Thirtieth Meeting of the Hipparcos Science Team

ESA Paris, 5-6 May 1992

Attendance:

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

ESTEC: M.A.C. Perryman

ESOC: D. Heger, O. Ojanguren

Invited: C. Petersen

The agenda attached was adopted.

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

1. Satellite Status

Ojanguren and Heger presented the status of the ESOC operations (Annexes I-III). Studies of improving the non-z gyro convergence time will continue at ESOC. ESOC are requested to continue tape production to the DRCs as rapidly as possible.

Star Positions: NDAC will provide an updated catalogue to INCA for verification (including sphere solution and star mapper updates) within 1-2 weeks (Action 1). A few double stars are found to have system shifts of > 3 arcsec, and it was agreed that these should be updated. Van Leeuwen will make a proposal for the updating procedure, for single and double stars (Action 2). Photometry should also be updated—van Leeuwen will supply any updated B and $B - V$, to allow INCA to derive any updated H magnitudes. Grenon will supply Turon with the prescription necessary to update H to allow for aging (Action 3). Grenon, Crézé and Turon will reflect on the updating procedures of the H photometry and the target observing time.

Star Observing Strategy: Crézé reported that the allocation of observing time was proceeding nominally on the basis of the star covariances distributed by ESOC on 13 March 1992 (note distributed separately). He recommended that the end of the mission should be targetted and implemented well before end 1992 (see Action 4).

Special Objects: no problems had been identified for observation of minor planets etc. Grenon raised the question of whether minor planets at the observability thresh-hold (with the magnitude limit evolving with time) should now be deleted from the observing programme. This was not supported: Perryman raised the idea of accumulating the photon counts of fainter objects (3C 273, minor planets) at either field crossing, or even mission level, in order to improve the efficiency of the positional estimates of these objects. In any case, the possible loss of observing time was not large.

2. Calibration Report

Schrijver presented the results of the instrument parameter monitoring from the first look. He summarised the investigations of the derivations of the apparent positions at all four data reduction locations—everything was in satisfactory agreement. Calibration results from FAST's analysis are given in Annex IV.

Presented presented the results of Matra's analysis of the focus evolution versus time. Radiation damage of the glass, affecting the focal length, appeared to be capable of explaining the evolution of the differential defocus, and the changing scale factors of both fields of view (Annex V).

3. NDAC Report

Van Leeuwen presented the status of the RGO side of the NDAC processing. Attitude updates had been made on the basis of the first-year sphere solution. 18 months of data processing should be completed within a month. Lindegren reported that, within CUO, GCR residuals accumulated over the first year show a stable structure, with some high-frequency components. Questions still remain on the validity of the POS treatment (Action 5). Minor planets have not yet been treated within NDAC.

4. FAST Report

Kovalevsky reported results of the RGC and sphere solution processing within FAST, and comparisons between the different sphere solutions (3 and 5 parameter; with the CERGA and CNES solution methods)—these results have been reported separately.

5. Comparison Activities

Lindegren presented results of the comparisons of the NDAC and FAST sphere solutions (Annex VI). These had been discussed extensively during the previous day's splinter session. In summary, the differences that existed between the solutions were particularly evident over the poorly observed (and interconnected) areas of the sky, and there was no reason for major concern at the present differences at this stage of the reductions. A series of actions linked to the 18 month sphere solution was agreed upon for the next sphere comparison exercise (Action 6). Turon reported on the early results of the comparisons between the FAST parallaxes and the available spectroscopic parallaxes, performed by Arenou in Meudon. It was agreed that this useful exercise should continue, with the NDAC and FAST sphere solution results communicated to Meudon to be used for this and no other purpose (unless otherwise approved).

6. TDAC Progress

Høg reported on progress in the generation of the provisional TICR, and in the astrometric and photometric treatment (including the geometric calibration being carried out at CUO), see Annex VII.

7. Photometry

Mignard reported on the photometric processing within FAST, giving 3 million transits and 118 000 global magnitudes. The instrumental evolution with respect to time has been fitted to the first year of data combined with the February 1992 ad hoc photometry data set.

Van Leeuwen reported that the first year of data had almost been processed (photometrically) in RGO. Grenon summarised the problems of the photometric calibration and time-evolution of the instrument. By end June, Grenon will supply an updated Input Catalogue of photometric and standard stars, including H and $V - I$. NDAC and FAST plan to include the background value per observation in the final file. All photometry actions, including those carried over from the Cambridge meeting, are listed under Action 7.

It was proposed by van Leeuwen (and agreed by the HST) that early photometric results are first verified by the other Consortium (e.g. period, zero-point, etc) and appropriately acknowledged (e.g. through co-authorship by both Consortia). Van Leeuwen proposed that a general publication of new variable stars, found by both Consortia, could be considered as a joint publication (time-scales of this were not discussed).

8. Double Stars

In NDAC, mass processing of the first year of data should start by end May. Mass processing will start in Bari/Frascati based on the first year of FAST data once the necessary tapes arrive from CNES. Financial problems may be encountered within Italy, but Bernacca will advise HST if further supportive action is required.

9. Miscellaneous

Liège Meeting: the programme of the Liège meeting was discussed, and a revised programme agreed upon (Annex VIII).

Input Catalogue: the first volume (Volume 3) of ESA SP-1136 was delivered during the meeting. The production was due for completion and distribution on 22 May.

Astronomy & Astrophysics Special Issue: Vol. 258/1 (May 1992) had appeared. Perryman had ordered 100 complete copies which would be distributed to authors, HST, etc.

Hipparcos Catalogue Publication: Perryman suggested that planning should start soon if the final production was not to be held up (Actions 8-9).

10. Agreement Update and Scientific Exploitation

A revised version of the 'Agreement' (Revision 2, 9 April 1992) had been prepared and distributed by Perryman. There were comments from the HST, of a detailed rather than of a strategic nature. In a future revision, Section 7.4 (Data Release to the HST) would be suppressed; and in the Annex, the name of Galligani would be replaced by that of Barbieri. Furthermore, it was pointed out that some sections were now of only a historical (and incorrect) nature, such as the intended time-scale for the release of the Input Catalogue. However, these 'inaccuracies' were rather self-evident, and to avoid confusion, a new update taking these items into consideration would not be distributed at the present time.

The shortcomings of the proposed approach (contained in the present Agreement) to the distribution of preliminary data to the Principal Investigators of approved observing programmes were discussed and recognised. HST now considered it unwise to distribute data from more than one consortium from two preliminary stages of the data processing. Procedures for distribution of preliminary data would be reviewed in due course.

Forms A and B (8 April 1992) had been distributed to the HST, and certain proposals had been duly forthcoming. These proposals were divided into those of a more urgent nature where an immediate decision was considered, and those for which a decision could be postponed. The HST's disposition on the 'urgent' forms is distributed separately.

11. Next HST Meeting

The 31st meeting of the HST will be held on 3-4 December 1992 (with a probable comparison splinter the previous afternoon) to be held in ESTEC.

M.A.C. Perryman, 19 May 1992

Distribution: HST, ESOC Participants, A. Wicenec, J. Halbwachs, U. Bastian, D. Pawlak (MATRA)

Actions

1. Van Leeuwen to supply updated catalogue to Turon for verification.

2. Van Leeuwen to propose procedure for updating of single and double stars parameters.

3. Grenon to provide Turon with prescription for photometric aging, to allow updated definition of H magnitudes for use in ESOC target times.

4. Crézé to define end conditions for SOS parameters at ESOC.

5. NDAC (Petersen/Lindegren) to pursue studies of POS and instrumental representation derived from GCR residuals.

6. Comparison actions:

(a) Lindegren and Froeschlé/Falin to produce report on the results of their first-year sphere solution comparison findings.

(b) NDAC/FAST to exchange and compare the results of their first-year 3-parameter solution.

(c) for verification of the parallax zero point, Kovalevsky will define some 3 RGCs, with poles close to the ecliptic, which will be reduced by FAST and NDAC and intercompared by van der Marel.

(d) FAST (Kovalevsky) and NDAC (Lindegren) to exchange their 18-month sphere solution around September 1992. Results of the sphere comparison should be available before the HST meeting at the start of December.

(e) the iterated sphere solution will be used to provide new results for comparison at RGC/instrument level (van der Marel) and attitude level (Donati). The results of these comparisons should be available before the HST meeting at the start of December.

7. Photometry (including actions from Cambridge splinter meeting):

(a) Grenon to supply updated catalogue of photometric and standard stars with H and $V - I$.

(b) Mignard and van Leeuwen to verify presence of background value per observation, and use of heliocentric times, in final photometric data set.

(c) Mignard and van Leeuwen to produce list of all stars which they consider can be treated as standards (end January 1992);

(d) Grenon to provide Hp, (V-I)c for all stars as input to re-reduction (end January).

(e) Grenon to define revised standard, taking into account the extension to fainter stars, (V-I)c revised transformation, and adoption of a smoothed standard (e.g. allowing for zonal variations on sky);

(f) NDAC/FAST to review background procedure treatment in view of zodiacal light and van Allen belt variations;

(g) Mignard to coordinate with Evans the comparison of the instrument response profile (including extreme star colours);

(h) Mignard to coordinate a background comparison for the first (e.g.) 100 days of mission data, proposing orbits versus galactic plane etc.

(i) Mignard to send the numbers and epochs of one or more 'constant' stars to Evans. Details from NDAC and FAST (epoch, magnitude, error) to be sent to Perryman/Grenon for analysis of the consistency of the results;

(j) Grenon to reflect on how the final photometric catalogues will be verified and merged.

8. Contents of the Final Hipparcos Catalogue: Murray, Lindegren and Kovalevsky (and other interested HST members) agreed to make a first proposal for the data, format, etc that they would like to see in the final Hipparcos Catalogue—among the topics that they would reflect on would be: inclusion of mission and ground-based data, finding charts (HIC, or supplemented), coordinate systems, cross-identifiers, inclusion of radial velocities, spectral types, Hipparcos and ground-based photometry, media (printed, tape, CD-ROM: including additonal data to be included in such media). Due date: end September.

9. Proposals for the procedures to be used for merging astrometric and photometric data to be made by Murray and van Leeuwen respectively. Due date: end September.

Thirtieth Meeting
of the
HIPPARCOS SCIENCE TEAM

ESA, PARIS
Room 137

5-6 May 1992

Start of meeting: 09.00 (5 May)
End of Meeting: 16.00 (6 May)

PROVISIONAL AGENDA

1. Satellite status:
   - consumables and timing (Heger)
   - z-gyro tests (McDonald)
   - nominal mission data tapes and future policy (Heger/Perryman)
   - requirements for updated star positions/magnitudes at ESOC
   - SOS and target times, end conditions for modulation strategy (Creze)
   - non-observability of stars during first year (van Leeuwen/Creze)
   - special objects: minor planets, NGC2516, Iapetus (McDonald)

2. Calibration report (Schrijver)
   - comparison of timing, velocity and apparent positions
   - RGC tests in sun-pointing
   - instrument modelling: focus, scale factor and basic angle (Perryman)

3. NDAC progress report (van Leeuwen/Lindegren)

4. FAST progress report (Kovalevsky)

5. TDAC progress report (Hoeg/Grewing)

6. Comparison activities and summaries of 4 May splinter session:
   - POS status and instrument representation in NDAC (Lindegren)
   - sphere solution comparison (Lindegren)
   - comparison with spectroscopic parallaxes (Turon)
   - future plans for attitude and RGC comparisons (iterated data)

7. Photometry and temporal evolution (van Leeuwen/Mignard/Grenon)
   - status of processing in FAST (Mignard)
   - review of actions from 29th HST + Cambridge meeting

8. Double star status in NDAC and FAST (Lindegren/Bernacca)

9. Miscellaneous:
   - the role of 3C273
   - A&A papers; Input Catalogue; mission extension
   - Liege Meeting (Turon)
   - planning for Hipparcos Catalogue publication
   - next HST meeting: date and place

Wednesday 6 May

Data Exploitation
- Introduction to Agreement update + Proposal Forms A and B (Perryman)
- the role of the HST in scientific exploitation
- Discussion of available Form A's

ANNEX I

SYSTEM STATUS

December 91 - April 92

- The S/C remains fully operational.
- Science data collection has been of 2959.95 hours. Ground coverage has been of 3825.21 hours.(176 days).
- Anomaly#58:"Unexpected battery charge during perigee". (013/1992) has been raised during the reporting period.
- None of the existing open anomalies is affecting science data collection.
- New eclipse season started FEB.06.92 and will continue without interruption up to mid MAY 1993.
- Reconditioning of the batteries in preparation for the eclipse took place during January without any problems.

R/T USAGE

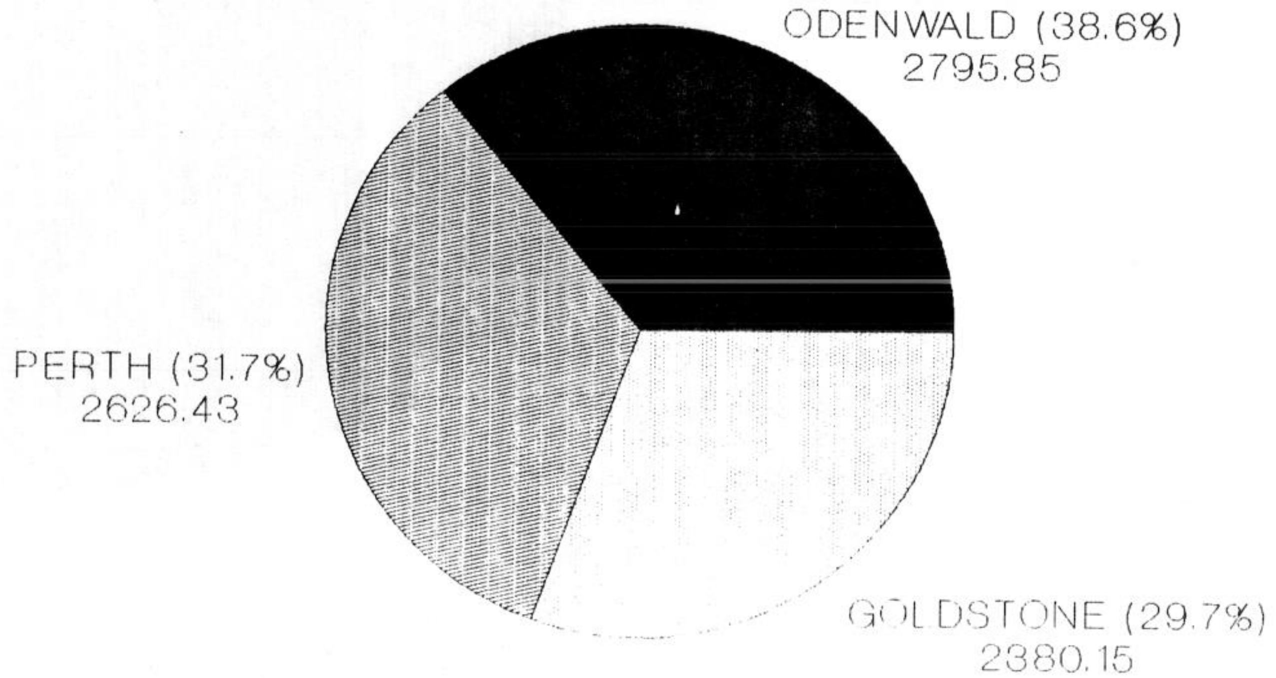
December 91 - April 92

REPORT #	COVERAGE	CONVERGED	PERCENT
45	349.37 h	275.41 h	78.83 %
46	348.44 h	254.92 h	73.16 %
47	347.94 h	252.30 h	72.51 %
48	353.47 h	266.67 h	75.44 %
49	350.35 h	295.54 h	84.36 %
50	349.90 h	271.90 h	77.71 %
51	346.14 h	264.69 h	76.47 %
52	347.21 h	291.23 h	83.88 %
53	346.74 h	237.85 h	68.60 %
54	345.82 h	290.18 h	83.91 %
55	339.83 h	259.26 h	76.26 %
11	3825.21 h	2959.95 h	
	347.75 h	269.09 h	77.38 %

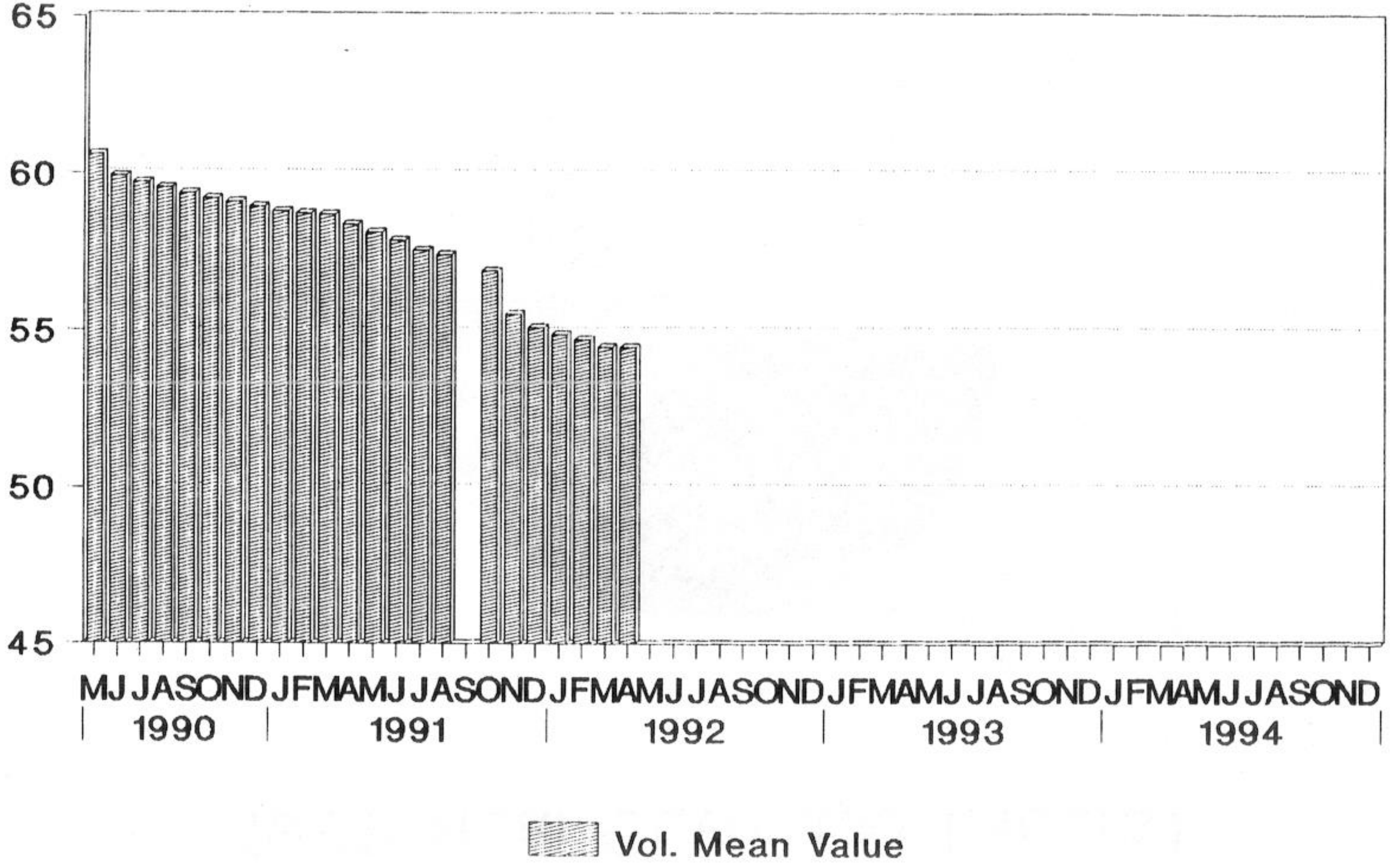
With respect to a 24 hours geosynchronous:

COVERAGE: 90.56 %
CONVERGED: 70.07 %

GROUND STATIONS
1992 Real Coverage (Hours)



SOLAR ARRAYS

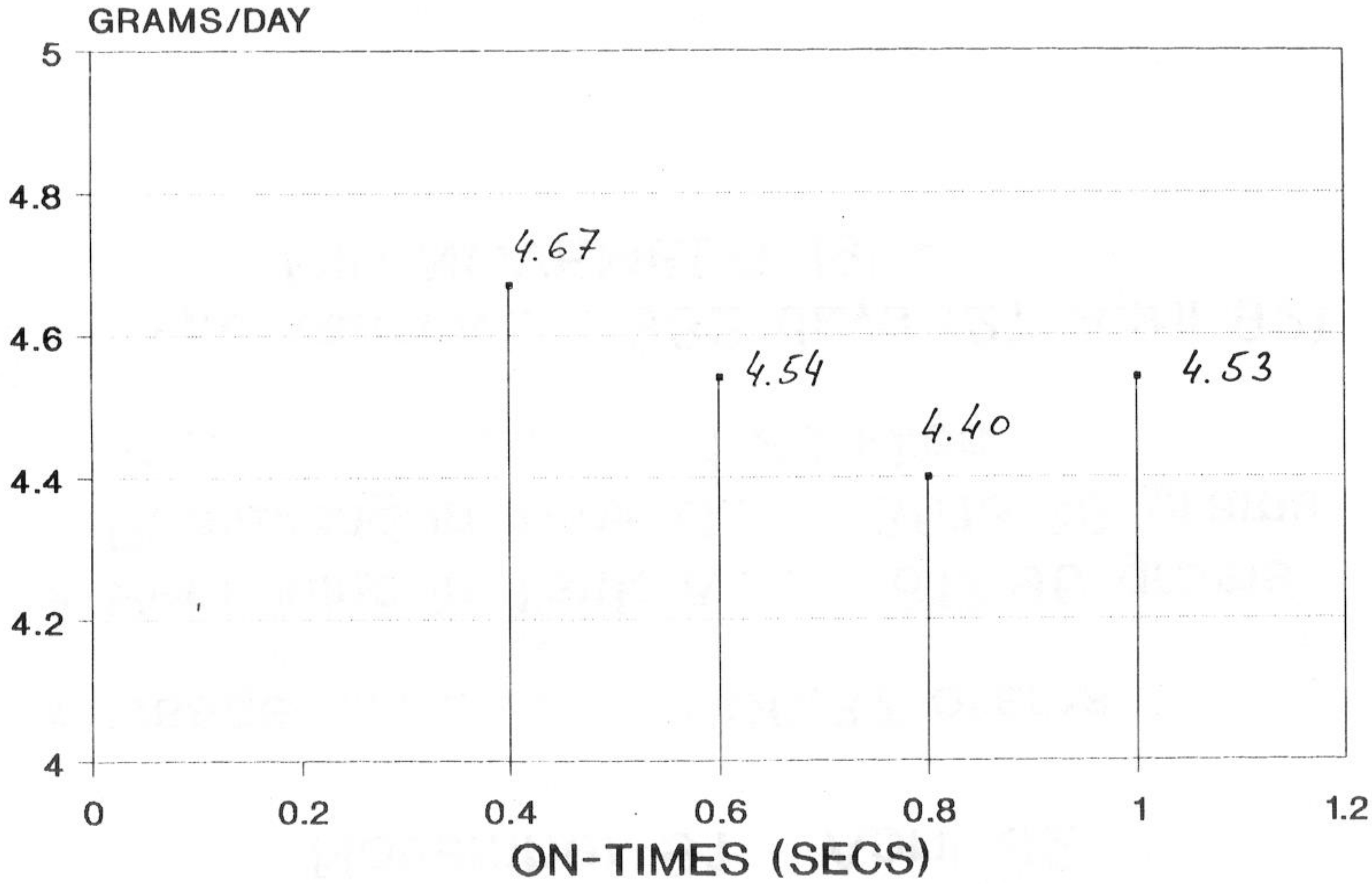


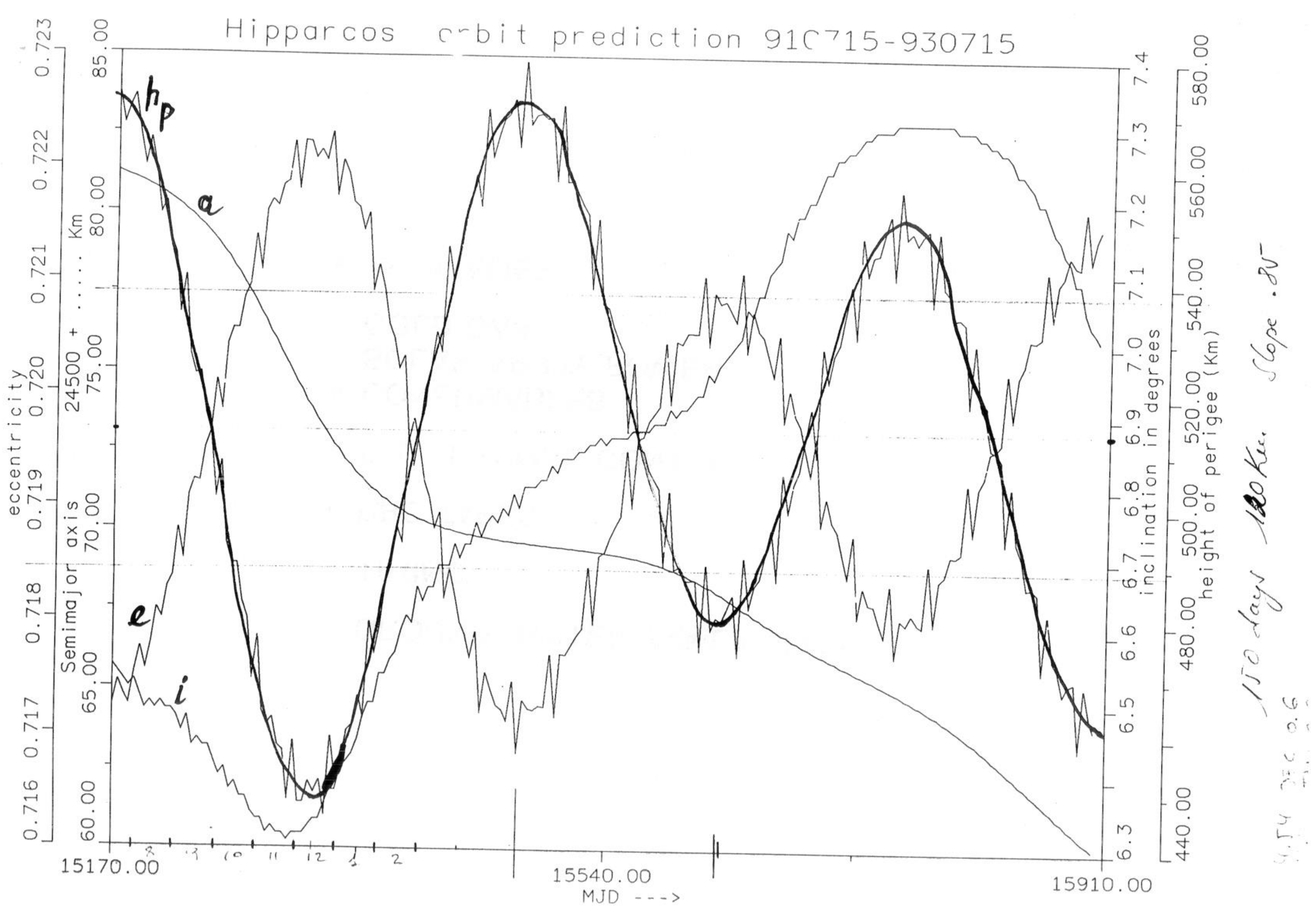
GAS CONSUMPTION

November 91 - April 92

- Usage .... 900.37 grams
- Remaining in Tank A......... 617.96 grams
  Remaining in Tank B........ 3613.38 grams
  Total..................... 4.23 kilos
- Expectations....... 932 days (27 April 92)
  MID NOVEMBER 1994

