Twenty Fifth Meeting of the Hipparcos Science Team

Genève, 10-11 May 1990

Attendance:

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

ESTEC: M.A.C. Perryman

ESOC: R. Blake, P. Davies, D. Heger, C. Sollazzo, A. Macdonald

Invited: H. Schrijver

Prof. M. Grewing was unable to attend

The agenda given in Annex I was adopted. Actions agreed at the meeting are distributed separately.

1. AWG/SSAC Debrief

Perryman reported on the Capri AWG/SSAC meetings, and distributed the draft recommendations. Kovalevsky distributed a draft resolution concerning the necessity of Hipparcos 2. A revision was drawn up on the basis of HST comments, withdrawing the the proposal for a Hipparcos 2, but requesting continued operations at least until the nominal mission goals were achieved. This was to be submitted to the SPC Chairman and ESA/DSci and DG before the June 12-13 meeting (Annex II, submitted 14 May).

2. Satellite Status

Heger reported on the satellite status (Annex III), including the ground station status, and anomaly reports. Sollazzo reported on the lifetime predictions (power and cold gas, see Annex IV). It is believed that the temperatures of array 3 are anomalously low. Le

Poole suggested that the solar array temperatures could be assessed analytically with a better than 4 degree precision (as given by the present measurements, Action 41).

Cold gas consumption indicates an end of life (at present consumption rates) around early 1994 (up to 20 April 1990, 2.5kg were used; 5gm are used per day, and tank 1 still contains 2.7kg, sufficient for operations until September 1991. Tank 2 is adequate for 950 days). Heger considers that optimisation in firing time in the controller strategy is still possible. McDonald is working on this optimisation. A report was requested for the next meeting (Action 42).

Donati requested RTAD plus actuation information (instant plus impulse) for 12 hours to make further studies. This will be sent by CNES (Kovalevsky, Action 43). Description of controller strategy will be sent by McDonald to van Leeuwen and Donati (Action 44).

ESOC will investigate optimising of the entrance/exit of occultations (Action 45, Davies).

Davies reported on the payload monitoring (Annex V) covering focus changes (1 move of 2 steps every 3-4 weeks is presently made), photometry degradation, payload monitoring, chromaticity. Focus and degradation of photometry are changing less rapidly than previously.

McDonald reported on the RTAD improvements that had been made (CBS patch on day 81 to remove false transits, magnitude dependence, use of V channel; see Annex VI).

Operations report: Heger will investigate the sending of reports by e-mail (requested by van Leeuwen, Action 46). Paper copies are still requested by Kovalevsky.

3. DDID status

Blake reported that the data tapes were now being sent by courier until further notice. The 'identical' data tape replacement policy, requested by the DRC, had also now been implemented.

McDonald reviewed the ESOC responses to the processing anomalies reported by the DRC (see ESTEC.STATUS.09, Item 8). Remaining open issues: item 5 (action ongoing in ESOC); item 6 (awaiting confirmation from Wicenec). See Action 71.

Schrijver had found duplicated IDT/SM/AOCS records in all data tapes. This would be investigated by ESOC (Action 47, Blake).

The two non-observed stars suggested by Schrijver were confirmed as problem cases by Turon. Schrijver will start to do a systematic search of this quick-look data for INCA problems, and communicate this information directly to Turon (Action 48). van Leeuwen and Kovalevsky will investigate whether a systematic checking within their chains is possible e.g. using the photometry task (Action 49).

Donati pointed out the value of conducting such investigations arising from the attitude comparison. He will send such information to Turon (Action 50, Donati).

Tape 8 status: NDAC are waiting for a replacement tape set: and will confirm acceptability to ESOC. FAST have read the tapes without problems but have not processed them.

The following future plans for data distribution (to all groups) was agreed (Action 51, Blake):

(a) Tape 9, 1 week of data with Goldstone will be sent out by ESOC.

(b) Tape 10 will consist of data until end 1989 (i.e. approx. 5 weeks). Unless ESOC reprocessing is needed, this provisional tape set should become the first real data set.

(c) Tape 11: Kovalevsky also requested a data tape (1RGC) covering the observations of Europa and Titan.

4. NDAC Report

Van Leeuwen provided a review of the RGO procedures, illustrating the SM catalogue updating sky plots, differences between the SM positions and IC6. A report on the SM photometry was being distributed. Photometry updates were being made, and would be communicated to INCA (Action 52, van Leeuwen). RGO can reduce 2 weeks of data in 1 week.

Høg reported on the GCR processing in CUO. 3 weeks of data could be processed in about 1 week (see Annex VII).

5. Fast Report

Schrijver reported on the first-look task in Utrecht (Annex VIII). 13 of the 15 tapes received had been processed, up to end of April. Donati noted the high power in the attitude residuals at the 24th harmonic of the spin period. Schrijver noted the change in the direction of basic angle evolution: to be followed up (Action 53): it could be due to the thermal variation caused by the payload RTU failure on day 89 (a temperature excursion of about 5C had been experienced).

An error had been identified in the MSI calibration file. Correction of this led to better behaviour of the LSC terms, as well as of the GCR solution.

Stars 107483 and 24389 showed curious phase behaviour. Schrijver would supply to INCA the positions of the IDT on the two FOV's to see if a star is present in the other FOV (e.g.

at the edge of the IFOV profile, Action 54). Kovalevsky reported on the CNES processing. Sets 6 and 7 have now been successfully processed.

6. TDAC Progress Report

Høg reported on the TDAC analysis (Annex IX). Heidelberg have treated all test tapes. The calibration tape received from CERGA has been implemented. A finalised tape will be sent in the near future, followed by updates at regular intervals. Heidelberg have also worked on the PGC updating. Using NDAC attitude tapes, a PGC update for tape 6 will be constructed.

Tübingen have worked on tapes up to number 7. They have developed a new non-linear filtering procedure which eliminates spikes as well as side lobes of bright stars. A new background filtering is also being developed.

Photometry is proceeding in Tübingen. Differences remain (with other DRC) at the level of 5 per cent. van Leeuwen will include the Tübingen results in his SM processing procedures if TDAC provide INCA numbers (see Action 55, Høg/Scales).

Høg reported that a new processing of the Tycho data using superposition of photon counts, using *a posteriori* attitudes, is under consideration. Limiting magnitude is presently about B=ll mag.

7. Comparisons

(a) IDT Comparisons: Perryman presented results of the IDT Comparisons. Problems still existed with the POS. Lindegren presented results of his comparison of the plans of the two analyses, and his proposed criteria for acceptability of the two reductions (Annex X). The data exchange procedure worked satisfactorily, and should be used for future assessments. He will follow this for the stars already identified. Some suspicion fell, during discussions and further analysis by Lindegren, that the MSI sign is incorrectly implemented.

Schrijver will investigate MSI implementation (Action 1). Kovalevsky will investigate use of the first sample in repositioning (currently neglected in FAST, leading to a 3 per cent data loss, Action 57). Van Leeuwen will consider an independent assessment of the MSI (Action 56). Perryman will investigate IDT rejected stars from test statistics (Action 58).

(b) SSRF and SM: Inclined SSRF are now in good agreement. Vertical are different (bumps seen in B and V). Van Leeuwen has produced an SSRF comparison document. Exchanges of data between Utrecht/RGO and ESOC were agreed (Action 34, Schrijver/van Leeuwen). (CNES is using the Utrecht calibration results. TDAC are investigating the use of both calibrations).

Van Leeuwen reported on results of the SM comparisons. Differences still exist due to the use of different SSRF. Fractions of accepted/rejected stars are very similar, although the overlap is only about 50 per cent. Systematic errors in transity times exist (Action: Schrijver/van Leeuwen to check implementation of IDT-SM time difference, Action 62). Transit velocities are in good agreements.

Van Leeuwen will send a list of the accepted/rejected stars to Schrijver/Kovalevsky, to be followed up by van Leeuwen (Action 61).

(c) Attitude: First tape from Copenhagen received 9/5/90. Donati will perform the comparison between the NDAC and FAST results. The FAST data is presently using the old MSI - a new tape is needed, this will be sent by Kovalevsky to Donati asap - also using the smoothed solution. A report will be issued by Donati on the results (Action 11).

(d) GCR: First results of the comparisons were presented by van der Marel and distributed at the meeting. van der Marel plans to provide an instrumental comparison routine, and the FAST minimum norm solution so that variances can be compared with the NDAC results. Some effects are expected to be removed by the new MSI implementation, but other discrepancies exist (Action 63, van der Marel).

Other agreements: new reduction of the comparison data set expected from Schrijver; e-mail data from CUO in future if possible.

van der Marel will send updated results of GCR comparison for inclusion in the HST minutes.

IDT Photometry: Grenon presented the results of his work on photometry with F. Mignard (Annex XI). Early results showed large rms. Investigations showed some problems in INCA magnitudes for some gravity corrections and for some Stromgren photometry. Unresolved binaries and stellar variability were also shown to contribute to the scatter.

The s/w changes are in progress in Cerga/CNES. There is no plan in FAST to change the Utrecht s/w (used only at ESOC). NDAC are now planning to implement IDT photometry at RGO, previously foreseen to be done in CUO.

SM Photometry: Comparison is being done between TDAC and RGO. Comparison will be done at 2 levels: final magnitudes supplied as part of photometric reduction by TDAC (Tübingen) in the van Leeuwen SM format and sent to FvL. This is an action on Scales (to be followed by Høg) who will send the data for the first comparison interval to van Leeuwen who will do the analysis. At the same time SM response functions (z-dependence etc.) derived by Tübingen (Scales) are being sent to RGO (Evans) who is doing the analysis (Action 64, Høg/Scales/Evans).

8. INCA

Crézé reported that the modulation strategy had started in ESOC on 1 May.

Turon reported on the exchange of variable star data from ESOC and updated ephareides from Mennessier to ESOC. (These should be sent to McDonald in future). McDonald to check that these have been received (Action 65, McDonald).

Davies (Action 66) will merge the IDT piloting quality flag with the variable star monitoring file data before distribution to Mennessier.

Minor planet update is expected in June (Action 67, Turon/Borsenberger). Missing stars reported by Schrijver had been investigated by Turon (see Annex XII).

Catalogue updates: Turon reported that IC7 will include:

- revision of list of standard stars

- updated values for BT-VT = 9.99

- positions of photocentre/geometric centre reversed

- new positions/proper motions

- erratic errors in positions/magnitudes.

The 9 stars with known error 3 arcsec will be sent immediately to ESOC. IC7 will be compiled and distributed by end June (to ESOC and DRC, Action 68). IC8 is foreseen for around end October.

Turon reported on the analysis of the INCA/satellite data (Annex XIII, XIV). Further feedback is considered desirable (e.g. data as sent by Canuto). FAST will check whether this can be done at CNES or Utrecht.

Publication: a revised draft format was distributed by Turon. Colour was considered desirable. Some changes were suggested and noted by Turon. Charts: 30 charts per page (300 sides) was foreseen by Grenon. Turon is investigating the distribution of the catalogue on CD-ROM. Cost of master = 30000 FF, each copy thereafter 5-30 FF.

Limiting magnitude: Grenon considered that no changes are necessary for the immediate future. SN1987 A is now too faint. Perryman proposed that 3C 273 be added (Action 69).

9. Miscellaneous

Letter to observers: Turon and Perryman to iterate and send out (Action 70).

COSPAR: a press conference on the occasion of the COSPAR meeting was suggested by Kovalevsky.

Failure Enquiry Board: a status report from S. Volonte (ESA, Paris) was read out by Perryman: *'A preliminary report of HEB on the ABM failure was presented to DG in November 1989 and resulted in a press communiqué indicating that although no conclusion could be drawn, a likely cause for the failure could be found in the pyrotechnic chain. In the meantime, HEB has continued its activities which will be concluded in June when the final report is released to DG'.*

Publications: Perryman asked HST to think about future publications (to publicise the present mission progress), and the role of the review team. The papers submitted for the forthcoming COSPAR meeting could be reviewed by the review team.

At the end of the meeting, the HST expressed their appreciation to Michel Grenon for the local organisation of the meeting, and to ESOC for their continued successes in operating the satellite.

Next meetings:

Friday 29 June, Delft: data comparison meeting, hosted by van der Marel. Participants: Perryman, Schrijver, Donati, Kovalevsky, Le Poole, van Leeuwen, Lindegren, Høg, Falin, Tübingen representative (to be invited by Høg), Petersen (travel financed by ESTEC).

HST: 25-26 October, Cambridge, hosted by van Leeuwen (now confirmed).

M.A.C. Perryman

11 May 1990

Distribution: Participants

Twenty Fifth Meeting

of the

HIPPARCOS SCIENCE TEAM

Geneva Observatory, 10-11 May 1990

Start of meeting: 09.30

AGENDA

1. AWG/SSAC debrief (Perryman)

2. Satellite status (Heger/Davies/McDonald)
   - payload and spacecraft status
   - lifetime and eclipse
   - ground station coverage

3. DDID status and interfaces (Blake/McDonald)
   - RTAD performance comments
   - replacement and tape distribution policy
   - PSF and other anomalies reported by DRC (see ESTEC.STATUS.09)
   - other open issues and comments on provisional tapes 7 and 8

4. NDAC (RGO/CUO) progress report (van Leeuwen/Hoeg)

5. FAST (Utrecht/CNES/CERGA) progress report (Kovalevsky/Schrijver)

6. TDAC (ARI/AIT) progress report (Hoeg/Grewing)

7. Comparisons:
   - IDT (Perryman)
   - SSRF and SM (van Leeuwen)
   - IDT and SM photometry (Grenon/Hoeg)
   - attitude and GCR

8. INCA: variable stars, minor planets, catalogue updates, non-observed (Turon)
   - PSF feedback to INCA (Creze)

9. Miscellaneous:
   - review of criteria for proceeding to full mission analysis
   - outstanding and planned actions/working meetings
   - next HST meeting: date and place
   - HST mission payments outstanding
   - failure enquiry board

Michel Grenon has kindly made the following hotel (2 nights) and meeting arrangements:

- Hotel Ascot, 55 rue Rotschild, phone 4122 7317604 for: Bernacca, Creze, Grewing, Hog, Kovalevsky, van Leuwen, Lindgren, van der Marel, Murray, Le Poole, Donati, van der Ha, Schutz, Davies, Perryman

- Hotel du Midi, Place Chevelu, phone 4122 7317800 for: Heger, McDonald, Sollazzo

- Hotel Rivoli, 6 rue des Paquis, phone 4122 7318550 for: Schrijver, Blake

Please cancel hotel reservations personally if you are unable to keep them.

Everybody will be collected by the observatory bus or by private cars at about 09:00 in order to reach the observatory at 09.30.

ANNEX II

esa estec european space research and technology centre

memorandum ref.: Noordwijk, 14 May 1990

from/de: M.A.C. Perryman

to/a: DG via D/Sci

cc: M.C.E. Huber (S), B.G. Taylor (SA), H. Hassan (PH), D. Dale (P)

Subject: Hipparcos 2 Resolution

I attach a resolution formulated by all members of the Hipparcos Science Team, at their meeting of 10-11 May, concerning their position on Hipparcos 2.

I am forwarding it, in parallel, to the AWG, SSAC and SPC Chairman.

M.A.C. Perryman (SA)
Project Scientist

Hipparcos Science Team Members: Prof. P.L. Bernacca, Asiago; Dr M. Crézé, Strasbourg; Prof. F. Donati, CSS Torino; Dr M. Grenon, Genève; Prof. M. Grewing, Tübingen; Prof. E. Høg, Copenhagen; Prof. J. Kovalevsky, CERGA; Dr F. van Leeuwen, Cambridge; Dr L. Lindegren, Lund; Dr H. van der Marel, Delft; Mr C.A. Murray, RGO; Mr R.S. Le Poole, Leiden; Dr C. Turon, Meudon

RESOLUTION

The undersigned members of the Hipparcos Science Team want to express their appreciation for the skillful and dedicated efforts of ESA, and especially of ESOC, in obtaining the maximum performances from the "revised" Hipparcos mission. They are impressed by the quality of the data acquired by the present Hipparcos mission . In consideration of the present predictions concerning the rate of degradation of the solar cells, the Science Team withdraws their proposal for an early second Hipparcos sent to ESA in November 1989.

In contrast we request ESA to continue the operations of Hipparcos in the present configuration (with Odenwald, Perth and Goldstone stations) at least for the time necessary to achieve the nominal objectives of the mission as originally defined. Since the satellite provides useful data for approximately 60 per cent of the time, our current expectations are that these goals will be achieved after approximately 36 – 42 months of scientific data acquisition (i.e. from 1 December 1989).

11 May 1990

HST members:

To: DG, D/Sci + SPC, SSAC, AWG Chairmen

ANNEX II

ANNEX III

SPACECRAFT STATUS

A summary of the spacecraft status is given below.

TCMS

Transmitter 1 ON
Transponder 1 ON during Ranging

EPSS

Configuration of EPSS is Parallel Battery Charge Mode (PBCM)
No Eclipses
Solar Array degradation measurement once/week

THERMAL

All S/C Heaters are OFF

DHSS

DHSS is NOMINAL
CBS configuration is IDT NOMINAL
FORMAT 3 selected
CBS VERSION 4.02
(CBS patch: RTAD filter - star transit rejection on one max. detection)

AOCS

S/W Normal Mode Selected
Nominal Gyro Configuration (1-2-4)
Control Parameter limit cycling within limits

PAYLOAD

P/L SUBSYSTEM NOMINAL WITH FOLLOWING EXCEPTION:
- FAILURE OF MUX 8 OF IMX2 OF THE P/L RTU 1 (AR 17)
- FAILURE IN THE P/L RTU 1 (AR 26)

P/L THERMAL CONTROL IS NOMINAL
IDT CHAIN 2 SELECTED
TYCHO CHAIN 2 SELECTED
MDE1, TCE1, AND INVERTER 1 ON

CALIBRATIONS as SCHEDULED

ANNEX III

HIPPARCOS DATA RECOVERY FIGURES

The below given recovery data refers always to a 4 day period (repetition of pass pattern).

1 = period (start/end day of year)
2 = max. possible data recovery
3 = data lost due to
- pass not scheduled
- bad data or late AOS
- ground station or HDCS problems

4 = no science data due to occultations (shutters closed)
5 = RTAD not in close loop (ACS/CBS transfer disabled)
6 = RTAD not observed to be within SM window
7 = RTAD observed to be within SM window

NOTE 1: 2 to 7 are given in hours

1	2	3	4	5	6	7
077-080	88.46	12.73	5.86	-.--	6.83	63.04
081-084	91.28	11.05	7.24	-.--	5.08	67.91
085-088	90.81	13.50	7.08	-.--	11.36	58.87
089-092	85.13	5.56	5.50	-.--	21.96	52.11
093-096	90.80	9.53	3.16	-.--	15.76	62.35
097-100	91.10	11.71	1.58	-.--	8.16	69.65
101-104	90.93	15.81	4.39	-.--	15.66	55.07
105-108	91.06	12.55	5.76	-.--	4.42	68.33
109-110	91.01	24.29*	3.79	-.--	1.20	61.73
111-114	90.93	24.20*	3.54	-.--	3.45	59.74
115-118	90.38	11.05*	2.86	-.--	5.25	71.22

* GOLDSTONE ground station has been added to the supporting network since day 078
The station has been removed from the HIPPARCOS mission plan starting day 110 until further notice, because data link problems (intermittent loss of data) does not allow safe spacecraft operations and consequent data recovery (PSF and automatic commanding).
The ground station is however still scheduled to support whenever possible (SPARSE PSF).
The GOLDSTONE support hours are added to 3) above.

R T A D P E R F O R M A N C E

RTAD PERFORMANCE HAS IMPROVED AFTER THE FOLLOWING CHANGES HAVE BEEN INCLUDED INTO THE OPERATIONS:

- GYRO DRIFT CORRECTION HAS BEEN INCLUDED INTO THE TAIT-BRYAN ANGLES AND DRIFTS UPLINKES
- NORMAL MODE DISTURBANCE TORQUE CONTROL PARAMETERS HAVE BEEN CALIBRATED ARE ROUTINELY UPLINKED WITH THE ORBITAL OSCILLATOR COMMANDS
- GRID ROTATION VALUE AS CALIBRATED HAS BEEN UPLINKED
- CUTOFF FOR STAR REFERENCE REDUCED TO MAGNITUDE 9
- PERIGEE CONTROLLER SWITCH-ON CHANGED IN STEPS DOWN TO 6000 KM (10000 KM ORIGINALITY)
- CBS PATCH TO IMPROVE FILTERING OF 'FALSE' STAR IDENTIFICATION DURING HIGH BACKGROUND NOISE
- STAR MAPPER PROCESSING SWITCHED FROM 'B' TO 'V' CHANNEL

MAIN DAY TO DAY ACTIVITIES

DAY 050 Trickle charge permanently added battery charge cycle

DAY 051 SM2 Geometric parameters uplinked
(Star Mapper 2 grid scale correction)

Day 057 HDCS uplinker task stopped

DAY 059 Gyro 3 destorage (run-up)

IDT and Tycho shutters closed by voice
- power problems at ESOC

DAY 060 HDCS down, power problems at ESOC (00:01z)

Back-up HDCS in use from 00:21z to 15:00z

DAY 063 see AR No. 25

DAY 067 Gyro 5 run-up

DAY 068 Telecommand link to KOUROU down. Voice Uplink of perigee control parameters and shutter closure commands

DAY 069 HDCS uplinker crashed

DAY 071 perigee control parameters execution changed from 10K to 8K altitude

DAY 072 innovation threshold for narrow window changed from 10" to 3" for 1 pass after convergence.
RTAD remained converged

DAY 073 innovation threshold for narrow window changed from 10" to 3" for 1 pass after convergence.
RTAD remained converged

DAY 074 GOLDSTONE telemetry and command test.
timing problems using the available data links

DAY 075 still problems with GOLDSTONE telemetry and command links

DAY 076 HDCS uplinker problem

DAY 078 GOLDSTONE added to ground station supporting network
data quality marginal (intermittent loss of data)

DAY 079 GOLDSTONE data quality marginal (intermittent loss of data)

MATRA's proposed change of narrow window to 3 arcsecs and extended window to 10 arcsecs canceled after 2.5 hours
since RTAD could not keep convergence.
old values were reinstated (10 and 30 arcsecs)

DAY 080 perigee controller switch-on at 6000 km for the descending and ascending part of orbit

uplink of CBS patch to improve filtering of 'false' star identification during high background noise

DAY 081 on minisystem until 12:00 because of RT disk power supply modification

DAY 082 GOLDSTONE data quality marginal (intermittent loss of data)

DAY 083 GOLDSTONE data quality marginal (intermittent loss of data)

DAY 085 perigee controller switch-on at 7000 km for the descending and ascending part of orbit

Solar Array degradation test

DAY 086 perigee controller switch-on at 7000 km for the descending and ascending part of orbit

GOLDSTONE data quality marginal (intermittent loss of data)

DAY 087 GOLDSTONE data quality marginal (intermittent loss of data)

DAY 088 test of CBS patch during Van Allen belt crossing between 5000 and 85000 counts.
(IDT2 and TYCHO2 shutters closed with valid PSF)
no ' FALSE' stars identified.

test to verify that RTAD is using the 'B' channel and not the 'V' channel

perigee controller switch-on at 6000 km for the descending part of orbit
thruster activation approximately once every 3 mins.
perigee controller switch-on at 8000 km for the ascending part of orbit

DAY 089 Failure of P/L RTU 1
possible loss of several hours of science data due to instable temperature environment

reference star limiting magnitude in the PSF set to 9.

DAY 090 GOLDSTONE data quality marginal (intermittent loss of data)

DAY 091 GOLDSTONE data quality marginal (intermittent loss of data)

092 Solar Array degradation test

DAY 096 POWER DEGRADATION TEST

DAY 097 PERTH LCT ranging no longer available

DAY 100 POWER DEGRADATION TEST

perigee controller set at 6000 Km altitude (TEST)

DAY 101 unidentified ground station radiating to the spacecraft

DAY 102 eclipse season ended

DAY 104 perigee controller permanently set at 6000 Km altitude

DAY 106 BDR1 MODULE 1 AND 2 O/V STATUS CHANGE (see AR. 27)

DAY 107 POWER DEGRADATION TEST

DAY 110 Mission plan created excluding GOLDSTONE

DAY 114 Database regeneration

Solar Array degradation test

Misplan event start with '+' and end with '-' having '*' in between

DAY 115 TM PSF 03 packets received indicating bad TTAG on PSF packets. The problem was traced to PSF data being received on day 113 during LOS period. The OBT of this data was used when generating new PSF

DAY 117 TMXXX 31 received indicating an ACS toggle bit error detected while sending SM results from CBS to ACS (AR 28)

Gyro 3 destorage

DAY 118 Solar Array degradation test

CBS halted (AR 29)

multiplexer in P/L RTU1 which failed 1989 day 336 is working again (AR 30)

both batteries reverted to charge mode without apparent reason (AR 31)

DAY 121 TMXXX 31 received indicating an ACS toggle bit error detected while sending SM results from CBS to ACS (AR 28)

DAY 118 Solar Array degradation test over 1 full S/C revolution

DAY 124 Gyro 5 destorage

HDCS crashed and could not be reloaded for 5 hours backup system in use

ANOMALIES

A complete list of observed anomalies and their current status is given hereafter.

AR NO.	DESCRIPTION	DAY	STATUS
1	SAS 3 OUTPUTS DURING HSA	255	OPEN
2	SOLAR ARRAY PANEL 3 MICROSWITCH ERRONEOUS STATUS	255	CLOSED
3	ARO (AUTOMATIC RECONFIGURATION ORDER) AFTER FILL-IN ANTENNA DEPLOYMENT	255	CLOSED
4	BATTERY 2 FAILS TO REACH EOC (END OF CHARGE)	258	CLOSED
5	BAD TELEMETRY WHILE COMMANDING WITH RANGING TRANSPONDER ON AND HIGH RATE FORMAT SELECTED		CLOSED
6	TEMPERATURE ANOMALY (C079)	257	CLOSED
7	BATTERY 2 TEMPERATURE O.O.L. BUT BATTERY STILL CHARGING	258 266	CLOSED CLOSED
8	ESRO DURING PERIGEE		
9	RTAD INIT SUN POINTING 1	270	CLOSED
10	RTAD INIT SUN POINTING 2	273	CLOSED
11	RTAD INIT SUN POINTING 3	277	CLOSED
12	IDT PILOTING	282	CLOSED
13	NO RTAD DUE TO EXCESSIVE STAR MAPPER NOISE ARISING FROM SOLAR FLARES AND EXCITATION OF VAN ALLEN BELTS	293 bis	OPEN
14	CBS/OBDH BUS ALARMS (TMXXX32)	305	OPEN
15	CBS TM CHANNEL ERROR (TMXXX34)	305	OPEN
16	TYCHO SHUTTER NOT CLOSED BEFORE OCCURRENCE OF OCCULTATION	310	CLOSED
17	TELEMETRY ANOMALY (MUX 8 OF IMX 2 OF P/L RTU 1)	336	CLOSED
18	CBS/OBDH BUS ALARMS (TMXXX01)	355	CLOSED
19	FOCUS ANOMALY	003	CLOSED
20	CBS WATCHDOG ELAPSED (CBS HALTED)	004	CLOSED
21	WRONG CORRELATION VALUE LOADED AFTER CBS CRASHED	004	CLOSED
22	IDT ANOMALY WITH THE ANALOGUE MODE (anomalous results of bright stars observed)	017	OPEN
23	CBS COMPUTED Pmax (T329)	N/A	OPEN
24	ESRO COMMANDS NOT UPLINKED	043	CLOSED
25	UNEXPECTED CLOSING OF THE IDT AND TYCHO SHUTTERS	063	CLOSED
26	TELEMETRY ANOMALY (P/L RTU 1)	089	CLOSED

AR NO.	DESCRIPTION	DAY	STATUS
27	BDR1 MODULE 1 AND 2 O/V STATUS CHANGE (BATTERY DISCHARGE REGULATOR 1 MODULES 1 AND 2 OF THE OVERVOLTAGE PROTECTION UNITS CHANGED STATUS FROM 'NORMAL' TO 'OVERVOLTAGE')	106	OPEN
28	ACS S/W ERROR DETECTED Star Mapper results being sent to ACS but not correctly received	117	OPEN
29	CBS WATCHDOG ELAPSED (CBS HALTED)	118	OPEN
30	TELEMETRY ANOMALY Parameters reported OOL in AR No. 17 (failure of MUX8 in PL RTU1) are functioning again	118	OPEN
31	BATTERY CHARGE ANOMALY Battery 1 & 2 went to charge mode without apparent reason	118	OPEN

LONG ECLIPSEPERIOD

- BETWEEN 13.02.90 AND 06.04.90 THE SPACECRAFT PASSES LONGER ECLIPSE PERIODS THAN THOSE DESIGNED FOR (72 MINS ONCE PER DAY).

- 2 ECLIPSES PER DAY WITH A MAXIMUM DURATION OF 104 MINS. BETWEEN 14.03.90 AND 20.03.90

- DURING MONTH OF MARCH POWER SAVING TO BE INTRODUCED FROM NOMINALLY 224 W. DURING ECLIPSE PERIODS TO ENSURE BATTERIES BEING FULLY CHARGED DURING SUNLIGHT PERIOD.

- MAXIMUM POWER TO BE SAVED DURING LONGEST ECLIPSE IS 26 WATTS.

- EASY WAY TO SAVE POWER IS TO REDUCE THE P/L ACTIVE THERMAL CONTROL, CURRENTLY USING ABOUT 48 WATTS.

- POWER SAVING PERFORMED SUCH THAT THE RECHARGE TIME OF THE BATTERIES KEEPS THE STAND-BY TIME WITHIN 30 MINS. TO NEXT ECLIPSE.

- PAYLOAD THERMAL CONTROL POWER SAVING DONE BY EITHER REDUCING THE Pmax VALUE OR REGULATING THE D-VALUES.

