Minutes

of the

HIPPARCOS

Inter-Consortium Meeting

3 June 1983

Attendance:

Consortia:	G. Andreasen J.L. Falin M. Grewing E. Hoeg J. Kovalevsky C.A. Murray C. Turon
ESA:	M.A.C. Perryman M. Schuyer S. Vaghi R. Wills R. Bonnefoy (part time)
MATRA:	E. Zeis
Other:	J. Russell (ST ScI)

PDR Preparations

PDR documentation would be sent to HST members at the end of June. The next HST meeting would be held on 19-20 July. DRC were invited to have one or two members at ESTEC on 11-12 July for a working review of the documentation before the HST meeting. DRC leaders would confirm attendance directly with M. Schuyer who will organise the working meeting.

Calibration

Wills reviewed the calibration document plans for the remainder of B2-C/D (see Annex I) and drew attention to the current key issues. The synthesis document would reflect the present status of thinking on calibration matters, whereas contractual agreement would be contained in the on-orbit calibration plan and in the ground calibration plan (the latter to be produced by IAL).

ESA will provide MATRA with information on photometry for in-orbit photometric calibration along with transformation formulae relating a suitable photometric system (e.g. Geneva) to the HIPPARCOS magnitudes (see Annex II, Section 4). The current commitment is that there will be 2 000 secondary photometric standard stars, with U, B, V each known to 0.02 mag. MATRA would accept a higher magnitude uncertainty if the number of stars could be increased.

Hoeg proposed a photometric stability requirement of 1% per 24 hours. Bonnefoy/Zeis expected that this would appear as a sub-system specification.

Hoeg expressed concern at the red leak of the TYCHO B channel. Bonnefoy would check present transmittance and Grewing would assess impact of such a leak for TDAC.

The importance of calibrating modulation coefficients as functions of star colour was stressed. In-orbit calibration was considered to require provision for special sky scanning (e.g. repeated scanning of the same great circle) and for 'special observing strategies' (which could however be implemented through use of the PSF and related parameters). Provision for these facilities was confirmed by Zeis.

Hoeg again stressed that provision should be made for satellite spin reversal to allow for identification of certain systematic effects, e.g. related to thermal environment.

Zeis/Kovalevsky considered that some form of GCR should be carried out at ESOC, for example to allow for correct IFOV piloting and RTAD.

Grid Status

Bonnefoy said that ESA were waiting for a report from TPD on the "Le Poole" grid writing technique and that an internal meeting would be held on the present status of the CEH grid.

Falin presented results of a study of the dead time due to crossings of the stitching lines in the presence of transverse displacements of the FOV (see Annex III).

IFOV Optimization

An IFOV size of 90um, perhaps decreasing to 70um, was considered by MATRA to be the optimum in view of depointing errors. These values were considered to be acceptable by FAST and NDAC (see Annex II, Section 2).

GCR Formula

Zeis presented the proposal of MATRA for revision of the SRD GCR formula. The preferred solution was considered unacceptable by ESA, departing significantly from the ITT approach and essentially making the GCR step invisible from ESA and the scientific consortia (see Annex II, Section 1).

MATRA would provide proposed coefficients for use in the SRD formula with harmonic mean. This proposal would be reviewed by the DRC and ESA for consideration at the next SAG and HST respectively. In parallel, DRC, MATRA and ESA would consider the new proposal by Lindegren (26 May 1983). The goal will be to include one or other of these formulae in the SRD at the time of the PDR.

TYCHO/TDAC

Grewing confirmed that replies to the ESA comments on the TDAC proposal would be submitted before the end of July.

Grewing would consider the form of the process definitions being used by NDAC and FAST with the aim of defining a TDAC convention in the near future.

TYCHO Requirements

With the approval of TDAC, NDAC and FAST leaders, ESA would propose a revised formulation of the TYCHO astrometric specification which would address an rms accuracy of 0.1 arcsec per full slit crossing in the longitudinal direction using information, suitably weighted, from both vertical and inclined slits. This revised specification would be acceptable to MATRA (see Annex I, Section 3).