GAS CONSUMPTION





Hipparcos orbit prediction 910715-930715
eccentricity
Semimajor axis 24500 + ... Km
inclination in degrees
height of perigee (Km)
MJD --->
15170.00
15540.00
15910.00
0.716 0.717 0.718 0.719 0.720 0.721 0.722 0.723
60.00 65.00 70.00 75.00 80.00 85.00
6.3 6.5 6.6 6.7 6.8 6.9 7.0 7.1 7.2 7.3 7.4
440.00 480.00 500.00 520.00 540.00 560.00 580.00
hp
a
e
i
150 days 120 Km Slope .8

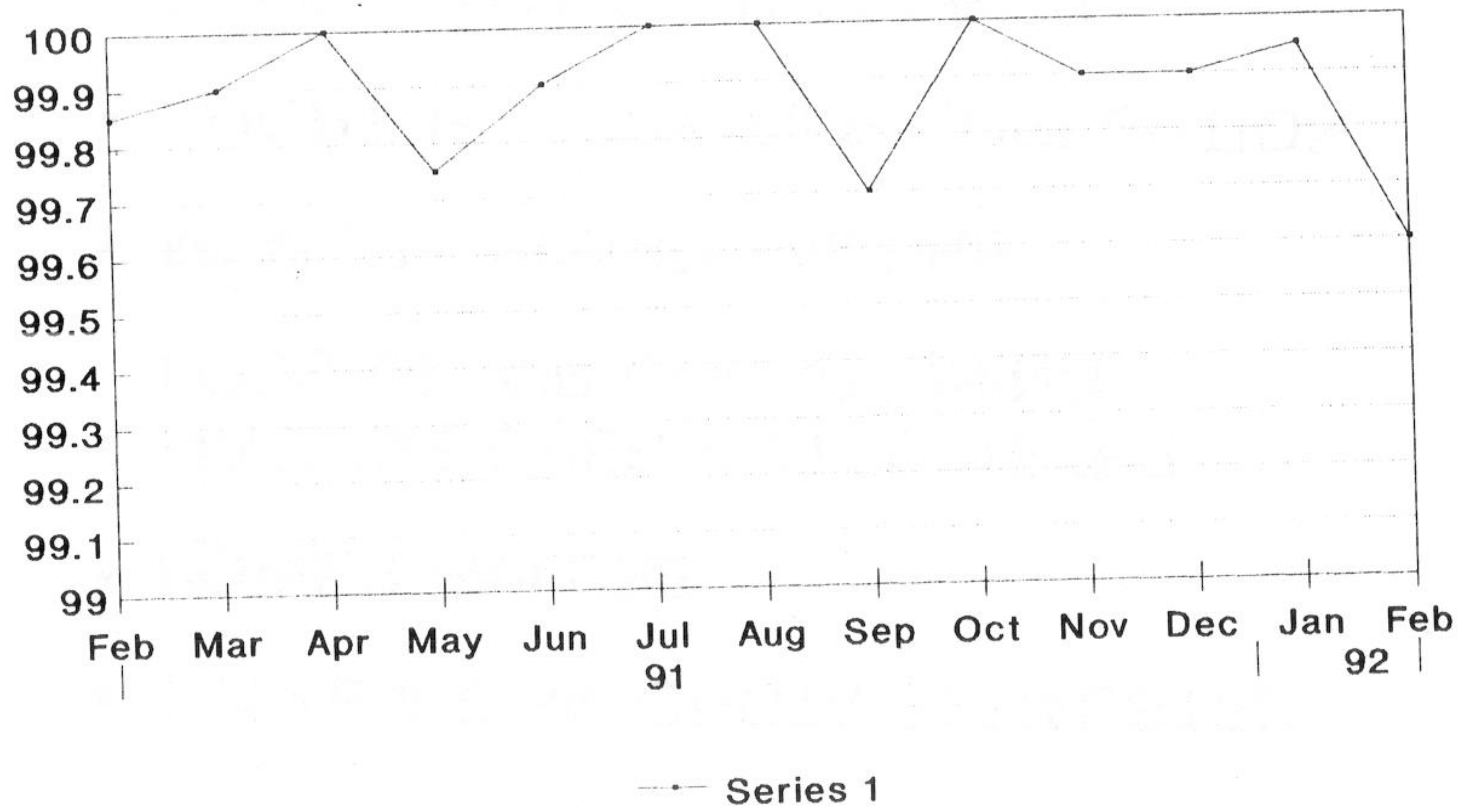
ANNEX II

- GROUND SYSTEM AVAILABILITY
- TIMING
- DRC TAPES
- P/L THERMAL CONTROL
- CONSUMABLES
  SOLAR ARRAY POWER
  COLD GAS
- ANOMALIES

HDCS INTERRUPTIONS

- SYSTEM DISK QUOTA EXHAUSTED
- POWER FAILURE
- MACHINE OVERHEATED AFTER LOSS OF AIR CONDITIONING
- MEMORY BOARD FAILURE
- SHORT HISTORY FILE CORRUPTION
- BUFFER MANAGER PROBLEM

HDCS SYSTEM
AVAILABILITY %



HDCS H/W CHANGES

REASON:
INCREASE HDCS AVAILABILITY

HDCS CHANGES:
REPLACEMENT OF DISK DRIVES (APRIL 92)

OLD SYSTEM:
RA81 456 MBYTES FIXED DISK

NEW SYSTEM
RA82 622 MBYTES FIXED DISK

IMPROVEMENTS :
PEAK TRANSFER RATE 10%
AVERAGE ACCESS TIME 10%
AVERAGE SEEK TIME 15%
DISK SPACE INCREASE OF 166 MBYTES

FASTER TAPE ARCHIVING
NO PROBLEMS WITH DISK QUOTA

TIMING ACCURACY

DATATION STABILITY REQUIREMENT: 10 MICROSEC
(CLOCK DRIFT)

1. PERTH & GOLDSTONE
   REFERENCE SYSTEM: GPS SATELLITE
   CHECKS PERFORMED: DAILY
   CORRECTIONS : WITHIN 1 MICROSEC (RESET)

2. ODENWALD
   REFERENCE SYSTEM: LORAN-C TRANSMITTER
   CHECKS PERFORMED: DAILY
   CORRECTIONS : OSC. ADJUSTMENT TO DRIFT BACK TO NOMINAL (TYPICALLY 2.5 MICROSEC)

TIMING HDCS

REFERENCE SYSTEM: DCS-77
CHECKS PERFORMED: EVERY 10 SECS
CORRECTIONS : AUTOMATIC TO DRIFT
FORMAT : WITHIN 50 MILLISEC
FRAME : WITHIN 2 MILLISEC
REJECT. CRITERIA: IF FRAME OUT THE REJECT
: IF 3 FRAMES OUT THE FORMAT REJECTED
: IF 3 FORMATS OUT THE LINK RECONFIGURED

DRC TAPE PROBLEMS

- PACKAGING
  ESOC DISPATCH REMINDED TO ENSURE TAPES ARE SUFFICIENTLY WELL PACKAGED TO SURVIVE TRANSPORT

- COURIER SERVICE
  VARIES GOVERNED BY COST AND EFFICIENCY

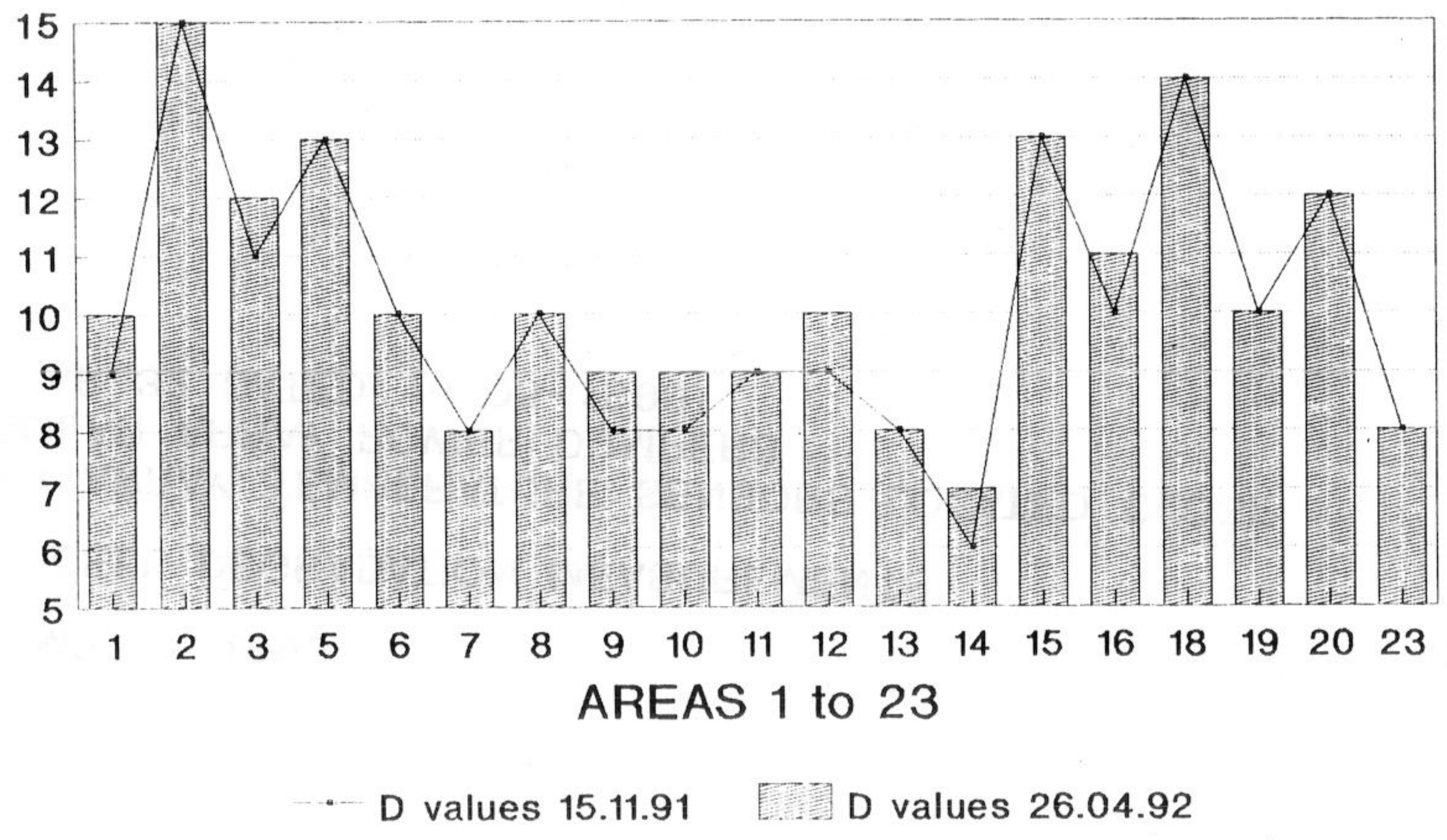
- PARITY ERRORS ON TAPES
  ONLY 'FAST' HAS REPORTED THIS PROBLEM
  ALL TAPES ARE PRODUCED ON SAME TAPE DRIVE
  (TAPES X-RAYED OR 'FAST' TAPE READER PROBLEM ?)

- IDT PILOTING ERRORS
  OAD PILOTING DATA WAS ARCHIVED AT END OF YEAR BEFORE DRC TAPES WERE PRODUCED.
  FILE LENGTH WAS INCREASED TO ELIMINATE FUTURE PROBLEM

- TAPE HX3045
  TAPE WAS RECREATED AT ESOC AND SHOWS A GREAT NUMBER OF REJECTED FORMATS (BAD DATA PROCESSED ?)
  RECOMMENDED TO SKIP THIS TAPE

TCE2

D values



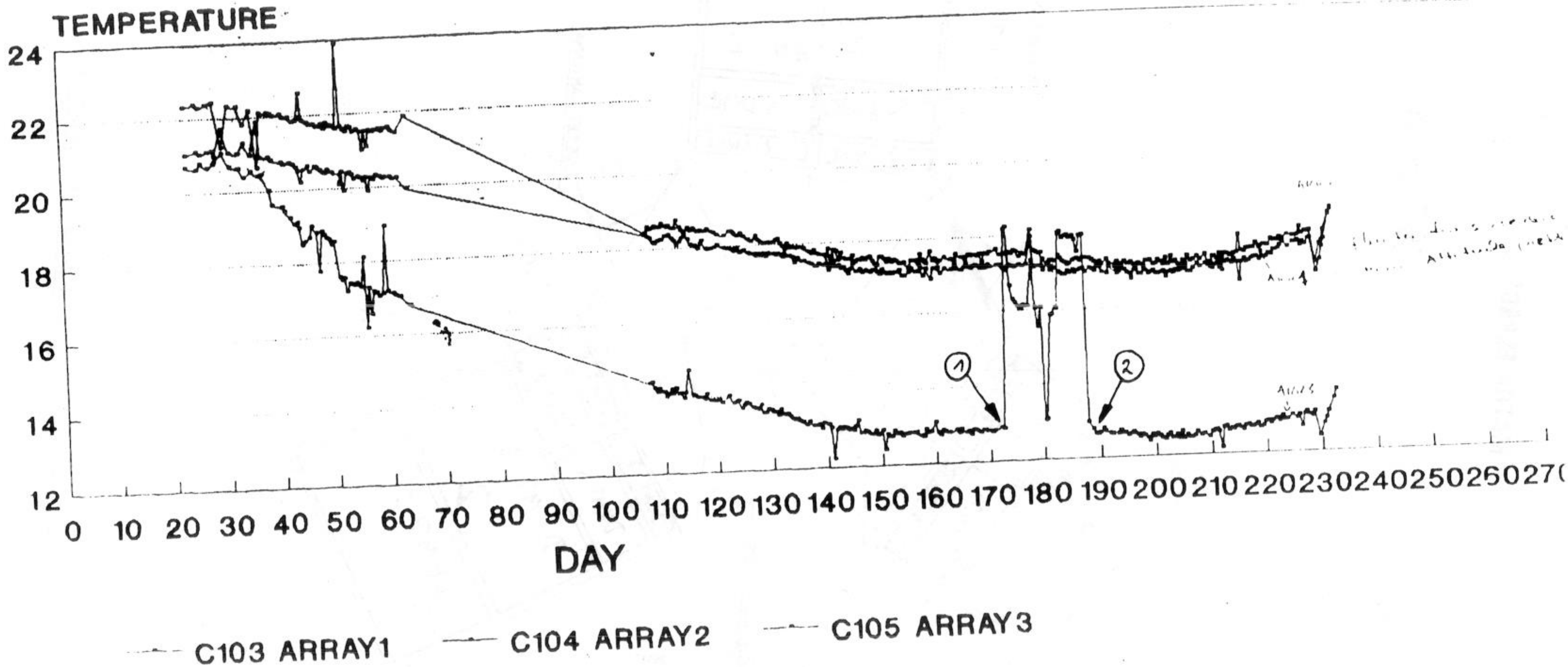
SOLAR ARRAY POWER

LIFETIME : > 1995

OPEN CELL DEGRADATION MEASUREMENTS

SOLAR ARRAY TEMPERATURE SENSORS LOCATED CLOSE
TO SOLAR ARRAY POWER DUMPERS
(REF. AR 32 DATED 15-05-1990)

HIPPARCOS ARRAY TEMPERATURE VARIATION FIRST 6 MONTHS OF 1990.



REVOLUTION AT APOGEE

Location of SA sections controlled by DUMP n

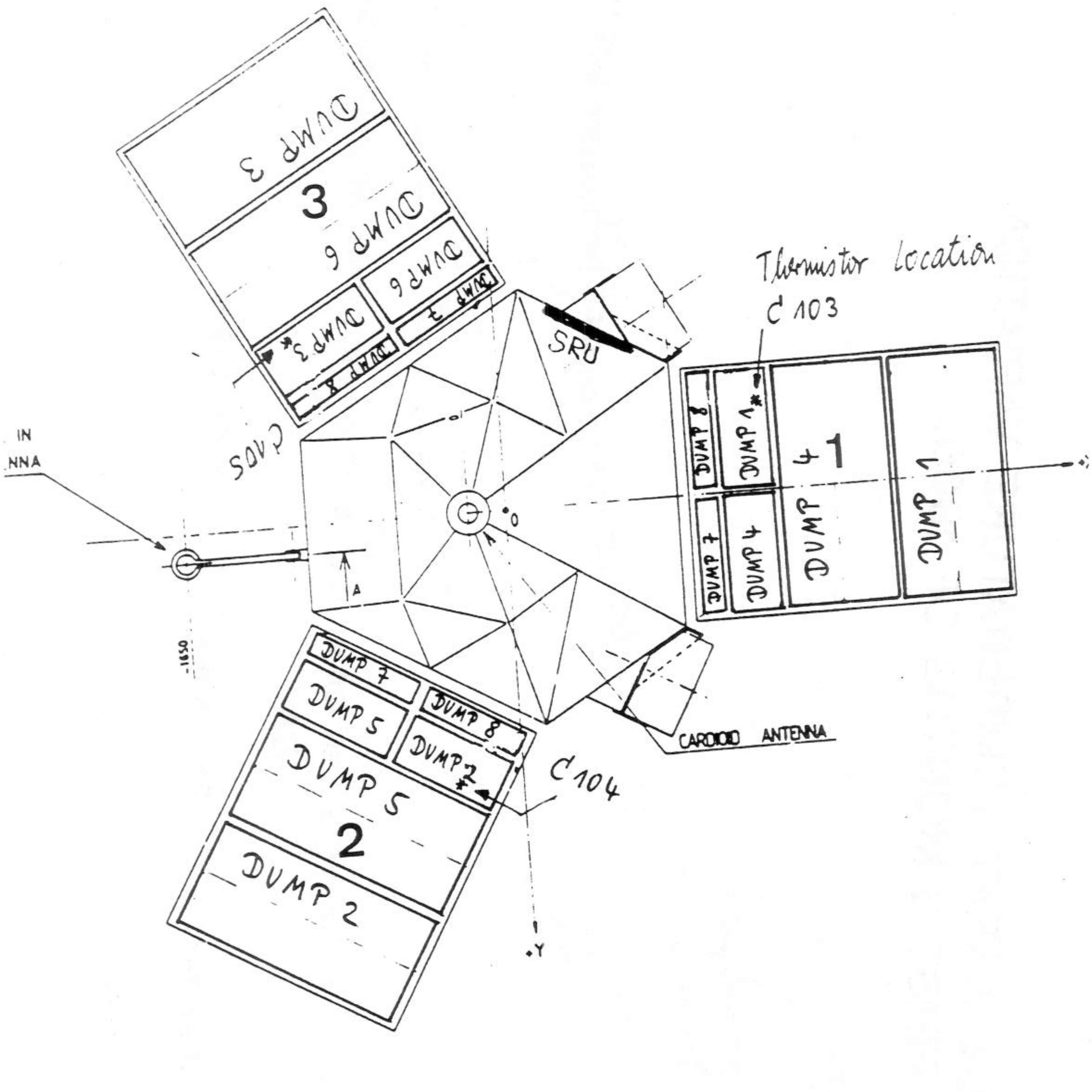
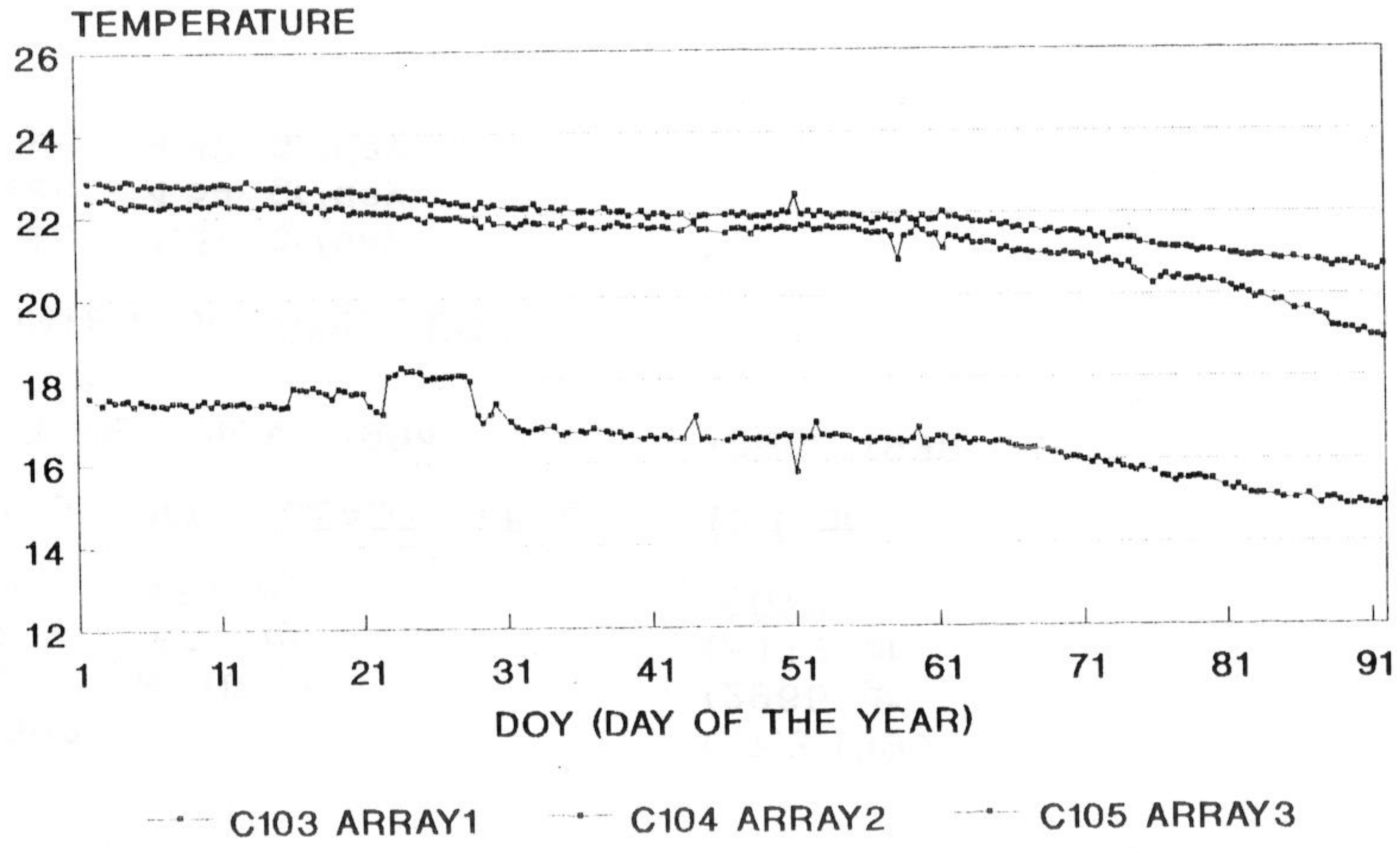


Figure S.A-3 : SOLAR PANELS CONFIGURATION

032008.1

HIPPARCOS ARRAY TEMPERATURE VARIATION
FIRST QUARTER OF 1992



1 REVOLUTION AT APOGEE

COLD GAS

1.3.1992	(17.3.1990
TANK 1 : 3846 gr	(2965 gr
TANK 2 : 635 gr	(5112 gr
TOTAL : 4481 gr	(8077 gr
AVERAGE DAILY USAGE: 4.5 gr	(6.1 gr
LIFE TIME : NOV. 1994	(DEC. 1993

THRUSTER ON-TIME TEST

0.4 sec : 4.67 gr/day
0.6 sec : 4.54 gr/day
0.8 sec : 4.40 gr/day

ANOMALIES

FROM A TOTAL OF 58 ANOMALIES, 5 ARE OPEN
NONE OF THE OPEN ANOMALIES ARE MISSION CRITICAL

ANOMALY No. 51
P/L RTU 2 TELEMETRY ANOMALY

ANOMALY No. 54
SUSPECT PREPROCESSED GYRO DATA READINGS WHILST IN ACS STANDBY MODE 2 AND GYROS IN FINE RANGE

ANOMALY No. 55
ANOMALOUS GYRO HEATING

ANOMALY No. 57
ANOMALOUS IDT 1 VOLTAGES

ANOMALY No. 58
UNEXPECTED BATTERY CHARGE DURING PERIGEE

ANNEX III

NON-Z-GYRO RTAD STATUS REPORT

Author: A.McDonald

Date: 27/04/92

ON-BOARD RTAD PERFORMANCE

During the period from 01/02/92 to 05/03/92, NZG-RTAD was initialised by Ground RTAD (GRTAD) software, whenever routine operations permitted. This has resulted in NZG-RTAD being converged for a minimum of four hours for most orbits. The results may be summarised as follows.

General performance

RTAD once converged, remained converged throughout the apogee region, except in the presence of a small number of occultations. On no occasion was RTAD seen to diverge outside of occultation.

Agreement between nominal and non-z-gyro regions are of the order 1-2 arcsecs in estimating Tait-Bryan angles.

Innovation levels have standard deviation between 0.5 and 1.0 asec. Comparable with nominal RTAD with noisy gyro 5.

Eclipse

RTAD remains converged during eclipses, where the shutters are not closed. Higher innovations can be seen, but always well within the narrow window (less than 5 asecs).

