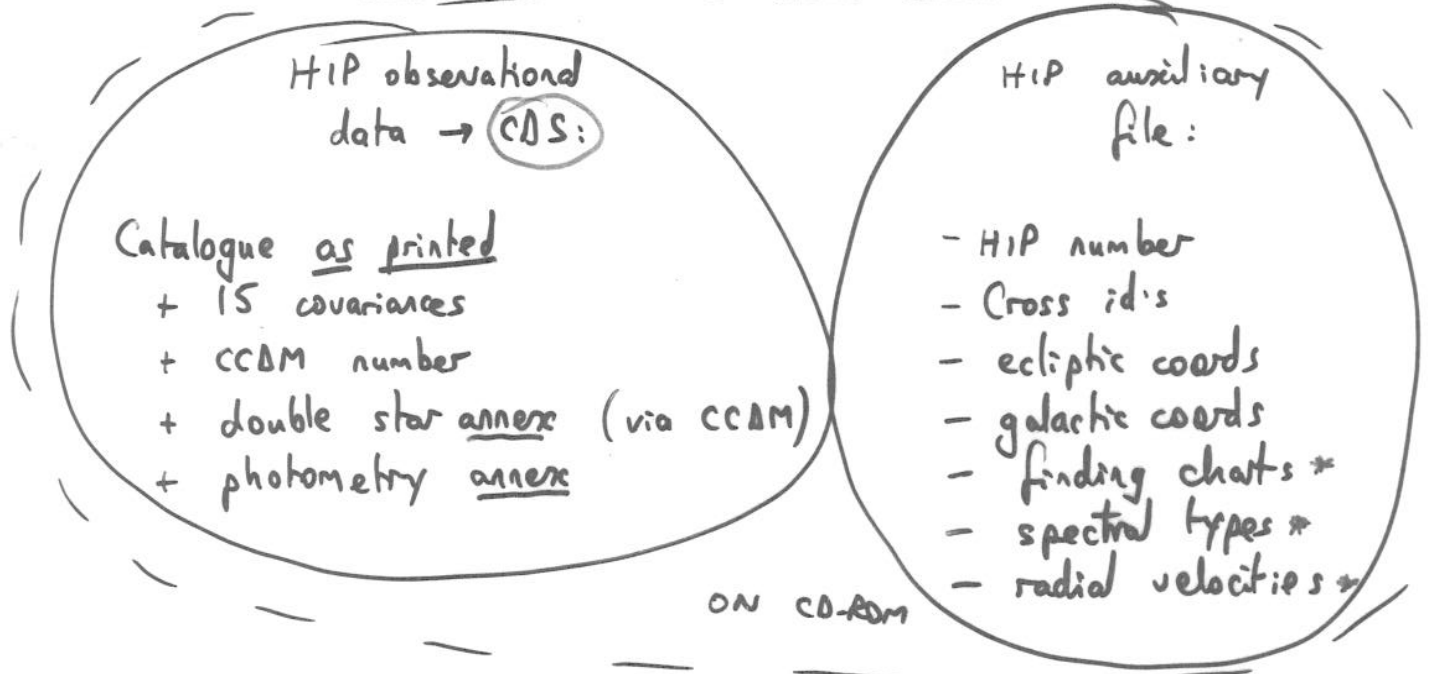
- machine version is Vol. 1-5 extended by covariance data + CCDM
+ double star annex
+ epoch photometry
- Tycho catalogue (summary) should be (TBC) very similar
to the HIP catalogue contents / structure

**CD-ROM
DATA + SW**

- Data resides on machine-independent discs (ISO 9660)
- s/w written in ANSI C targeted at:



- portability of s/w is a problem
- investigate hierarchical structuring of s/w becoming progressively more n/c dependent to assist portability
- concept of auxiliary + annex files:



- + provisional for non-CD-ROM file input:
 - spectral types (MSS updates)
 - radial velocities (ESO K-P updates)
 - + information etc.