Observing Strategy

The revised SOS proposed by Zeis was considered acceptable by Kovalevsky, with the reservation that proper provision should be made for observations of high density areas e.g. by alternating sets of stars in alternate frames. Zeis stated that such provisions would probably be made.

Vaghi gave a description of the simulation software that was being developed by ESA to study the acceptability of the revised SOS. Results were expected by the end of July (see attached Annex IV).

Global Observing Strategy

Hoeg agreed with the completeness limit principle being studied by INCA (completeness at approx. 1.5 star per square degree giving completeness to V = 7.7 at the galactic plane and V = 8.7 at the galactic poles).

Hoeg argued that the entire IRS should not necessarily appear in the Input Catalogue. Turon said that inclusion of the IRS would be reviewed when the contents of the Catalogue at the time of the first iteration would be known.

MATRA would consider the use of non-programme star-mapper stars (e.g. the IRS) for the purposes of RTAD.

INCA's assessment of the expected contents of the Input Catalogue revealed an excess of faint blue stars compared with the expected numbers given in the SRD. Perryman had stated in Strasbourg that the Selection Committee's recommendations could be interpreted as applying to V magnitudes. Since this would distort the B distribution of the SRD this now appears to have been an incorrect interpretation. Even though the HIPPARCOS system is better matched to V than B, the accuracy analysis is made in terms of B magnitudes and magnitude distributions. The effects of modifying this model distribution at this time would therefore have impacts on the final achievable accuracies. No course of action to resolve this situation was identified.

ESOC Inputs on Telemetry/Tape Formats

A document* had been prepared by ESOC, and after an internal review would be distributed to the scientific Consortia.

MoU Status

There was no progress to report at this stage.

* DPD Working Paper 167 received in ESTEC 6th June, 1983

S/W Coordination

Vaghi would distribute a renewed request for details of programmes under development by the consortia.