GROUND STATIONS

1. GROUND STATIONS IN USE:

   ODENWALD

   PERTH

   KOUROU

   (GOLDSTONE)

2. POSSIBLE DATA RECOVERY

   ODENWALD, PERTH, KOUROU: 79 TO 80 HOURS/4 DAYS

   ADDING GOLDSTONE : 90 TO 91 HOURS/4 DAYS

3. GROUND STATION PROBLEMS:

   ODENWALD: NONE

   PERTH : NONE

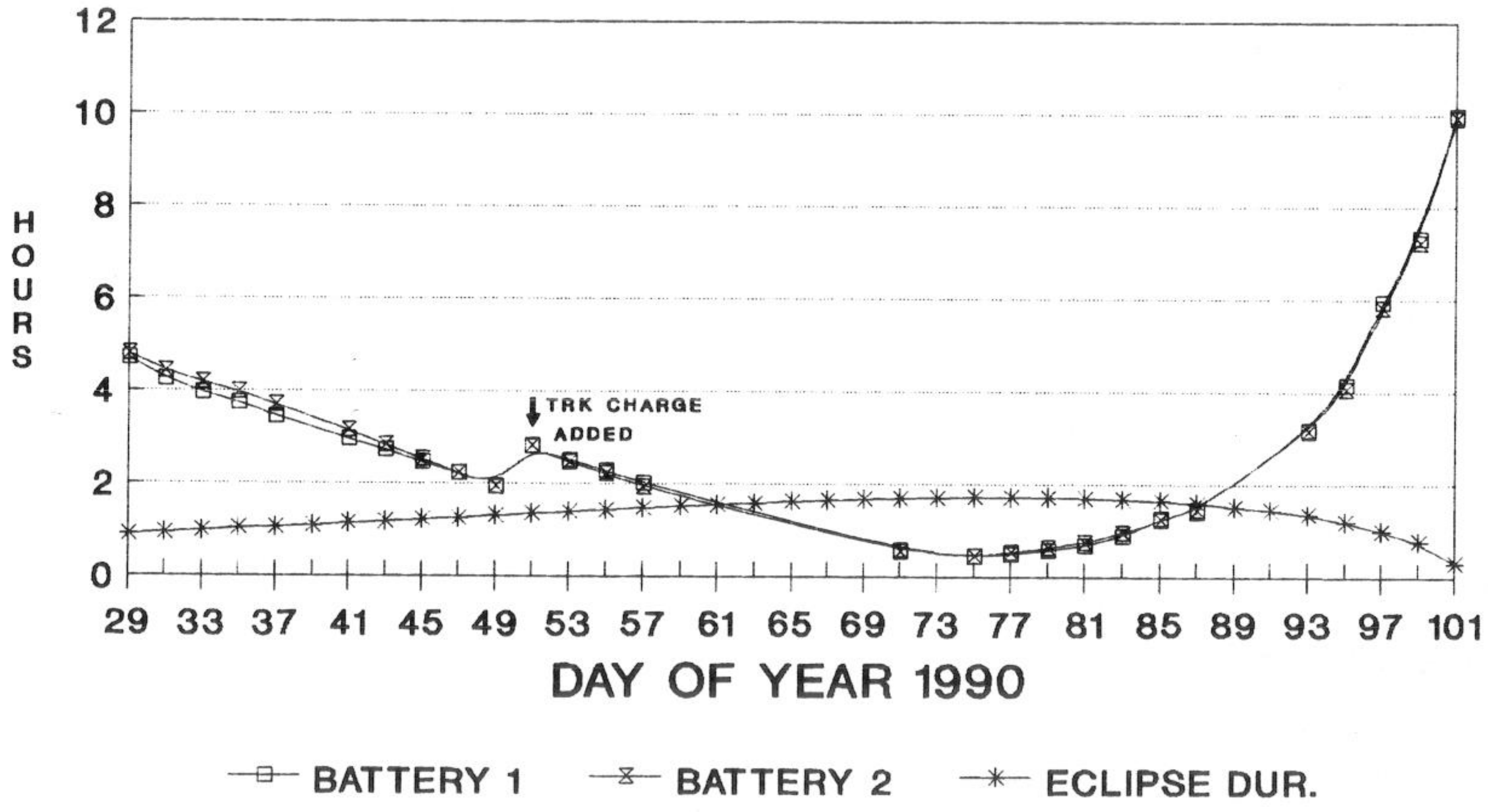
   HIPPARCOS WILL BE SUPPORTED FROM A TRANSPORTABLE STATION BETWEEN 6/8/90 TO BEGINNING OF NOVEMBER WHILE PERTH MAIN EQIPMENT ROOM IS RELOCATED

   KOUROU : SUPPORT TO OTHER SPACECRAFTS (SPOT, TDF), RANGING CAMPAIGNS AND ROCKET LAUNCH ACTIVITIES

   GOLDSTONE: THE STATION HAD BEEN ADDED TO THE NETWORK ON DAY 078

   DUE TO APPARENT DATA LINK PROBLEMS THE STATION HAD BEEN REMOVED AGAIN ON DAY 110

BATTERY CHARGE
DELTA-T



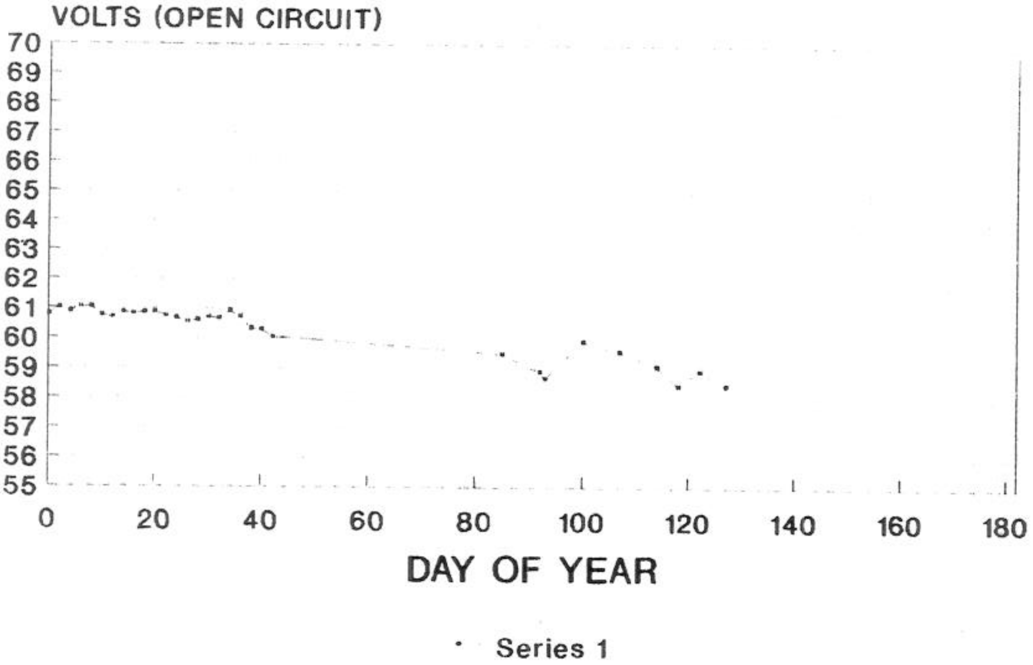
12.APRIL 90

L I F E T I M E   P R E D I C T I O N S

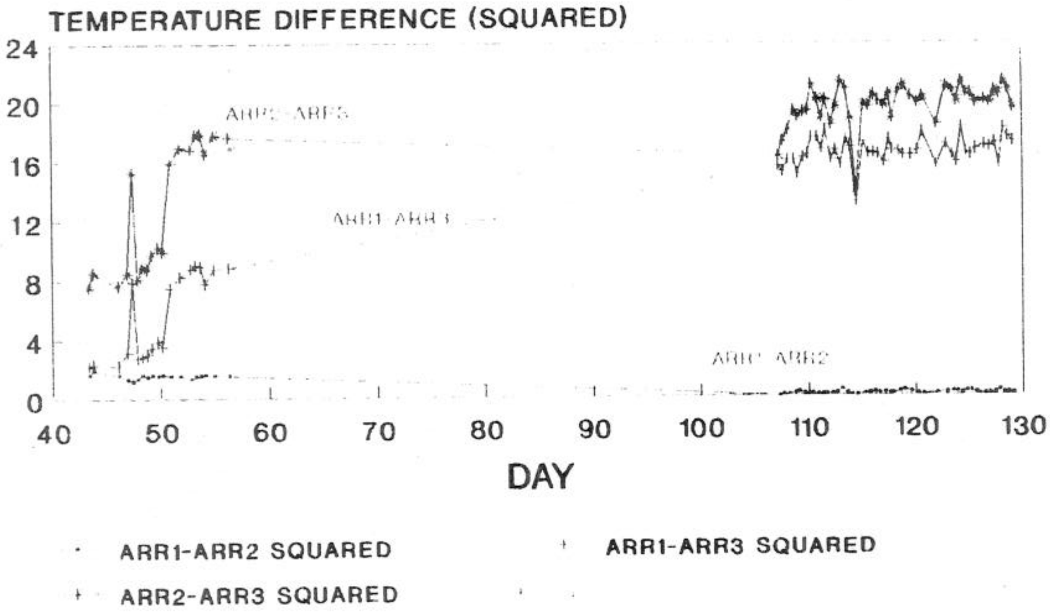
1 POWER

2 COLD GAS

HIPPARCOS SOLAR ARRAY DEGRADATION
FIRST 6 MONTHS OF 1990.

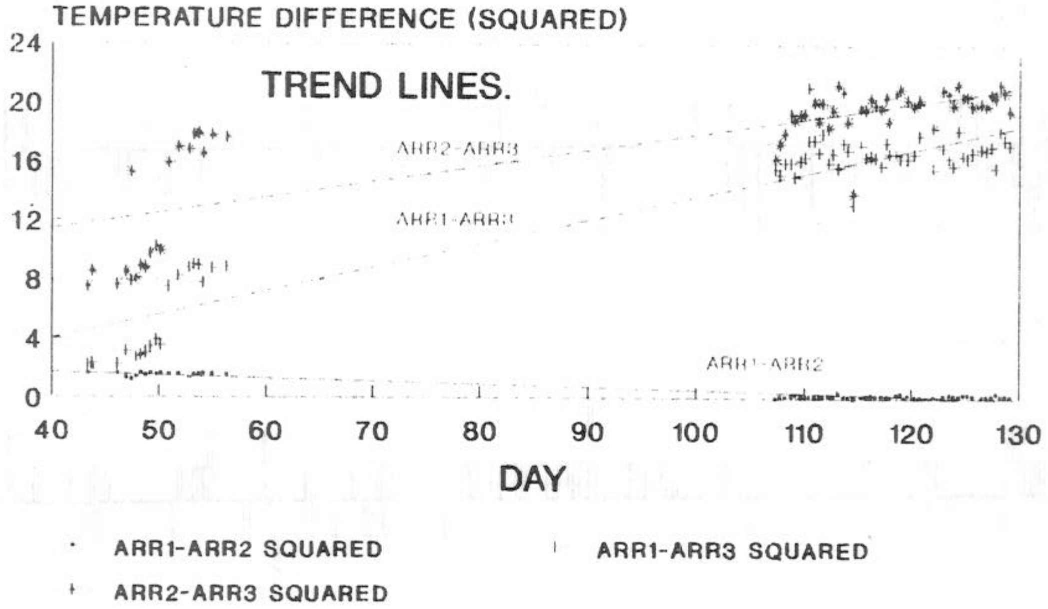


HIPPARCOS
ARRAY TEMPERATURE VARIATION



1 REVOLUTION AT APOGEE

HIPPARCOS
ARRAY TEMPERATURE VARIATION

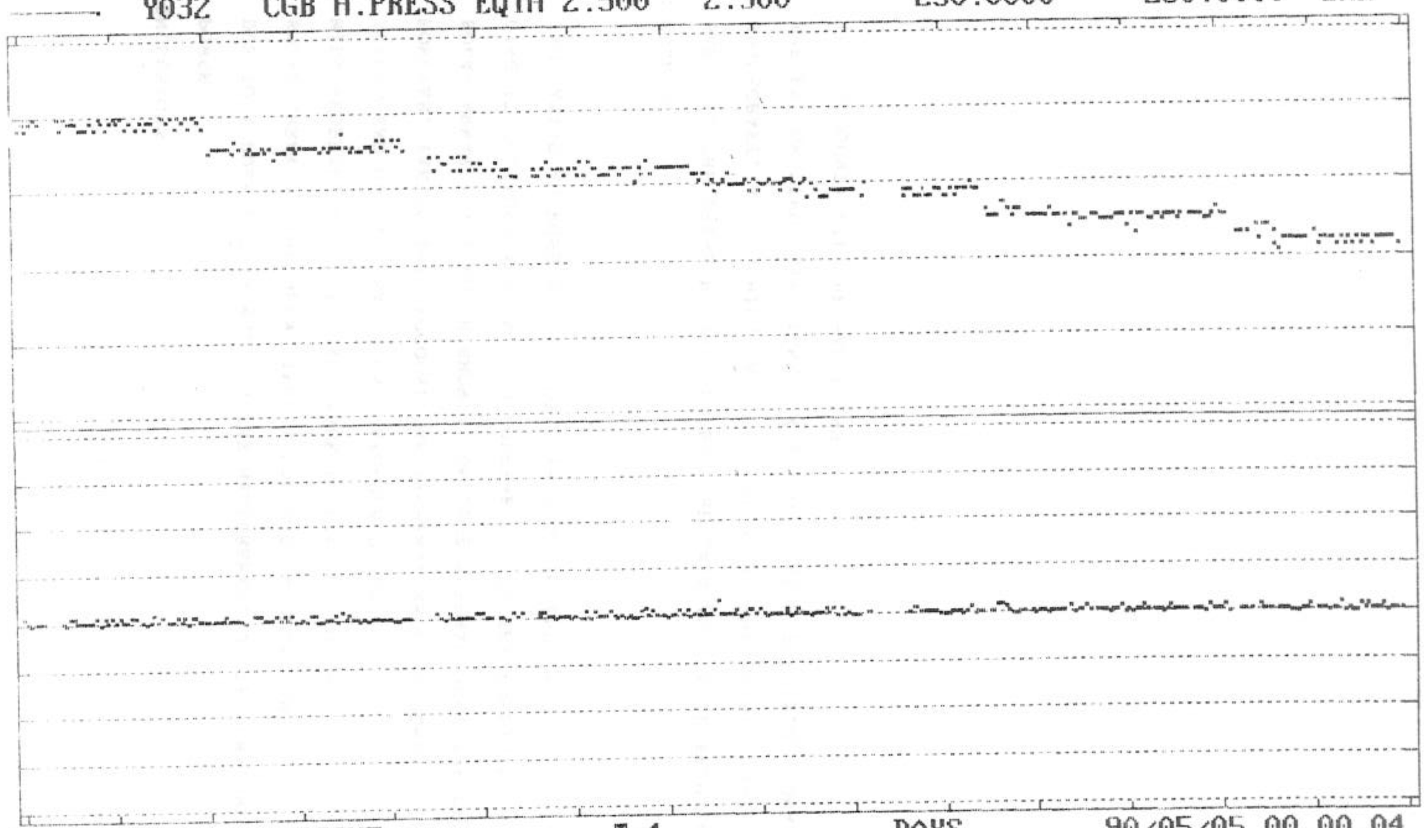


I REVOLUTION AT APOGEE

SPES·HIPP02·GPD·DIS 90/05/08 12.19.39

GPD: CGP1 COLD GAS TANK A + B PRESSURE DsId: TM OwnerId: PRIVAT

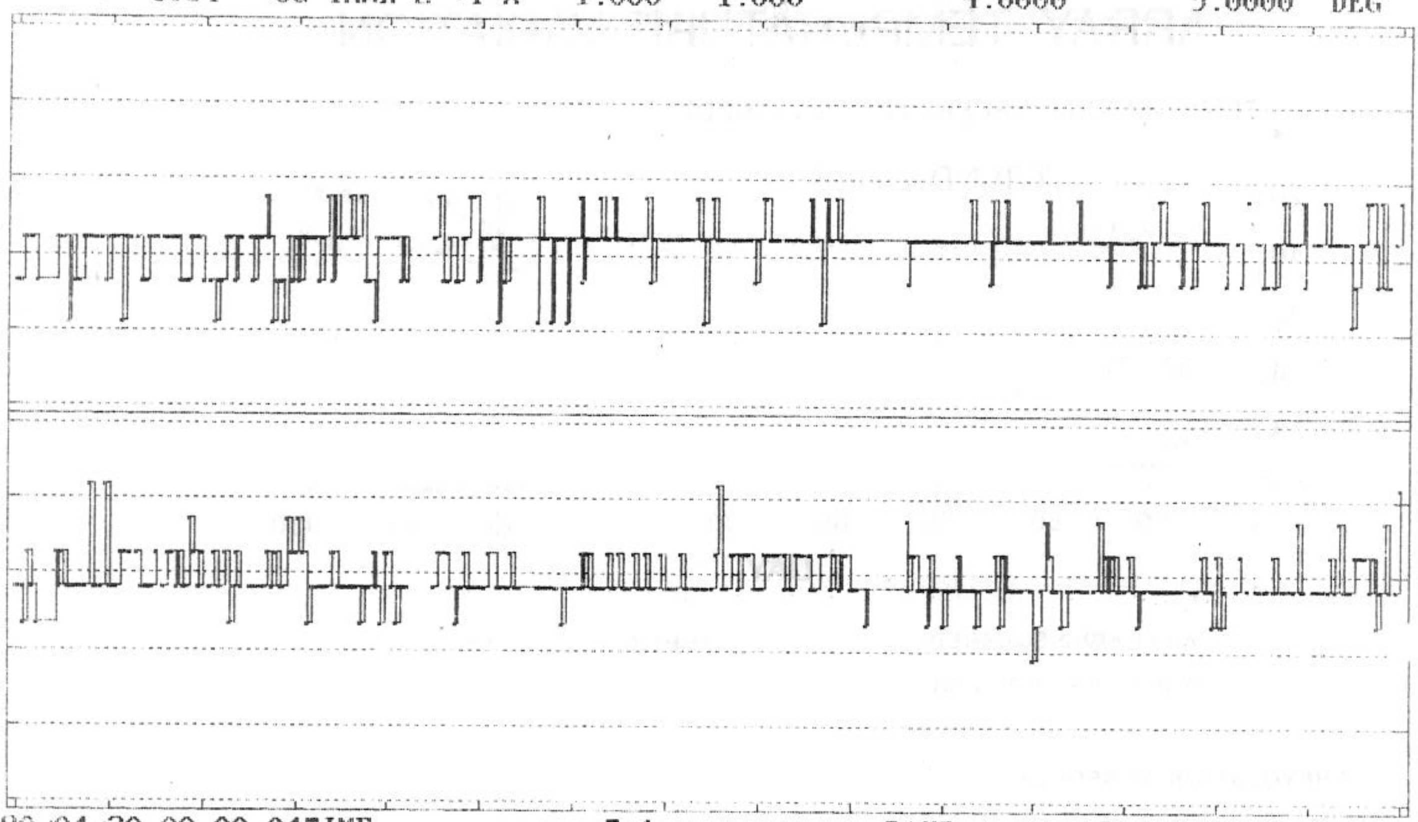
SYMBOLS	ID	DESCRIPTION	TICKS	GRIDS	MINIMUM	MAXIMUM	UNIT
———	Y030	CGA H.PRESS EQIA	2.000	2.000	120.0000	130.0000	BAR
———	Y032	CGB H.PRESS EQIA	2.500	2.500	230.0000	250.0000	BAR



90/04/20 00.00.04TIME T=1 DAYS 90/05/05 00.00.04

GPD: CGP2 COLD GAS TANK A + B TEMPERATURE DsId: TM OwnerId: PRIVAT

SYMBOLS	ID	DESCRIPTION	TICKS	GRIDS	MINIMUM	MAXIMUM	UNIT
——	C085	CG TANK 1 -Y+X	1.000	1.000	0.0000	5.0000	DEG
——	C084	CG TANK 2 +Y-X	1.000	1.000	4.0000	9.0000	DEG



CONCLUSIONS:

1 POWER

DUE TO A POSSIBLE ANOMALY IN THE MEASUREMENT OF TEMPERATURE OF SOLAR ARRAY 3, THE OPEN CIRCUIT VOLTAGE CALCULATIONS AFTER MID. FEBRUARY ARE NOT A RELIABLE INDICATION TO PREDICT THE ACTUAL END OF LIFE BASED ON AVAILABLE POWER.
HOWEVER, TAKING INTO ACCOUNT THE TEMPERATURE MEASUREMENTS OF SOLAR ARRAY 1 & 2 WHICH SHOW A CONSISTENT BEHAVIOUR, THE OPEN CIRCUIT VOLTAGES ARE IN GOOD AGREEMENT WITH THE PREDICTED MODEL INDICATING AN POSSIBLE END OF LIFE MID. TO END 1992.

2 COLD GAS

BASED ON THE PRESSURE AND TEMPERATURE DATA AVAILABLE FROM THE SPACECRAFT, AN ASSUMING GAS CONSUMPTION AT THE PRESENT RATE THE END OF LIFE USING TANK 1 & 2 (NOT TAKING POSSIBLE ANOMALIES INTO ACCOUNT) WILL BE EARLY 1994.

Status on 9-MAY-1990

- **Regular monitoring of:**
  - **focus position**
  - **photometric performance of IDT/SM**
  - **real-time reduction of observations for ops- purposes:**
    - **RTAD support**
    - **long-term trends**
    - **IDT piloting status**
    - **large amplitude variable stars**
  - **chromaticity of main FOV**

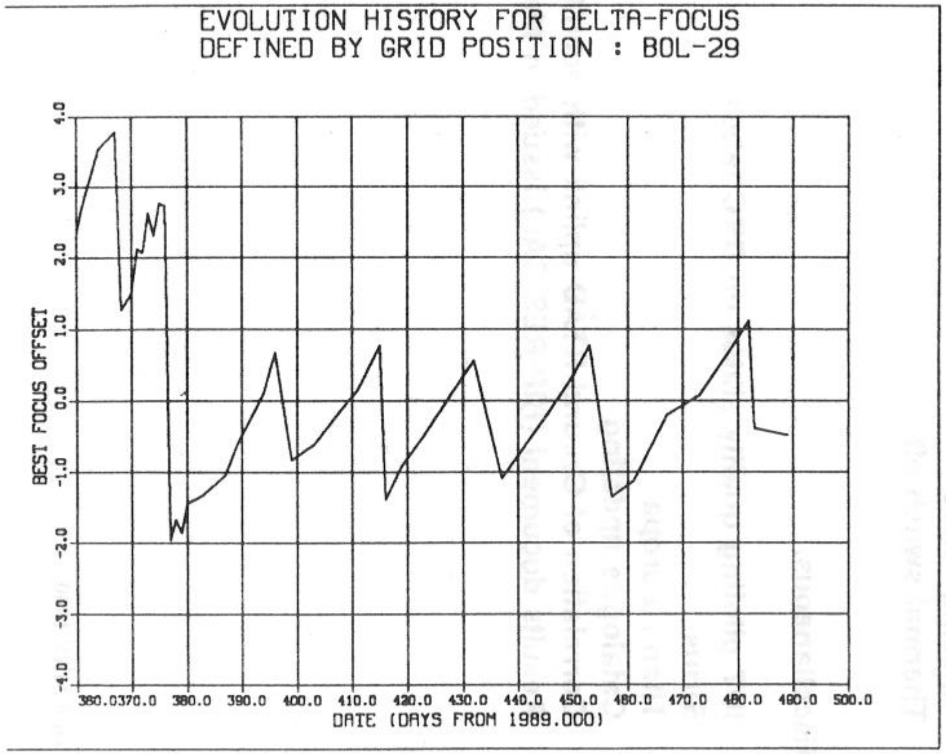
- **On-Board Support**
  - **star magnitude cut-off**
  - **use of V_T channel**
  - **monitoring of improved algorithm for high noise regions**

- **Investigation of anomalies**
  - **PSF id duplication**
  - **Minor Planets (e.g. Hebe on 1989.331)**
  - **"Missing" stars**
  - **Thermal switch off**

- **Miscellaneous:**
  - **IDT piloting quality status on DRC tapes**
  - **Sirius**
  - **Titan / Europa**
  - **Catalogue updating**
  - **Correlation of Ground RTAD uplink with occultations**
  - **Results document (HIP-RES-CAL) issued in March 1990**

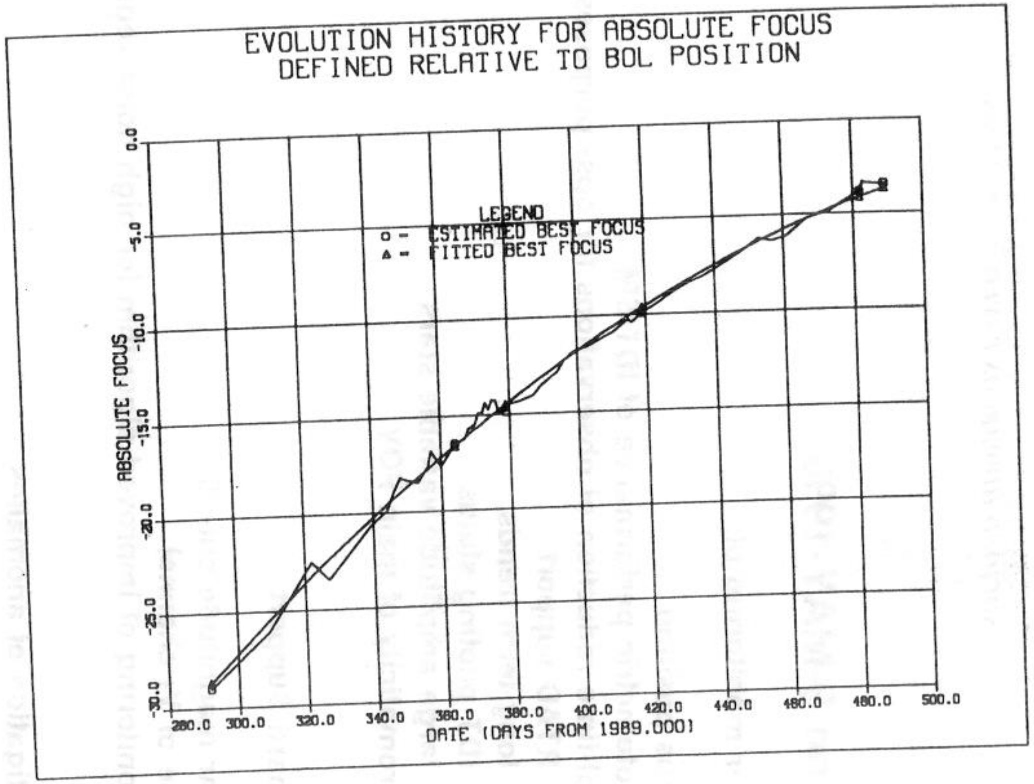
Focus Evolution

- Monitored regularly using 4 hour batches of telemetry
- Linear fit currently made to preceding 40 days of monitoring
- Current strategy is move of -2 when focus offset reaches +1
- 5 of these moves have now been made - strategy works
- Graph gives distance from actual focus position to "best" focus



Absolute Focus

- Focus evolution from start of mission fitted by quadratic
- Gradient from linear fit for period centred on 1990.102 is 1 step/ 11.3 days
- Gradient from quadratic at same epoch is 1 step/13.2 days



IDT Photometric Performance

Type of stars processed:

- S+C = photometric secondary standard and constant stars
- S = photometric secondary standard stars

Normalised as % w.r.t. day 292 we have:

Date	Star Type	Colour 1		Colour 2		Colour 3	
		#obs	%dev	#obs	%dev	#obs	%dev
1989.292	S+C	397	0.00	405	0.00	198	0.00
1989.301	S+C	295	-0.64	352	+1.61	85	+0.78
1989.344	S+C	572	-4.18	655	-3.31	464	-2.00
1990.003	S+C	678	-9.09	819	-1.61	447	-2.97
1990.018	S	363	-7.34	180	-4.63	48	-3.37
1990.022	S+C	2622	-8.61	1127	-4.02	631	-2.45
1990.031	S+C	976	-6.62	517	-5.43	265	-2.52
1990.038	S+C	267	-8.29	570	-4.48	319	-4.55
1990.046	S+C	399	-12.91	743	-5.14	432	-2.06
1990.051	S+C	521	-7.31	947	-5.01	522	-3.83
1990.063	S+C	1169	-10.13	738	-6.28	321	-4.73
1990.080	S+C	1276	-9.31	903	-6.62	378	-3.75
1990.094	S+C	344	-7.85	441	-7.20	410	-3.81
1990.113	S+C	1378	-10.16	940	-6.82	466	-2.42

Linear Fit gives following degradations:

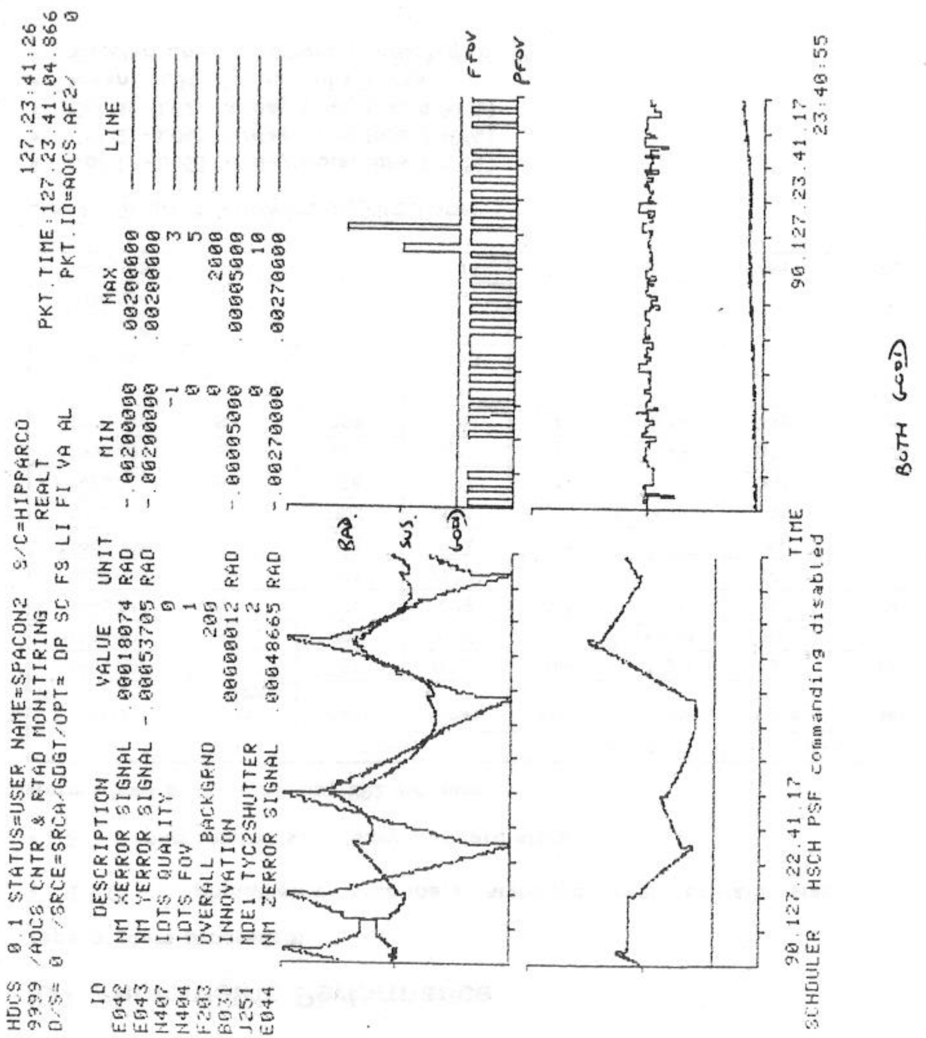
- Col 1: -0.053 %/day (total loss 9.92%)
- Col 2: -0.045 %/day (total loss 8.40%)
- Col 3: -0.021 %/day (total loss 4.00%)
- Mean: -0.040%/day; 14.6%/year
- Slowing down (previously reported -0.058%/day)

IDT Piloting Quality Summary

- Done at request of DRC to indicate (via DRC tapes) intervals when IDT piloting is "good" for both FOVs
- Achieved by post-processing of IDT payload monitoring data
- Payload monitoring modified to switch FOVs more often (by priority boost of 'other' FOV)
- Normally detects change of state within 3-5 minutes
- Real-time graphical display of quality and FOV. Easy to decide if:
  1. both FOVs piloting badly
  2. one FOV piloting well, the other badly
  3. both FOVs piloting well

These are the results obtained up to May 1990:

Time Period	#days	% Good	% Bad	% Un-known	% Good/ Recov-ered
Nov/Dec 89	34	43.47	14.70	41.83	74.73
Jan 90	31	53.95	16.33	29.72	76.76
Feb 90	28	65.83	9.80	24.37	87.04
Mar 90	31	61.43	13.02	25.55	82.51
Apr 90	30	73.43	7.90	18.68	90.29
May 90	8	63.05	12.45	24.49	83.51
ALL	163	59.35	12.56	28.09	82.53



IDT Piloting Quality Algorithm

- a batch of payload monitoring outputs e.g. 1 week are retrieved from the operational HDCS VAX computer:

  1. each observed "I0" is converted into a H magnitude (HEST)
  2. the predicted H magnitude is read from INCA (HPRED)
  3. the observation is marked as good if ABS(HEST-HPRED) is less than a threshold (currently 1.5 mag) otherwise it is bad. An attenuation of 1.5 mag corresponds to about 20 arcsec on the IFOV profile.