Occultation

Divergence can be seen on those occasions where an actuation occurs during an occultation. In a two week period, the following was observed:

```
Number of occultations       : 20

Occultations with actuations:  8

Number of divergences during:  3
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Combined Eclipse/Occultation

On Day 65, 1992, a test was performed using the non-z-gyro (NZG) RTAD on-board software, to assess its performance during a combined occultation and eclipse.

The eclipses were 67 minutes in duration and visible at the end of each pass as the spacecraft descended toward perigee. There were no naturally occurring occultations during these eclipses, therefore one was simulated by closing the star-mapper shutters for 12 minutes, as close as possible to loss-of-signal, (minimising the impact of the loss of science data during the test)..

RTAD diverged immediately after the shutters were closed. This was due to the gravity gradient torques exerting an acceleration around the z-axis (seen in the curvature of the nominal Tait-Bryan psi angle) which is not modelled on-board. It is expected that even outside an eclipse, an occultation at that height (below 9000 Km) would have produced similar results.

The conclusion is that any form of occultation near the perigee region is likely to cause a rapid divergence in psi, due to the limitation of the disturbance torque model. We have seen that normally, RTAD convergence is maintained through eclipses where star-mapper data are available. Given that the eclipses occur around perigee, where the science return becomes increasingly suspect, the rare occurrence of combined eclipse and occultation is unlikely to seriously impact on the science return.

GROUND RTAD SOFTWARE

Two versions have been used to re-initialise NZG-RTAD:

1. Full version with scan-rate determination from the star mapper. Software performs adequately, but star pattern recognition can occasionally misidentify stars causing, convergence of attitude on ground to be delayed.

   Further enhancements are nearing completion to give the operator greater visibility into these misidentifications, so that he may delete them.

   Time to initialise using this method is typically 90 minutes.

2. Hybrid version with scan-rate estimation from gyro 5. Software performance is comparable to the nominal GRTAD software, ie. re-initialisation in under 30 minutes.

GYRO 5 NOISE

Graphical results of noise analysis show that gyro 5 performance has degraded in the last month. Amplitude has increased and the range of frequencies has also increased.

OUTSTANDING ACTIONS AND QUESTIONS

1. Thruster calibration for onboard AOCS parameter optimisation. Possibility of using Real-Time Attitude Monitor results (comparing with RGO results) to calibrate estimated thruster torques.

2. Star Pattern Recognition software enhancements.

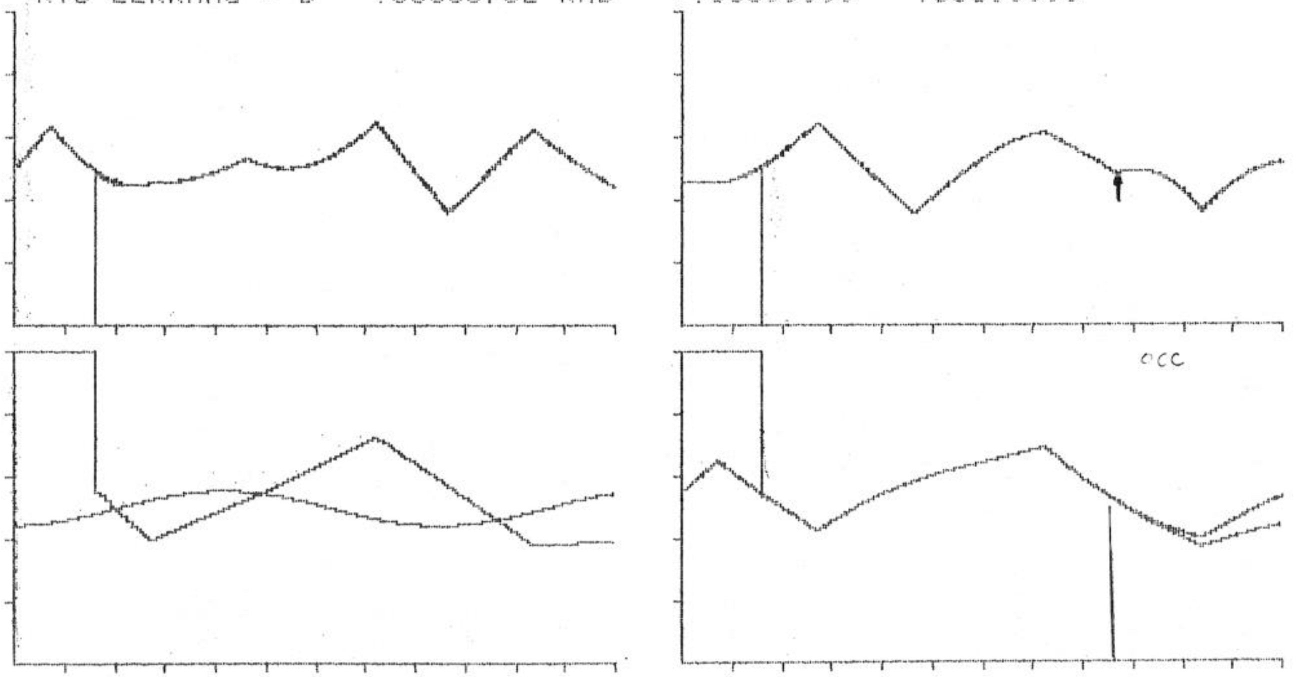
3. What are the criteria for switching to the NZG-RTAD software for routine operations?

4. Should we be considering early use of a hybrid scenario, ie. nominal RTAD in perigee region until RTAD converged, then use NZG software through apogee for better performance?

5. Should we look to change the Kalman gain set for the nominal RTAD first?

```
HDCS  0.1 STATUS=SPAC NAME=SPACON   S/C=HIPPARCO                    32:09:48:56
$159 /NEW NON Z GYRO SW MONITORING      REALT           PKT.TIME:032.09.48.33.739
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
B007	RTD XERROR ANGLE	-.00072369	RAD	-.00599999	.00599999	
B210	RTD XERR.ANG.NEW	-.00070624	RAD	-.00599999	.00599999	
B008	RTD YERROR ANGLE	.00023747	RAD	-.00599999	.00599999	
B211	RTD YERR.ANG.NEW	.00026616	RAD	-.00599999	.00599999	
B009	RTD ZERROR ANGLE	.00036590	RAD	-.00599999	.00599999	
B212	RTD ZERR.ANG.NEW	-.00074072	RAD	-.00599999	.00599999	
B217	RTD ZERRANG - 1	-.00129379	RAD	-.00599999	.00599999	
B219	RTD ZERRANG - D	.00055762	RAD	-.00599999	.00599999	



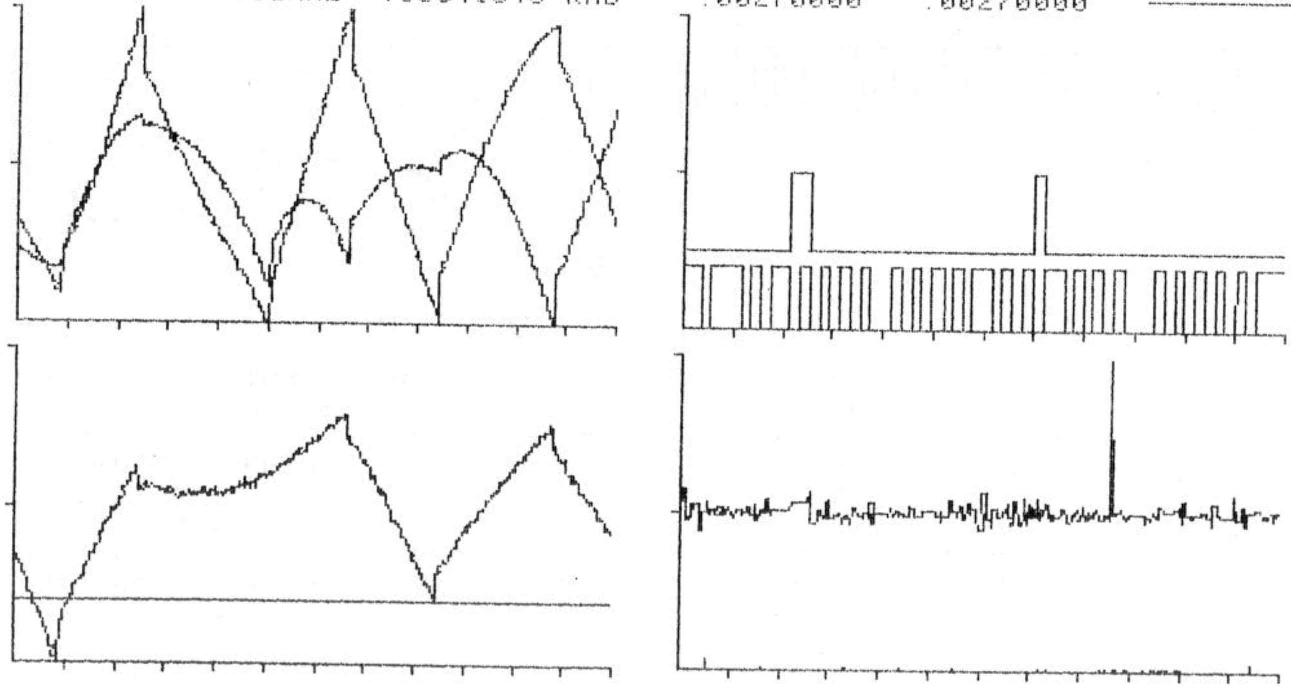
92.032.08.48.34 TIME 92.032.09.48.34

GO FIRE 1 09:44:09

Divergence during occultation

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 63:11:40:45
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:063.11.40.30.877
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=AOCS.AF2/ 0

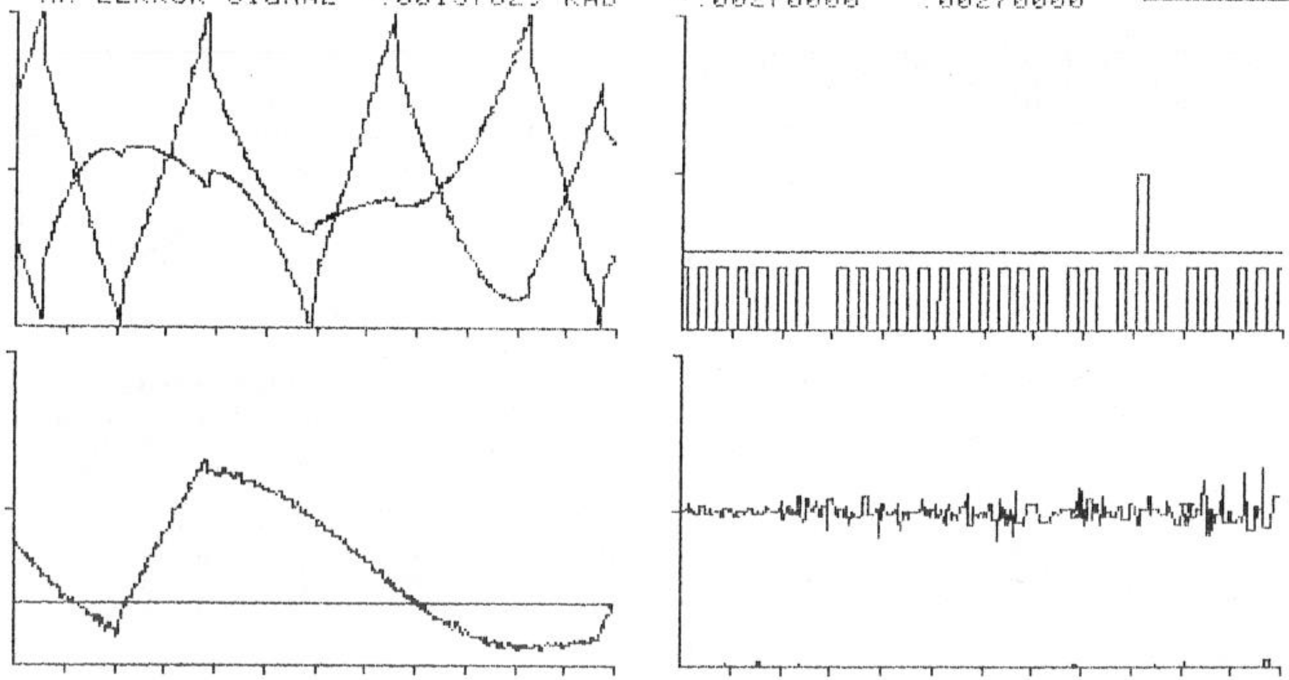
ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	-.00070690	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	.00075193	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	0		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	4		0	2000	
B031	INNOVATION	.00000087	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	-.00041546	RAD	-.00270000	.00270000	



92.063.10.40.43 TIME 92.063.11.40.43
SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 11:40:00

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 63:12:41:20
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:063.12.40.57.534
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=AOCS.AF2/ 0

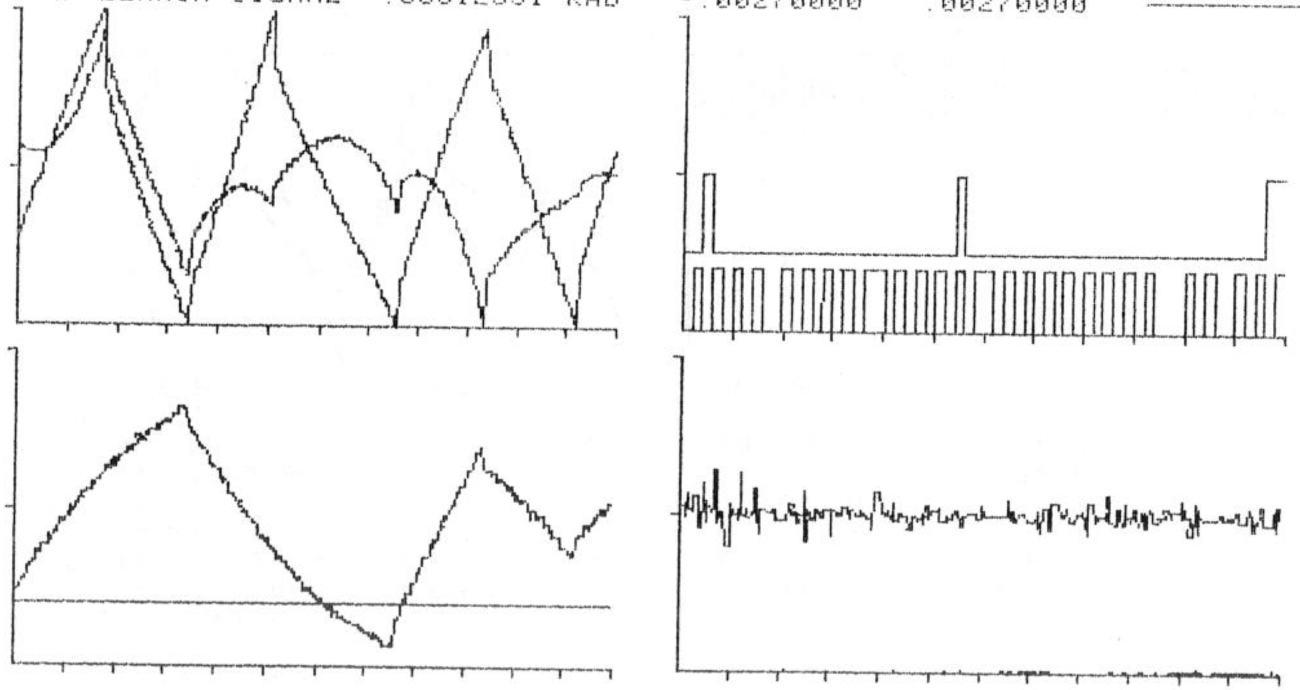
ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00033524	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	-.00098098	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	0		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	4		0	2000	
B031	INNOVATION	.00000499	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	-.00157629	RAD	-.00270000	.00270000	



92.063.11.41.08 TIME 92.063.12.41.08
SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 12:40:00

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 63:13:41:34
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:063.13.41.26.851
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=SMP .01 / 0

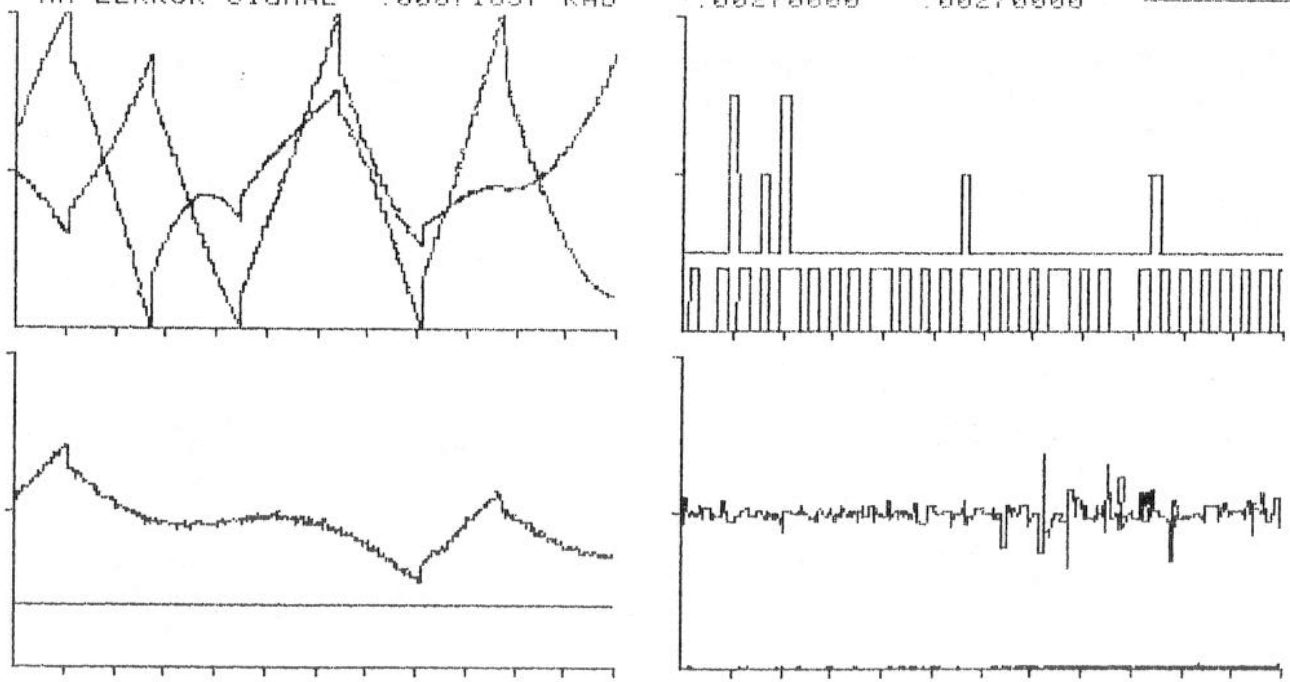
ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00028054	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	-.00003190	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	1		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	14		0	2000	
B031	INNOVATION	.00000041	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	.00012531	RAD	-.00270000	.00270000	



92.063.12.41.31 TIME 92.063.13.41.31
SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 13:40:01

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 63:14:42:04
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:063.14.41.50.828
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=AOCS.AF2/ 0

ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	-.00157165	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	.00150747	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	0		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	28		0	2000	
B031	INNOVATION	.00000145	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	-.00071637	RAD	-.00270000	.00270000	



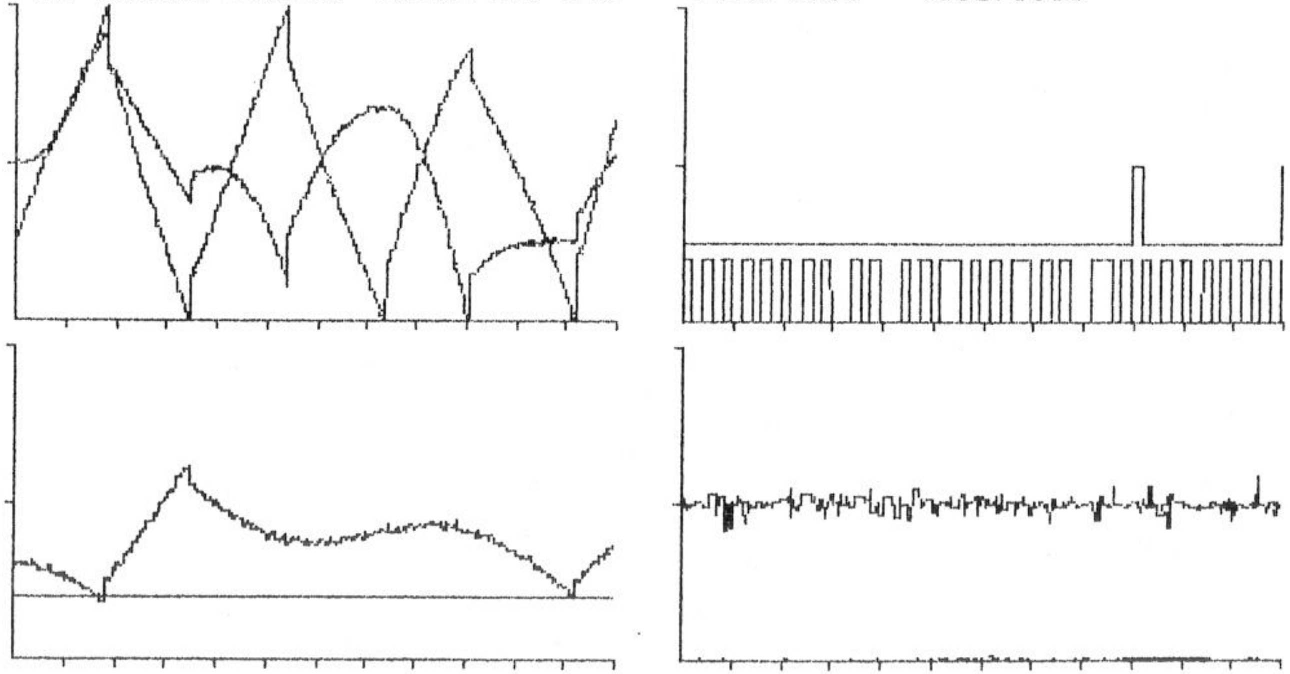
92.063.13.41.54 TIME 92.063.14.41.54
SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 14:40:00

Start Time: 92/03/03-11.00.00 End Time: 92/03/03-14.00.00

B231	Min	(Time)	-0.00002	(92/03/03-11.06.01)	Mean	1.4622E-008	NZG
(RAD)	Max	(Time)	0.00003	(92/03/03-13.38.22)	StDv	2.2690E-006	
B031	Min	(Time)	-9.8009E-006	(92/03/03-12.45.56)	Mean	7.8533E-008	NJM
(RAD)	Max	(Time)	0.00005	(92/03/03-11.23.37)	StDv	3.0151E-006	

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 65:08:28:08
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:065.08.27.47.929
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=AOCS.AF2/ 0

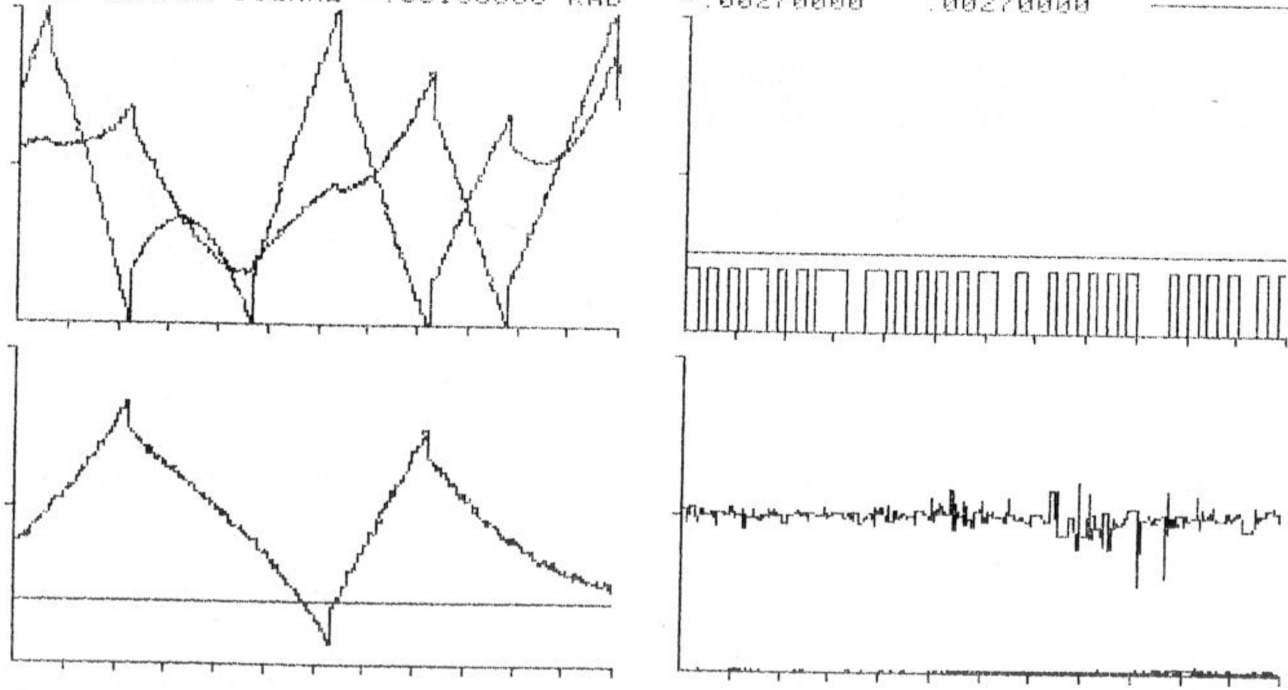
ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00064631	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	.00012893	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	1		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	11		0	2000	
B031	INNOVATION	.00000078	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	-.00077251	RAD	-.00270000	.00270000	



92.065.07.27.53 TIME 92.065.08.27.53
SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 08:25:00
GRD/LIVE : 9999 DS: OPT:N INIT: VDEP: Y

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 65:09:28:29
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:065.09.28.14.571
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=AOCS.AF2/ 0

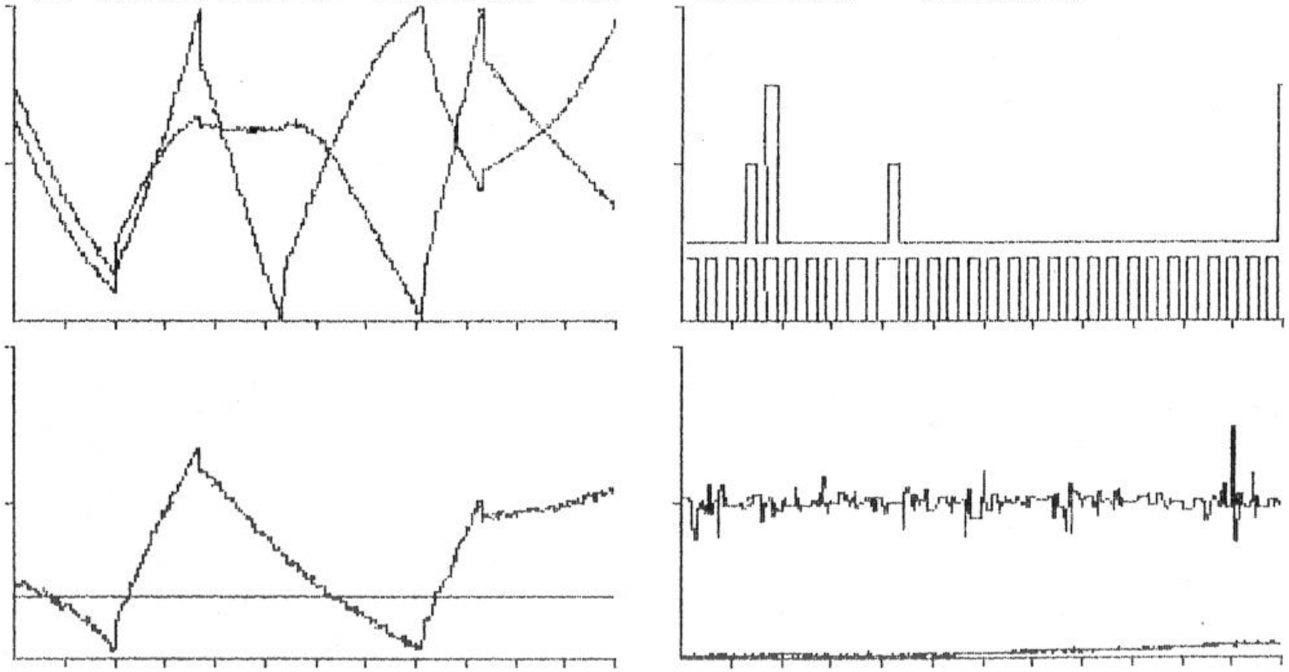
ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00080475	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	.00126026	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	0		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	27		0	2000	
B031	INNOVATION	-.00000081	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	-.00138868	RAD	-.00270000	.00270000	



SCHD_DSP D104 Job AUTO_1....2 dispatched to process SFS_BATCHSE 09:25:00

```
HDCS  0.1 STATUS=USER NAME=USER2     S/C=HIPPARCO                        65:10:29:07
9999 /AOCS CNTR & RTAD MONITORING         REALT            PKT.TIME:065.10.28.51.867
D/S= 0  /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL                PKT.ID=HHR .HK /    0
```