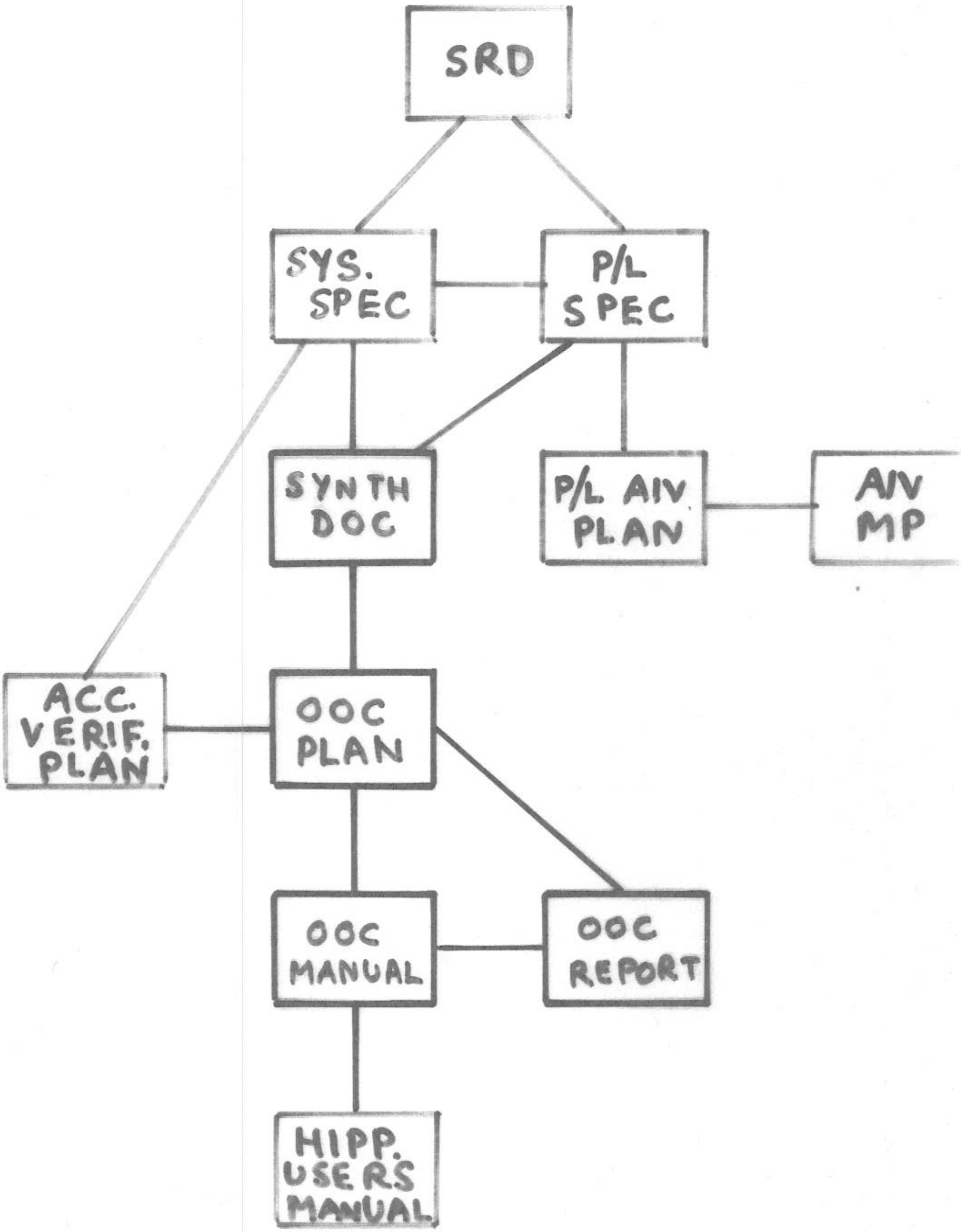
Hoeg repeated his request that ESA coordinate exchange of simulated data. This was foreseen by the Project Team.

Documention Exchange

In future, documents from the scientific consortia would not be distributed by ESA. Requests for such documents would go directly to the relevant consortia leaders.

M.A.C. Perryman
3 June 1983

Annex I


SRD
SYS. SPEC
P/L SPEC
SYNTH DOC
P/L AIV PLAN
AIV MP
ACC. VERIF. PLAN
OOC PLAN
OOC MANUAL
OOC REPORT
HIPP. USERS MANUAL

SYNTHESIS DOCUMENT ON CALIBRATION

Synthesis of all calibration requirements, foreseen methods and implications for operations, and data reduction.

Evolving throughout Phase B2

Latest Issue: Issue 1, Rev. 1 (24 May 83)

ON-ORBIT CALIBRATION PLAN

General description of calibration requirements, methods and operations.

Incorporated in Accuracy Verification Plan

PDR

ON-ORBIT CALIBRATION MANUAL

Detailed description of all operational implications of the calibration activities

Incorporated in Hipparcos Users' Manual

4 issues during Phase C/D

ON-ORBIT CALIBRATION REPORT

Detailed description of technical work performed by CAPTEC/UCD-PD

3 issues during Phase B2

3 issues during Phase C/D

Latest Issue: Mid Term Report Issue 2 (15 Apr 83)

KEY ISSUES

Photometric Requirements – absolute
- spectral response
- variation over FOV
- ITF
- modulation coefficients

Secondary photometric standard stars

Operations – special scanning laws
- special observation strategies
- specific hardware – chromaticity filters
  - internal star pattern
  - grid reference marks