POSSIBLE CD-ROM
DATA PARTITIONING

HIP CD-ROM

HIP astrometry
 HIP mean photometry (HIP)
 (TYCHO) mean photometry (B, B-V)
 for HIP stars
 HIP double star cases
 HIP epoch photometry
 + (if room)

TYCHO epoch photometry for
 LAV to (500-1000)
 (otherwise Tycho epoch photometry
 of 'limited' value in face of HIP...)

TO BE
 DISCUSSED:

- (1) Data volume
- (2) Commonality of integration slw
 (1 slw package for HIP + Tycho - separate)

TYCHO CD-ROMS

#1 Tycho astrometry
 Tycho mean photometry
 HIP astrometry (plates/meridian
 circles)

#2 Tycho epoch photometry } most
 for brightest 100 k* (TBC) } useful
 + HIP photometry

#3-12 (?) Tycho epoch photometry
 for remaining 900 k*
 (more marginal)
 (preferably, all Tycho * in sequence)

CD ROM SOW

Inputs + system recommendation ... 25 April
Inputs on #14 (transformations) ... LL ---
Inputs on #13 (photometry) ... CT/FvL ---
Inputs on #11.1(12) (doubles) ... LL/SS ---
Inputs on radial velocities ... ??

Responsibility for testing sequences: FvL/CT/H/S/MP

Interface with contractor: CT + MACP

Introduction to CD-ROM: MP + CT

NOTE TO HST

- Criticality of schedule
- Formal control of SOW (contract)
- Reluctance to introduce new requirements or to change agreed structures

Processing of the Minor Planets

- Data available for 37 months (non iterated) for 48 planets
 - Five parameter solution
 - Apparent RGC abscissae at the frame level
 - Origin on the RGC's
 - Apparent Photometry for each transit in DC and AC scales

Objectives

- 1-
 - To produce 1-D astrometric position for each grid-crossing
 - Normalized photometry in the DC and AC scales
- 2-
 - Corrections to orbital elements
 - Rotational and surface properties

Minor planets II

Work in progress

- Comparison observed - computed with a new ephemeris at the frame level
- Recognition of the polluted transits
 - ⇨ Photometry
 - ⇨ Linear motion on a grid crossing
- Transformation apparent to astrometric position at each frame
 - ⇨ Hipparcos Parallax
 - ⇨ Stellar Aberration
- Computation of a normal point for the grid crossing
- Sorting by planets
- Recognition of grid step errors
- Corrections to orbital parameters with SVD

Not yet finalized

- Phase correction for the largest planets
- Exploitation of the AC-DC signal
- Normalized photometry

Processing of the Minor Planets

- Data available for 37 months (non iterated) for 48 planets
 - Five parameter solution
 - Apparent RGC abscissae at the frame level
 - Origin on the RGC's
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- Corrections to orbital parameters with SVD

Not yet finalized

- Phase correction for the largest planets
- Exploitation of the AC-DC signal
- Normalized photometry

30-month solution dispatching, 21/03/1994

Hipparcos Link

Number	P.I.	Short Title	N	Key	Sent to	Date
Link 3	Lestrade J.F.	Link to VLBI via radiostars	7	xxx...	Lestrade	22/12/93
Link 3	Lestrade J.F.	Link to VLBI via radiostars (version H30a)	7	xxx...	Lestrade	20/01/94

Ad hoc proposals

Number	P.I.	Short Title	N	Key	Sent to	Date
ADHC003	Baglin A.	Targets of the EVRIS mission	80	.x....	Baglin	24/12/93
ADHC003	Baglin A.	Targets of the EVRIS mission	98x.	Baglin	14/01/94

A & A papers 1994

Number	P.I.	Short Title	N	Key	Sent to	Date
13	Réquième Y.	Meridian circle reductions	4 398	x.x...	Réquième	21/03/94
16	van Altena W.	Positional errors in the SPM plates	1 152	x.x...	Platais	21/03/94