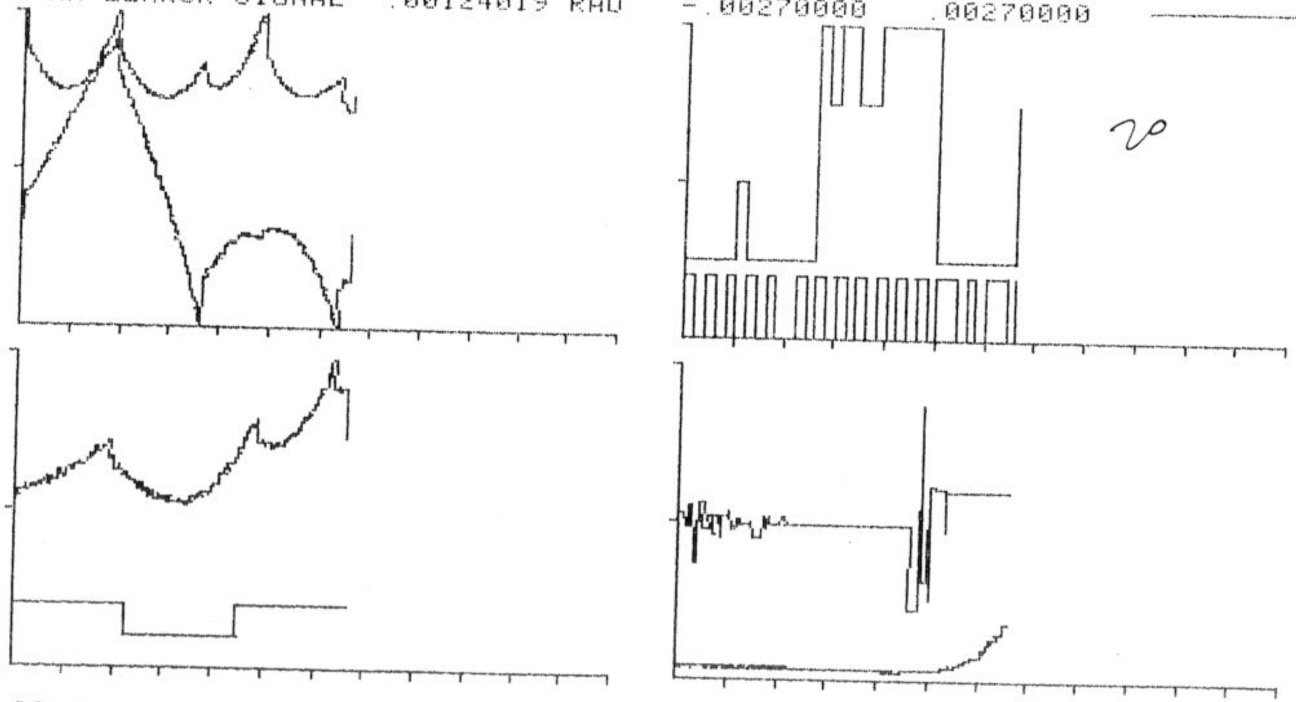
ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00183548	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	-.00057605	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	2		-1	3	
N404	IDTS FOV	0		0	5	
F203	OVERALL BACKGRND	90		0	2000	
B031	INNOVATION	-.00000082	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	.00027908	RAD	-.00270000	.00270000	



```
92.065.09.29.01                TIME                      92.065.10.29.01
SCHD_DSP   D104 Job AUTO_1....2     dispatched to process SFS_BATCHSE 10:25:00
GRD/LIVE    : 9999 DS:    OPT:N INIT:    VDEP: Y
```

HDCS 0.1 STATUS=USER NAME=USER2   S/C=HIPPARCO   65:11:02:46
9999 /AOCS CNTR & RTAD MONITORING   REALT   PKT.TIME:065.11.02.40.250
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL   PKT.ID=OAD .07 / 0

ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00097698	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	-.00081451	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	2		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	383		0	2000	
B031	INNOVATION	.00000984	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	.00124019	RAD	-.00270000	.00270000	



92.065.10.29.21   TIME   92.065.11.29.21
UPLINKER COP0 Changed to COP 0   11:02:08

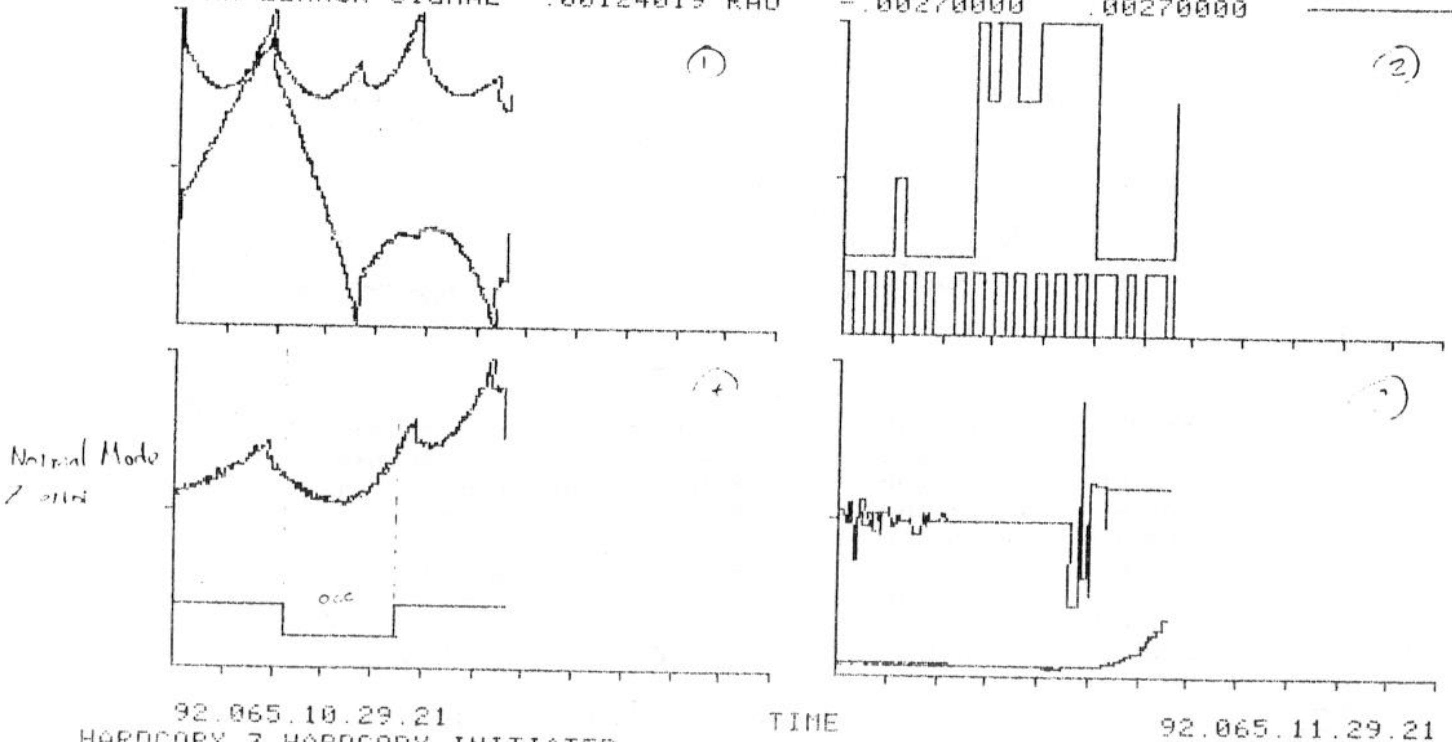
SPACECRAFT PERFORMANCE EVALUATION SERVICE ScId: HIPP UserId: HIPP05
APD:INNO INNOVATIONS Type:MM DsId:TM OwnId:PRIVAT

Start Time: 92/03/05-07.50.00 End Time: 92/03/05-10.50.00

B231	Min	(Time)	-0.00003	(92/03/05-09.58.59)	Mean	1.2322E-007
(RAD)	Max	(Time)	0.00005	(92/03/05-09.56.51)	StDv	4.5317E-006
B031	Min	(Time)	-0.00002	(92/03/05-09.14.01)	Mean	-1.5226E-007
(RAD)	Max	(Time)	0.00002	(92/03/05-10.23.53)	StDv	2.9853E-006

HDCS 0.1 STATUS=USER NAME=USER2 S/C=HIPPARCO 65:11:03:07
9999 /AOCS CNTR & RTAD MONITORING REALT PKT.TIME:065.11.02.40.250
D/S= 0 /SRCE=SRCA/GDGT/OPT= DP SC FS LI FI VA AL PKT.ID=OAD .07 / 0

ID	DESCRIPTION	VALUE	UNIT	MIN	MAX	LINE
E042	NM XERROR SIGNAL	.00097698	RAD	-.00200000	.00200000	
E043	NM YERROR SIGNAL	-.00081451	RAD	-.00200000	.00200000	
N407	IDTS QUALITY	2		-1	3	
N404	IDTS FOV	1		0	5	
F203	OVERALL BACKGRND	383		0	2000	
B031	INNOVATION	.00000984	RAD	-.00005000	.00005000	
K251	MDE2 TYC2SHUTTER	2		0	10	
E044	NM ZERROR SIGNAL	.00124019	RAD	-.00270000	.00270000	

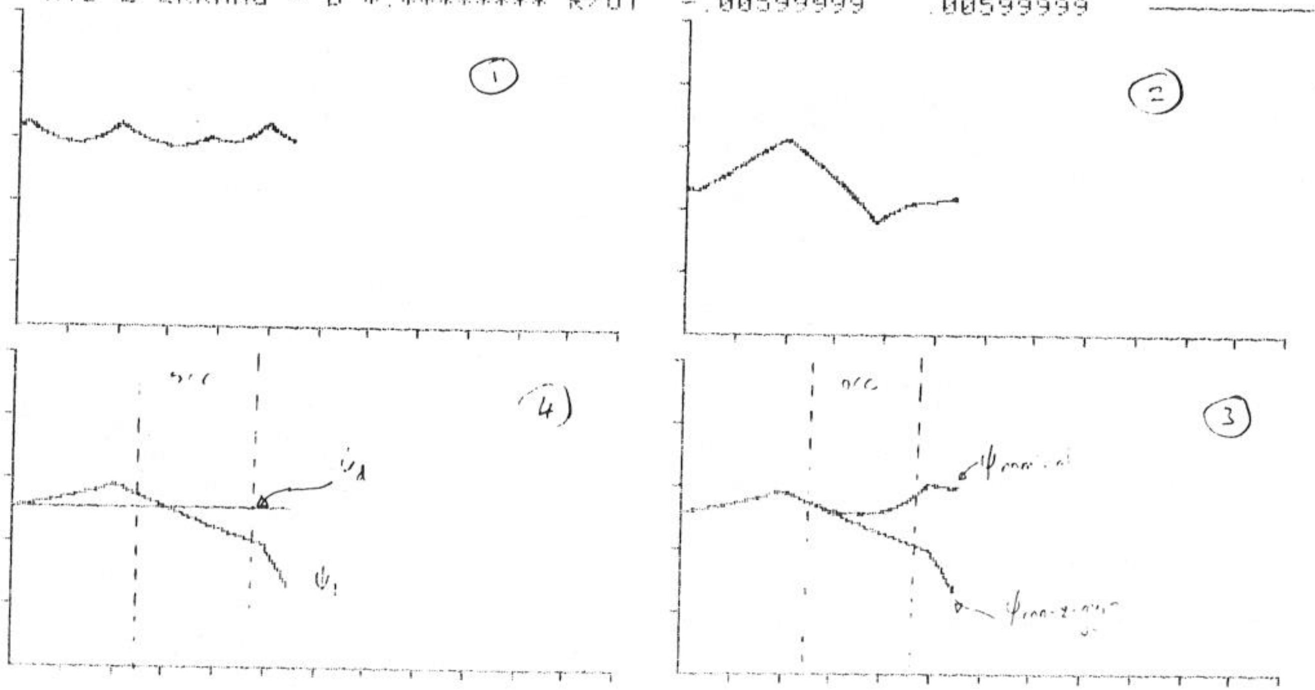


HARDCOPY 3 HARDCOPY INITIATED 11:02:47

(3)

HDCS 0.1 STATUS=SPAC NAME=SPACON S/C=HIPPARCO 65:10:57:35
#159 /NEW NON Z GYRO SW MONITORING REALT PKT.TIME:065.10.57.18.508
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
① B007	RTD XERROR ANGLE	.00100799	RAD	-.00599999	.00599999	
B210	RTD XERR.ANG.AUX	*.********	RAD	-.00599999	.00599999	
② B008	RTD YERROR ANGLE	-.00084674	RAD	-.00599999	.00599999	
B232	RTD YERR.ANG.NEW	.11718750	RAD	-.00599999	.00599999	
③ B009	RTD ZERROR ANGLE	.00124436	RAD	-.00599999	.00599999	
B233	RTD ZERR.ANG.NEW	0.00000000	RAD	-.00599999	.00599999	
④ B238	RTD Z ERRANG - 1	*.********	R/UT	-.00599999	.00599999	
B240	RTD Z ERRANG - D	*.********	R/UT	-.00599999	.00599999	



92.065.10.28.39 TIME 92.065.11.28.39
REJECT 1 10:52:52

④

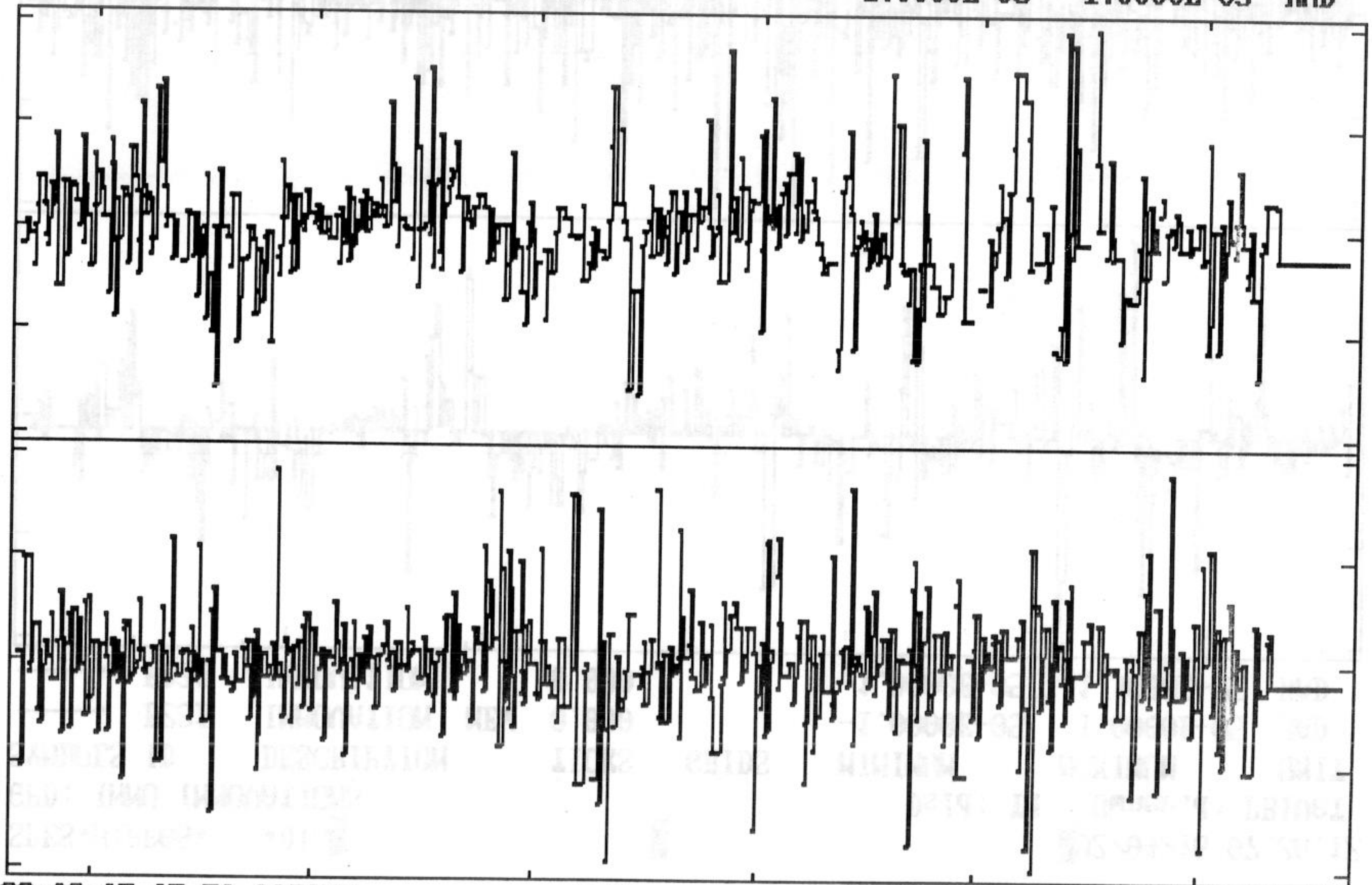
SPES•HIPP05•   DIS

GPD: INNO INNOVATIONS

92/04/23 11.46.09

DsId: TM   OwnerId: PRIVAT

SYMBOLS	ID	DESCRIPTION	TICKS	GRIDS	MINIMUM	MAXIMUM	UNIT
———	B231	INNOVATION NEW	0.000		-1.0000E-05	1.0000E-05	RAD
———	B031	INNOVATION	0.000		-1.0000E-05	1.0000E-05	RAD

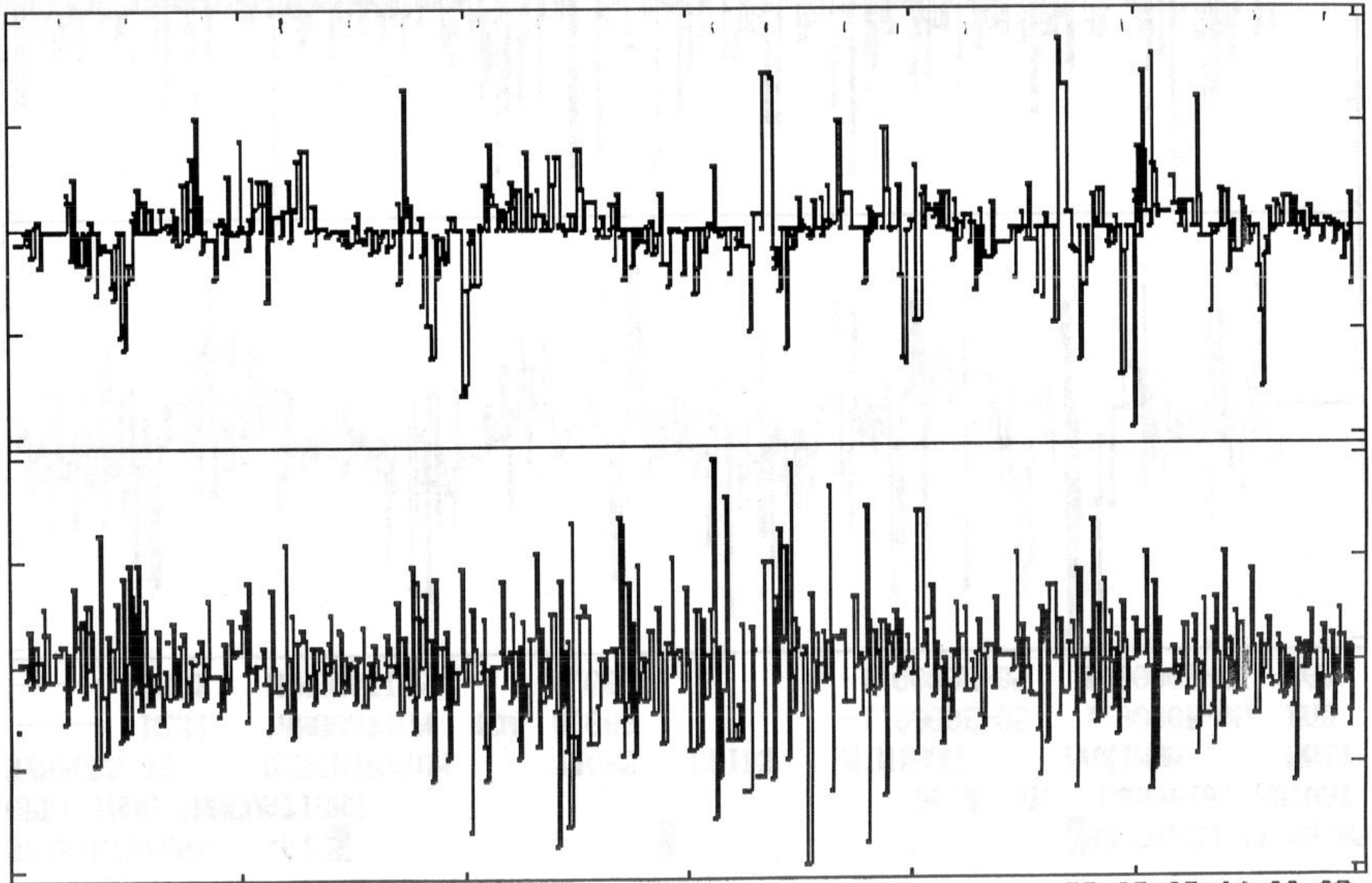


92/03/05 07.50.06 TIME   T=30   MIN   92/03/05 10.50.06

SPES•HIPP05•   •DIS   92/04/16 07.26.12

GPD: INNO INNOVATIONS   DsId: TM   OwnerId: PRIVAT

SYMBOLS	ID	DESCRIPTION	TICKS	GRIDS	MINIMUM	MAXIMUM	UNIT
——	B231	INNOVATION NEW	0.000		-1.0000E-05	1.0000E-05	RAD
——	B031	INNOVATION	0.000		-1.0000E-05	1.0000E-05	RAD



92/03/03 11.00.09TIME   T=30   MIN   92/03/03 14.00.09

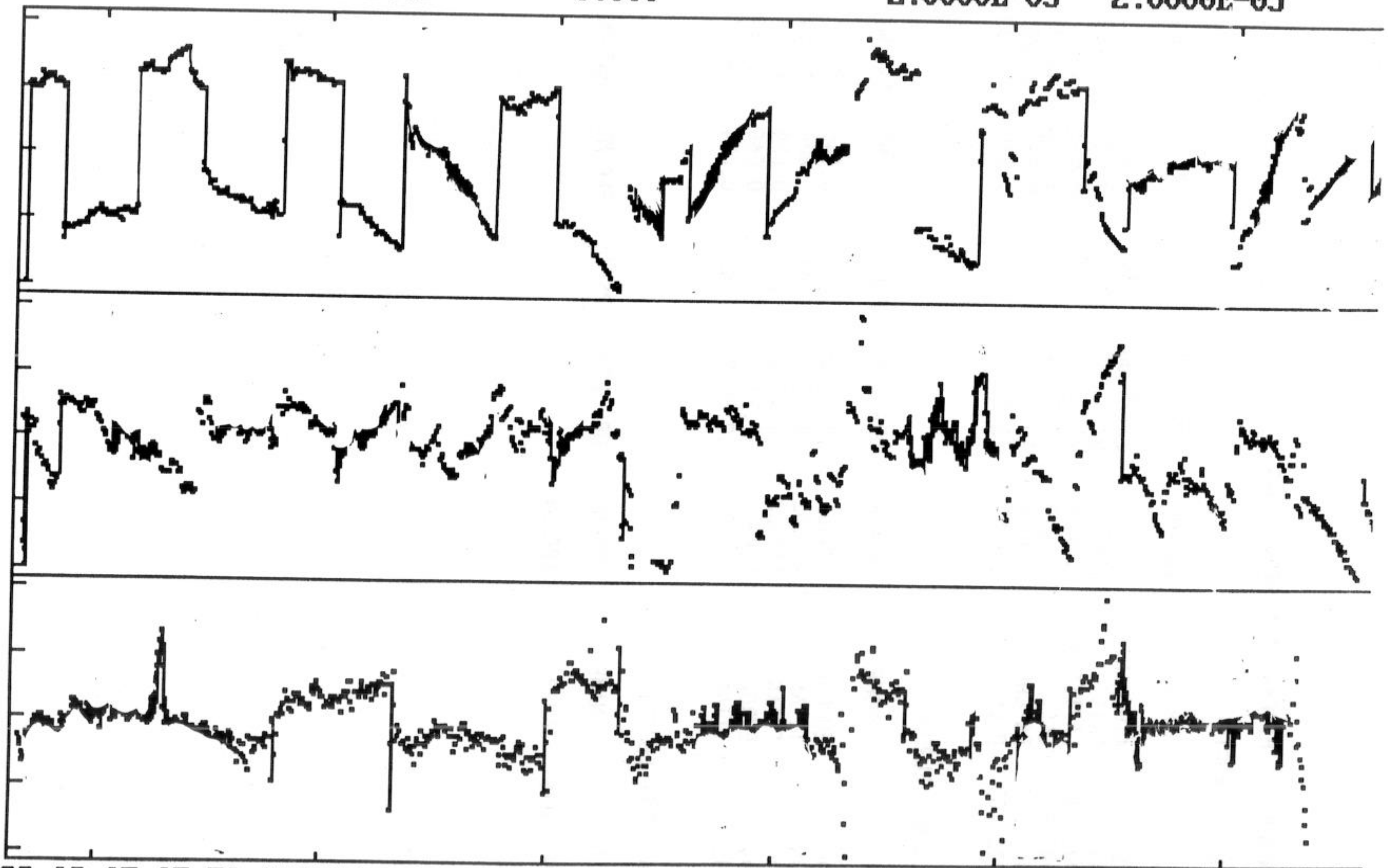
SPES•HIPP05 •DIS

92/04/24 13.49.4

GPD: RTAD NON Z GYRO RTAD PERFORMANCE

DsId: TM OwnerId: PRIVAT

SYMBOLS	ID	DESCRIPTION	TICKS	GRIDS	MINIMUM	MAXIMUM	UNIT
———	XERZNZ	B210-B007	0.000		-4.0000E-05	4.0000E-05	
———	YERZNZ	B232-B008	0.000		-2.0000E-05	2.0000E-05	
———	ZERZNZ	B233-B009	0.000		-2.0000E-05	2.0000E-05	



SUMMARY OF HIPPARCOS OBSERVATIONS

MINOR PLANETS:

DAY	NAME	INCANR.	OBS.TIME	PSFID	EXP.M1	EST.M1
1991.126	ATHEMANTIS	129230	23:25.06	38	0.649	0.243
1991.197	IRIS	129007	07:54.20	238	0.649	1.751
1991.248	LAETITIA	129039	21:15.27	12	0.649	0.577
1991.328	LAETITIA	129039	14:47.14	99	0.649	0.673
1992.016	PSYCHE	129016	10:27.39	12	0.649	0.391
1992.107	PALLAS	129002	11:28.14	131	0.649	0.683

TITAN + EUROPE:

DAY	NAME	INCANR.	OBS.TIME	PSFID	EXP.M1	EST.M1
1991.106	EUROPE	129901	19:22.29	25	0.646	0.333
1991.107	TITAN	129902	02:29.14	244	0.624	0.227
1991.310	TITAN	129902	02:47.30	198	0.624	0.414
1991.336	EUROPE	129901	17:27.17	111	0.646	0.267
1992.108	TITAN	129902	00:56.23	148	0.624	0.203