Role of ESOC during commissioning and routine
- GCR?
- software to be used
- feedback to operations

etc

etc

1 GREAT CIRCLE REDUCTION FORMULA

1.1 DEFINITION: EQUATION RELATING THE ERROR VARIANCE ON STAR ABSCISSAE TO THE ERROR VARIANCE ON LONGITUDINAL FIELD COORDINATES

$$\sigma_{\alpha_I}^2 = F\left(\sigma_{\eta_{JK}}^2, \sigma_{\eta_{JL}}^2, \text{STAR DISTRIBUTION}, \text{REDUCTION METHOD}\right)$$

I → STAR INDEX; K → FRAME INDEX

1.2 ASSUMPTIONS:

A. REDUCTION METHOD: WEIGHTED LEAST SQUARES (WEIGHT $\propto$ 1/ ERROR VARIANCE)

B. $\sigma_{\eta_{JK}}^2 \propto 1/\tau_{JK}$

C. FORM OF THE GCR FORMULA:

$$\sigma_{\alpha_I}^2 = \underbrace{F_1\left(\sigma_{\eta_{JK}}^2\right)}_{\text{STAR DEPENDENT TERM}} + \underbrace{F_2\left(\sigma_{\eta_{JL}}^2, \text{STAR DISTR.}\right)}_{\text{CONSTANT ADDITIVE TERM}}$$

STAR DEPENDENT TERM (PERFECT ATTITUDE KNOWLEDGE)

CONSTANT ADDITIVE TERM (ELIMINATION OF ATTITUDE PARAMETERS)

1.3 CANDIDATE FORMULAE

ESTEC (Without 1.65 Margin)	MATRA

STAR DEPENDENT TERM : $\sigma_{\alpha_{J_0}}^2$

$$1 / \left(\sum_K \sigma_{\eta_{JK}}^{-2} \right) \leftarrow \text{EQUIVALENT UNDER ASSUMPTION B} \rightarrow \sigma_{\eta_I}^2 (\overline{B_{JK}}) / N_I$$

CONSTANT ADDITIVE TERM

ESTEC	MATRA
$1.77 < \sigma_{\eta_{JK}}^2 > / \overline{N_J}$	$(\nu - 1) < \sigma_{\eta_{JK}}^2 > / \overline{N_J}$

ESTEC

ARITHMETIC MEAN

$$< \sigma_{\eta_{JK}}^2 > = \sum_{J,K} \sigma_{\eta_{JK}}^2 / M$$

RIGIDITY FACTOR

2.77

MATRA

ARITHMETIC MEAN	HARMONIC MEAN
$< \sigma_{\eta_{JK}}^2 > = \sum_{J,K} \sigma_{\eta_{JK}}^2 / M$	$< \sigma_{\eta_{JK}}^2 > = 1 / \left(\sum_{J,K} \sigma_{\eta_{JK}}^{-2} \right)$

