Thirty Eighth Meeting of the Hipparcos Science Team

Leiden, 14–15 December 1995

Attendance:

HST: Prof. P.L. Bernacca, Dr M. Crézé, Dr M. Grenon (first day), 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: Dr M.A.C. Perryman (second day)

Consortia: Dr C. Fabricius

Unable to attend: Dr U. Bastian, Prof. F. Donati, Prof. M. Grewing

The Documentation Working Group Meeting (13 December) and the HST meeting were chaired by Dr Catherine Turon due to illness of M. Perryman.

The agenda attached was adopted.

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

Details of the recommendations of the Documentation Working Group, which met on 13 December, are given under Item 10.

1 Overview of status and schedule

No specific items to report. The 31 March 1996 release date to PI's has been maintained.

2 TDAC progress report and schedule

See transparencies of E. Høg and C. Fabricius (Annex 1). See Action 38.1.

3 Main astrometric catalogue merging

C.A. Murray presents the results of the computations made by F. Arenou (see Annex 2). Two problems left: choice of 9-parameters solutions; correlation with orbit number. See Action 38.2.

F. Mignard presents comparisons of the merged solution with F37. The mean improvement is of about 0.16 mas. The variation versus ecliptic latitude is much more pronounced for latitude, much less for longitude (merged solution versus F37). See Annex 3. Very few stars have distances merged-F37 larger than 1 mas. FM will investigate what they are. See Action 38.3.

4 Sphere comparisons, including TYC

No work on that subject since last HST. HS received provisional TYC yesterday. See Action 38.4. Action 37.2 still in standby.

5 Data base activities

A long time is devoted to go through each field and update the table prepared by HS on the responsibilities for columns of main catalogue. The updated version is given in Annex 4 (distributed separately).

An addendum to this table, prepared by HS for the data required by the CD-ROM software, and not appearing in the printed catalogue is also given.

See Annex 4 for detailed actions related to each column of the main catalogue and to the additional data needed for the Celestia 2000 CD-ROM production.

See also actions 38.5 to 38.10.

6 Double Star Working Group Report

See transparencies of F. Mignard (Annex 5) and L. Lindegren (Annex 6). See actions 38.5, 38.7, 38.9, 38.10 to 38.14.

Parts of the DMSA:
- C: from the merging of FAST and NDAC solution performed by L. Lindegren.
- G: from F. Arenou merging
- O: from ARI. Still expected.
- V: from ARI. Provisional results received.
- X: nothing !!

Questions:
- are ARI results to be considered as final FAST results ?
- is the merging FAST/NDAC feasible for these stars ?
- are VIM's credible ?? (LL not convinced).

Triple stars: J. Kovalevsky shows preliminary results for some triple systems (Annex 7, not attached). L. Lindegren says that they are using the 'HIF' (Hipparcos Imaging Facility) in Lund to solve some triple systems. In addition, R. Le Poole is performing ground-based observations to help solving difficult cases (also for some double systems). He already sent about a third of listed difficult cases to L. Lindegren.

All what is available as new observations or new solutions for triple systems will be incorporated by L. Lindegren if received by mid-January 1996.

CCDM and component identification: F. Mignard reports that the list of considered systems was sent to Brussels in November.
- CCDM identification is made by J. Dommanget and O. Nys. FM received 9 000 records last week. Not yet worked on it.
- component identification is made by P. Lampens. Waited for February 1996. See Action 38.15.

Distribution of double star data to proposers: see Action 38.16.

7 Photometry Working Group Report

F. van Leeuwen presents the merging of FAST and NDAC data performed by D. Evans and the preliminary results of the variability analysis performed at Cambridge (see Annex 8).

Comments, notes and/or references are available for 8 100 HIP entries, notes and/or references for 5 460 variable stars. FvL is preparing these for the publication.

M. Grenon presents the variability analysis performed at Geneva (see annex 9). This study should be finished by mid-January.

Threshold to consider a star as micro-variable: depends on magnitude amplitude and magnitude.

FvL and MG will be in a position to definitively conclude on that, finalise the explanations for the catalogue introduction, and start writing a paper for A&A by the end of February 1996, when they are through their variability analysis and cross-check.

Allocation of variable star names: see Action 38.17. This name allocation should be finished by the end of June 1996.

See actions 37.14, 37.15 about the finalisation of the variable star annex. Also required for related CD-ROM window.

Question about the use of the median versus mean magnitude: FvL and MG disagree with the use of the median ... Prefer a weighted mean. FM thinks that the median is more robust ... and that it was decided 3 years ago ... See Action 38.18. This has consequences on the keys to right pages, on the documentation for the main catalogue and the DMSA (introduction, description of the fields).

Distribution of epoch photometry to proposers: do not distribute epoch photometry without the related documentation. Documentation should be ready by the end of March 1996. This imply only a small delay in the distribution with respect to data from the main catalogue. F. Mignard has made a proposal to distribute these data from Cerga. See Action 38.19.

8 Report from Reference Frame Working Group

J. Kovalevsky presents the results of the various teams involved in the Link WG and the resulting rotation of the system (orientation and time-dependent solution). See Annex 10 (not attached).

L. Lindegren presents his solution following the method described in A&A. For the orientation, ϵ, 90% of the weight comes from the VLBI solution. For the rotation, ω, most of the weight comes from Earth rotation and Lick/San Juan solutions. Only 8% from the VLBI. See Annex 11.

Schedule:
- individual link solution from each team by 20 January 1996.
- final rotation available by mid-February.

Rotation applied by:
- H. Schrijver to Hipparcos stars, checked by F. Mignard and Lennart Lindegren
- E. Høg to Tycho stars, checked by H. Schrijver
- D. Hestroffer to Hipparcos and Tycho solar system objects, checked by H. Schrijver

See also Documentation WG Section 1.2, and actions 38.20 and 38.21.

9 Solar System Objects

D. Hestroffer presents the results obtained by FAST, NDAC and TDAC for solar system objects. See Annex 12.

Publication:
• one dimensional data for objects observed by Hipparcos. No merging between FAST and NDAC, neither for minor planets nor for satellites of major planets. Final list of objects with astrometric and/or photometric data: see recapitulation of DH in annex 12.
• two dimensional data for objects observed by Tycho. Final list of objects with astrometric and/or photometric data: see recapitulation of DH in Annex 12.

Schedule: see recapitulation of actions by DH in Annex 12.

See also Action 38.22 and 38.23.

10 Documentation Working Group Activities

See minutes of the meeting of Documentation Working Group held in Leiden on 13 December 1995 in Annex 13 (distributed separately).

Many actions enclosed in these minutes, and in Annex 4. See also actions 38.24 (short deadline), 37.10, 37.11, 37.14, 37.15, 36.10, 35.8 and 35.15.

11 Sky & Telescope Millennium Atlas

HST members had been kept up to date with the MoU being drawn up by M. Perryman and the Sky Publishing Corporation. Basically, this calls for Hipparcos and Tycho data to be made available to S&T in advance of publication (actually, early in 1996), with the Millennium Atlas being targetted for production at the same time as (but not in advance of) the Hipparcos and Tycho Catalogues. Changes in the MoU were still going on to reflect the possible creation of a version of the Atlas which could be published as Volumes 15–16 of the Hipparcos/Tycho Catalogue set. HST expressed their support for this development.

12 Venice Symposium

P.L. Bernacca had been pursuing investigations for the Symposium. Local support facilities were being identified. Bernacca and Perryman were investigation financial sponsorshop. Bernacca had met with ESA/Paris Public Relations representatives (M.-P. Hubrecht and R. Elaerts) with a view to holding a scientific exhibition in parallel with the Symposium.

13 Miscellaneous

(a) Perryman had written to D. Egret (CDS) to ensure that the Hipparcos and Tycho Catalogues would be available within the CDS data base as swiftly as possible after their release.

(b) the address list for catalogue distribution, prepared by M. Perryman, was distributed to all participants. See Action 38.25. See also Section 1.8 of the Documentation WG minutes.

14 Next Meetings

The following dates were set aside as provisional dates for future meetings, which would be confirmed as appropriate (regarding topic, date, and location): 28 February (Documentation Working Group); 29 February–1 March (Double Star Working Group); 18-19 April (HST I); 4-5 June (HST II).

C. Turon, 20 December 1995

Distribution: HST, A. Wicenec, J.L. Halbwachs, D. Hestroffer

Actions

(see also detailed actions related to data base activities in annex 4 and in the minutes of the Documentation WG, Annex 13)

38.1 Høg/van Leeuwen (+ Tűbingen) to reflect on what could be done in Cambridge and Tűbingen in the context of variable star analysis for TDAC.

38.2 Lindegren to send a message to Arenou to congratulate him for his huge work; to give him additional criteria to select solutions with 9 parameters; to enquire about the time necessary to perform a new solution, allowing to correct for the correlation with orbit number.

38.3 Mignard to investigate stars with distances (merged solution-F37) larger than 1 mas.

38.4 Schrijver to compare spheres HIP and TYC.

38.5 Lindegren/Mignard to reflect on the sense of H29-30 for double stars.

38.6 Revision of the transformations B and V (Johnson) to B_T and V_T, and reverse: Schrijver to send to Grenon the stars used by TDAC for standards. Grenon to send to Høg these transformation formulae by end 1995.

38.7 Høg to make the cross-identifications TYC versus HIP and entries of the DMSA (after HS has merged the FA, LL files + merged photometry). Høg to extract B_T and V_T for each entry, and to send these data to HS, DMSA entries also to FM, by 15-3-96. Mignard to check these entries, make joint entries where necessary, and send back to HS by 30-3-96.

38.8 Grenon to write software to update the epoch photometry once V-I is updated using B_T and V_T of Tycho standard stars, by 15-1-96. This will change the values of Hp for about 1 000 stars. Grenon to send these to Schrijver by 31-1-96.

38.9 Mignard to correct Hp for double star effect, compute Hp for components, for two-pointing double stars, and joint entries, and then correct the epoch photometry for these stars (once he received the merged photometry from van Leeuwen, and once the list of ρ and Δm is finalised with Lindegren).

38.10 Mignard to ask Dommanget to provide input for flag H56.

38.11 Lindegren to investigate if there exists stars common to the various parts of the DMSA. This has consequences on the use of flag H60 and on the CD-ROM windows.

38.12 Lindegren/Mignard to reflect on the contents of flag H61, only related to the quality of relative astrometry in the present description. Use H60 for the quality of absolute astrometry ??

38.13 Lindegren to investigate how many systems will have solutions for different regions (field 3 of DMSA, with consequences on field 2). This has consequences on the CD-ROM windows.

38.14 Lindegren to finalise the contents of parts O, V, X of DMSA.

38.15 Mignard to check that Patricia Lampens does not encounter too many drastic problems in the component identification.

38.16 Lindegren/Mignard to reflect on the practical aspects of double star data distribution to proposers.

38.17 Grenon to prepare, by the end of 1995, a precise contract with the Russian colleagues who will allocate variable star names to the new variable stars discovered by Hipparcos. This will include precisions on the schedule and will fix the conditions of publications (**not** before the publication of the HIP).

38.18 van Leeuwen/Grenon to definitively choose between the use of a mean or a median magnitude for the main catalogue and the DMSA. [MP comment: this has been discussed extensively and widely agreed on. I do not favour re-opening the discussions and associated effort in updating the documentation. Arguments for changes should be very convincing].

38.19 Mignard to finalise the practical aspects of the distribution of epoch photometry to proposers.

38.20 Turon to undertake distribution of 'final' data to RFWG immediately after completion of the new merging run (end of December). These data would be distributed in parallel with the validation of the merged data—if unexpected problems appeared, new data would be circulated to the RFWG, and the schedule would have to be reconsidered accordingly.

38.21 Kovalevsky/Lindegren to finalise the determination of the rotation / orientation by mid-February 1996.

38.22 Hestroffer to update Sections 1.7 and I of the documentation, versus both Hipparcos and Tycho data. Circulate to Lindegren, Mignard, Høg and Perryman.

38.23 Høg will check whether global systematic corrections to Tycho minor planet astrometry has been applied correctly. Communicate to Hestroffer.

38.24 HST to comment within one week on the proposed CD-ROM window layouts.

38.25 HST to check the list of people in the address list data base (distributed during the meeting) and if the addresses are correct.

From Previous Meeting(s)

37.2 Mignard/Lindegren to reflect on the cause of the modulation of the latitude/parallax correlation coefficient.

37.10 Perryman to investigate use of CUP, Springer, or ESA as a publisher for the CD-ROM.

37.11 Turon to be responsible for first draft of CD-ROM on-line documentation.

37.15 van Leeuwen to prepare a note on who is responsible for which columns in the tabular part of the variable star annex, and what time-scales.

37.20 Turon to propose that a JD would be held on Hipparcos at the IAU 1997 GA.

35.8 Notes for the Utrecht results data base would be expected as follows: (a) misidentifications collated by Meudon, from Turon; (b) stars not detected by the star mapper, or wrong by 15–60 arcsec, or incorrectly identified double systems or variable stars, from van Leeuwen; (c) notes on

finding charts and other photometric discrepancies (e.g. $V-I$ updates), from Grenon; (d) anomalies from the sphere solution, from Mignard and Lindegren (who would reflect on the categorisation of such discrepancies).

35.15 Grenon to finalise plans and schedule for the Finding Chart Volume of the main catalogue (e.g. LMC/SMC and cluster charts to be based on GSC scans, etc; update INCA volume using revised identifications and photometry, etc).

Thirty Eighth Meeting
of the
HIPPARCOS SCIENCE TEAM

Leiden University
Academisch Gebouw, Rapenburg 73, Leiden

14-15 December 1995
Start of meeting: 09.00 (14 December)

AGENDA

1. Overview of status and schedule (Perryman)

2. TDAC progress report and schedule (Hoeg)

3. Main astrometric catalogue merging (Murray/Mignard/Lindegren)

4. Sphere comparisons, including TYC (Schrijver/Lindegren/Mignard)

5. Data base activities (Schrijver)

6. Report from Double Star Working Group
   - structure of the double and multiple star annex (Lindegren)
   - final comparisons (Lindegren/Kovalevsky/Mignard)
   - merging strategy (Lindegren/Mignard)
   - DSWG issues, including allocation of CCDM numbers (Mignard)
   - status of ground-based preparatory programmes (Le Poole)

7. Report from Photometry Working Group
   - results of merging (van Leeuwen)
   - status of epoch photometry annex (Grenon/van Leeuwen)
   - status of variable star annex (tables and plots) (Grenon/van Leeuwen)
   - required data for photometric transformation verifications (Grenon)
   - allocation of variable star names (Grenon)
   - verification, schedule, and imlementation in results data base

8. Report from Reference Frame Working Group (Kovalevsky/Lindegren)

9. Minor planet update: FAST/NDAC/TDAC (D. Hestroffer)

10. Report of Documentation Working Group (Perryman)

11. Sky & Telescope/Hipparcos Millenium Atlas (Perryman)

12. Status of Venice Symposium Organisation (May 97) (Bernacca/Perryman)

13. Miscellaneous:
   - availability of final catalogues within stellar data centres/SIMBAD
   - IAU preparations (Turon - deadline: April 1996)
   - outstanding Form B's
   - paper on light-bending (Mignard)
   - project address list data base
   - project position on 51 Peg (Bastian)
   - next HST meeting

---> please review any outstanding actions from 37th HST (see minutes)

Documentation Working Group Meeting

Leiden University
Academisch Gebouw, Rapenburg 73, Leiden

13 December: 09:00 - 18:00

Agenda

1. The printed Hipparcos Catalogue:
   - status of production plans at Utrecht
   - status of the main catalogue
   - status of double star annex (LL)
   - variable star catalogue: contents, formats and schedule (MG/FvL)
   - convention for Greek characters
   - status of finding charts, including clusters and LMC/SMC (MG)
   - logistics of production and distribution, and schedule
   - cover design
   - distribution policy and address lists

2. Status of intermediate data file archiving (Mignard/Lindegren)
   - RGC data
   - double star case history files

3. The status of the explanatory documentation (Volumes 1-4):
   - status of WWW documentation, and information to internal proposers
   - contents
   - overall schedule

4. The CD-ROM development (Catherine Turon) including:
   - development status
   - data content
   - present structure and inter-relationship of the HIC/HIP/TYC files
   - proposed target platforms
   - product name
   - activities of evaluation group
   - status of planned documentation (on-line/off-line)
   - schedule

Goals: The goals of the DWG are to review the status of all documentation planned for the project, and ensure its proper completion by 31 March 1996.

Attendance: Perryman, Bernacca, van Leeuwen, Lindegren, Mignard, Schrijver, Turon, Hoeg, Bastian, Murray, Kovalevsky
+ others interested

(1)

ANNEX 1

Subject: TDAC schedule #2
From: erik
Date: Tue Jul 12 12:10:38 1995

Agreed at the TDAC meeting in July 95:

Tycho Catalogue Generation (TCG) Mar.95 - July 96:
==========

incl. details for the astrometry at CUO:

CUO:receives the last IT from AIT		1 Apr 95
Main proc. at CUO, add 7 months -> AT,	T37f	11 Apr
Main processing ->Fs, but not Ta	T37f+	
The T37f+ with Fs values have been computed by April 30,		
and the values have been checked.		
Reprocessing at CUO ->OE	TU37a	10 May
Reprocessing -> planetary objects	TU37b	1 Jun
Reprocessing ->AT + Ta + Fs	TU37c	15 Jun
CUO: Quality flagging -> TC.R and TC.U		1 Aug
CUO: Merging of TC.R and TC.U -> TC.RU1		
CUO: Redundancy analysis -> TC.RU2		
CUO: Provisional Numbering at CUO of TYC3		
CUO: Rejection of redundant stars (ie. TYC3=0)		
-> TYC_CUO_11 send to ARI, CDS, AIT		1 Sep DONE 21 Aug
ARI, CDS, AIT use the TYC_CUO_11 to make their contribution		
and send in TYC_CUO format to CUO, see below		1 Nov DONE ÷ ARI
CUO: Double stars, OEC -> resolved comp., rho<3 arcsec		
Resolved comp. + TC.RU2 -> TC.RU3 , changes only TYC3		1 Nov DONE
CUO: send updated TYC_CUO version#1 to ARI AIT CDS		1 Dec = the max TCAT
CUO send to HST a TYC version#1 with:		
B,V provisional (mean) values		
incl. double stars and		
final rotation to HIP system, after Nov 1995		1 Dec 95 Done 8 Dec
AIT send TPC version#1 to HST		31 Dec
AIT: send B,V version#2 by survival a. to CUO		1 Feb 96
ARI CDS: send version#2 of their data to CUO		1 Feb
CUO: send version#2 TYC to HST		1 Mar
AIT send TPC version#2 to HST		1 Mar
Final TYC, internal target date		1 Apr 96
Final TYC, expected before		1 Jul 96

TDAC agrees to general release to the scientific community by 1 Jan 1997 which implies that TDAC will have between 9 and 6 months with exclusive data rights. Note that epoch photometry in TPC is available at the same time as B,V.

Details:

	prod.	verif.	time
AIT: Final TPOC2	VG	AW	8 Sep -> 20 Sep
AIT: B, V provisional mean values	VG	AW	1 Oct } main proc Done
AIT: B, V mean values etc.,TYC_CUO-format	VG	AW	1 Nov }
ARI: Various ,TYC_CUO-format	PS	UB	1 Nov ~~+15Nov exp~~ ÷
CDS: Various ,TYC_CUO-format	DE	JLH	1 Nov Done 5 Nov
CUO: TYC Version#1, provisional, TYC-format.	VM	CF	1 Dec 95 Done 8 Dec

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To UB now for pair statistics: TYC_CUO_10 = the stars in T37f with:
D1-4 OR (D5-9 AND COMPI=1) OR (D5-9 AND COMPI=10)

Tycho Photometry

$2s$ = perc (85%) − perc (15%)

Standard error of the median:

$$\sigma_m = s\sqrt{\frac{\pi}{2N}}$$

σ_m was estimated for 17028 stars of TPHC which were assumed to be constant

Fig. 1: σ_m versus N for 2 V_T intervals

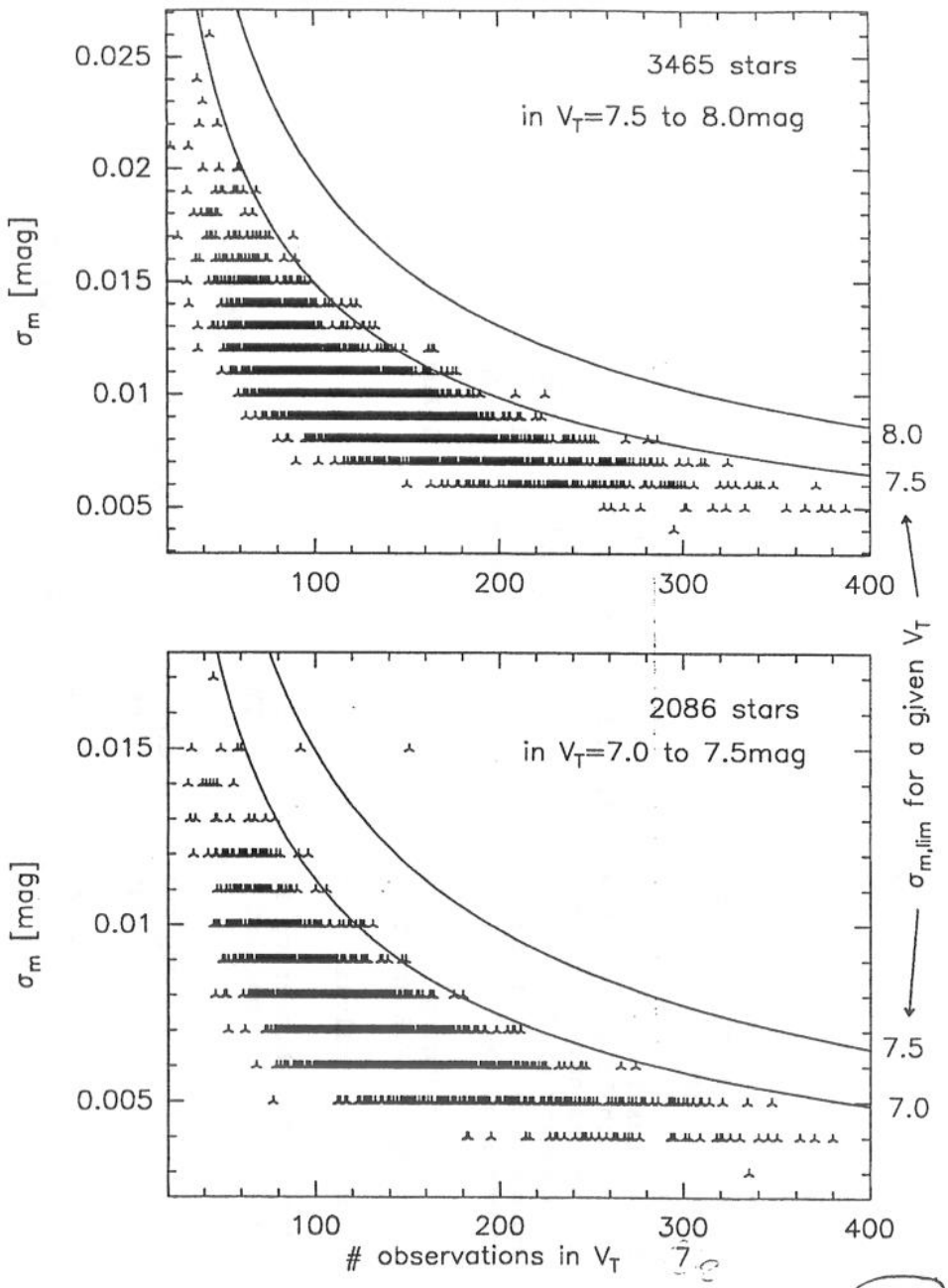
An empirical limiting function is plotted:

$$\sigma_{m\,lim}(V_T, N) = 1.754^{V_T}\, N^{-0.6}\, 0.0035 \text{ mag}$$

2 outliers are seen in lower plot: variables for further analysis, if $N > 30$

10000 outliers expected.

Fig. 1 8 Jan 95



2

1312 488 1 V_{CAT}=7.192 $(B-V)_{CAT}$= 0.149

#obs=92 median (width): B_T= 7.07 (0.011) V_T= 7.215 (0.015) B−V or T= −0.143 (0.011)
mean (err): B_T= 7.082 (5.E−03) V_T= 7.219 (6.E−03) B−V or T= −0.136 (8.E−03)

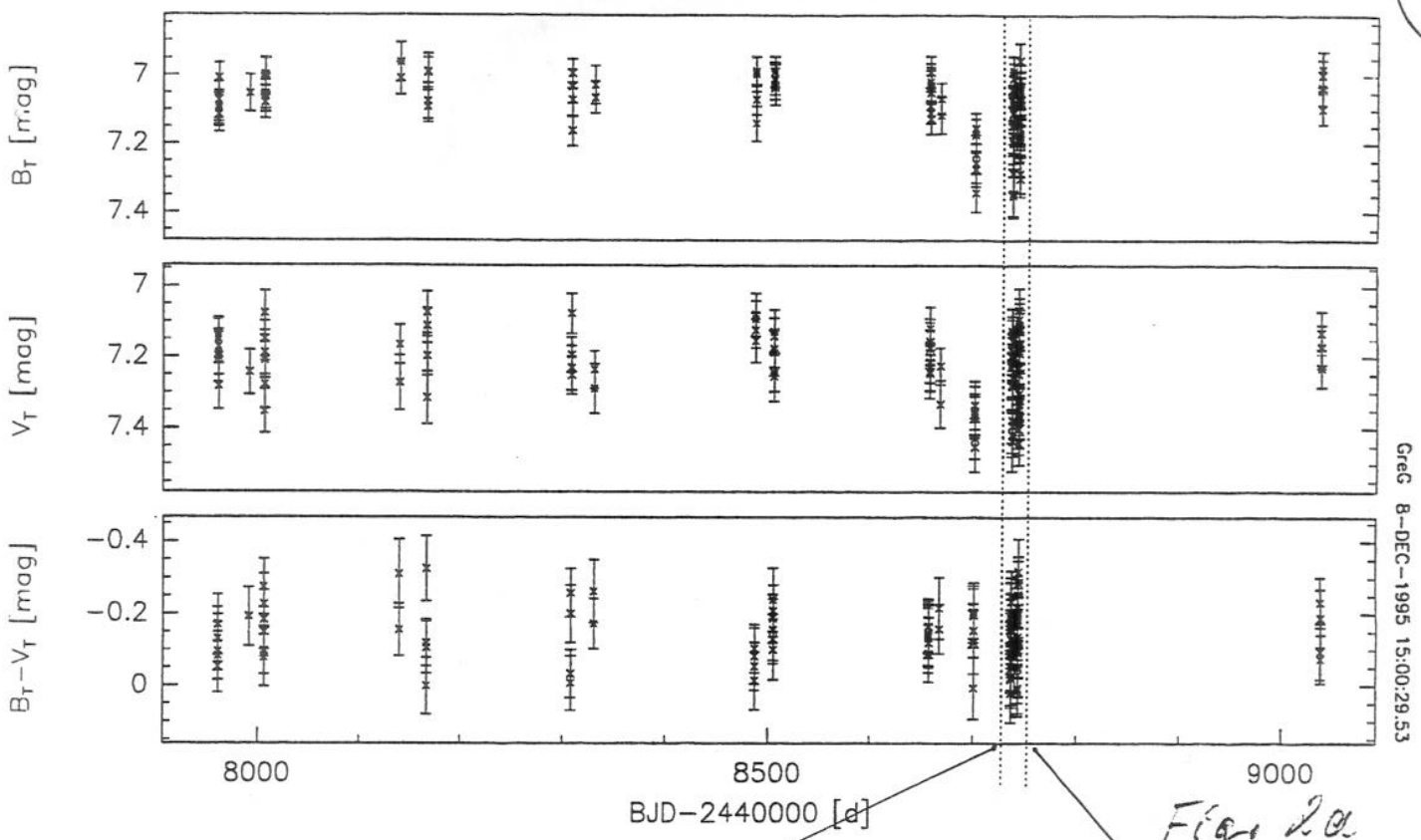


Fig. 2a

Fig. 2b

1312 488 1 V_{CAT}=7.192 $(B-V)_{CAT}$=−0.149

#obs=92 median (width): B_T= 7.07 (0.011) V_T= 7.215 (0.015) B−V or T= −0.143 (0.011)
mean (err): B_T= 7.082 (5.E−03) V_T= 7.219 (6.E−03) B−V or T= −0.136 (8.E−03)

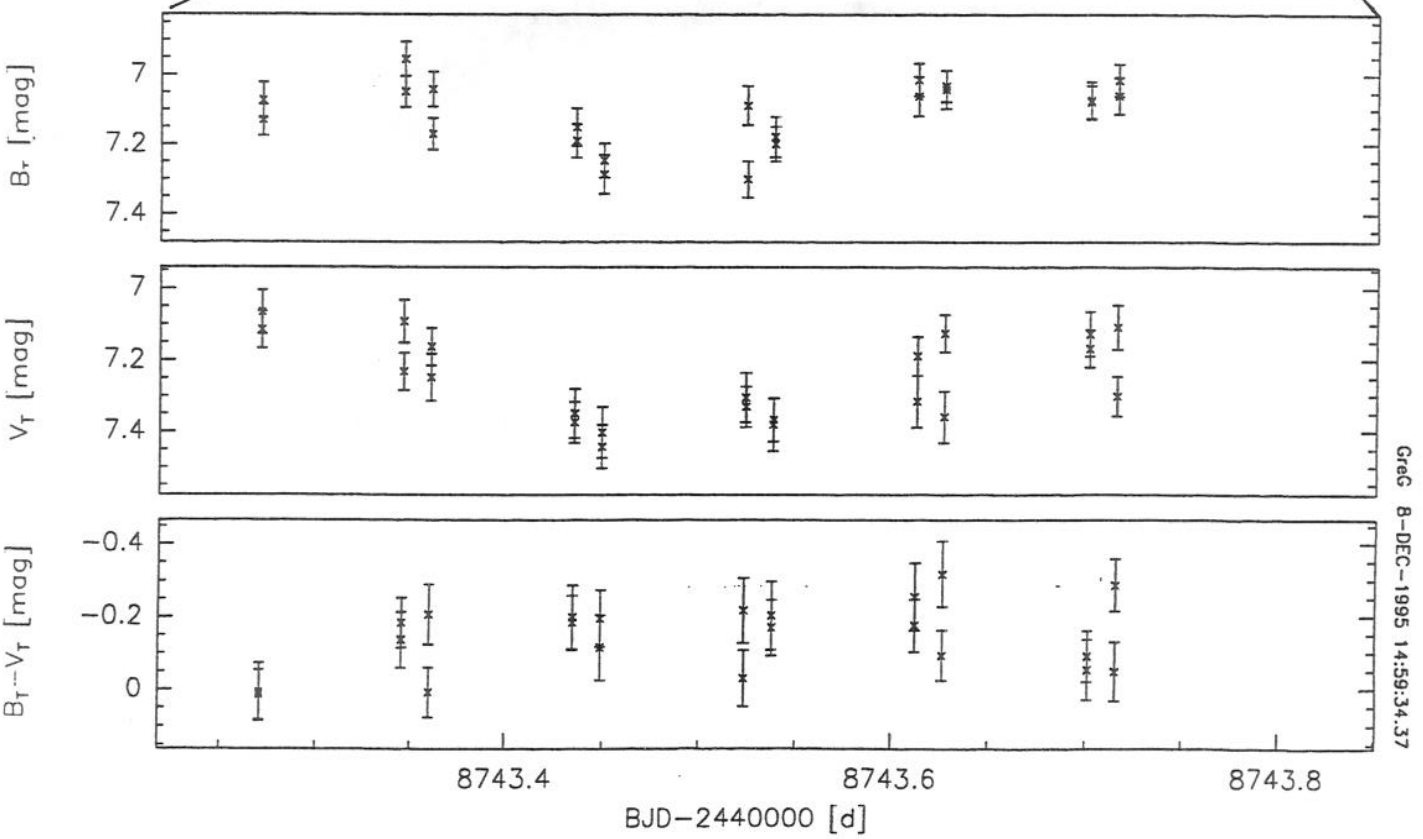
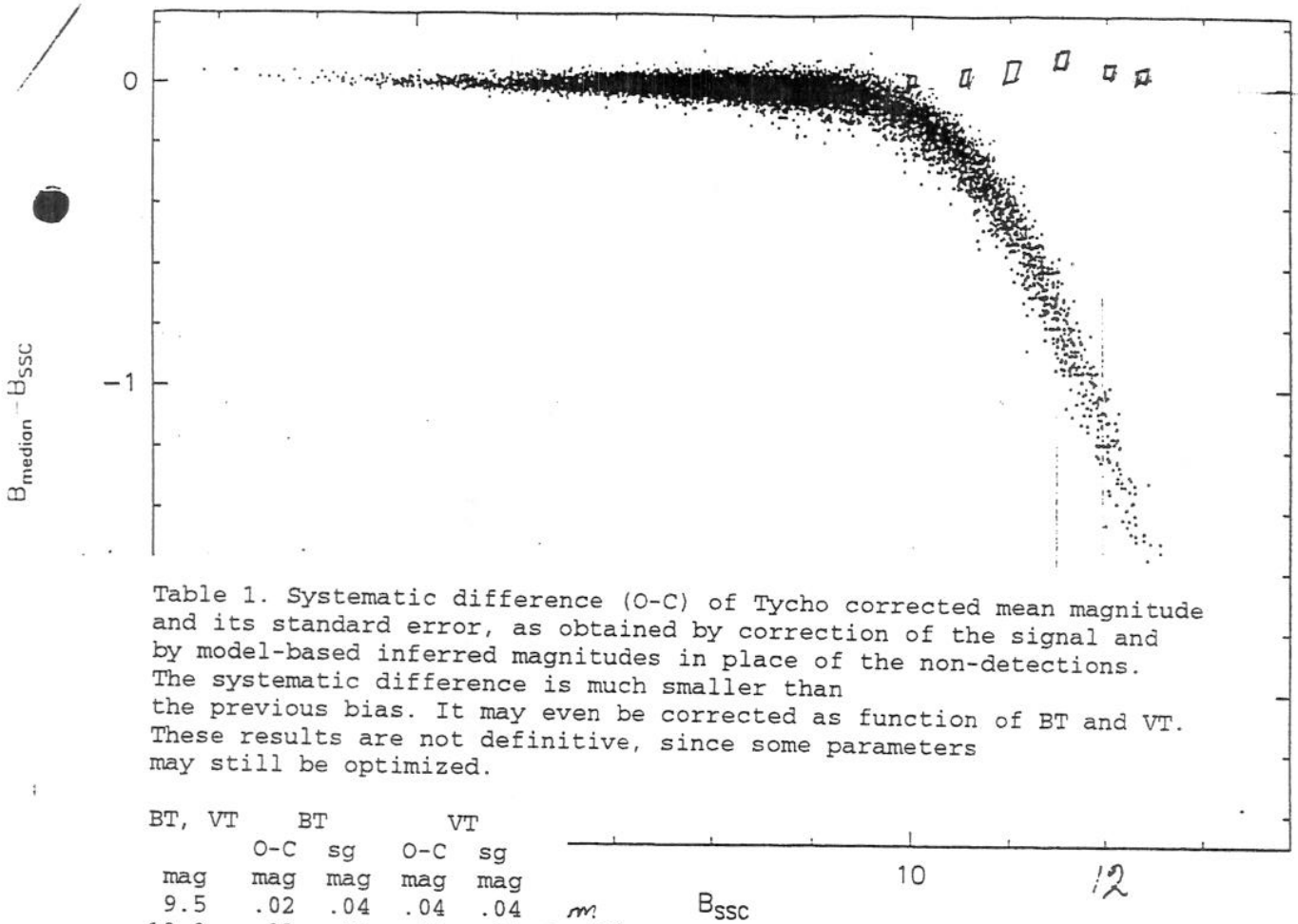


Fig 2
a
4



GreG 22-AUG-1995 15:33:31.58

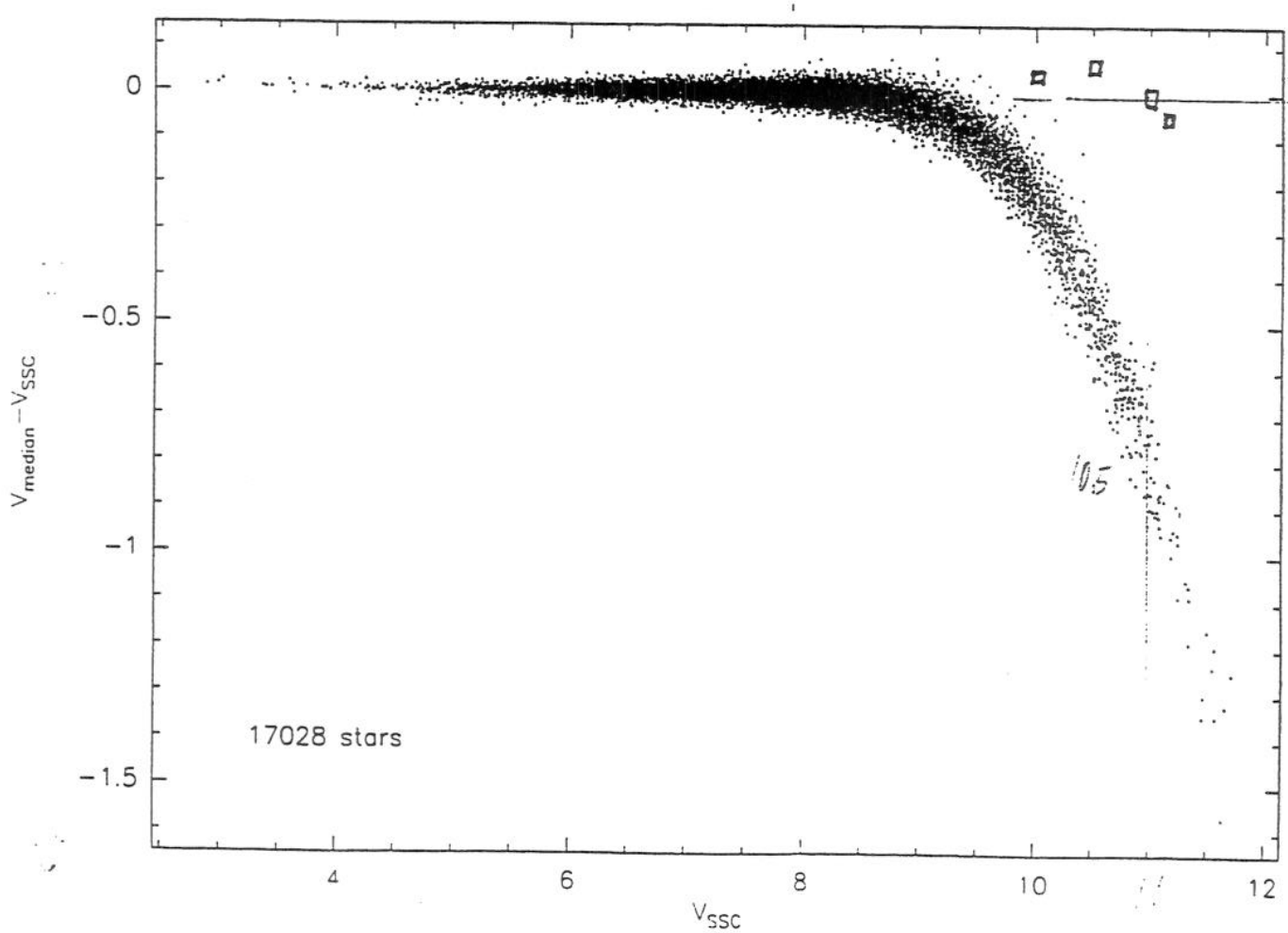
Table 1. Systematic difference (O-C) of Tycho corrected mean magnitude and its standard error, as obtained by correction of the signal and by model-based inferred magnitudes in place of the non-detections. The systematic difference is much smaller than the previous bias. It may even be corrected as function of BT and VT. These results are not definitive, since some parameters may still be optimized.