- the algorithm goes into a 'don't know' state at the start of the batch

- the algorithm will switch to 'bad' if one FOV has 3 consecutive bad observations (within a time limit)

- the algorithm will switch to 'good' if both FOVS have 3 consecutive good observations (within a time limit)

- data gaps e.g. occultations up to 50 min will be ignored i.e. the state will not change over these gaps. Therefore, 'good' intervals can contain occultations and any statistics produced on % good time will include these short 'gaps'

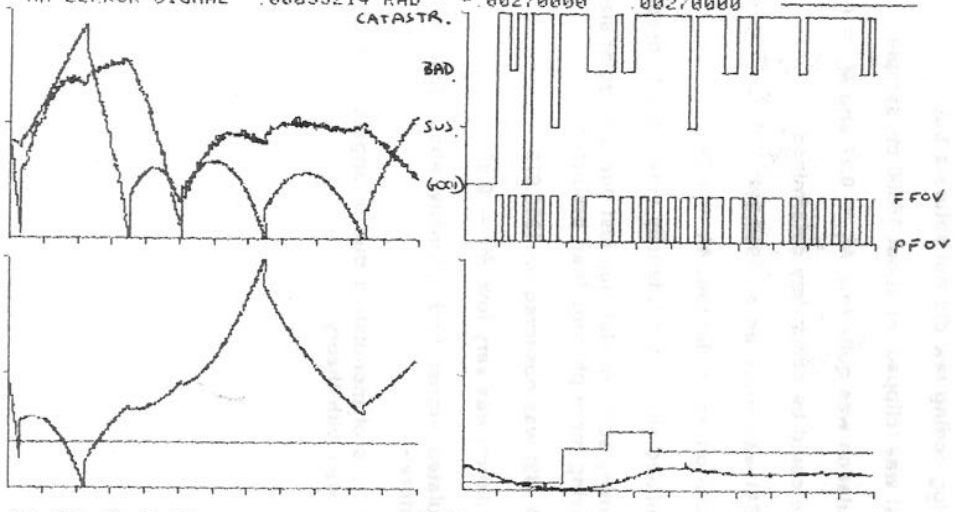
- data gaps more than 50 min e.g. perigees, long LOS's will cause the algorithm to go back into a 'don't know' state

  (all of the above parameters are actually configurable)

- Each change of state will produce a new time interval and a record is created for a master file covering the whole mission. Each record consists of 3 fields:- start time, end time and status (1=good, 2=bad, 3=unknown)

HDCS 0.1 STATUS=USER NAME=SPACON2 S/C=HIPPARCO 125:20:47:05
9999 /AOCS CNTR & RTAD MONITIRING REALT PKT.TIME:125.20.46.51.622
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=HHR .HK / 0

ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00017697	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	-.00090334	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	2		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	157		0	2000	
B031	INNOVATION	-.00003227	RAD	-.00005000	.00005000	
J251	MDE1 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	.00033214	RAD	-.00270000	.00270000	

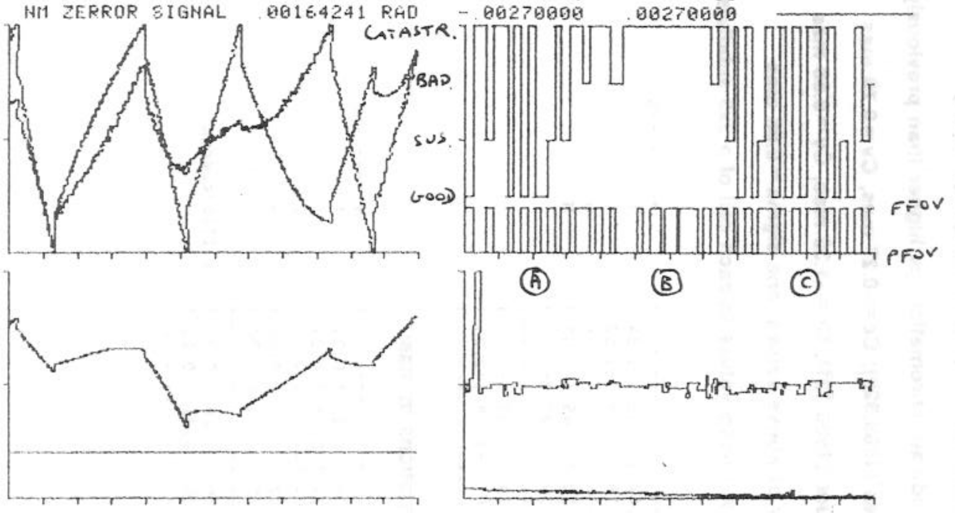


90.125.19.47.00 TIME 90.125.20.47.00
SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 20:40:00

BOTH BAD

HDCS 0.1 STATUS=USER NAME=SPACON2 S/C=HIPPARCO 128:03:05:27
9999 /AOCS CNTR & RTAD MONITIRING REALT PKT.TIME:128.03.05.21.984
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=SMP .01 / 0

ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00155192	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	.00154832	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	2		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	22		0	2000	
B031	INNOVATION	.00000073	RAD	-.00005000	.00005000	
J251	MDE1 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	.00164241	RAD	-.00270000	.00270000	



90.128.02.05.26 TIME 90.128.03.05.26
SCHD_DSP D104 Job OOLP_00016 dispatched to process SFS_BATCHSE 03:00:00

(A) FFOV GOOD
(B) BOTH BAD
(C) PFOV GOOD

Main FOV Chromaticity

- Performed on day 1990.121 using 1 great circle of special PSF
- Will be repeated every 12 weeks (as planned)
- Results indicate chromaticity is higher than previously reported
- Old values (1989.329); Cc=-0.27 mas, Cv=0.79 mas
- New values (1990.121); Cc=-1.36 mas, Cv=0.58 mas
- Accuracy of above values: one sigma=0.06 mas

Results follow (mean values in each cell of a 3x3 subdivision of the FOV in mas):

```
       +------+------+------+        +------->G
Pfov:  !-1.47 !-1.22 !-1.34 !        !
Ffov:  !-0.18 !-1.18 !-1.50 !        !
       +------+------+------+        v
       !-1.20 !-1.45 !-2.00 !        H
       !-0.39 !-1.20 !-1.20 !
       +------+------+------+
       !-1.78 !-2.37 !-2.14 !
       !-0.67 !-1.18 !-2.03 !
       +------+------+------+
```

Standard deviations in mas:

```
       +------+------+------+        +------->G
Pfov:  ! 0.26 ! 0.23 ! 0.21 !        !
Ffov:  ! 0.22 ! 0.28 ! 0.29 !        !
       +------+------+------+        v
       ! 0.22 ! 0.21 ! 0.26 !        H
       ! 0.25 ! 0.25 ! 0.30 !
       +------+------+------+
       ! 0.26 ! 0.26 ! 0.32 !   milliarcseconds
       ! 0.26 ! 0.21 ! 0.23 !
       +------+------+------+
```


Miscellaneous

- SIRIUS observed on day 1990.067 operating the IDT in photon counting mode:
  - Semilog coding law did not saturate but:-
  - signal was 'clipped' at about 16500 cts/sample
  - modulation was quite low, $M_1 = 0.27$ and $M_2 = 0.05$
  - phase could be accurately determined
- TITAN (S6) was observed on 1989.314
  - modulation was quite low, $M_1 = 0.34$
  - modulated signal had intensity very close to prediction for Titan
  - assuming some modulation lost due to angular size then probably receiving more photons than predicted
- EUROPA (J2) was observed on 1990.072
  - modulation was very low, $M_1 = 0.25$
  - modulated signal had intensity about half of that predicted, therefore:-
  - some loss of modulation due to angular size of Europa (agrees quite well with theory)

RTAD Innovation and Star Transit Time Error Analysis

Innovation

Sample	(A)fter or (B)efore Patch	(A)pogee or (P)erigee	Day (1990)	Start Time	End Time	Sample Size	Mean (")	Standard Deviation (")
1	B	A	76	16:00	18:15	356	-0.100	0.957
2	B	A	80	05:00	09:00	576	-0.069	1.770
3	B	P	77	07:20	08:40	157	-0.008	1.248
4	B	P	80	09:30	11:40	263	0.122	1.877
5	A	A	82	01:30	03:00	228	0.014	1.164
6	A	A	83	08:30	11:00	323	-0.142	1.330
7	A	P	82	04:00	06:00	205	0.018	1.055
8	A	P	83	11:00	13:45	206	0.184	1.328
9	A(V)	A	124	15:15	16:45	241	-0.064	0.743

Star Transit Time Error (Measured - Expected)

Sample	(A)fter or (B)efore Patch	(A)pogee or (P)erigee	Day (1990)	Start Time	End Time	Sample Size	Mean (msec)	Standard Deviation (msec)
1	B	A	76	16:00	18:15	574	-0.095	3.006
2	B	A	80	05:00	09:00	853	-0.154	5.909
3	B	P	77	07:20	08:40	230	-0.053	4.760
4	B	P	80	09:30	11:40	382	0.206	5.829
5	A	A	82	01:30	03:00	370	-0.156	4.030
6	A	A	83	08:30	11:00	496	-0.156	4.396
7	A	P	82	04:00	06:00	284	0.124	3.298
8	A	P	83	11:00	13:45	258	0.128	3.332
9	A(V)	A	124	15:15	16:45	313	-0.134	2.546
10	A(V)	A	128	15:00	17:00	307	-0.041	3.077

GRTAD Uplinks and Occultations around Perigee

The perigee passes are split into two categories: those after which an uplink by GRTAD was required; and those after which no uplink was required.

All perigees between day 81 and day 122 are considered. Day 81 was the day that the CBS patch was implemented.

```
Perigee passes with uplink:
 - no. of passes                  : 29
 - no. of occultations            : 32
 - average no. of occultations   : 1.10 occ./pass
 - total occultation time         : 763.3 min
 - average occultation duration: 23.85 min/occ.
 - average occultation time       : 26.85 min/pass

Perigee passes without uplink:
 - no. of passes                  : 64
 - no. of occultations            : 49
 - average no. of occultations   : 0.77 occ./pass
 - total occultation time         : 1335.0 min
 - average occultation duration: 27.24 min/occ.
 - average occultation time       : 20.86 min/pass
```

Some evidence of a relation between number of occultations, their duration and number of GRTAD Uplinks.

Given recent changes in RTAD, eg. CBS patch, B/V channel swap, further monitoring is needed to confirm any trends.

Annex VII

NDAC/CUO GCR Reduction

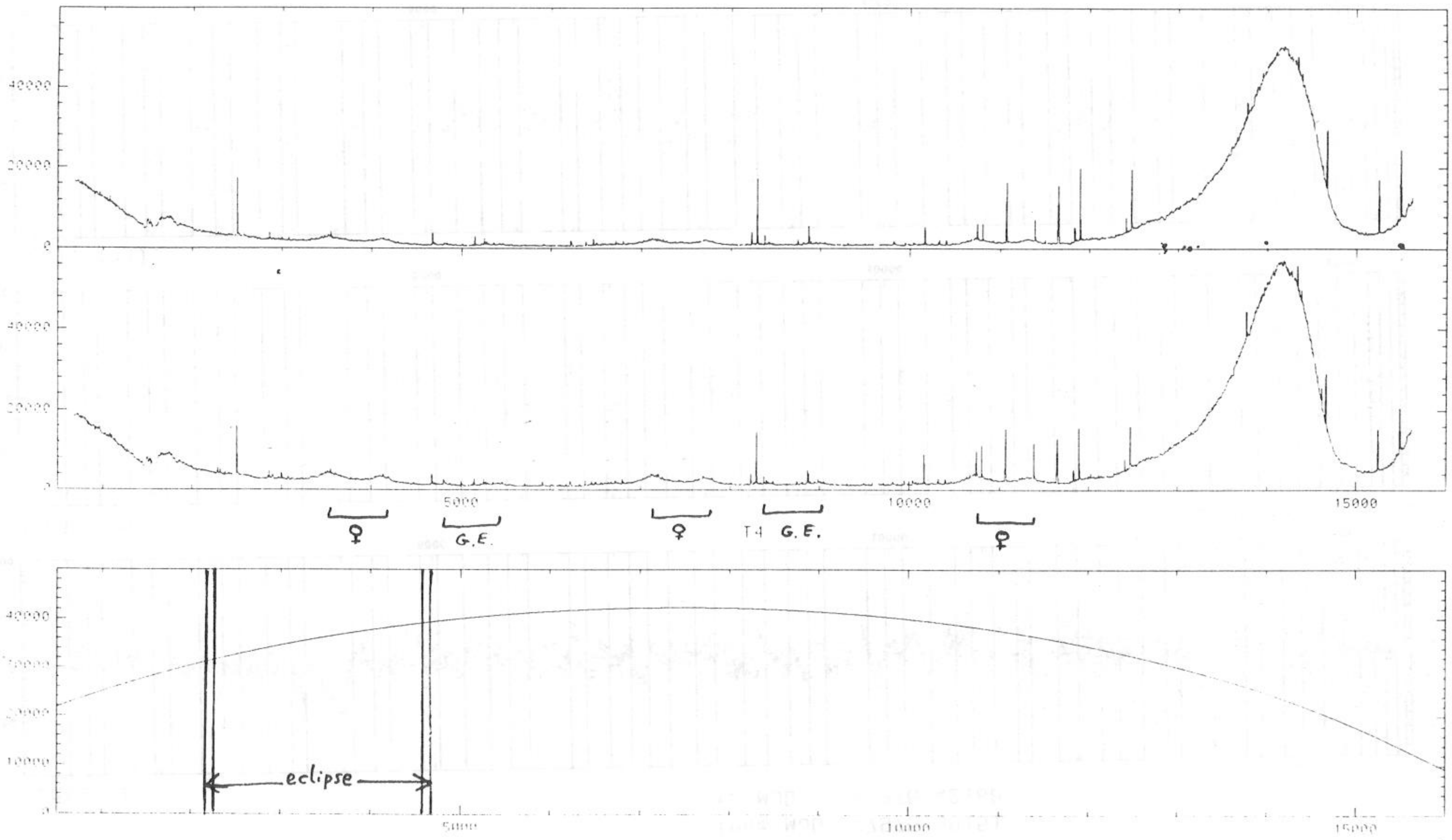
May 9 14:25 1990 res4 Page 1

ID	n	observed	start	length	frames	stars	obs	s.d.	max.
COM1	2	9/12/89	20:53	7.59h	12024	1626	49200	4.5	56.3
4001	1	5/11/89	5:54	7.23h	12196	1600	52608	4.2	40.3
4002	1	(skipped)							
4003	1	(skipped)							
4004	1	26/11/89	1:51	8.42h	12712	1376	37367	4.6	43.5
4005	1	26/11/89	23:10	8.43h	13009	1657	52209	4.4	40.7
4006	2	27/11/89	9:59	5.16h	8525	1152	26309	5.4	47.4
4009	3	27/11/89	21:15	7.67h	12125	1344	34302	8.5	166.7
4012	2	28/11/89	7:07	8.47h	10652	1406	32504	6.2	97.6
4014	1	28/11/89	18:41	7.57h	12050	1450	40528	11.2	390.0
4015	1	29/11/89	4:34	7.18h	11428	1339	35663	21.6	680.0
4016	1	3/12/89	17:00	6.58h	11105	1646	44675	5.3	111.9
4017	1	4/12/89	1:41	8.56h	14450	1872	61635	11.5	467.2
4018	1	4/12/89	23:01	8.56h	14450	1743	54776	8.3	302.1
4020	3	5/12/89	23:30	5.40h	8920	1322	31182	4.6	36.1
4023	1	6/12/89	17:39	8.59h	14502	1488	39645	9.5	325.3
4024	1	7/12/89	4:38	8.29h	13125	1750	56351	4.1	41.9
4025	1	7/12/89	15:00	8.59h	14497	1393	34047	5.3	90.6
4026	1	8/12/89	1:37	8.64h	13985	1766	57297	4.1	45.1
4027	1	8/12/89	23:00	8.60h	13665	1593	44915	4.6	30.9
4028	2	9/12/89	20:16	8.68h	13860	1761	55367	4.6	55.9
4030	1	(skipped)							
4031	1	10/12/89	17:35	8.71h	14055	1644	47784	14.8	562.9
4032	1	11/12/89	4:21	6.00h	10120	1150	20863	5.4	33.4

n = number of frame files used to form the set.
s.d. = RMS of all abscissa standard deviations [mas].
max. = maximum of all abscissa standard deviations [mas].

The ID of the set = the ID of the first frame file. File 4019 was not received from RGO. COM1 is a subset of set 4028. These sets were reduced in 3 working days (this includes reading the input tape, manual inspection of results, reprocessing of some sets, writing of output tapes, and cleaning up). The Apollo DN-10000 was used.

from MJD 47976.00380 — 26 March 1990 0h - 9h 15m UT
to MJD 47976.38463 — Star Mapper Background Rates (Raw)

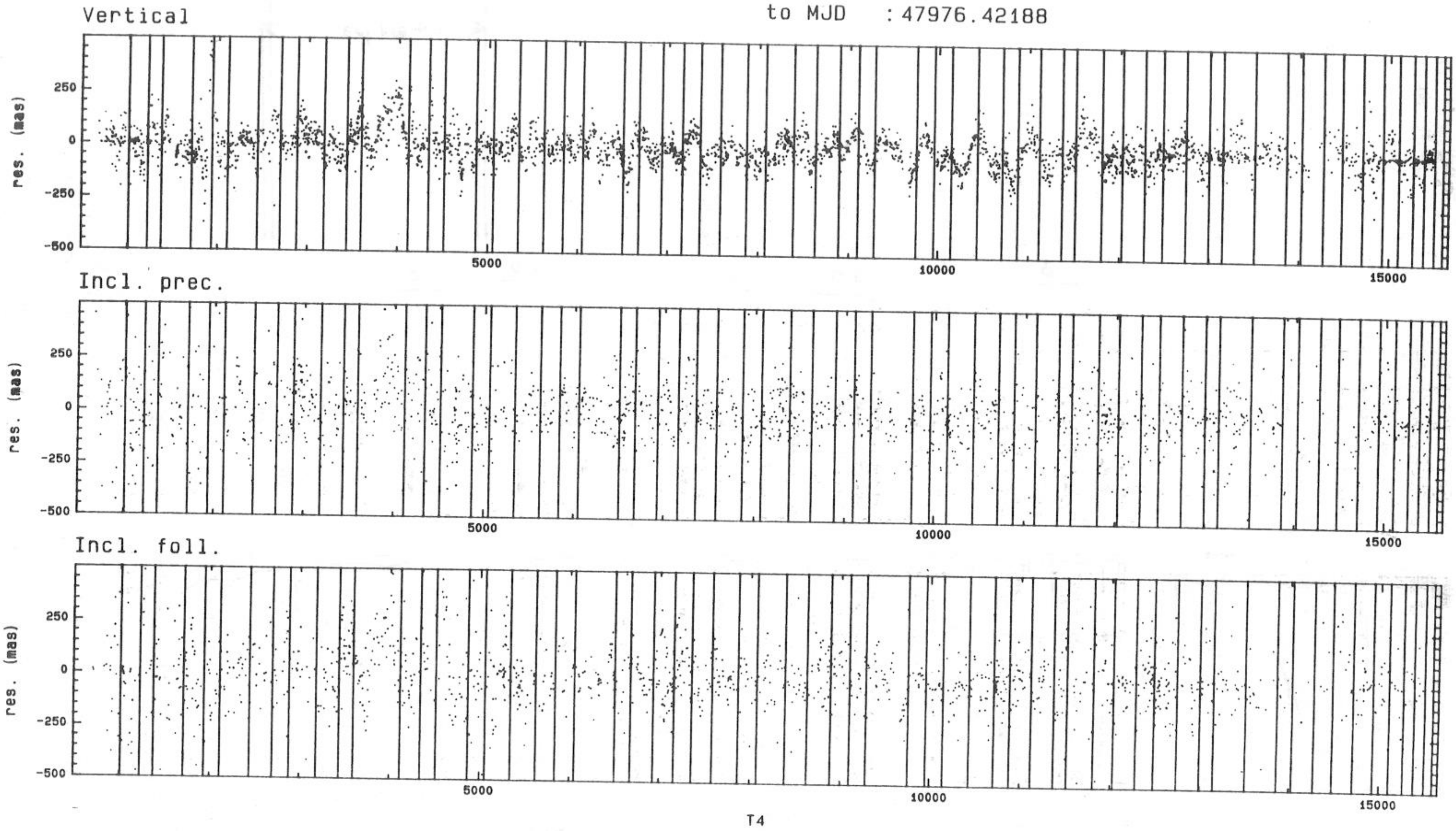


VIII

Residuals of SM transit times vs. reconstructed attitude and corrected star positions

Attitude from OGARO

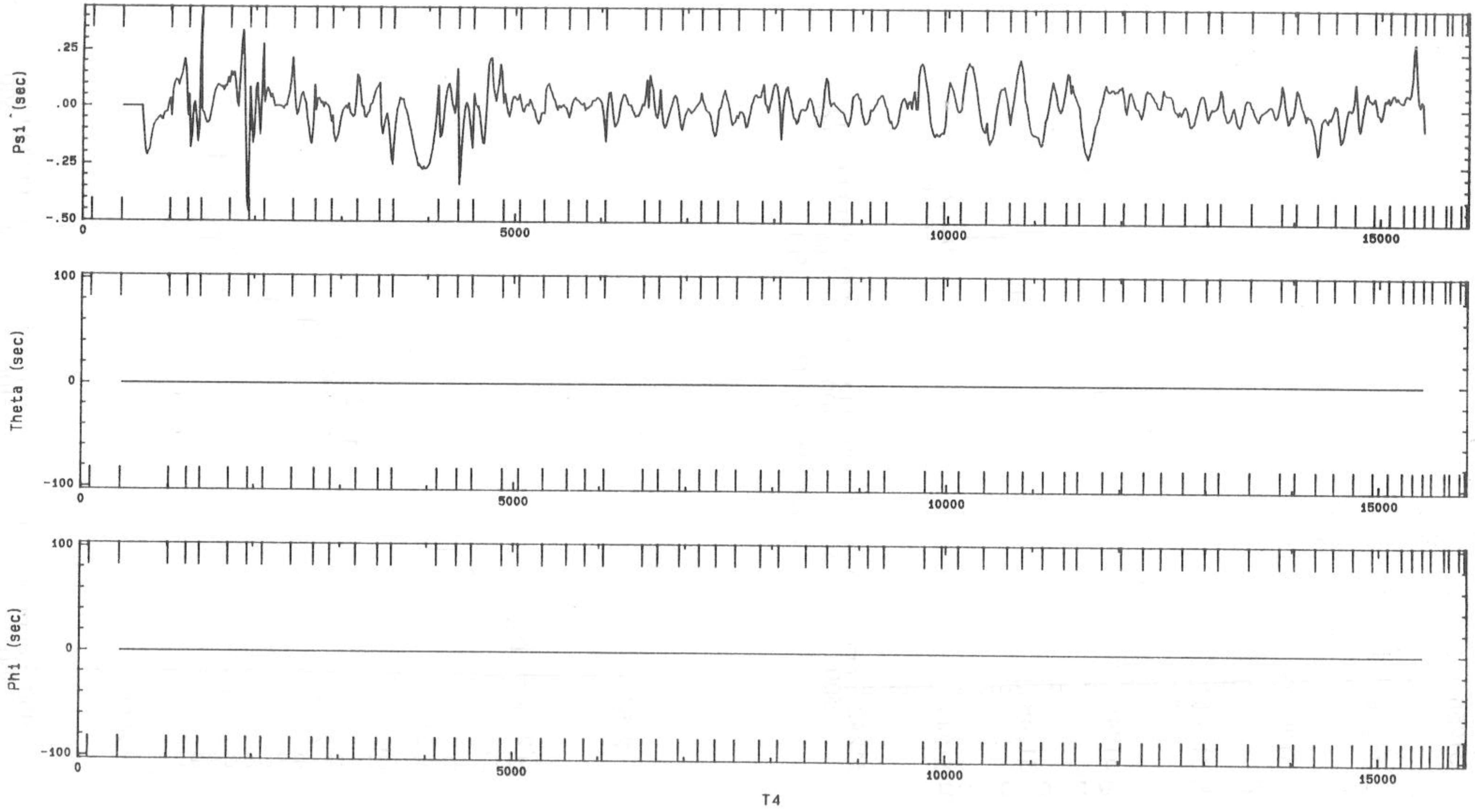
RGC : 516
from MJD : 47975.99151
to MJD : 47976.42188