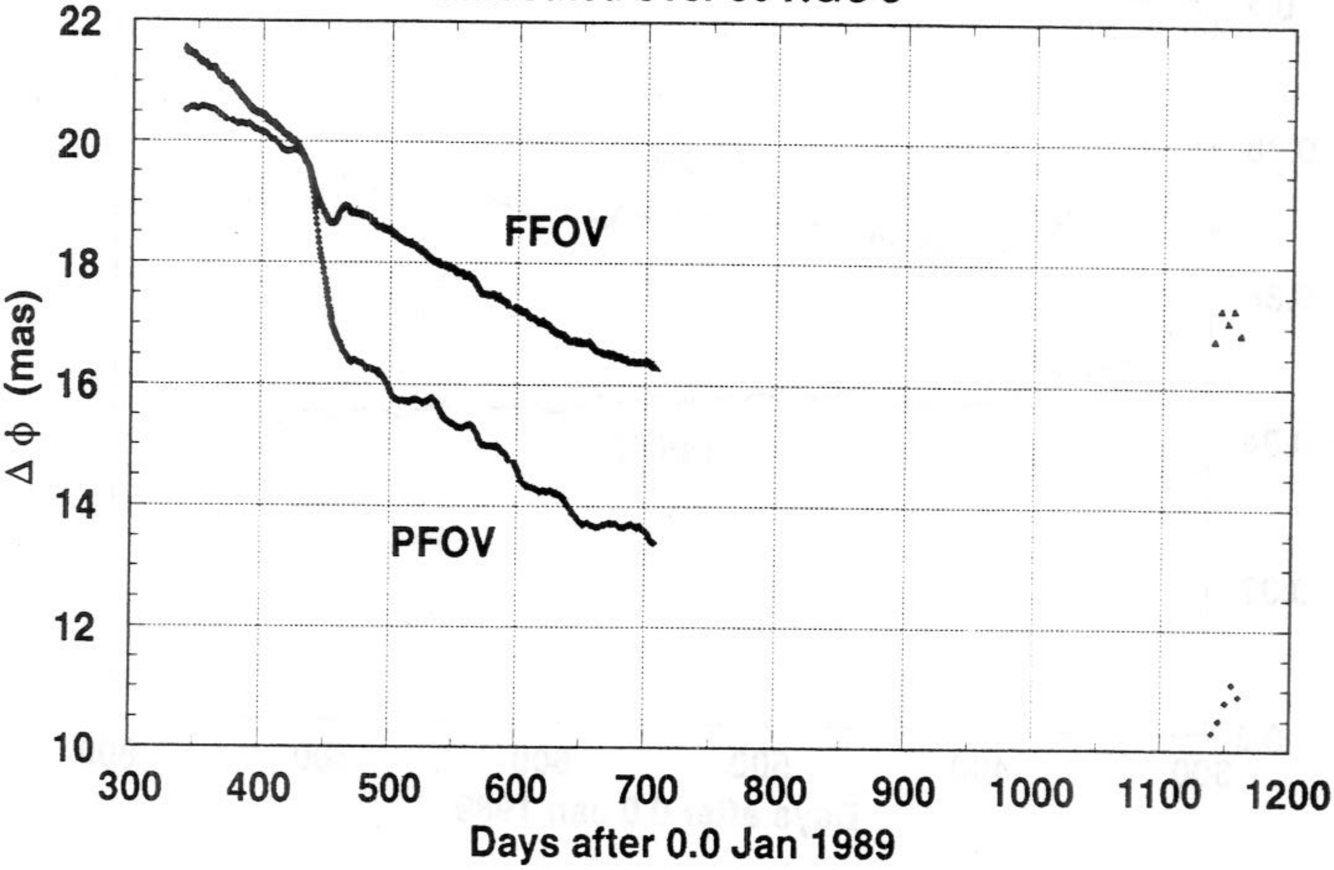
FAINTEST OBJECT:

DAY	NAME	INCANR.	OBS.TIME	PSFID	EXP.M1	EST.M1
1991.036	3C273	120194				

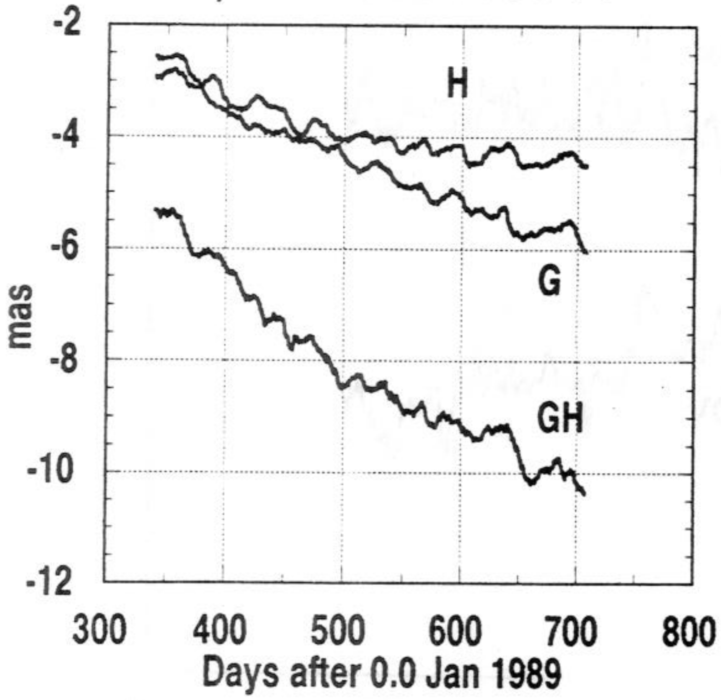
Annex IV

PHASE DIFFERENCE $\phi_2 - \phi_1$ in mas

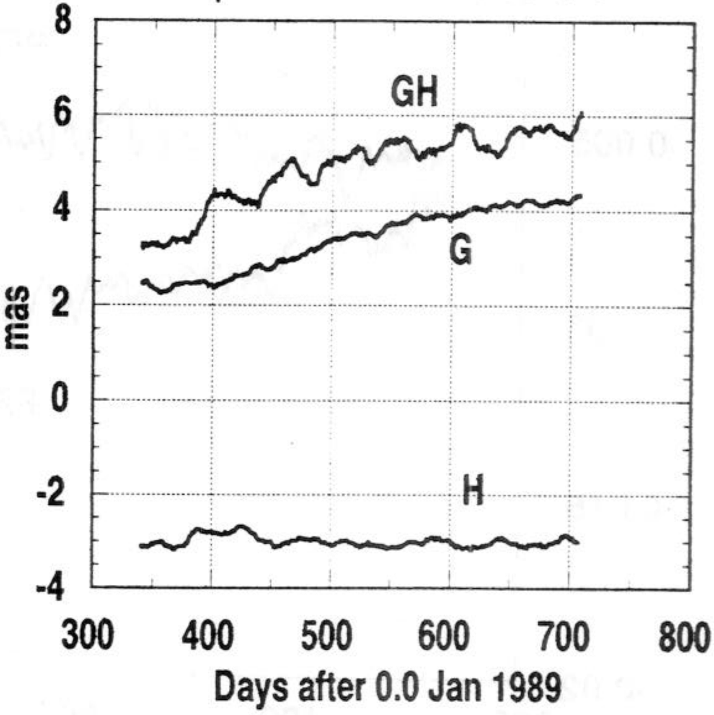
Smoothed over 30 RGC's

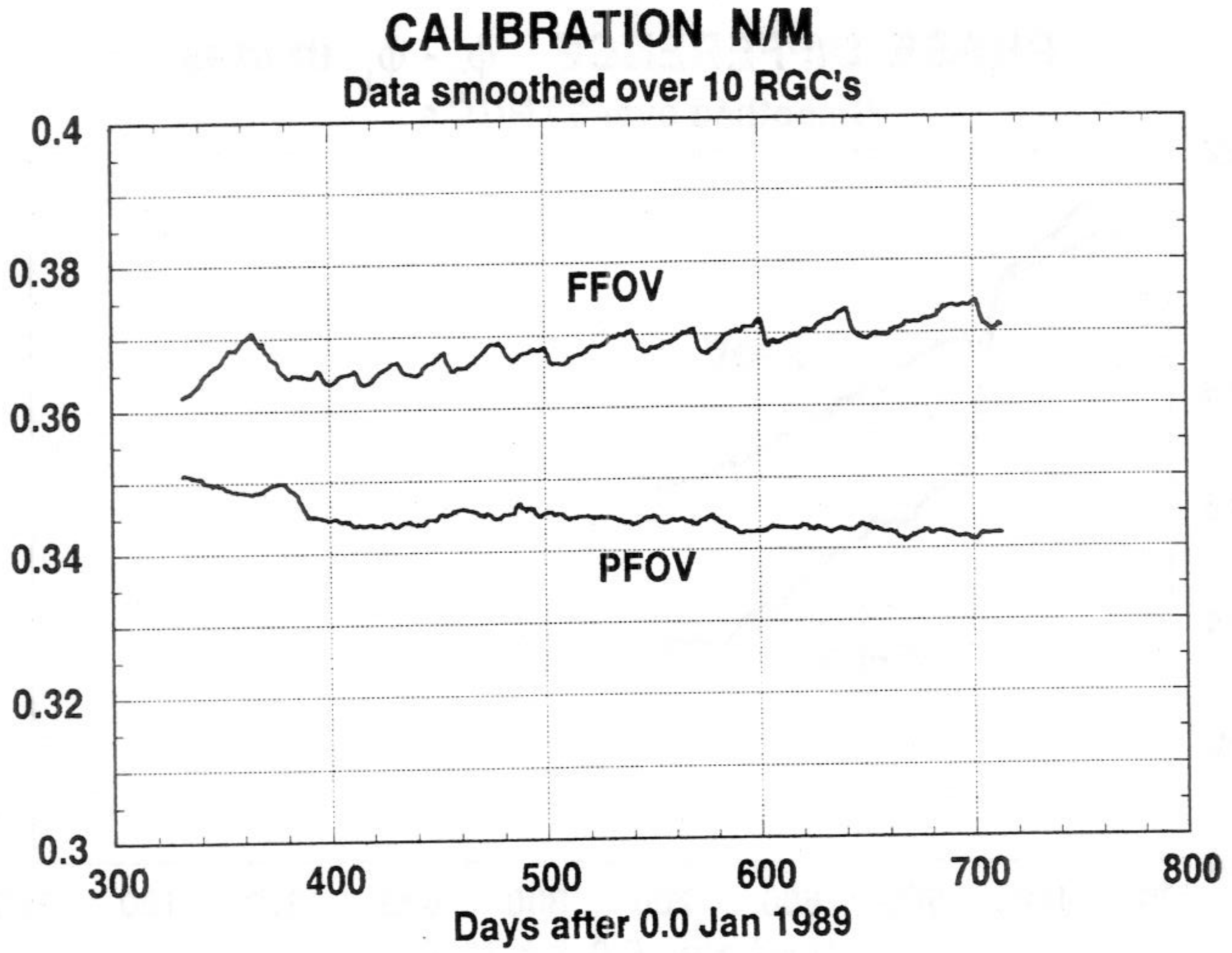


$\Delta\phi$ Calibration : PFOV

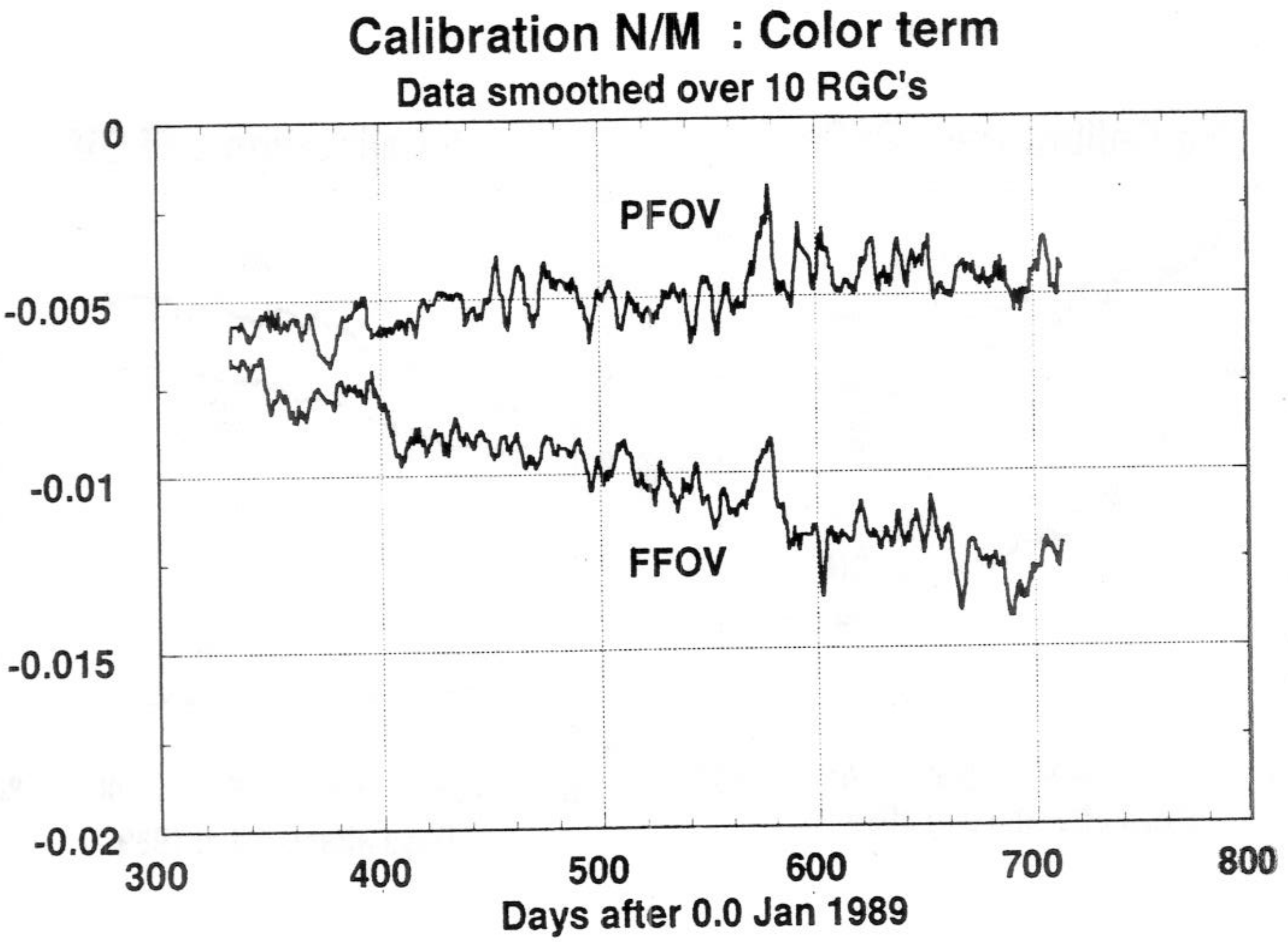


$\Delta\phi$ Calibration : FFOV

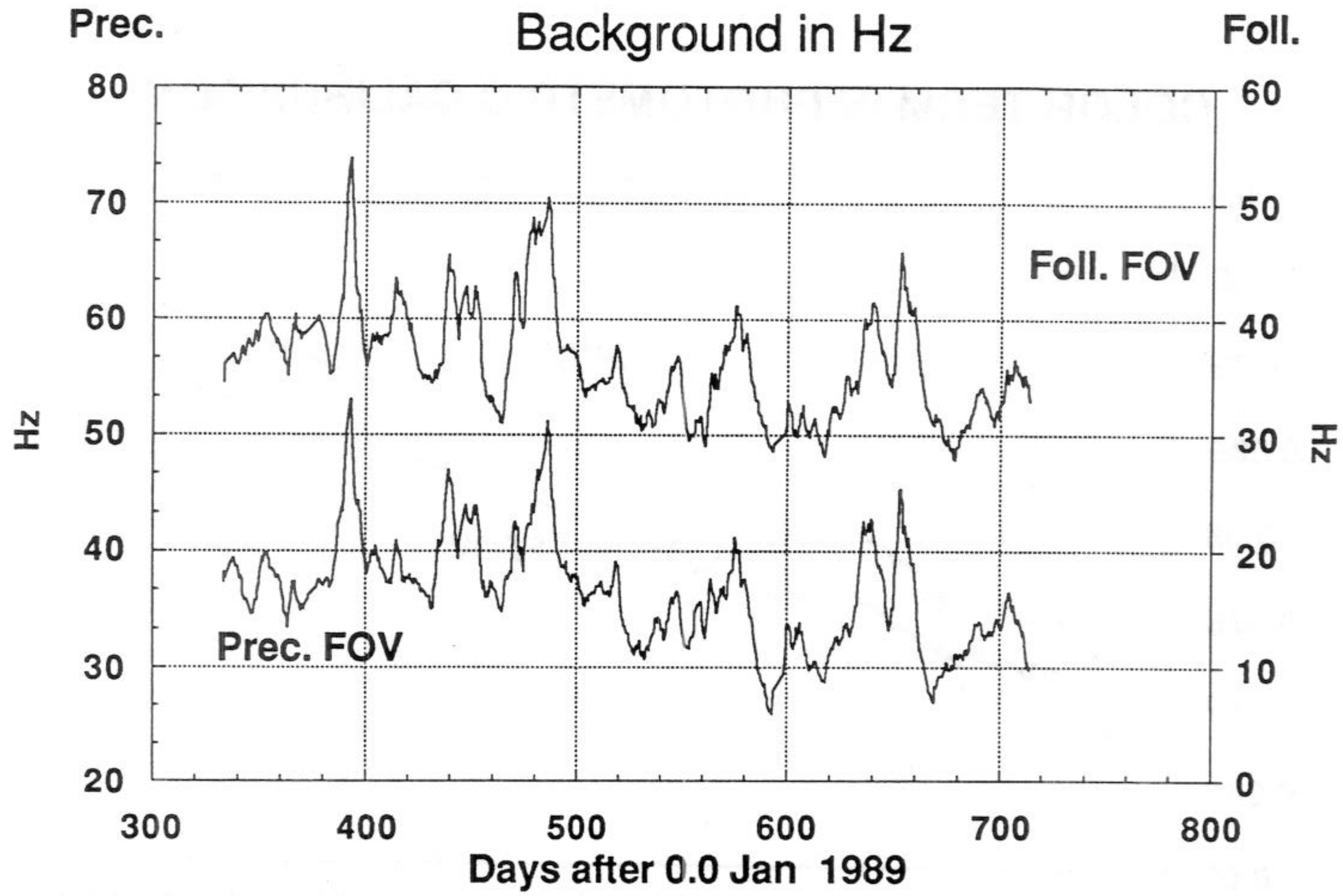




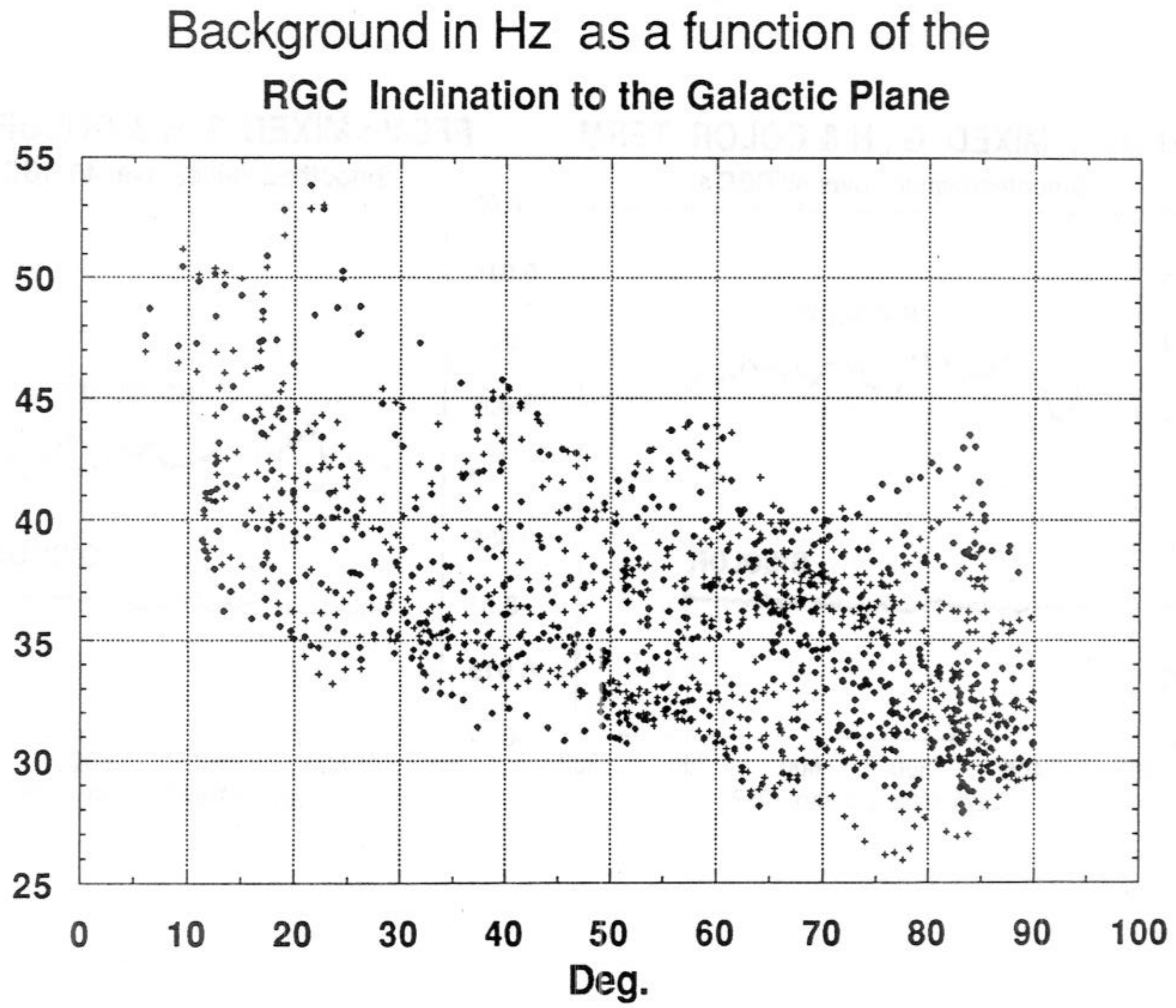
CALIBRATION N/M
Data smoothed over 10 RGC's
0.4
0.38
0.36
0.34
0.32
0.3
FFOV
PFOV
300
400
500
600
700
800
Days after 0.0 Jan 1989



Calibration N/M : Color term
Data smoothed over 10 RGC's
0
-0.005
-0.01
-0.015
-0.02
PFOV
FFOV
300
400
500
600
700
800
Days after 0.0 Jan 1989

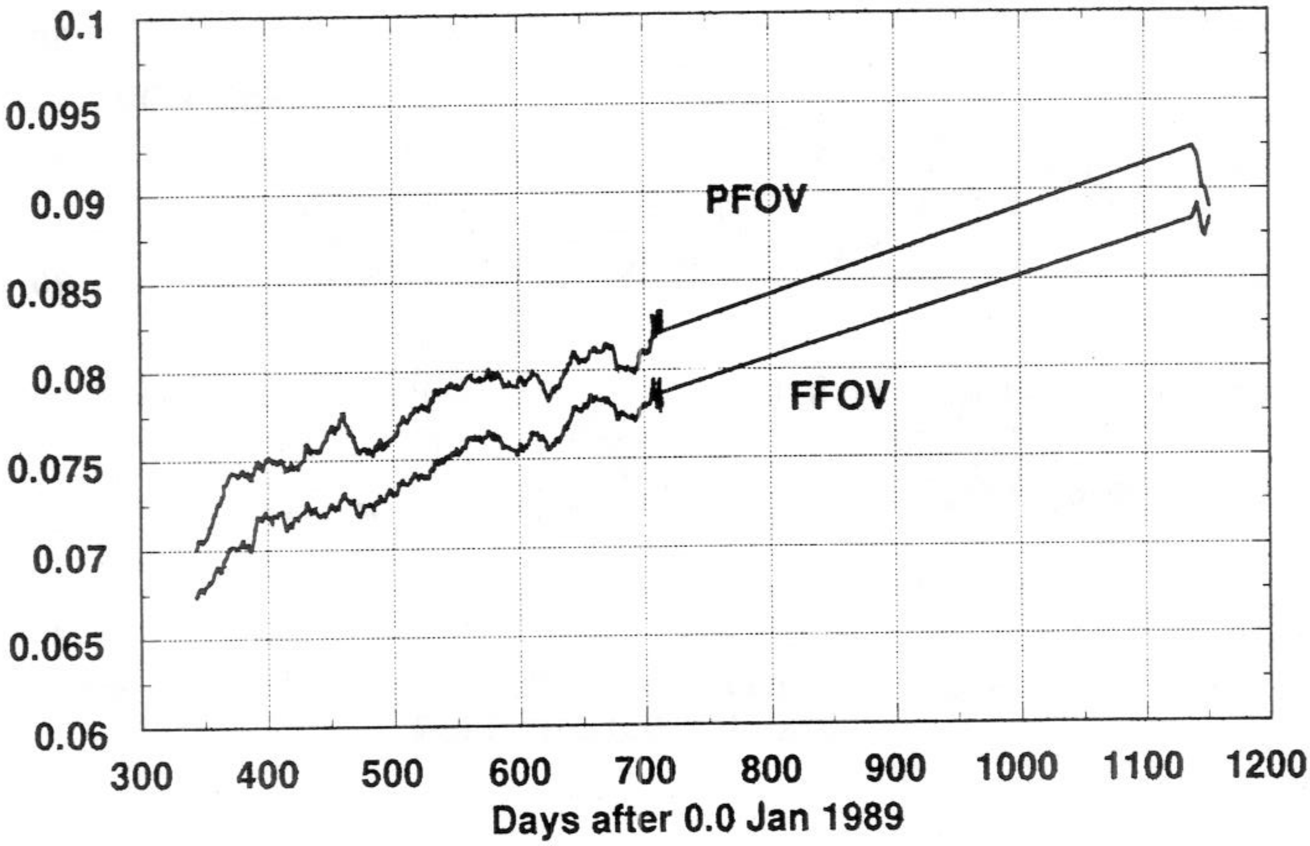


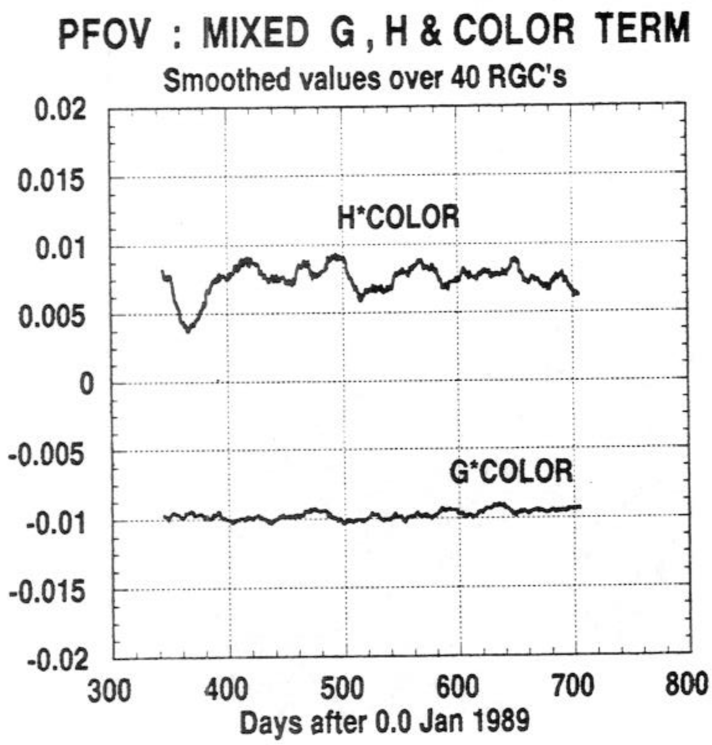
Prec.
Background in Hz
Foll.
80
70
60
50
40
30
20
60
50
40
30
20
10
0
Hz
Hz
Foll. FOV
Prec. FOV
300
400
500
600
700
800
Days after 0.0 Jan 1989