BT, VT	BT		VT	
	O-C	sg	O-C	sg
mag	mag	mag	mag	mag
9.5	.02	.04	.04	.04
10.0	.03	.05	.06	.06
10.5	.05	.06	.08	.08
11.0	.07	.09	.01	.10
11.5	.10	.13		
12.0	.08	.19		

m
>.03

∴ median O-C
□ corrected O-C 4.12.95

b



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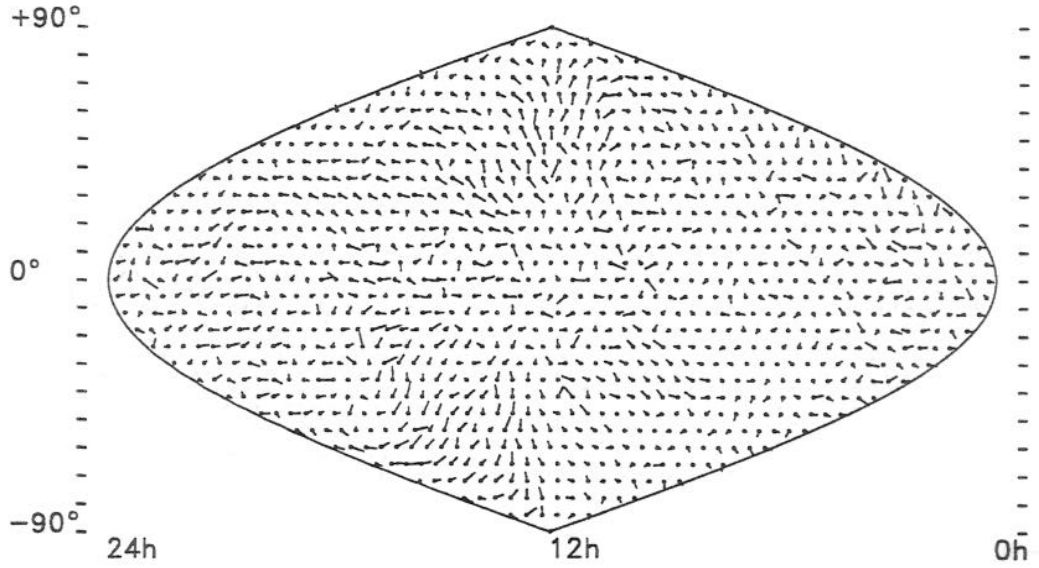
7.12.95

(5)

TCAT_15 - H37

Mean difference in pos (T-H)

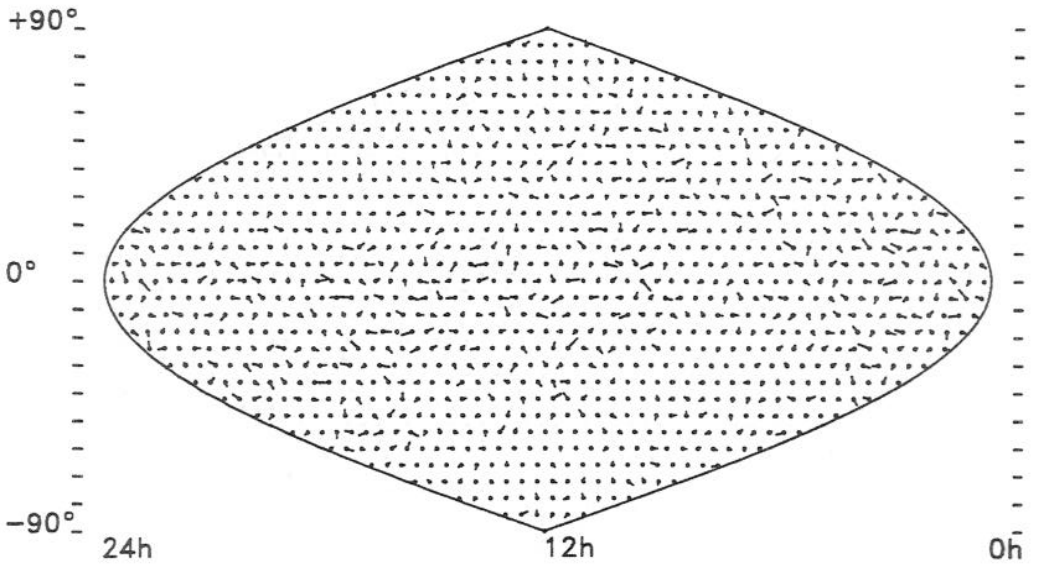
median



1.3

⊕ radius = 2 mas

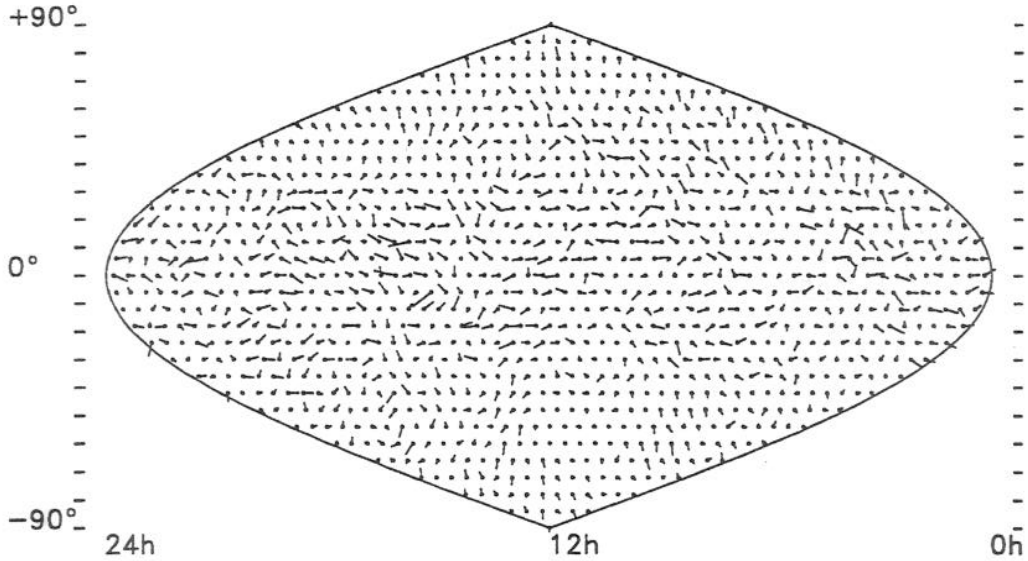
after correction



0.8

⊕ radius = 2 mas

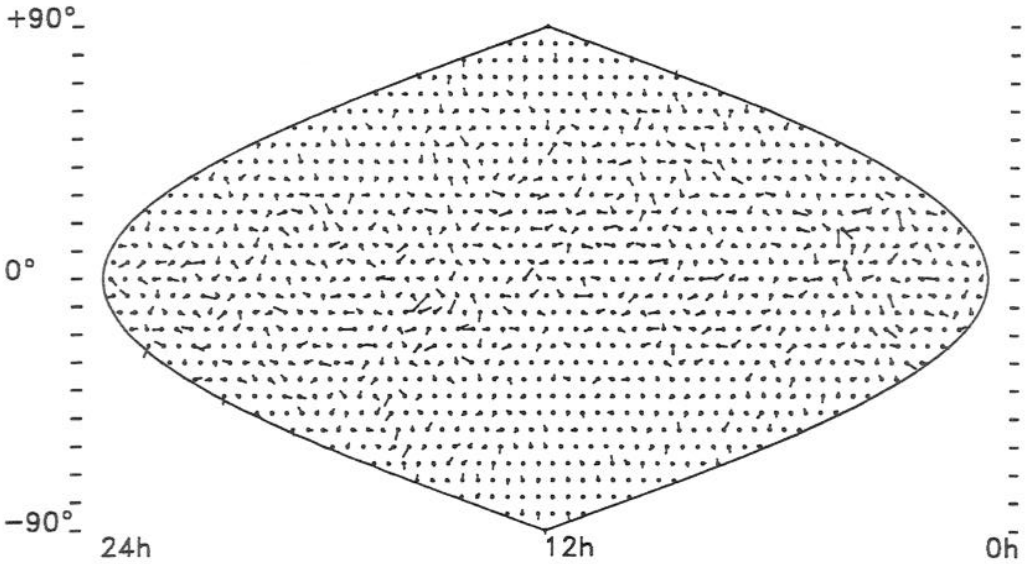
Mean difference in pm (T-H)



1.2

⊕ radius = 2 mas/y

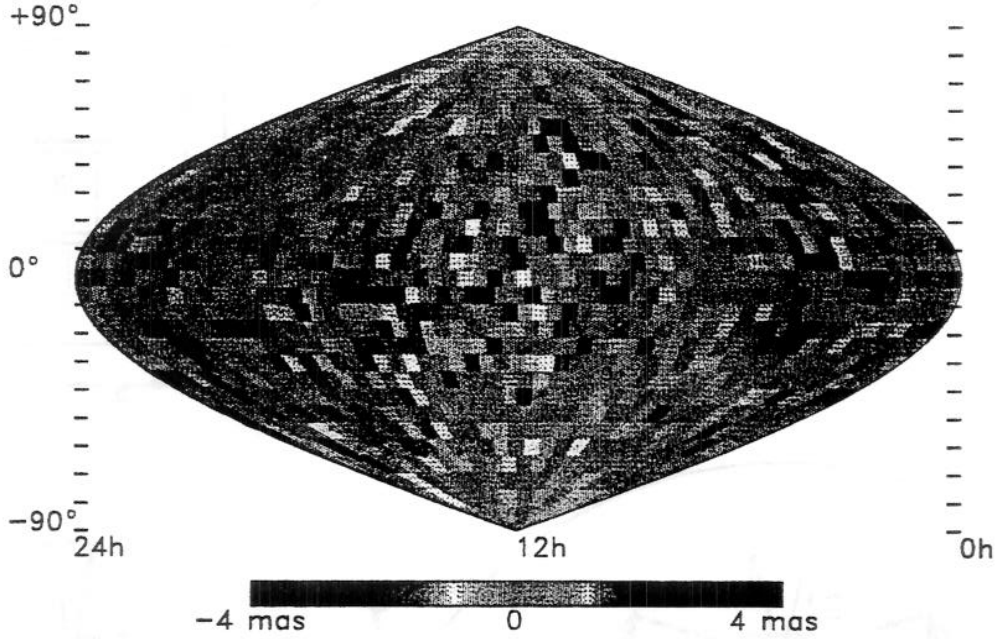
after correction



0.9

⊕ radius = 2 mas/y

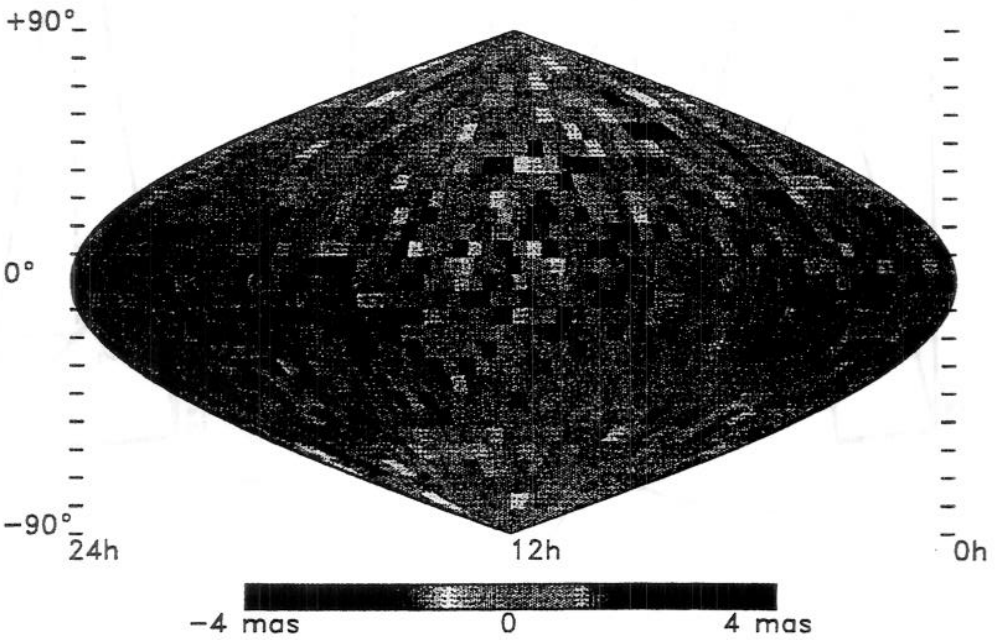
Mean difference in parallax (T-H)



mean abs. diff.

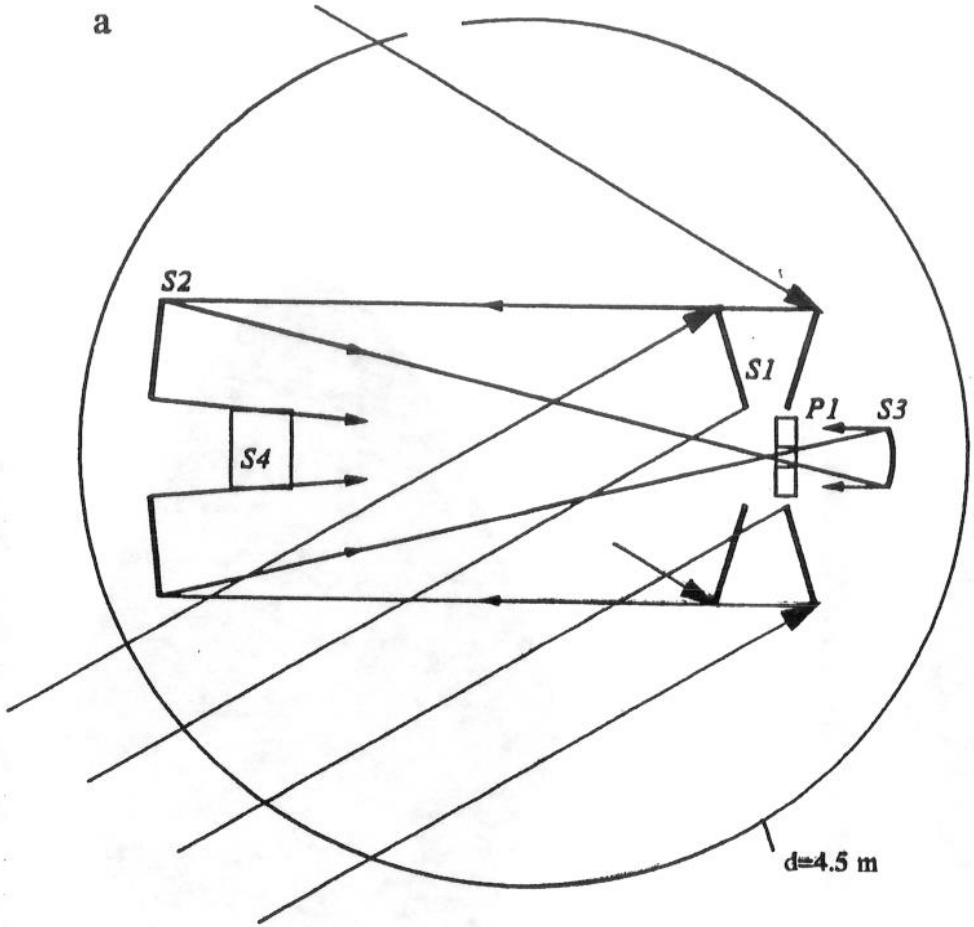
0.85

after correction

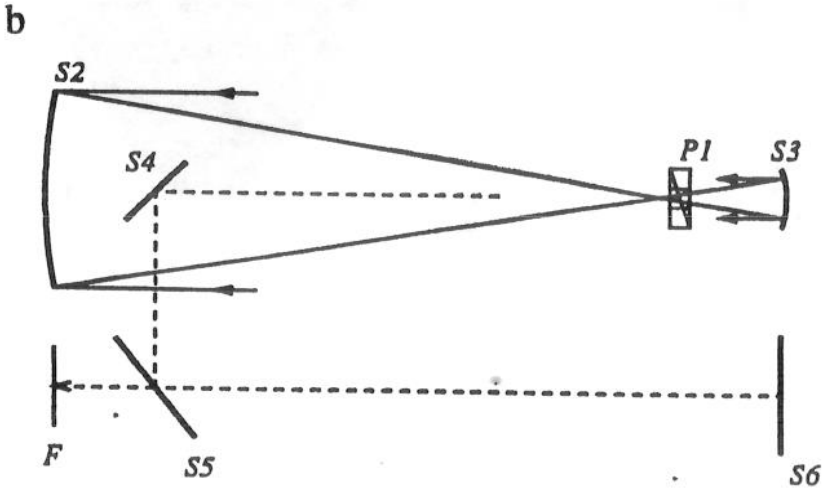


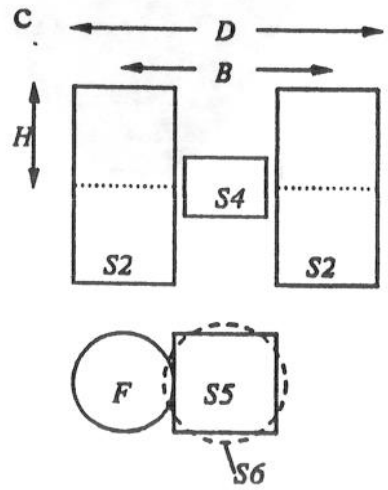
0.84

GAIA 95



B = 100 cm





8

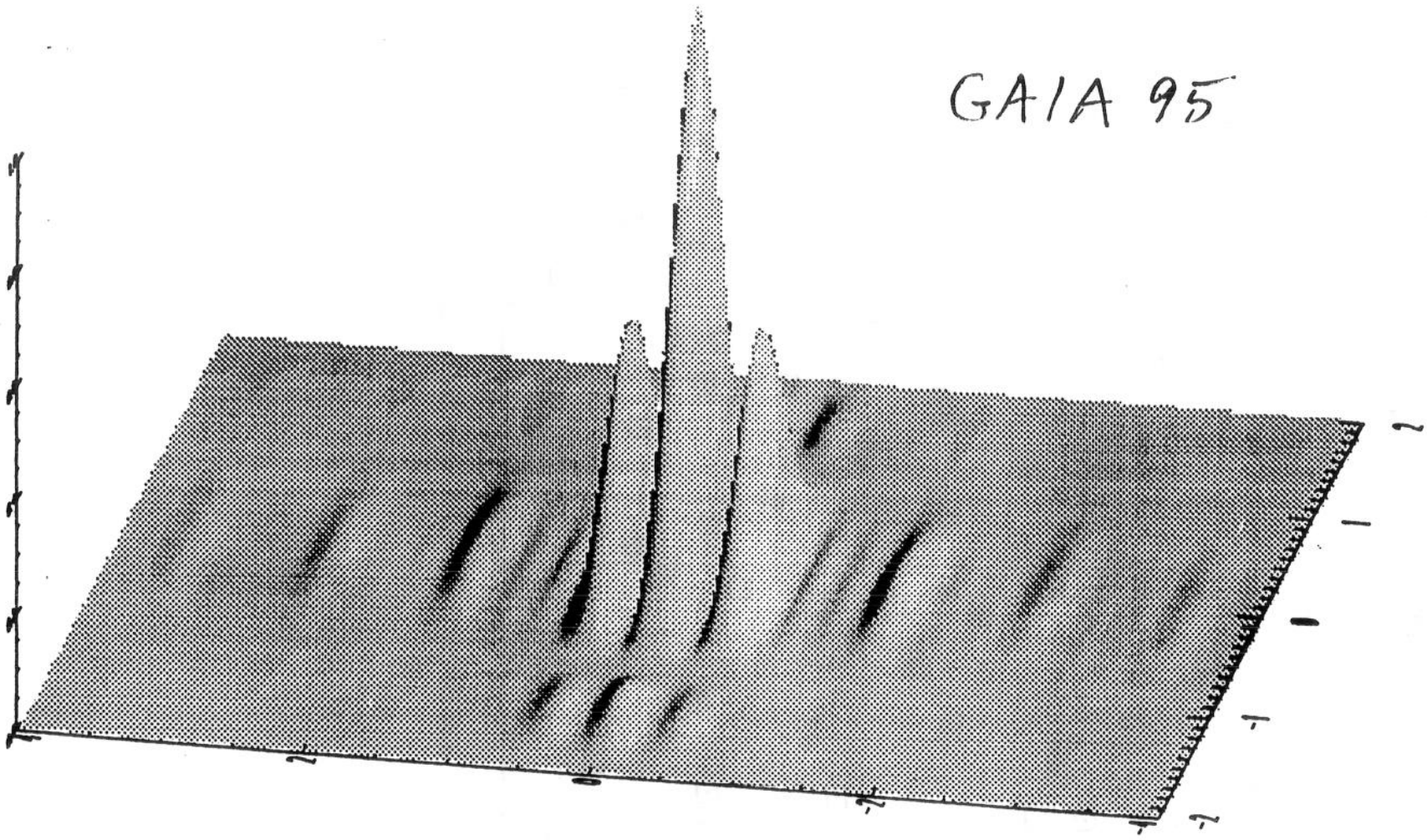
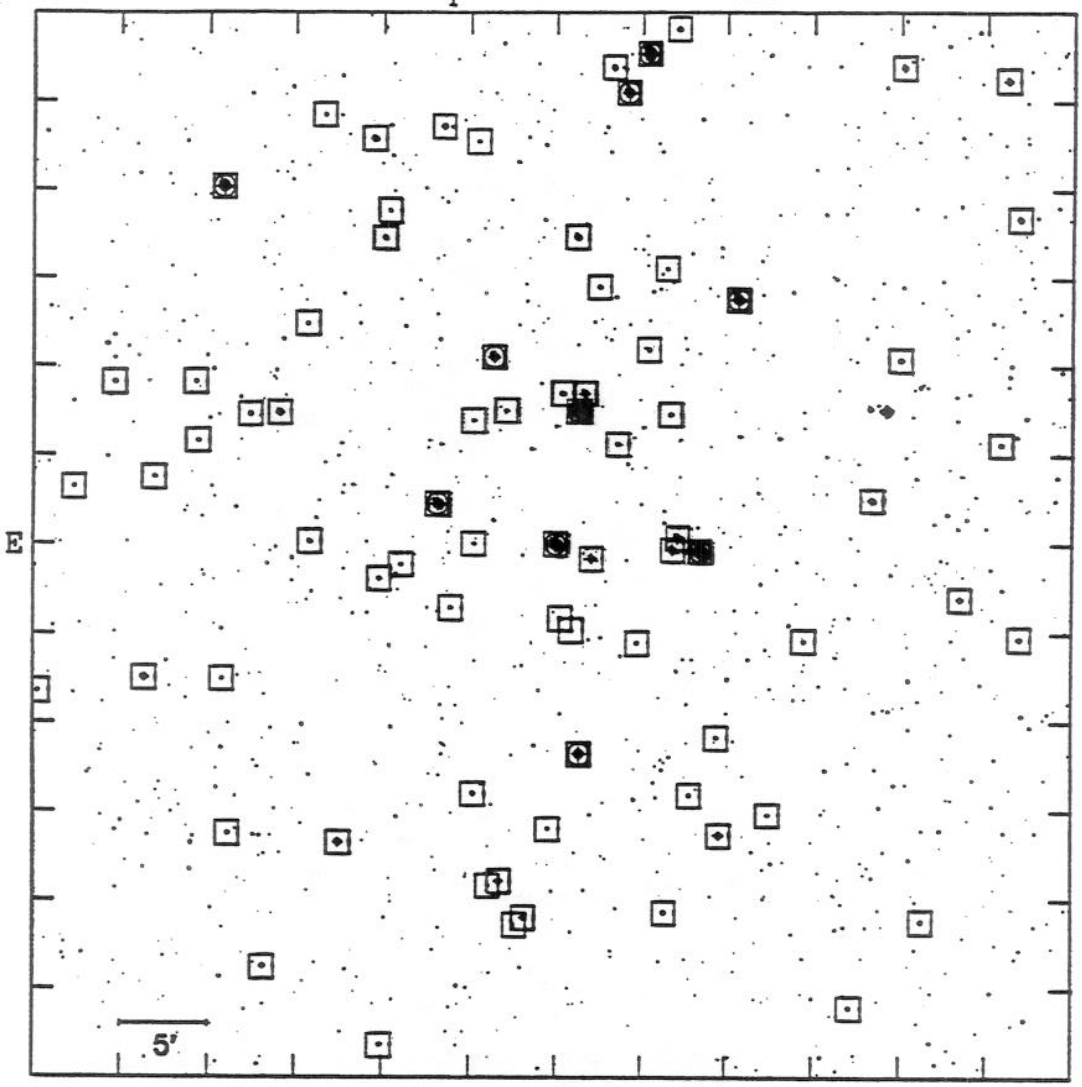


Figure 5: The two-dimensional monochromatic diffraction image, cf. Sect. 4, Fig. 3.

TYAC

(10)

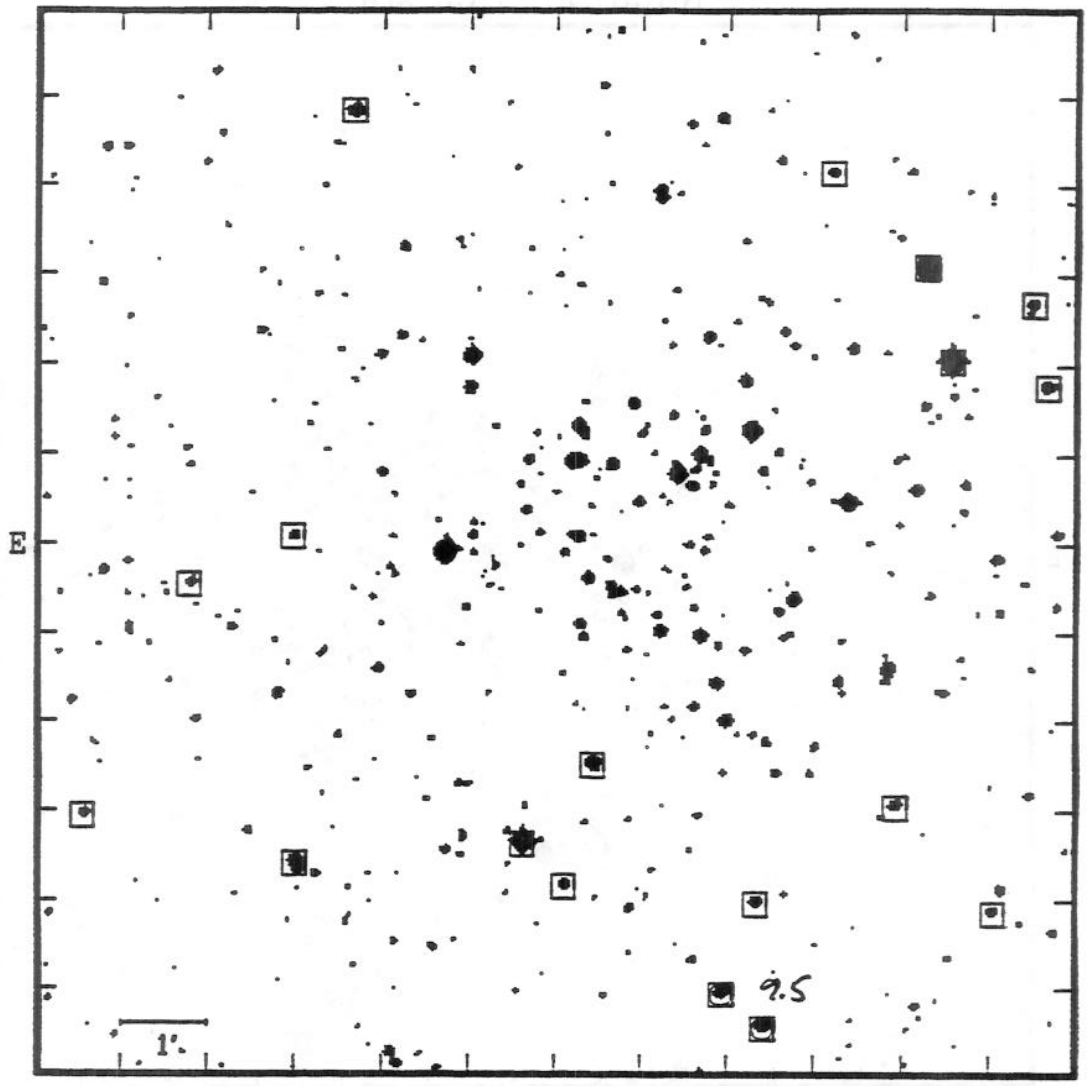
Praesepe □: TYC o: HIP



α,δ: 08^{h}40^m, +19°32′ ℓ,b: 206°, +32°

TCAT_S AH 3 Nov 1996 10:13

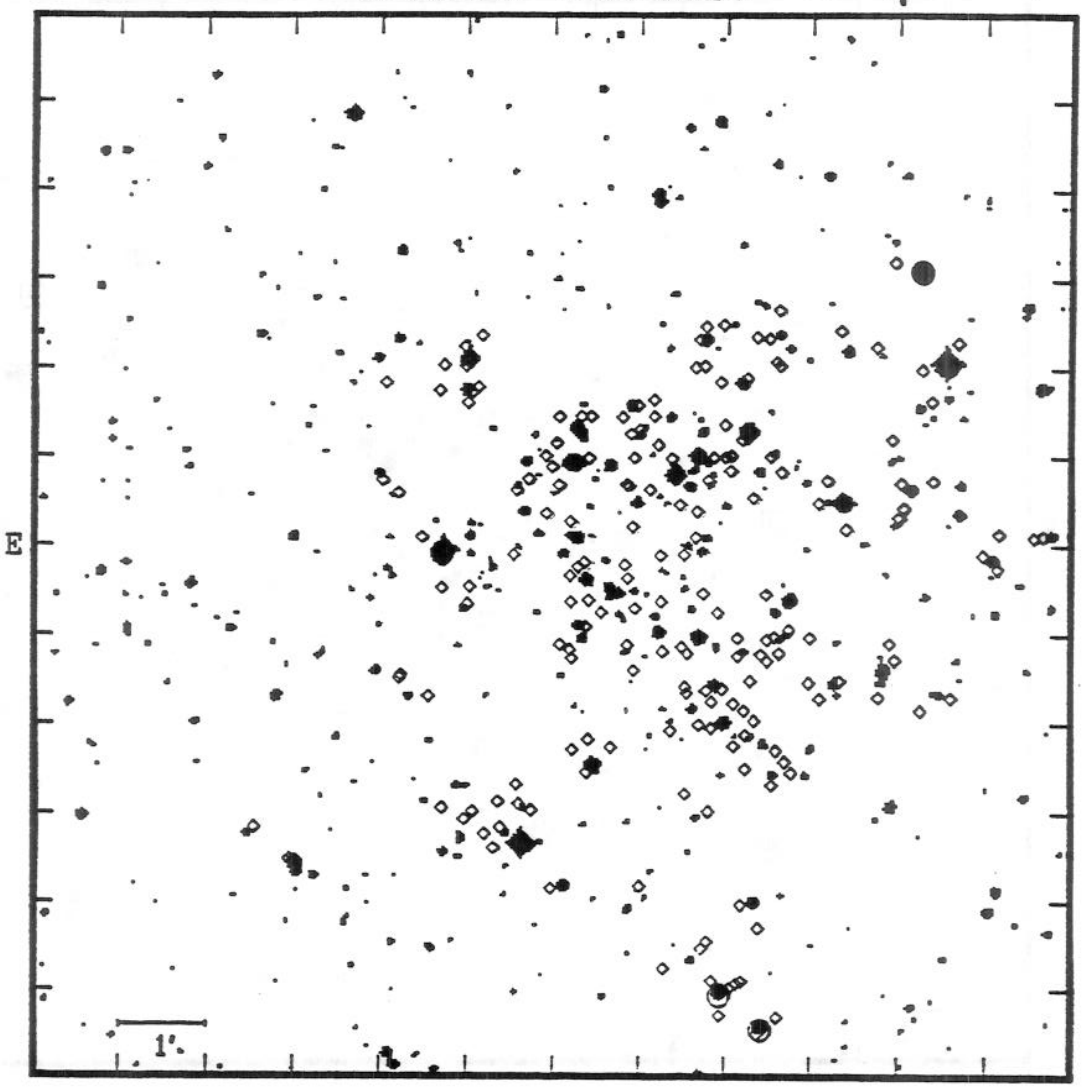
NGC3766 □: TYC o: HIP



α,δ: 11^h36^m, $-61°36'$ l,b: 294°, −0°

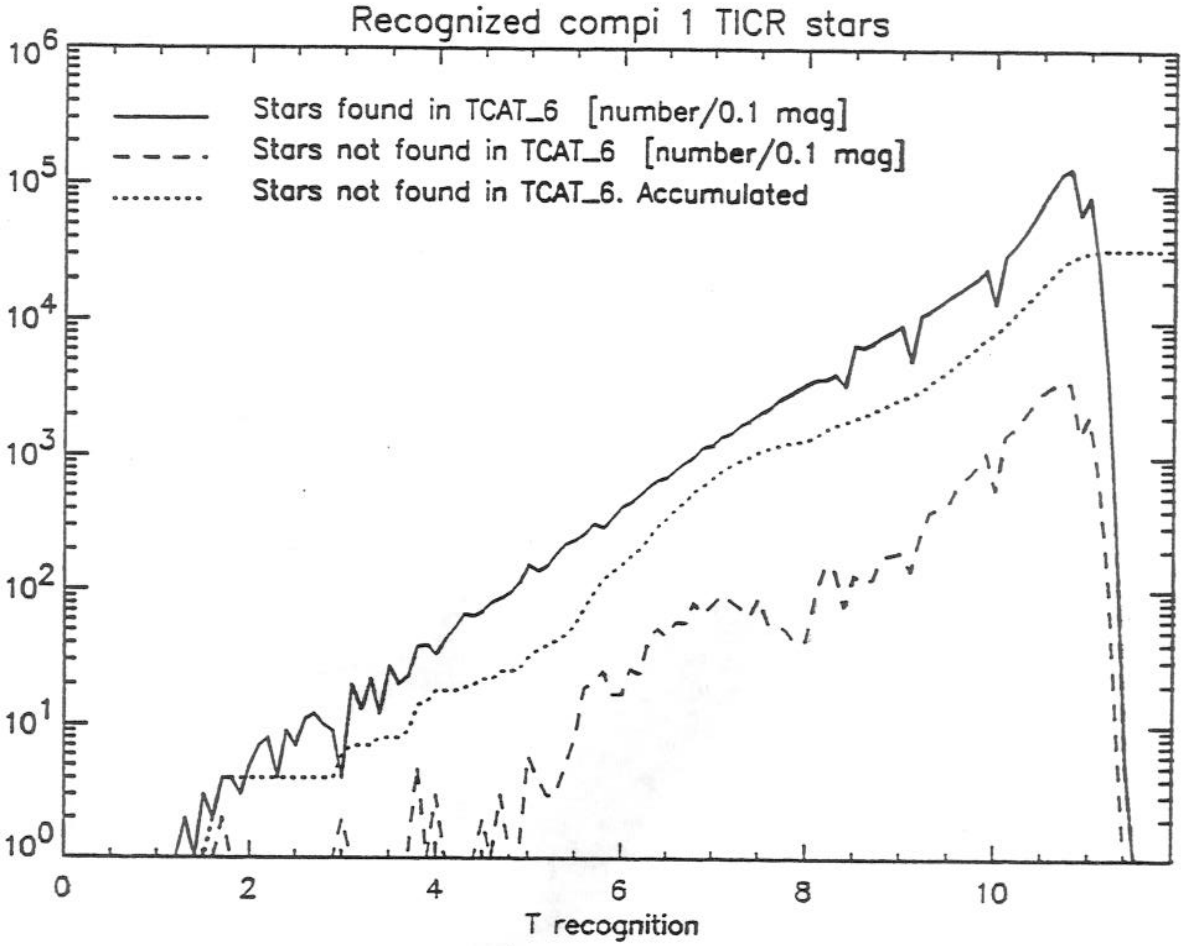
(12)

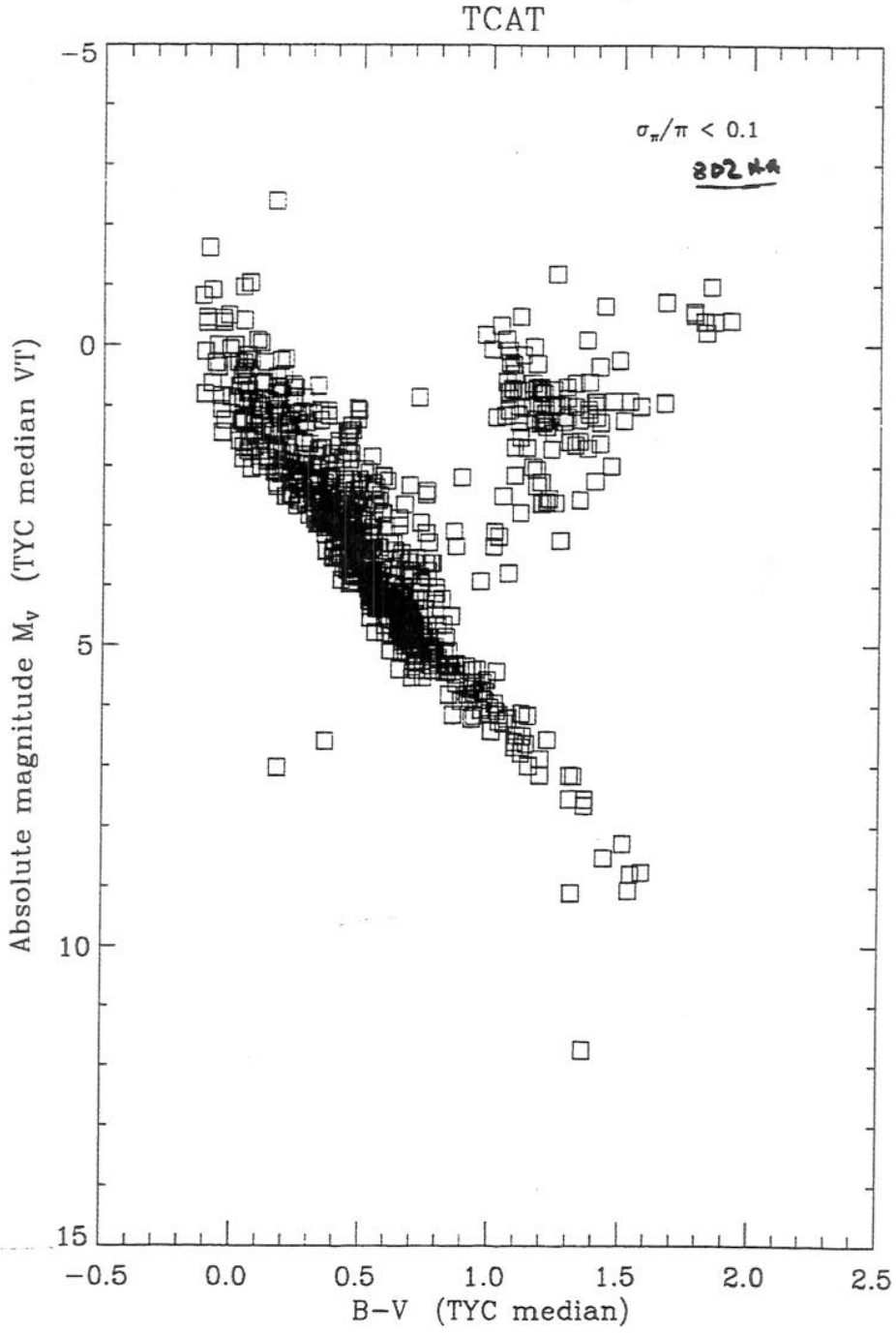
NGC3766 TICR stars compi 2-9

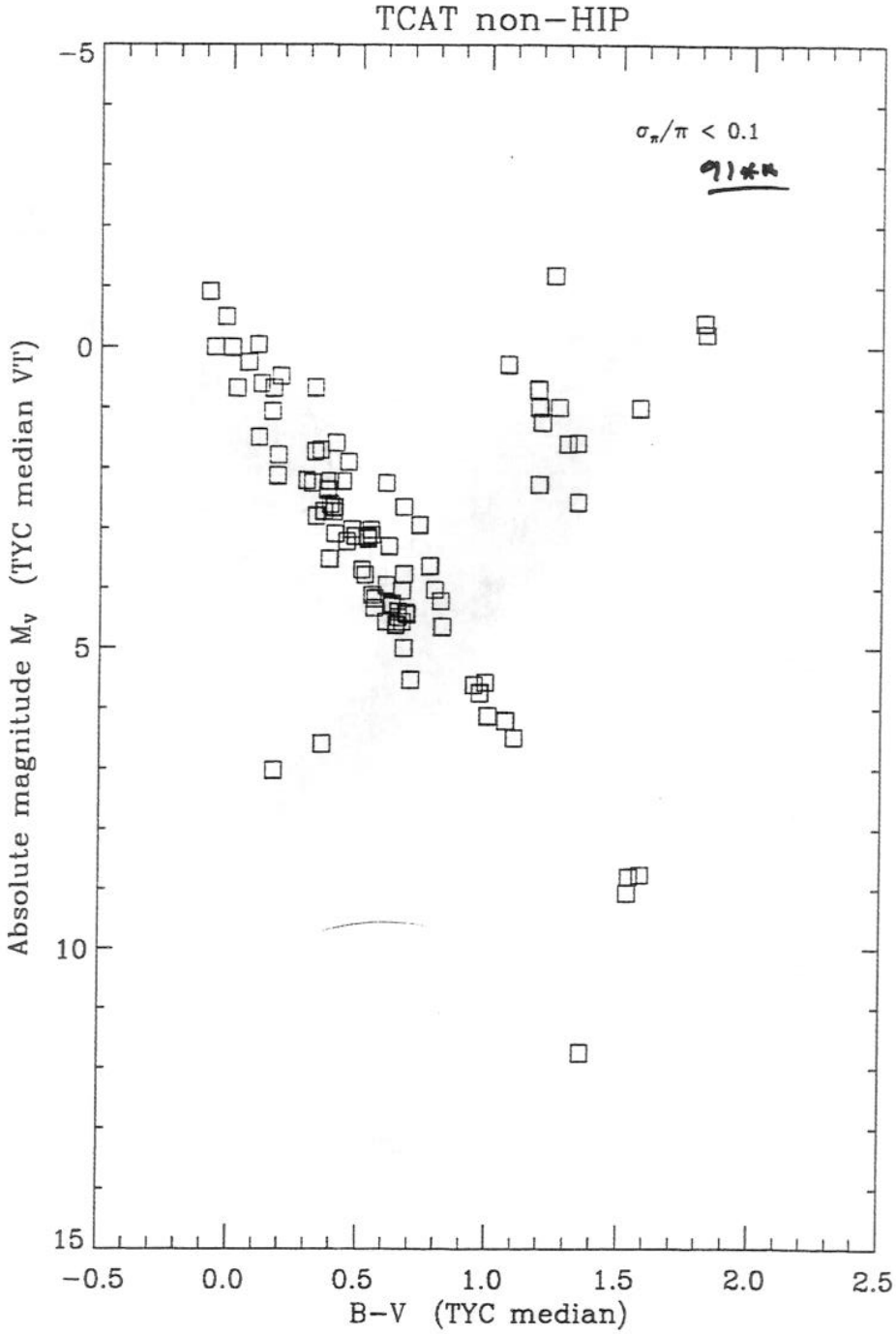


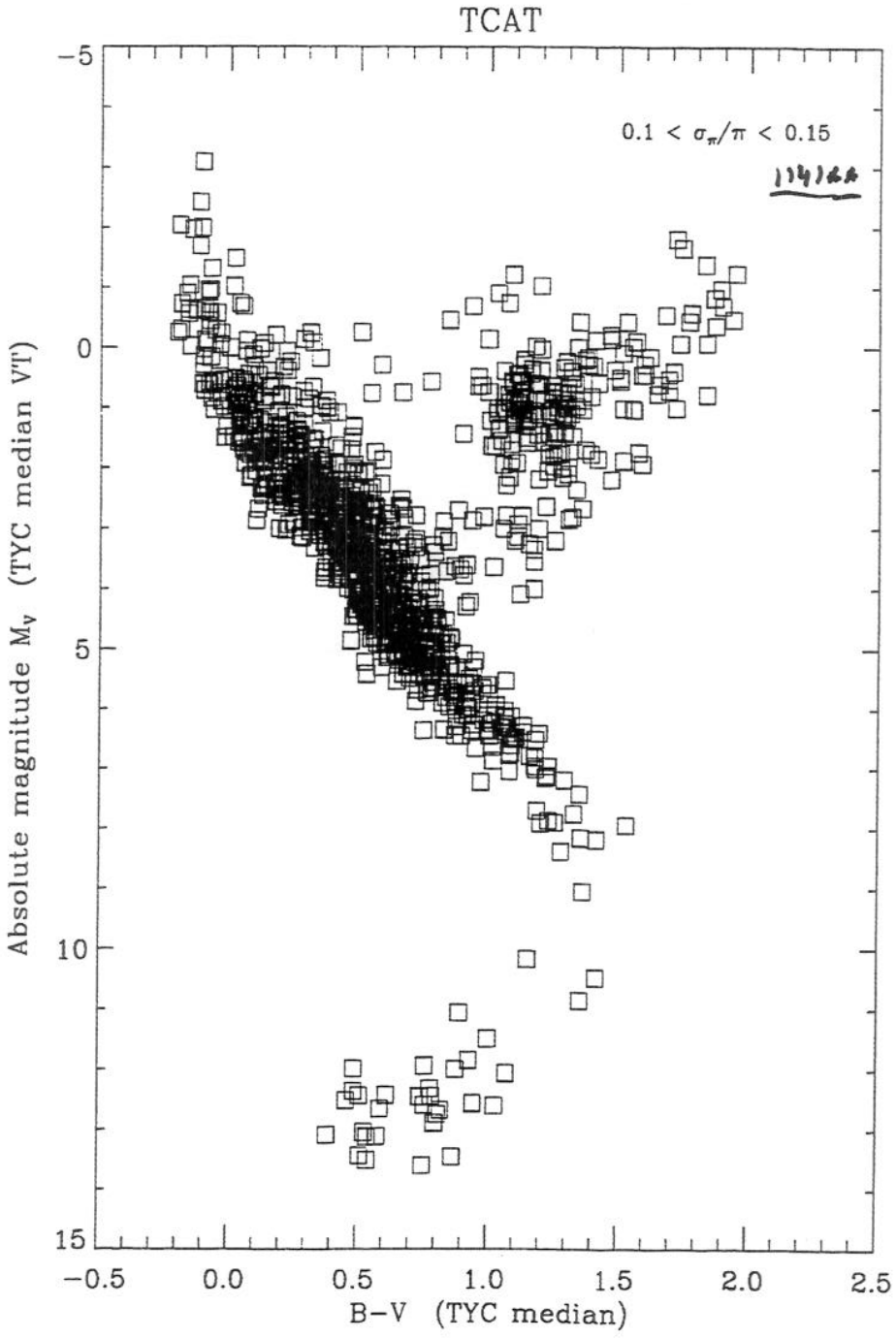
α,δ: 11^h36^m, $-61°36'$ l,b: $294°$, $-0°$