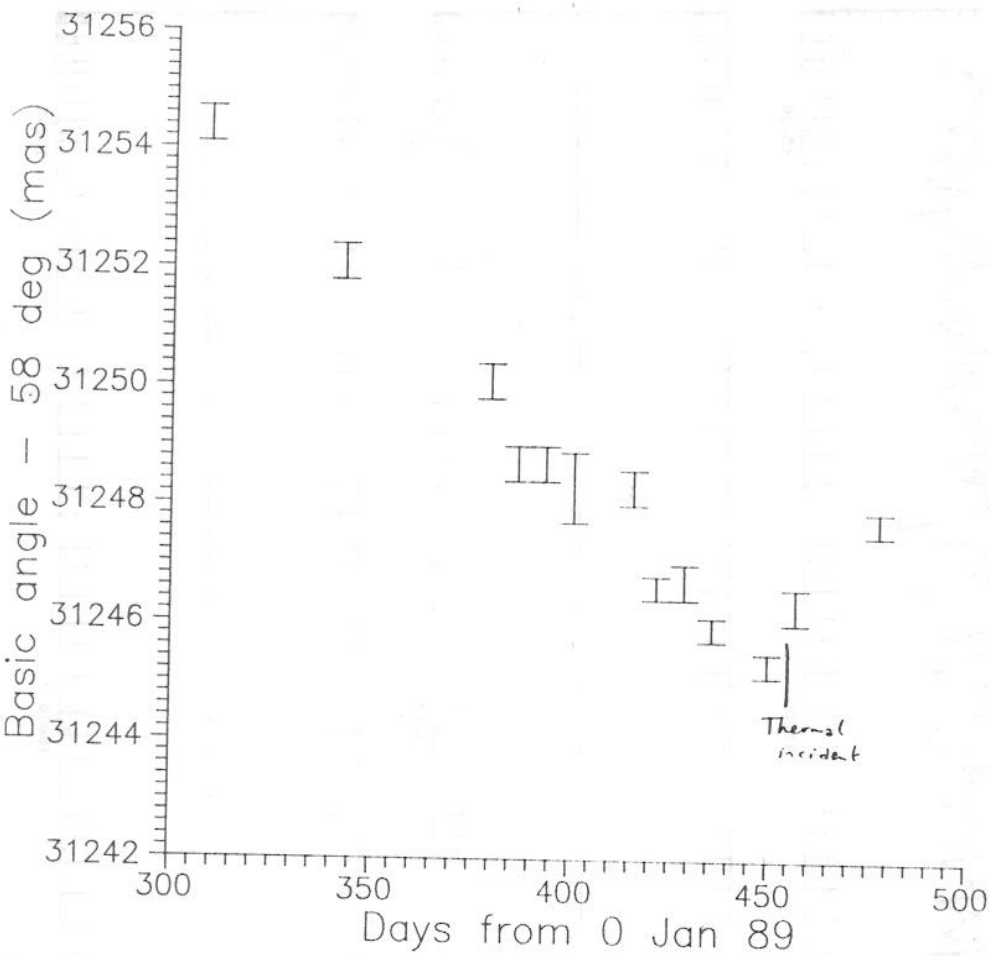


Attitude correction by great-circle reduction

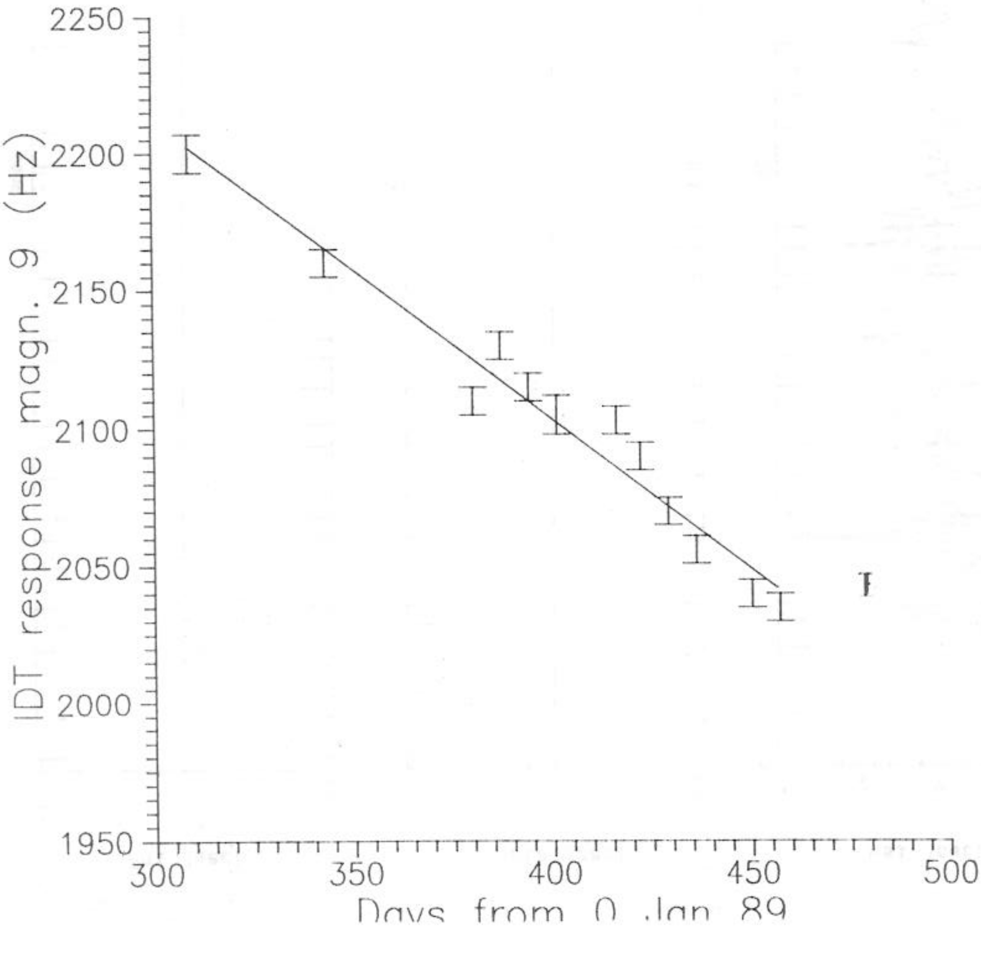
RGC : 516
from MJD : 47975.99151
to MJD : 47976.42188

Attitudes from OGARO
and C/G





Basic angle − 58 deg (mas)
31256
31254
31252
31250
31248
31246
31244
31242
300
350
400
450
500
Days from 0 Jan 89
Thermal incident



IDT response magn. 9 (Hz)
2250
2200
2150
2100
2050
2000
1950
300
350
400
450
500
Days from 0 Jan 89

Table 1: Geometric calibrations

Date	Basic angle - 58°	Scale factor		Rotation	
		preceding	following	preceding	following
05-Nov-89	31254.4 (.2)	-871	-870	-2425	-2799
09-Dec-89	31252.1 (.3)	-864	-858	-2421	-2793
15-Jan-90	31250.1 (.3)	-861	-854	-2427	-2783
22-Jan-90	31248.7 (.3)	-863	-854	-2427	-2784
29-Jan-90	31248.7 (.3)	-864	-855	-2427	-2785
05-Feb-90	31248.3 (.6)	-862	-854	-2430	-2786
20-Feb-90	31248.3 (.3)	-861	-851	-2426	-2782
26-Feb-90	31246.6 (.2)	-862	-853	-2425	-2784
05-Mar-90	31246.7 (.3)	-864	-854	-2425	-2785
12-Mar-90	31245.9 (.2)	-862	-850	-2421	-2784
26-Mar-90	31245.6 (.2)	-863	-853	-2421	-2782
26-Mar-90	31245.3 (.2)	-858	-847	-2431	-2793
02-Apr-90	31246.3 (.3)	-857	-844	-2429	-2793
23-Apr-90	31247.4 (.2)	-859	-847	-2429	-2791

← Correction of MSI cal file

Table 2: Photometry IDT

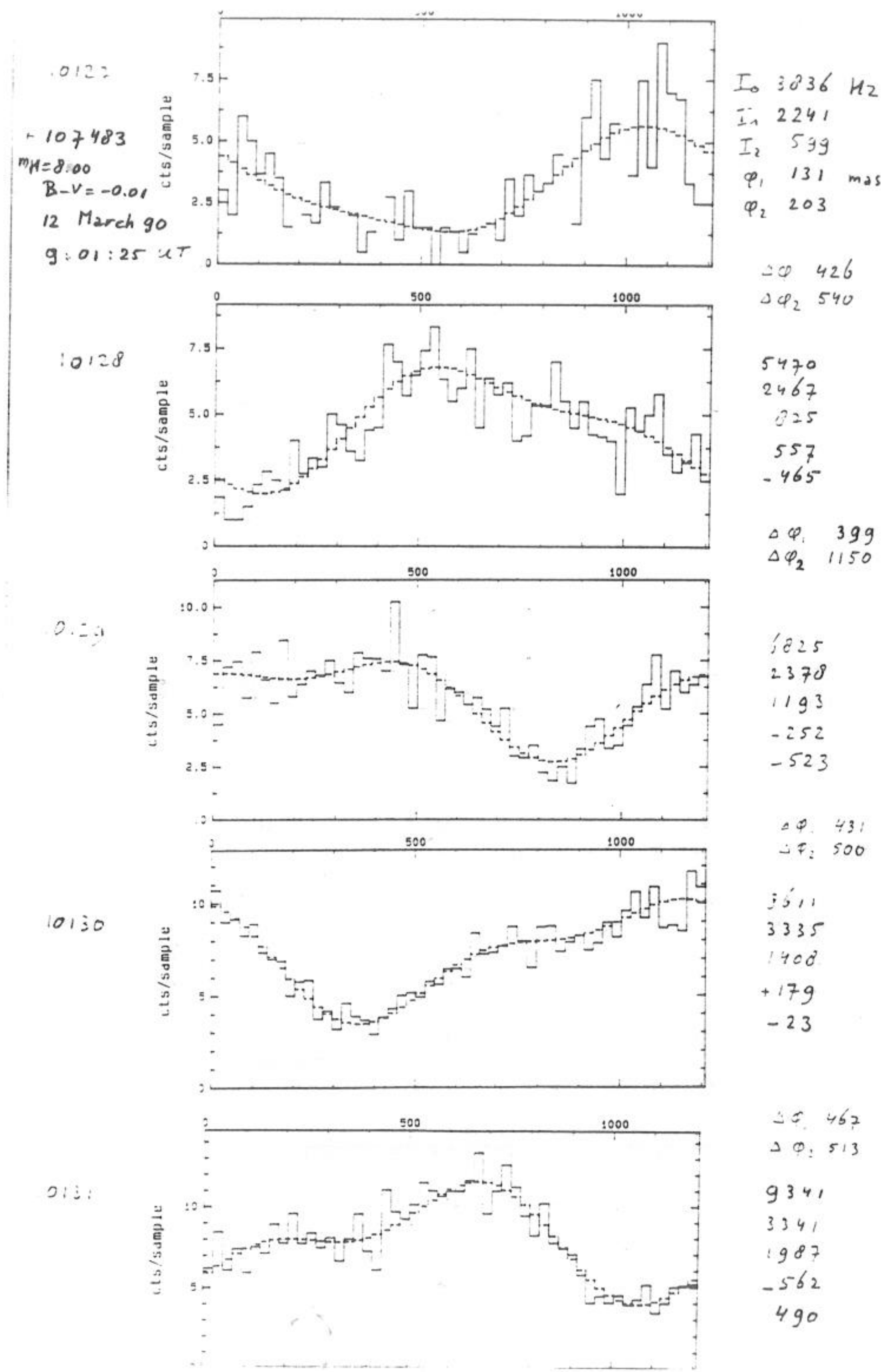
Date	Response	M_1		M_2	
	($m_H = 9$)	preceding	following	preceding	following
05-Nov-89	2200 (7)	0.742	0.693	0.253	0.241
09-Dec-89	2160 (5)	0.723	0.722	0.250	0.254
15-Jan-90	2110 (5)	0.703	0.738	0.241	0.261
22-Jan-90	2130 (5)	0.709	0.735	0.244	0.257
29-Jan-90	2115 (5)	0.715	0.734	0.243	0.259
05-Feb-90	2105 (7)	0.707	0.730	0.243	0.253
20-Feb-90	2103 (5)	0.695	0.737	0.237	0.257
26-Feb-90	2090 (5)	0.695	0.708	0.235	0.249
05-Mar-90	2070 (5)	0.712	0.723	0.244	0.254
12-Mar-90	2056 (5)	0.696	0.729	0.236	0.256
26-Mar-90	2040 (5)	0.708	0.715	0.242	0.249
02-Apr-90	2035 (5)	0.695	0.723	0.238	0.258
23-Apr-90	2045 (4)	0.708	0.710	0.243	0.253

Change of large-scale transformation after correction of MSI file

	Before		After	
Preceding				
G	-863	.4	-858	.4
H	-2421	.5	-2431	.4
G^2	7	.3	7	.3
GH	1	.2	1	.2
H^2	7	.3	7	.3
G^3	22	.5	13	.5
G^2H	-2	.5	-2	.5
GH^2	43	.5	44	.5
H^3	-21	.6	-3	.6
Following				
G	-853	.4	-847	.4
H	-2782	.5	-2793	.4
G^2	2	.3	2	.3
GH	5	.2	5	.2
H^2	7	.3	7	.3
G^3	22	.5	13	.5
G^2H	-5	.5	-4	.5
GH^2	42	.5	44	.5
H^3	-22	.6	-4	.6
Basic angle	31245.6	.2	31245.3	.2

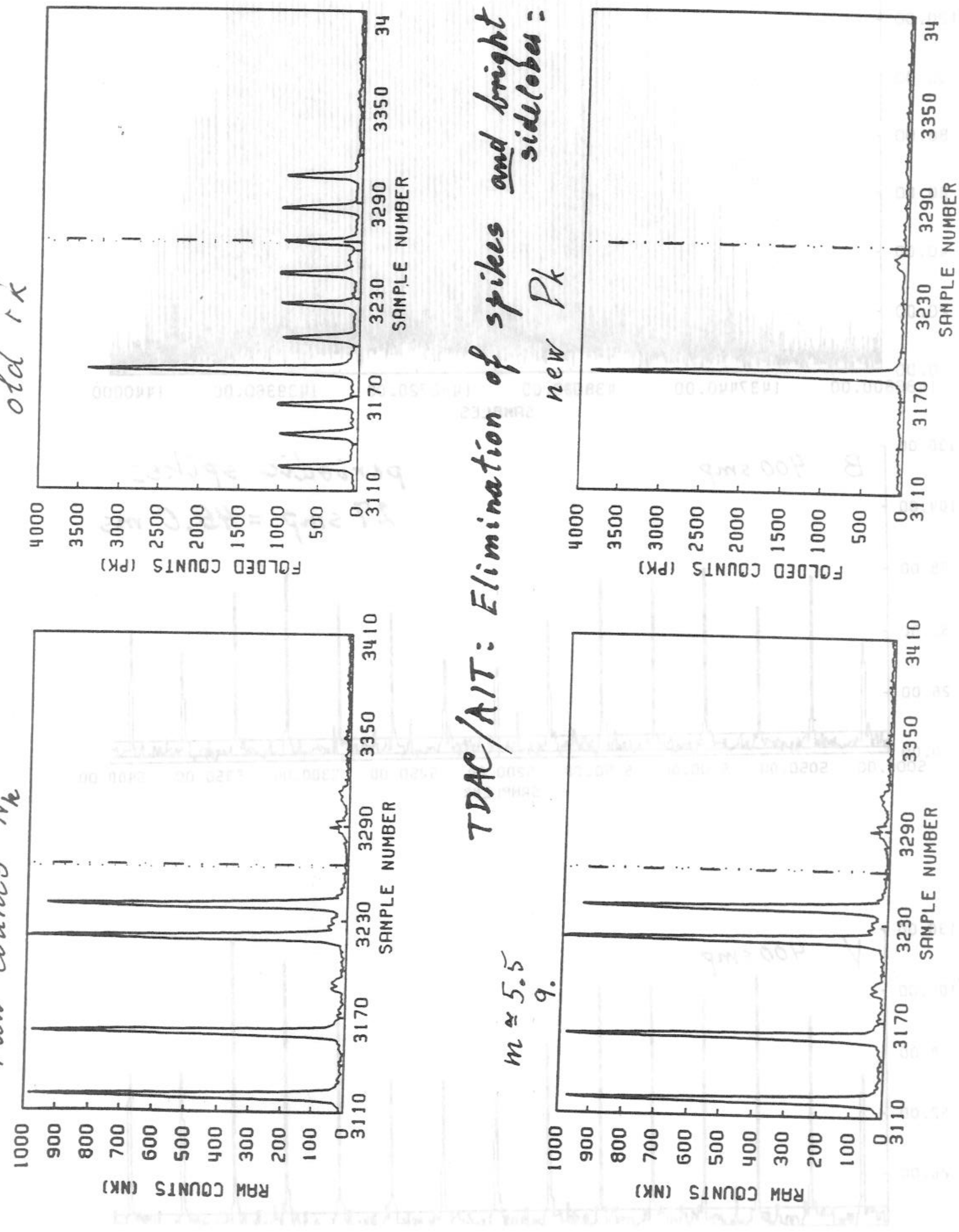
<u>Influence on great-circle solution of MSI file correction</u>

Estimated standard deviation of unit weight (a priori 10 mas):	11.64	10.82 mas
Fisher test variate:	1.3551	1.1731
R.m.s. of the residuals:	12.26	11.67 mas
Square root mean variance attitude:	7.01	6.62 mas

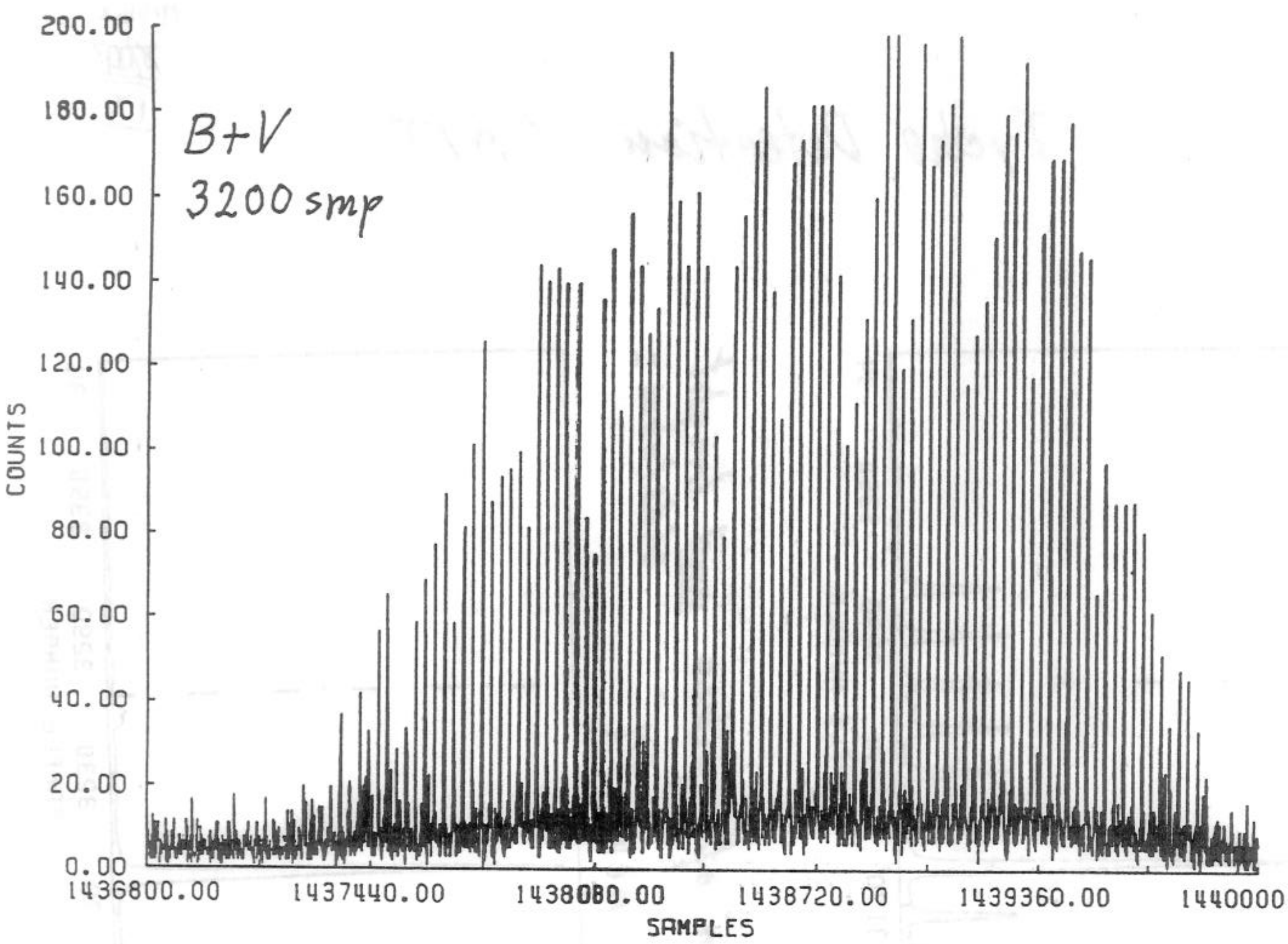


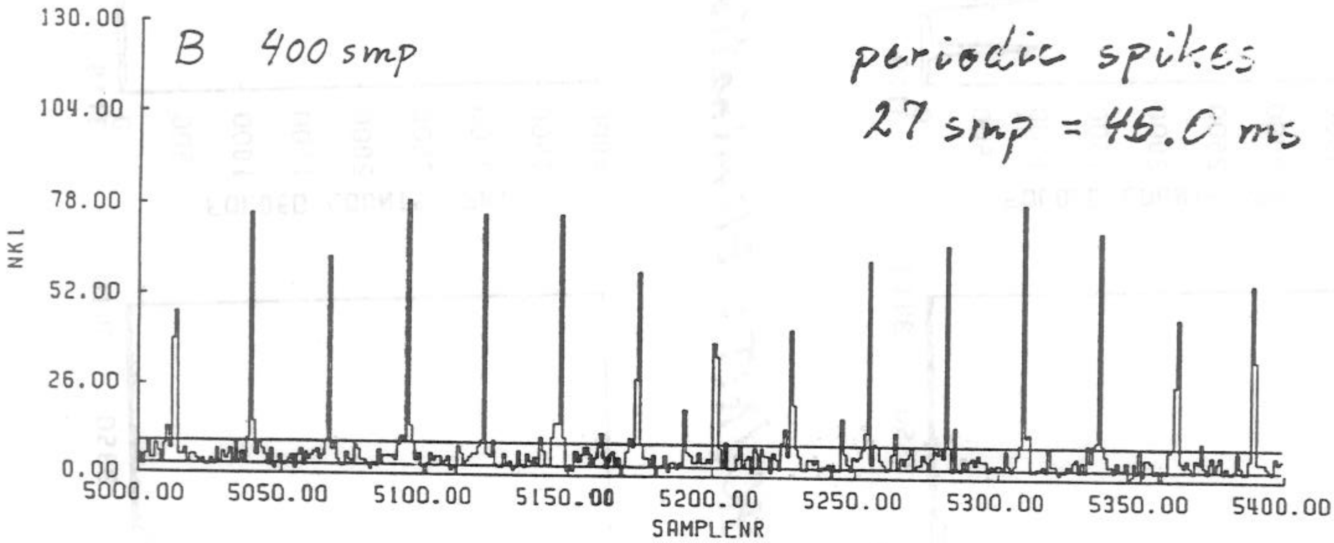
Annex IX

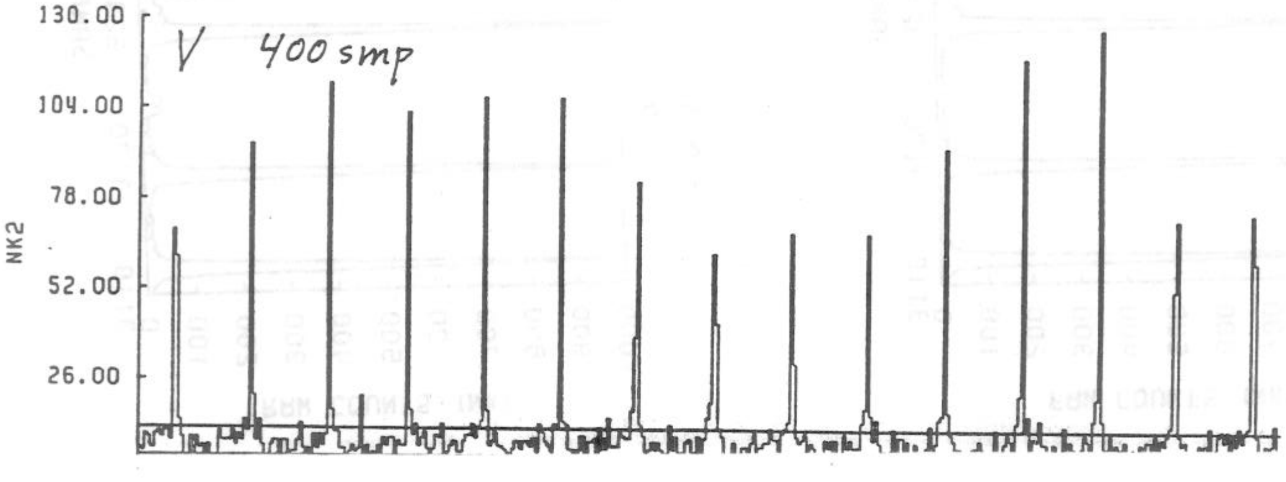
Tycho Detection / AIT



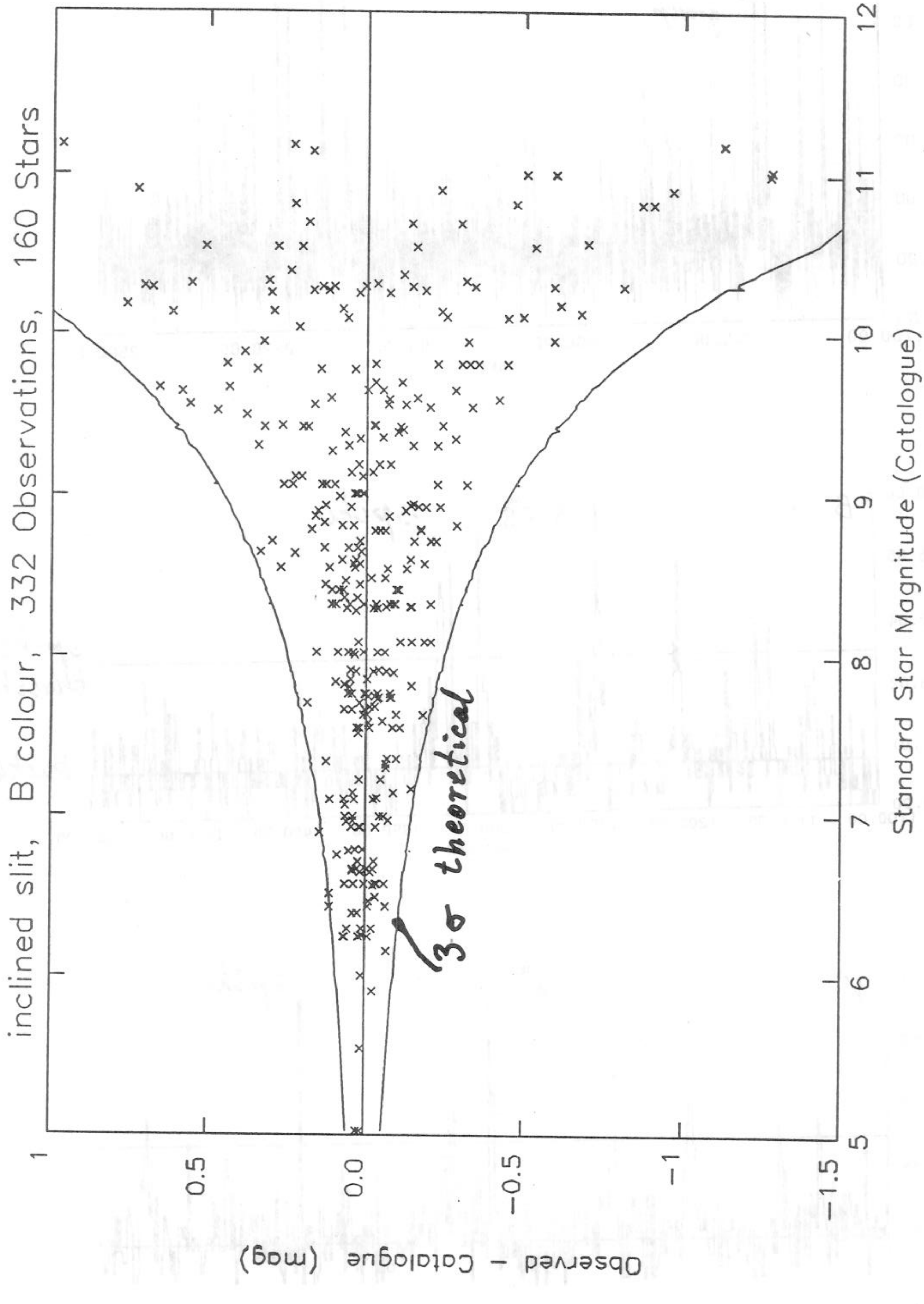
TDAC/AIT: Elimination of spikes and bright sidelobes:

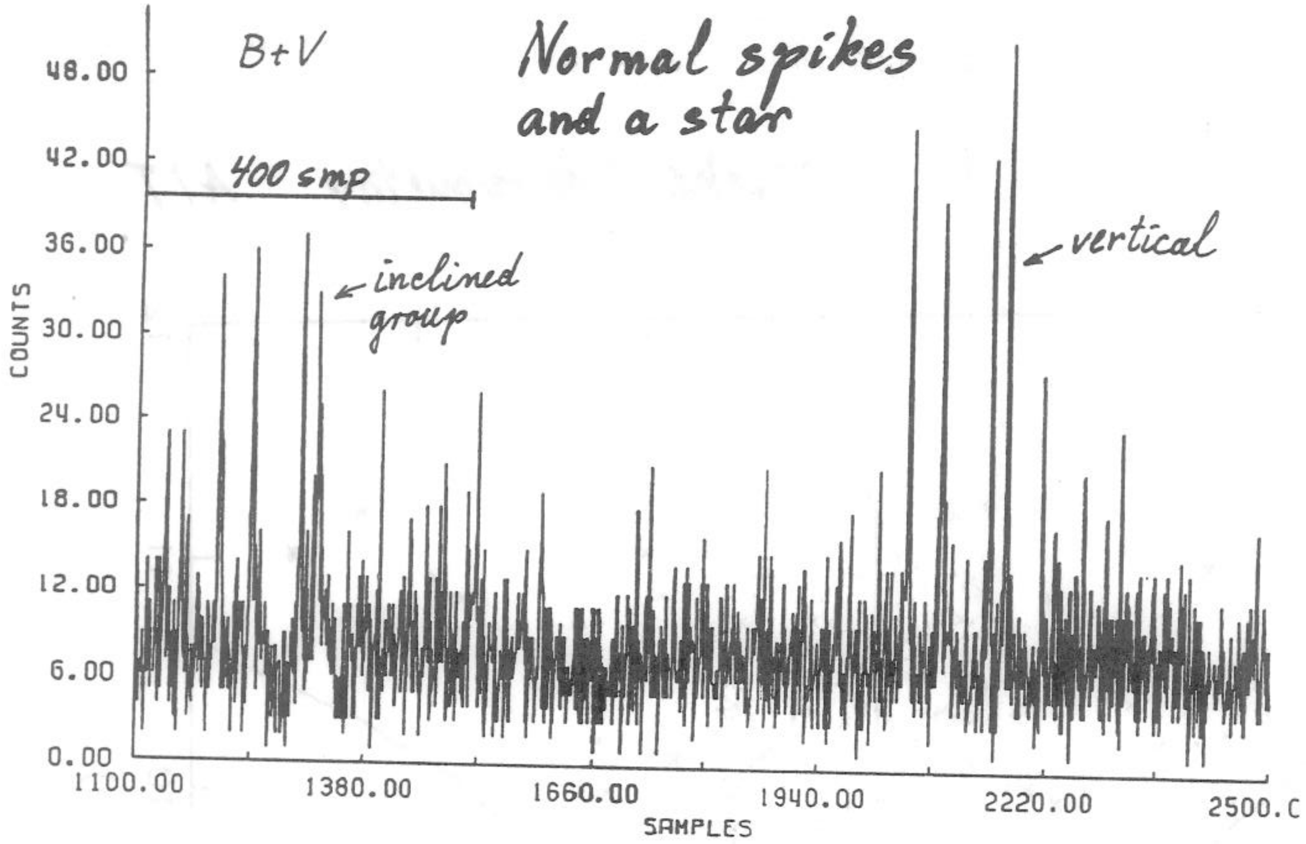

B+V
3200 smp
COUNTS
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1436800.00
1437440.00
1438080.00
1438720.00
1439360.00
1440000
SAMPLES