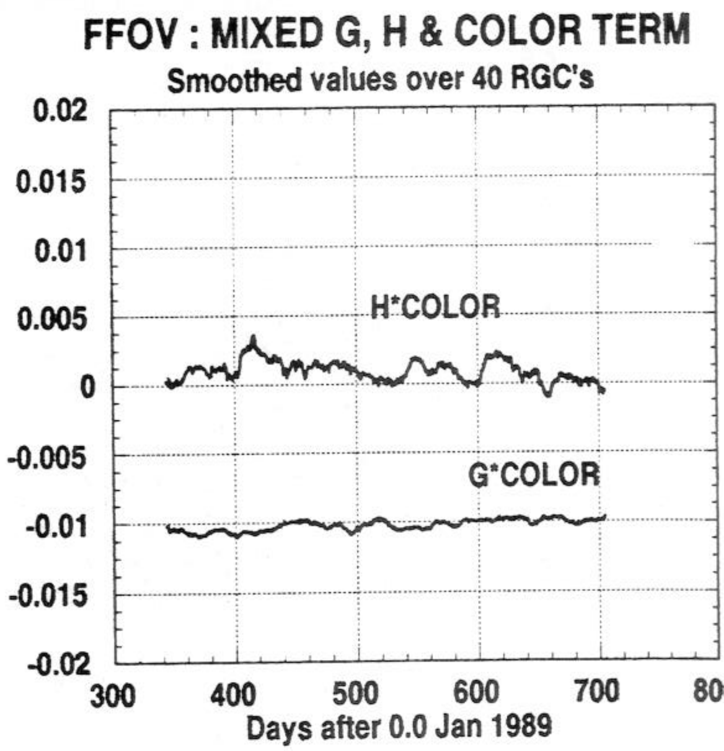


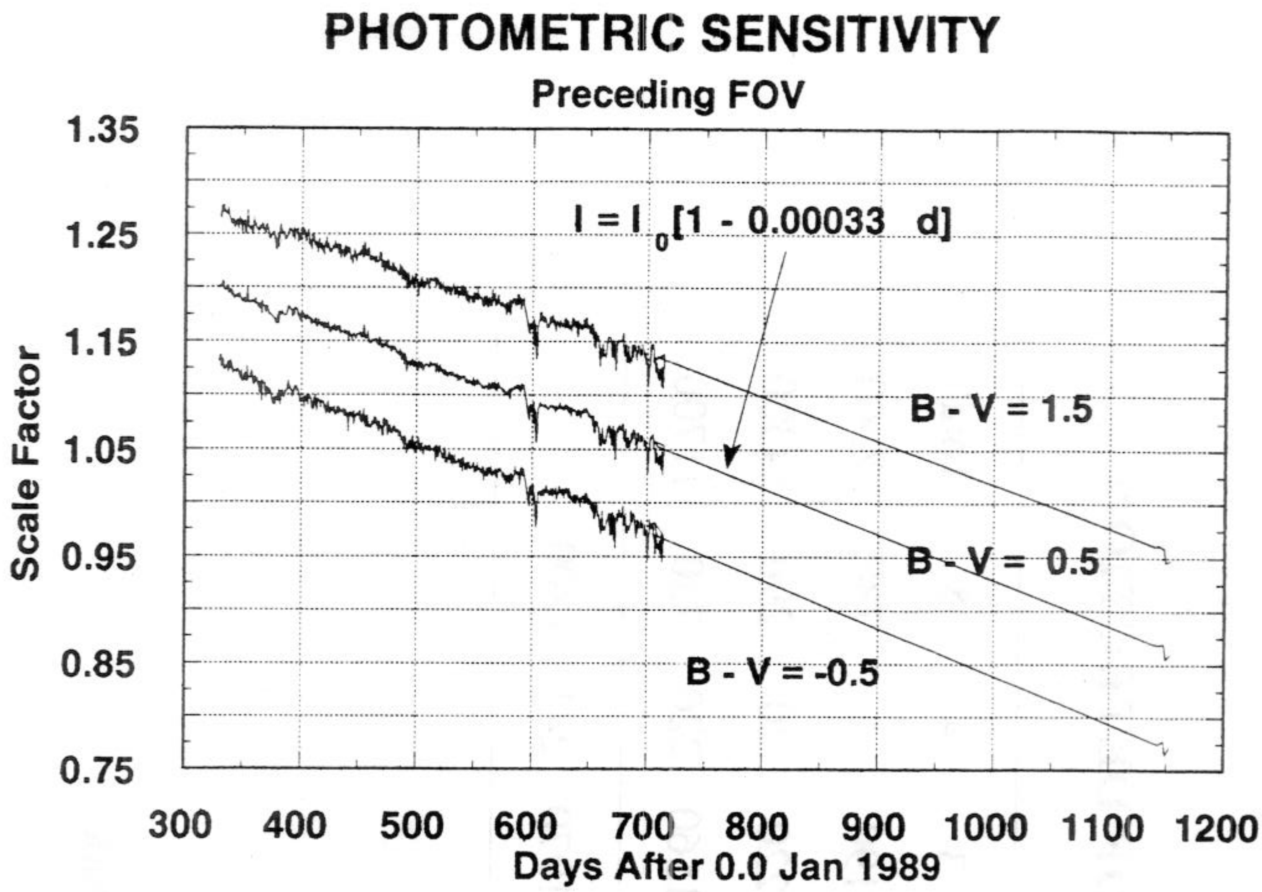
Background in Hz as a function of the
RGC Inclination to the Galactic Plane
55
50
45
40
35
30
25
0
10
20
30
40
50
60
70
80
90
100
Deg.

COLOR TERM IN PHOTOMETRIC CALIBRATION

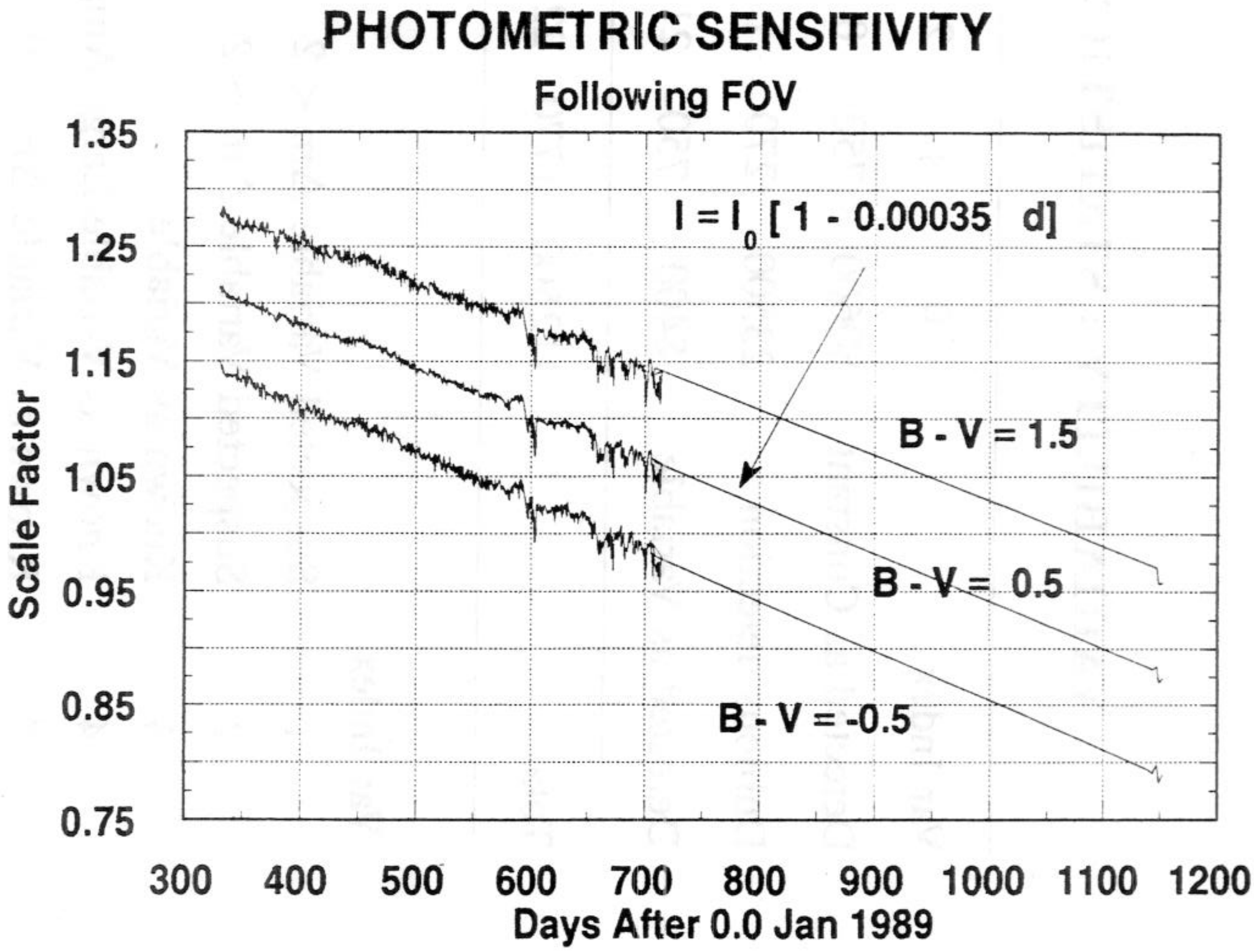








PHOTOMETRIC SENSITIVITY
Preceding FOV
I = I0[1 - 0.00033 d]
B - V = 1.5
B - V = 0.5
B - V = -0.5
Scale Factor
1.35
1.25
1.15
1.05
0.95
0.85
0.75
300
400
500
600
700
800
900
1000
1100
1200
Days After 0.0 Jan 1989



PHOTOMETRIC SENSITIVITY
Following FOV
I = I0 [1 - 0.00035 d]
B - V = 1.5
B - V = 0.5
B - V = -0.5
Scale Factor
1.35
1.25
1.15
1.05
0.95
0.85
0.75
300
400
500
600
700
800
900
1000
1100
1200
Days After 0.0 Jan 1989

VARIABILITY : STATISTICS OF DETECTION

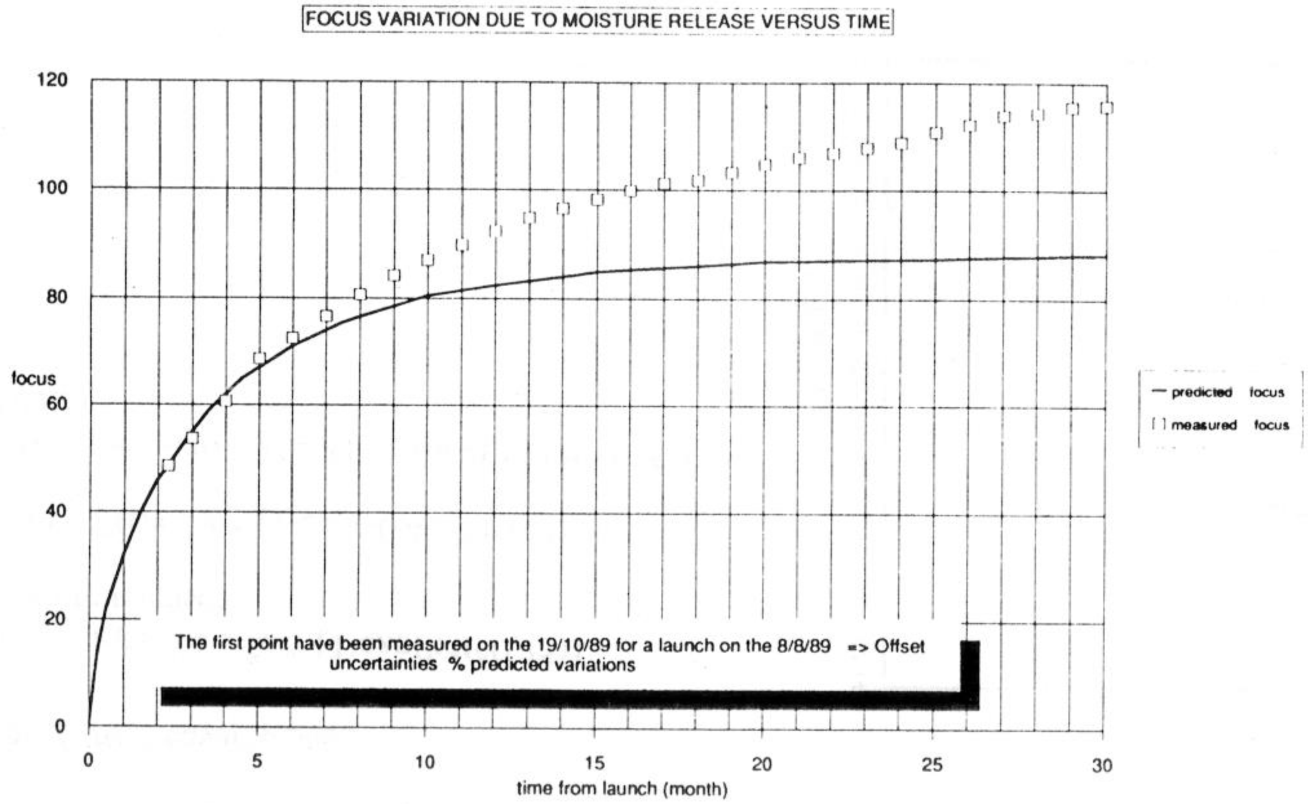
Var Index	0	1	2	3	4	5	Total
Detected as Constant	80600	750	0	190	1	780	82300
Dubious detection	23500	270	1	220	20	290	24300
Detected as Variable	8400	750	21	1560	220	730	11700
Total	112500	1770	22	1970	241	1800	

Var Index	
1	Suspected Variable $\Delta m < 2$
2	Suspected Variable $\Delta m > 2$
3	Known as Variable
4	Known as Variable Large Amplitude
5	Known as Variable $\Delta m < 0.2$

Annex V

ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (1)

The measured variation of the focus position and the initial moisture release prediction



→ Significant deviations appeared after 6 months in orbit and have been regularly increasing since then

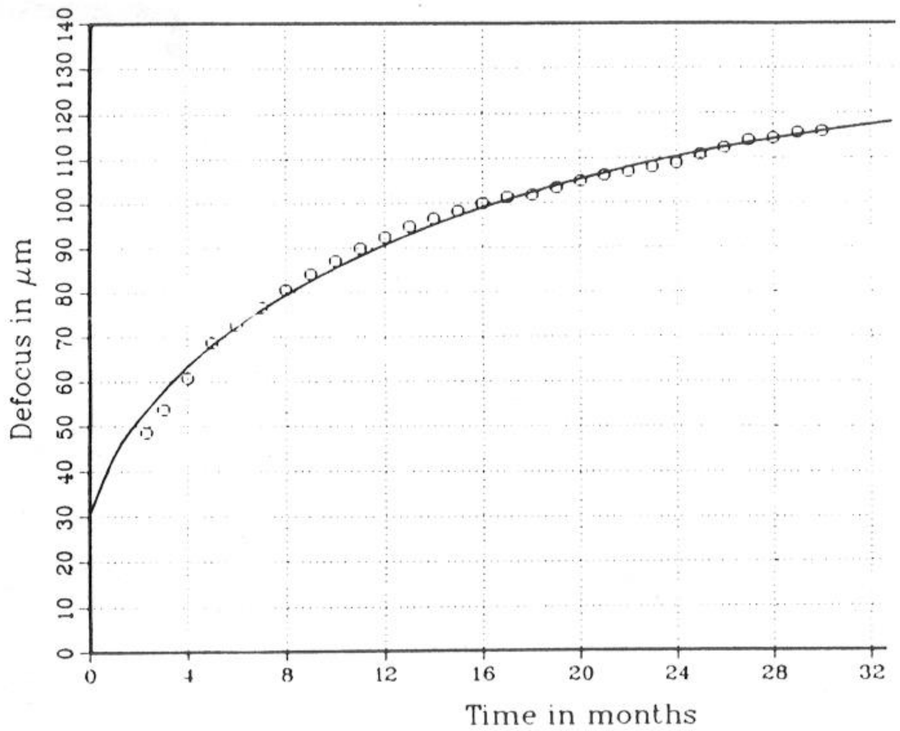
ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (2)

First assessment of the measured data:

Basic equation: $F(t)= F_0 + f_m * \{1-\exp(k*t^{0,75})\}$
(ruling the moisture release)

Inital prediction: $F(t)= 89 * \{1-\exp(-0,427*t^{0,75})\}$

"Straight best fit": $F(t)= 30 + 104 * \{1-\exp(-0,134*t^{0,75})\}$
(of measured data)



A relatively good fit of the measured data with the basic equation ruling the moisture release is obtainable.

→ It makes believe the moisture release of the telescope CFRP panels takes place with a greater time constant

ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (3)

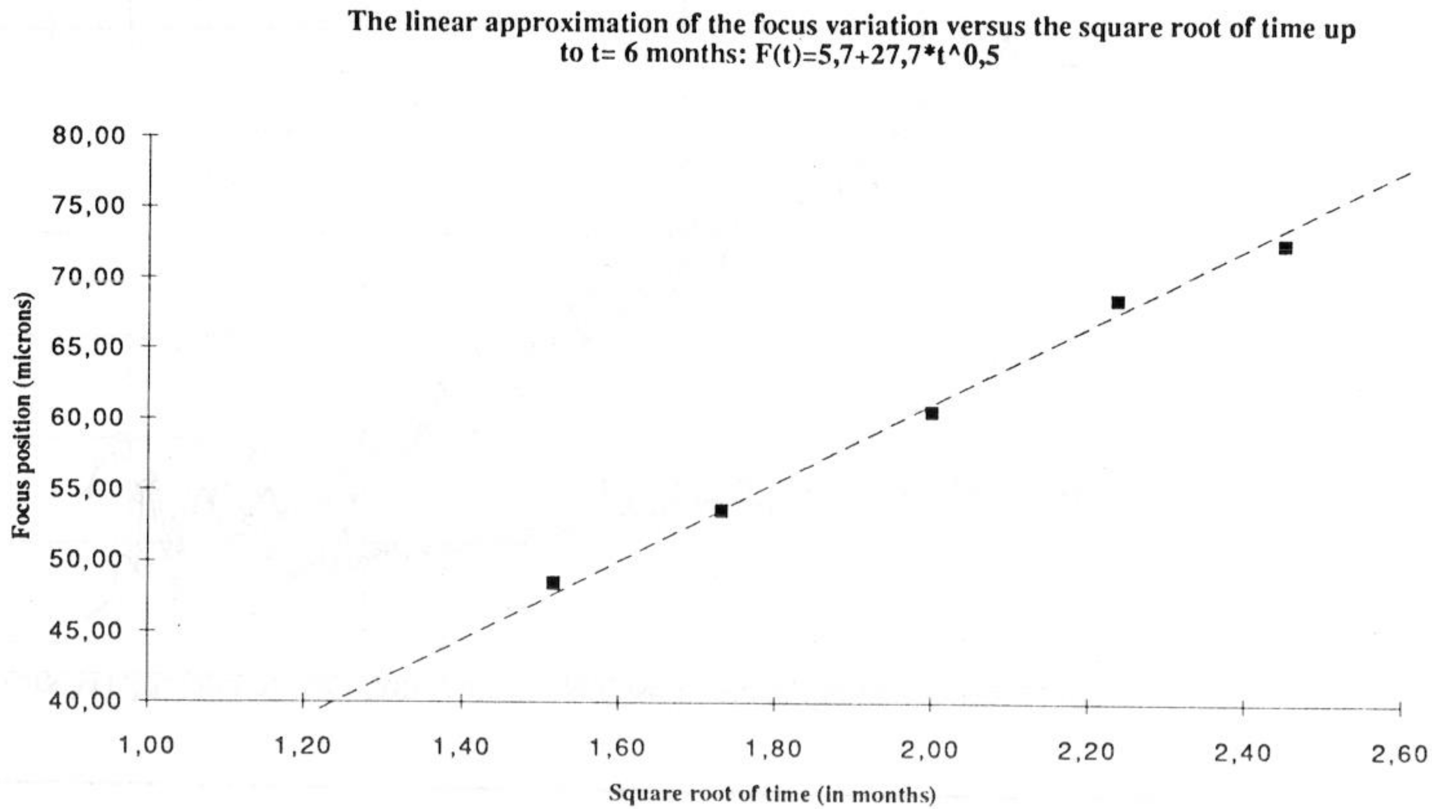
<u>Analysis of the first points</u>

The basic equation is approximated by a linear variation of the focus with the square root of time over the first part of the moisture release effect, i. e. when the rate of desorption is the most significant: $F(t) = F_0 + K*t^{0,5}$

The amplitude of the moisture effect and the time constant are linked through the factor K

For the initial prediction: K= 30

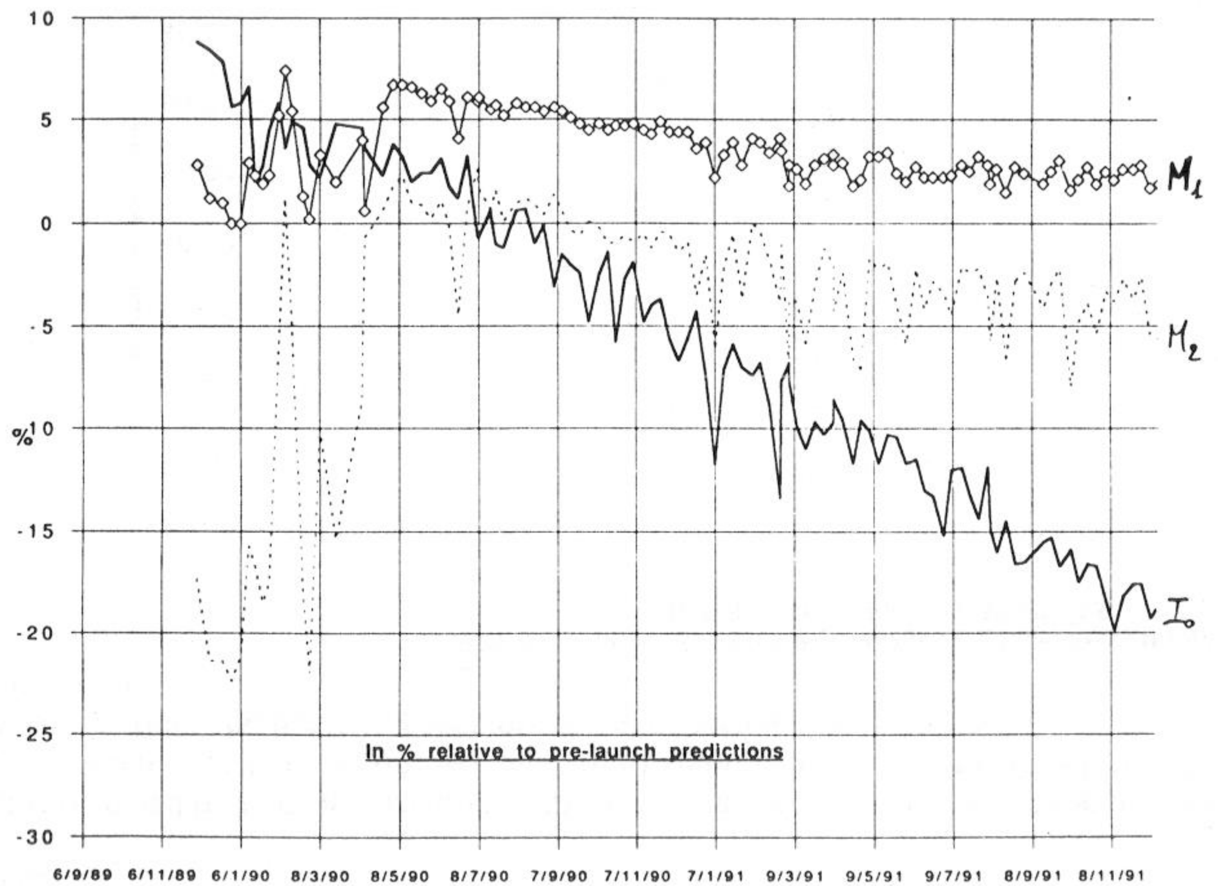
For the best fit: K= 16



→ The measured data in orbit over the 6 first months yield an amplitude/time constant dependance in accordance with the initial prediction and contradicting the straight best fit.

ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (4)

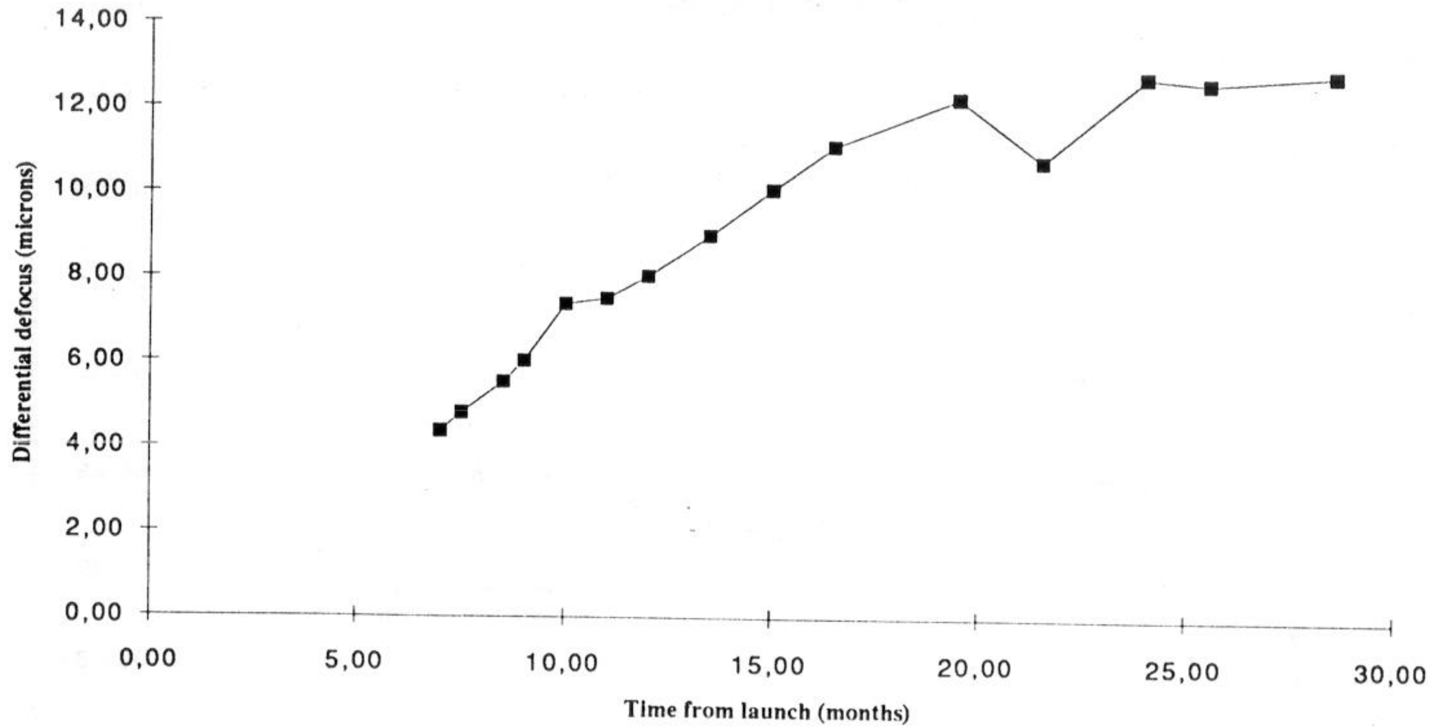
Evolution of the modulation factors M1,M2 and of the photometric response I0 since the beginning of life



The photometric response I0 decreases "as expected"with time due to the effect of the irradiations on the refractive optics
The modulation factors M1,M2 show a significant and *unexpected* degradation with time

ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (5)

The differential defocus measured in orbit



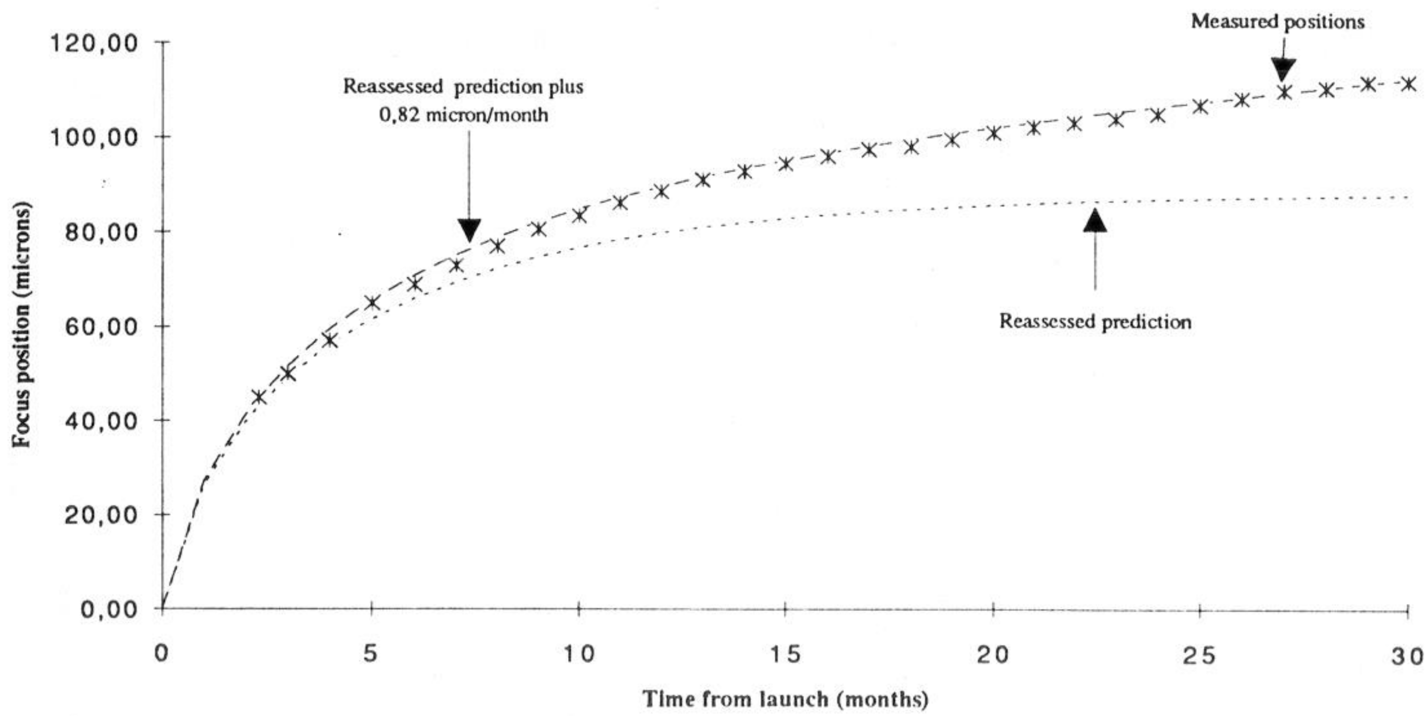
We do not have this info!