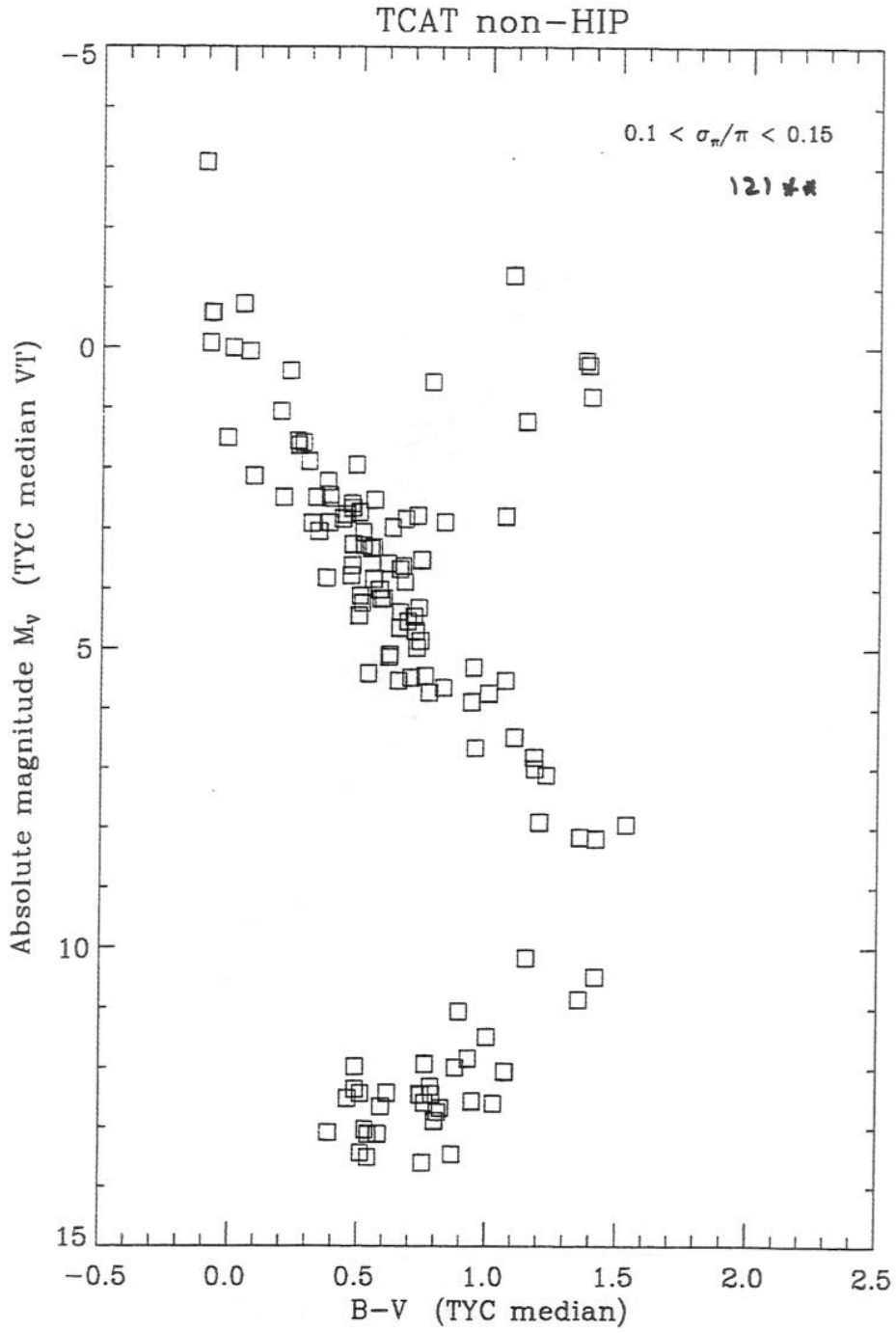
TICR compi 2-9 26 Oct 1998 15:08


Recognized compi 1 TICR stars
Stars found in TCAT_6 [number/0.1 mag]
Stars not found in TCAT_6 [number/0.1 mag]
Stars not found in TCAT_6. Accumulated
10^6
10^5
10^4
10^3
10^2
10^1
10^0
0
2
4
6
8
10
T recognition


TCAT
$\sigma_\pi/\pi < 0.1$
BD2 44
Absolute magnitude M_V (TYC median VT)
B−V (TYC median)
−5
0
5
10
15
−0.5
0.0
0.5
1.0
1.5
2.0
2.5


TCAT non−HIP
σ_π/π < 0.1
9148
Absolute magnitude M_V (TYC median VT)
B−V (TYC median)
−5
0
5
10
15
−0.5
0.0
0.5
1.0
1.5
2.0
2.5


TCAT
$0.1 < \sigma_\pi/\pi < 0.15$
114168
Absolute magnitude M_V (TYC median VT)
B−V (TYC median)
−5
0
5
10
15
−0.5
0.0
0.5
1.0
1.5
2.0
2.5


TCAT non−HIP
0.1 < σπ/π < 0.15
1214
Absolute magnitude MV (TYC median VT)
B−V (TYC median)
−5
0
5
10
15
−0.5
0.0
0.5
1.0
1.5
2.0
2.5

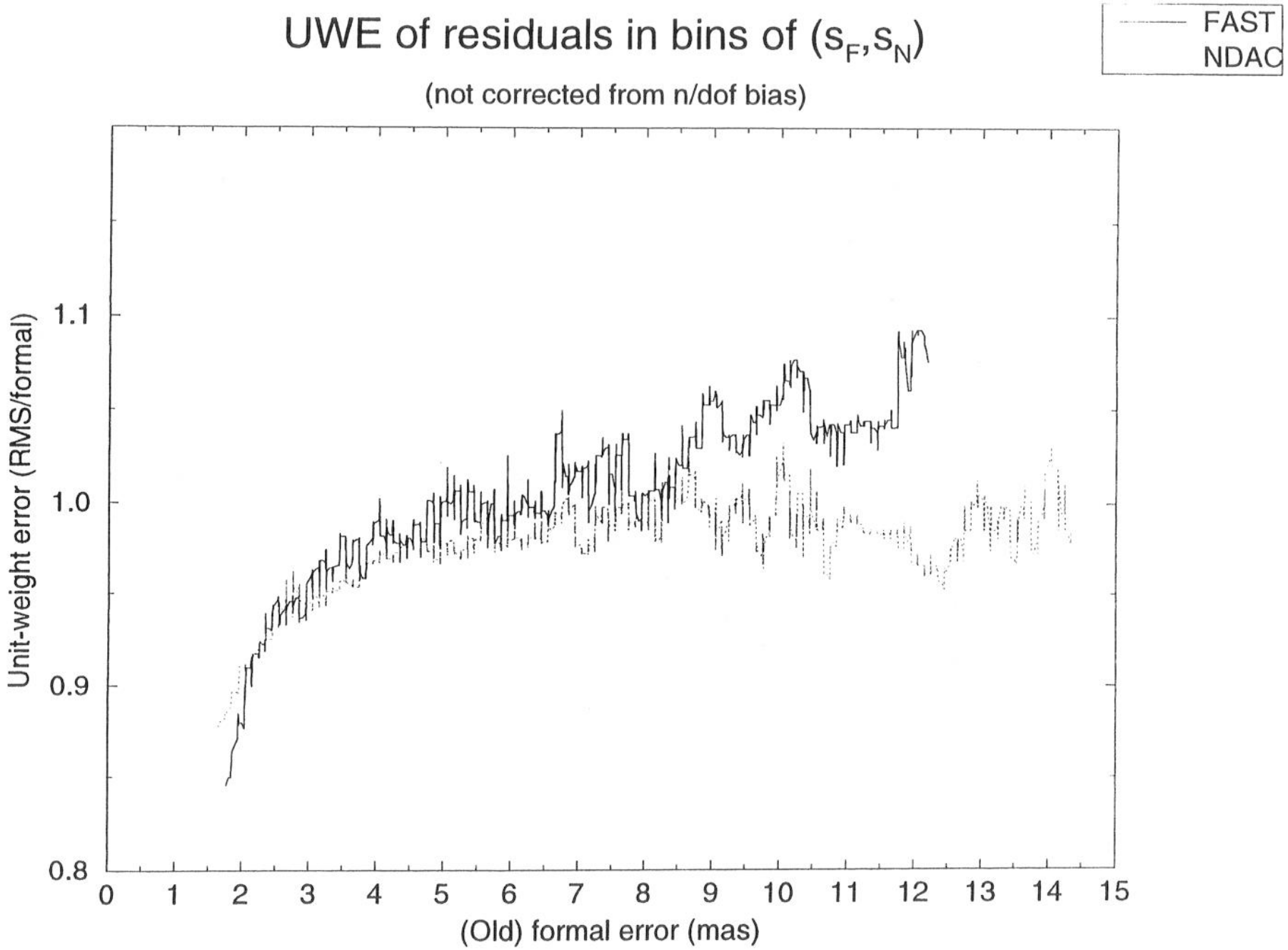

UWE of residuals in bins of (s_F,s_N)
(not corrected from n/dof bias)
FAST
NDAC
Unit-weight error (RMS/formal)
1.1
1.0
0.9
0.8
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
(Old) formal error (mas)

Fig -2

ANNEX 2

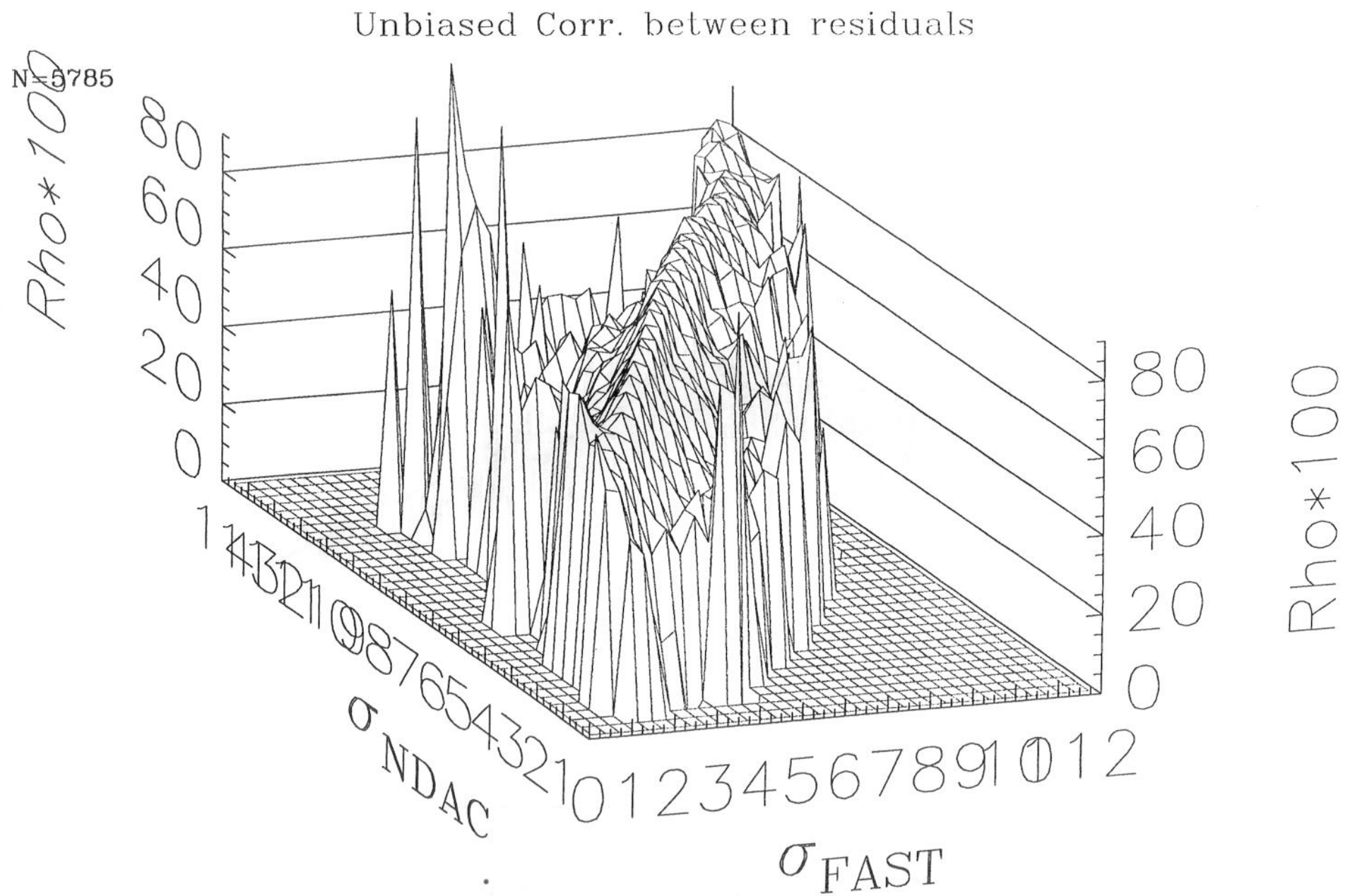

Unbiased Corr. between residuals
N=5785
Rho*100
80
60
40
20
0
Rho*100
σ NDAC
σ FAST

fig - 1

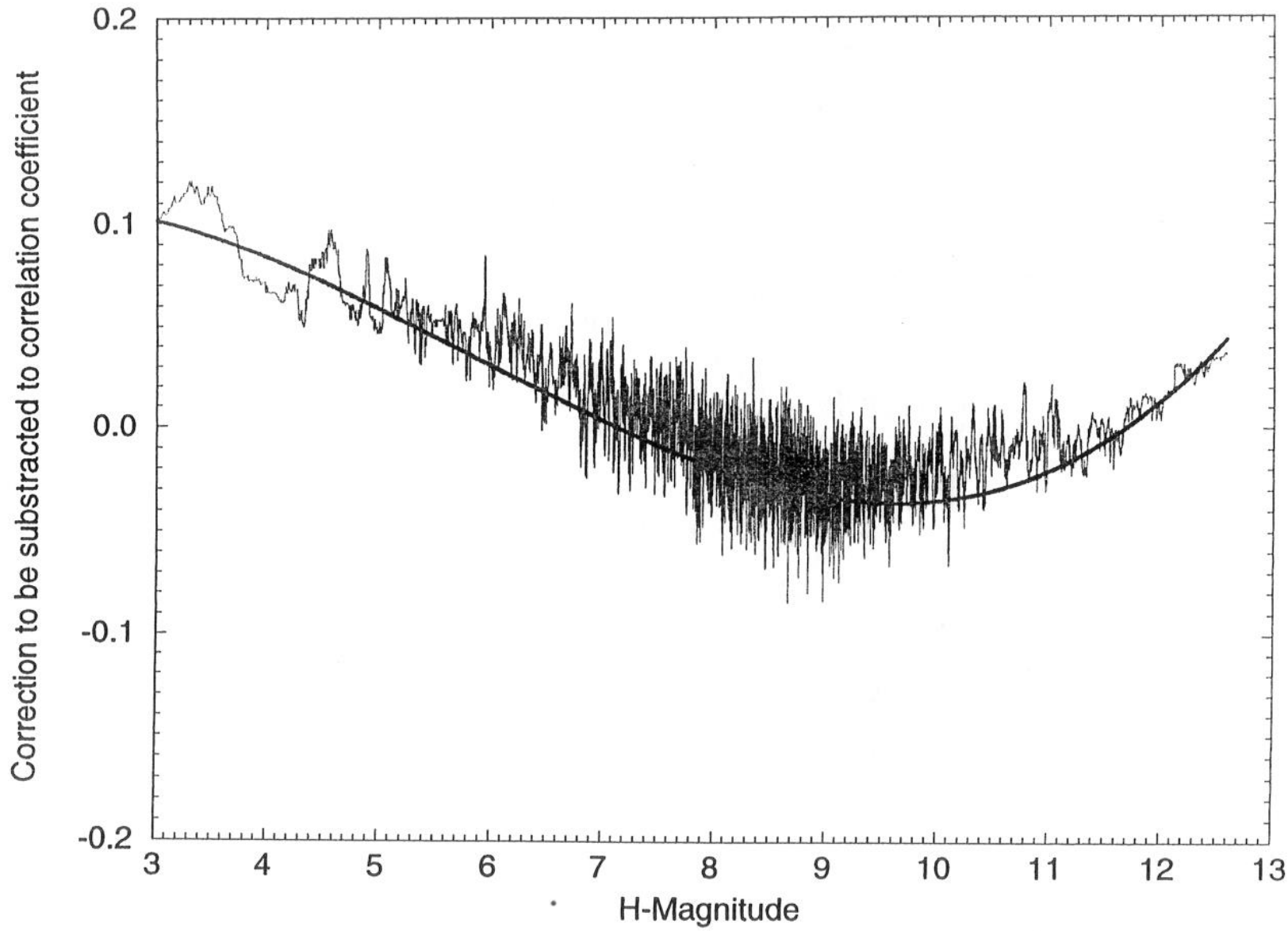
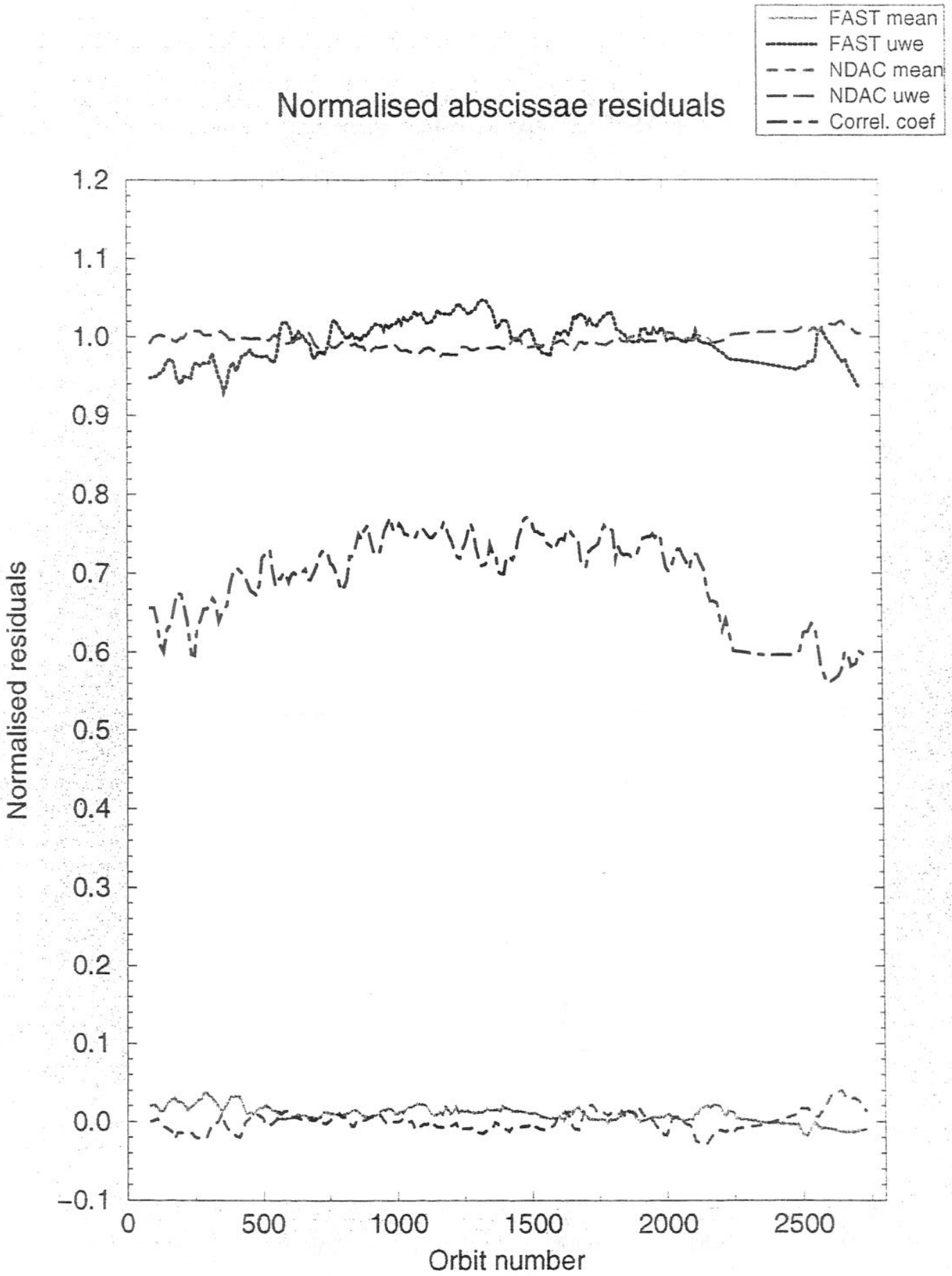

After calibration of ρ=f(s_F,s_N)
Correction to be substracted to correlation coefficient
0.2
0.1
0.0
-0.1
-0.2
3
4
5
6
7
8
9
10
11
12
13
H-Magnitude

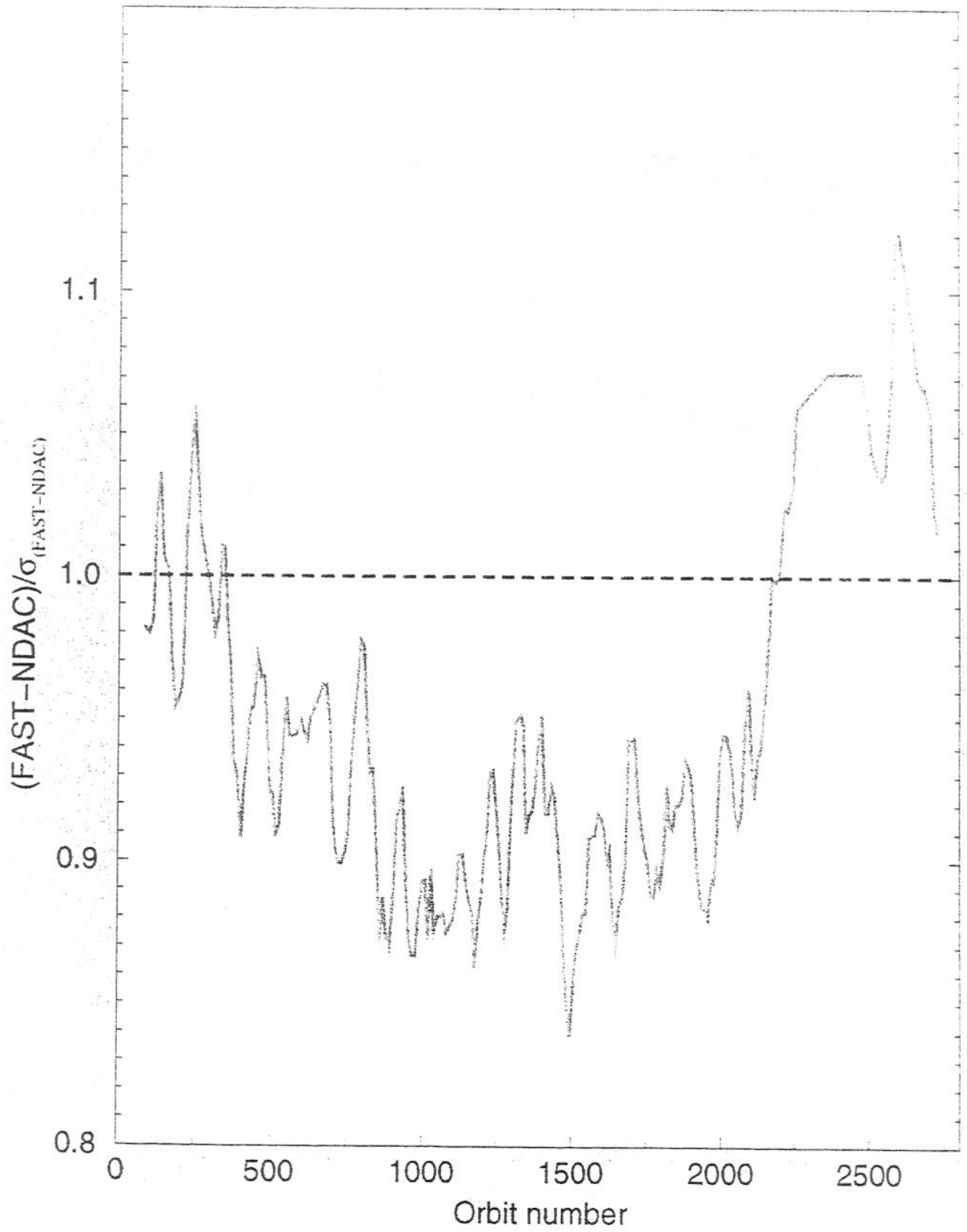
Fig 0



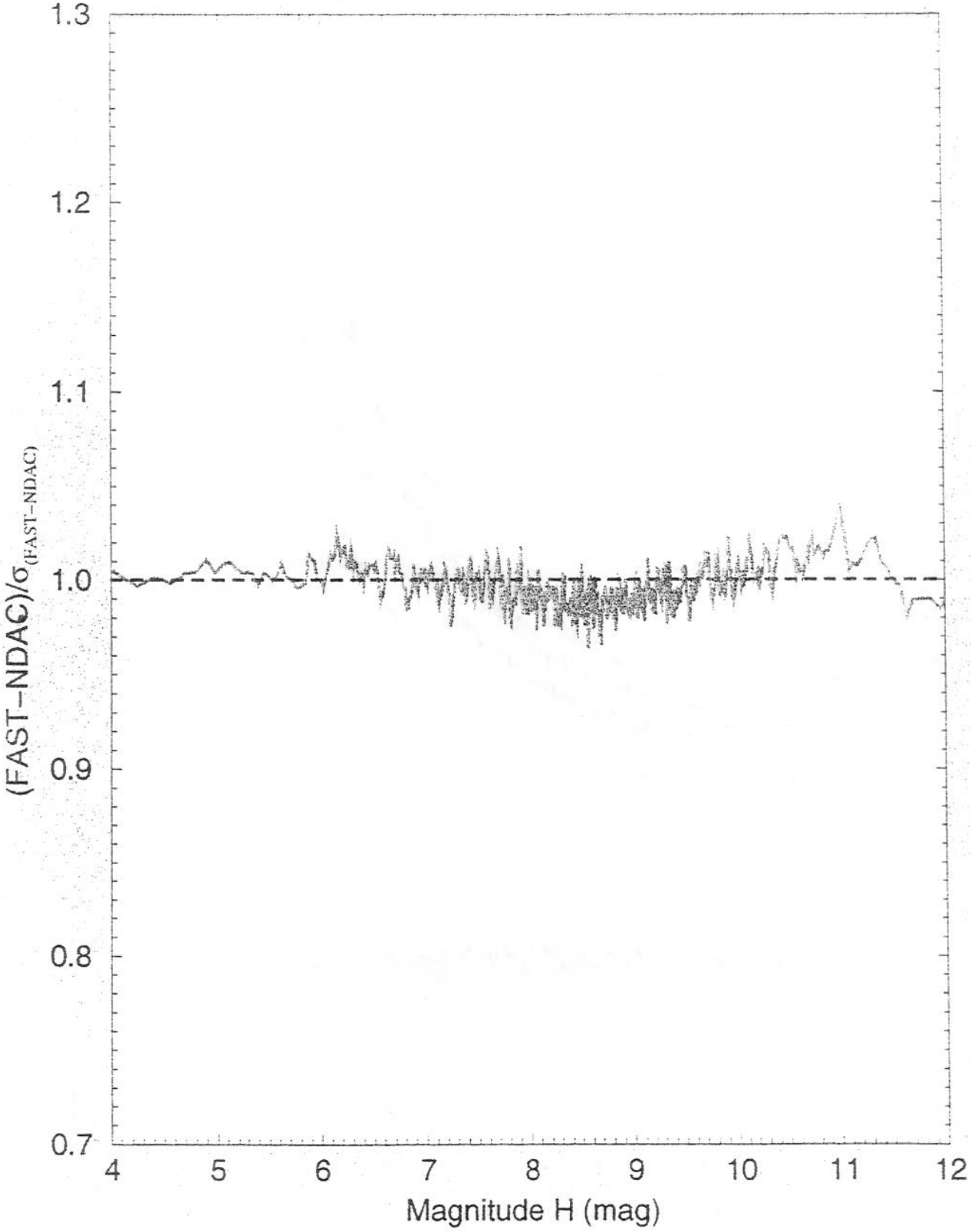
1 Dec 95 at 15:13 – Fig 01 – Global correction from bias – 50–points running median – rgcgraph.v 1.21 arenou

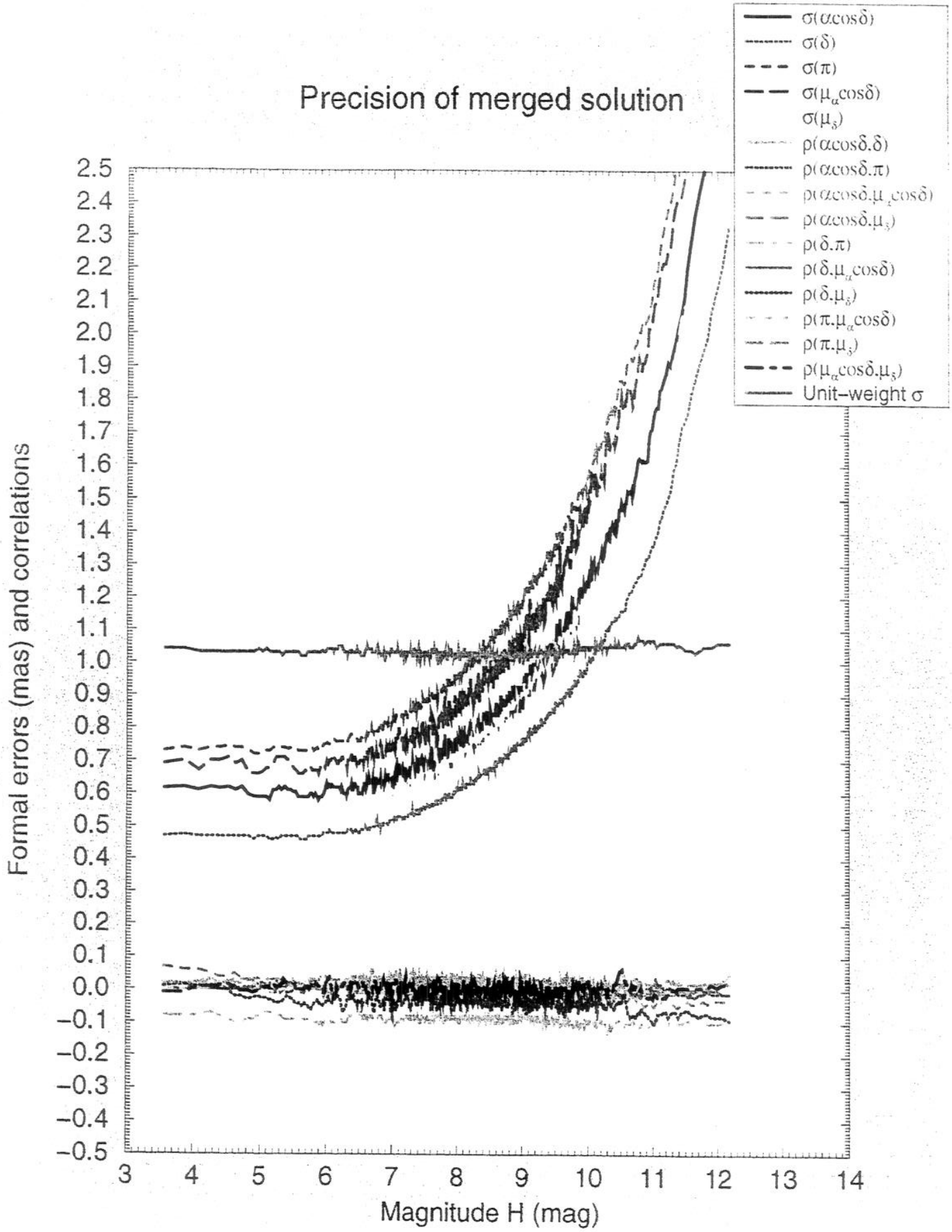
FAST–NDAC unit–weight error

using calibrated correlation coefficient



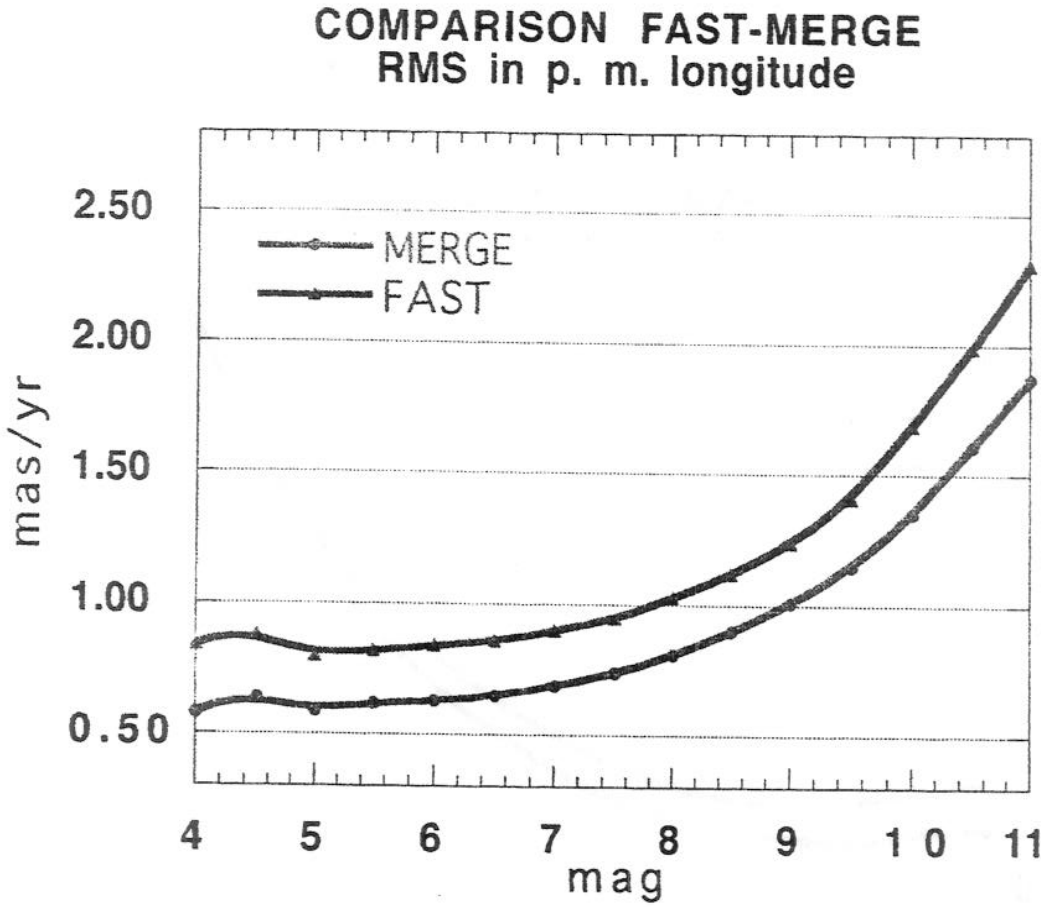
1 Dec 95 at 15:16 – Fig 09 – 50–points running median – rgcgraph.v 1.21 arenou

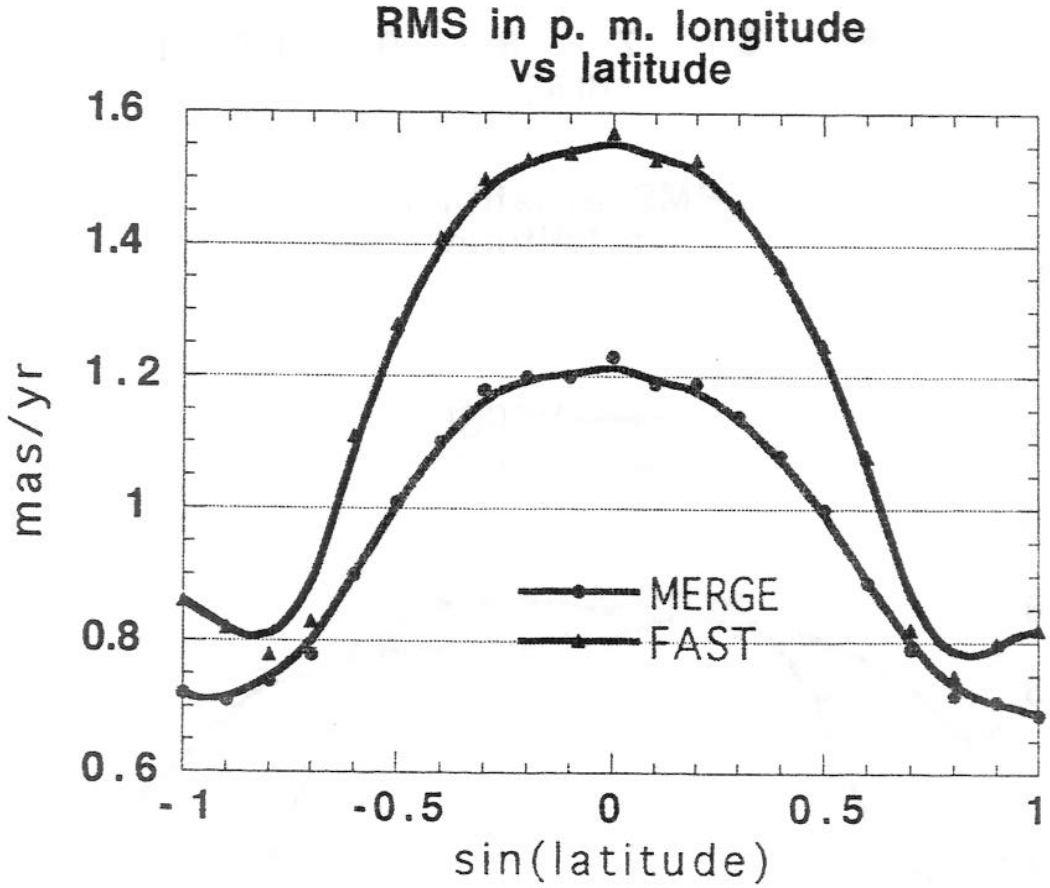

FAST–NDAC unit–weight error
using calibrated correlation coefficient
1.3
1.2
1.1
1.0
0.9
0.8
0.7
(FAST–NDAC)/σ(FAST–NDAC)
4
5
6
7
8
9
10
11
12
Magnitude H (mag)

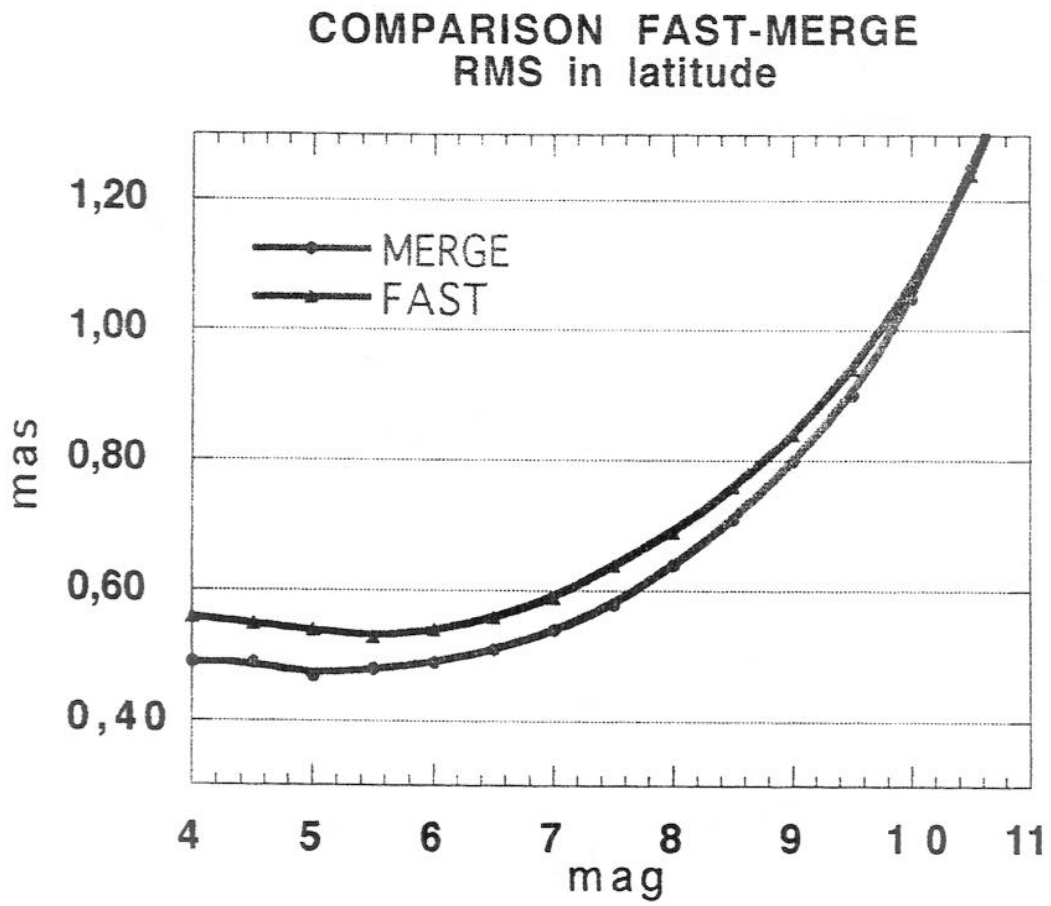


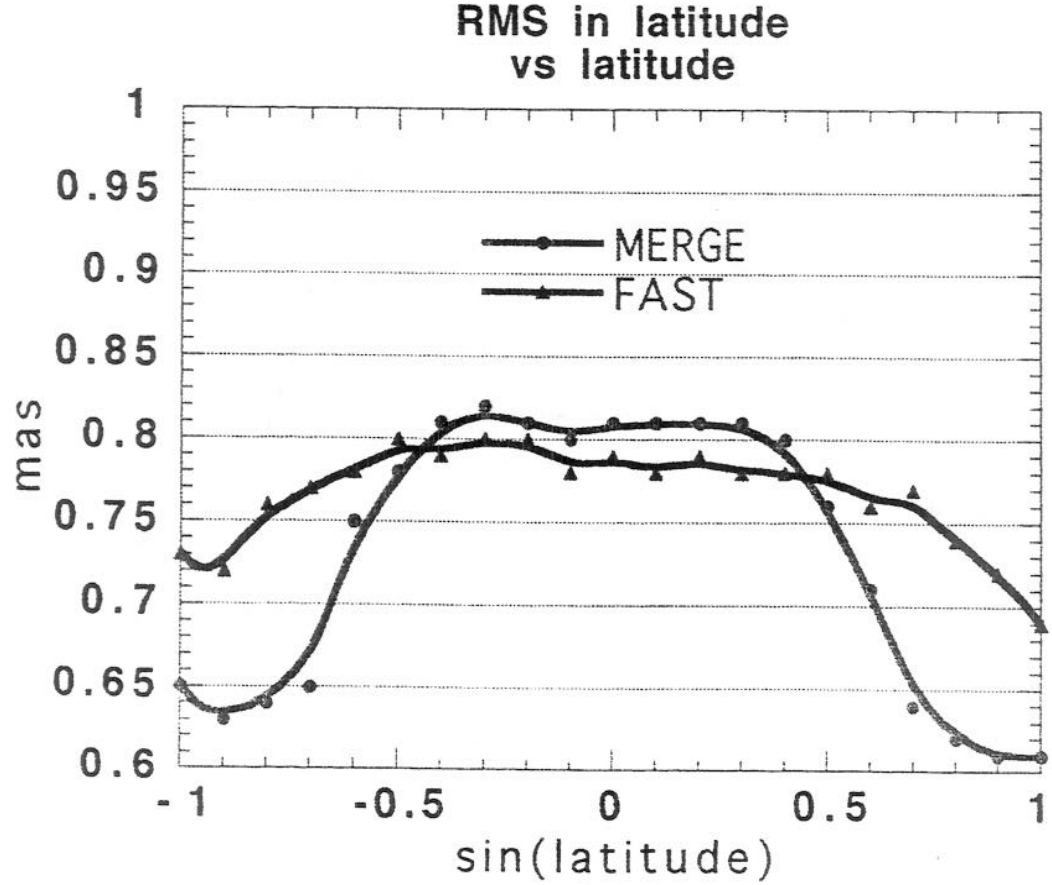
30 Nov 95 at 19:47 – Fig 17 – 500-point running median – covgraph,v 1.14 arenou