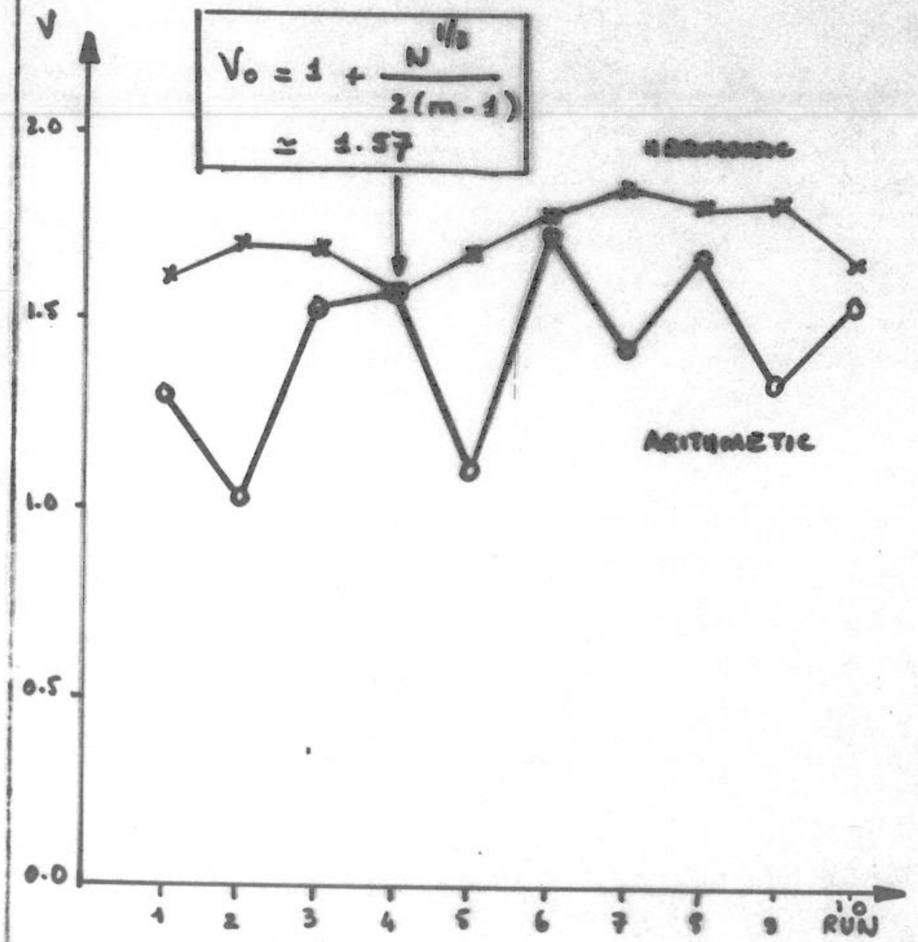
RIGIDITY FACTOR

$\nu = \dfrac{\sum_J \sigma_{\alpha_J}^2}{\sum_J \sigma_{\alpha_{J_0}}^2}$	$\nu = \sum_J \dfrac{\sigma_{\alpha_J}^2}{\sigma_{\alpha_{J_0}}^2}$

1.4 COMPARISON OF FORMULAE

STAR CATALOGUE : 40 STARS EVENLY DISTRIBUTED
FOV SIZE : 4 STARS PER FOV

$$V_0 = 1 + \frac{N^{1/3}}{2(m-1)} \simeq 1.57$$



RUN	TYPE OF ERROR VARIANCE	GOODNESS OF FIT	
		HARM.	ARITH.
1	$1/(IT)$ (PHOT. NOISE)	$6.7\ 10^{-2}$	$9.2\ 10^{-2}$
2	$1/(I^2T)$ (BACK.)	$9.0\ 10^{-2}$	$37.9\ 10^{-2}$
3	$1/T$ (S.S.J.)	$6.8\ 10^{-2}$	$6.8\ 10^{-2}$
4	1 (L.S.J)	$9.2\ 10^{-2}$	$9.2\ 10^{-2}$
5	$(1/IT)$ & $(1/(I^2T))$	$14.1\ 10^{-2}$	$27.4\ 10^{-2}$
6	$(1/IT)$ & $(1/T)$	$7.0\ 10^{-2}$	$7.2\ 10^{-2}$
7	$(1/I^2T)$ & $(1/T)$	$11.7\ 10^{-2}$	$11.9\ 10^{-2}$
8	$(1/IT)$ & 1	$6.0\ 10^{-2}$	$6.0\ 10^{-2}$
9	$(1/I^2T)$ & 1	$10.6\ 10^{-2}$	$12.3\ 10^{-2}$
10	$(1/T)$ & 1	$16.6\ 10^{-2}$	$17.6\ 10^{-2}$

1.4 COMPARISON OF FORMULAE (CONT'D)

- REFERENCE STAR DISTRIBUTION : { HARMONIC $\langle \sigma_\eta^2 \rangle_H$ V_H ; ARITHMETIC $\langle \sigma_\eta^2 \rangle_A$ V_A }