The stability of the modulation factors M1,M2 at the respective best focus positions of the preceding and following fields of view indicate the intrisic optical quality of the telescope remains at first order unchanged since the beginning of life. The differential defocus continuously increases with time, apparently linearly over the 20 first months and remains about stable afterwards.

→ Another phenomenon than the only moisture release is suspected

ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (6)

The measured positions are remarkably approximated by a linear variation versus time added to the moisture release prediction:



← slight longer time constant

➡ The existence of a phenomenon causing a linear variation with time is likely.

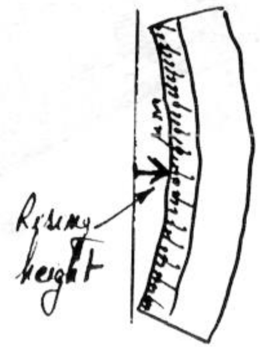
ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (7)

The irradiation of the spherical mirror from the back side is a possible explanation, considering:

- the results of irradiation tests of zerodur samples
- the dose observed by Hipparcos after 2,5 years in orbit
- the sign of the linear deviation additional to the moisture induced focus evolution
- the configuration of the Hipparcos harware

Rising height of Zerodur (ø 100 x 5 mm)

electron dose 0.8 MeV	+ 0.3 MeV	equivalent to time in orbit	Zerodur
20.5 Gy	+ $1.3 \cdot 10^4$ Gy	10 years	- 1.6 µm
$4.1 \cdot 10^3$ Gy	+ $1.3 \cdot 10^6$ Gy	10^3 years	- 12.5 µm

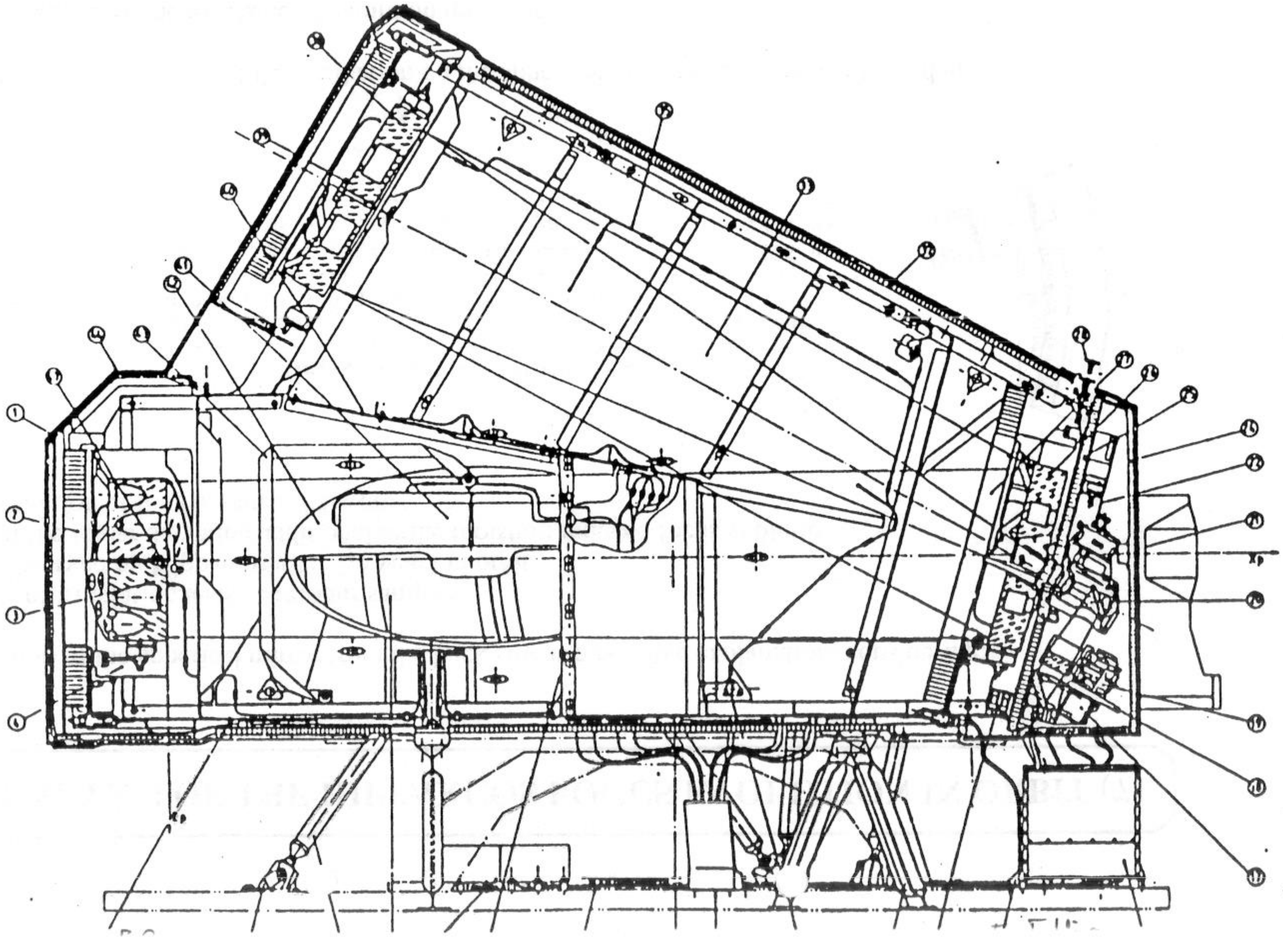


The hypothesis of the impact of the irradiation on the spherical mirror need to be confirmed after:

- extensive analysis of the available literature on the subject
- a determination of the irradiation dose actually observed by the mirrors
- an analysis of the sensitivity of the Hipparcos mirrors

→ Further analyses are desirable due to potential impacts on future missions

ANALYSIS OF THE HIPPARCOS FOCUS EVOLUTION IN ORBIT (8)



FAST / NDAC SPHERE SOLUTION COMPARISON

HST 5-6 MAY '92

DATA SETS:

RGO8	(FEBR. '92)	120,287 **	IC + UPDATED POS.
N44	(MARCH '92)	109,266 **	SPHERE RUN #44 POS + PAR + PM*
[N3	(APRIL '92)	72,211 **	SPHERE RUN #48 POS + PAR]
N5	(APRIL '92)	47,061 **	SPHERE RUN #50 POS + PAR + PM
F3	(MARCH '92)	5525 **	π ONLY, $\sigma_\pi < 2$ MAS
F5	(APRIL '92)	31,921 **	POS + PAR + PM

STARS IN COMMON:

N44 ∩ F3 = 3044 ** ($\sigma_{\pi\,NDAC} < 2$ MAS)

N5 ∩ F5 = 29,478 **

POSITIONS

[MAS]

N5 − F5 (29,478 **): $\langle \Delta\alpha \cos\delta \rangle = -8.01$, $\sigma = 10.83$
$\langle \Delta\delta \rangle = -0.30$, $\sigma = 14.37$

ROTATION ANALYSIS: $\varphi = +15.03 \pm .04$
$\theta = +11.38 \pm .04$
$\psi = +9.59 \pm .04$

($|\vec{\omega}| = 21.15$ MAS
POLE AT $\alpha = 37\overset{\circ}{.}1$, $\delta = +27\overset{\circ}{.}0$)

AFTER ROTATION: $\langle \Delta\alpha \cos\delta \rangle = +0.11$, $\sigma = 3.91$
$\langle \Delta\delta \rangle = +0.07$, $\sigma = 3.46$

PARALLAXES

N5 − F5 (29,478 ★★) $\langle \Delta\pi \rangle = -0.07$, $\sigma = 4.59$

BUT:

- FOR $\delta > 0$: $\langle \Delta\pi \rangle = +0.25$, $\sigma = 4.51$
- FOR $\delta < 0$: $\langle \Delta\pi \rangle = -0.25$, $\sigma = 4.61$

N44 − F3 (3044 ★★ WITH $\sigma_\pi < 2$ MAS IN BOTH DRC)

$\langle \Delta\pi \rangle = +0.13$, $\sigma = 2.09$

$\delta > 0$: $\langle \Delta\pi \rangle = +0.72$, $\sigma = 1.92$

$\delta < 0$: $\langle \Delta\pi \rangle = -0.68$, $\sigma = 2.04$

PROPER MOTIONS

UPDATES W.R.T IC:

NS − RG08 $\langle D\mu_\alpha \cos\delta \rangle = +0.35$, $\sigma = 11.69$ MAS/YR

$\langle \Delta\delta \rangle = +0.61$, $\sigma = 11.09$

$\dot{\varphi} = +0.32 \pm .06$ MAS/YR

$\dot{\theta} = -0.43 \pm .06$

$\dot{\psi} = +0.21 \pm .06$

FS − RG08 $\langle D\mu_\alpha \cos\delta \rangle = +1.24$, $\sigma = 16.93$

$\langle D\mu_\delta \rangle = +0.71$, $\sigma = 15.98$

$\dot{\varphi} = -0.88 \pm .13$

$\dot{\theta} = -0.92 \pm .13$

$\dot{\psi} = -0.68 \pm .13$

COMPARISON:

NS − FS $\langle D\mu_\alpha \cos\delta \rangle = -0.90$, $\sigma = 12.76$

$\langle D\mu_\delta \rangle = -0.11$, $\sigma = 11.84$

$\dot{\varphi} = +1.33 \pm .08$

$\dot{\theta} = +0.62 \pm .08$

$\dot{\psi} = +0.54 \pm .08$

CORRELATION COEFFICIENT

NS-RG08 / FS-RG08: $\rho \sim +0.67$

PARALLAXES IN SMC/LMC

FROM A LIST OF 11 + 35 = 46 STARS IN THE SMC + LMC,

$2 + 14 = 16 \in FS \quad \langle \pi \rangle = +2.10 \pm 0.77$

$7 + 25 = 32 \in NS \quad \langle \pi \rangle = +0.28 \pm 0.48$

$$\sigma_{\pi} = \begin{cases} 3.16 \text{ mas} & \text{(FAST)} \\ 2.74 \text{ mas} & \text{(NDAC)} \end{cases}$$

11 'FOREGROUND' STARS IN DIRECTION OF LMC GAVE

$\langle \pi \rangle = +0.45 \pm 0.91$ MAS (NDAC) [9 **]

$\langle \pi \rangle = +1.17 \pm 1.40$ MAS (FAST) [6 **]

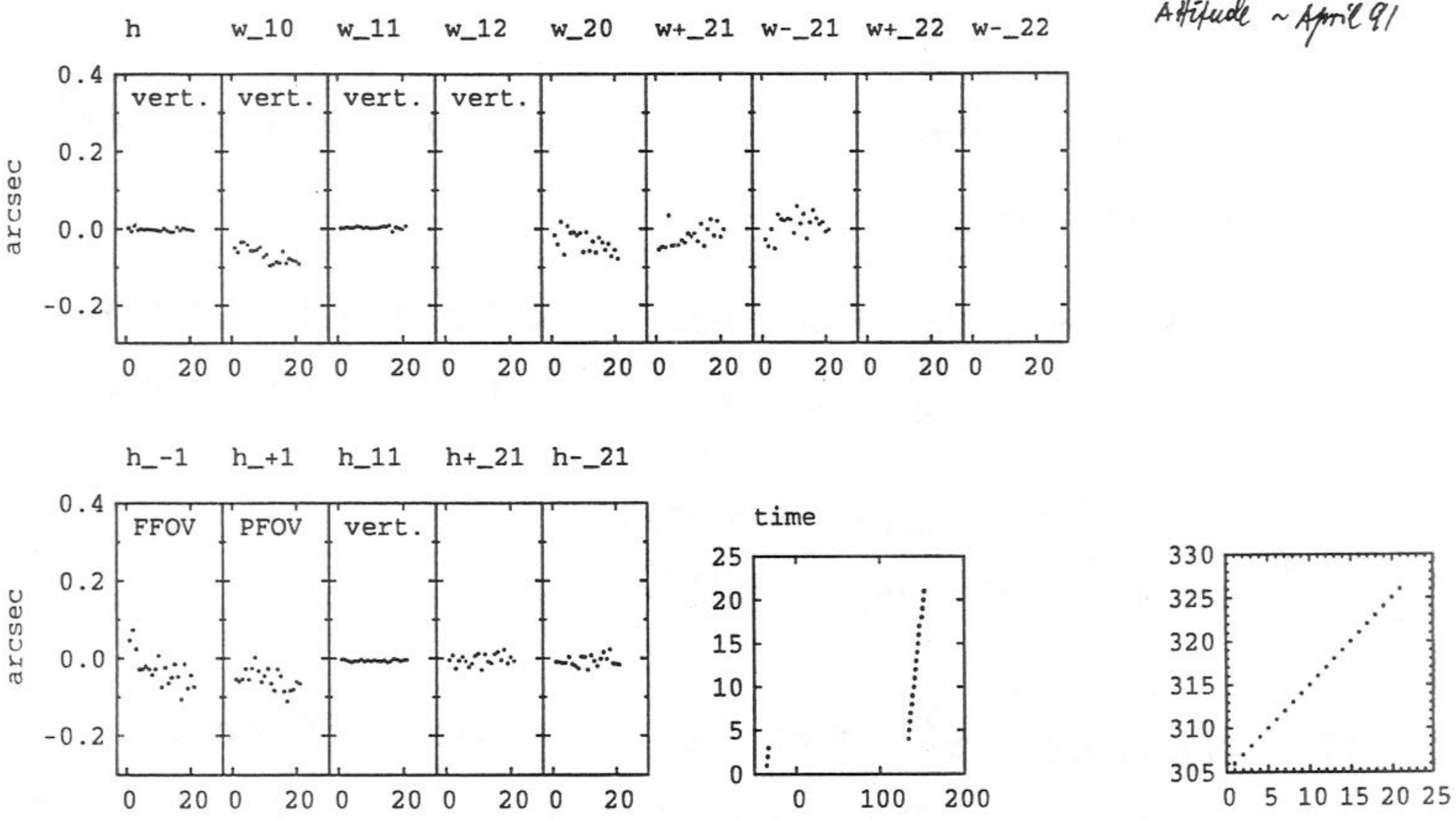
ANNEX VII

(1) 18.7.91

A&A

IRS + FK5 - positions
Attitude ~ April 91

Calibration parameters as function of set number
Set number as function of days after 1990.0

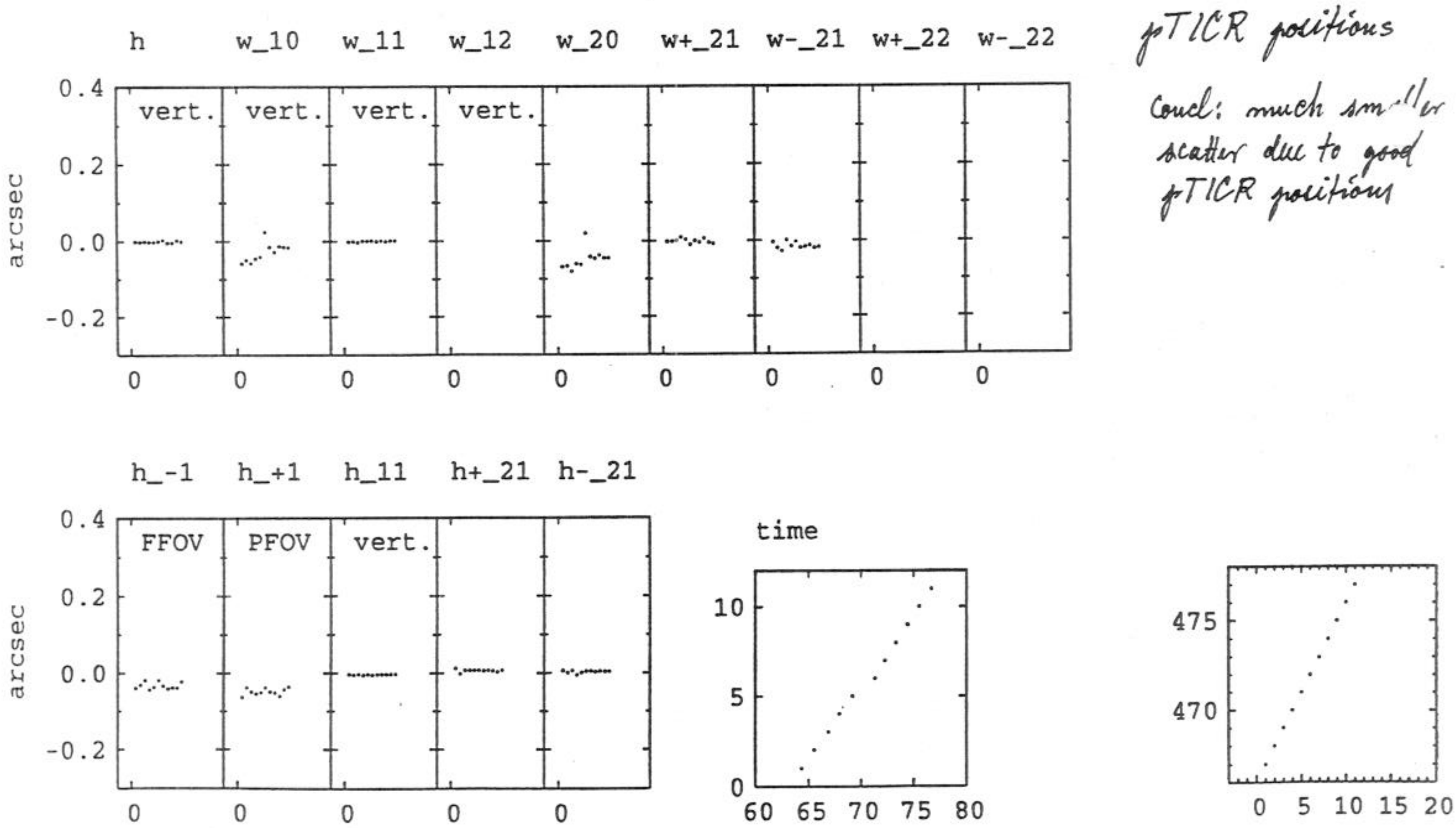


(2) DSD 30.3.92

Cal. all stars pTICR positions

Concl: much smaller scatter due to good pTICR positions

Calibration parameters as function of set number
Set number as function of days after 1990.0

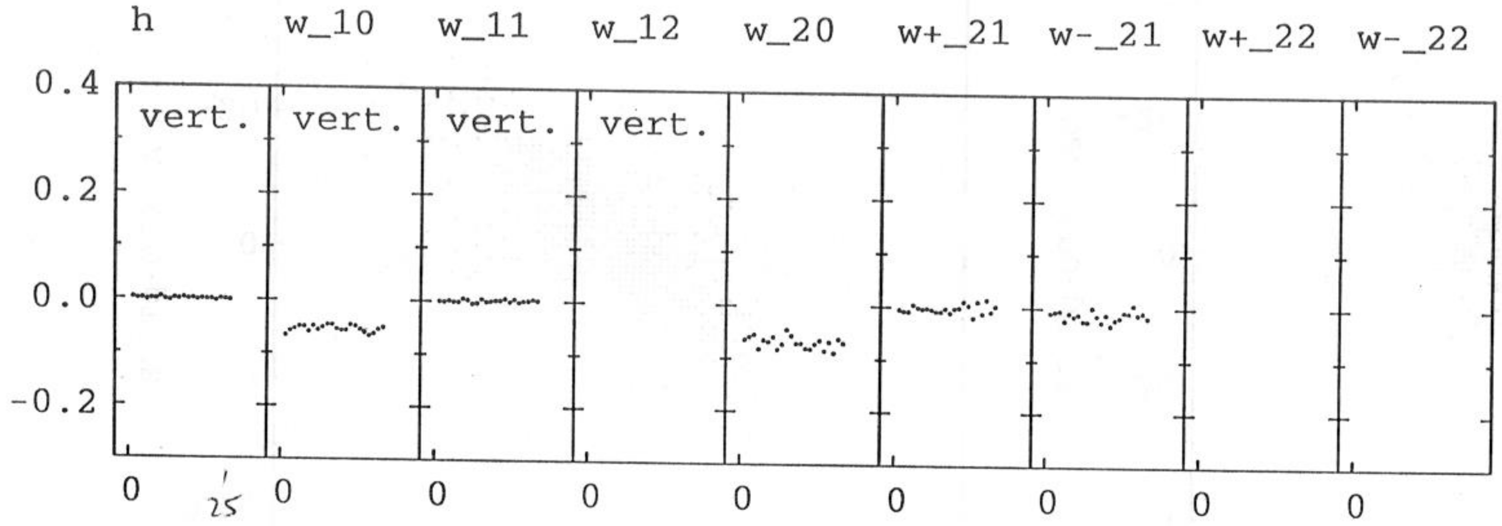


Calibration parameters as function of set number

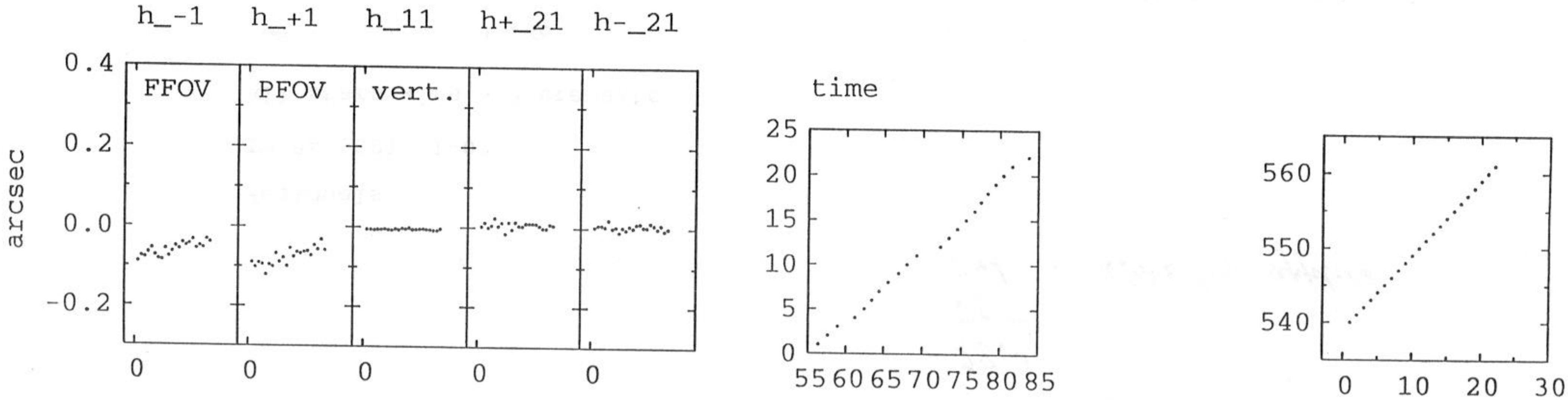
Set number as function of days after 1990.0

③

28.4.92
DSE, all stars of pTICR
NDAC 1yr positions



Concl: No drift of w_{10} and w_{20} due to NDAC 1yr positions.
The drift of h_{-1}, h_{+1} will disappear with attitude from NDAC 1yr.