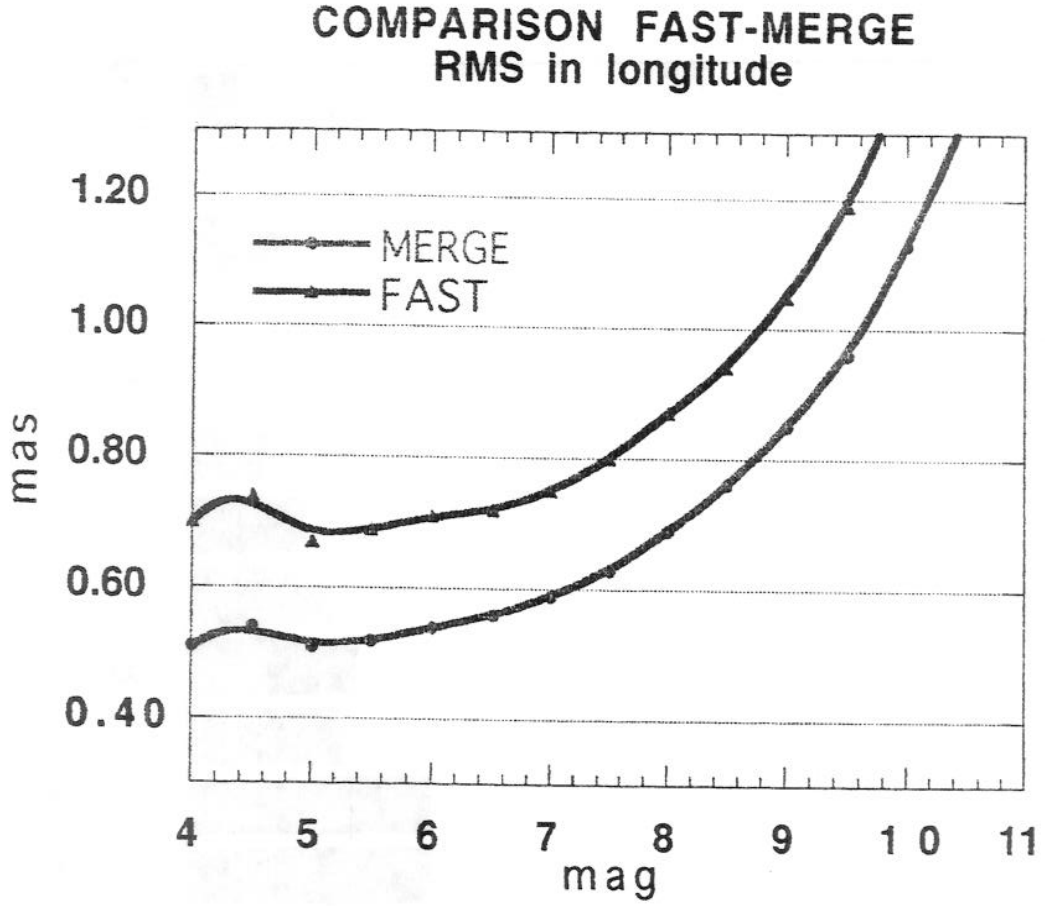
ANNEX 3

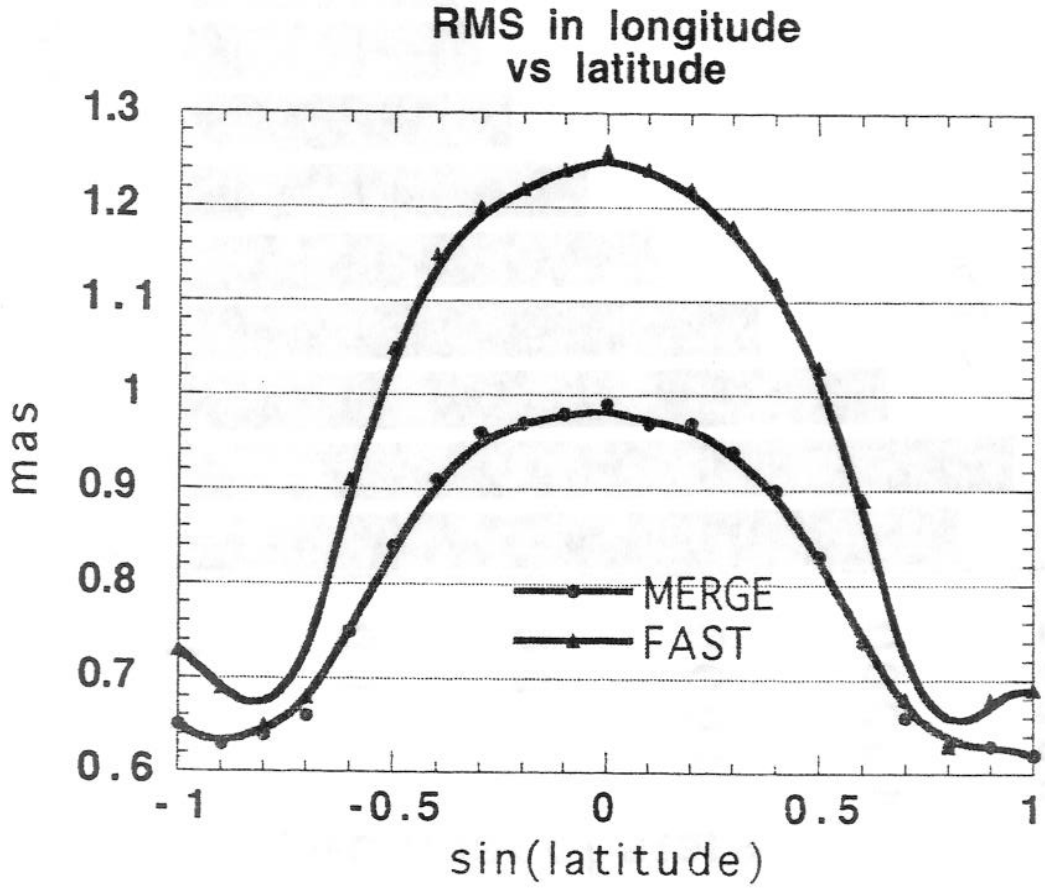

COMPARISON FAST-MERGE
RMS in p. m. longitude
2.50
2.00
1.50
1.00
0.50
mas/yr
MERGE
FAST
4
5
6
7
8
9
10
11
mag

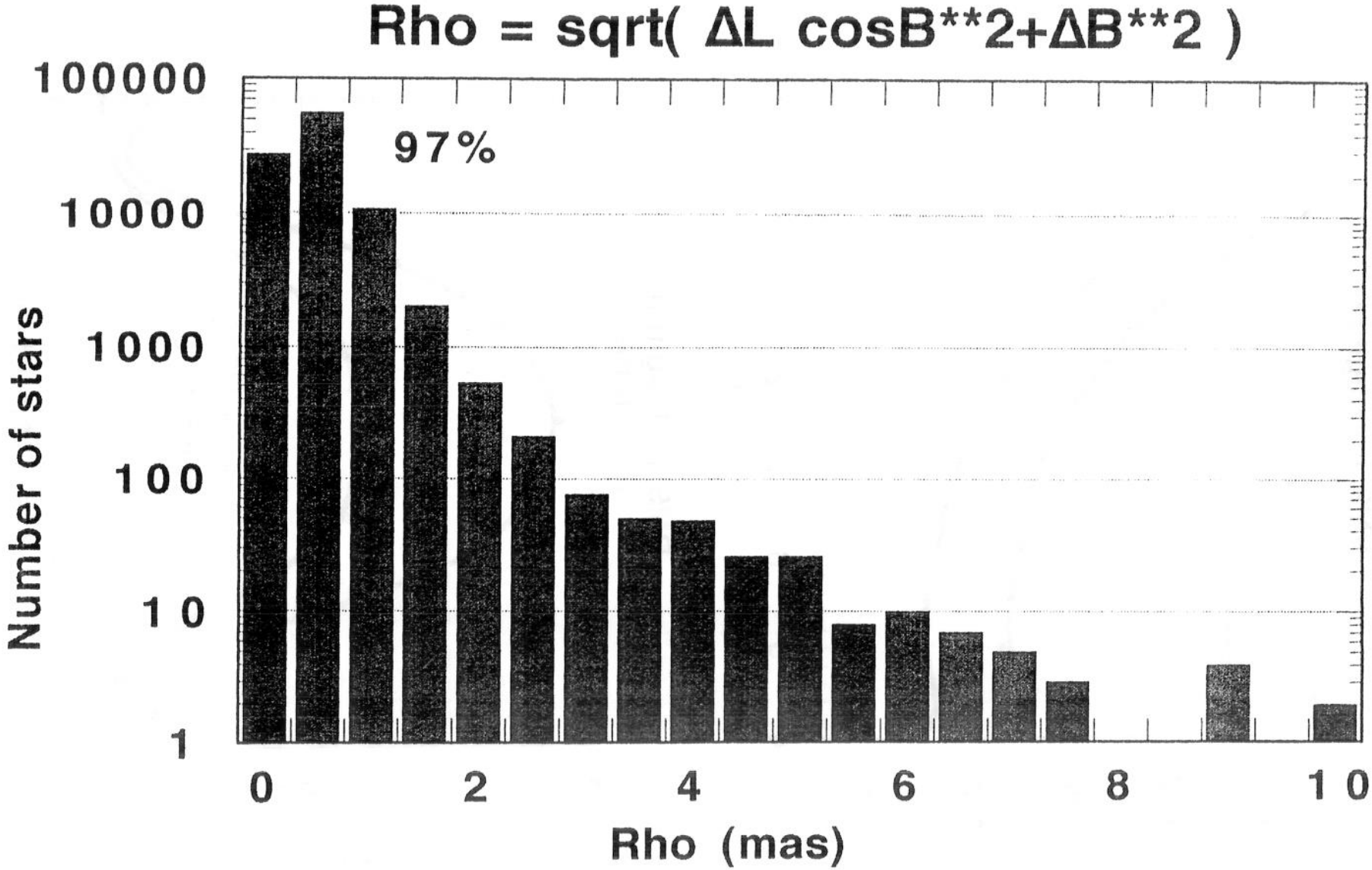

RMS in p. m. longitude
vs latitude
1.6
1.4
1.2
1
0.8
0.6
mas/yr
MERGE
FAST
-1
-0.5
0
0.5
1
sin(latitude)

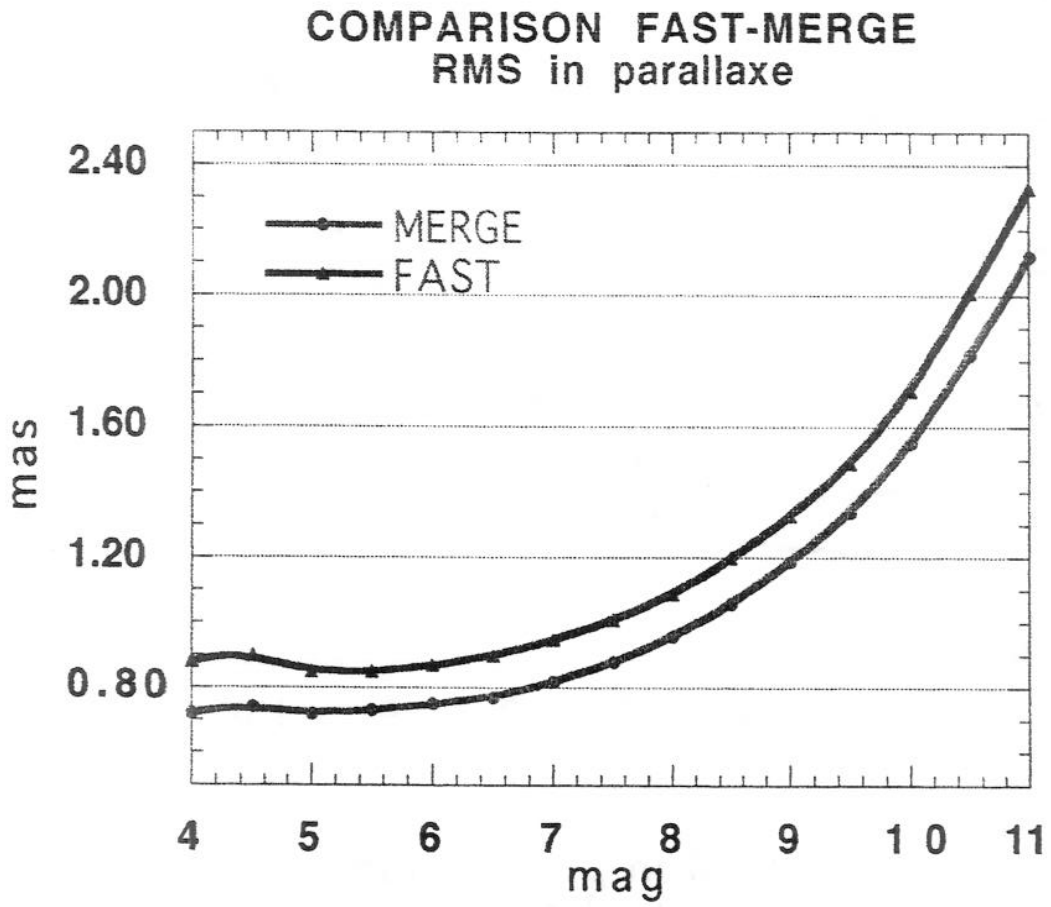

COMPARISON FAST-MERGE
RMS in latitude
1,20
1,00
0,80
0,60
0,40
mas
MERGE
FAST
4
5
6
7
8
9
10
11
mag

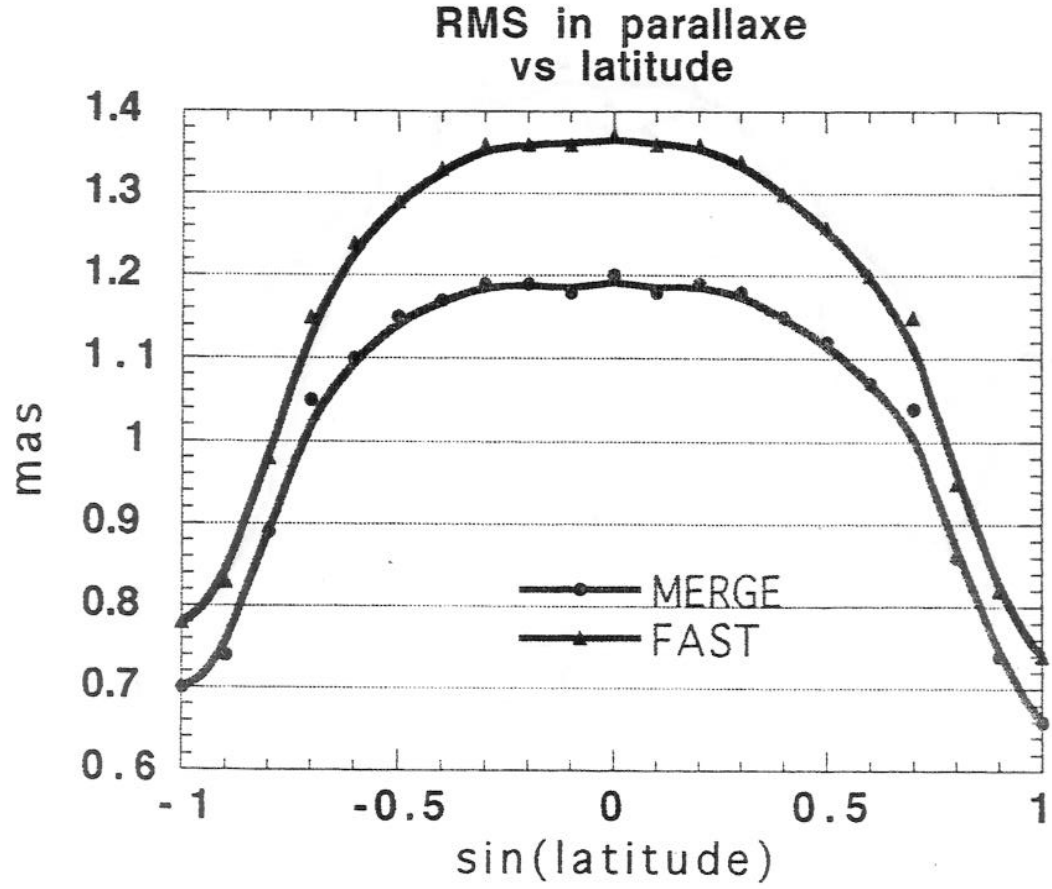

RMS in latitude
vs latitude
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
mas
MERGE
FAST
-1
-0.5
0
0.5
1
sin(latitude)

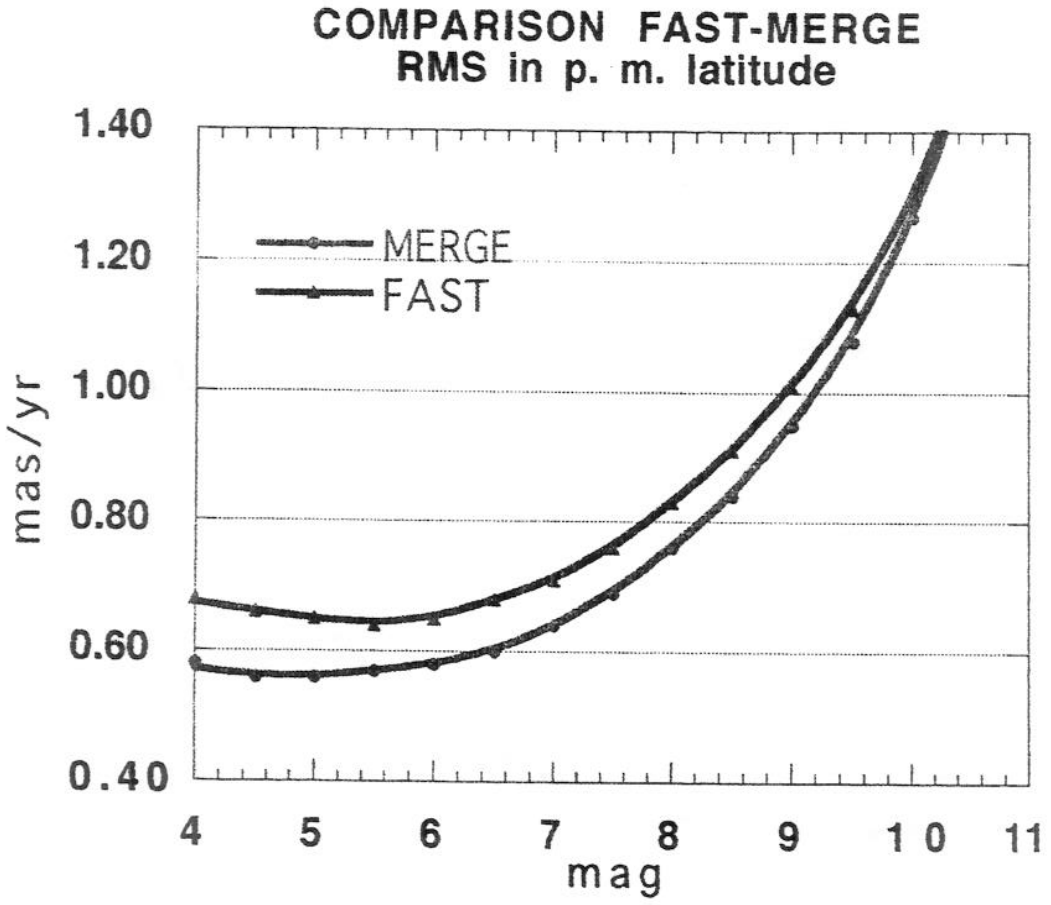

COMPARISON FAST-MERGE
RMS in longitude
1.20
1.00
0.80
0.60
0.40
mas
MERGE
FAST
4
5
6
7
8
9
10
11
mag

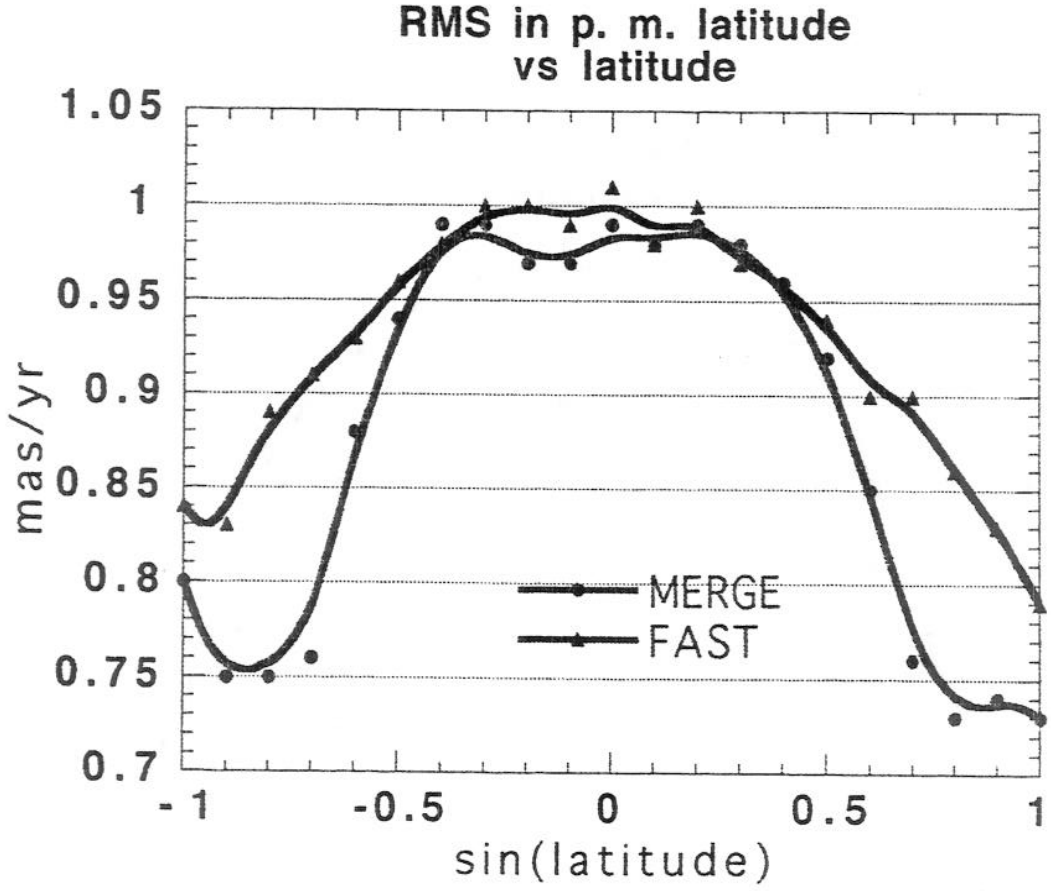

RMS in longitude
vs latitude
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
mas
MERGE
FAST
-1
-0.5
0
0.5
1
sin(latitude)

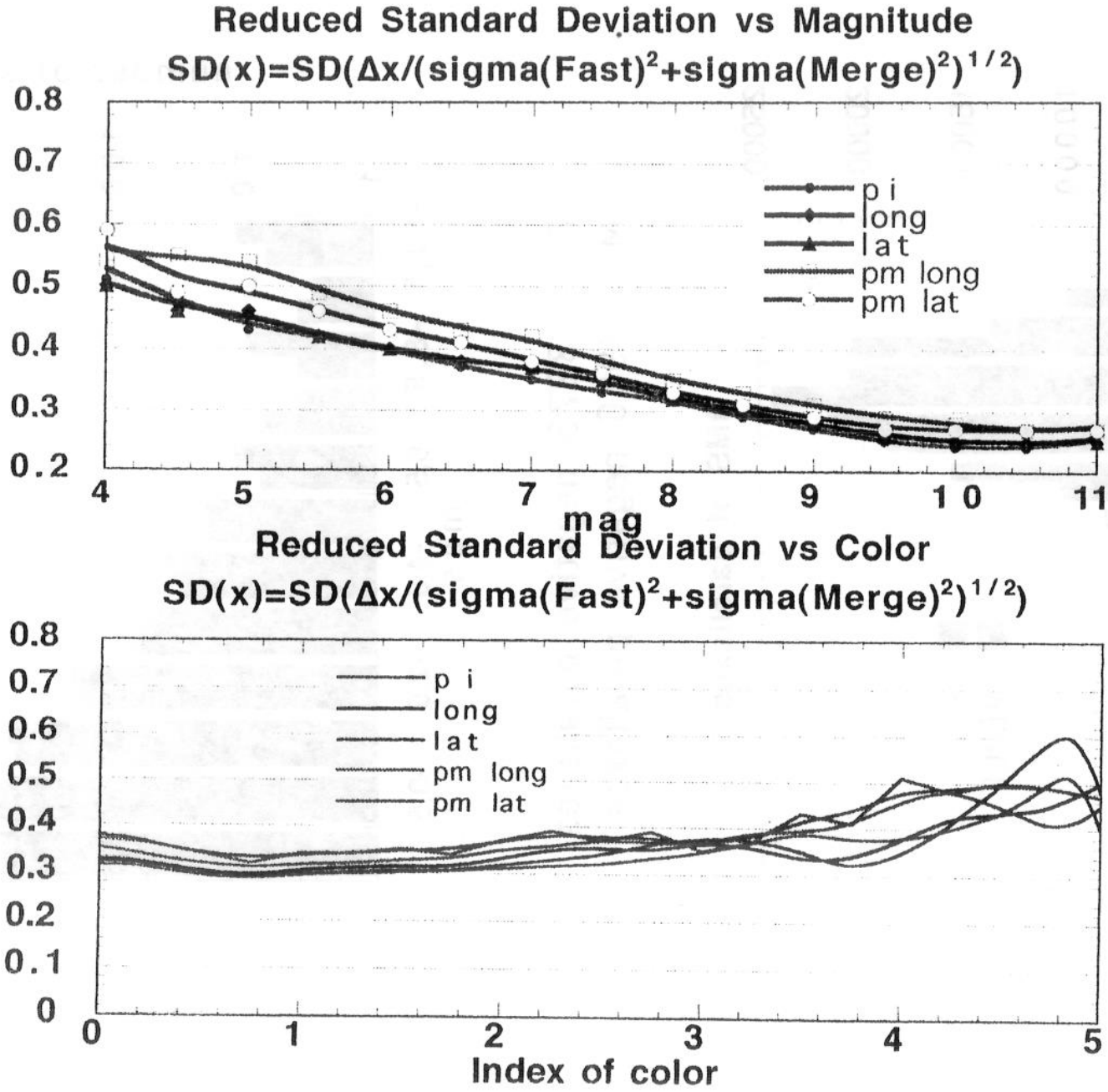

Rho = sqrt(ΔL cosB**2+ΔB**2)
97%
100000
10000
1000
100
10
1
Number of stars
0
2
4
6
8
10
Rho (mas)

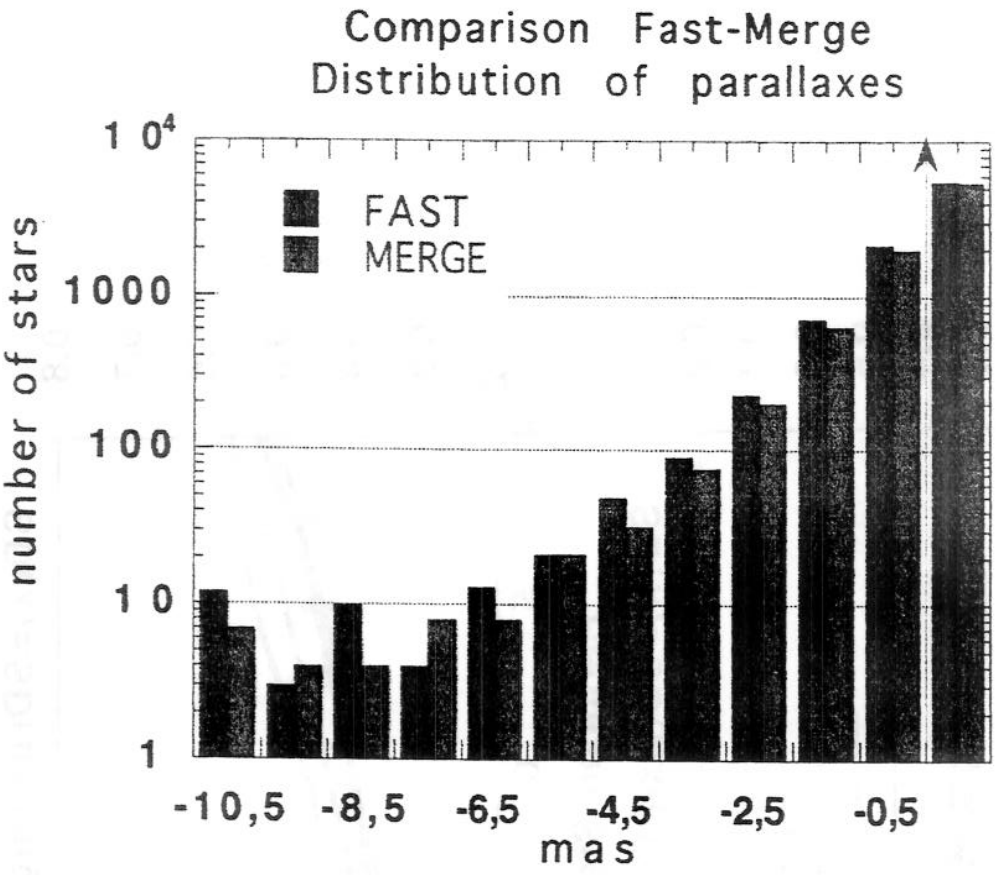

COMPARISON FAST-MERGE
RMS in parallaxe
2.40
2.00
1.60
1.20
0.80
mas
MERGE
FAST
4
5
6
7
8
9
10
11
mag


RMS in parallaxe
vs latitude
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
mas
MERGE
FAST
-1
-0.5
0
0.5
1
sin(latitude)

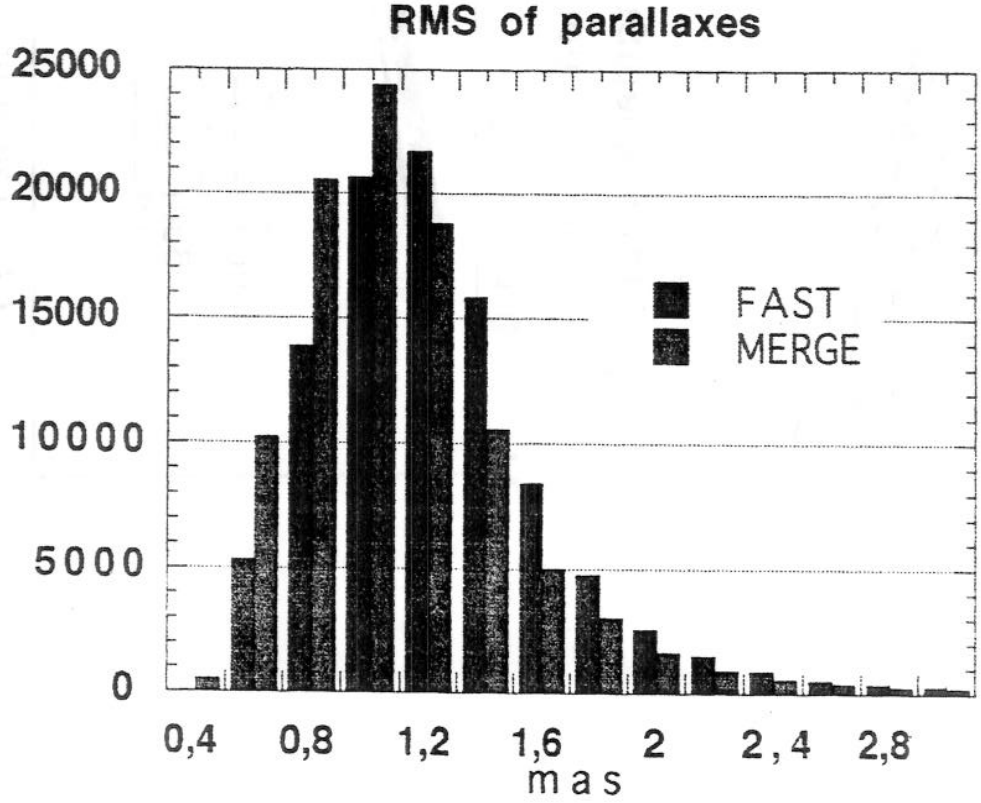

COMPARISON FAST-MERGE
RMS in p. m. latitude
1.40
1.20
1.00
0.80
0.60
0.40
mas/yr
MERGE
FAST
4
5
6
7
8
9
10
11
mag

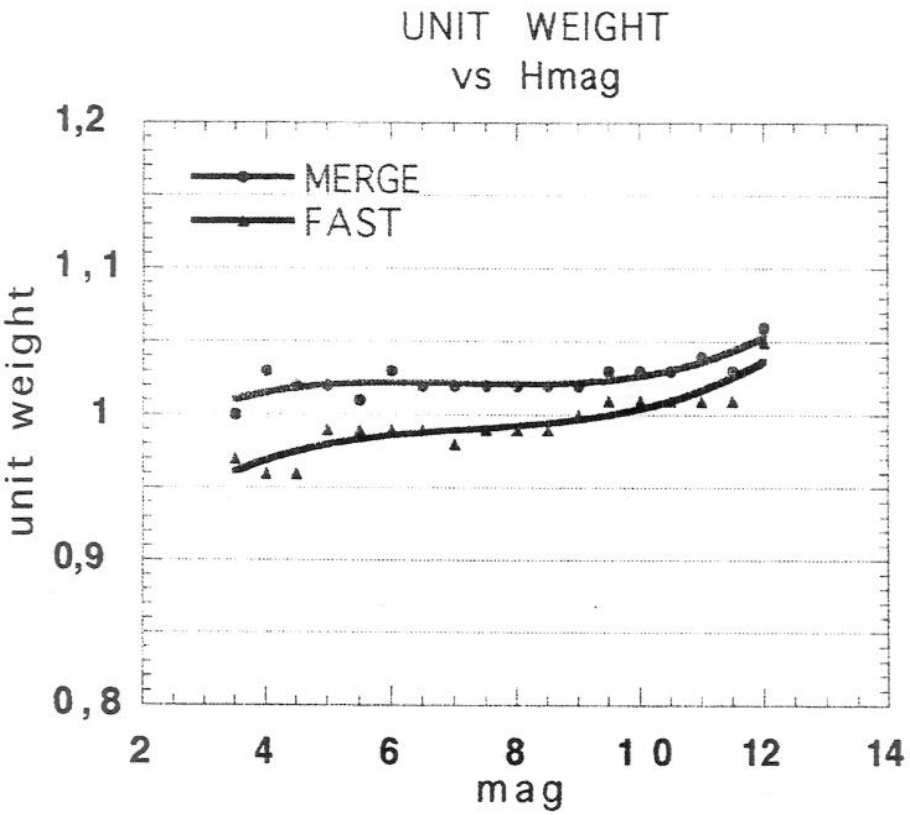

RMS in p. m. latitude
vs latitude
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
mas/yr
MERGE
FAST
-1
-0.5
0
0.5
1
sin(latitude)

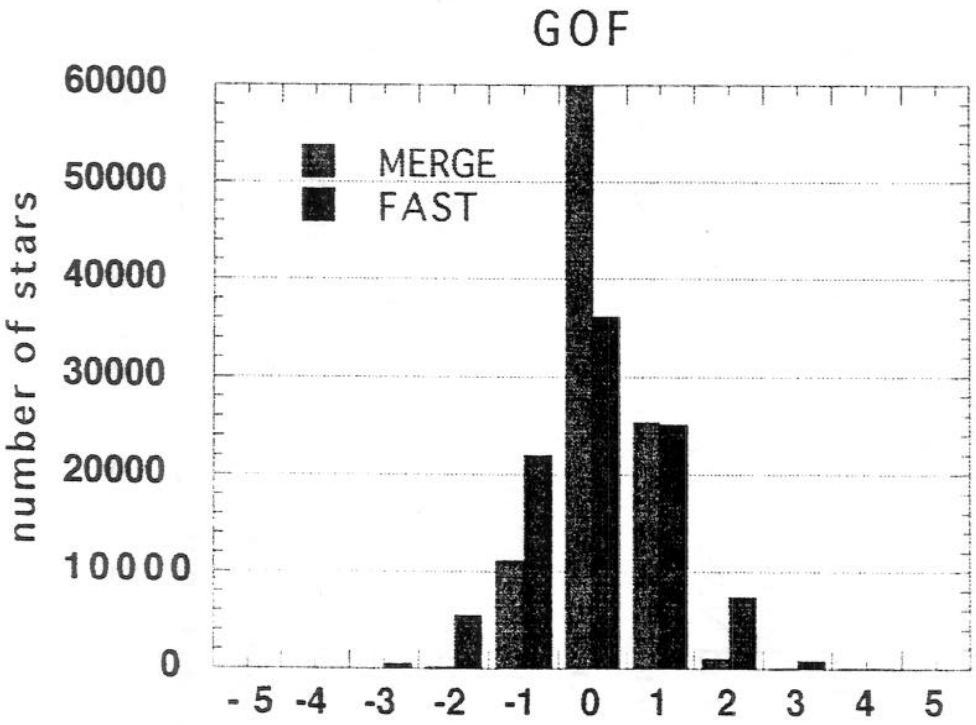

Reduced Standard Deviation vs Magnitude
SD(x)=SD(Δx/(sigma(Fast)²+sigma(Merge)²)^1/2)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
4
5
6
7
8
9
10
11
mag
p i
long
lat
pm long
pm lat
Reduced Standard Deviation vs Color
SD(x)=SD(Δx/(sigma(Fast)²+sigma(Merge)²)^1/2)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
Index of color
p i
long
lat
pm long
pm lat



F 3273 negative parallaxes
M 2986 negative parallaxes




UNIT WEIGHT
vs Hmag
MERGE
FAST
unit weight
1,2
1,1
1
0,9
0,8
2
4
6
8
10
12
14
mag


GOF
MERGE
FAST
number of stars
60000
50000
40000
30000
20000
10000
0
-5
-4
-3
-2
-1
0
1
2
3
4
5

DSWG REPORT

Meeting : 25-26 October, Bruxelles.