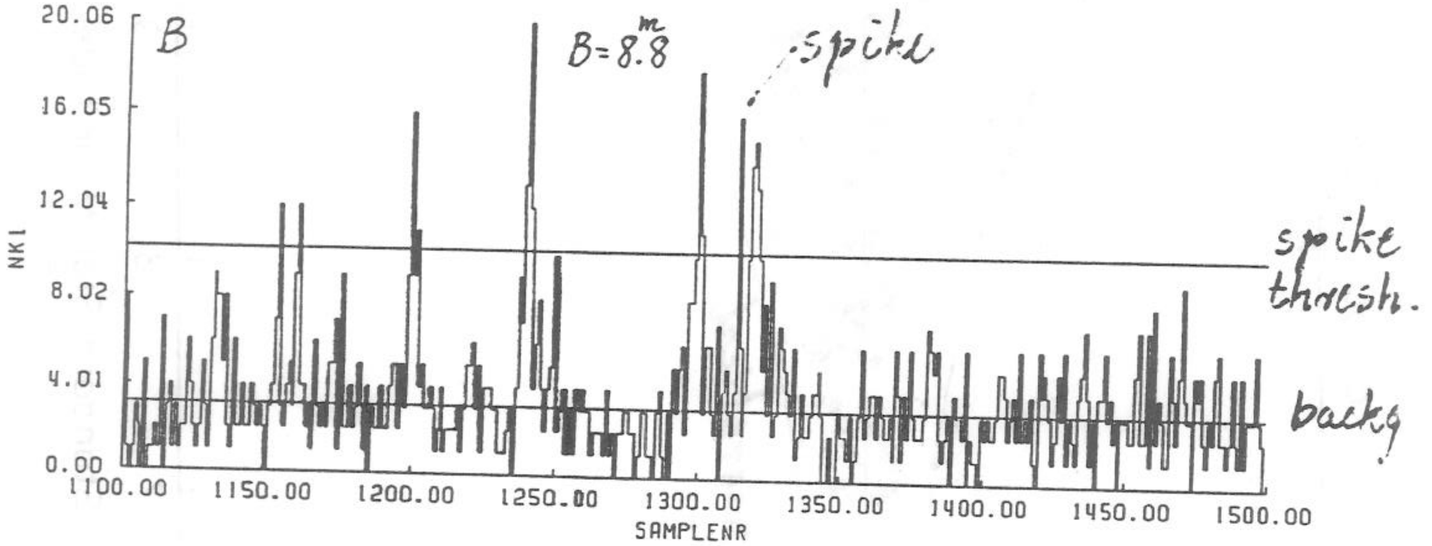

B 400 smp
periodic spikes
27 smp = 45.0 ms
NK1
130.00
104.00
78.00
52.00
26.00
0.00
5000.00
5050.00
5100.00
5150.00
5200.00
5250.00
5300.00
5350.00
5400.00
SAMPLENR

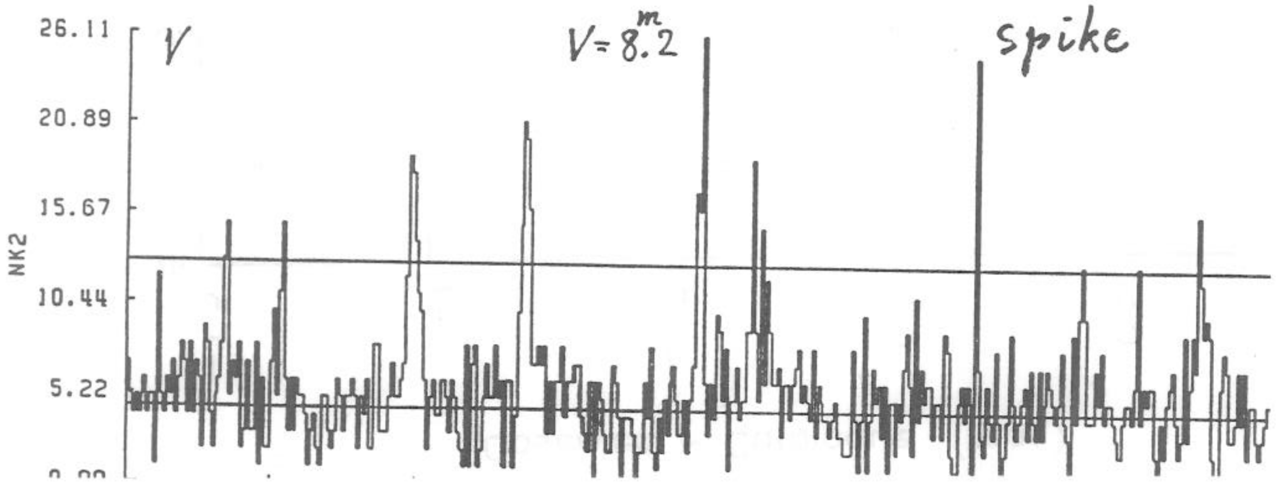

V 400 smp
NK2
130.00
104.00
78.00
52.00
26.00

Tycho Photometry A/T

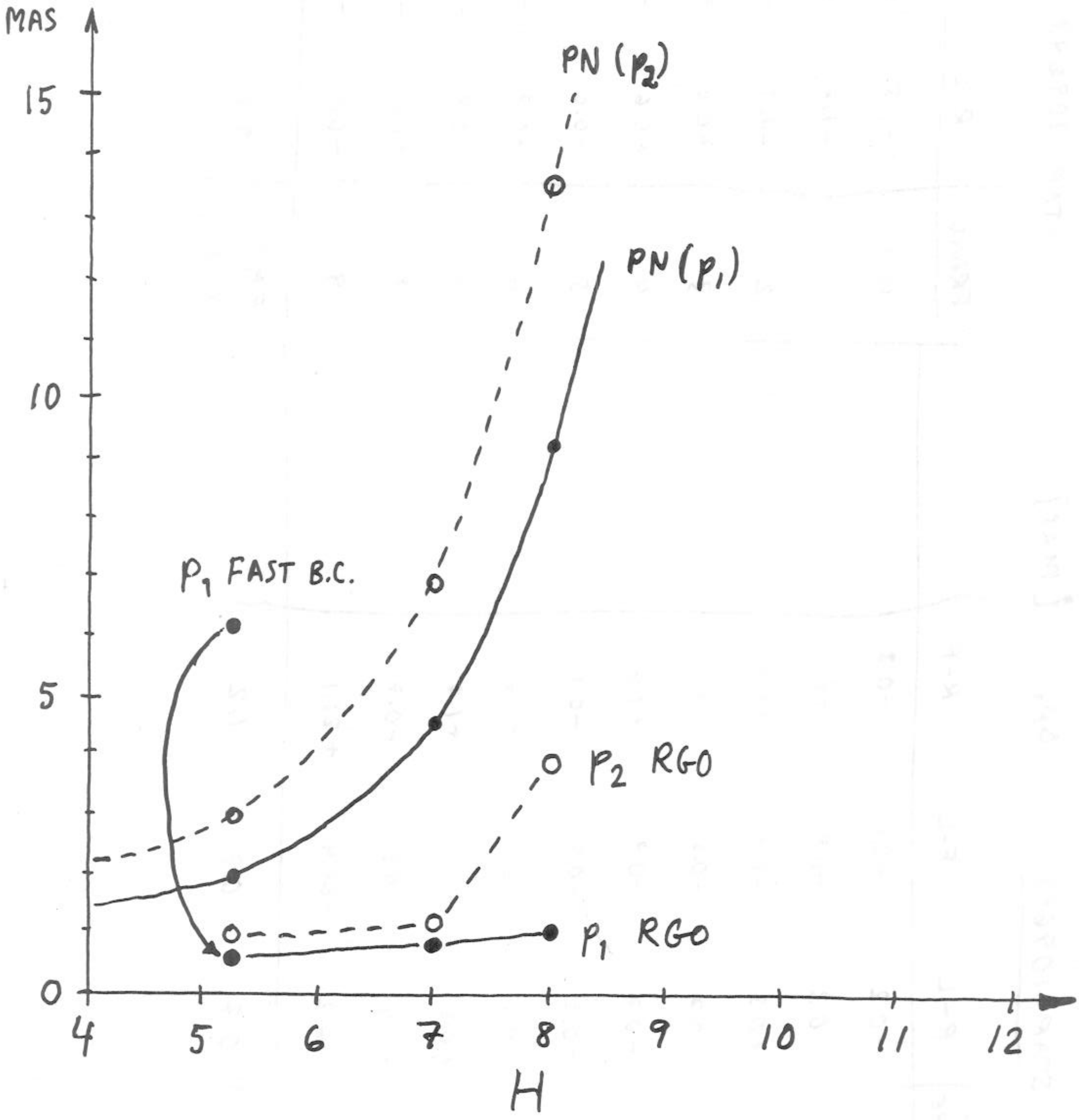



B+V
Normal spikes
and a star
400 smp
inclined
group
vertical
COUNTS
SAMPLES
48.00
42.00
36.00
30.00
24.00
18.00
12.00
6.00
0.00
1100.00
1380.00
1660.00
1940.00
2220.00
2500.C


B
B=8.8^m
spike
spike
thresh.
backg
NK1
SAMPLENR
20.06
16.05
12.04
8.02
4.01
0.00
1100.00
1150.00
1200.00
1250.00
1300.00
1350.00
1400.00
1450.00
1500.00


V
V=8.2^m
spike
NK2
26.11
20.89
15.67
10.44
5.22

Annex X

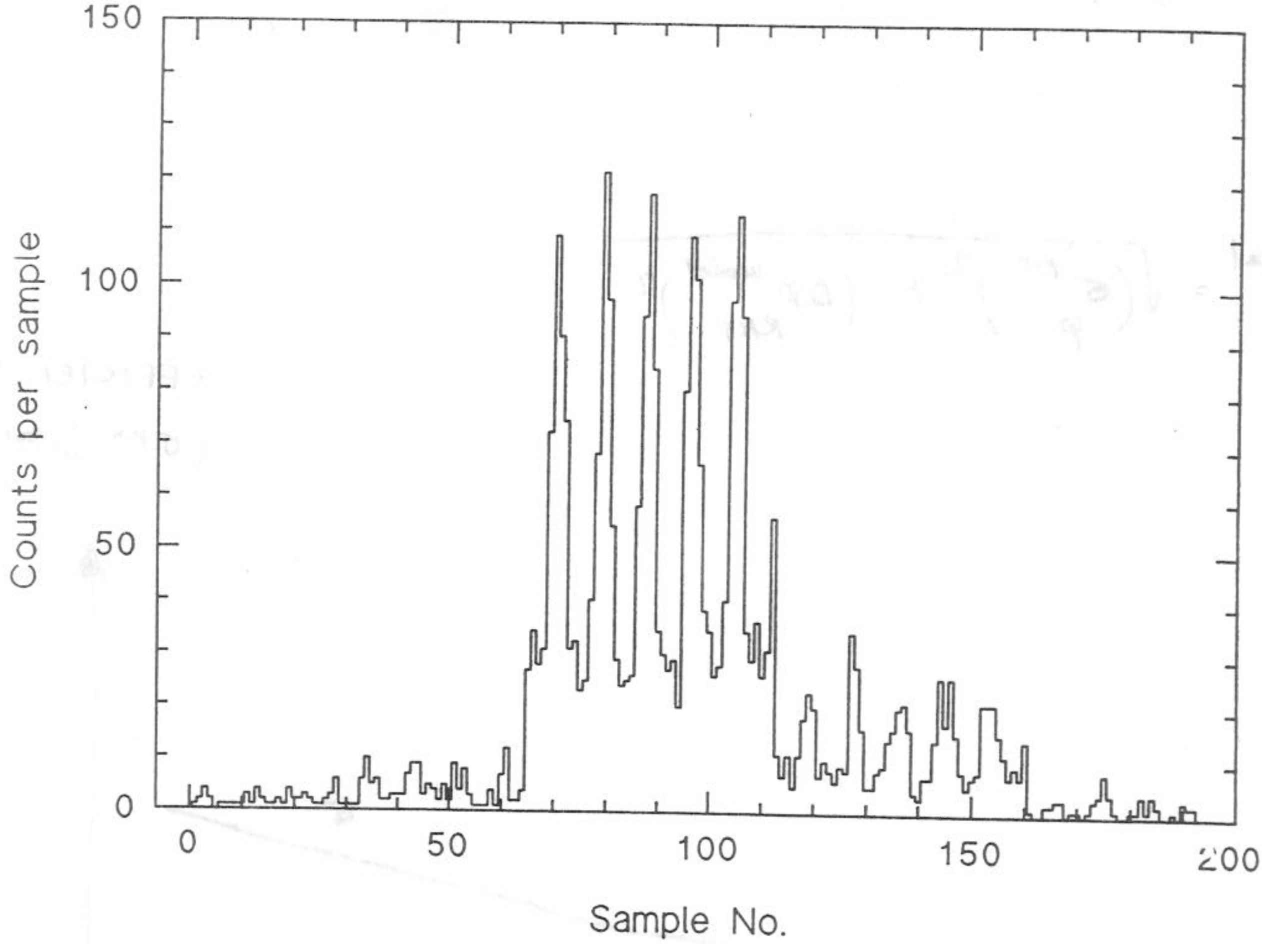


STAR 109693 Δp_1 [mas]

FRAME	R−L	F−L	R−F
0	−0.2	+0.1	−0.3
1	+0.3	−0.8	+1.1
2	+0.3	−0.9	+1.3
3	+0.7	−0.5	+1.2
4	+0.7	−0.9	+1.6
5	+0.3	+0.5	−0.1
6	+0.5	−0.1	+0.6
7	+0.5	−1.2	+1.7
8	+0.4	−0.3	+0.7
9	−6.2	−27.4	+21.1
RMS 1−8	0.7	0.7	1.2

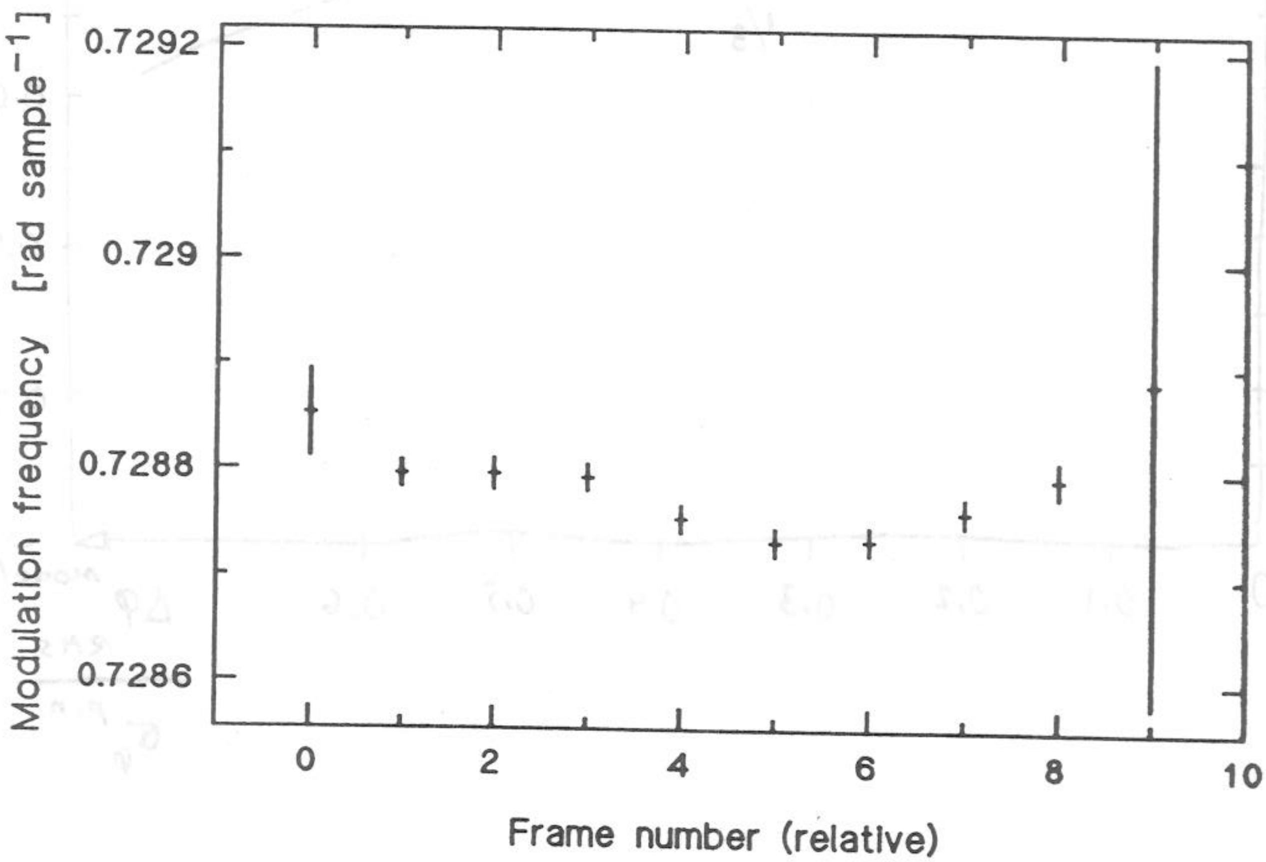
STAR 109693 Δp_2 [mas]

FRAME	R−L	F−L	R−F
0	−1.5	−4.8	+3.3
1	+1.7	−0.1	+1.8
2	+1.3	−1.3	+2.6
3	+0.0	−0.7	+0.7
4	+0.6	−0.6	+1.2
5	−0.0	−0.6	+0.6
6	+0.7	+0.0	+0.6
7	−0.4	−1.1	+0.7
8	+1.2	−0.2	+1.4
9	−6.9	−47.6	+40.8
RMS 1−8	0.9	0.7	1.4



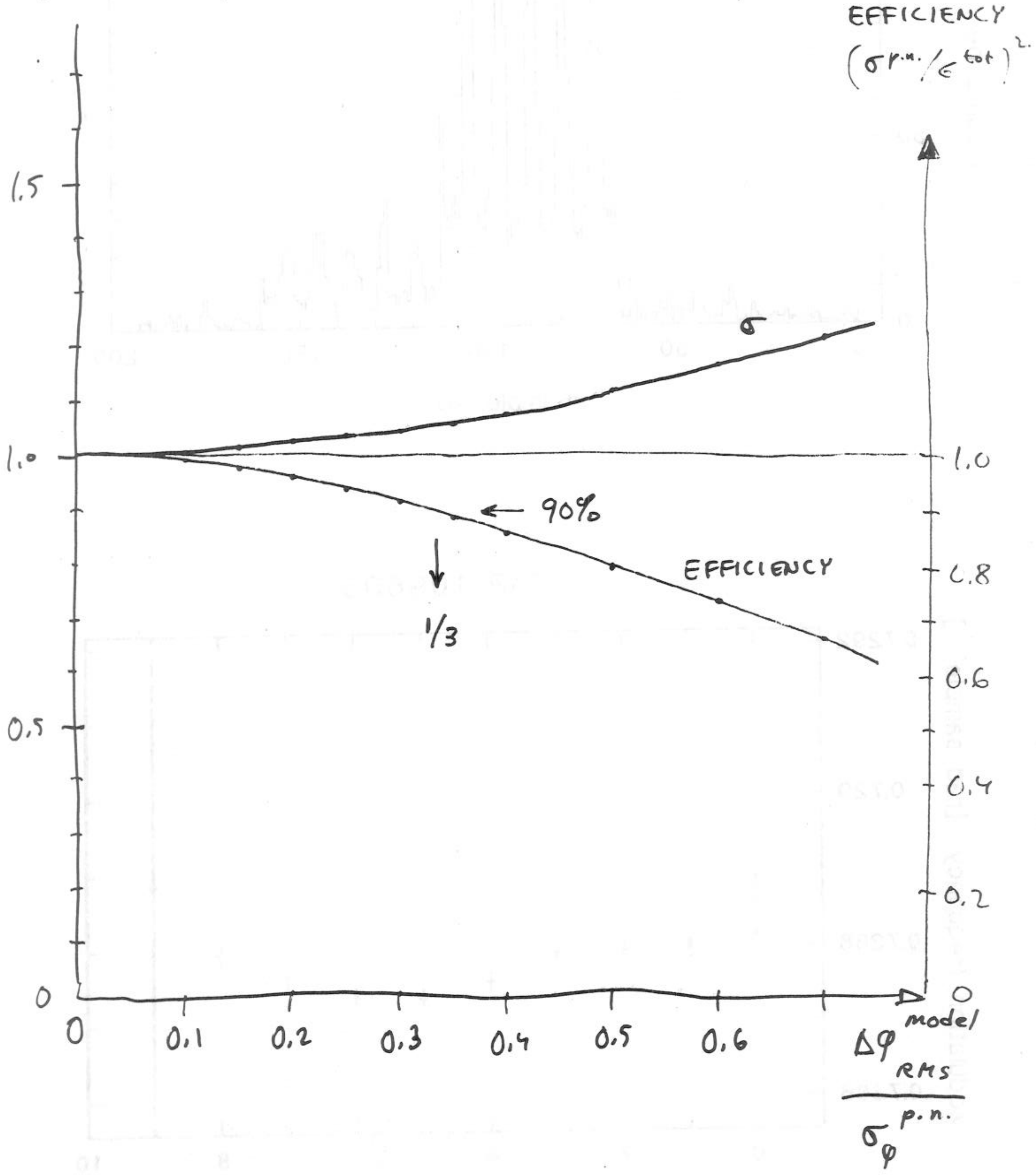
150
100
50
0
Counts per sample
0
50
100
150
200
Sample No.

STAR 109693



0.7292
0.729
0.7288
0.7286
Modulation frequency [rad sample⁻¹]
0
2
4
6
8
10
Frame number (relative)

$$\sigma_\varphi^{total} = \sqrt{\left(\sigma_\varphi^{p.n.}\right)^2 + \left(\Delta\varphi_{RMS}^{model}\right)^2}$$



ANNEX XI

RGC 601 - A TEST RGC

ORDRE DES COLONNES:
NHIP, HAMG/IC6, COLOR/IC6, FLAG FAST DE MULTIPLICITE, CODE INCA DES VARIABLES, HMAG/FST, SIGMA, DIFFERENCE SIGNEE, RAPPORT DIFF/SIGMA, NOMBRE DE TRANSITS, DATE MOYENNE EN MJD.

	Hp INCA				Hp FAST	σ Hp		O-C			
50756	10.75	1.09	1	0	11.205	.042	-	.455	10.8	6	47856.3
7776	12.20	1.71	1	0	12.020	.067	+	.180	2.7	4	47856.3
10312	11.37	1.71	1	0	11.527	.059	-	.157	2.7	1	47856.3
38615	6.76	.08	1	0	6.634	.008	+	.126	16.4	5	47856.3
1539	11.21	1.61	1	0	11.097	.085	+	.113	1.3	3	47856.2
37927	8.02	.27	1	0	7.924	.008	+	.096	12.1	2	47856.4
66291	11.76	-.20	1	0	11.668	.077	+	.092	1.2	6	47856.3
64945	9.36	.19	1	0	9.276	.014	+	.084	6.1	4	47856.3
78241	8.24	.84	1	0	8.156	.036	+	.084	2.3	6	47856.3
1866	10.93	1.27	1	0	10.847	.053	+	.083	1.6	3	47856.2
99677	8.34	.53	1	0	8.423	.030	-	.083	2.8	1	47856.4
111657	10.87	1.49	1	0	10.788	.038	+	.082	2.2	2	47856.2
68234	7.58	.20	1	0	7.500	.006	+	.080	12.6	6	47856.3
62231	11.31	1.28	1	0	11.239	.027	+	.071	2.6	4	47856.4
8438	9.92	.89	1	0	9.974	.028	-	.054	1.9	4	47856.2
37641	10.08	.21	1	0	10.134	.024	-	.054	2.2	1	47856.4
49444	11.09	.98	1	0	11.036	.016	+	.054	3.4	3	47856.4
51987	9.14	.74	1	0	9.192	.020	-	.052	2.6	2	47856.2

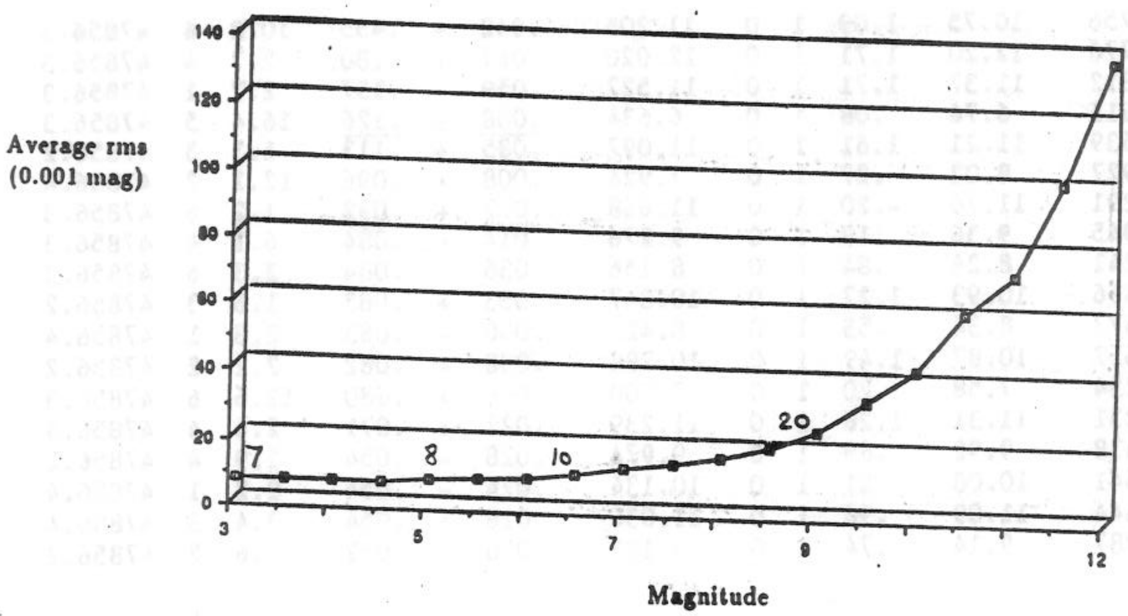
≤ ± .020 mag

130* Standard Quality

37399	6.68	-.17	1	0	6.677	.009	+	.003	.4	2	47856.2
37692	8.04	-.15	1	0	8.037	.021	+	.003	.2	5	47856.3
52279	8.71	.54	1	0	8.707	.011	+	.003	.3	4	47856.4
6276	8.68	.88	1	0	8.678	.013	+	.002	.2	4	47856.2
14426	10.70	.87	1	0	10.702	.105	-	.002	.0	4	47856.2
22280	6.64	1.24	1	0	6.638	.008	+	.002	.2	5	47856.3
46332	9.16	1.07	1	0	9.158	.032	+	.002	.1	5	47856.3
97420	7.09	.71	1	0	7.088	.012	+	.002	.2	3	47856.2
99467	8.98	.63	1	0	8.982	.021	-	.002	.1	2	47856.2
5164	5.58	0.00	1	0	5.579	.009	+	.001	.1	4	47856.2
35168	7.04	-.21	1	0	7.041	.016	-	.001	.1	1	47856.4
51491	5.57	-.03	1	0	5.569	.005	+	.001	.1	4	47856.4
54582	7.00	.65	1	0	6.999	.008	+	.001	.1	4	47856.3
13479	6.21	1.19	1	0	6.210	.006	+	.000	.1	4	47856.2
19095	5.70	.35	1	0	5.700	.007	-	.000	.0	5	47856.3
38467	9.79	-.03	1	0	9.790	.059	-	.000	.0	1	47856.4
44268	6.97	.09	1	0	6.970	.007	+	.000	.0	1	47856.4
49689	6.25	-.02	1	0	6.250	.011	-	.000	.0	4	47856.3

MAXIMUM ACCURACY

photon noise controlled



Not reached in early work :

R.M.S. ~ 0.024 mag.
SHOULD BE LESS FOR BRIGHT *

SOURCES OF NOISE

1. Photometric Standard

2. IFF

3. Data Reduction Method
   - Effect of binaries
   - Effect of noise on Hp (Amplitude)
   - Accuracy on FOV sensitivity mapping

THE REVISED STANDARD

1. Erratz error on gravity correction for Johnson UBV data CORRECTED
   ΔHp up to +.125 mag.
   if data from UBV only

2. Stromgren magnitudes no more used

   uvby data introduce more noise than reliability on the long-term STABILITY of standard stars

Ex HD 5268

	V	B	σ_V	σ_B	Nm	B_T-V_T	Hp
UBV	6.16	7.08	.005	.007	9	.924	6.416
uvby	6.20*	7.13	-	-	2	.933	6.465
Wel	6.16	7.01	-	-	3	.847	6.404
Gen	6.16	7.08	.011	.011	3	.923	6.421
W. Mean	6.16	7.07	.014	.035	17	.911 ±.030	6.421
	not p.e.			without uvby			6.417 ±.006