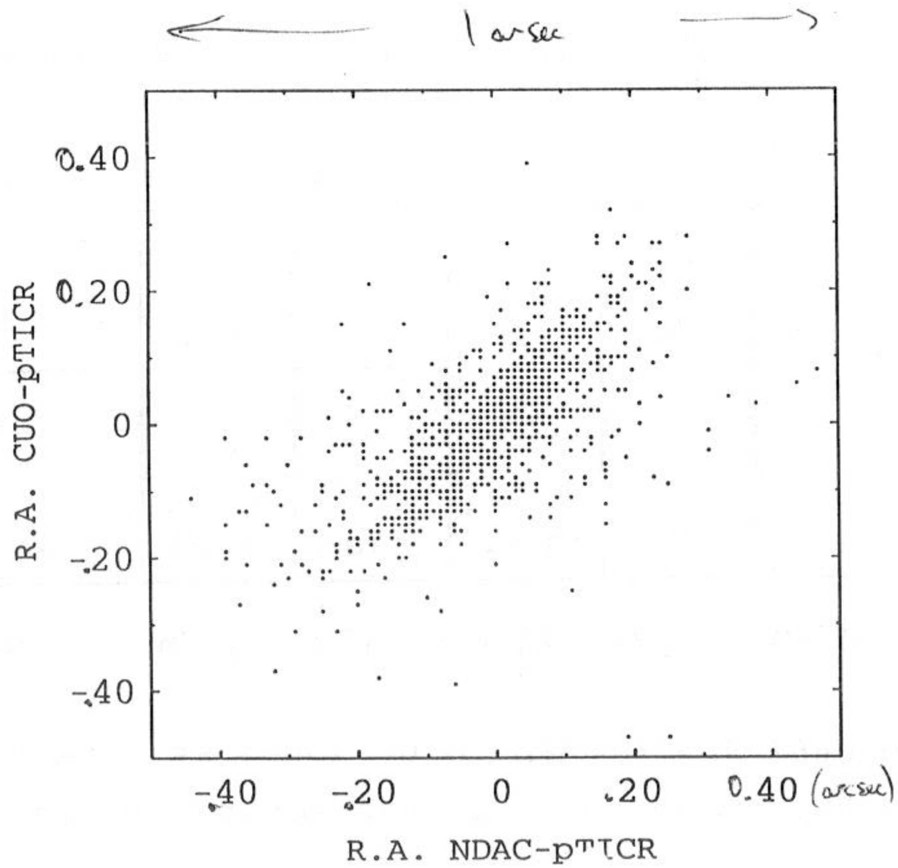
(4)

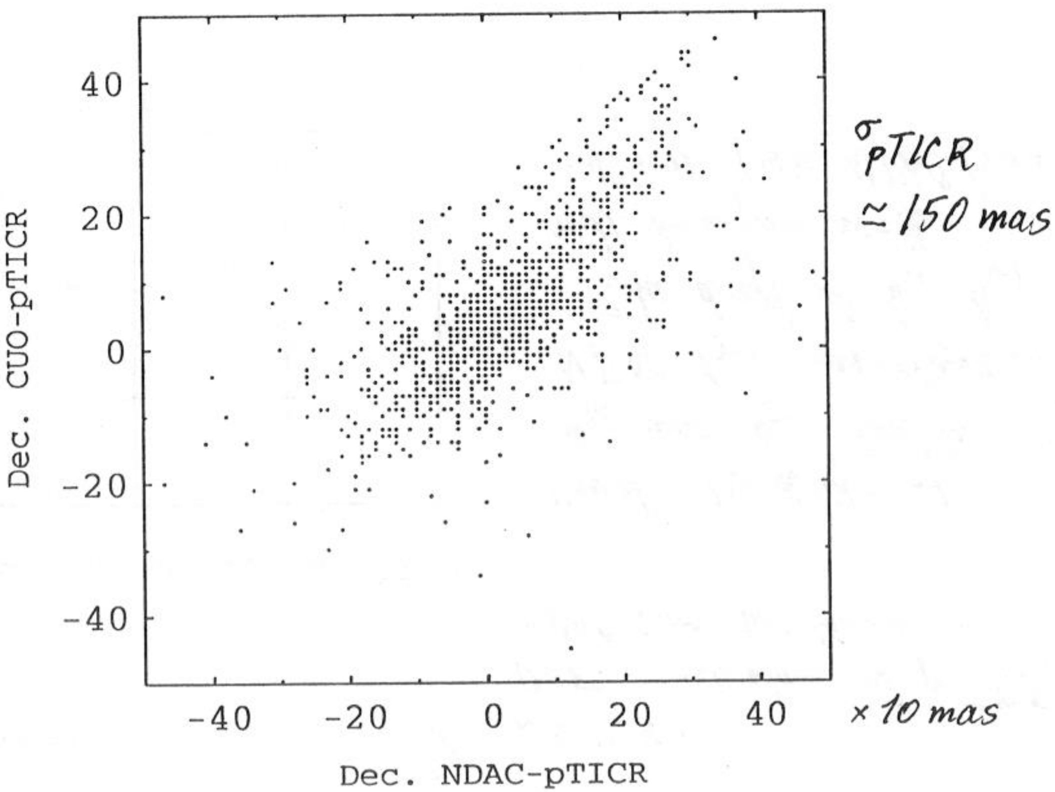
28.4
DSE
Cal. w. NDAC 1yr applied

Residuals

IT_04_0001_01-07

All stars with > 9 transits





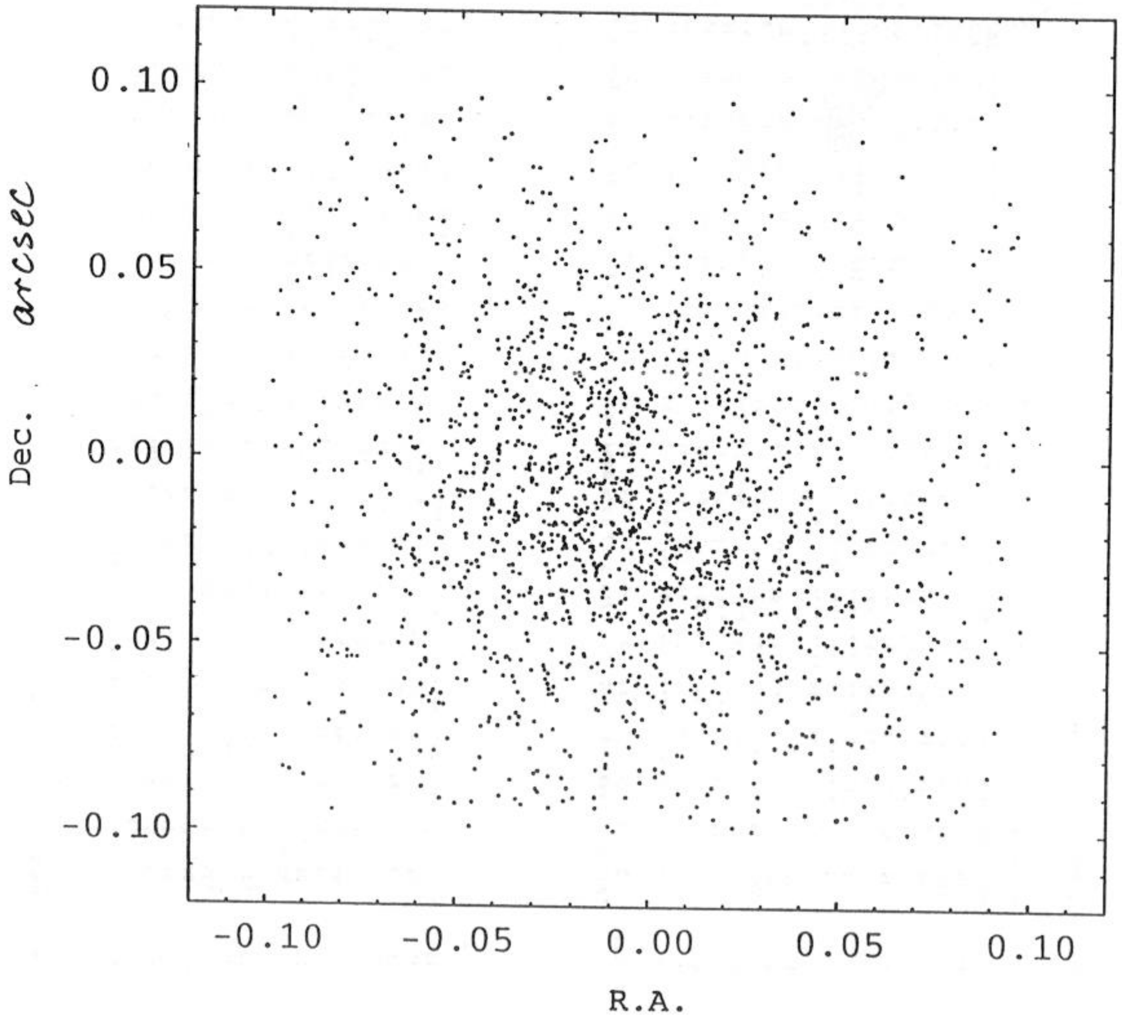
(5)

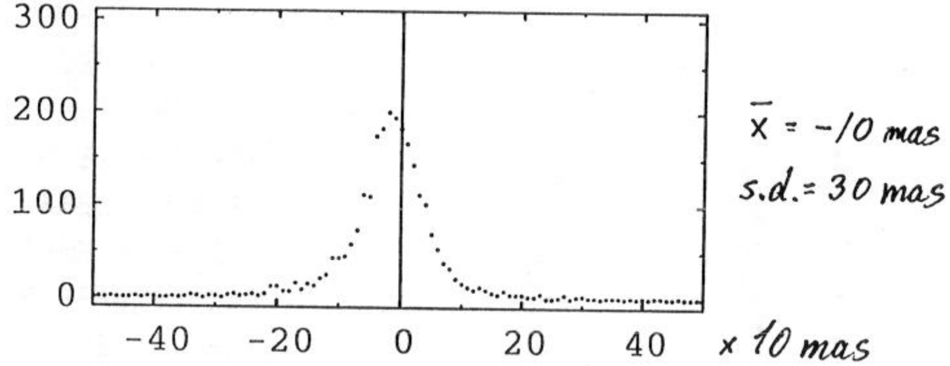
28.4.92
DSE
Calib. w. NDAC 1yr applied

Residuals CUO-NDAC

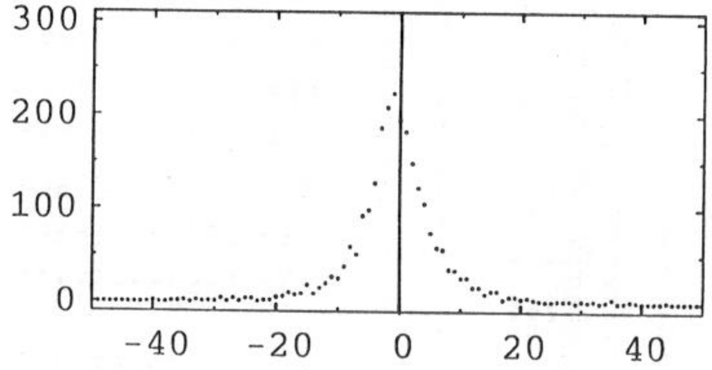
IT_04_000{1,2}_{1,...,11}

All stars with > 9 transits





Marginal distribution, Decl.



Marginal distribution, R.A.

NDAC 1yr / pTICR

number of common objects 40943

Comparison between common entries in the NDAC1yr catalogue delivered by Lindegren in March 1992 and the provisional Tycho Input Catalogue Revision (pTICR).

Selection criteria:

1. COMPI = 1 (causing a few misidentifications)
2. R.A.(NDAC1yr-pTICR) and Decl.(NDAY1yr-pTICR) both smaller than 0.600 arcseconds, numerically.
3a. COMPXYE less than 0.300
3a. COMPXYE gtr than 0.000
4a. COMPM less than 10.500 ← brighter than 10.5^m s.d. = 110 mas
4b. COMPM gtr than -9.990

Number of stars both in NDAC1yr and pTICR

	23.5	22.5	21.5	20.5	19.5	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11.5	10.5	9.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5	0.5	n
85	5	18	7	5	5	3	5	8	9	8	4	6	13	10	10	8	10	10	12	14	15	21	19	8	233
75	41	17	12	19	21	27	25	22	13	5	29	8	36	42	54	56	47	40	32	32	59	59	62	53	811
65	43	74	154	90	85	80	71	80	41	19	20	66	130	131	91	39	9	15	50	87	19	66	171	134	1765
55	122	246	141	100	120	92	91	93	115	61	65	122	180	93	42	0	0	0	0	114	186	66	166	253	2468
45	241	165	66	63	99	114	90	119	116	117	156	171	142	94	1	0	0	0	0	37	270	83	75	194	2413
35	75	59	174	259	295	253	256	195	139	175	210	175	80	94	0	0	0	0	31	6	93	113	117	166	2965
25	148	147	144	150	130	52	101	147	225	233	245	143	70	53	0	0	0	17	11	0	37	61	141	153	2408
15	202	88	22	32	9	0	0	0	34	249	243	86	84	20	0	0	0	30	0	0	8	69	127	142	1445
5	150	2	0	0	29	0	0	0	6	206	262	132	98	3	0	0	31	14	0	0	1	63	158	194	1349
-5	81	2	0	0	25	10	0	0	8	200	193	226	162	1	0	0	34	0	0	0	2	94	225	97	1360
-15	85	25	0	0	0	25	0	0	47	140	179	134	202	102	17	25	6	0	0	0	15	206	218	60	14[illegible]
-25	64	59	0	0	0	12	18	0	91	108	133	127	135	164	160	97	58	46	49	143	187	238	178	115	[illegible]
-35	61	106	0	0	0	0	45	17	121	123	88	163	69	59	155	219	289	216	215	178	166	153	152	141	2[illegible]
-45	129	104	0	0	0	0	0	60	296	91	111	206	267	166	90	77	102	136	74	133	116	106	128	137	2529
-55	185	75	48	0	0	0	0	153	221	64	214	333	149	217	248	162	112	97	89	87	83	55	70	150	2812
-65	149	169	113	53	17	21	72	120	21	91	203	170	80	85	159	119	128	83	78	68	50	27	11	84	2171
-75	34	50	75	61	62	42	27	37	63	54	55	56	54	25	27	34	34	35	32	26	12	14	41	3	953
-85	8	14	12	8	5	10	14	6	10	20	13	7	4	16	6	4	4	6	6	4	6	6	11	10	210
n	1823	1420	968	840	902	741	815	1057	1576	1964	2423	2331	1955	1375	1060	840	864	745	679	929	1325	1500	2070	2094	32296

R.A. (Hip-Tyc)   [mas]   (n > 10)

Δα or Δδ > 200 mas abs

	23.5	22.5	21.5	20.5	19.5	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11.5	10.5	9.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5	0.5	0,24	n
85	****	68	****	****	****	****	****	****	****	****	****	****	65	****	****	****	****	****	102	138	124	155	178	****	86	233
75	80	182	162	43	10	-10	19	-9	-1	****	-68	****	53	67	58	52	79	73	88	86	118	155	226	237	90	811
65	148	43	8	48	15	-9	4	-18	-49	-68	-62	54	29	61	75	64	****	50	15	22	135	179	144	136	54	1765
55	62	4	14	-18	-24	-37	4	52	-43	-43	32	9	4	55	105	****	****	****	****	53	115	100	126	44	32	2468
45	9	6	-101	-92	-70	-75	-87	-35	13	3	22	-14	-23	39	****	****	****	****	****	72	75	79	141	61	8	2413
35	-36	-52	-21	-8	-31	-21	-31	-50	-56	-5	-2	34	2	68	****	****	****	****	108	****	118	4	63	66	-2	2965
25	-19	32	20	-27	-39	-86	-87	-74	-61	19	15	69	-2	30	****	****	****	197	190	****	120	75	129	50	7	2408
15	33	11	-17	37	****	****	****	****	-19	-31	31	152	66	165	****	****	****	134	****	****	****	133	144	7	44	1445
5	-8	****	****	****	23	****	****	****	****	1	-12	-7	49	****	****	****	229	178	****	****	****	56	49	-18	13	1349
-5	-51	****	****	****	46	****	****	****	****	-2	-29	-3	30	****	****	****	116	****	****	****	****	78	-6	-25	2	1360
-15	-13	-64	****	****	****	-59	****	****	106	64	21	-12	-15	-96	-85	65	****	****	****	****	-52	-15	-10	-14	-5	1486
-25	56	88	****	****	****	40	41	****	35	68	66	-2	-24	-8	-44	-2	-62	-89	-83	-36	-43	49	-3	-46	-1	2182
-35	-29	18	****	****	****	****	21	-13	-17	87	26	23	-90	-79	-41	-44	-31	-10	8	-2	14	48	-34	-78	-10	2736
-45	-117	-126	****	****	****	****	****	16	88	114	-104	11	-107	-56	-83	-98	-32	-17	-53	-37	-10	-67	-102	-127	-42	2529
-55	-53	-6	60	****	****	****	****	96	48	90	30	36	-137	-125	-30	31	23	46	26	20	-72	-78	-97	-66	-8	2812
-65	15	38	108	112	101	102	159	109	-34	133	93	30	-25	-88	-65	-4	55	44	20	-18	9	-44	-19	11	38	
-75	80	70	57	79	82	98	96	103	119	146	120	29	49	25	-3	-6	8	37	102	53	152	174	48	****	74	
-85	****	75	64	****	****	****	81	****	****	55	99	****	****	55	****	****	****	****	****	****	****	****	148	****	62	210
-90,90	-2	10	19	5	-14	-23	-8	11	14	28	17	22	-21	-19	-23	-7	13	21	17	8	44	46	48	12		
n	1823	1420	968	840	902	741	815	1057	1576	1964	2423	2331	1955	1375	1060	840	864	745	679	929	1325	1500	2070	2094		32296

Mean value in R.A. 12 [mas]
Stand.dev. in R.A. 105 [mas]
Number of stars 32296

s.d.

	23.5	22.5	21.5	20.5	19.5	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11.5	10.5	9.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5	0.5
85	****	105	****	****	****	****	****	****	****	****	****	****	97	****	****	****	****	****	44	61	85	85	107	****
75	96	59	56	81	71	86	75	86	50	****	86	****	102	67	52	44	29	36	25	36	49	67	89	77
65	86	78	81	44	70	49	51	81	65	65	62	68	58	56	32	35	****	25	51	53	79	80	88	102
55	112	80	81	66	60	61	81	71	104	89	87	83	72	83	60	****	****	****	****	58	60	63	71	72
45	76	105	78	64	60	69	65	86	105	108	85	95	100	71	****	****	****	****	****	60	67	78	74	80
35	85	99	60	64	59	54	54	70	92	99	89	110	92	98	****	****	****	****	41	****	91	102	79	70
25	93	87	81	66	64	41	47	55	76	98	110	109	147	106	****	****	****	47	98	****	93	132	88	65
15	100	121	86	50	****	****	****	****	73	70	92	96	150	104	****	****	****	66	****	****	****	117	117	103
5	80	****	****	****	57	****	****	****	****	83	73	92	115	****	****	****	68	29	****	****	****	108	101	82
-5	145	****	****	****	91	****	****	****	****	78	70	69	87	****	****	****	64	****	****	****	****	115	96	83
-15	122	59	****	****	****	75	****	****	83	128	73	80	86	84	24	81	****	****	****	****	117	95	81	70
-25	132	129	****	****	****	54	94	****	80	114	82	100	78	87	71	59	52	30	39	83	93	97	104	72
-35	139	129	****	****	****	****	62	65	102	132	113	63	146	113	80	57	64	53	71	91	108	103	83	128
-45	76	110	****	****	****	****	****	98	92	102	87	103	102	80	105	75	63	78	77	114	95	98	92	83
-55	80	68	57	****	****	****	****	83	88	78	101	82	126	81	54	63	82	76	79	73	96	93	95	88
-65	57	53	42	28	19	30	37	75	94	103	89	87	91	98	76	51	61	78	92	93	91	108	179	78
-75	103	118	52	33	29	21	21	38	51	99	80	95	77	51	53	86	91	102	100	100	62	113	108	****
-85	****	165	107	****	****	****	48	****	****	61	109	****	****	52	****	****	****	****	****	****	****	****	102	****

Decl. (Hip-Tyc)   [mas]   (n > 10)

23.5	22.5	21.5	20.5	19.5	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11.5	10.5	9.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5	0.5	0,24	n

85	****	66	****	****	****	****	****	****	****	****	****	****	-28	****	****	****	****	****	-79	-61	-59	-40	40	****	3	233
75	46	101	219	130	94	56	74	102	120	****	-16	****	-86	-61	-55	-58	-17	0	-8	7	-39	-22	-19	52	3	811
65	48	41	29	136	135	100	-5	-3	52	123	90	-54	-73	-56	-43	-62	****	79	120	104	14	-60	-6	63	23	1765
55	45	-16	38	-33	54	99	31	-11	16	28	7	-72	-104	-91	-37	****	****	****	****	47	20	51	-13	57	5	2468
45	1	67	3	10	72	66	22	-6	23	-14	-28	-97	-117	-79	****	****	****	****	****	7	35	59	-75	45	1	2413
35	93	68	52	99	22	-22	12	41	34	6	-51	-80	-115	-64	****	****	****	****	-47	****	21	83	-52	26	11	2965
25	101	103	108	70	63	-52	21	14	18	33	-53	-78	-119	-91	****	****	****	30	39	****	23	50	2	67	23	2408
15	104	48	39	100	****	****	****	****	69	25	-31	-69	-90	-59	****	****	****	-27	****	****	****	24	14	100	23	1445
5	72	****	****	****	121	****	****	****	****	10	-34	-52	-99	****	****	****	40	5	****	****	****	41	16	66	7	1349
-5	101	****	****	****	63	****	****	****	****	-30	7	-52	-50	****	****	****	-47	****	****	****	****	2	28	67	-2	1360
-15	104	104	****	****	****	165	****	****	-54	-53	33	-97	-4	143	-31	-89	****	****	****	****	-52	-11	28	92	12	1486
-25	82	63	****	****	****	88	102	****	-52	-59	24	-49	-81	-15	59	-5	-100	-74	24	41	10	-9	33	115	4	2182
-35	109	88	****	****	****	****	92	165	-74	-52	77	-5	-19	-20	49	131	156	53	70	15	2	-16	43	111	52	2736
-45	141	137	****	****	****	****	****	83	-21	-41	105	-14	163	117	130	133	129	50	5	-45	-64	-55	53	129	58	2529
-55	131	115	72	****	****	****	****	-12	-67	36	51	-17	162	234	231	137	121	107	-21	-58	-87	-78	45	100	73	2812
-65	82	65	-22	-27	-6	53	77	-21	-180	21	2	-31	58	145	177	225	199	47	-1	-65	-65	-61	-74	56	52	2171
-75	99	75	5	-84	-25	-19	-63	-35	33	57	-1	-26	1	117	104	164	132	44	32	-38	-9	-61	19	****	19	953
-85	****	29	73	****	****	****	89	****	****	29	-65	****	****	-28	****	****	****	****	****	****	****	****	-32	****	14	210
ave =	60			50			10			-20			40			80			10			30				
-90,90	83	63	42	54	51	35	28	12	-12	-1	-1	-49	-16	42	102	101	109	42	29	6	-3	0	11	74		
n	1823	1420	968	840	902	741	815	1057	1576	1964	2423	2331	1955	1375	1060	840	864	745	679	929	1325	1500	2070	2094		32296

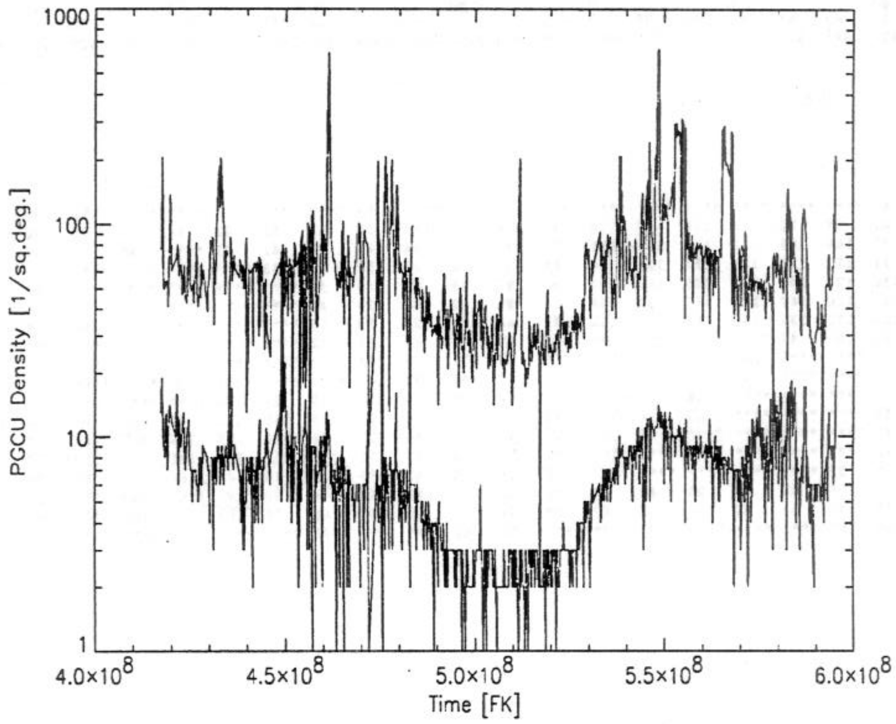
ave = 60 ~0 11,5 60 20

Mean value in Decl. 26 [mas]
Stand.dev. in Decl. 115 [mas]
Number of stars 32296

s.d.

85	****	42	****	****	****	****	****	****	****	****	****	****	59	****	****	****	****	****	151	174	78	71	51	****
75	54	63	77	72	110	120	86	76	33	****	67	****	37	48	61	82	44	67	71	80	84	69	77	40
65	62	77	106	109	111	118	100	110	70	36	34	44	46	60	41	41	****	38	50	58	82	73	68	47
55	74	93	111	126	121	133	125	90	90	90	76	49	53	61	43	****	****	****	****	43	52	68	81	54
45	76	130	123	128	138	105	110	124	98	91	59	65	60	39	****	****	****	****	****	60	50	62	34	69
35	66	124	116	160	127	147	97	104	94	85	60	60	39	46	****	****	****	****	57	****	40	57	67	68
25	58	124	112	136	115	69	102	112	97	66	63	64	58	51	****	****	****	53	86	****	49	62	60	85
15	100	168	105	47	****	****	****	****	88	67	68	49	51	42	****	****	****	52	****	****	****	47	65	72
5	62	****	****	****	84	****	****	****	****	66	71	75	44	****	****	****	52	24	****	****	****	52	66	67
-5	76	****	****	****	67	****	****	****	****	66	86	78	63	****	****	****	60	****	****	****	****	64	56	56
-15	43	27	****	****	****	58	****	****	67	48	60	59	144	196	49	70	****	****	****	****	94	52	73	32
-25	45	42	****	****	****	47	74	****	43	64	71	86	102	139	135	111	78	100	84	106	102	59	72	50
-35	54	48	****	****	****	****	96	82	51	66	63	84	122	98	149	119	176	147	112	114	83	76	61	60
-45	61	42	****	****	****	****	****	150	71	57	39	97	91	157	129	145	141	111	110	110	77	55	83	53
-55	58	53	33	****	****	****	****	57	76	134	78	81	99	139	119	143	166	134	82	73	62	66	98	58
-65	55	57	75	58	33	29	45	97	96	92	70	83	103	116	120	130	154	157	116	91	59	71	39	57
-75	45	77	90	94	52	38	48	87	69	76	56	99	99	65	78	103	162	106	107	89	30	34	70	****
-85	****	108	57	****	****	****	177	****	****	55	41	****	****	94	****	****	****	****	****	****	****	****	115	****

PGCU Density in DSD



PGCU Densities for each file in DSD.
Density is calculated for each format, the maximum and the average density for each file are stored.
Upper curve: Maximum density
Lower curve: Average density

TDAC schedule 1992

30.4.92

May + June:
- Data Stream E (DSE) = Identified Transits from prov. TICR and NDAC 1991-attitude.
- DSE for NM months 1-4 will be produced and analyzed by Astrometry and Photometry.

July:
- Receive NDAC 1yr-attitude (or at least 2 months) based on NDAC 1yr-catalogue. DSF = Ident. Tr. from pTICR + NDAC1yr-att.
- Complete Assignment in Recognition.

Aug.-Oct.:
- Complete Astrom. + Phot. validation by DSF for ~6 mths.
- Complete Mapping in Recognition → final TICR.

Nov.-Dec:
- Install TICR; Start final Ident. Tr. produc.

Apr.-Dec.:
- Prediction + Detection for 2nd year of NM.

ANNEX VIII

PROVISIONAL PROGRAMME FOR THE EAS HIPPARCOS SESSION
version 7 May 1992

The Impact of Hipparcos on Astronomy and Astrophysics

Coordinators: M.A.C. Perryman and C. Turon

Session 1:
The Hipparcos programme and its status: M.A.C. Perryman (20 min)
Global astrometry by Hipparcos: J. Kovalevsky et al. (25 min)
Comparison of the one-year sphere solution with ground-based positions: S. Roeser (15 min)
Hipparcos parallaxes - the present status: L. Lindegren (TBC, 20 min)
The HR Diagram and the Hipparcos data: A. Gomez et al. (15 min)
Applications of the Hipparcos parallaxes: Y. Lebreton and A. Baglin (15 min)
Discussion (10 min)

Session 2:
Hipparcos photometry: ~~F. van Leeuwen (or~~ D. Evans ~~??~~ 20 min)
Applications of Hipparcos photometry: M. Grenon (15 min)
Observation of large amplitude variable stars with Hipparcos: M.O. Mennessier (15 min)
Hipparcos Double star observations: F. Mignard et al. (15 min)
Scientific applications of Double star observations: P.L. Bernacca (15 min)
~~Comparison with ground-based double star studies: A. Duquennoy (TBC, 15 min)~~ deleted
Discussion (10 min)

Concluding Remarks: J. Lequeux (15 min)

Remarks :
- the titles may not be definitive,
- the exact list of authors are not definitive,
- there is a possibility that L. Martinet from Geneva Observatory gives a talk on the uses of Hipparcos proper motions. For the moment, uses of Hipparcos proper motions are planned in the introductory paper by M. Perryman.
- there is no specific paper planned about solar systems bodies. This will be part of the paper by J. Kovalevsky.

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- we wait for your confirmations, comments, suggestions, modifications

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