- MAIN ACTIONS
  - More conservative approach in the DS detection
  - Use of NDAC <==> FAST solution a starting position
  - More stringent criteria for the DS with linear motion
  - FAST to generate both solutions
  - FAST and NDAC to produce as many as possible solutions in the single star mode to Arenou
  - CCDM identification to solved systems from a list NDAC ∪ FAST by J. Dommanget
  - Creation of a file with all the solutions F+N and the detected DS w/o solution
  - Subsequent component description by P. Lampens
  - L. Lindegren has received delegation to take any decision related to the merging
  - Modification of few flags in the main catalogue
  - Overlap between the various sections of the Annex
  - DS relative solutions with acceleration dropped
  - Agreement on the DMSA format ==> Dommanget comments on the documentation
  - Definition of the files to be prepared for the merging and the schedule

ANNEX 5

STATISTICS FAST - NDAC

❑ INPUT FILES

	Solved	Detected	
N	15200	4500	
F	16600	4100	(300 very strong)
H	**19000**	**6000**	

❑ COMPARISON

Common solutions	13000	
Disagree > 0"2	*1800*	==> *Ground based obs.*
180° ambig.	*250*	
Only in NDAC	2200	
Only in FAST	3600	
Total	**18800**	

STATISTICS OF THE MERGING in FAST

❑ INPUT FILES

	Known	New		Known	New	Total
I	8500	2000	I ∩C	8500	1700	**10200**
C	10000	6300				

❑ MERGED FILE

	Two solutions		**One solution**
Merged	7600		
I selected	400	I	300
C selected	2200	C	6100
TOTAL	**10200**	**6400**	

Number of solutions : 16600

ABSOLUTE ASTROMETRY

❑ MIXED PROCESSING :

Solution for the 13000 DS with relative solution F and N

Processed with FAST abscissae

1 - with Ndac relative solutions

2 - with Fast relative solutions

❑ RESULTS

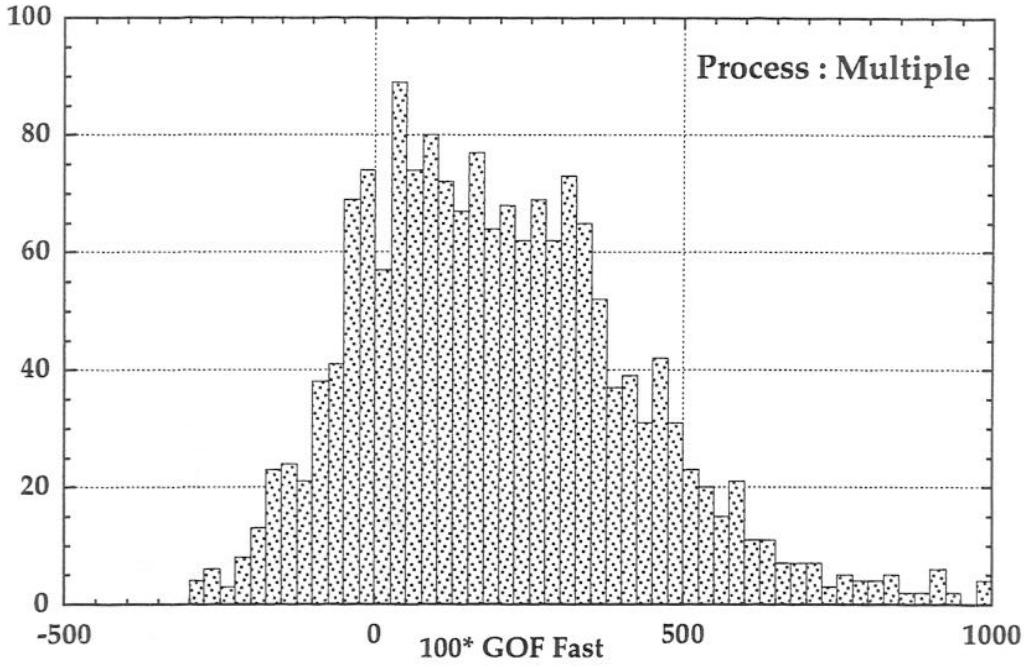
850 stars with Δ (pos) > 20 mas

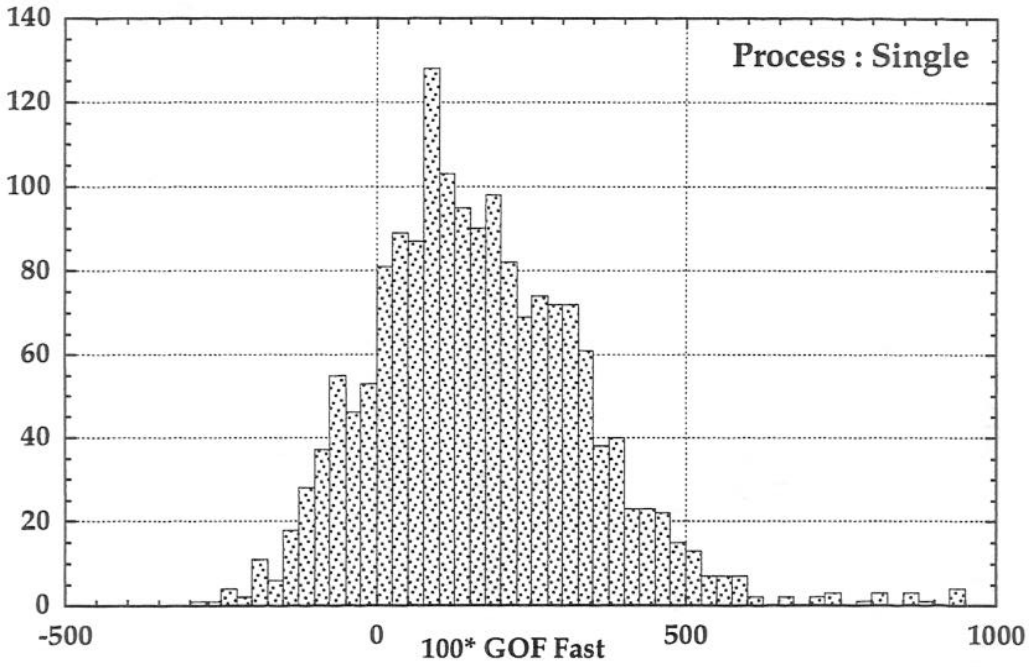
-500 are double pointing ; often secondary ==> *Way out : Primary + rel. sol.*

- Out of the remaining 350 :

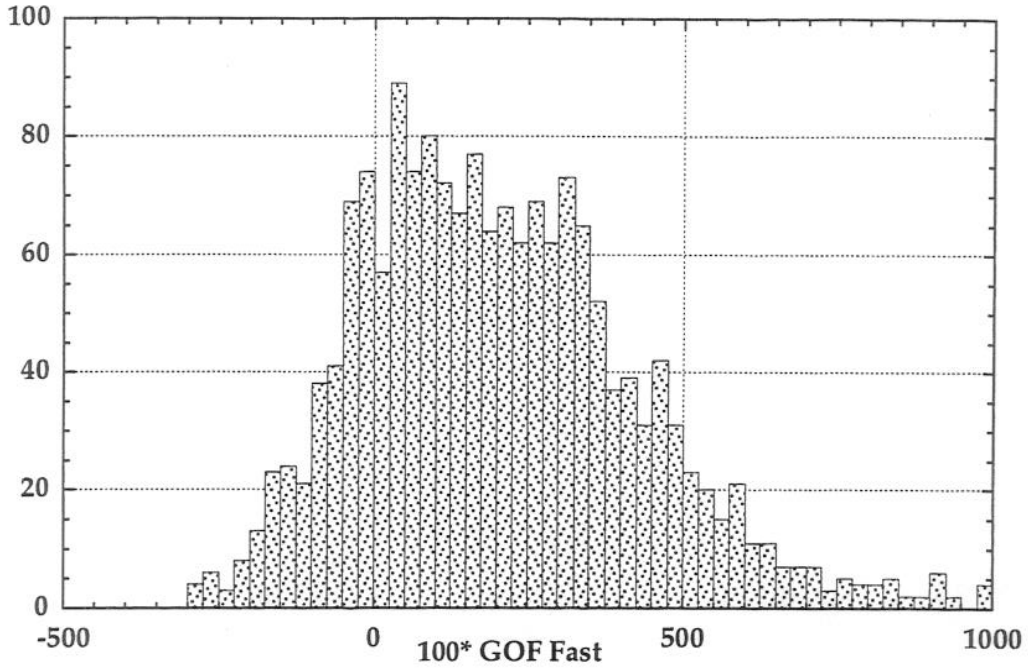
150 agree in π and PM ==> 180 ° ambig.
200 usually poor solution in F and N

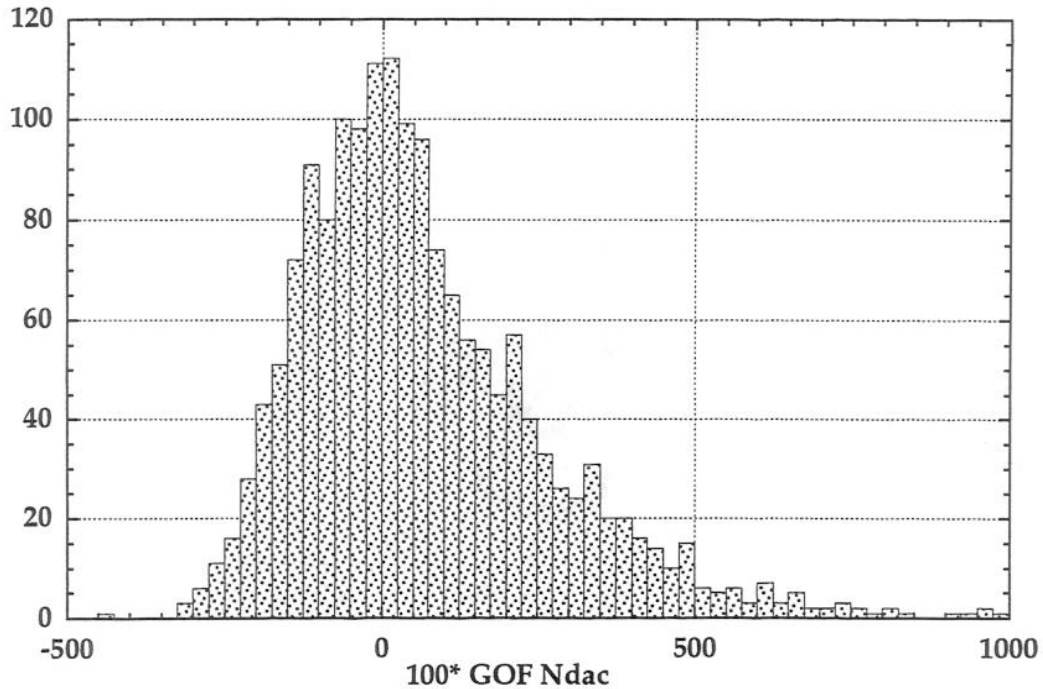
1800 Discrepant stars

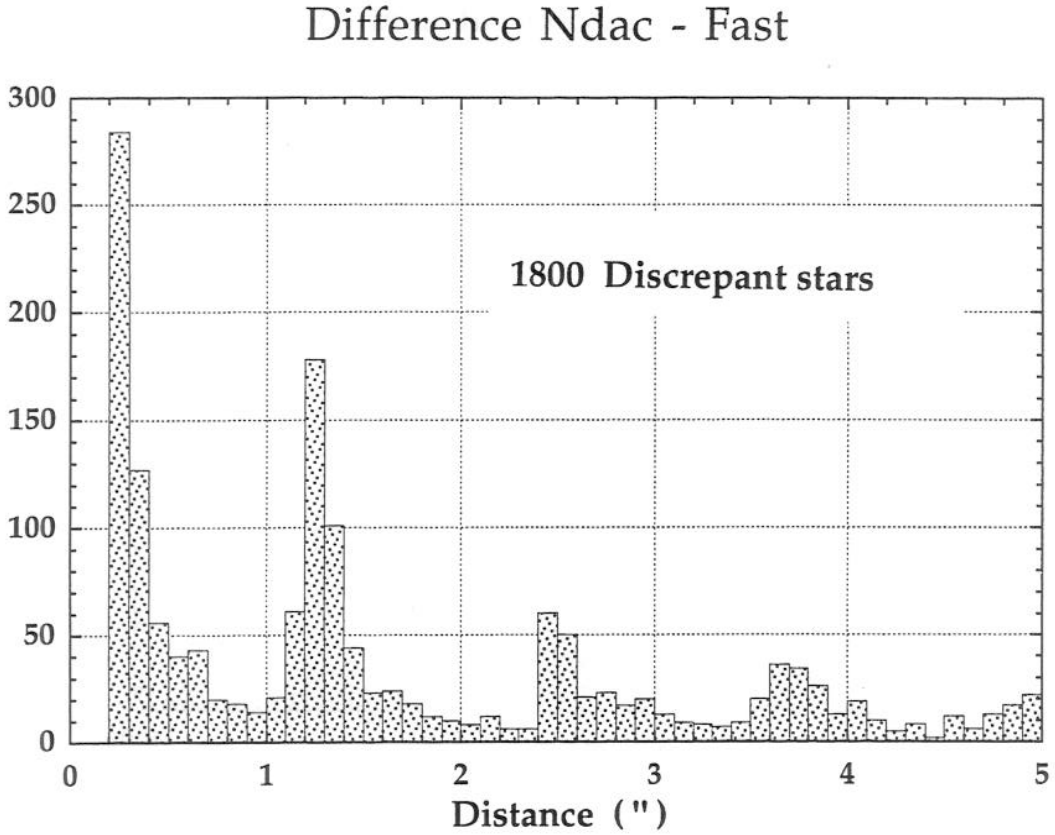


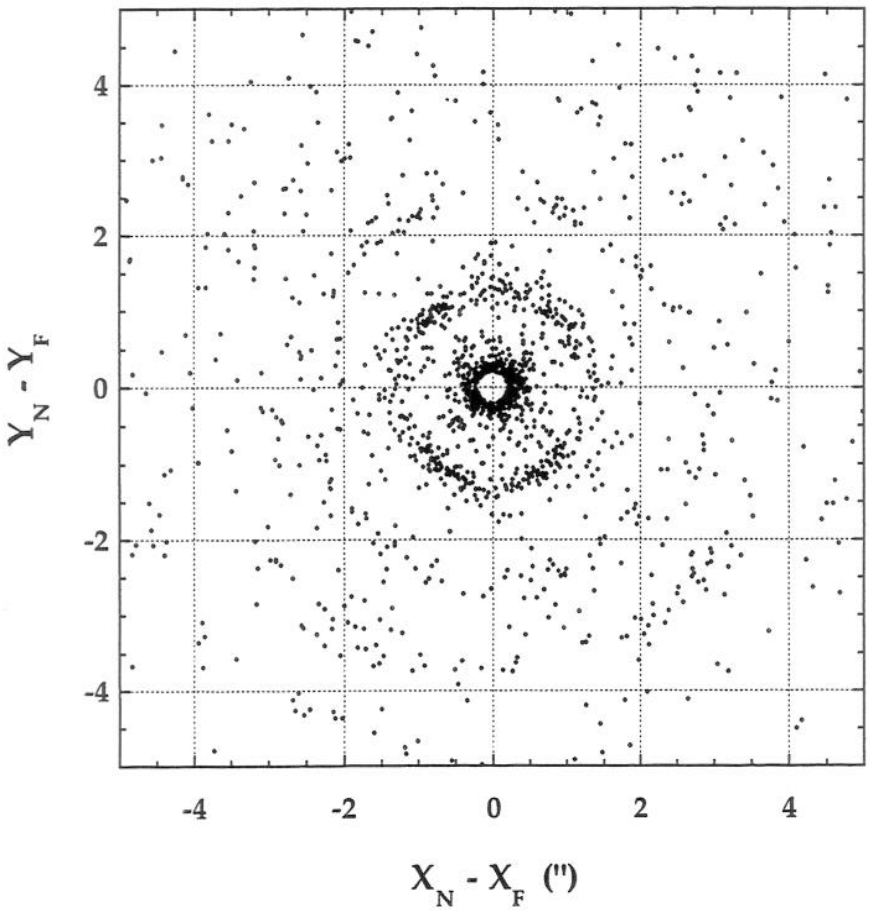


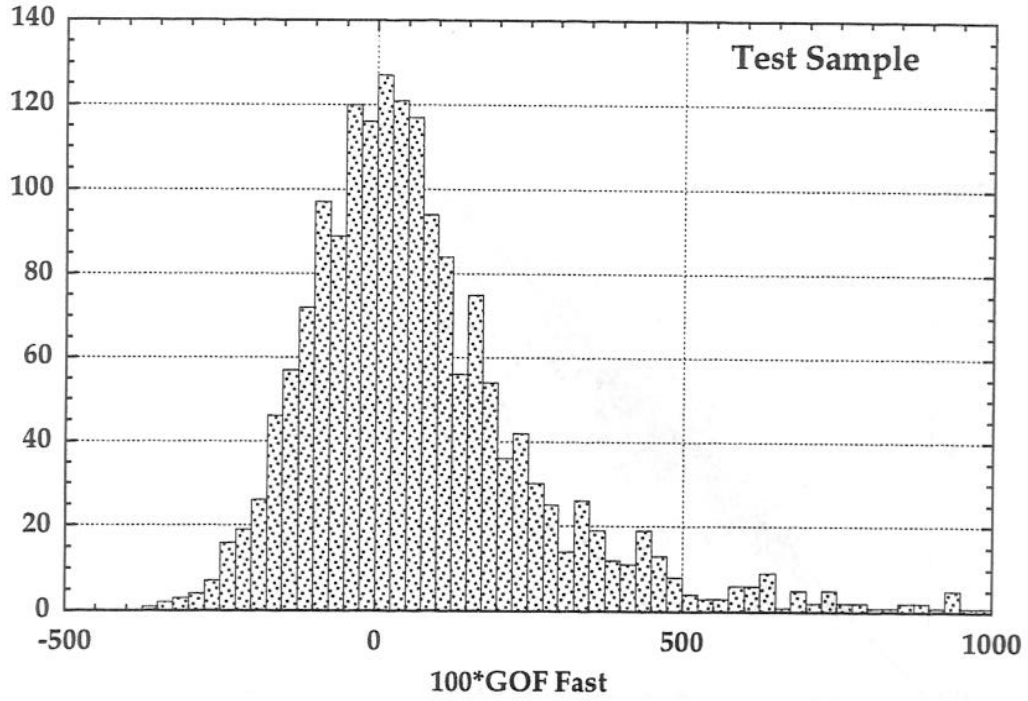
1800 Discrepant stars

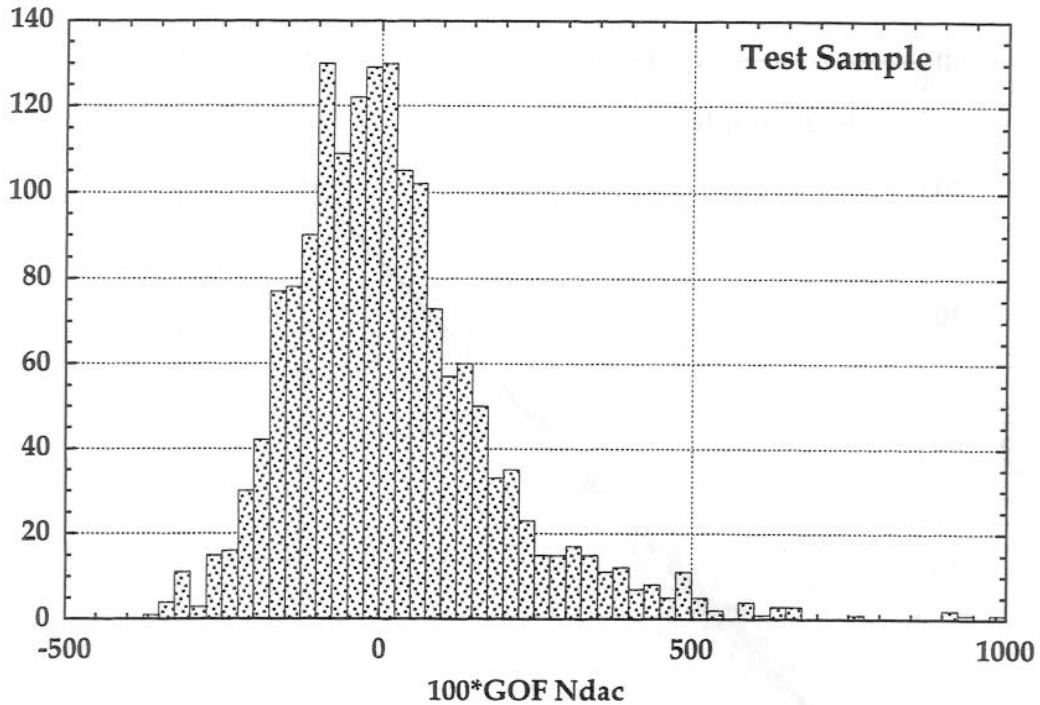


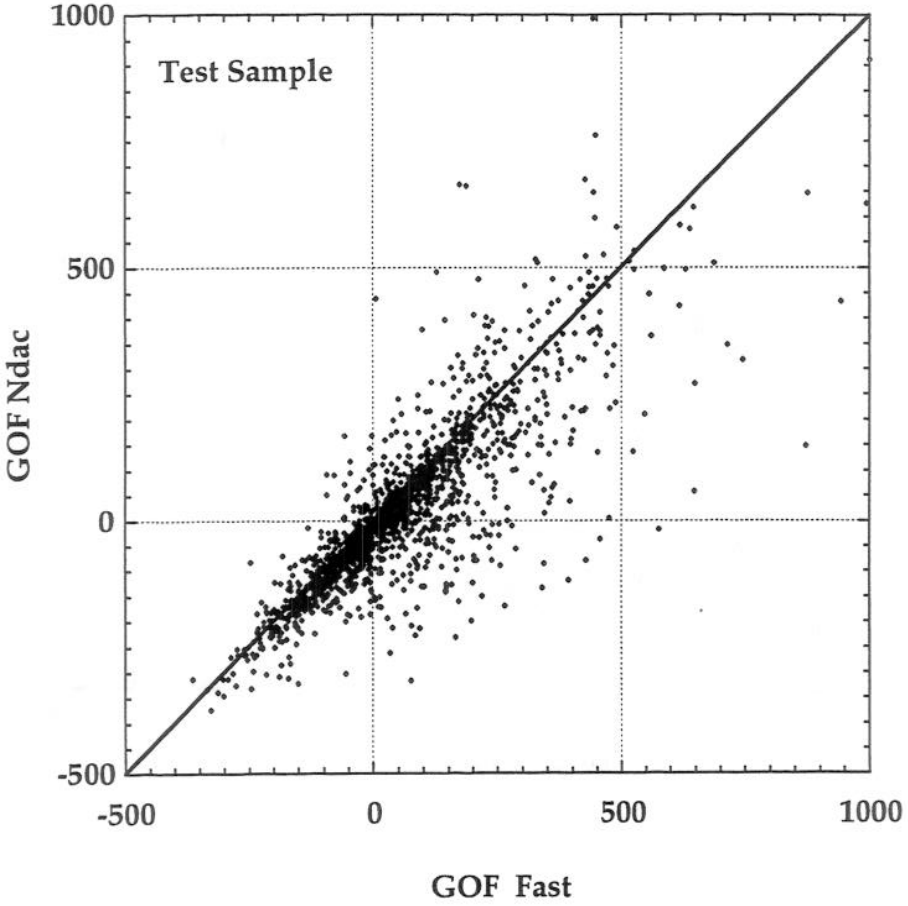


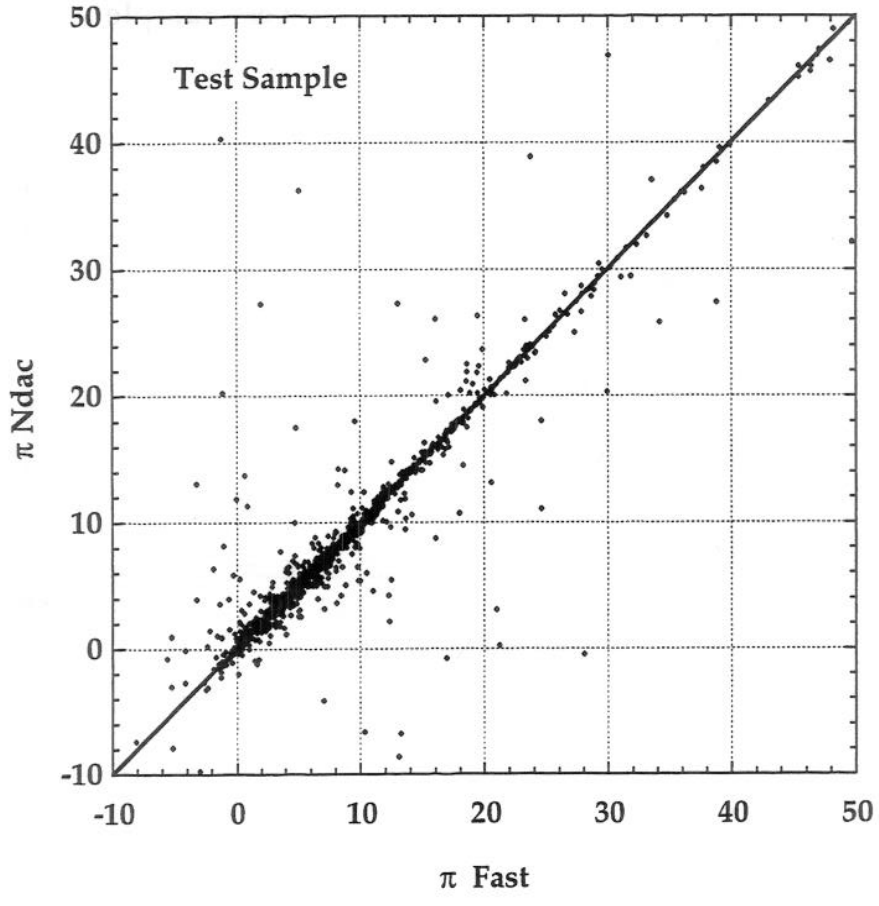

Difference Ndac - Fast
1800 Discrepant stars
300
250
200
150
100
50
0
0
1
2
3
4
5
Distance (")


4
2
0
-2
-4
-4
-2
0
2
4
$Y_N - Y_F$
$X_N - X_F$ (")

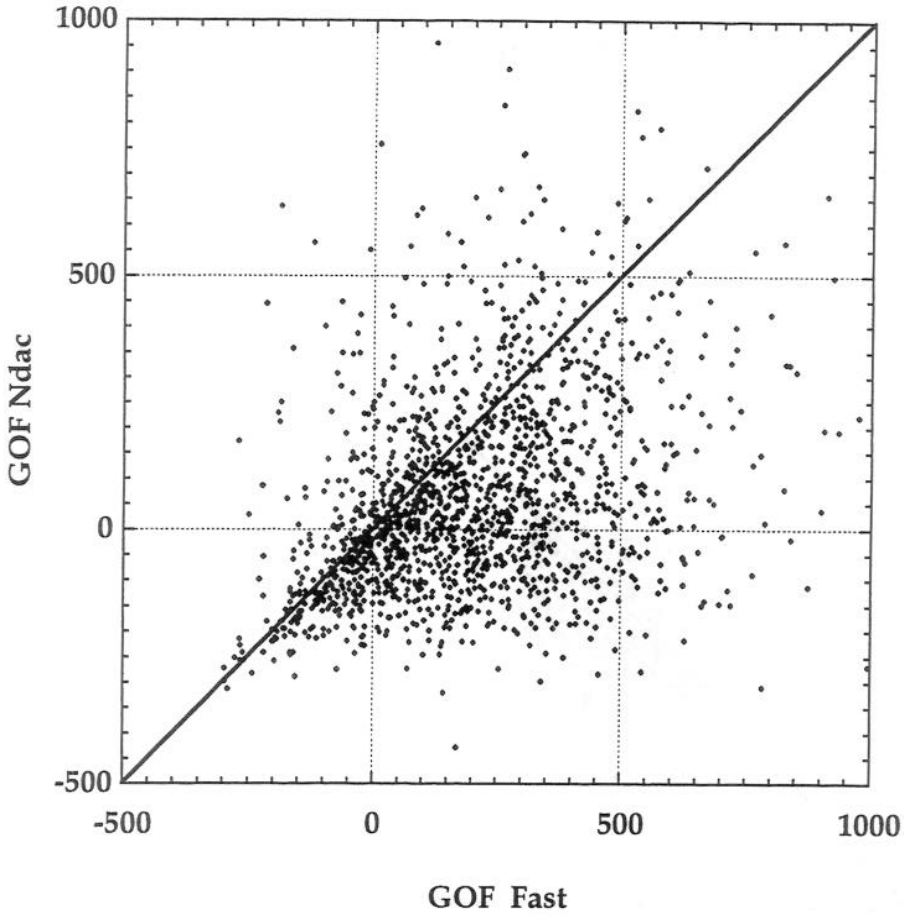

Test Sample
140
120
100
80
60
40
20
0
-500
0
500
1000
100*GOF Fast

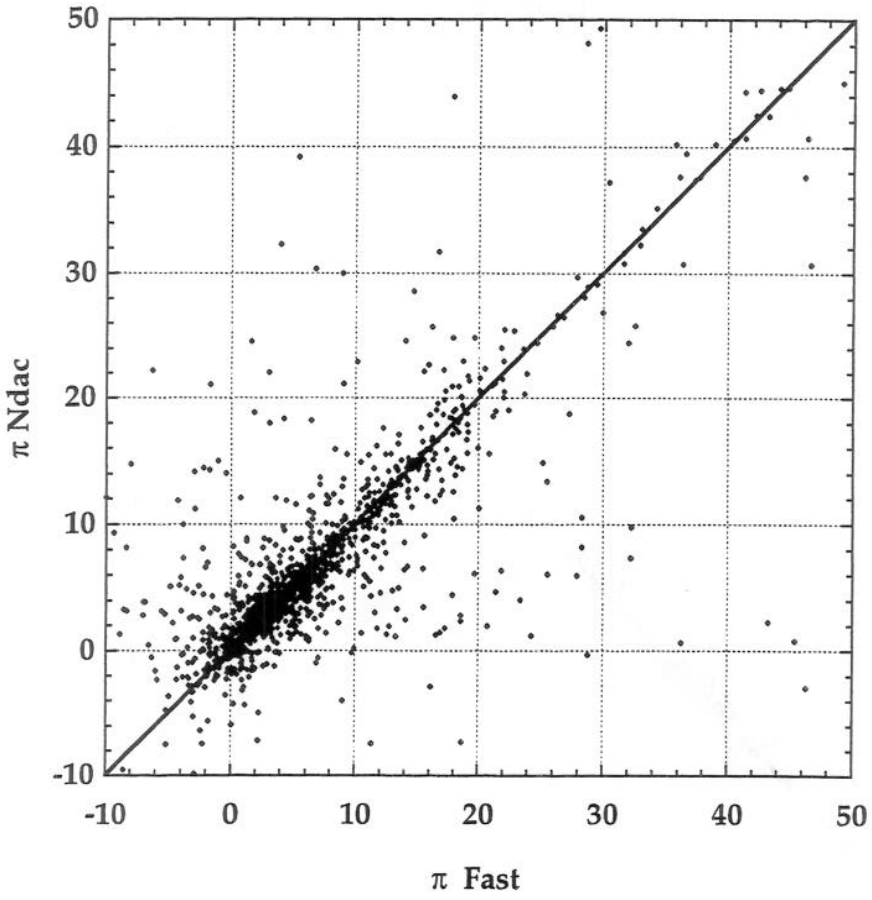

Test Sample
140
120
100
80
60
40
20
0
-500
0
500
1000
100*GOF Ndac


Test Sample
GOF Ndac
GOF Fast
1000
500
0
-500
-500
0
500
1000

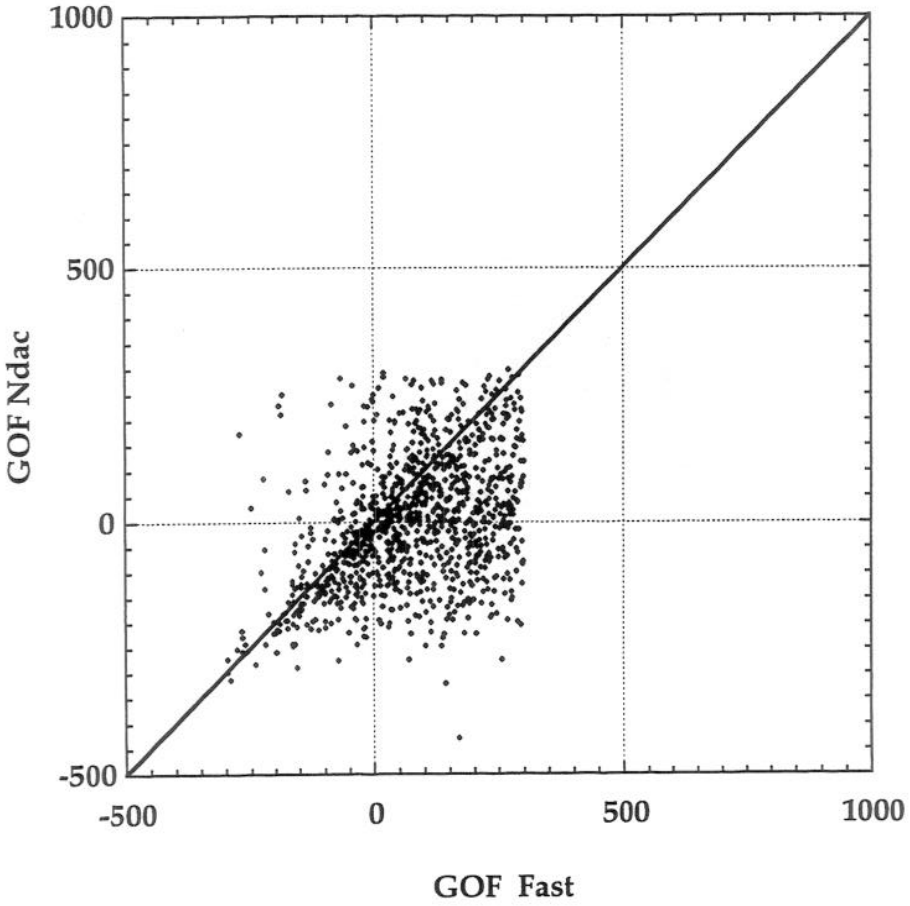

Test Sample
π Ndac
π Fast
50
40
30
20
10
0
-10
-10
0
10
20
30
40
50

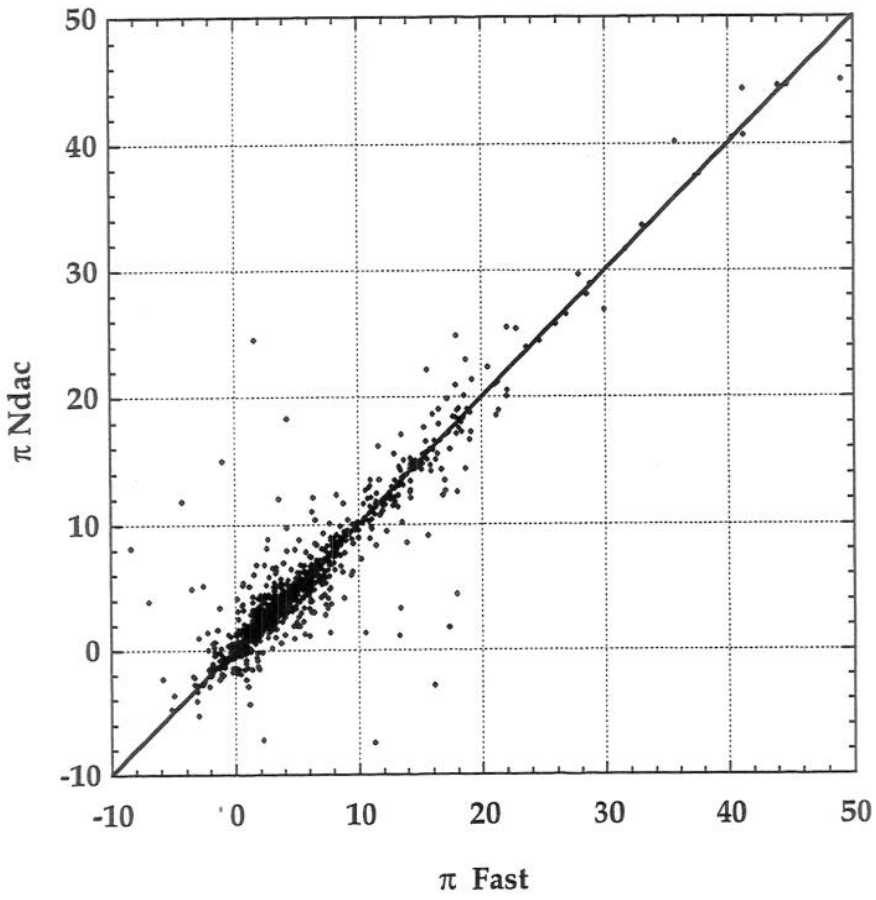
1800 Discrepant stars





1800 Discrepant stars





ANNEX 6

MERGING OF COMPONENT DS DATA

INPUT DATA (AS OF 21 NOV):

FAST:
- RELATIVE DATA $(\Delta m, x, y, \dot{x}, \dot{y})$ FOR 16633 ENTRIES
- ABSOLUTE DATA $(\alpha, \delta, \pi, \mu_\alpha, \mu_\delta)$ FOR 15437 ENTRIES
  [REFERRED TO PC IF $\varrho < 0.35''$, OTHERWISE PRIMARY]
- 296 ENTRIES DETECTED AS NON-SINGLE BUT WITHOUT SOL.
- 1196 WITH REJECTED ABSOLUTE ASTROMETRY

NDAC: F, L, I AND SINGLE SOLUTIONS FOR ~33000 ENTRIES OF WHICH 15072 WERE ACCEPTED AS F, L OR I
[RELATIVE AND ABSOLUTE DATA SIMULTANEOUSLY]

PRE-PROCESSING OF DATA:

FAST:
- IC8 → HIP# [HS TABLES]
- ECL → EQU OF ALL FILES
- F37i3 → H30 [+5.095, +19.046, −35.316, −0.133, +0.506, −3.189]

NDAC:
- CHECK THAT HIP (HIC)# ARE USED CONSISTENTLY
- N37.05 → H30 [+20.648, +33.151, −46.719, +0.584, −0.657, −0.508]

COMPARISON OF QUALITY CLASSES:

CORRELATION – SEE TABLE

INVESTIGATION OF SINGLE-POINTING SYSTEMS:

11375 COMMON ENTRIES, OF WHICH
9740 HAVE ACCEPTABLE AGREEMENT IN RELATIVE ASTROMETRY

$$\left[(x_N - x_F)^2 + (y_N - y_F)^2 \leq 0.3^2 \text{ ARCSEC}^2 \wedge |\theta_N - \theta_F| \leq 45^\circ \right]$$

+ MANY "FLIPPED" SYSTEMS NOT YET ANALYSED...

		(WORST)			(BEST)		
	Q_F \ Q_N	0	1	2	3	ALL Q_N	F ONLY
	−1	54	137	219	88	498	193
(WORST)	0	1	1	0	0	2	6
	1	44	89	46	7	186	696
	2	171	365	298	21	855	111
	3	159	317	562	79	1117	650
	4	74	191	668	202	1135	309
	5	41	80	617	459	1197	182
	6	20	55	415	800	1290	155
	7	5	47	200	1100	1362	120
	8	2	33	130	1570	1735	101
	9	0	13	114	2370	2500	90
(BEST)	10	0	9	53	1047	1109	34
	ALL Q_F	571	1337	3332	7746	12986	3647
	N ONLY	778	957	295	56	2086	0

CALIBRATIONS AND SYSTEMATIC CORRECTIONS BEFORE MERGING OF DOUBLE STARS

1. Δm SHOWS A SYSTEMATIC DIFFERENCE
   $\Rightarrow \frac{1}{2}(\Delta m_N + \Delta m_F)$ ADOPTED AS "TRUE" Δm-SCALE
   $\Rightarrow$ CORRECTIONS TO Δm_N, Δm_F AS FUNCTION OF $\frac{1}{2}(\Delta m_N + \Delta m_F)$

2. TO RECONCILE $\Delta m_N - \Delta m_F$ WITH $\sigma_{\Delta m_N}$, $\sigma_{\Delta m_F}$, THE S.E. MUST BE MULTIPLIED BY FACTORS OF 2.2 - 2.8 DEPENDING ON QUALITY INDEX (BUT NOT ON H_p)

3. A STATISTICAL STUDY OF $(\Delta\mu_{\alpha*}, \Delta\mu_\delta) = (\dot{x}, \dot{y})$ FOR L-SOLUTIONS SHOWS THAT THE S.E. MUST BE MULTIPLIED BY 1.3 (FAST) AND 1.2 (NDAC). $\rho = 0.3$.

4. TO RECONCILE $\Delta\alpha^*_N - \Delta\alpha^*_F$ AND $\Delta\delta_N - \Delta\delta_F$ WITH THEIR S.E. (ASSUMING $\rho = 0.3$), THE S.E. MUST BE MULTIPIED BY 1.7 - 2.0. DEP. ON QUALITY <u>AND</u> H_p (VERIFIED BY COMPARISON WITH SPECKLE OBSERVATIONS)

5. TO RECONCILE $\alpha^*_N - \alpha^*_F$, $\delta_N - \delta_F$, $\pi_N - \pi_F$, $\mu_{\alpha*N} - \mu_{\alpha F}$, $\mu_{\delta N} - \mu_{\delta F}$ WITH THEIR S.E., THE S.E. MUST BE MULTIPLIED BY $\simeq 1.1$ (NDAC) AND <u>0.9</u> (FAST). ($\rho \simeq 0$ FOR $H_p \leq 5$, UP TO $\rho \simeq 0.8$ FOR $H_p \geq 11$)

PRINCIPLE OF MERGING REL + ABS DATA

- 50/50 AVERAGE IS MOST ROBUST W.R.T. OUTLIERS

- COMBINE ABSOLUTE DATA FOR "NEUTRAL POINT":

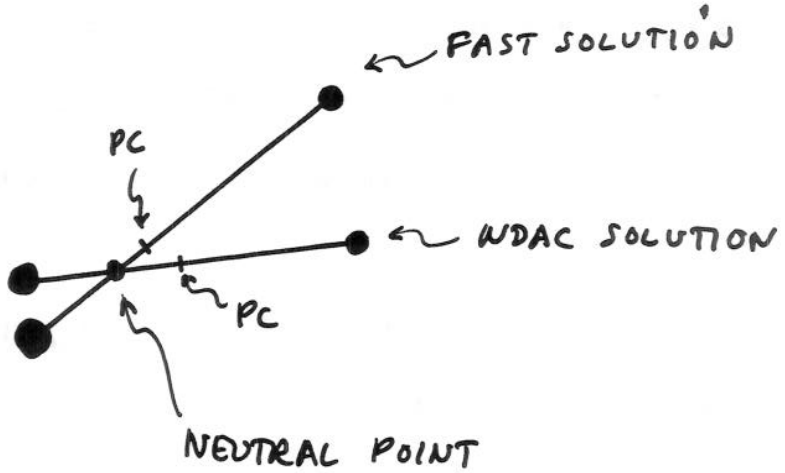
1. $\bar{\rho} = \frac{1}{2}(\rho_N + \rho_F) \Rightarrow w$ (AN ADOPTED CONSTANT FOR EACH SYSTEM)

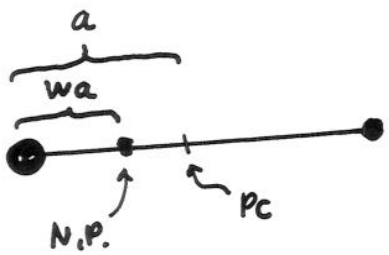
2. $(\alpha, \delta, \pi, \mu_\alpha, \mu_\delta)_F + (\Delta m, x, y, \dot{x}, \dot{y})_F + w \Rightarrow (\alpha, \delta, \pi, \mu_\alpha, \mu_\delta)_{F,\,N.P.}$

3. (NDAC PARAMETERS) + w $\Rightarrow (\alpha, \delta, \pi, \mu_\alpha, \mu_\delta)_{N,\,N.P.}$

4. MEAN $\Rightarrow (\alpha, \delta, \pi, \mu_\alpha, \mu_\delta)_{H,\,N.P.}$

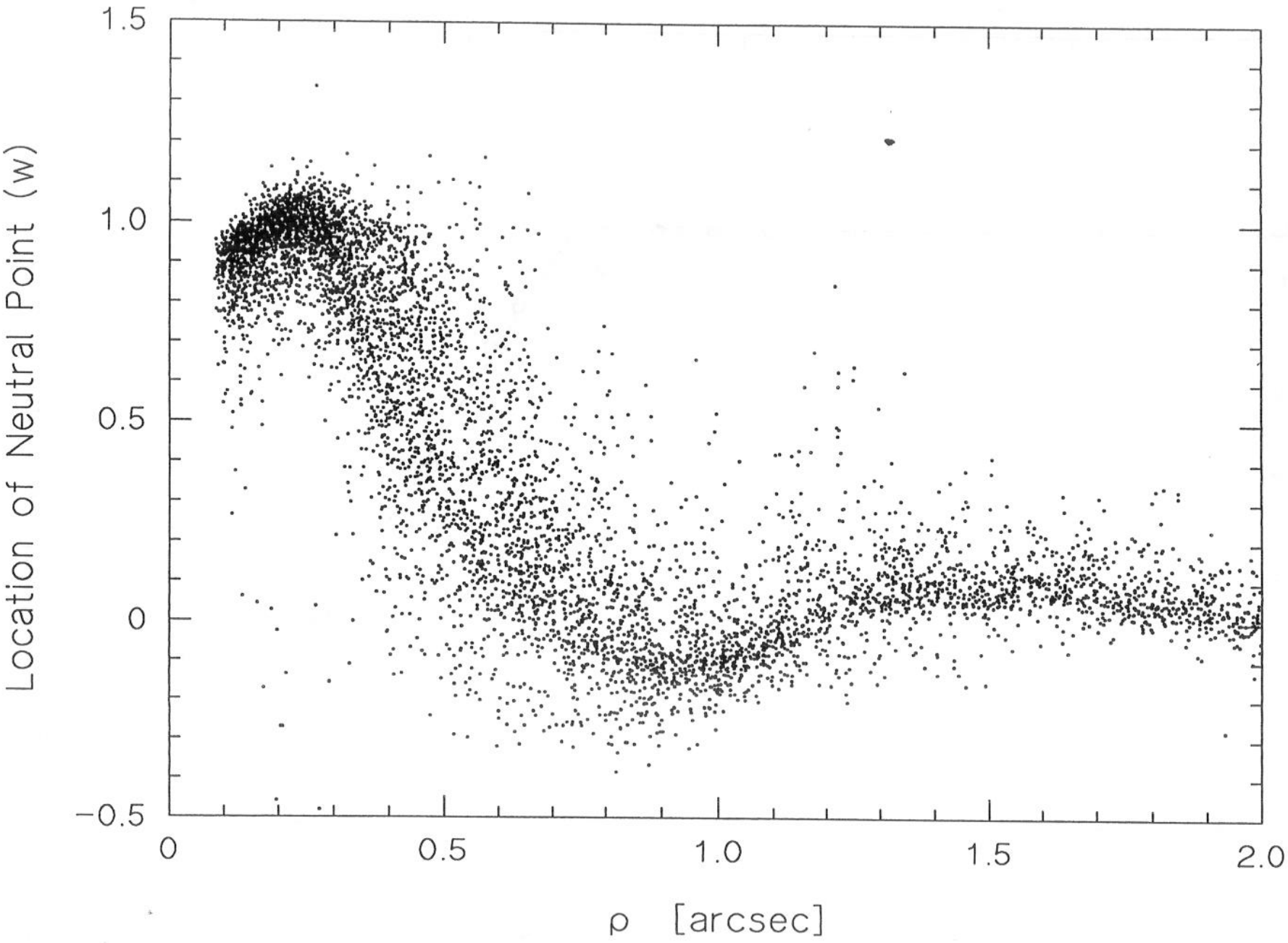
5. $+ (\overline{\Delta m}, \bar{x}, \bar{y}, \bar{\dot{x}}, \bar{\dot{y}}) + w \Rightarrow$ COMPLETE H-DATA

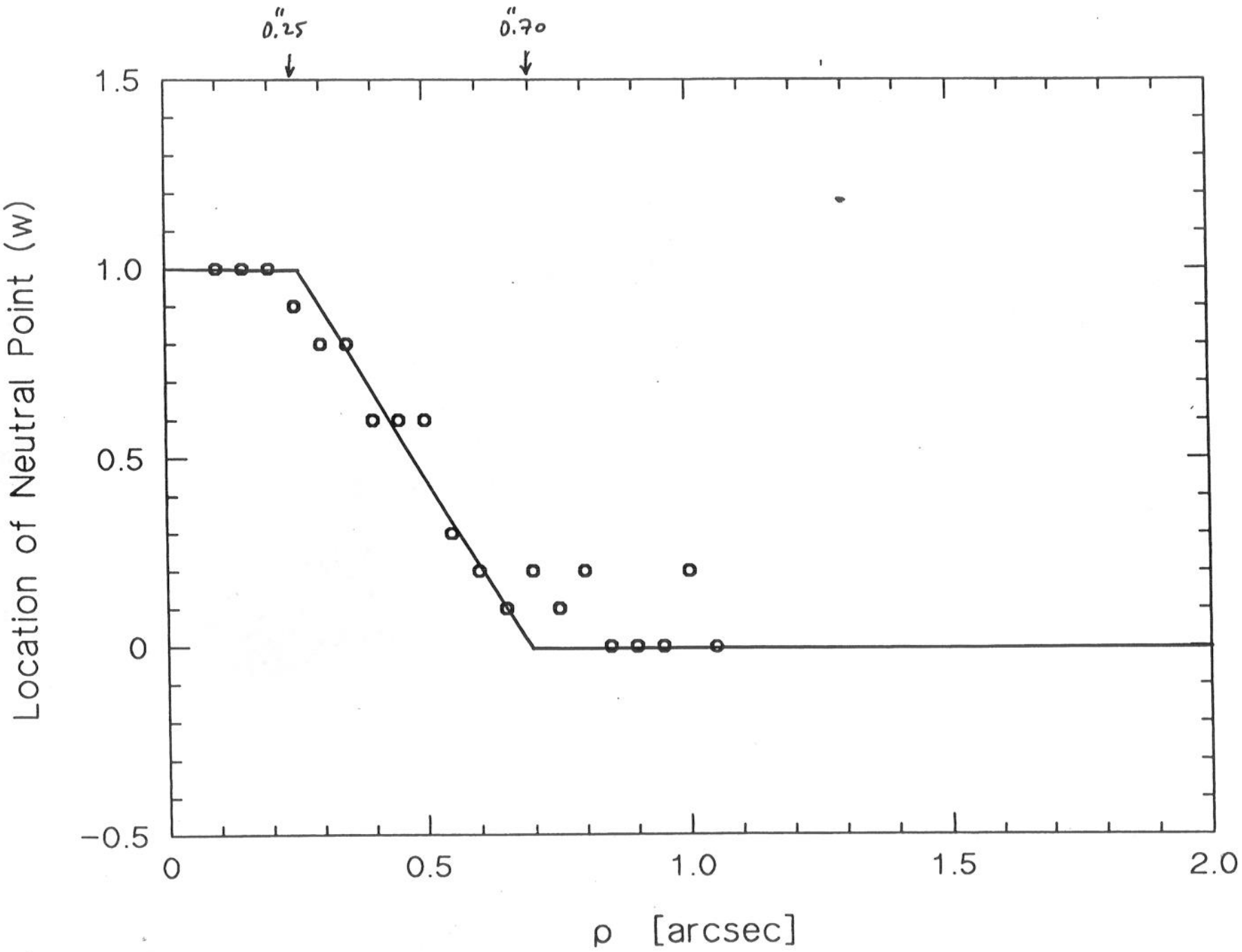




$w = 0 \Leftrightarrow$ N.P. = PRIMARY

$w = 1 \Leftrightarrow$ N.P. = PC


Location of Neutral Point (w)
1.5
1.0
0.5
0
−0.5
0
0.5
1.0
1.5
2.0
ρ [arcsec]


0."25
0."70
1.5
1.0
0.5
0
−0.5
0
0.5
1.0
1.5
2.0
Location of Neutral Point (w)
ρ [arcsec]

RESULTS SO FAR:

- PROVISIONAL MERGE OF 8522 'Fixed'
  + 1156 'Linear' ($F > 2.80 \equiv 2\%$)

  BUT INPUT FILES ARE STILL BEING UPDATED

- DATA LACKING FOR DMSA/C:

  DC1 + DC8: CCDM# + COMP – IN PROGRESS

  DC10-11: $H_p + \sigma$ (FOR WHOLE HIP ENTRY)

  [FROM FM AFTER IFOV CORR. OF MERGED PHOTOMETRY]

  DC13-16: $B_T, V_T + \sigma$ [WILL BE LEFT BLANK UNTIL ....]