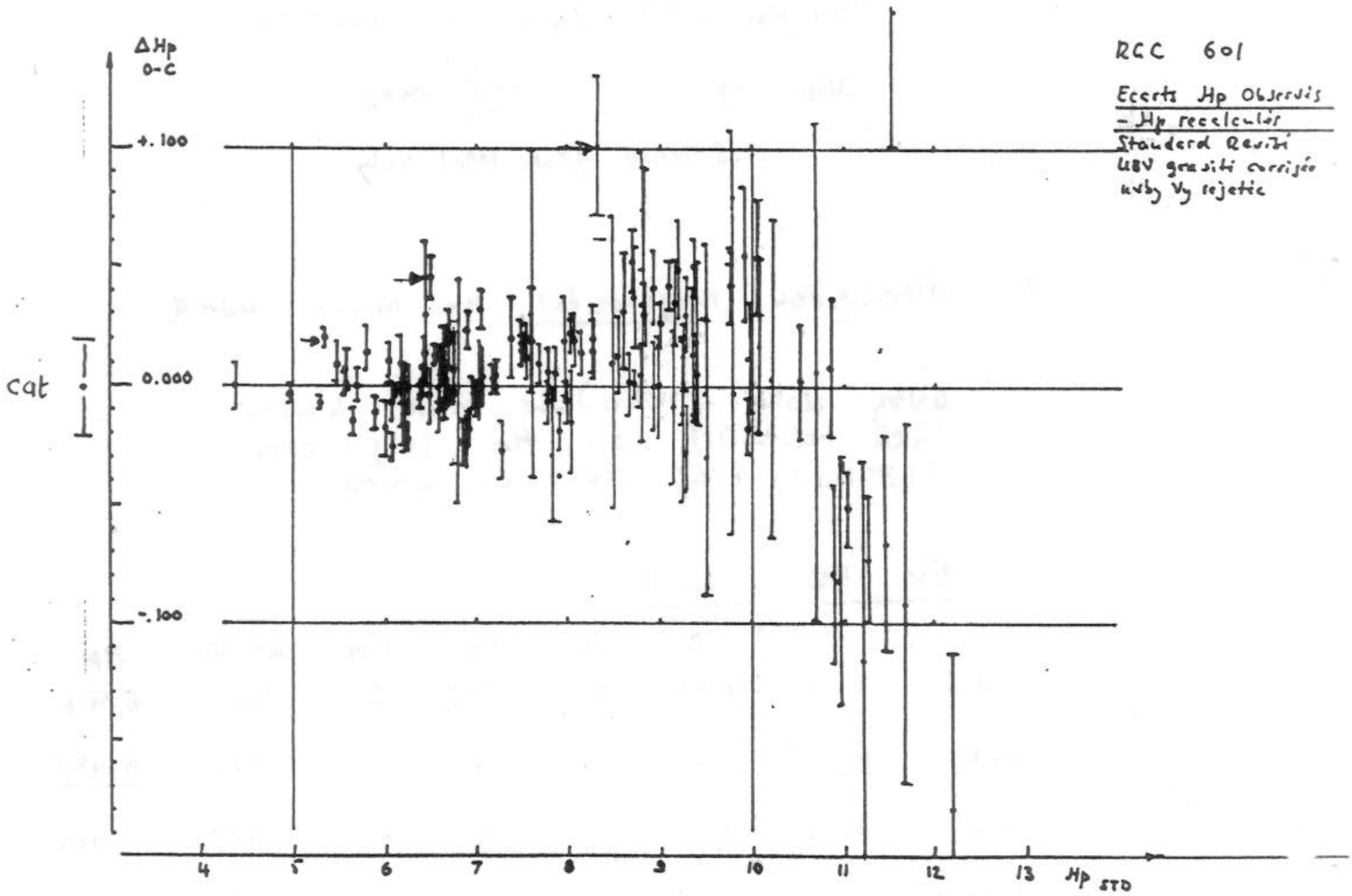
REVISED STANDARD FOR TEST RGC

601, 604, 704, 709

3 % less standards

11 % C → S standards

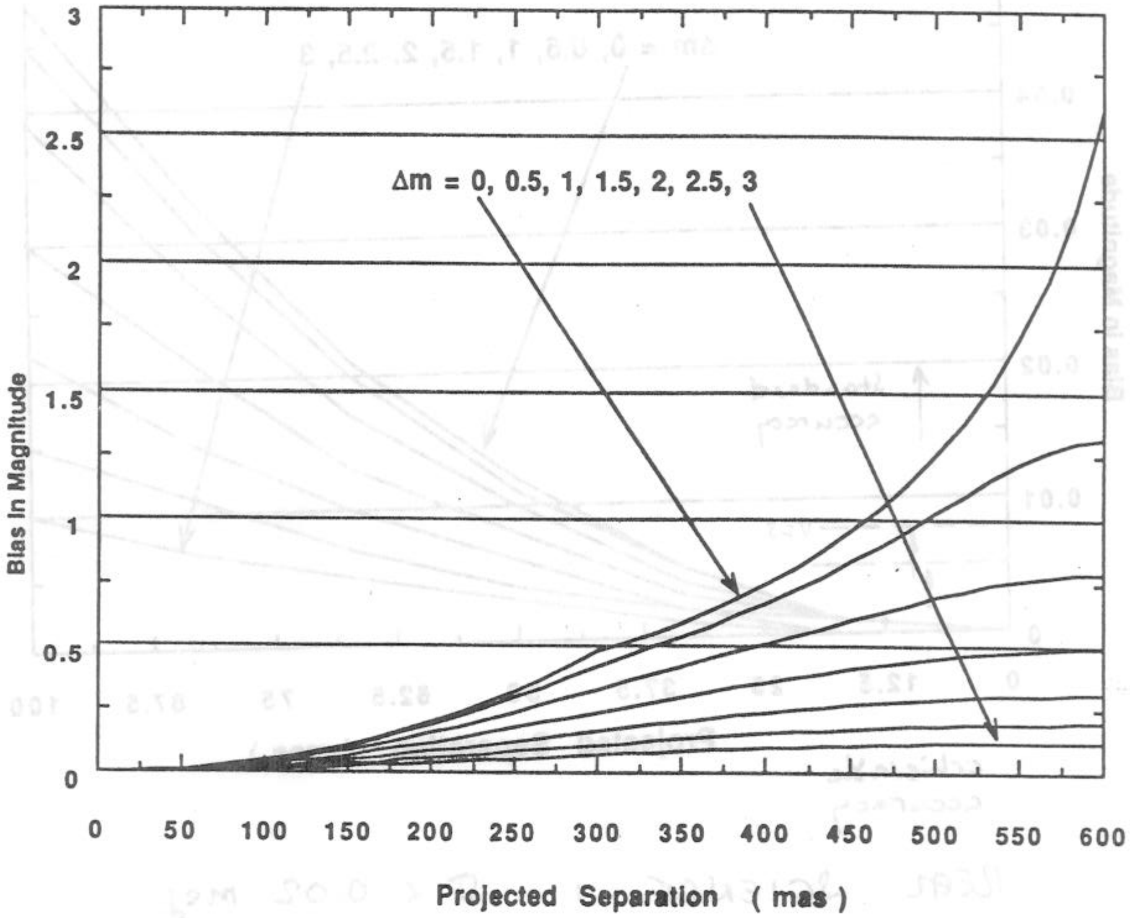
RGC 601 with Revised Standard



- Significant differences for some bright *
- Noise on faint end

BIAS in MAGNITUDE

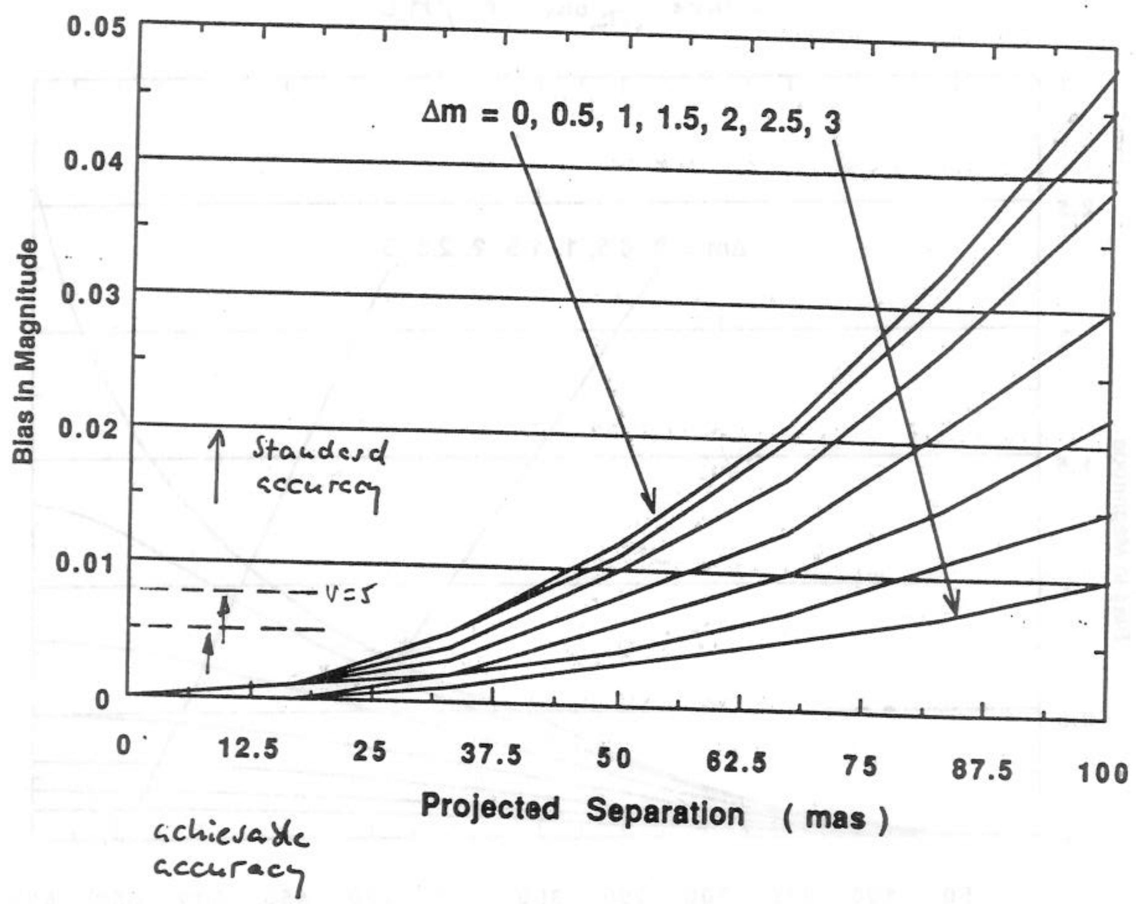
deduced from M1/M2



UNRESOLVED BINARIES (UNKNOWN)

systematic errors on Hp (M_1)

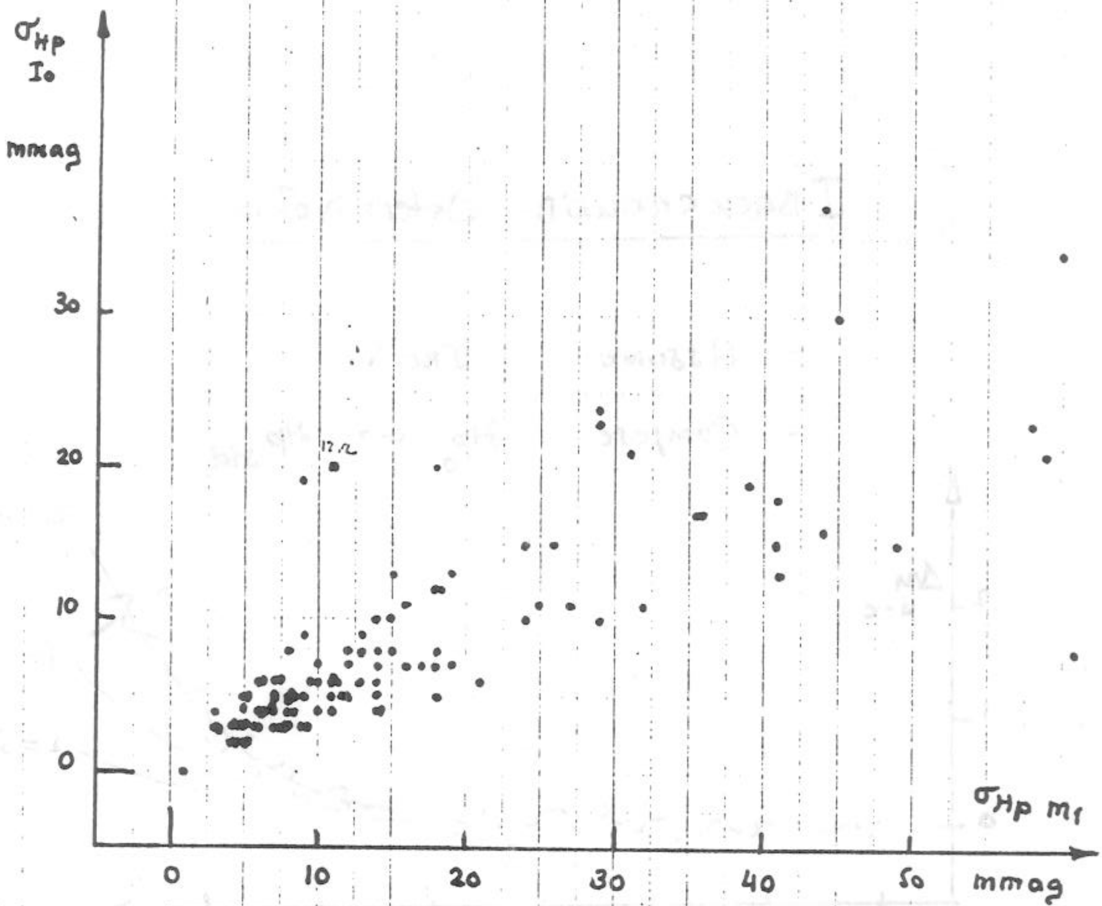
f (Δm , $\rho_\perp$)



REAL SCIENCE : σ < 0.02 mag

DECOUPLE : Stellar VARIABILITY

& Binarity effect



If IBG properly estimated :

m(Io) more accurate than m(M1)

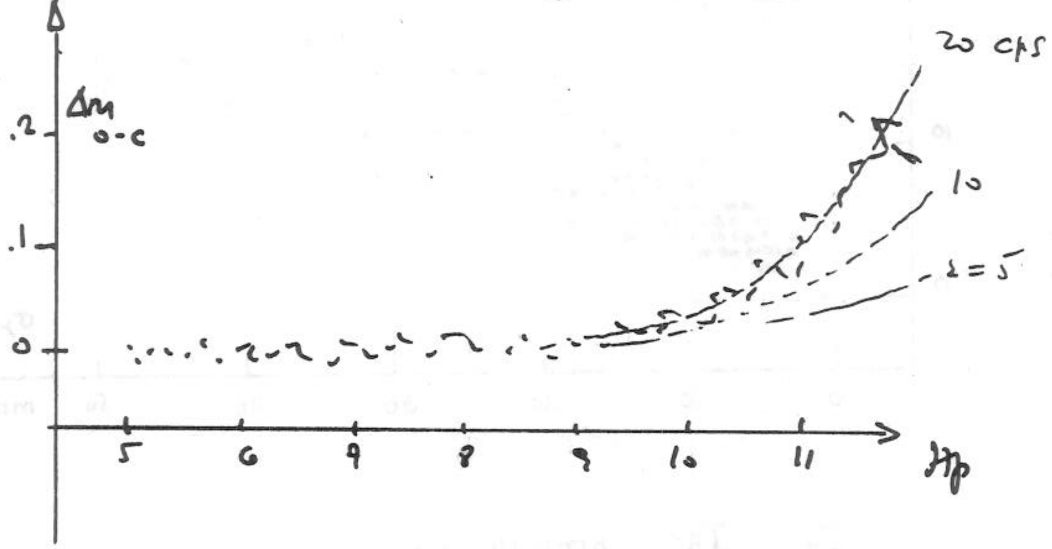
$$\sigma_{Hp\ I_0} \simeq 0.47 \cdot \sigma_{Hp\ m_1}$$

- LOSS OF MODULATION FOR BINARIES
- Io REPRESENTATIVE OF COMBINED FLUXES

→ COMPUTE Hp from Amplitude
& from Io
and compare !

I Background Determination:

- Assume ⟨ I_{BG} ⟩
- Compare Hp_0 ⟷ Hp_{std}

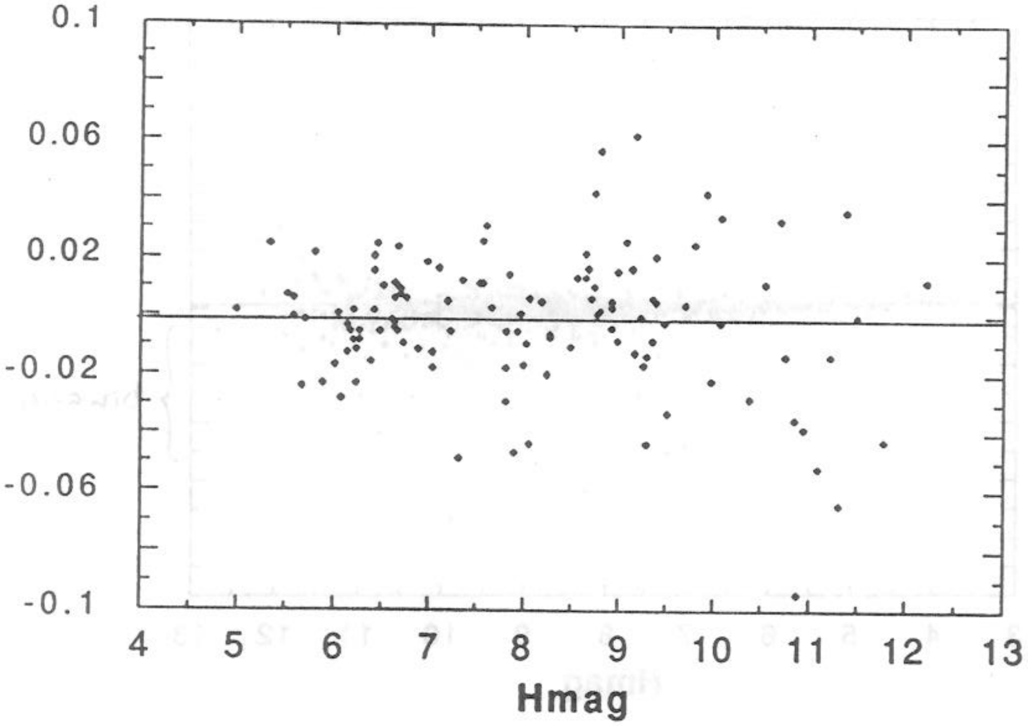


$$\Delta m = 2.5 \log \left[1 + \varepsilon / 8.82 \cdot 10^{6} \cdot 10^{-0.4 m} \right]$$

$$I_{BG} = \langle I_{BG} \rangle - \varepsilon$$

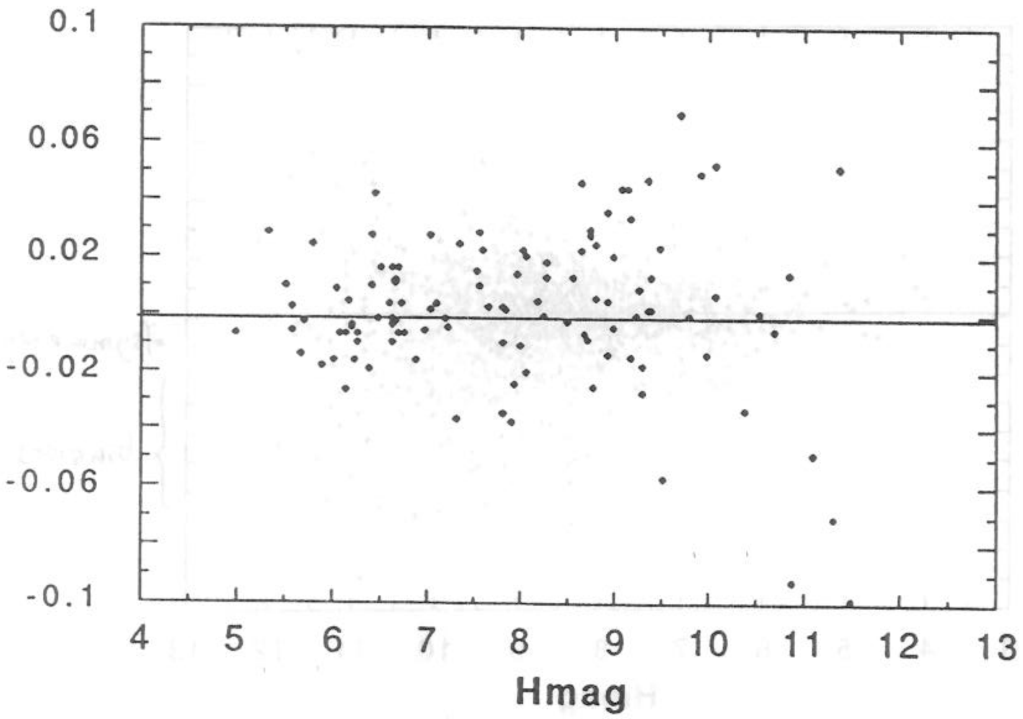
Accuracy 3-5 Hz

H intens. - H input



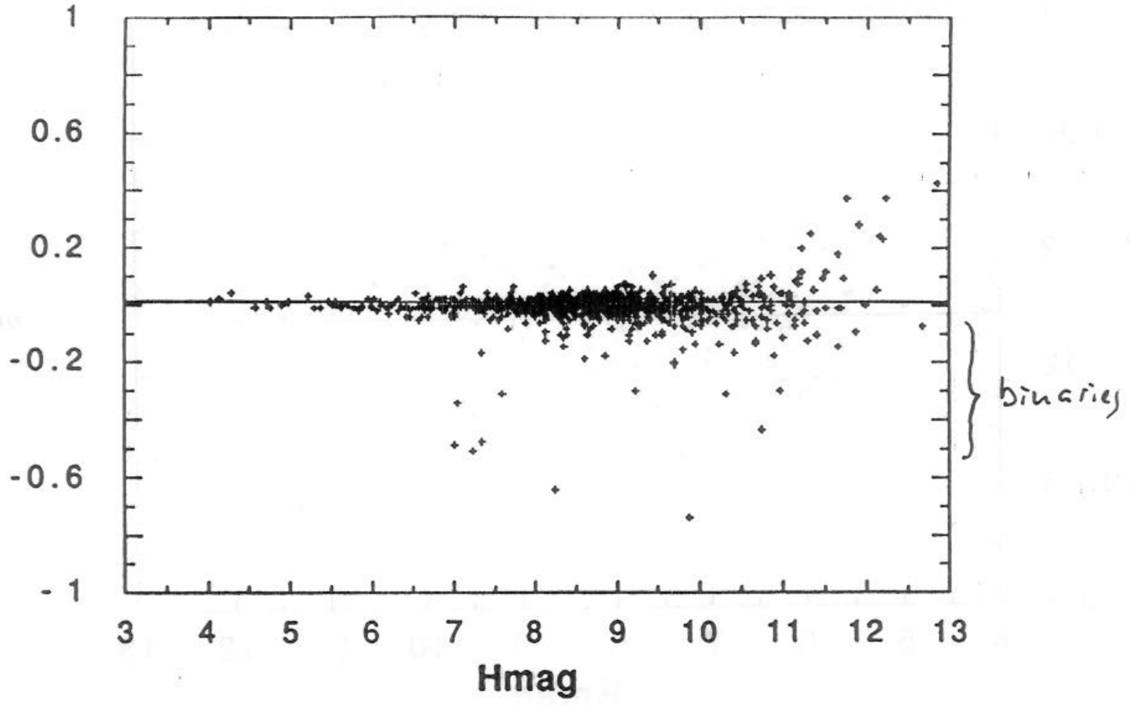
≤ .002

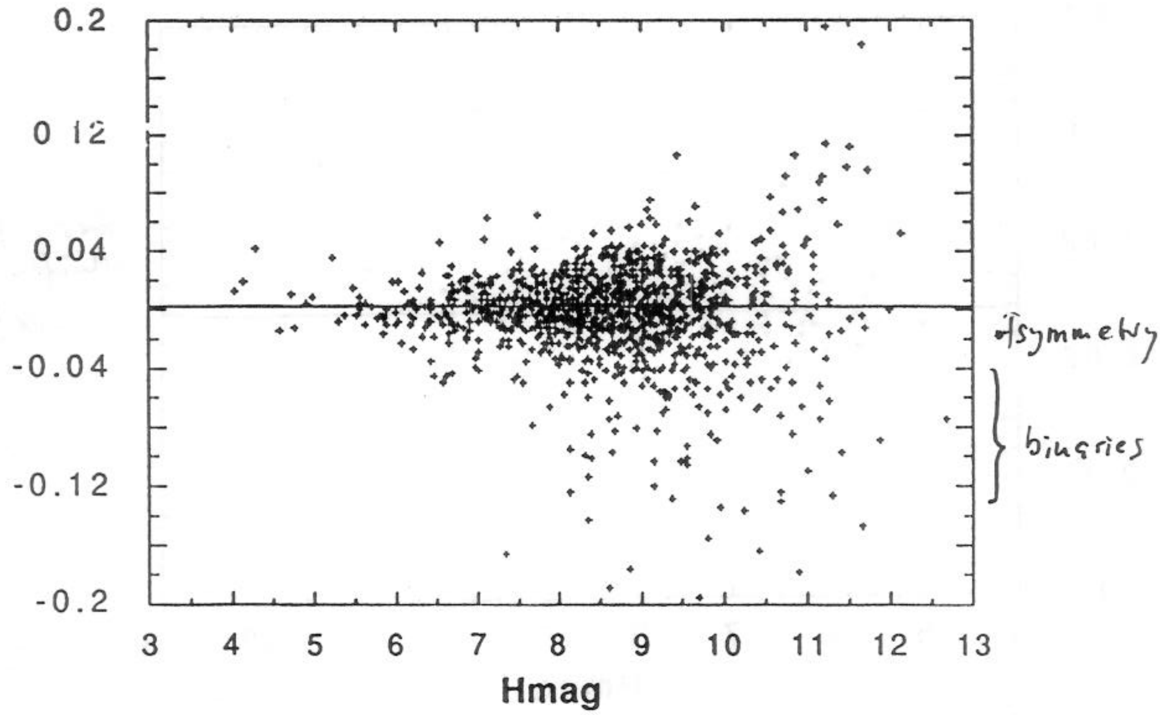
H amp. - H input



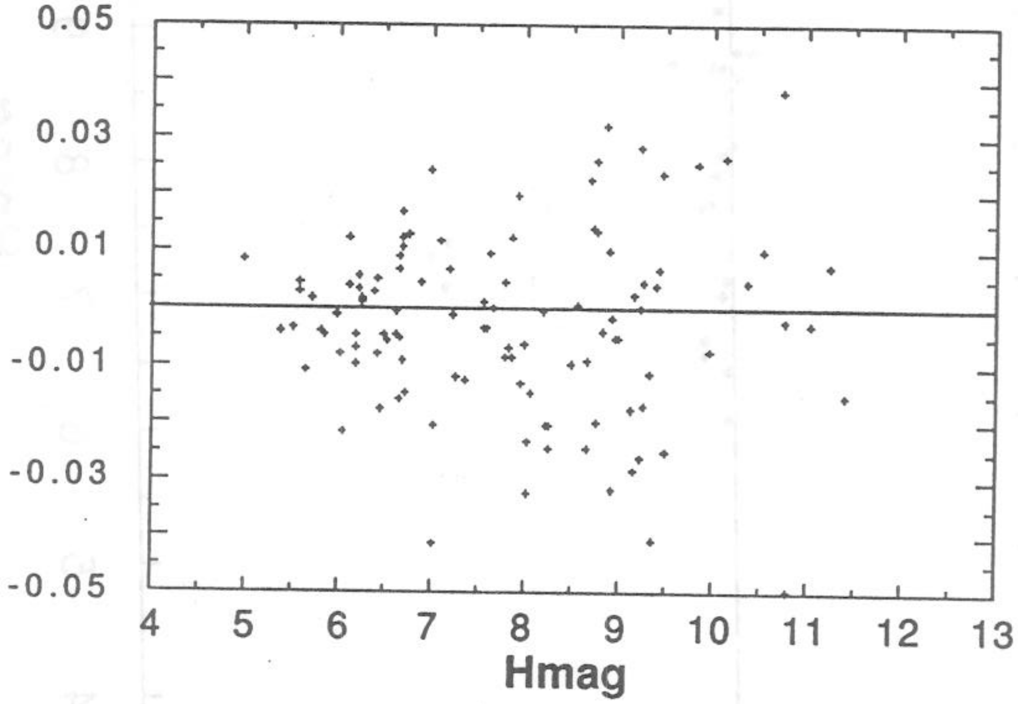
Zero point shift
~ .005 mag

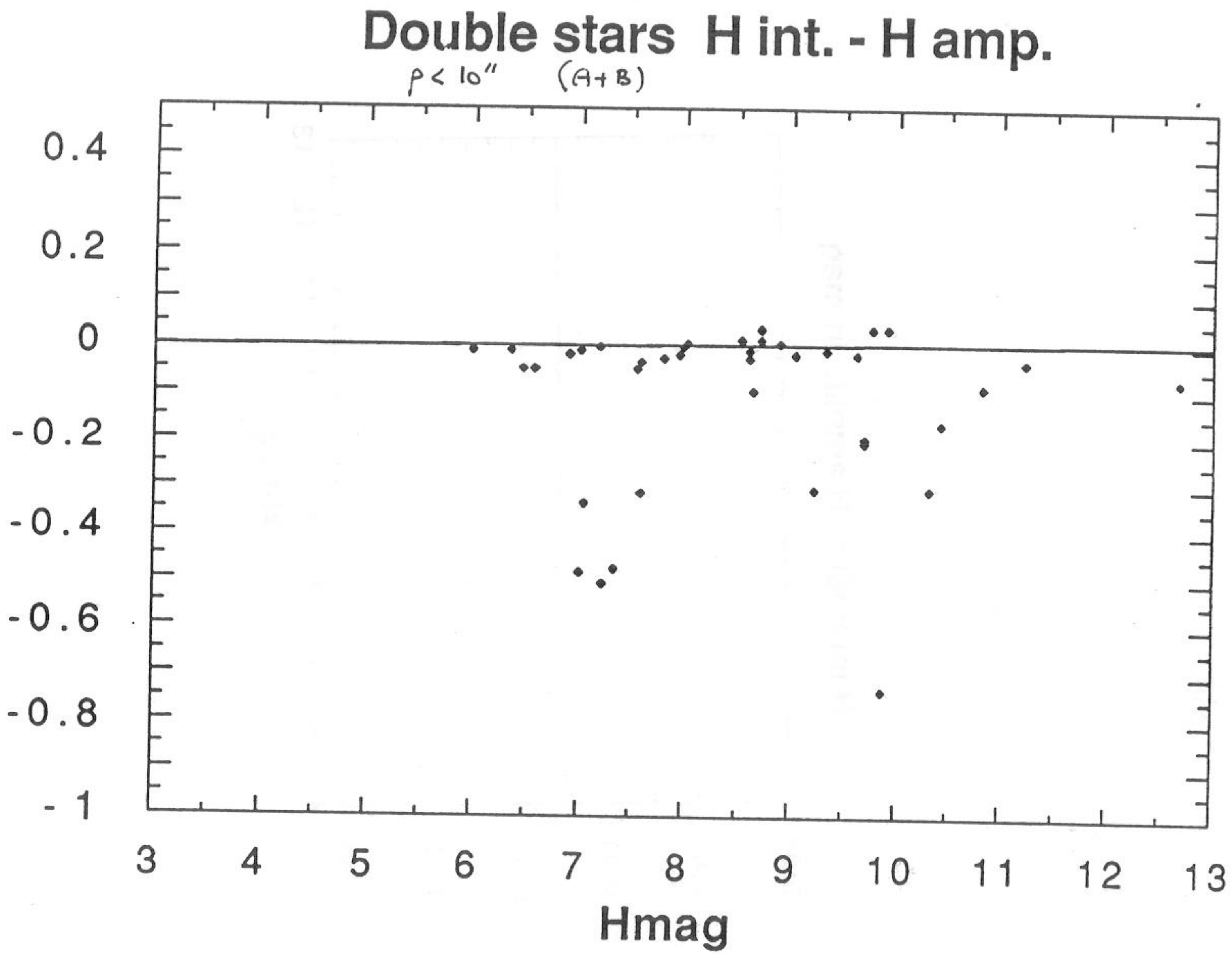
H intensity - H amplit. in mag





H intensity - H amplit. in mag




Double stars H int. - H amp.
ρ < 10"
(A+B)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
3
4
5
6
7
8
9
10
11
12
13
Hmag