- STAR DISTRIBUTION N° 1 : OBTAINED FROM THE REFERENCE ONE BY REPLACING AVERAGE STARS BY BRIGHT STARS
  - THE GCR PERFORMANCES IMPROVE ⇒ $(V-1)\langle \sigma_\eta^2 \rangle$ MUST DECREASE
  - HARMONIC : $\langle \sigma_\eta^2 \rangle_H$ DECREASES ⇒ V_H ALMOST CONSTANT
  - ARITHMETIC: $\langle \sigma_\eta^2 \rangle_A$ ALMOST CONSTANT ⇒ V_A MUST DECREASE

- STAR DISTRIBUTION N° 2 : OBTAINED FROM THE REFERENCE ONE BY REPLACING AVERAGE STARS BY FAINT STARS
  - THE GCR PERFORMANCES ALMOST CONSTANT ⇒ $(V-1)\langle \sigma_\eta^2 \rangle$ ABOUT THE SAME
  - HARMONIC : $\langle \sigma_\eta^2 \rangle_H$ ALMOST CONSTANT ⇒ V_H ALMOST CONSTANT
  - ARITHMETIC : $\langle \sigma_\eta^2 \rangle_A$ INCREASES ⇒ V_A MUST DECREASE

1.5 MAIN RESULTS

- THE PRESENCE OF A CONSTANT ADDITIVE TERM IN THE GCR FORMULA HAS BEEN VALIDATED THROUGH SIMULATION RUNS (THE WEIGHTED FORMULA YIELDS BETTER RESULTS)

- THE HARMONIC MEAN IS A GOOD INDICATOR OF THE OVERALL PERFORMANCE WHILE THE ARITHMETIC MEAN IS NOT

- FOR A GIVEN OBSERVING STRATEGY, THE OVERALL PERFORMANCES DEPEND ON THE FOLLOWING FACTORS:

  * GEOMETRICAL STAR DISTRIBUTION ALONG THE GREAT CIRCLE

  * WEIGHTS ALLOCATED TO THE DIFFERENT STARS IN THE REDUCTION PROCESS

  * STAR MAGNITUDE & COLOUR DISTRIBUTION

  * SCALING FACTORS FOR THE DIFFERENT TYPES OF ERROR VARIANCES ($1/IT$; $1/I^2T$; $1/T$; 1)

1.6 CONCLUSIONS

TWO SOLUTIONS RECOMMENDED BY MATRA :

PREFERRED SOLUTION

- ESTEC TO DEFINE ONE OR A SET OF TYPICAL GREAT CIRCLES (POSITION, MAG., COLOUR & OBSERVING TIME DISTRIBUTION)
- MATRA TO DETERMINE FOR THE ABOVE GREAT CIRCLES THE CONSTANT ADDITIVE TERM THROUGH SIMULATION RUNS (GCR SOFTWARE)

ALTERNATE SOLUTION

- ESTEC TO FREEZE THE VALUE OF THE RIGIDITY FACTOR IN THE SRD FORMULA
- USE THE HARMONIC MEAN IN THE SRD FORMULA
- MATRA TO DETERMINE THE HARMONIC MEAN FROM AN APPLICABLE MODEL OF GREAT CIRCLE STARS (MAG, COLOUR, OVERALL OBS. TIME).

POLICY OF MARGINS FOR THE MAIN MISSION

- MATRA THINK THAT AN OVERALL MARGIN OF **30%** ON THE FINAL ASTROMETRIC PARAMETER RMS ERRORS IS A REASONABLE VALUE AT THIS STAGE OF THE PROGRAM

- MATRA PROPOSE THE FOLLOWING DECOMPOSITION OF THE MARGIN BETWEEN THE DIFFERENT REDUCTION STEPS :

GREAT CIRCLE REDUCTION STEP : **20%** MARGIN IN THE GCR FORMULA (VERSUS 45% AT THE MOMENT)

COEFFICIENTS OF IMPROVEMENT : **20%** MARGIN APPLIED ON THE FOLLOWING PARAMETERS:

* FOR POSITION - $(C_\beta + C_{\lambda\cos\beta})/2$
* FOR PROPER MOTION - $(C_{\mu_\beta} + C_{\mu_{\lambda\cos\beta}})/2$
* FOR PARALLAX - C_{ϖ}

NOTA BENE : THE CHOICE OF THE ABOVE PARAMETERS WAS THE CHOICE ORIGINALLY ADOPTED (PF616) AND IT HAS ALWAYS BEEN RECOGNIZED THAT THE PERFORMANCE ON THE LONGITUDE PROPER MOTION COULD NOT BE AS GOOD AS FOR THE OTHER ASTROMETRIC PARAMETERS

2. OPTIMIZATION OF THE IFOV SIZE

2.1 STATEMENT OF THE PROBLEM :

FIND THE IFOV SIZE WHICH MINIMIZES THE OVERALL ERROR VARIANCE DUE TO THE FOLLOWING TERMS :

A – PHOTON NOISE FOR PERFECT IFOV POINTING

B – MEASUREMENT ERROR INDUCED BY IFOV DEPOINTING

C – MEASUREMENT ERROR INDUCED BY PARASITIC STARS

A & B PUSH TO INCREASE THE IFOV SIZE } THERE IS AN OPTIMAL VALUE WHICH
C PUSH TO DECREASE THE IFOV SIZE } TRADES OFF THOSE CONFLICTING EFFECTS

2.2 PHOTON NOISE ERROR FOR PERFECT IFOV POINTING

THE NUMBER OF PHOTONS COLLECTED FOR PERFECT IFOV POINTING DECREASES WITH THE IFOV SIZE , HENCE AN INCREASE IN PHOTON NOISE STATISTICS BY A FACTOR Y_{IP}

2.3 IFOV DEPOINTING - INDUCED ERROR

EFFECT OF A DEPOINTING R OF THE IFOV:

- MODIFICATION OF THE AVERAGE COUNT RATE I_0 AND MODULATION FACTORS M1 AND M2, RESULTING INTO A CHANGE IN PHOTON NOISE STATISTICS BY A FACTOR $Y_{PE}(R)$
- DISTORTION OF THE 1ST TWO HARMONIC PHASES RESULTING INTO A SUPPLEMENTARY ERROR VARIANCE ON THE WEIGHTED PHASE ESTIMATE $\sigma_{\eta_{PE}}(R)$

DEPOINTING ERROR

THE RANDOM VARIABLE R FOLLOWS A LAW CHARACTERIZED BY A DENSITY OF PROBABILITY G(R) (RAYLEIGH LAW)

OVERALL EFFECT

$$Y_{PE} = \int_0^{RMAX} G(R)\, Y_{PE}(R)\, dR$$

$$\sigma_{\eta_{PE}}^2 = \int_0^{RMAX} G(R)\, \sigma_{\eta_{PE}}^2(R)\, dR$$

2.4 ERROR DUE TO PARASITIC STARS

ERROR INDUCED BY ONE PARASITIC STAR $(\Delta M, \Delta\phi, R)$:

- MODIFICATION OF THE PHOTON NOISE STATISTICS BY A FACTOR $\gamma_{VG}(\Delta M, \Delta\phi, R)$
- DISTORTION OF THE OBSERVED STAR APPARENT PHASE BY $\delta\varphi_{VG}(\Delta M, \Delta\phi, R)$

IF THE PARASITIC STAR BELONGS TO :

- THE SAME FOV :
  - * DISTURBANCE OF A SYSTEMATIC NATURE
  - * THE AVERAGING EFFECT PLAYS ON $\Delta\phi$ ONLY
- THE OTHER FOV :
  - * THE AVERAGING EFFECT PLAYS ON $\Delta\phi$ AND ΔM AND R