- ALONG WITH DMSA/C, THE FOLLOWING FIELDS OF MAIN CATALOGUE WILL BE GIVEN, SUPERSEDING PREVIOUS DATA:

  H8 – H30, H44-45, H48, H55, H57 – H67

  + LIST OF ADDITIONAL ENTRIES TO FLAG AS H61 = S

- REMAINING SYSTEMS FOR DMSA/C:

  ~ 1000 2-3-POINTING SYSTEMS

  ~ 2000 DISCREPANT SYSTEMS (MOST CAN BE RESOLVED?)

  ~ 4000? FAST-ONLY AND NDAC-ONLY SOLUTIONS (≃ EASY)

- TRIPLE STARS ?

- USE GB + HIF TO RESOLVE DISCREPANCIES

- QUALITY GRADING (A, B, C, D, (REJECT))

  CRITERIA: $Q_F, Q_N, (\Delta m, \varrho, Hp_{tot})$, GOF?

  [+ agreement for common stars ?]

STATUS FOR DMSA/G, O, V, X

G: 7 OR 9-PARAMETER FITS FROM ARENOU
(DONE, BUT MAY BE REDONE)
CRITERION FOR ACCEPTING (7) 9 PARAMETERS?

O: DATA FROM ARI EXPECTED THIS WEEK
(TEST SAMPLES RECEIVED)

V: DATA FROM ARI (PROVISIONAL LIST RECEIVED)

X: NOTHING!

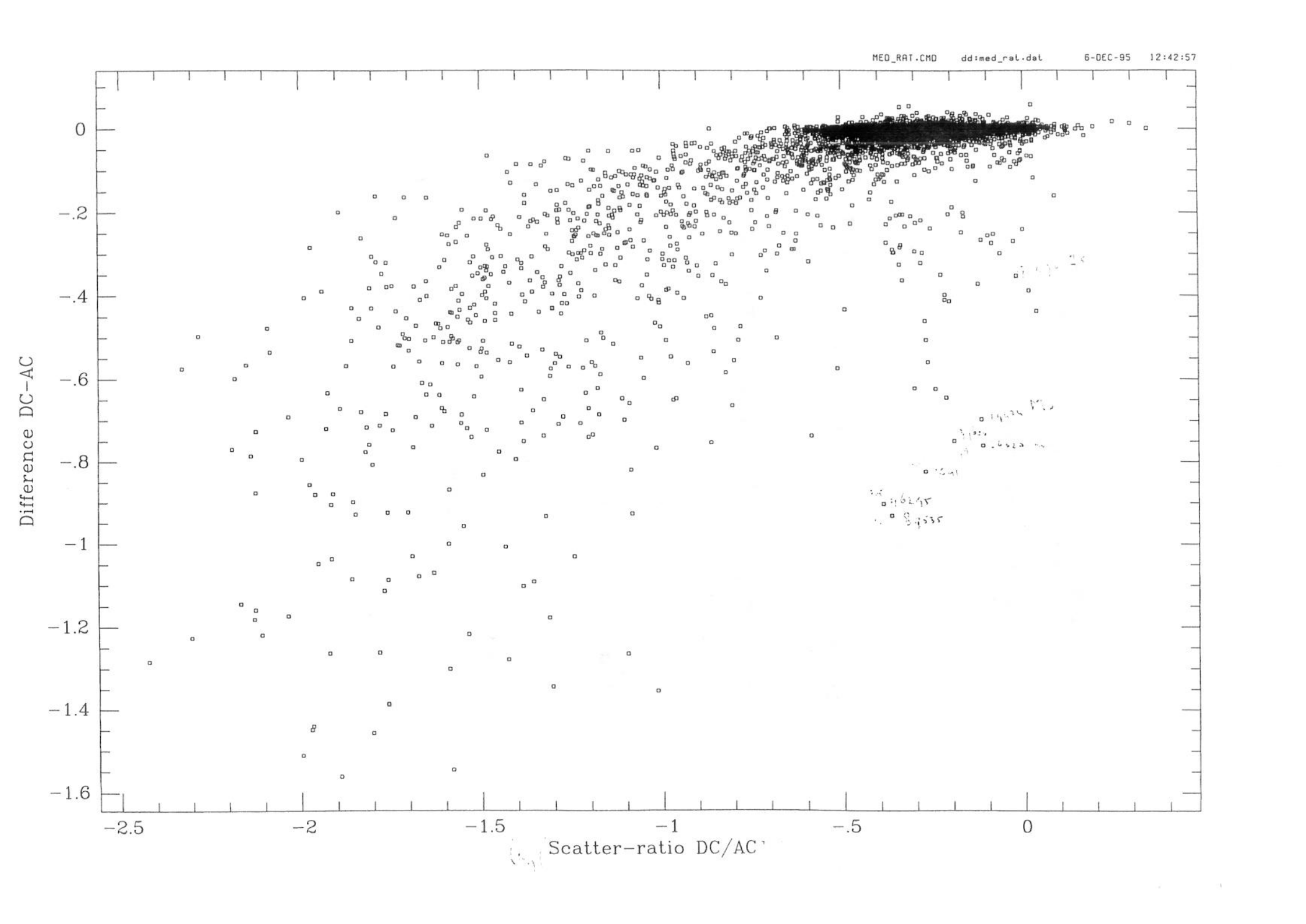
QUESTIONS: (O, V, X):

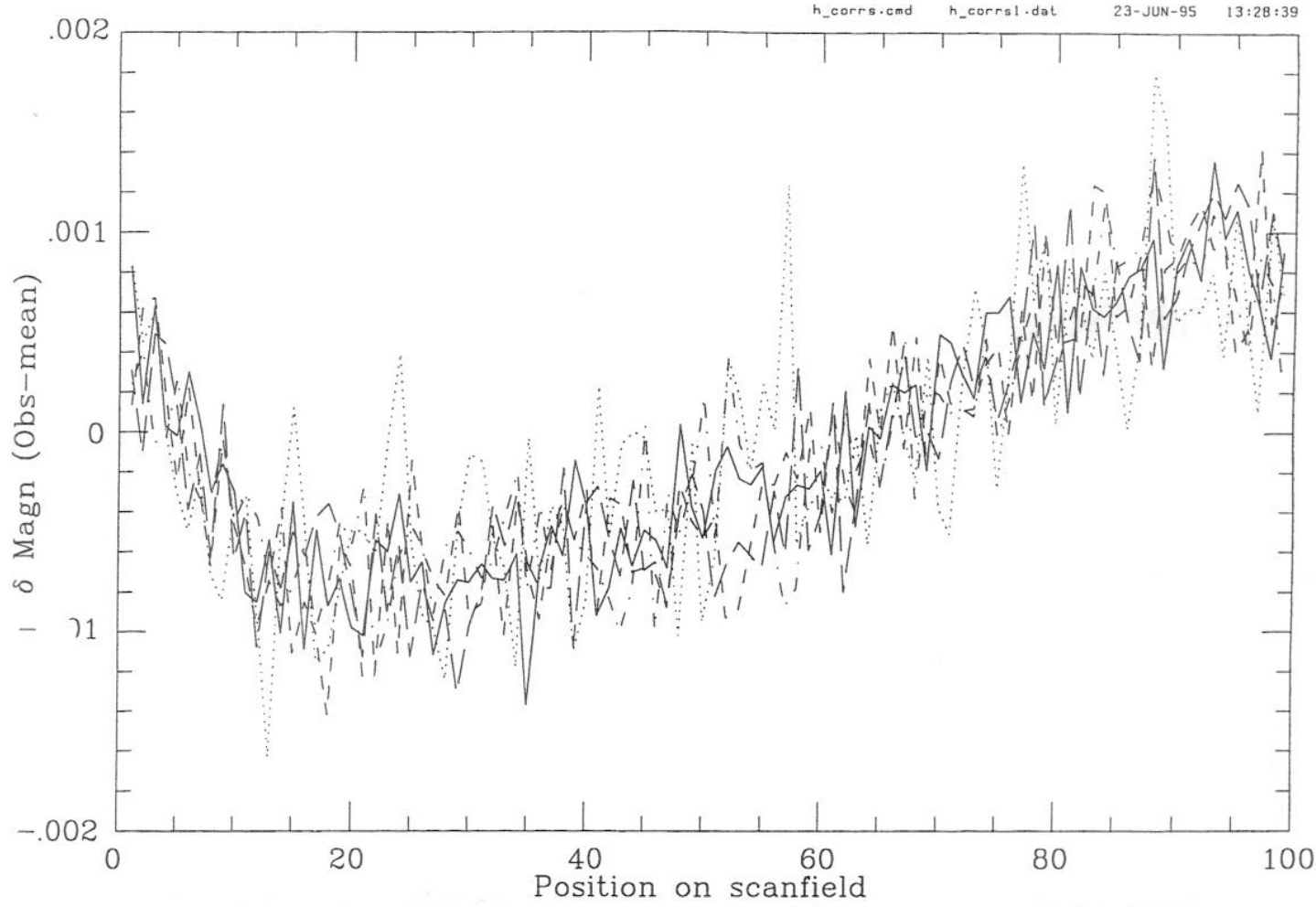
- ARI RESULTS ARE THE FINAL FAST RESULTS?
- IS FAST/NDAC MERGING FEASIBLE?
- ARE VIM'S CREDIBLE?

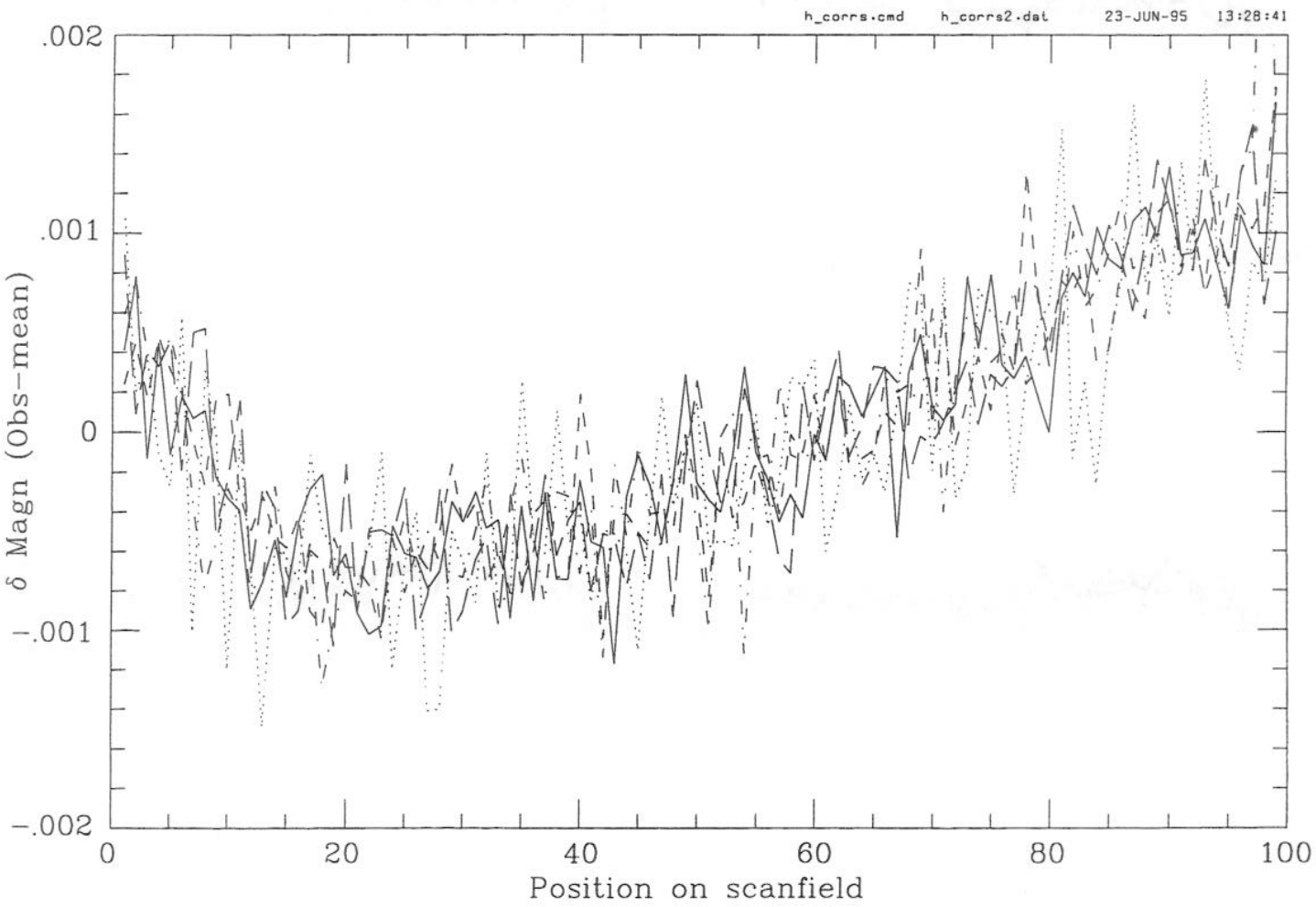
ANNEX 8

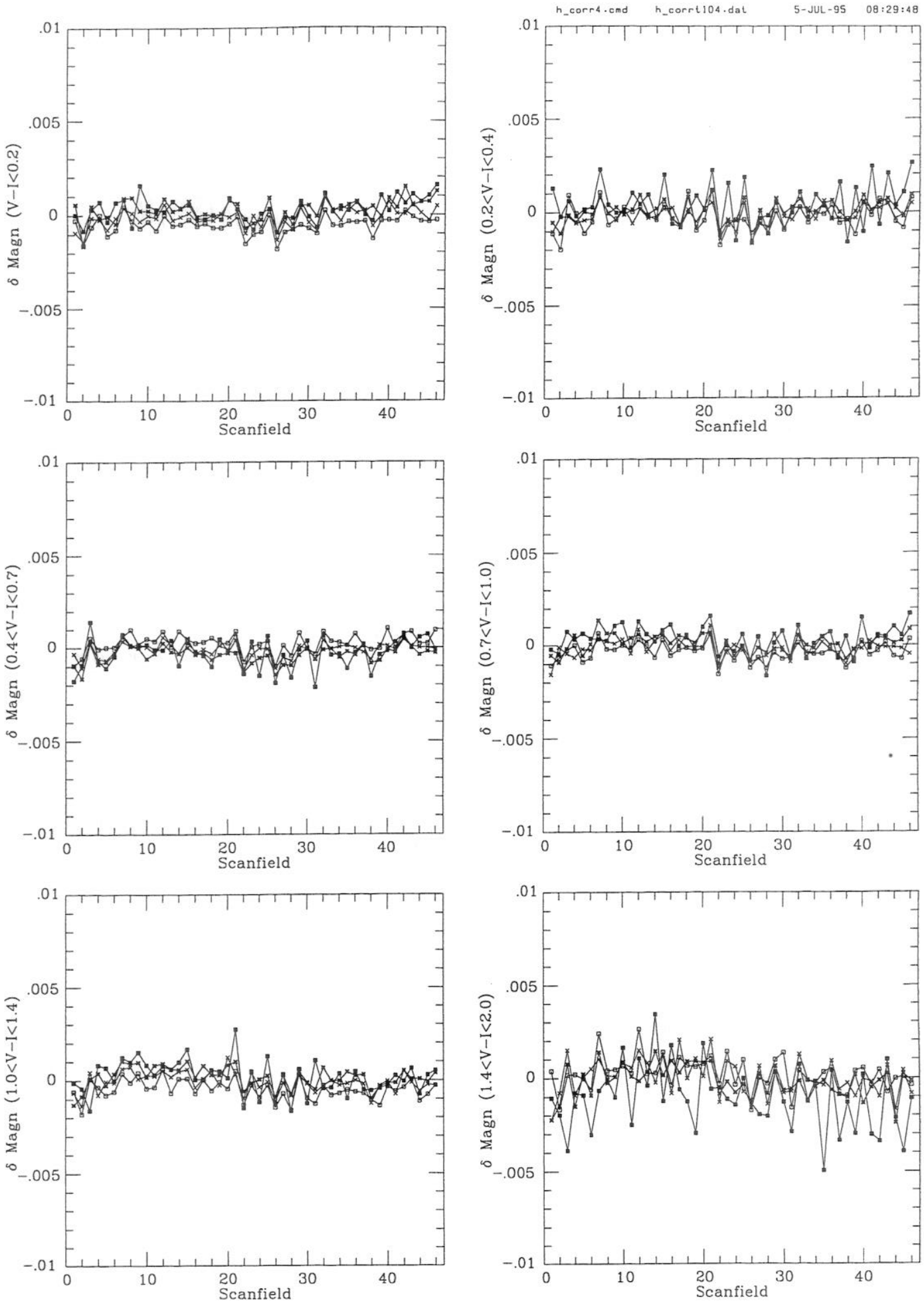
Main mission photometry

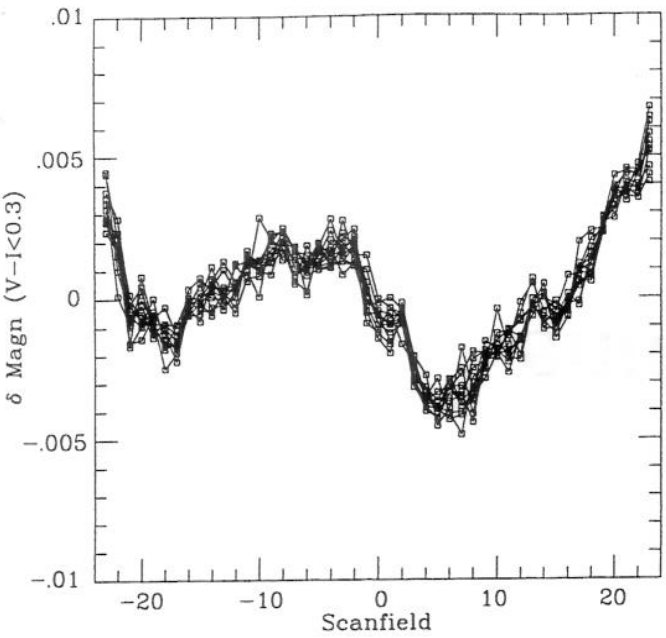
- All data reductions finished
- Ageing corrections applied and checked
- FAST and NDAC data compared and merged
  - report by Dafydd Evans
- Variability research progressing well
  - RGO all stars with uw-sd>3.0 ready, with 2<uw-sd<3 : 50% done.
  - periodic variables: 1900-2200
  - non-period variables: 3600 with uw-sd>3

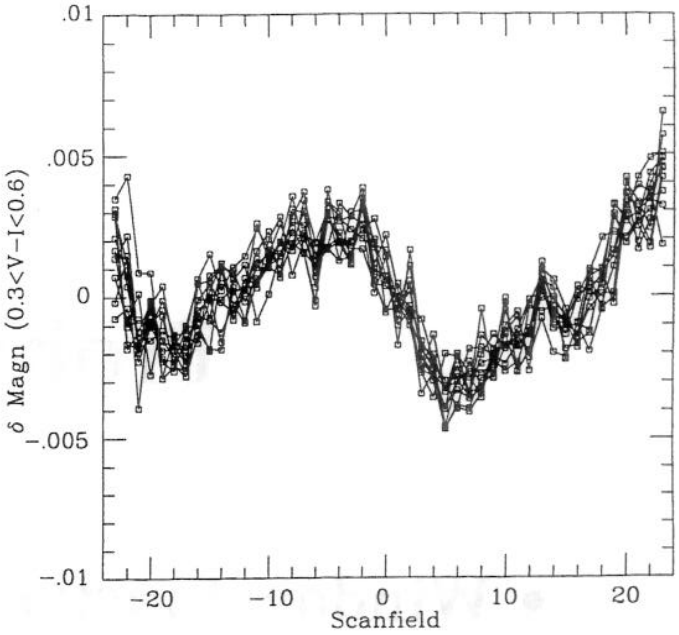

MED_RAT.CMD dd:med_rat.dat 6-DEC-95 12:42:57
0
-.2
-.4
-.6
-.8
-1
-1.2
-1.4
-1.6
Difference DC-AC
-2.5
-2
-1.5
-1
-.5
0
Scatter-ratio DC/AC

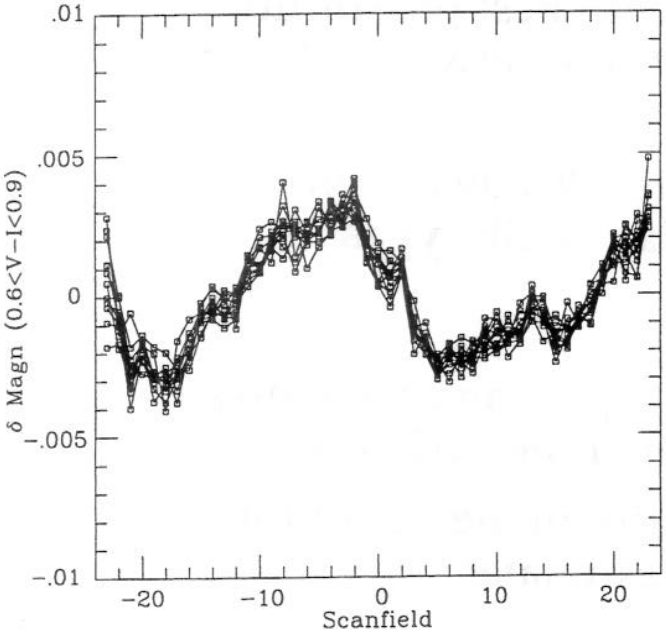

h_corrs.cmd h_corrs1.dat 23-JUN-95 13:28:39
.002
.001
0
-.002
δ Magn (Obs-mean)
0
20
40
60
80
100
Position on scanfield

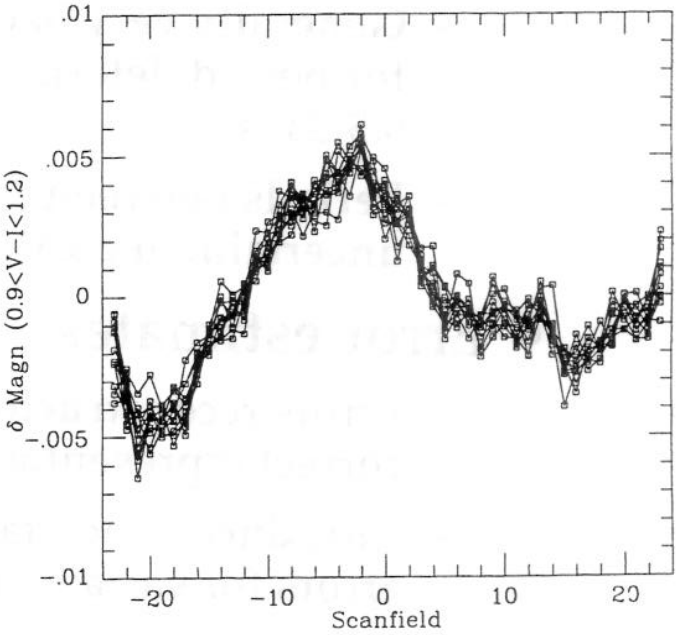

h_corrs.cmd h_corrs2.dat 23-JUN-95 13:28:41
.002
.001
0
-.001
-.002
δ Magn (Obs-mean)
0
20
40
60
80
100
Position on scanfield

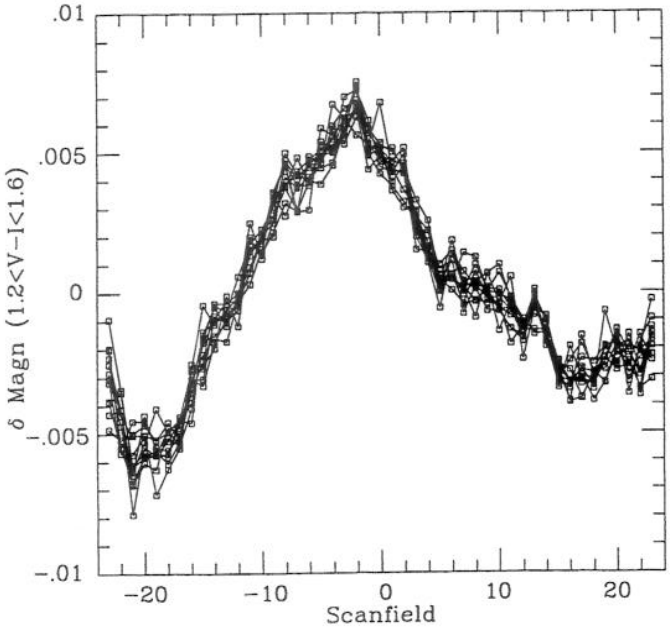

h_corr4.cmd h_corrt104.dat 5-JUL-95 08:29:48
δ Magn (V−I<0.2)
δ Magn (0.2<V−I<0.4)
δ Magn (0.4<V−I<0.7)
δ Magn (0.7<V−I<1.0)
δ Magn (1.0<V−I<1.4)
δ Magn (1.4<V−I<2.0)
Scanfield
.01
.005
0
−.005
−.01
0
10
20
30
40

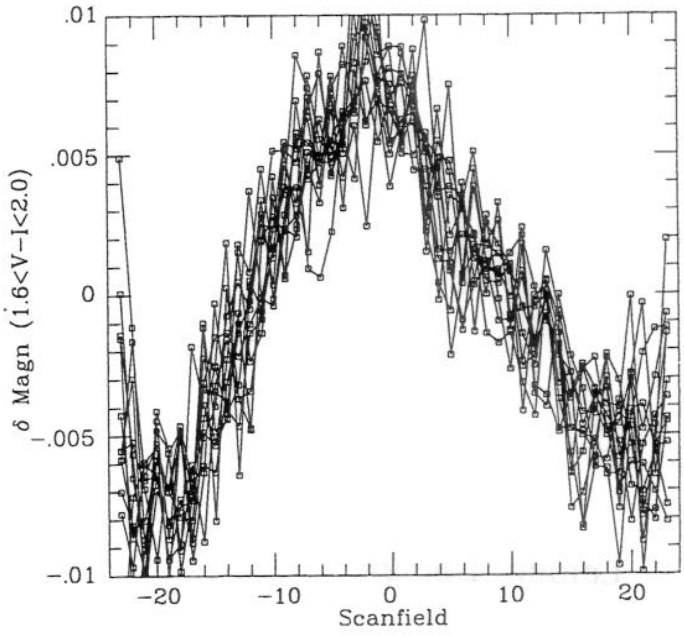

.01
.005
0
−.005
−.01
δ Magn (V−I<0.3)
−20
−10
0
10
20
Scanfield


.01
.005
0
−.005
−.01
δ Magn (0.3<V−I<0.6)
−20
−10
0
10
20
Scanfield


.01
.005
0
−.005
−.01
δ Magn (0.6<V−I<0.9)
−20
−10
0
10
20
Scanfield

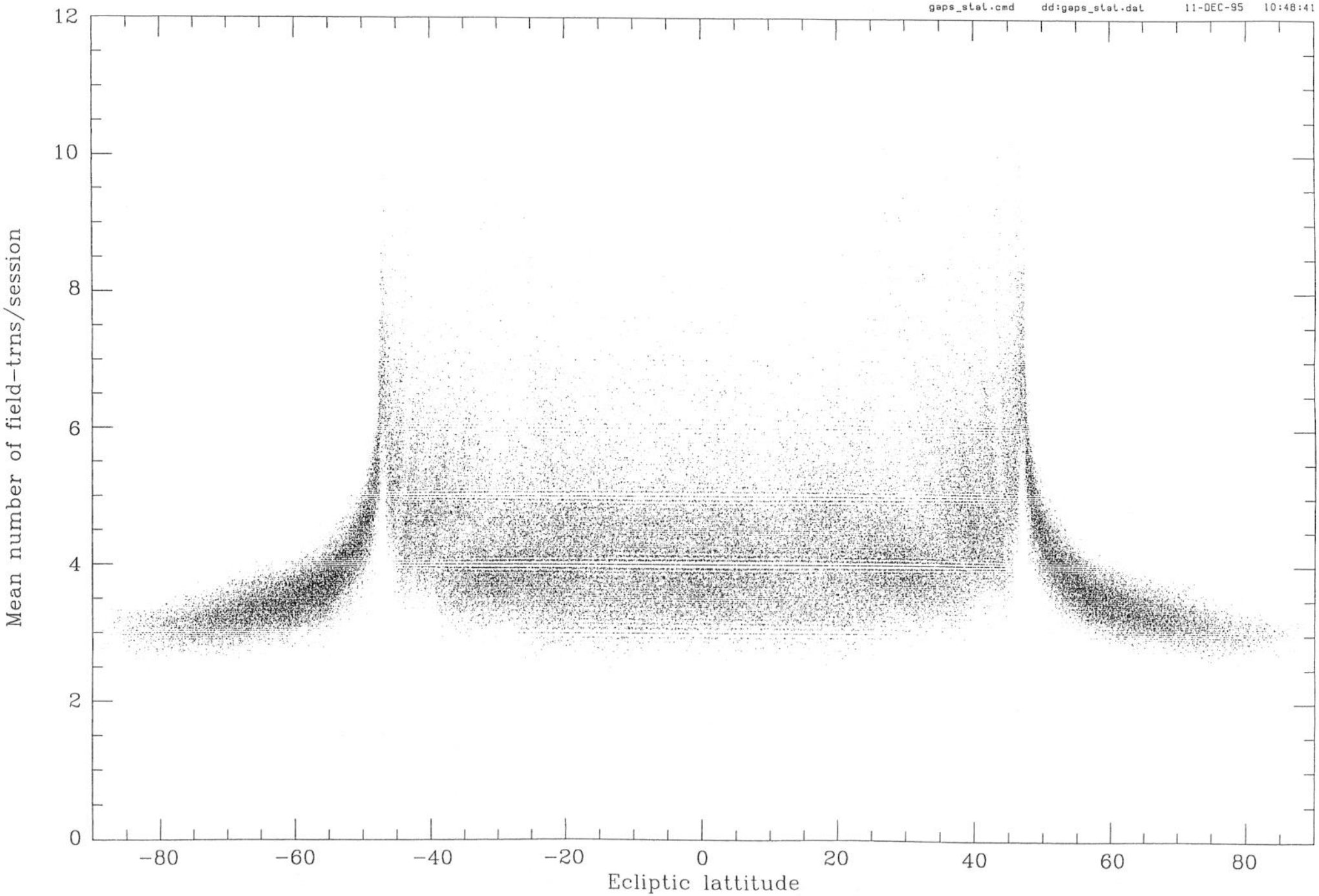

.01
.005
0
−.005
−.01
δ Magn (0.9<V−I<1.2)
−20
−10
0
10
20
Scanfield

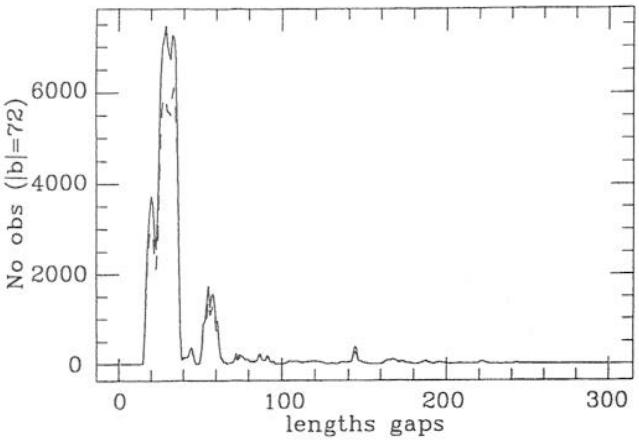

.01
.005
0
−.005
−.01
δ Magn (1.2<V−I<1.6)
−20
−10
0
10
20
Scanfield

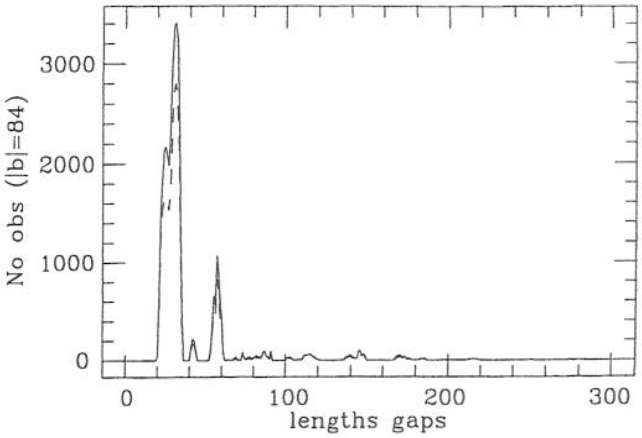

.01
.005
0
−.005
−.01
δ Magn (1.6<V−I<2.0)
−20
−10
0
10
20
Scanfield

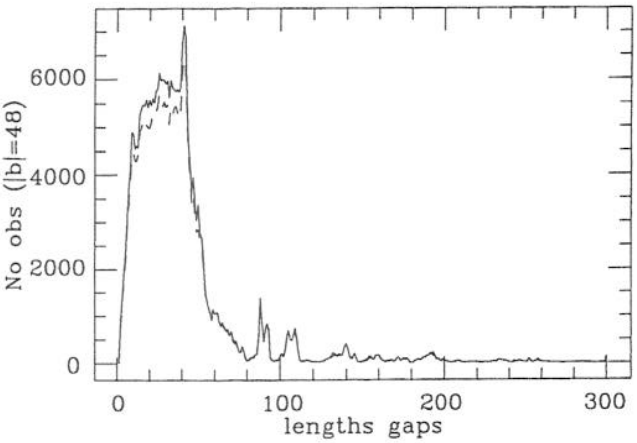
Problems

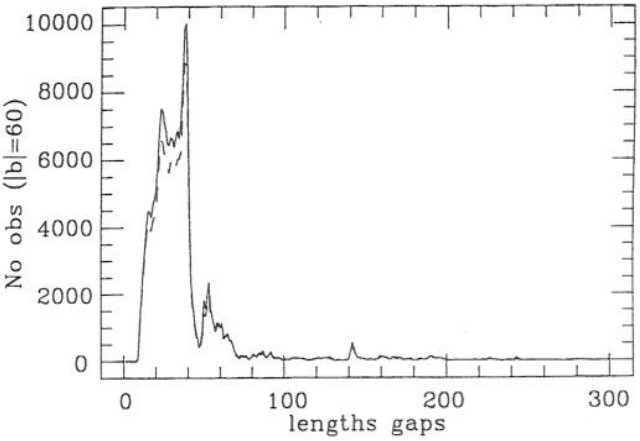
- Window function
  - Generally very bad, with best possibilities for period determinations between 0.2 and 0.5 days
  - Periods between 2 and 100 days often uncertain, in particular for SR types
- Error estimates
  - Errors reconstructed to give an apparently correct representation of the variances
  - Introduces uncertainties in the use of these errors for variability estimates

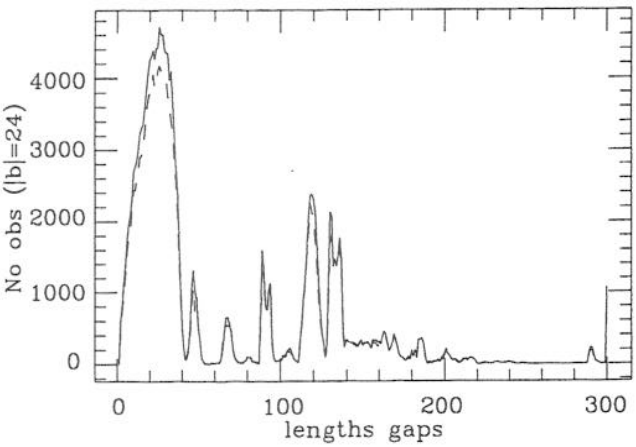

gaps_stat.cmd dd:gaps_stat.dat 11-DEC-95 10:48:41
Mean number of field-trns/session
0
2
4
6
8
10
12
-80
-60
-40
-20
0
20
40
60
80
Ecliptic lattitude