DETECTION OF BINARIES

Examples :

ICS	Hp INCA	Hp m_1	σ	Hp I_0	σ	
42668	9.36	9.426	.015	9.435	.010	SINGLE
39574	9.71	9.824	.041	9.769	.015	double ?
44268	6.97	6.962	.007	7.046	.005	SINGLE
46332	9.17	9.151	.012	9.215	.008	"
49444	11.09	11.029	.049	11.102	.015	"
50756	10.75	11.144	.027	10.744	.011	DOUBLE not known by INCA
		Δm +.394				

A new double :

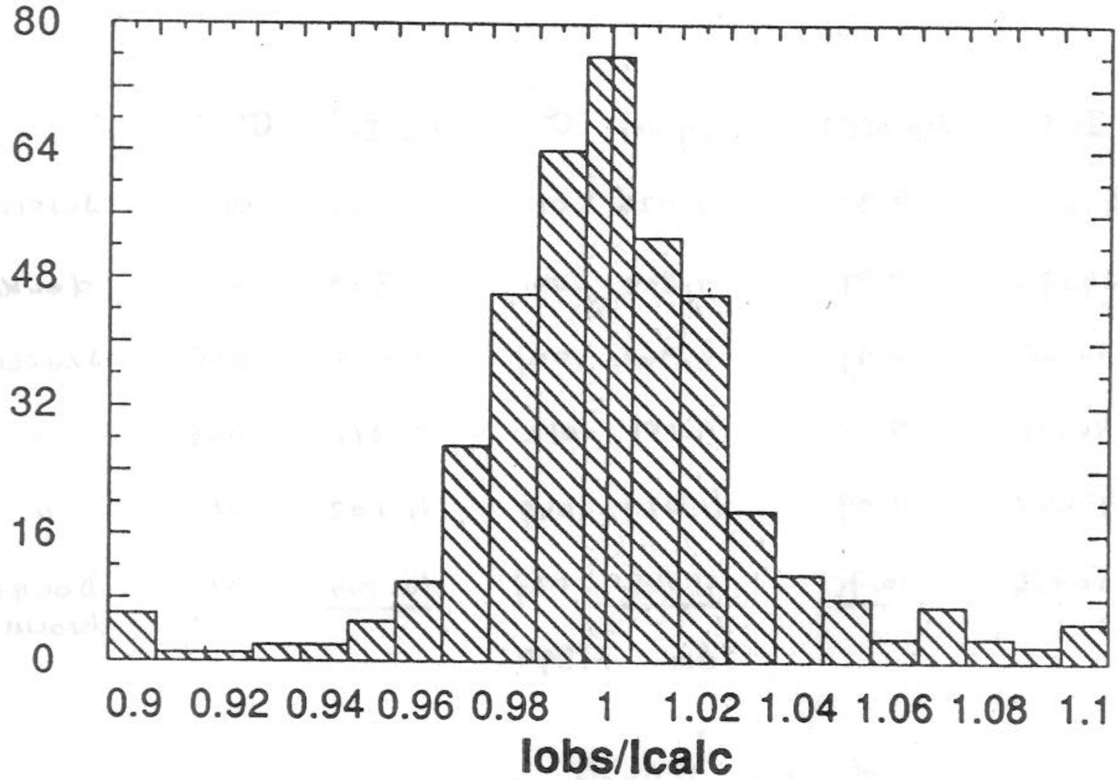
115112	8.27	8.885	8.238
		Δm +.615	

A SYSTEMATIC DETECTION OF BINARIES in the ρ range 60 - 600 mas where catalogues are the most uncomplete

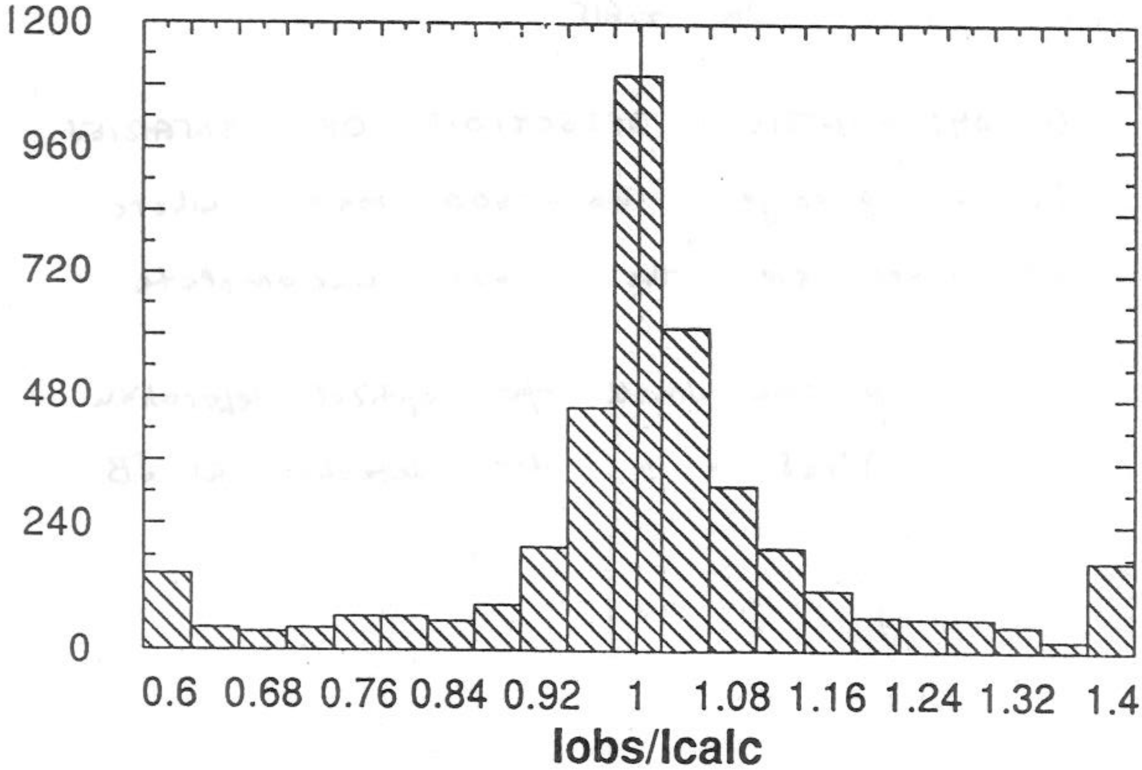
ρ too small for optical separation

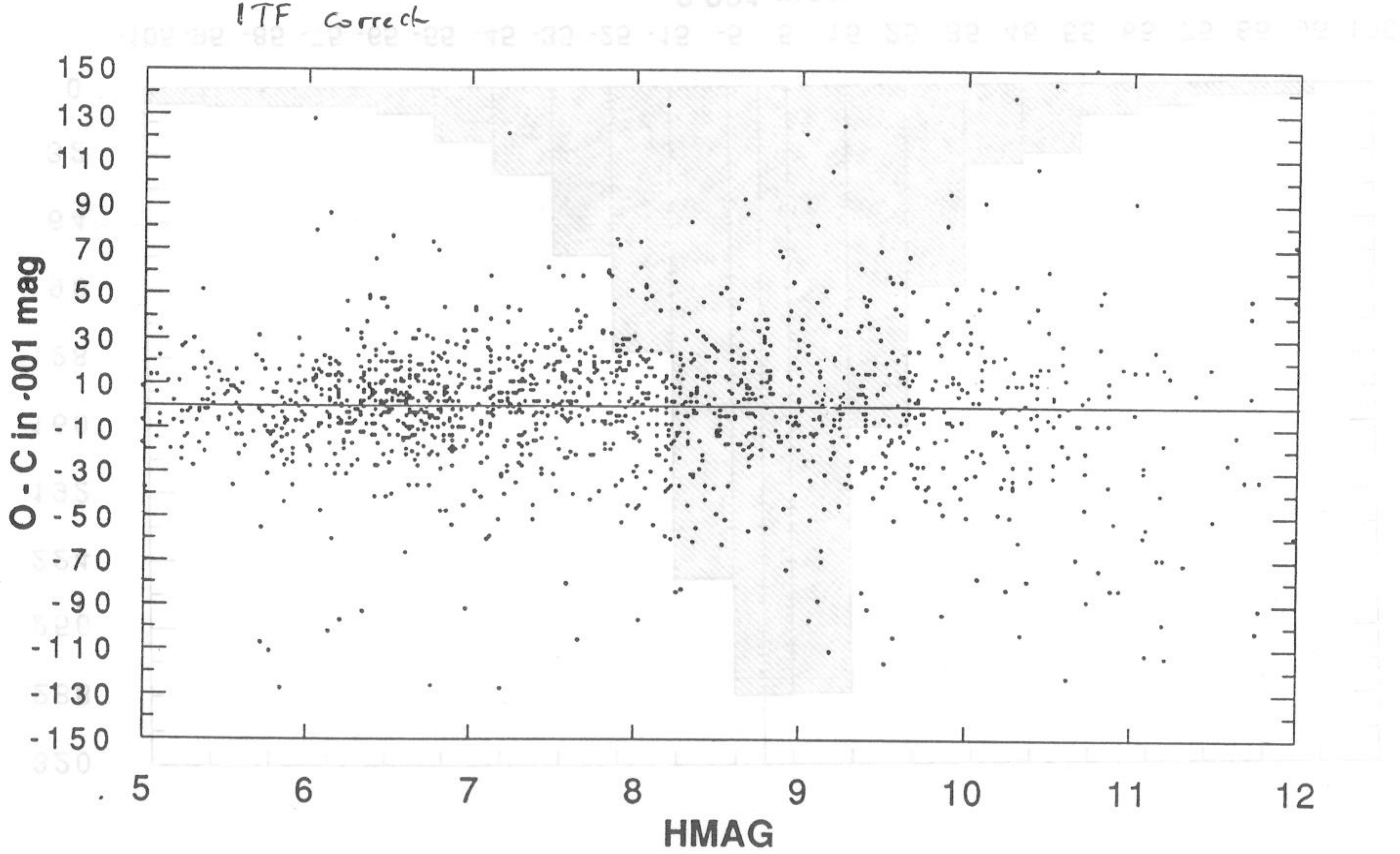
ΔVrad " " for detection as SB

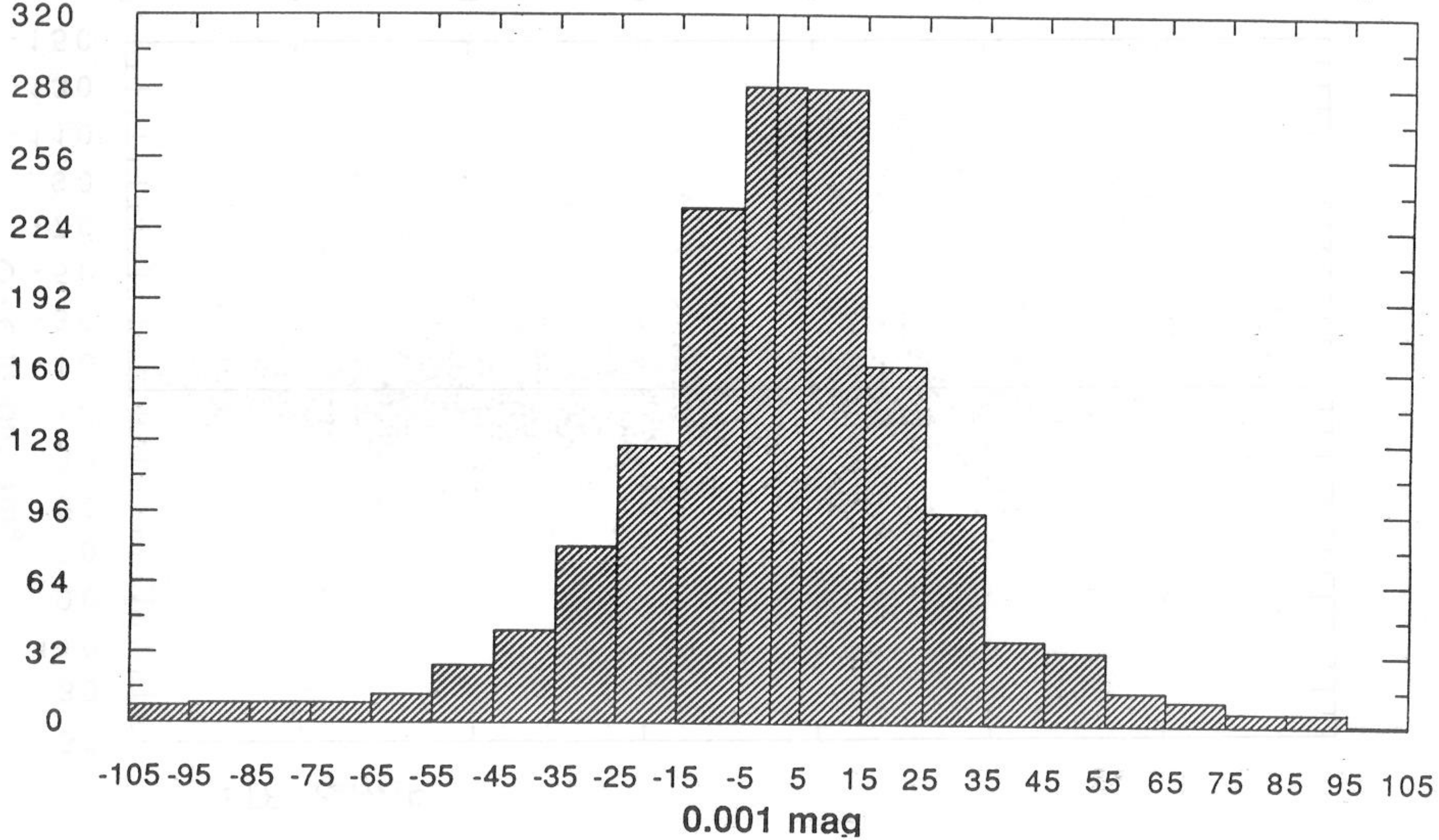
Results for standard stars



Results for single stars

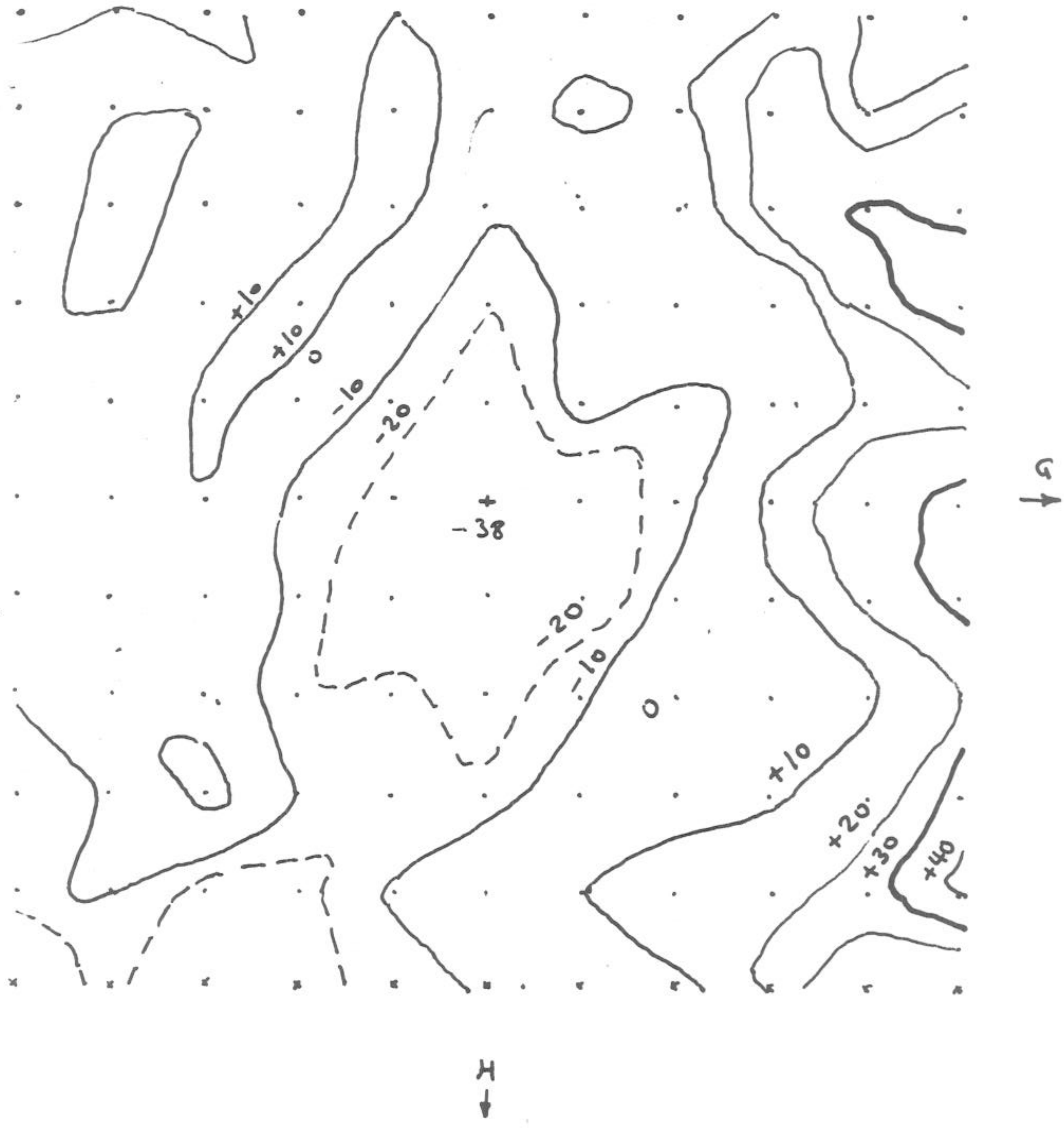



ITF correct
150
130
110
90
70
50
30
10
-10
-30
-50
-70
-90
-110
-130
-150
O - C in ·001 mag
5
6
7
8
9
10
11
12
HMAG


320
288
256
224
192
160
128
96
64
32
0
-105 -95 -85 -75 -65 -55 -45 -35 -25 -15 -5 5 15 25 35 45 55 65 75 85 95 105
0.001 mag

FOV 1 , C = 1 , λ 555 nm

IAC Report 1989



- Sensitivity gradients up to 20 mmes / step
- Almost impossible to redetermine on-orbit with a sufficient accuracy from polynomial fit

→ INTRODUCE A DETAILED MAPPING

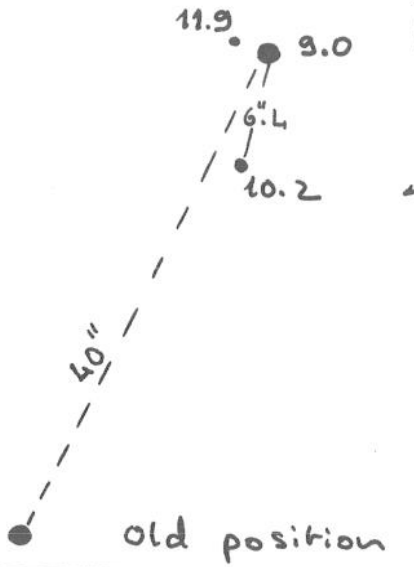
→ CALIBRATE THE LARGE-SCALE DEPARTURES due to ageing, gain variations etc.

MAPS FROM IAC NOT AVAILABLE WITH SUFFICIENT RESOLUTION FOR C = 2 (6 x 6 mesh)

ANNEX XII

Missing stars

IC 105 862 = joint triple system centered on A



new position for the system (Rousseau)

Old position (SIMBAD = CCDM)

Error of 40" in position !!

IC 104 519 = high proper motion star

Position measured by CAMC for a neighbour, much fainter star (under exposed and then not detected)

Identification error

Catalogue updates

1. Photometry

In progress • Revision of the list of standard stars (following the work of Grenon-Mignard)

In progress • Values of $B_T - V_T$ for stars with $B_T - V_T = 9.99$ in IC 6.

2. Positions

Done 12/3/90 • Correction of a mistake in the computation for photocenter ⇔ geometric center for joint systems:
[787 systems with a wrong position.
Mean difference : 0".65
9 * away by more than 3"].

In progress • Collection of additional proper motions or new positions (for those with epochs earlier than 1972).

3. "Erratic" errors

Always!! In positions or magnitudes

INCA contribution - 15 March 1990

Hipparcos reference and "non reference" star positions

F. Arenou, C. Turon
Observatoire de Paris - CNRS

I) Introduction

We received on 26 Feb. 1990 an e-mail from Phil Davis including :

- the data supplied by Hans van der Marel (DELFTA from test-tape 5 and DELFTB from test-tape 3) from the first great circle reduction,
- the data added by Phil Davies at ESOC, i.e. the INCA position accuracy predictions and the "star type" :
  - 1 : non reference star
  - 2 : "bad" reference star
  - 3 : "good" reference star

along with some statistics on the data.

Two first graphs, fig. 1 and fig. 2, show the distribution of good and bad reference stars and of non reference stars with respect to the abscissa on the great circle and the difference (INCA - g.c abscissa). These graphs first alerted us on the fact that "non reference stars" may be as good as "bad" or even perhaps "good" reference stars with respect to the quality of positions.

The note underneath presents the results of this first analysis of these preliminary results.

II) Reference stars.

"Reference stars" are defined at ESOC by the following criteria :

- B_T 5 to 10 mag.
  σ_{BT} < 0.5 mag.
- variable stars : only those with an amplitude of variation $\Delta m < 0.2$ mag. are kept. (i.e. those quoted *5 in the Input Cat.)
- double and multiple stars are kept only :
  - if : $\rho > 23$ arcsec. (separation)
  - or : $\Delta m > 1.5$ mag. (difference of magnitude between components)
  - or : $\rho < 0.8$ arcsec and $\sqrt{\rho^2 + \sigma_{pos}^2} < 0.8$ arcsec

Among these stars :

- $\sigma_{pos} \leq 0.4$ arcsec ⇒ "good reference stars"
- $0.4 < \sigma_{pos} \leq 0.8$ arcsec ⇒ "bad reference stars"

The distribution of these "good" and "bad" reference stars versus :

- "INCA - g.c. abscissa" = difference between the abscissa on the great circle as computed from position given in the Input Catalogue and the abscissa on the great ci[rcle] as resulting from the great circle reduction. It is reminded that va[lues] outside [-.6",+.6"] are folded back into that range.
- σ_{INCA} = sigma on position $= \sqrt{\sigma^2_{\alpha\cos\delta} + \sigma^2_\delta}$ as given in the Input Catalogue

are given in fig. 3.

III - Non reference stars.

The distribution of non reference stars versus (INCA - g.c. abscissa) is given in fig. 4, in compari[son] with those of good and bad reference stars. The comparison of these distributions lead to the idea that [non] reference stars may be a mixture of stars with precise and less precise positions.

The distribution of non reference stars versus σ_{INCA} and B_T magnitude are given in fig. 5 and fig respectively. They show that the bulk of these stars :

- have a $\sigma_{INCA} < 0.5$ arcsec.
- have a magnitude brighter than 11 in B_T.

The distribution of some subgroups among non reference stars (variable stars excluded) versus "INC[A -] g.c. abs." are given in fig. 7 :

(a) good and bad reference stars for comparison,
(b) non reference stars, spread into two groups versus σ_{INCA} :
  $\sigma_{INCA} < 0.4$ arcsec.
  $0.4 \leq \sigma_{INCA} < 0.8$ arcsec.
(c) non reference stars with $\sigma_{INCA} < 0.4$ arcsec, spread into two groups versus B_T :
  $B_T < 10.5$ mag.
  $10.5 \leq B_T < 11$ mag.

The conclusion is that "non reference stars" with $\sigma_{INCA} < 0.4$ arcsec are not worse than "good reference sta[rs]" even up to $B_T = 11$ mag.(and the choice of V_T instead of B_T would still be more appropriate !).

IV - Conclusion.

The two-dimensional distributions of the non-reference stars (variable stars excluded)

- versus B_T and σ_{INCA},
- versus B_T and "INCA - g.c. abs."

are given in fig. 8 and 9, respectively.

The conclusion is that 300 to 500 additional stars may be considered as reference st[ars] (depending on the exact limits used in B_T and σ_{INCA}) as compared with the ~ 1500 refere[nce] stars of these two tapes presently used for RTAD.