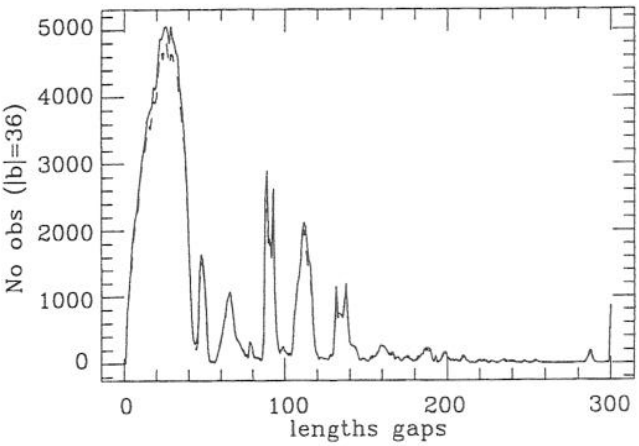

No obs (|b|=72)
6000
4000
2000
0
0
100
200
300
lengths gaps

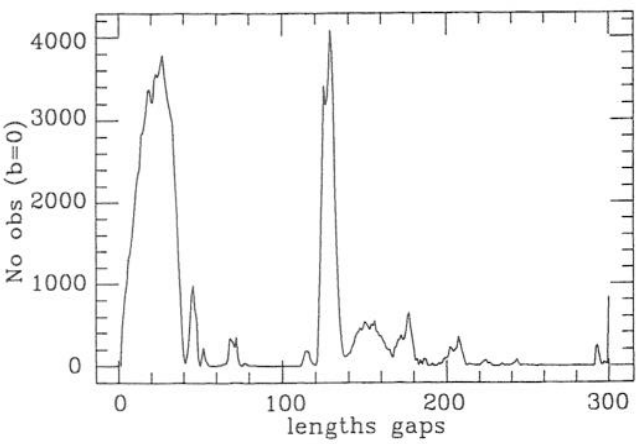

No obs (|b|=84)
3000
2000
1000
0
0
100
200
300
lengths gaps

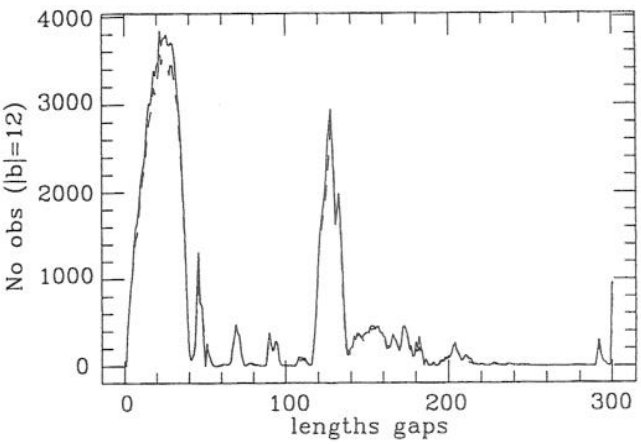

No obs (|b|=48)
6000
4000
2000
0
0
100
200
300
lengths gaps


No obs (|b|=60)
10000
8000
6000
4000
2000
0
0
100
200
300
lengths gaps


No obs (|b|=24)
4000
3000
2000
1000
0
0
100
200
300
lengths gaps

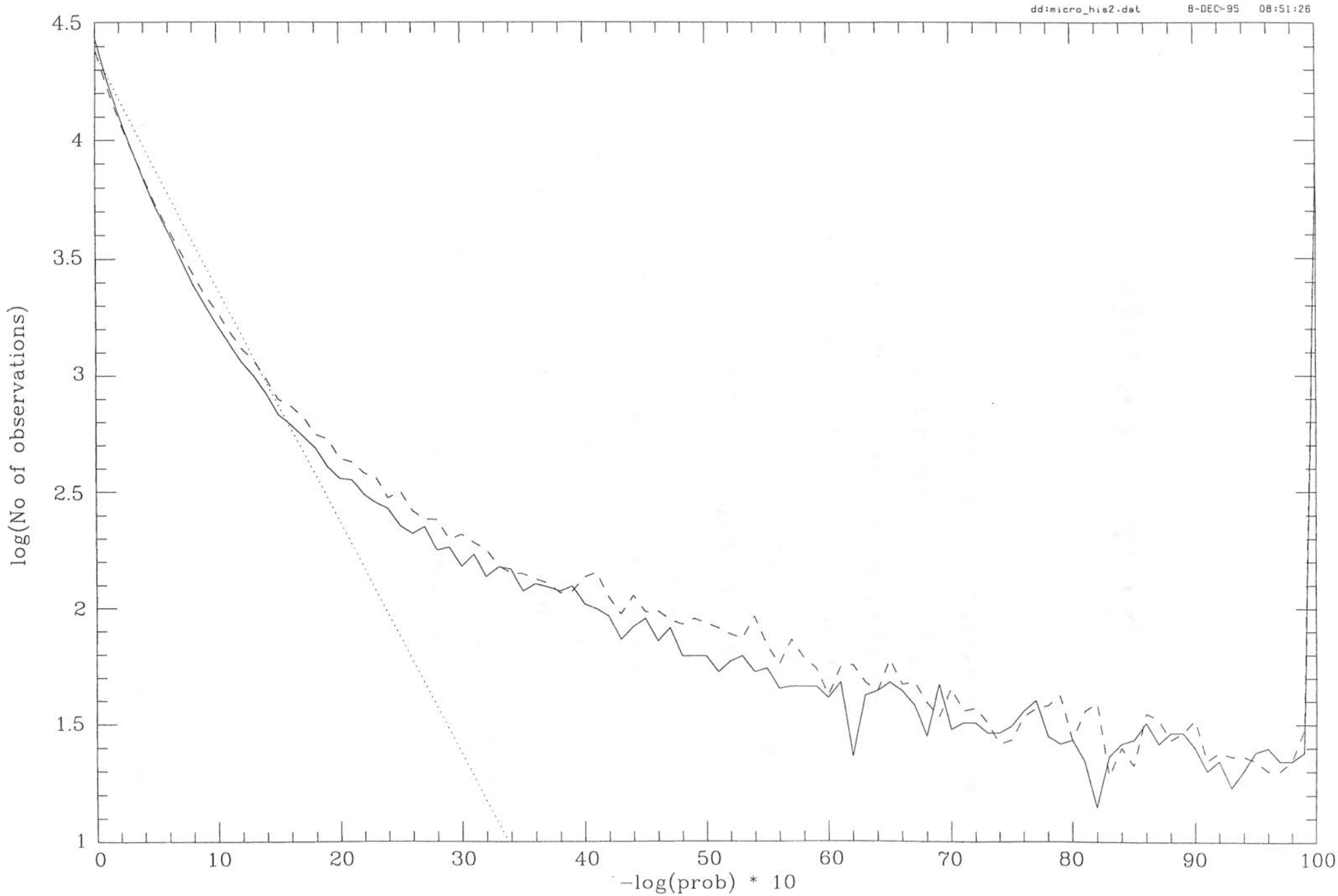

No obs (|b|=36)
5000
4000
3000
2000
1000
0
0
100
200
300
lengths gaps


No obs (b=0)
4000
3000
2000
1000
0
0
100
200
300
lengths gaps


No obs (|b|=12)
4000
3000
2000
1000
0
0
100
200
300
lengths gaps

Some results

- Eclipsing binaries
  - Algol types: Known 272, new 158
  - beta Lyraes: Known 79, new 152
  - W UMa : Known 78, new 39
- Pulsating stars
  - Cepheids : Known 268, new 4
  - RR Lyraes: Known 170, new 16
  - DSct, SXPhe: Known 66, new 23
  - BCep: Known 17, new 14
  - SR : Known 69, new 116
- Not periodic
  - known 1068, new 2591


dd:micro_his2.dat 8-DEC-95 08:51:26
4.5
4
3.5
3
2.5
2
1.5
1
log(No of observations)
0
10
20
30
40
50
60
70
80
90
100
-log(prob) * 10

Rounding off

- Data from RGO and Geneva to be combined
  - Checks to be carried out at RGO between Jan.15 and Feb.28
  - Comparisons between results and with data in literature
    - » periods
    - » zeropoints
    - » types
    - » amplitudes
    - » mean brightness
- Selection of comments and references from RGO data base
  - data on 8109 HIP entries
  - notes or references for 5463 variables, 315 probable variables, 803 possible variables and 1414 non-variables

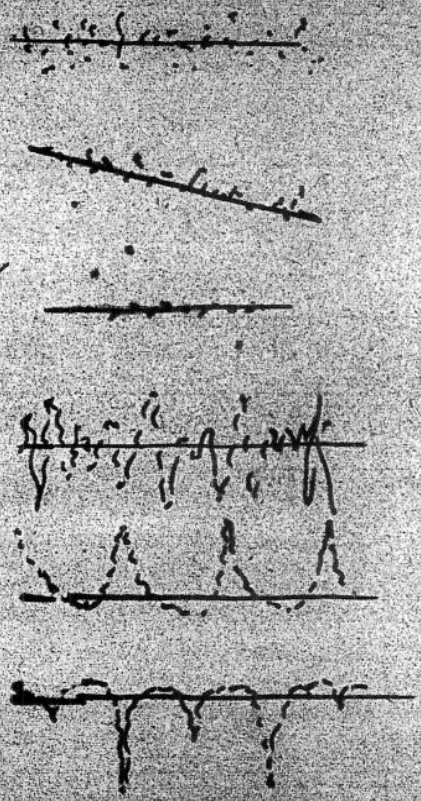
ANNEX 9

CATALOGUE ANALYSIS

6 statistical tests :

χ^2	, value, freq.
kurtosis	,
asymmetry	,
outliers	,
shapiro -	,
aberrant data	,

to check the various situations



CHECK OF STABILITY

&

→ ANALYSIS METHOD

MAIN - MISSION PHOTOMETRY ANALYSIS

Receives : 11520 + DC Epoch Φ

NEW + : Flags for
- FAST or NDAC only
- discrepancies FN
- high-background
- contamination by * in other FOV

- : No AC → No test for duplicity
→ No detection of overlapping images

NEW : External error on single transit

CHECKING ACTIVITY

> Resides & correct

> Linear function of external error

Slope = 1.0 Mp 2-10

Weighting according to Er
- straightforward
- useful (bins)

RESULTS

- Identification of constant observations effected at RGO

→ **60050** * CONSTANT

- Few spikes still present:

  ft = 0 (Quality flag)

  Search for aberrant values during one satellite rotation:

  After rejection of 1-2 aberrant data

  (ΔHp/σ s.d. Test over 0.08 day)

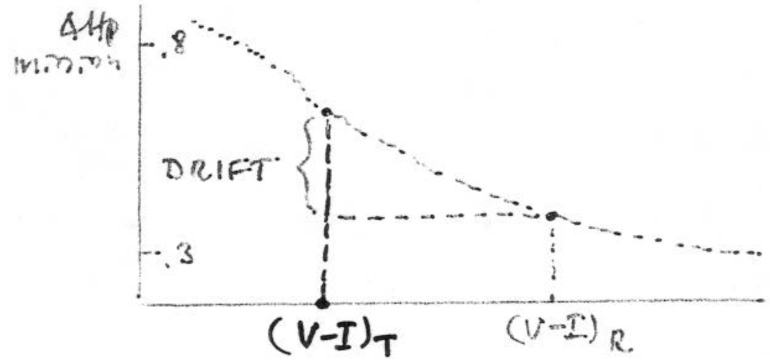
→ **16223** * CONSTANT

(few flares lost, DKM + to be checked)

- About 22% of stars with approximate (V-I)

  → Reduction error

  → Linear drifts



If $(V-I)_T < (V-I)_R$ negative drifts

After correction for a linear drift:

→ 3325 ★ constant

Hartel 'L'

(Scatter not intrinsic)

- Slope not statistically significant:

2224 ★ No action

- Significant slope:

Estimate of a neutral (V-I) comp

1105 ★

→ Detection of errors

Correction of V-I

→ Updating of Epoch Photometry

~ 0.5 - 1.0 % of wrong V-I

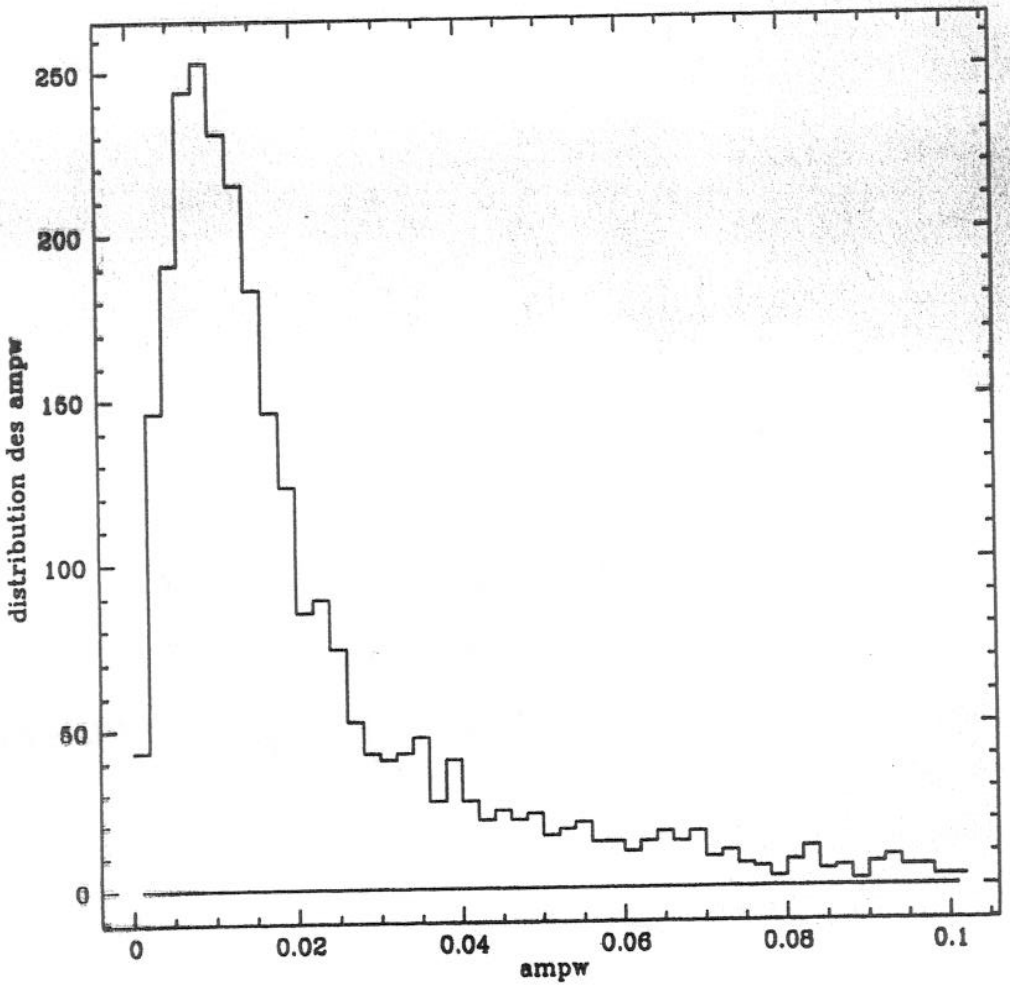
→ Detection of true drifts

Be, supergiants, C stars ...

Res 00 - 1-20000

microvariables + * à enlever

amps > 0.000



Dec 12 11:46:15 1995 fichier : AMPL

ANNEX 4

LINK SYNTHESIS (A&A, 304, 189, 1995)

EACH LINK DETERMINATION (j) PROVIDES A (NOMINAL) INFORMATION ARRAY $[\underline{N}_j, \underline{h}_j]$ SUCH THAT $\hat{\underline{S}}_j = \underline{N}_j^{+}\,\underline{h}_j$ WITH $\hat{Cov}(\hat{\underline{s}}_j) = \underline{N}_j^{+}$. $\quad \underline{s} = (\varepsilon_{0x}\ \varepsilon_{0y}\ \varepsilon_{02}\ \omega_x\ \omega_y\ \omega_z)'$.

TO EACH LINK A RELATIVE WEIGHT $w_j \in [0, 1]$ IS ASSIGNED.

THEN WEIGHTED LINK RESULT:

$$\hat{\underline{s}} = \underbrace{\left(\sum_j w_j \underline{N}_j\right)^{-1}}_{\hat{Cov}(\hat{\underline{s}})} \sum_j w_j \underline{h}_j$$

AND "LINK RESIDUALS"

$$\underline{d}_j = w_j \underline{h}_j - w_j \underline{N}_j \hat{\underline{s}}$$

$$\hat{Cov}(\underline{d}_j) = w_j \underline{N}_j - w_j \underline{N}_j \left(\sum_k w_k \underline{N}_k\right)^{-1} w_j \underline{N}_j$$

$$GOF_j = \underline{d}_j' \, \hat{Cov}(\underline{d}_j)^{-1} \underline{d}_j$$

$$E(GOF_j) = RANK(\underline{N}_j) \qquad (= 2, 3 \text{ OR } 6)$$

$$GOF = \sum_j GOF_j \,, \quad E(GOF) = \sum_j RANK(\underline{N}_j) = 42 \qquad \Big\} \underline{\underline{A}}$$

$\{w_j\}$ ARE ADJUSTED SO THAT $\underline{\underline{A}}$ IS SATISFIED

PRELIMINARY LINK RESULTS (H37)

METHOD	EPOCH	ε_{ox}	ε_{oy}	ε_{oz}	ω_x	ω_y	ω_z	$W^{-1/2}$	GOF
VLBI	91.25	-19.88 .51	-8.97 .49	+20.56 .56	**-0.09** .49	**-0.59** .44	+0.59 .51	1.0	6.2
MERLIN	94.06	-20.39 2.24	-9.10 1.59	+20.23 2.15	+3.1 1.9	-1.6 1.4	+5.1 1.8	1.5	7.4
HAMBURG	88.0	-13.8 5.0	-8.8 4.9	+10.5 4.7	-	-	-	1.0	3.7
HST	94.24	-28.24 2.63	-12.38 1.87	+27.01 2.66	+4.0 3.6	+0.7 2.1	+3.3 3.6	1.5	5.7
EOP	85.0	-13.79 .72	-6.75 3.7	-	-1.13 .24	+0.12 .24	-	2.0	7
NPM (Röser)	—	-	-	-	-1.45 .17	+0.10 .14	+0.46 .14	2.0	4.5
SPM α	—	-	-	-	**+0.28** .10	**+0.78** .13	+0.26 .06	4.0	4.7
SPM δ	—	-	-	-	-0.51 .10	**+0.74** .11	-	4.0	3.2
BONN	—	-	-	-	**+0.53** .37	-0.37 .27	+0.15 .35	2.0	4.6
KIEV	—	-	-	-	-1.1 .8	0.0 .6	-0.5 .8	1.0	1.8
POTSDAM	—	-	-	-	-0.68 .8	+0.04 .6	+1.02 .8	1.0	0.5
SYNTHESIS	91.25	-19.88 .47	-8.93 .47	+20.41 .54	-0.82 .13	+0.04 .13	+0.49 .15		44.0

Σ_j RANK $(\underline{N}_j) = 42$

JOHNSTON	85?	-18.4 6.7	-12.9 7.7	+16.0 7.2	-	-	-		

FOR $\underline{\Sigma}$, 90% OF THE WEIGHT COMES FROM VLBI.

FOR $\underline{\omega}$, MOST WEIGHT COMES FROM EOP, NPM, SPM, ONLY 8% FROM VLBI.

SOLAR SYSTEM OBJECTS
FAST–NDAC & TDAC

I FAST–NDAC MERGING

II HIPPARCOS–SATELLITES

III TYCHO

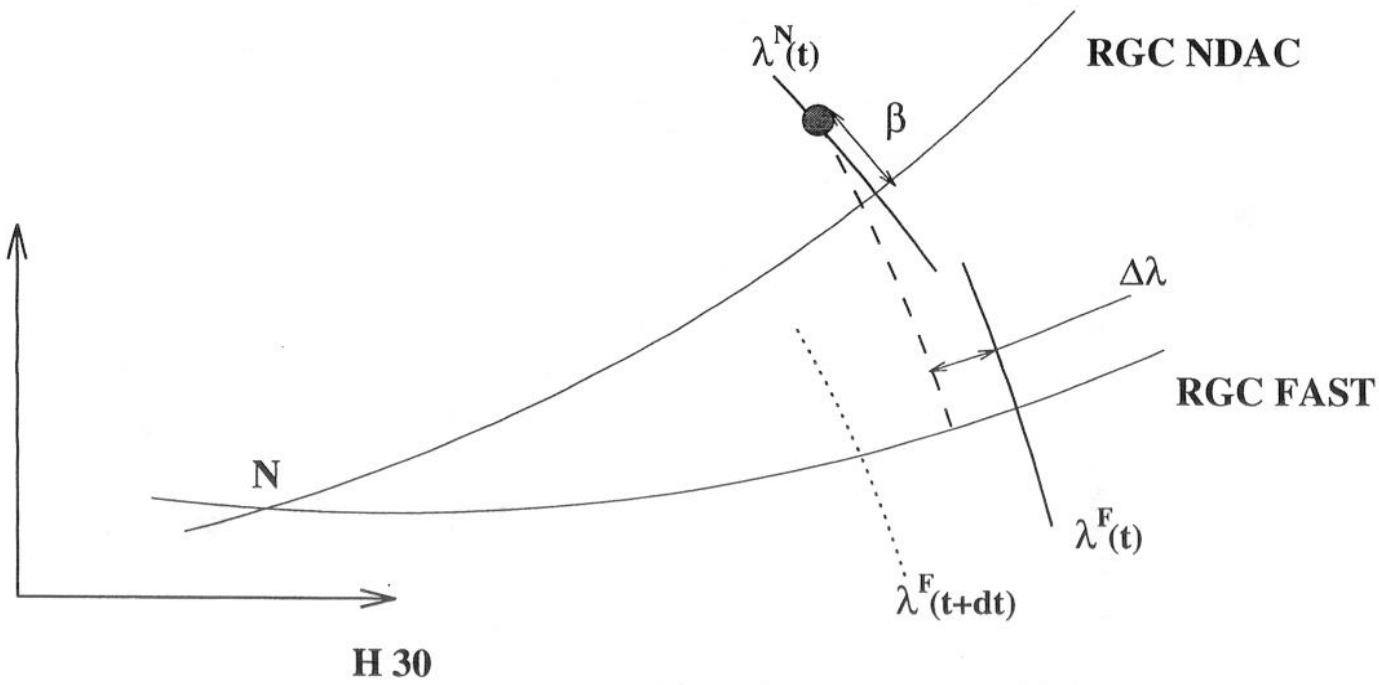
Annex 12

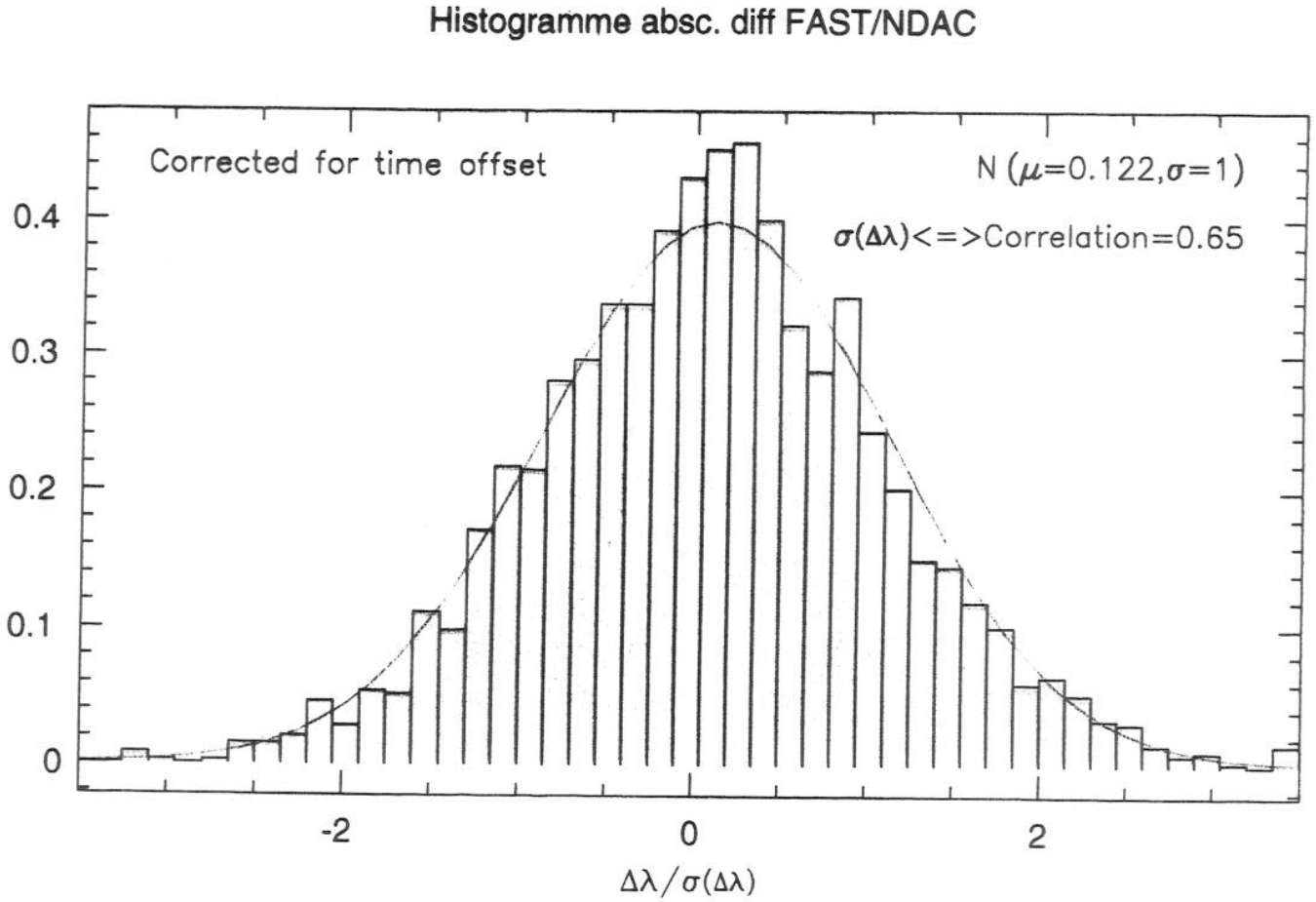
I.1 FAST–NDAC COMPARISON

- Photometry $\rightarrow$ FAST only
- Satellitocentric directions (NDAC)
- Comparison NDAC-FAST (minor planets)

$$\Delta\lambda = \lambda_F - \lambda_N$$

- **Rotation to H30**
- **Correction of time offset dt**
- **Projection to a single RGC**
- **Normalized difference**





$\sigma = 1$ par construction

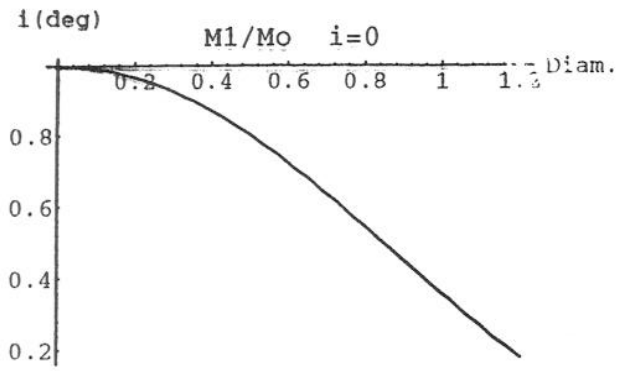
$\mu = 0.12$ ~ 2 mas

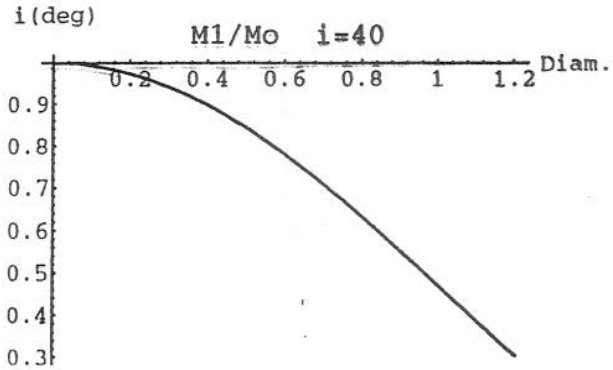
I.2 FAST–NDAC MERGING

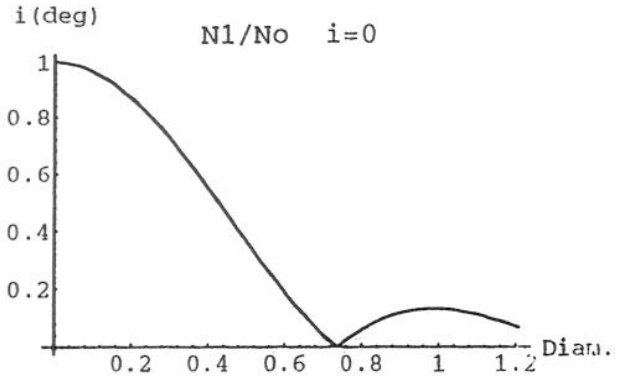
- Abscissae in the single Hipparcos reference frame
- $\tilde{\lambda}(t) = \dfrac{\lambda_F(t) + \lambda_N(t)}{2}$ on one RGC
- Hypothesis: $\mathbf{d\lambda_F/dt}$; β
- Accuracy: $\Delta\beta \sin i \approx 2\ mas$
- If $E(\lambda_F) = E(\lambda_N)$

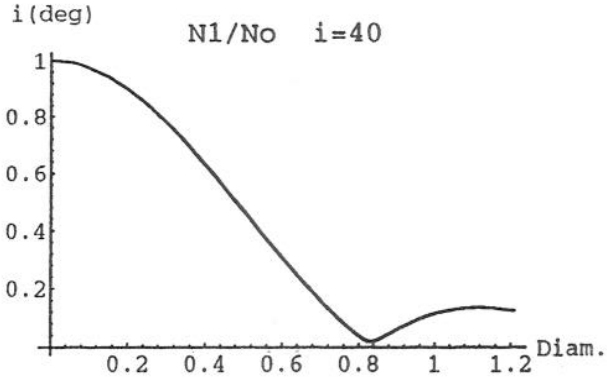
$$E = I\left[1 + M_1 \cos(\omega + \phi) + N_1 \sin(2\omega + 2\psi)\right]$$

FAST INFLUENCE OF SIZE

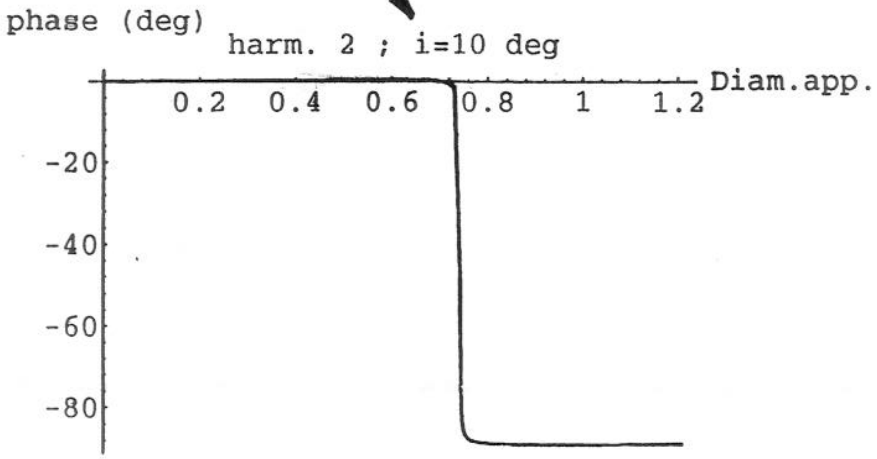




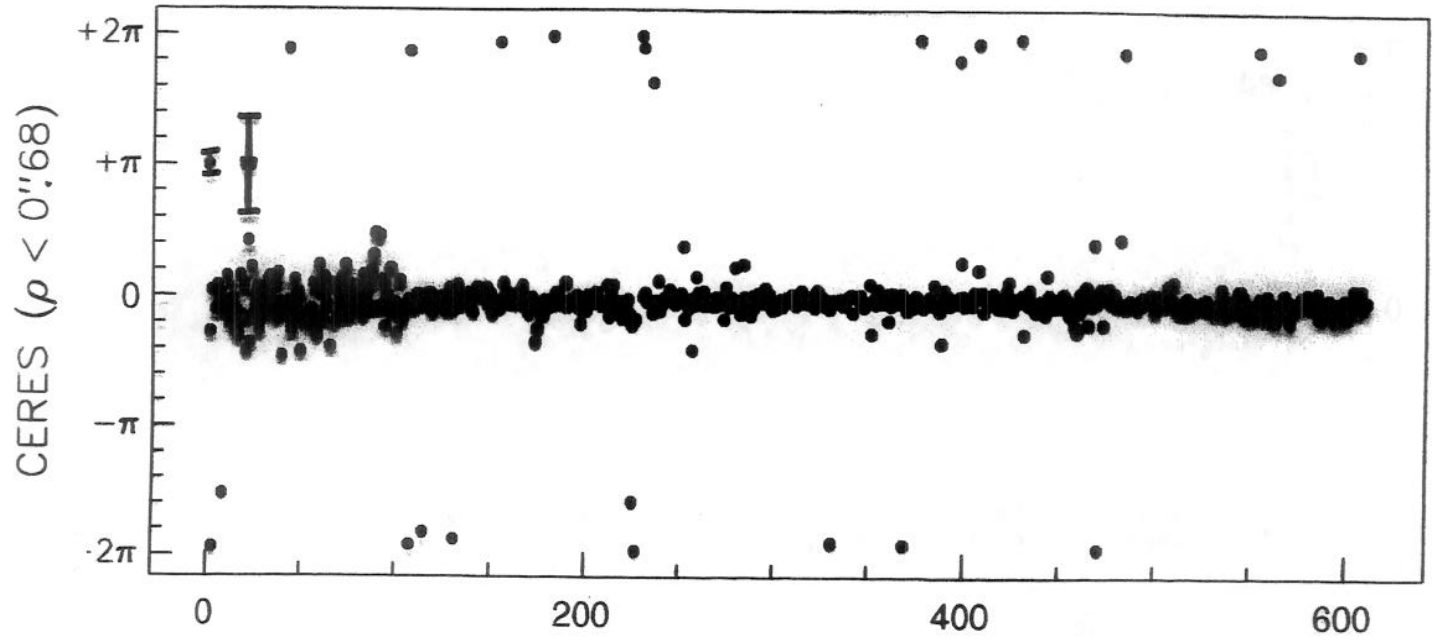


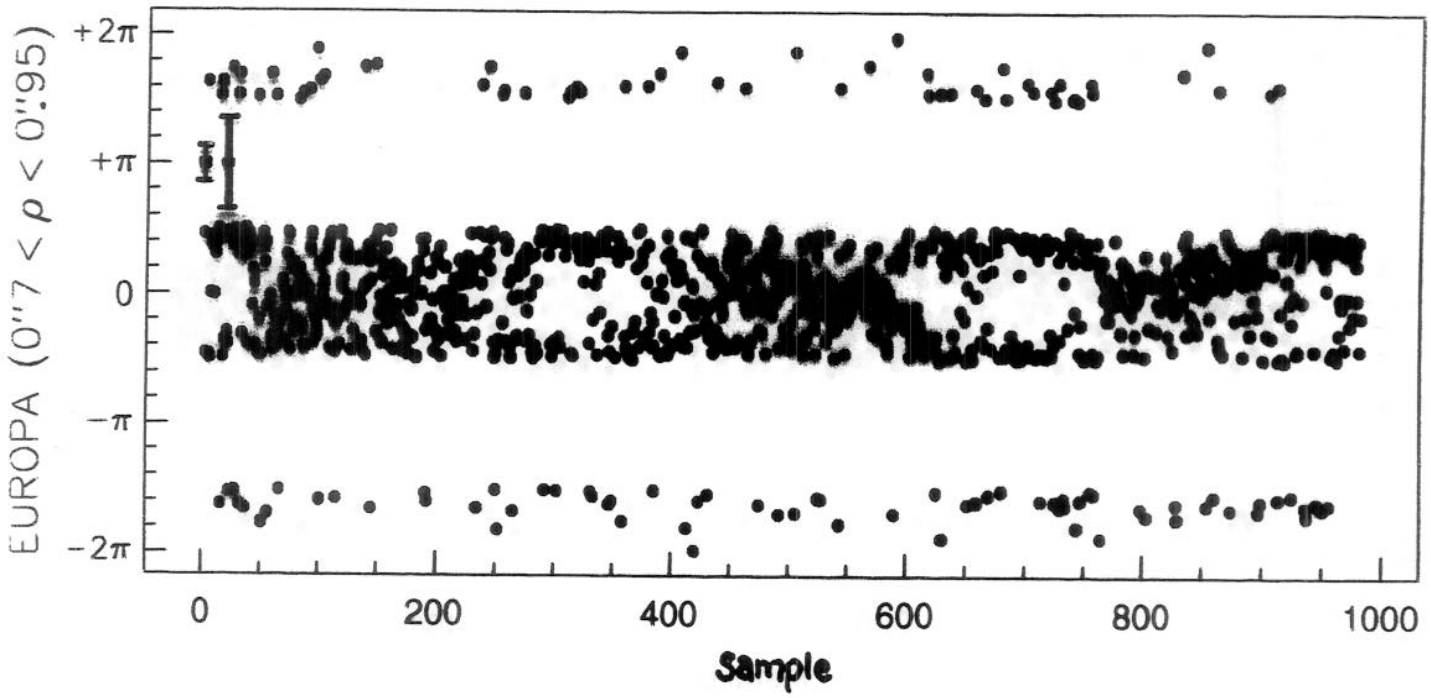


$\epsilon N 0.75$ 2nd harmonic disappears

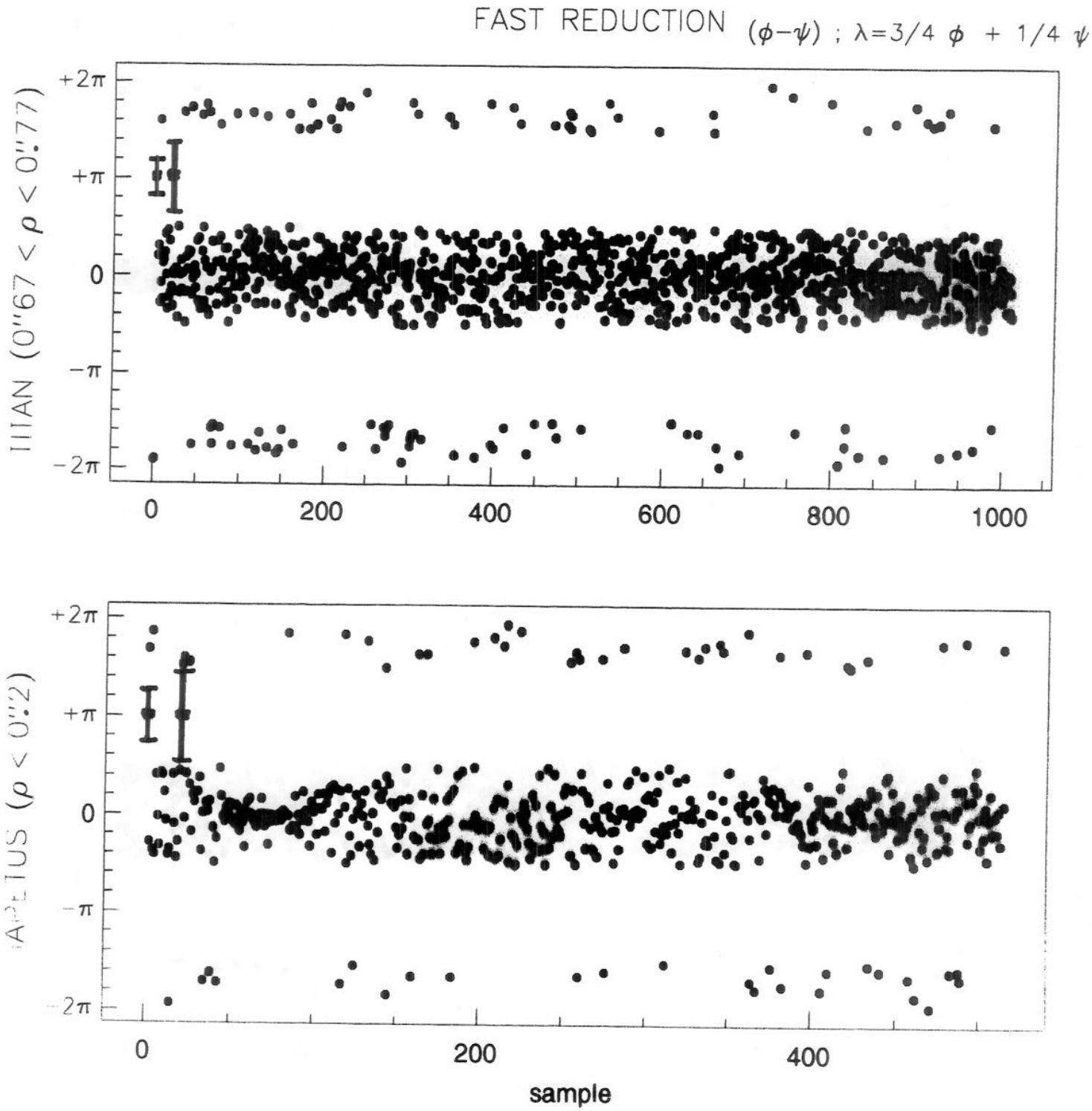


FAST REDUCTION $(\phi-\psi)$; $\lambda = 3/4\ \phi + 1/4\ \psi$





$|\phi - \psi| = \frac{\pi}{2} \Rightarrow$ offset ~ 75 mas


FAST REDUCTION $(\phi-\psi)$; $\lambda=3/4\ \phi + 1/4\ \psi$
IIIAN ($0''.67 < \rho < 0''.77$)
$+2\pi$
$+\pi$
0
$-\pi$
-2π
0
200
400
600
800
1000
APOLLONIUS ($\rho < 0''.2$)
$+2\pi$
$+\pi$
0
$-\pi$
-2π
0
200
400
sample

II HIPPARCOS–SATELLITES

- Suspicious data (Titan–Iapetus over $\approx$ 5 days)

  – Venus at 4° $\rightsquigarrow$ complex scattering ??

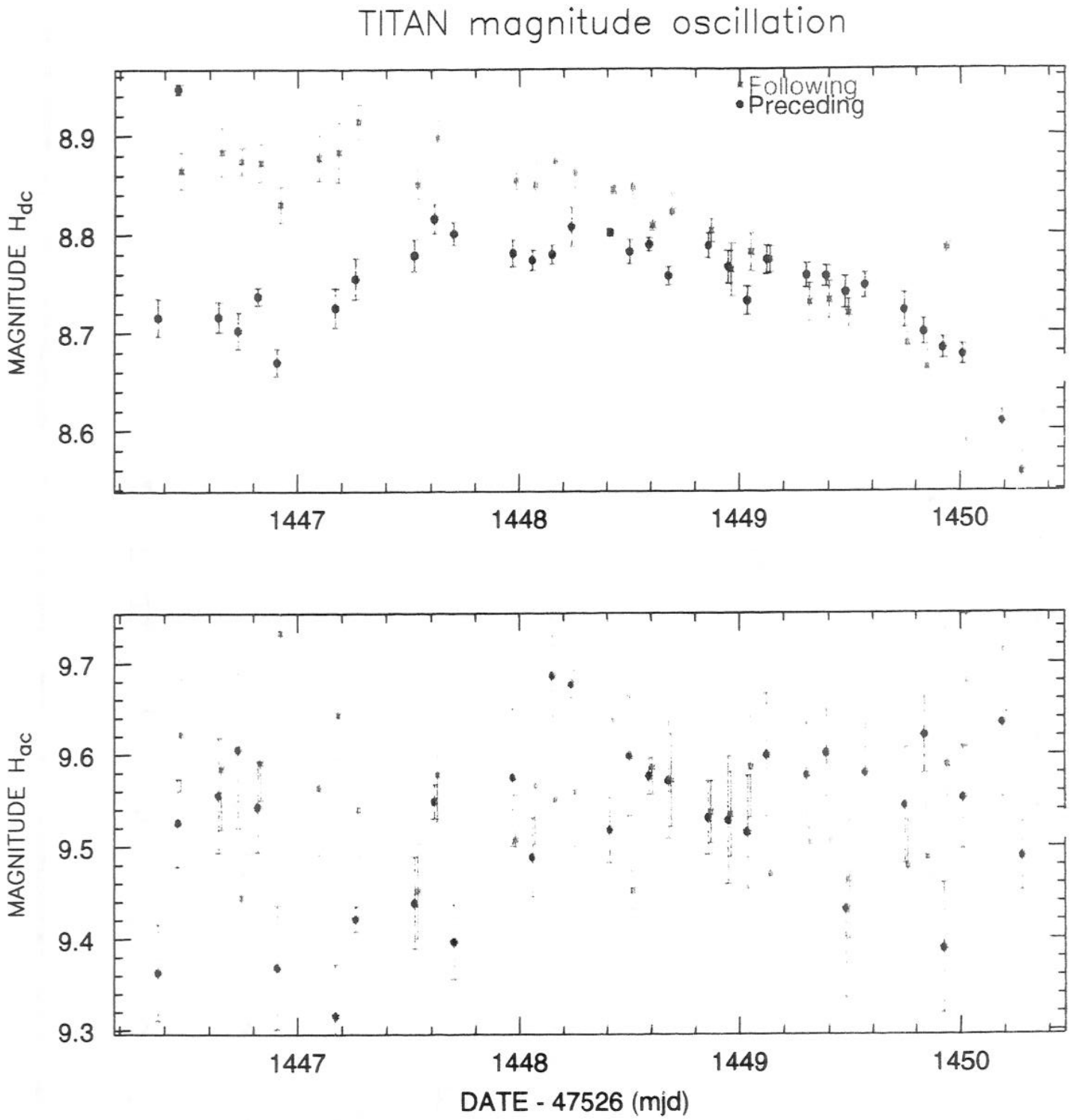
  $\Rightarrow$ Reject all observations ($\approx$ 86% for Iapetus)

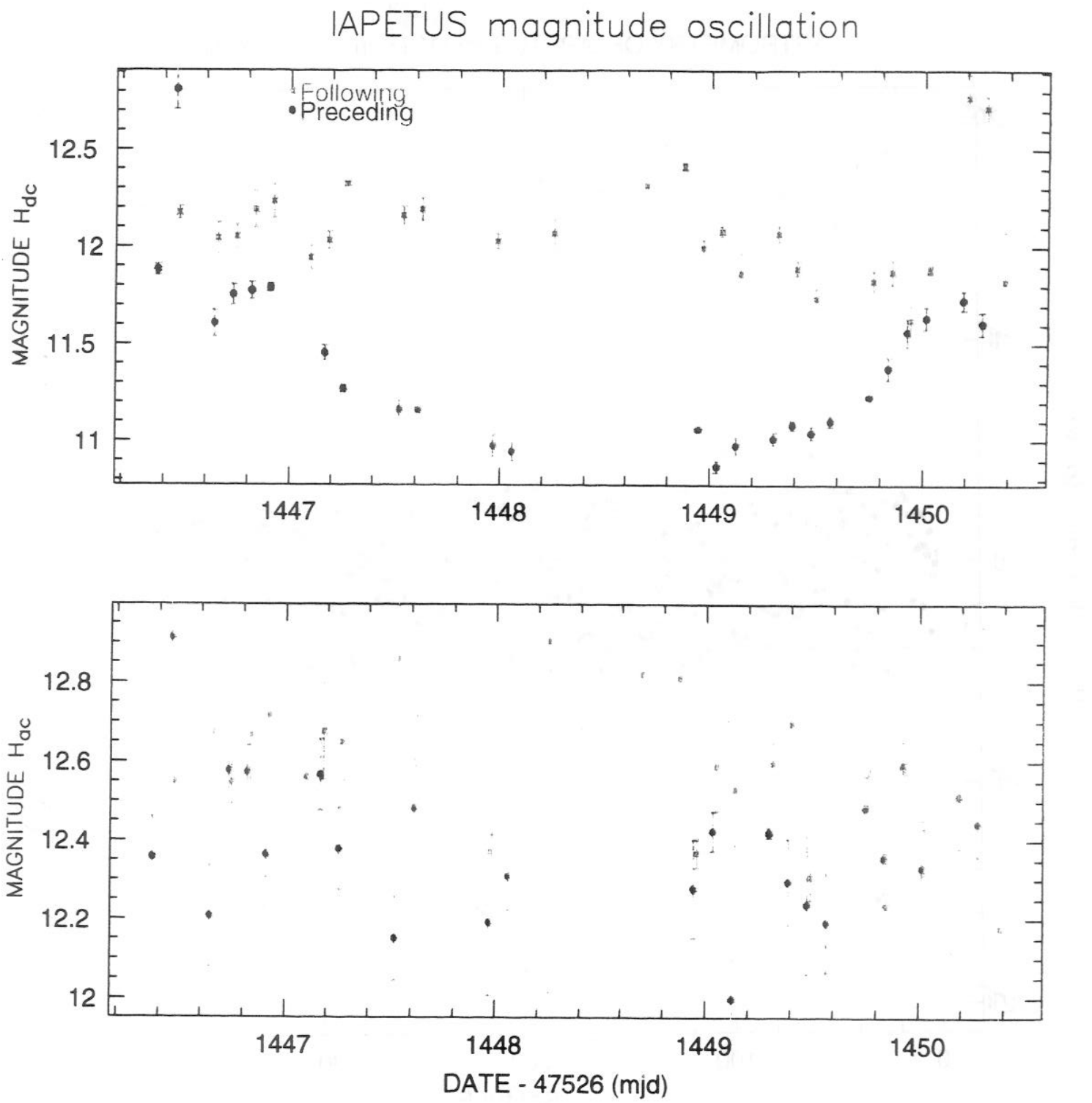
- Veiling glare by planet/satellite

  – Jupiter $\rightarrow$ OK

  – Saturn $\rightarrow$ model ??

  $\Rightarrow$ Reject photometry & astrometry

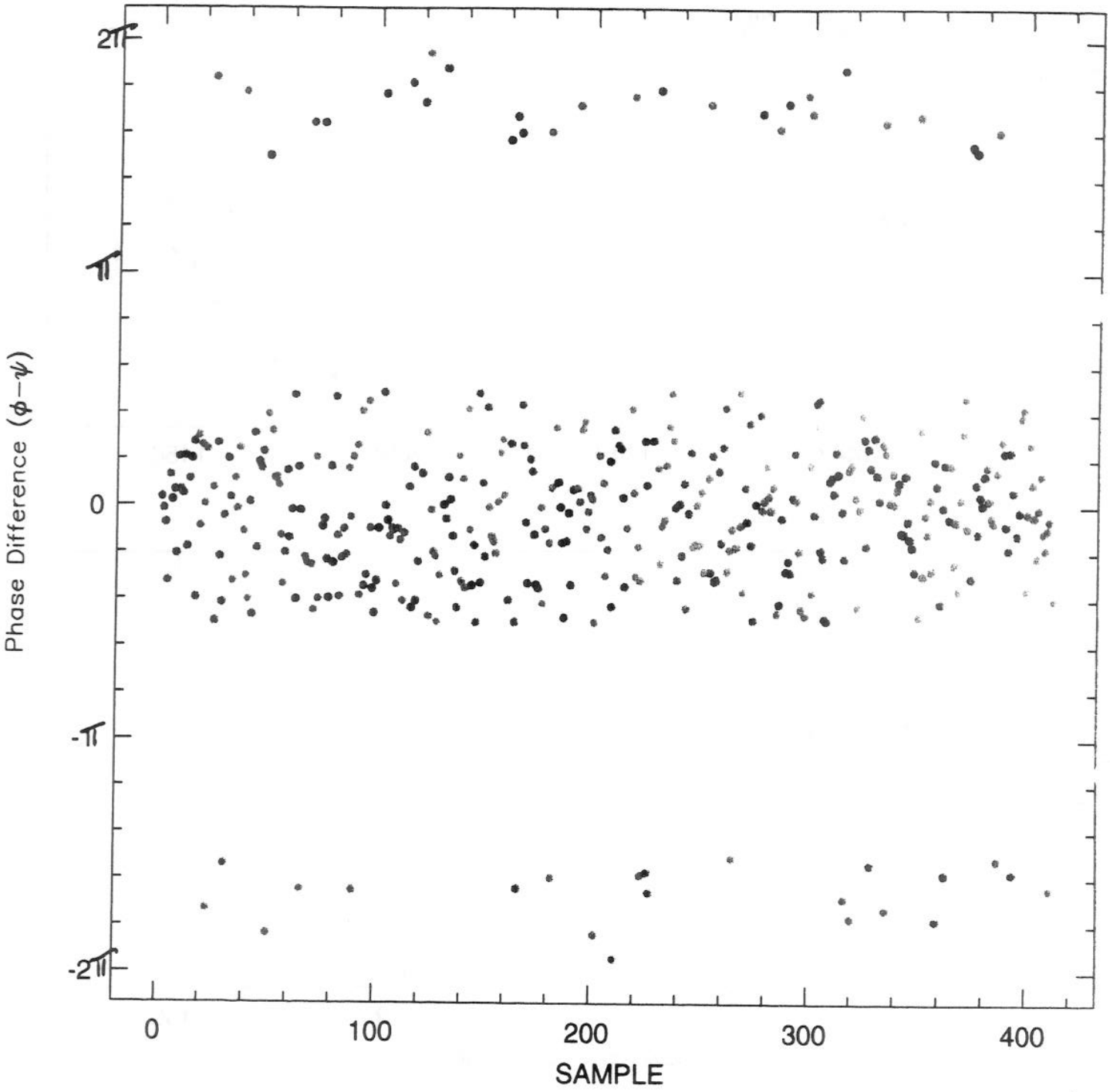

TITAN magnitude oscillation
Following
Preceding
MAGNITUDE H_{dc}
8.9
8.8
8.7
8.6
1447
1448
1449
1450
MAGNITUDE H_{ac}
9.7
9.6
9.5
9.4
9.3
1447
1448
1449
1450
DATE - 47526 (mjd)


IAPETUS magnitude oscillation
Following
Preceding
MAGNITUDE H_{dc}
12.5
12
11.5
11
1447
1448
1449
1450
MAGNITUDE H_{ac}
12.8
12.6
12.4
12.2
12
1447
1448
1449
1450
DATE - 47526 (mjd)

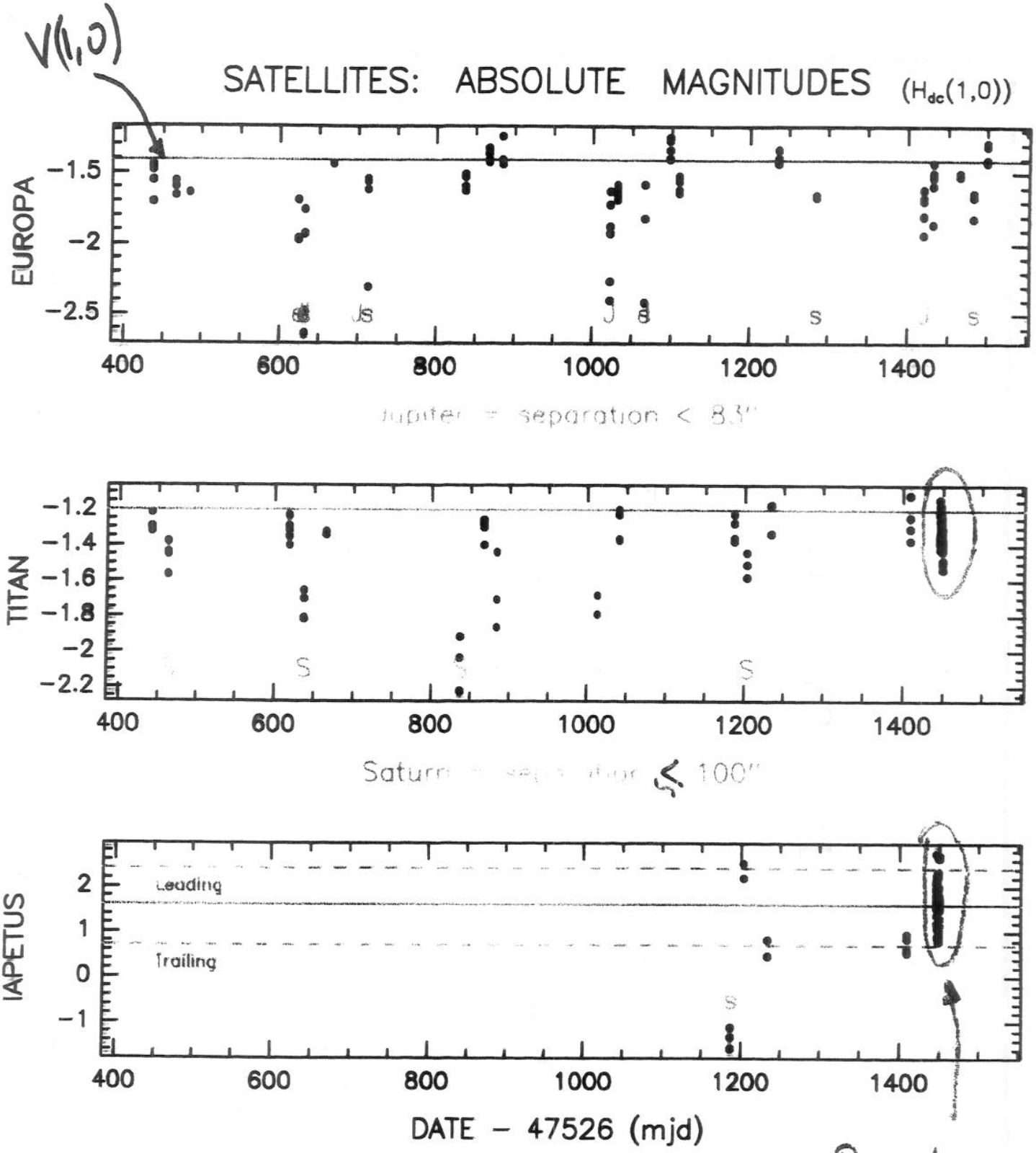
$I = \frac{I_0}{2}[1 + \Pi \cos(\phi + \phi_0) + N \cos(\dots + \dots)]$

$+ I_p$

ASTROMETRY OF IAPETUS for DATE in [1446; 1451]



V(1,0)

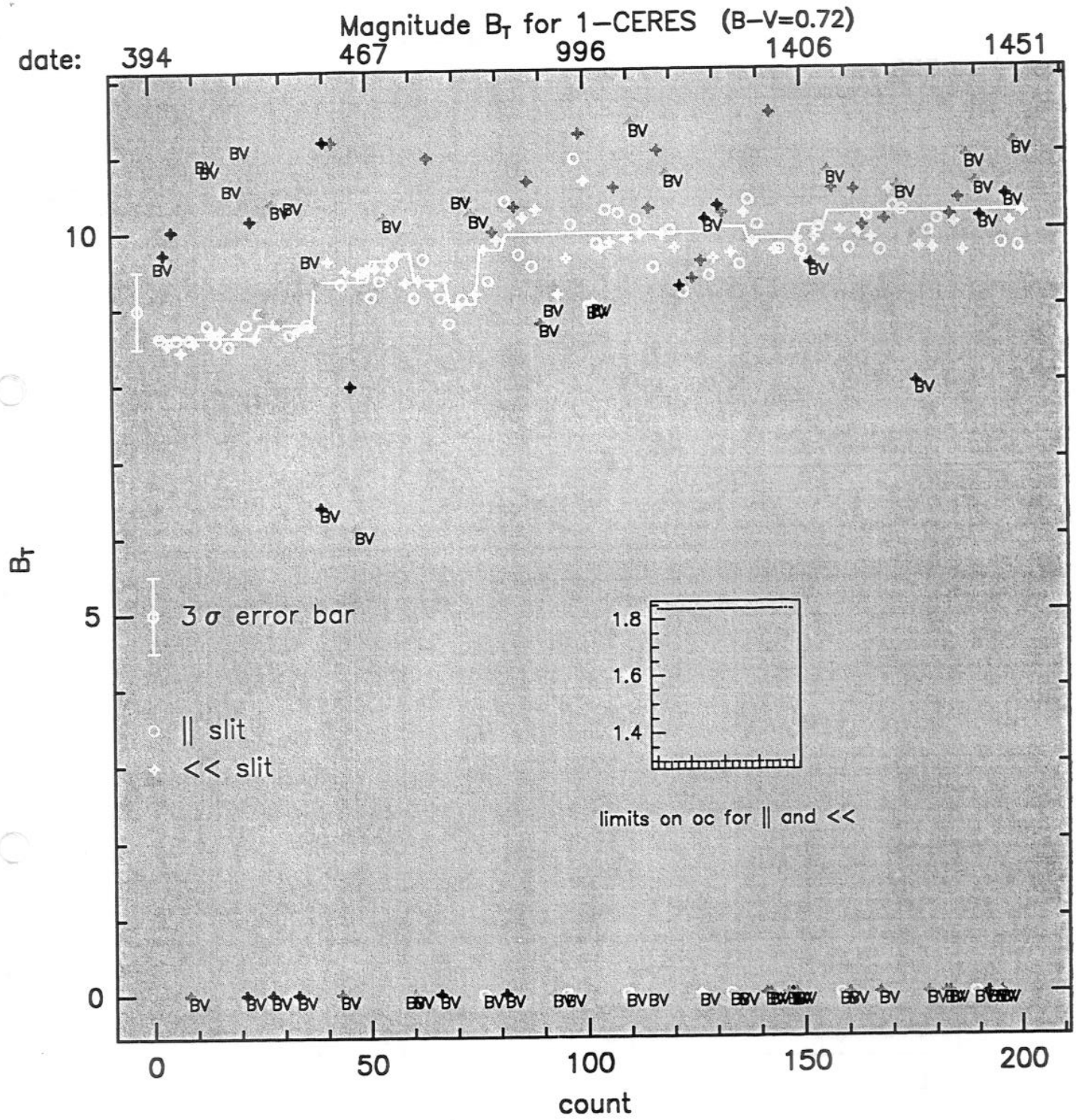


Parasit light

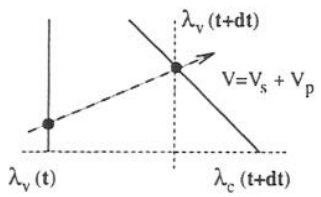
Europa: • no occultation
• no astrometry

III TYCHO

- Limit in magnitude $B \approx 10.7$ (V=10)
- Limit in size $\rho \approx (3".3\,;\ 6")$
- False/Real data
- Normal point $(\alpha\,;\ \delta)$ / FOV transit
- Objects

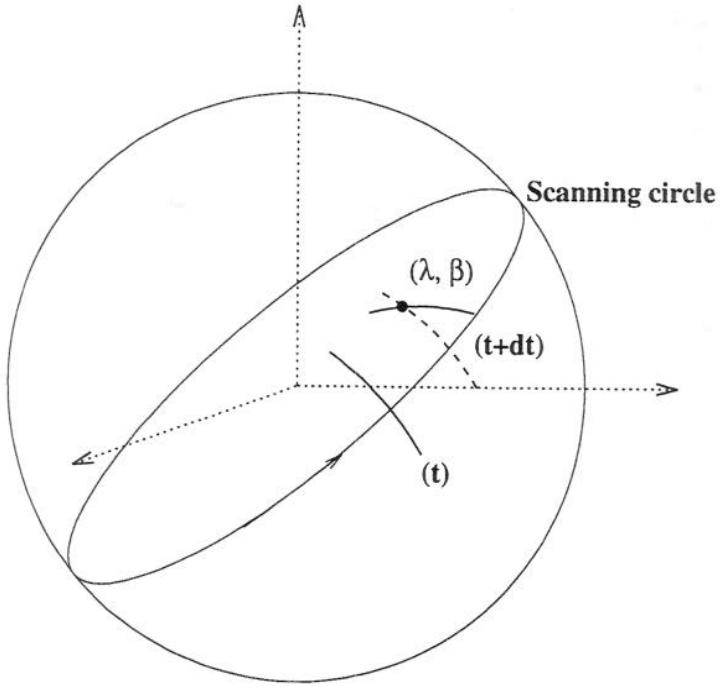

Magnitude B_T for 1–CERES (B–V=0.72)
date: 394
467
996
1406
1451
10
5
0
B_T
3 σ error bar
|| slit
<< slit
1.8
1.6
1.4
limits on oc for || and <<
0
50
100
150
200
count

TYCHO NORMAL POINT



1 ⊥ & 1 >> for each FOV crossing

$$\lambda_v(t+dt) = \lambda_v(t) + \frac{\delta \lambda_v}{\delta t} dt$$

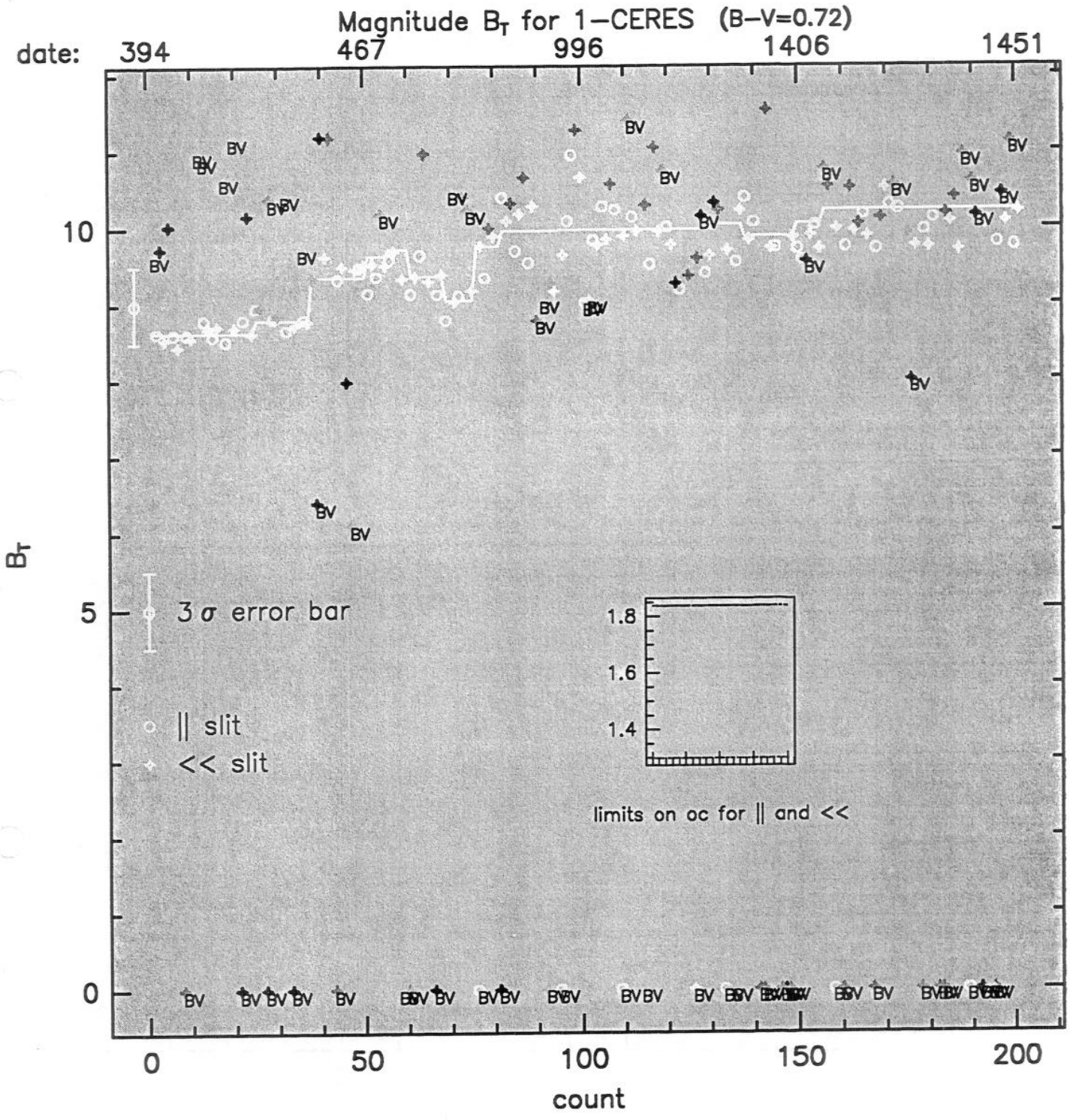


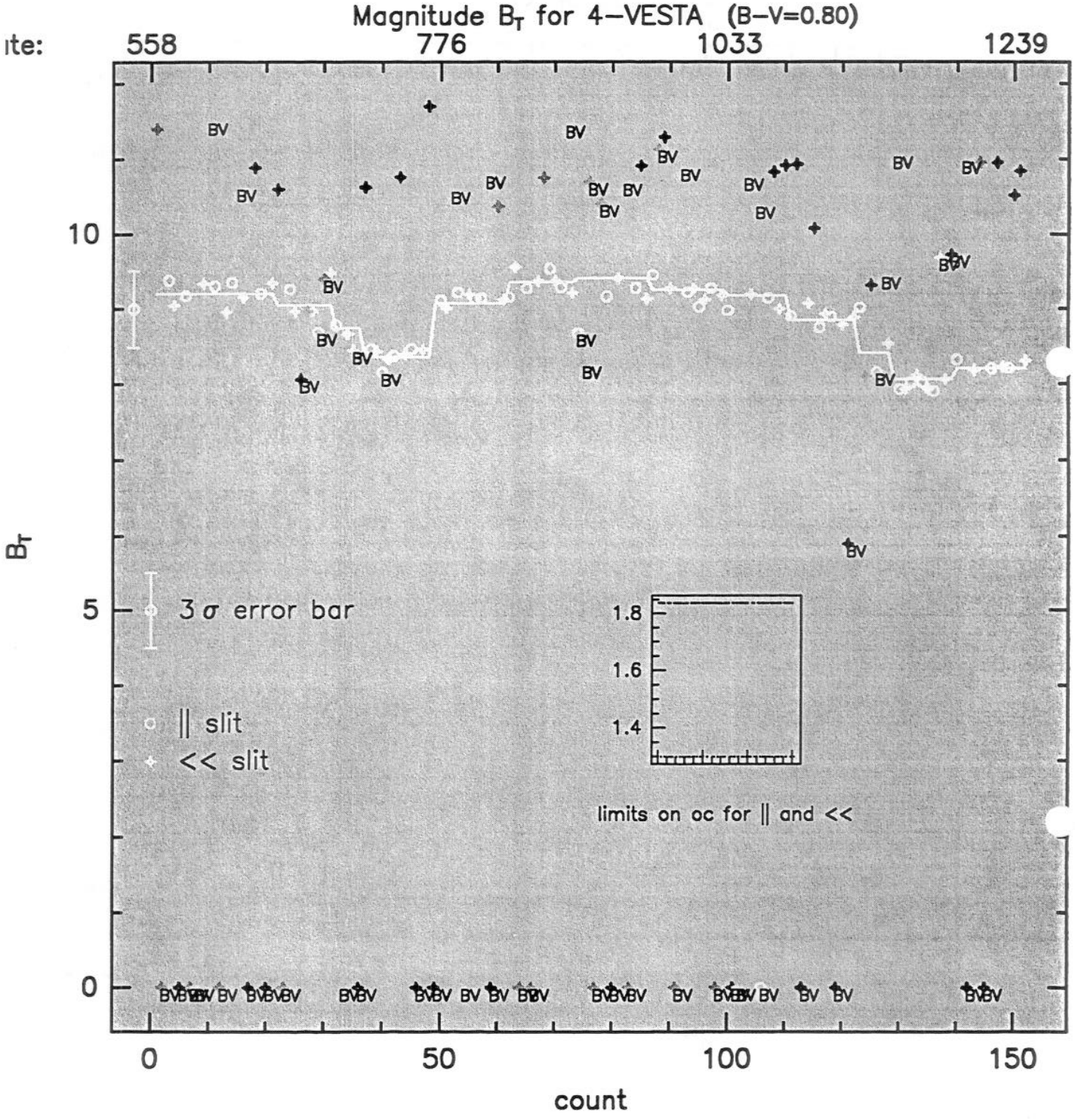
PUBLICATION – SCHEDULE

- Hipparcos (1 FOV)
  - Photometry → FAST (H_{dc}; H_{ac})
  - Astrometry → Astrometric $\tilde{\lambda}(t)$ [TT]
    % RGC in Hipparcos (∼ICRF)
    - ∗ NDAC/FAST : minor planets (48); Iapetus
    - ∗ NDAC : Europa, Titan, (Ceres)
    - ◇ January 1996

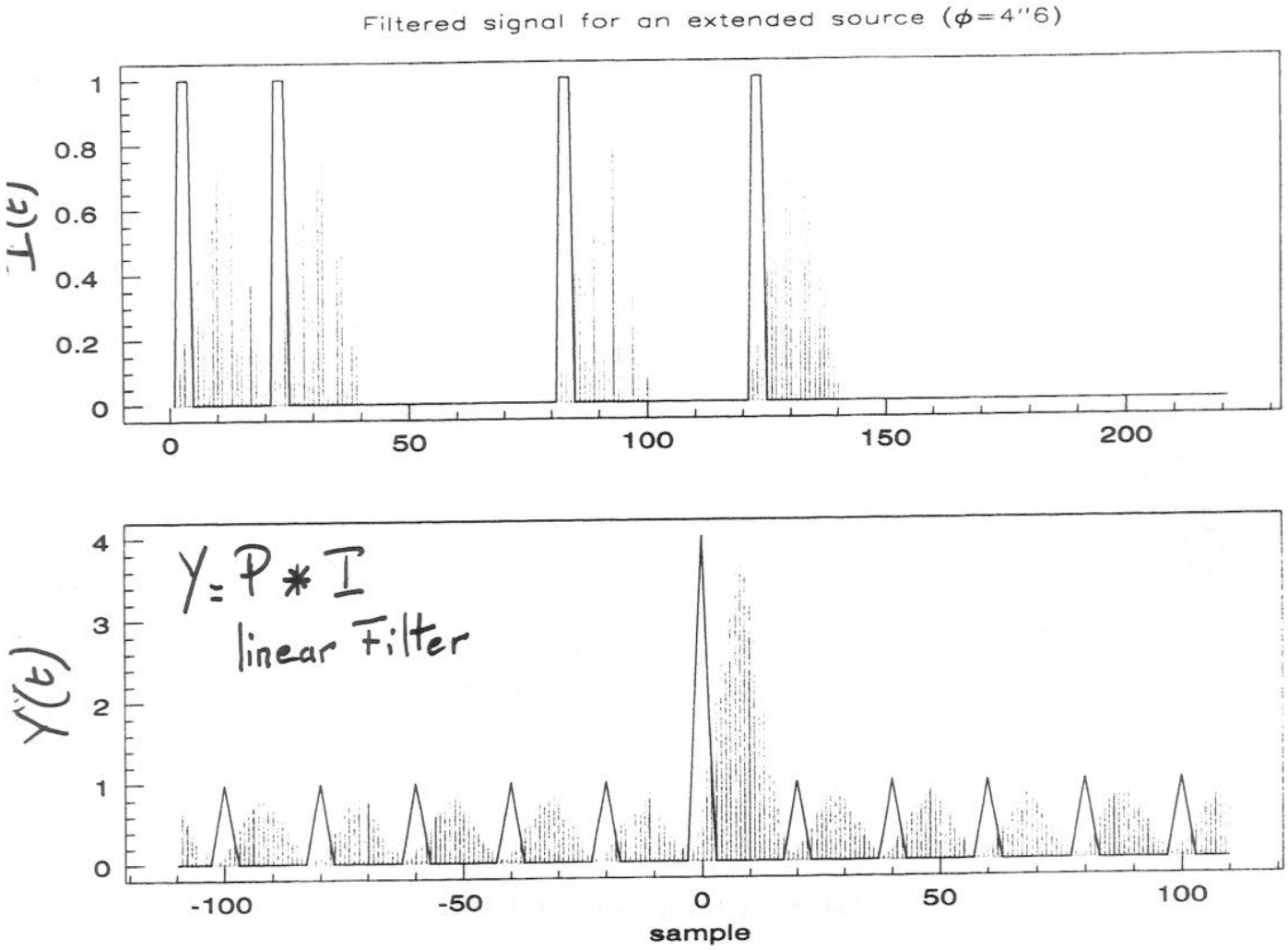
PUBLICATION – SCHEDULE

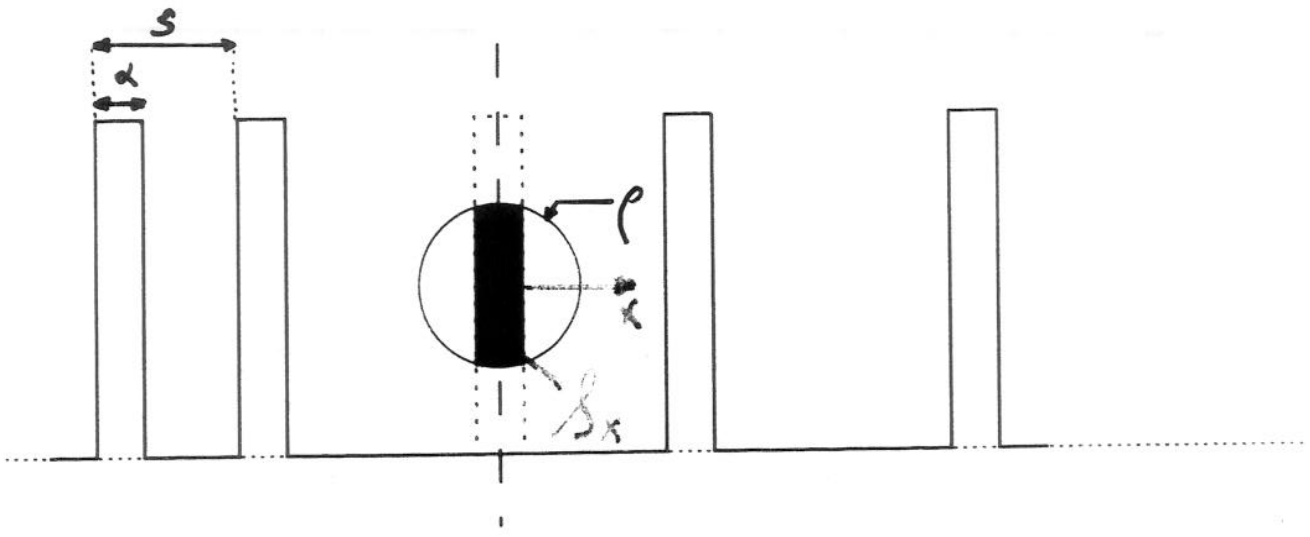
- Tycho (1 FOV)
  - Photometry → (B,V) small objects (Europa ?)
  - Astrometry → Astrometric $(\alpha_H ; \delta_H)$ % Hipparcos
  - ◇ February-March 1996
- Tycho astrometry of Mars
  Hipparcos photometry of Europa


Magnitude B_T for 1–CERES (B–V=0.72)
date: 394 467 996 1406 1451
10
5
0
B_T
3 σ error bar
|| slit
<< slit
1.8
1.6
1.4
limits on oc for || and <<
0 50 100 150 200
count


Magnitude B_T for 4–VESTA (B–V=0.80)
ite:
558
776
1033
1239
10
5
0
B_T
3 σ error bar
|| slit
<< slit
1.8
1.6
1.4
limits on oc for || and <<
0
50
100
150
count

TYCHO OBSERVATION OF A PLANET



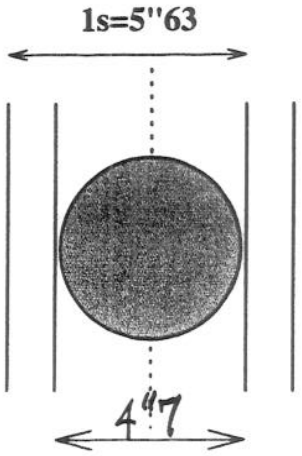


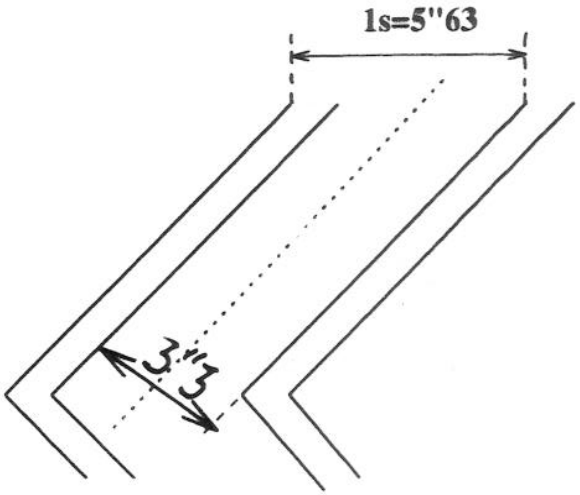
- $\rho < \alpha$: photocenter $\leftrightarrow \iint_{\delta_x} I(u,v)\,\vec{r}_x\,du\,dv$

- $\alpha < \rho < ??$: N photocenter $\leftrightarrow \max_x \left\{ \iint_{\delta_x} I(u,v)\,du\,dv \right\}$

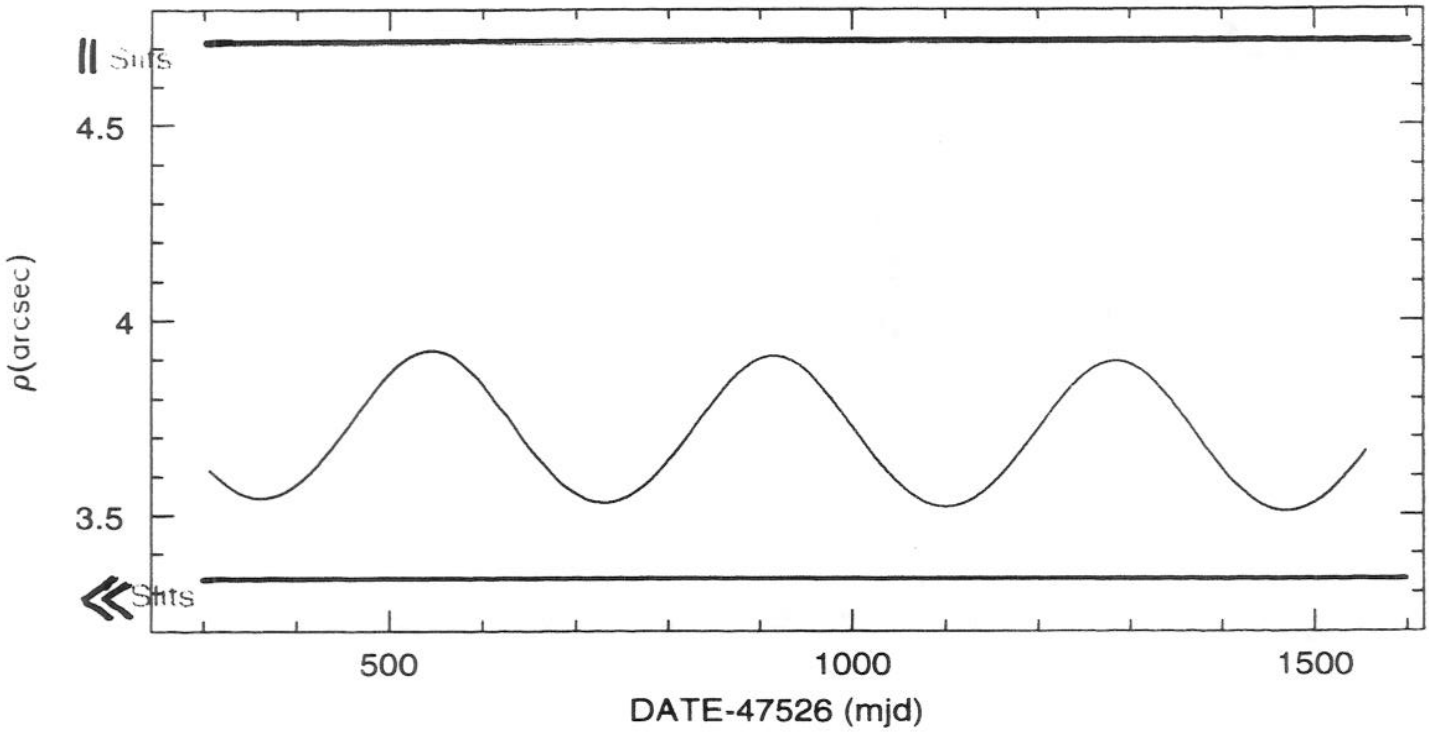
TYCHO LIMIT IN SIZE

(1st step)





APPARENT DIAMETER OF URANUS

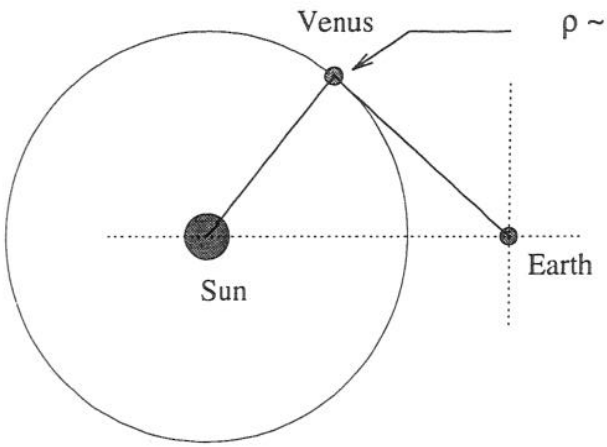


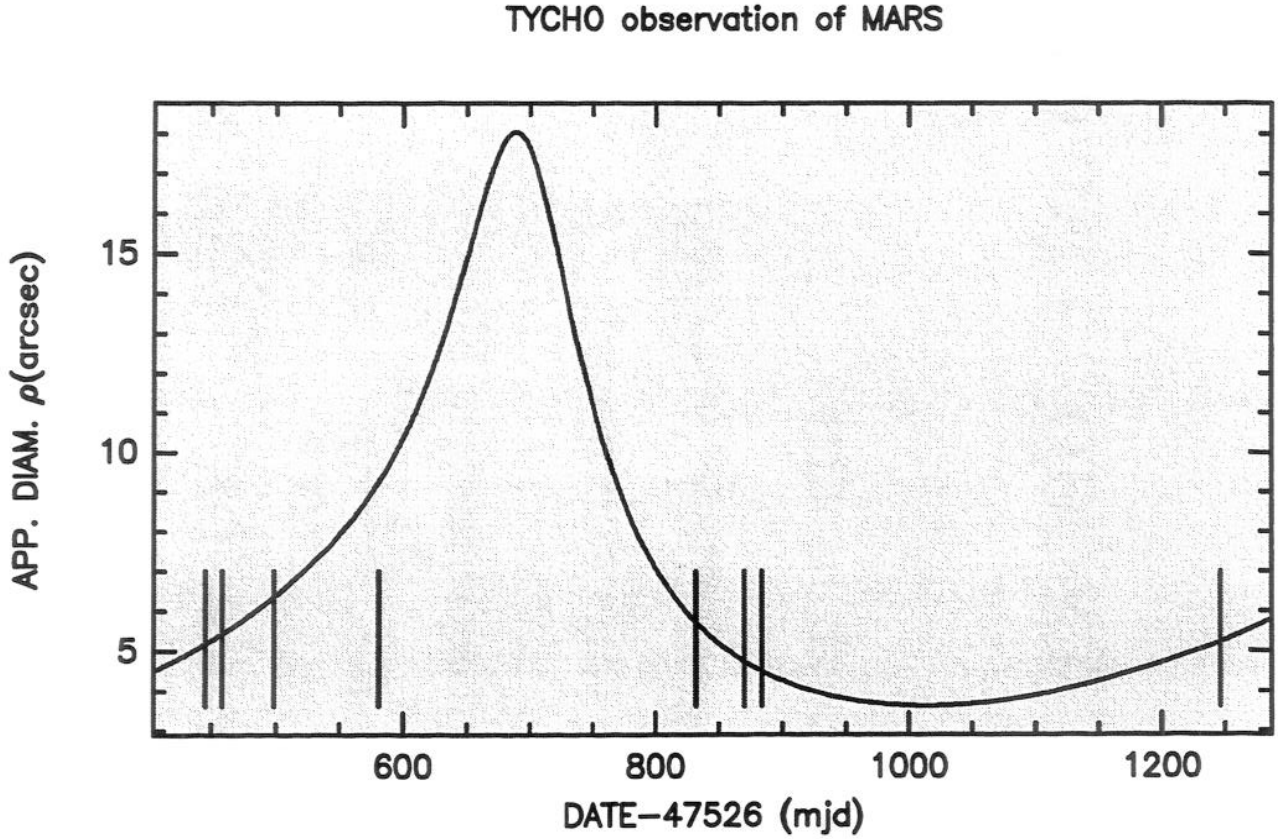
TYCHO – LIMIT IN SIZE (2^{nd} step)

- Chevrons slits
- Linear filter P central peak
  $\rightarrow$ tails corrupted
- Antisymmetric filter Q
  $\rightarrow \rho < \dfrac{2\,s - 3\,\alpha}{\sqrt{2}} \simeq 6$”

$\Rightarrow$ Uranus: OK ; Mars: limit (+ phase)

TYCHO – VENUS AND MARS

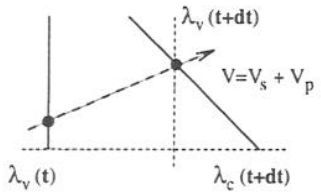




TYCHO OBJECTS

Name	Photo	Astro	Name	Photo	Astro
Ceres	Y	Y	Io	N	Y
Pallas	Y	Y	Europa	?	Y
Vesta	Y	Y	Ganymede	N	Y
Uranus	N	Y	Callisto	N	Y
Neptune	N	Y	Titan	Y	Y

TYCHO NORMAL POINT



1 ⫫ & 1 >> for each FOV crossing

$$\lambda_v(t+dt) = \lambda_v(t) + \frac{\delta \lambda_v}{\delta t} dt$$