Annex XVII

fig 1
(tape 5)

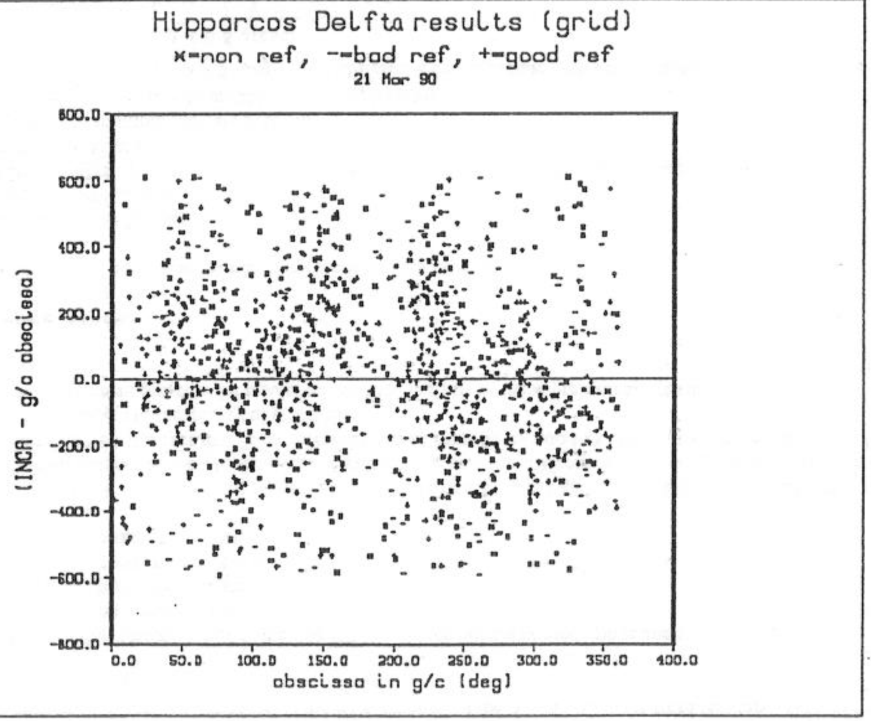
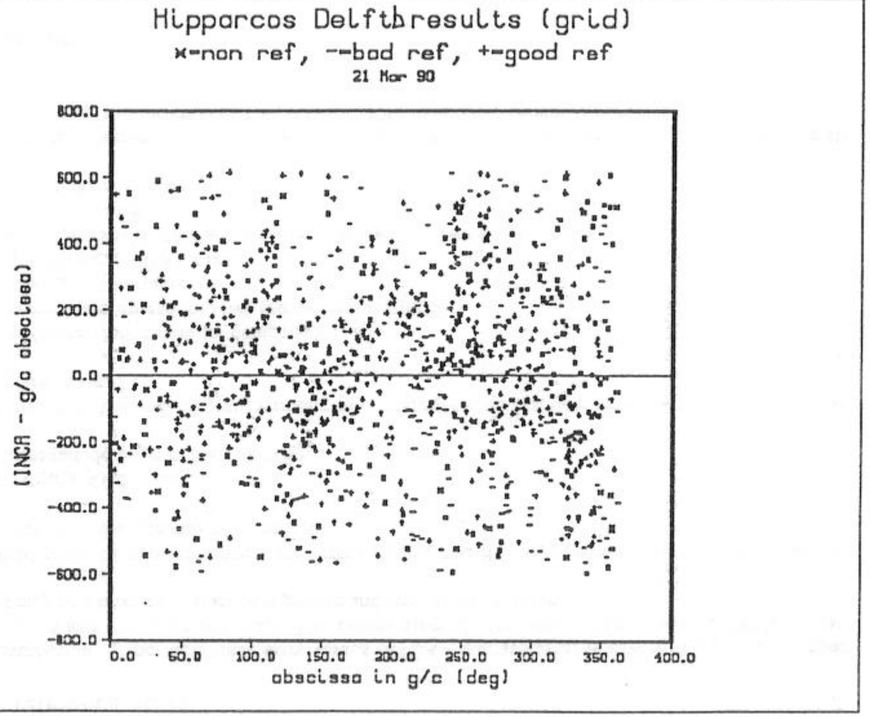


fig 2
(tape 3)



DELFT A+B

FiG3

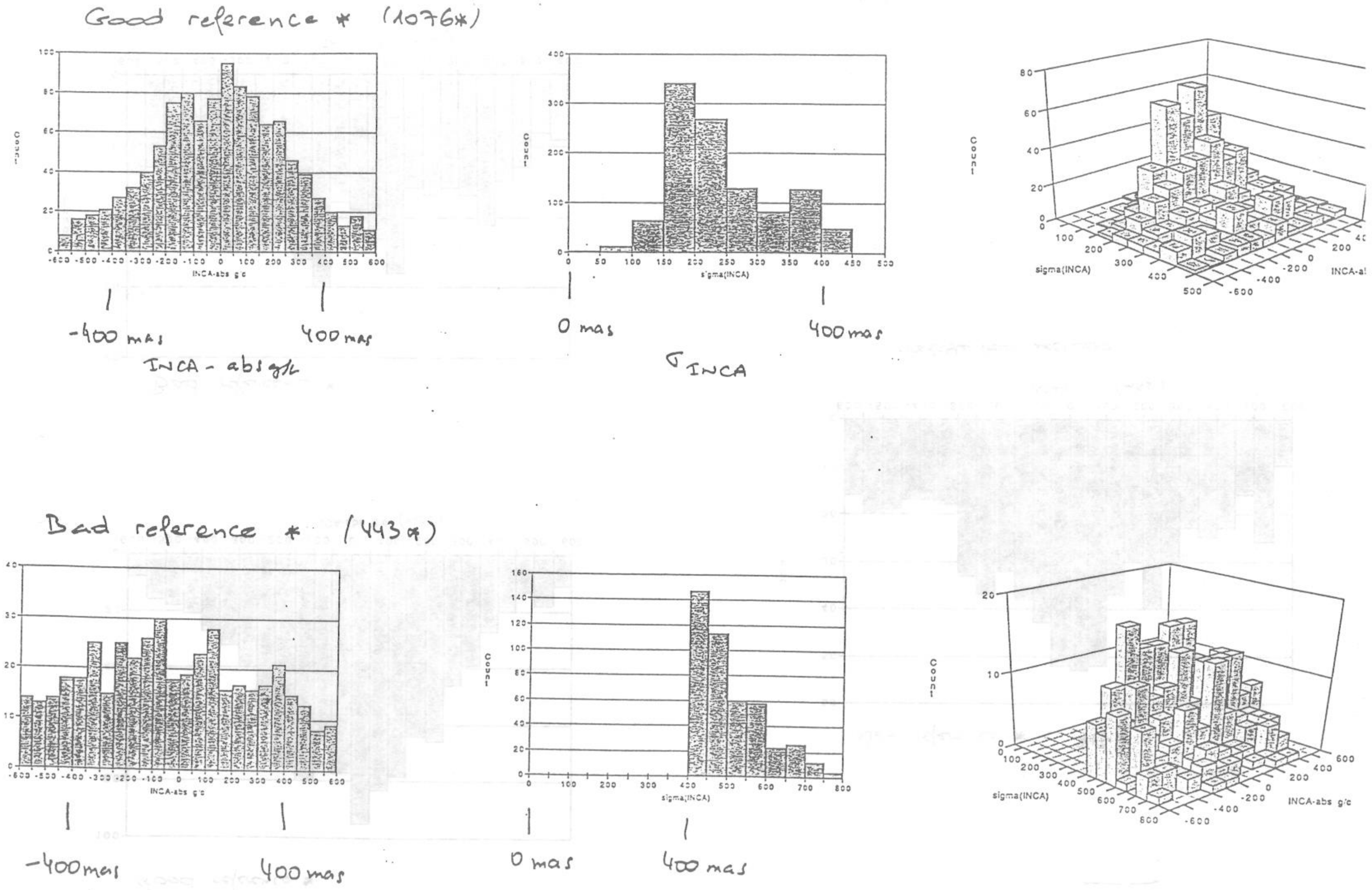
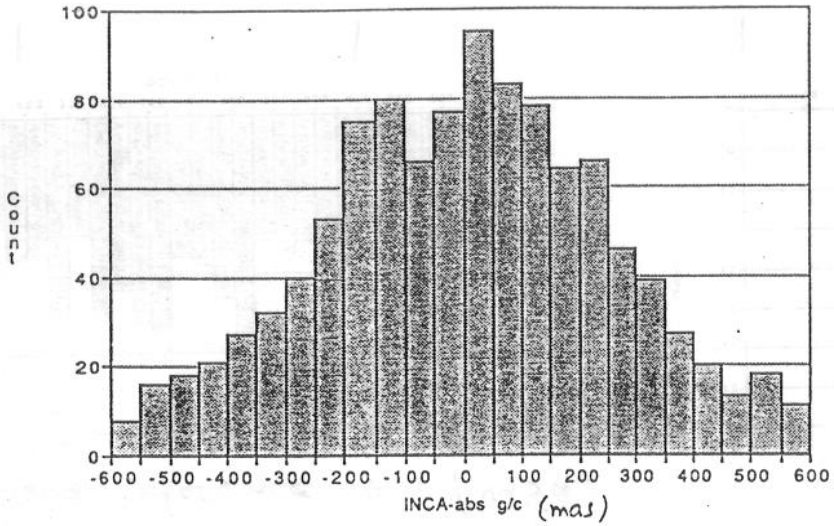
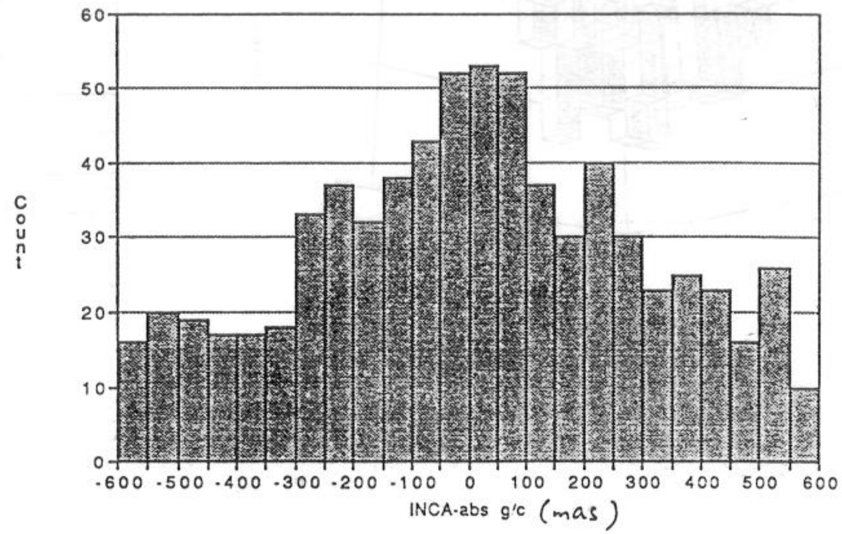


FiG 4

Good reference *

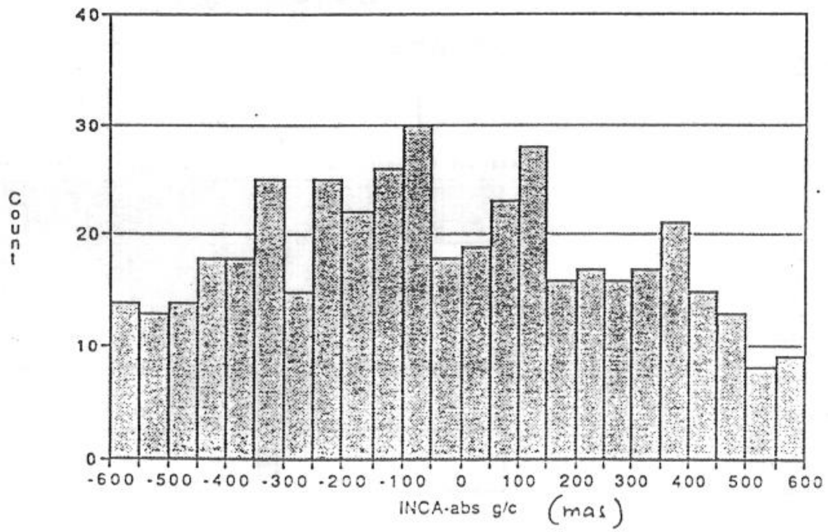


Non reference * : 713 *



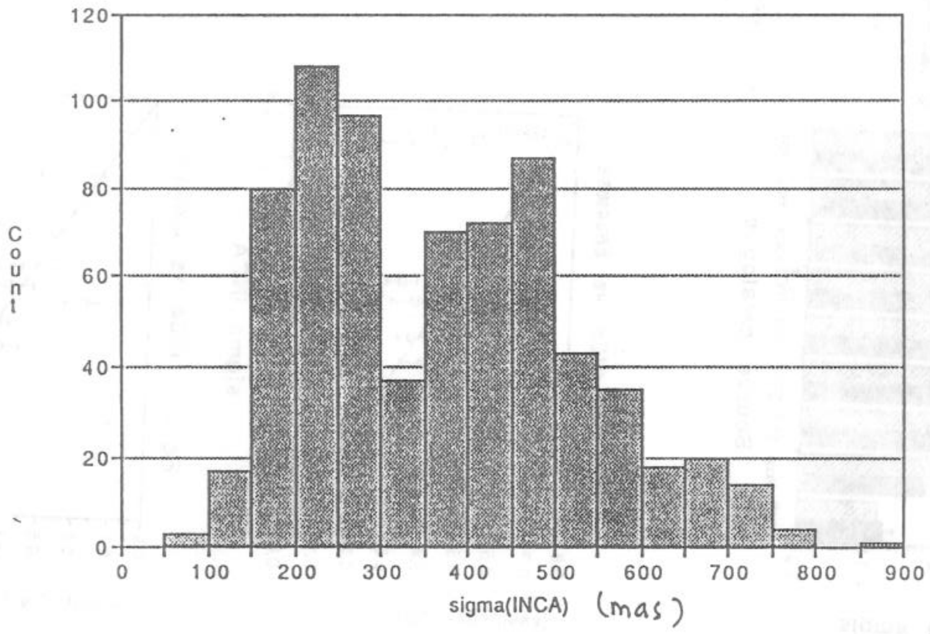
(variable stars excluded)

Bad reference *



Non reference *

FIG 5



~500 *

FIG 6

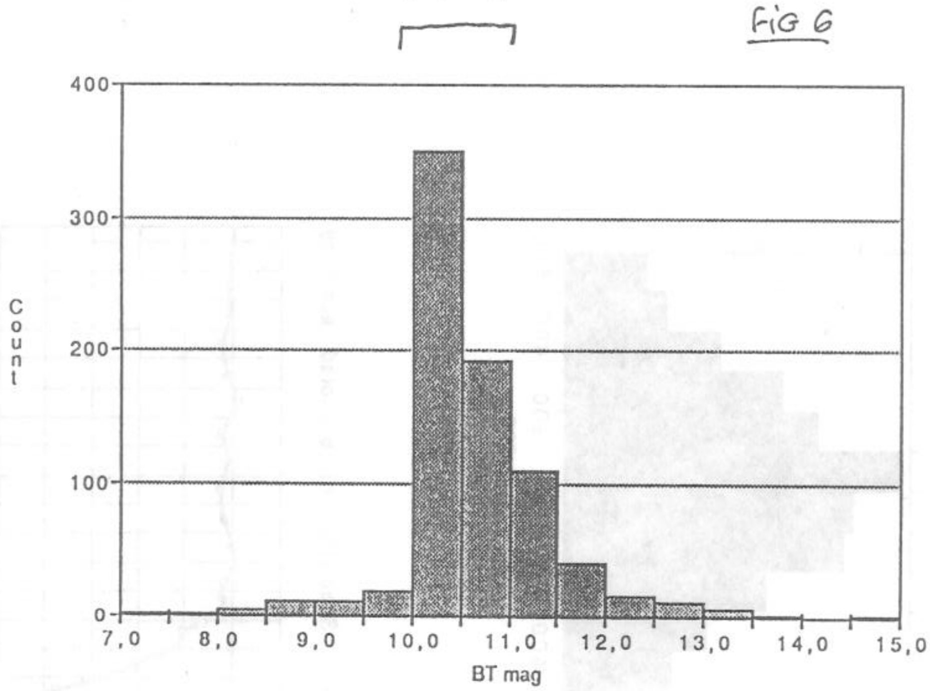


FIG 1 : distribution of (INCA-abs)

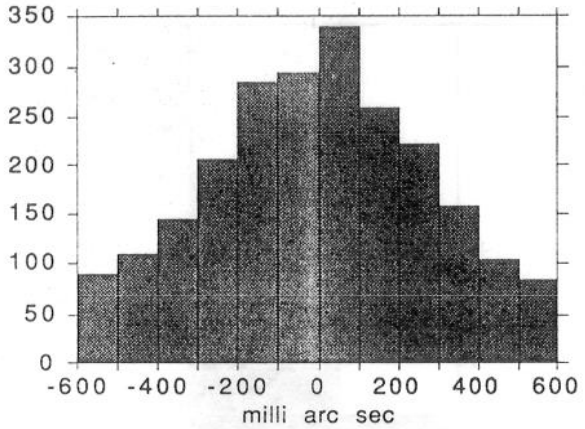


Fig 2 : Simulation of expected accuracy

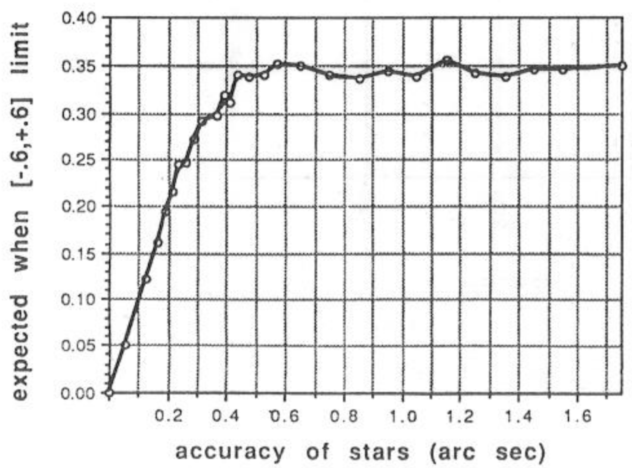


Fig 3 : accuracy comparison

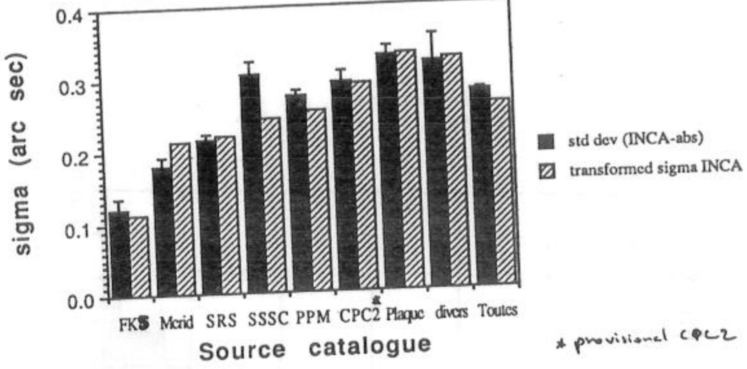


Fig 4 : INCA vs abscissa

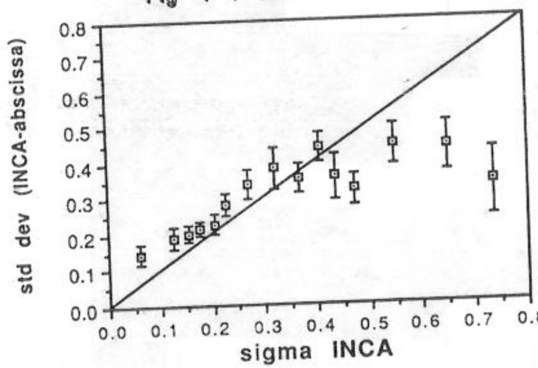
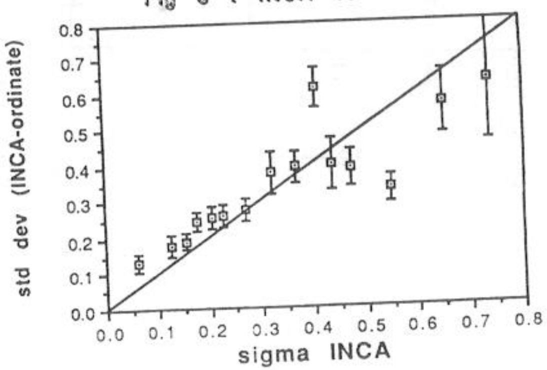


Fig 5 : INCA vs ordinate



ANNEX XIV

INCA contribution - 12 April 1990

INCA star position accuracy

F. Arenou, C. Turon
Observatoire de Paris - CNRS

I) Introduction

Of interest here is the analysis of the first results of great circle reduction. For the grid, the data were supplied by Hans van der Marel -DELFTA from test-tape 5 and DELFTB from test-tape 3- with data added by Phil Davies at ESOC. For the star mapper, the data were supplied by Enrico Canuto at Torino and concerned apparently the test-tape 3.

From the point of view of INCA, three main questions must be raised :
1) Are there individual stars for which the positions given by INCA are erroneous ?
2) Were the uncertainties about positions correctly estimated ?
3) If not, how do position catalogues behave with respect to the precision on positions ?

It is stressed that this work is a first look analysis based on these very preliminary results.

II - The grid.

The data used underneath are (INCA-abscissa) corrections on great circle (noted "INCA-abs") and precision on INCA position (noted "σ_{INCA}") coming from tape 3+tape 5 (2321 stars). Distribution of (INCA-abs) is in **fig 1**.

The individual precision on (INCA-abs) is expected to be $\sqrt{\sigma^2_{INCA} + \sigma^2_{abs}}$ where σ_{abs} (mainly due to photon noise) can be found in [1] and is strongly dependent on magnitude and colour of the stars.

(INCA-abs) correction being folded back into [-.6",+.6"], **fig 2** shows a simulation of the way the individual expected accuracy should be "transformed" to take this fact into account.

The sample was cut into 15 thin bins of σ_{INCA} and **table 1** gives, for each bin, the number of stars, the mean σ_{INCA} , the mean σ_{INCA} "transformed", to be compared with the standard deviation of (INCA-abs).

It shows that :
1) there is a mean σ_{abs} of about 0.1", consistent with [1] ;
2) as σ_{INCA} and σ_{abs} should increase with magnitude, it is thus suggested that INCA stars may have in fact a more precise position.

With respect to the catalogues where the INCA positions came from, **fig 3** gives the comparison between the standard deviation of (INCA-abs) and σ_{INCA}.

TABLE 1

bins of σ_{INCA}	number of stars	mean σ_{INCA}	transformed σ_{INCA}	std dev. (s.e.) INCA-abs	
0.≤ <.10	18	.074	.074	.139	.023
.10≤ <.15	85	.130	.130	.181	.014
.15≤ <.17	191	.154	.154	.183	.009
.17≤ <.20	240	.179	.179	.193	.009
.20≤ <.22	174	.206	.206	.252	.014
.22≤ <.25	217	.228	.227	.254	.012
.25≤ <.30	241	.269	.255	.267	.012
.30≤ <.35	182	.331	.287	.287	.015
.35≤ <.40	149	.374	.305	.315	.018
.40≤ <.43	182	.410	.317	.298	.016
.43≤ <.45	98	.435	.324	.316	.023
.45≤ <.50	206	.469	.332	.319	.016
.50≤ <.60	203	.546	.344	.331	.016
.60≤ <.70	95	.649	.346	.363	.026
.70≤ <.80	30	.732	.346	.332	.043
≥.80	10				

III - The star mapper.

The data come from tape 3, giving about 916 stars (stars with B_T>10. or rejected by the star mapper reduction are excluded whereas some bright stars or some double stars were not in the data given by ESOC for the grid results). The data used in this first analysis are (INCA-abscissa) and (INCA-ordinate) corrections (as for the grid, their small individual rms were not taken into account).

The comparison between σ_{INCA} and standard deviation of corrections is in **fig 4** for the abscissa and **fig 5** for the ordinate, the points representing the same bins as in table 1 (from 14 to 119 stars). We may notice that :
1) for stars with σ_{INCA}<0.4", the standard deviation of (INCA-abs) or (INCA-ord) is greater than σ_{INCA} , the difference being due to a σ_{abs} of about 0.15" in each bin ;
2) stars with σ_{INCA}=0.4" are mainly double stars (with 10"< ρ <30"), indicating a possible problem in position or data reduction ;
2) for stars with σ_{INCA}>0.4", INCA position accuracy was too pessimistic.

IV - Conclusion.

All this leads to the conclusion that :
1) precision on corrections σ_{abs} is about 0.1" for the grid and about 0.15" for the star mapper ;
2) for stars with σ_{INCA} >0.4", the positions given by INCA are more accurate than it was announced.

This work will be undertaken again when more data is available and if the individual σ_{abs} is known ; this will allow to find possible outliers in order to correct their position and to verify the above preliminary remarks.

Reference : [1] The Hipparcos Mission, vol III, p201, ESA SP-1111

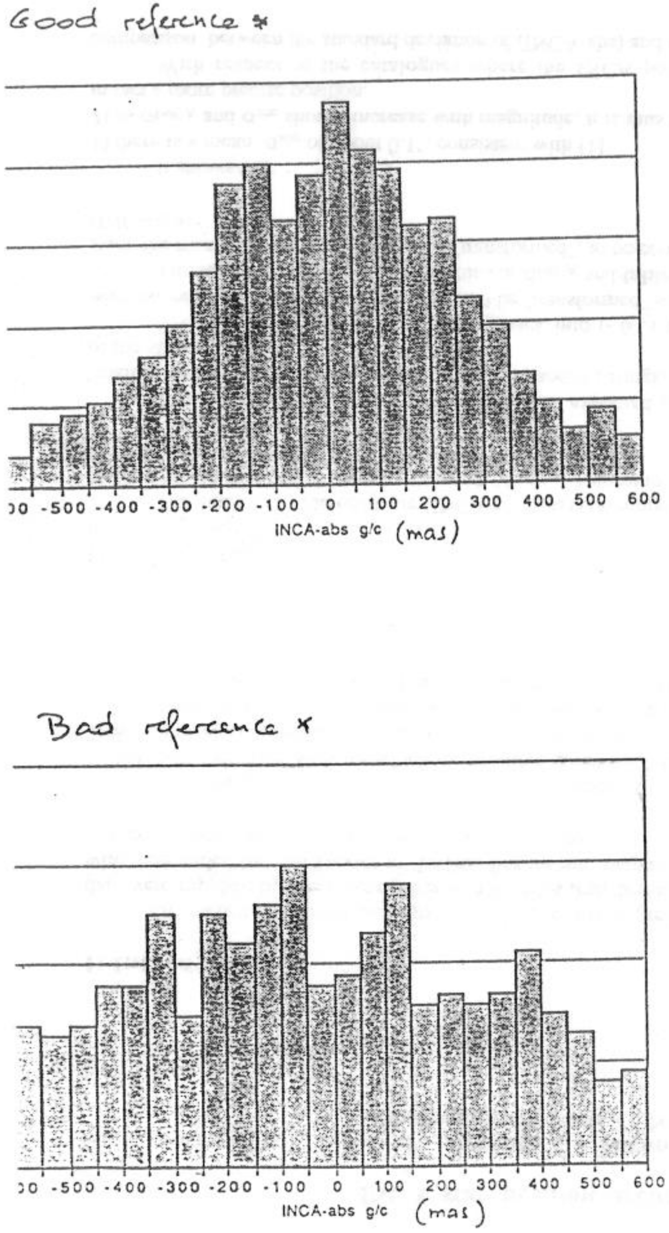


Fig 7a

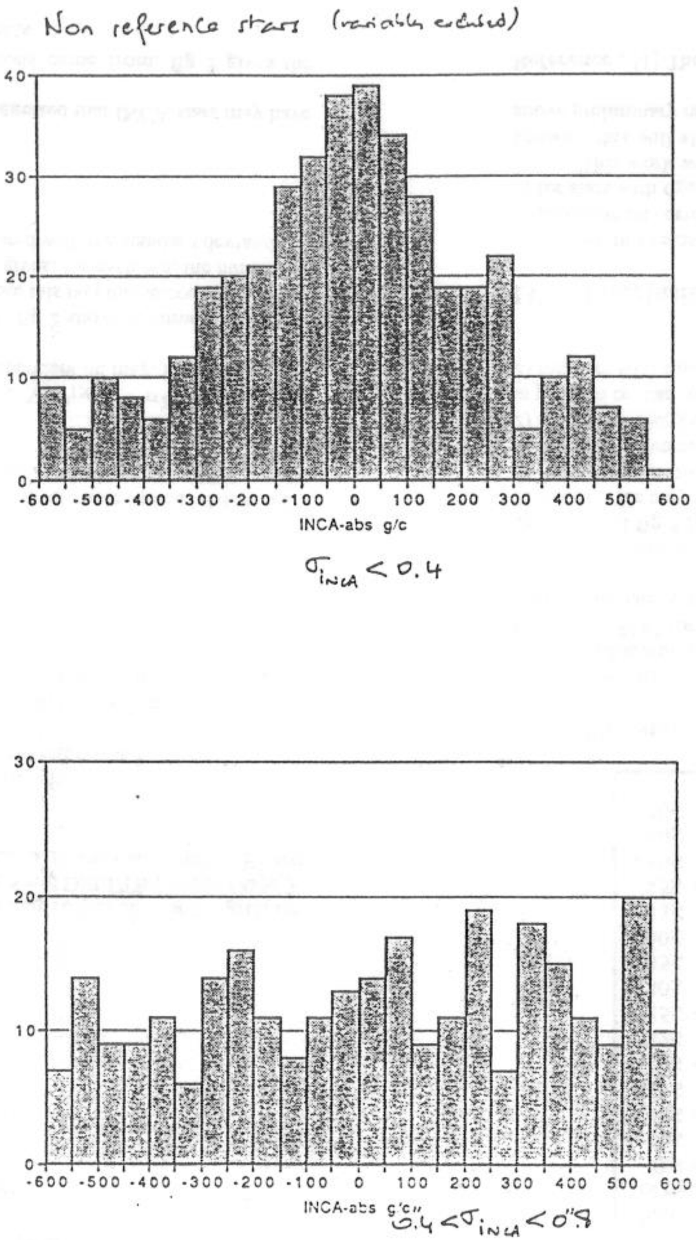


Fig 7 b

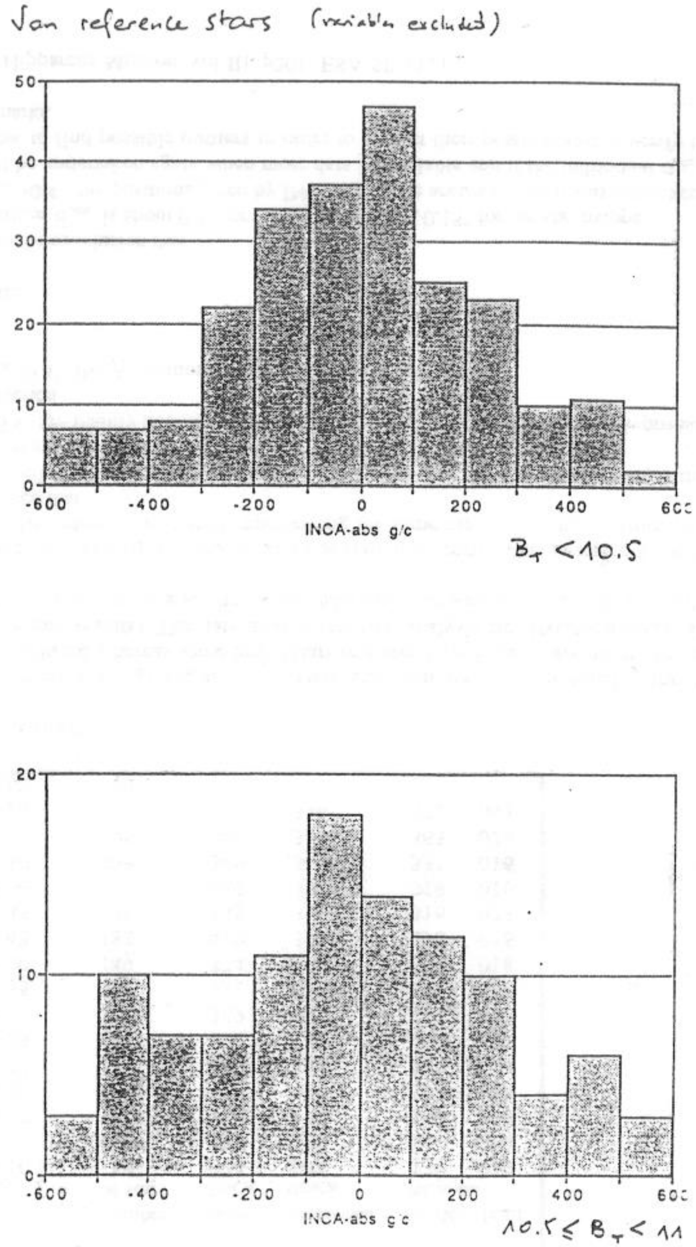


Fig 7c

Catalogue updates

1. Photometry

In progress • Revision of the list of standard stars (following the work of Grenon - Mignard)

In progress • Values of $B_T - V_T$ for stars with $B_T - V_T = 9.99$ in IC 6 -

2. Positions

Done 12/3/90 • Correction of a mistake in the computation for photocenter ⇔ geometric center for joint systems. [787 systems with a wrong position. Mean difference : 0".65
9 * away by more than 3"].

In progress • Collection of additional proper motions or new positions (for those with epochs earlier than 1972).

3. "Erratic" errors

Always!! In positions or magnitudes