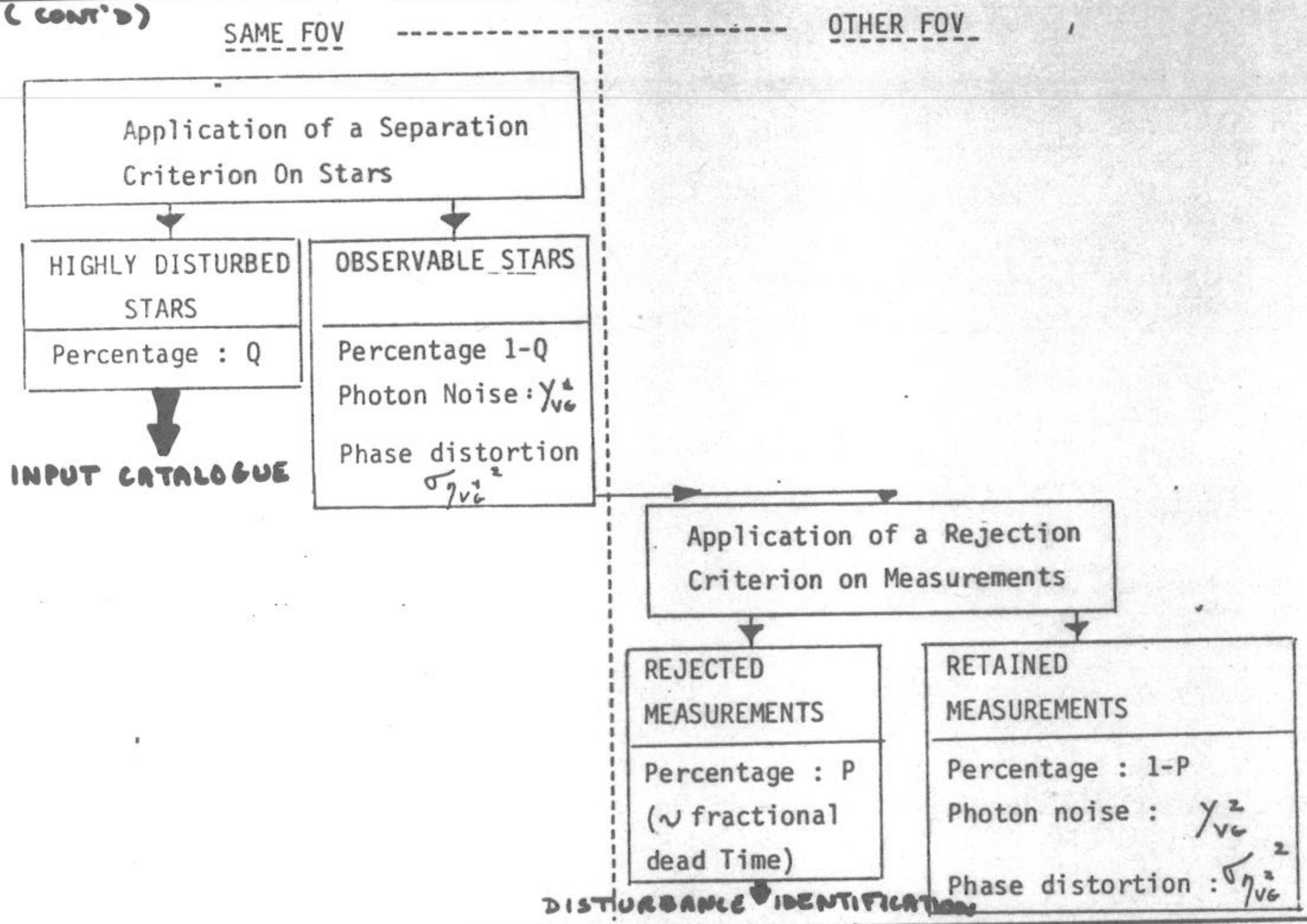
PARASITIC STAR MODEL :

SUPERPOSITION OF 2 COMPONENTS :

- SINGLE STAR MODEL : ALLEN (POISSON DISTRIBUTION)
- MULTIPLE STAR MODEL : LINDEGREN'S FORMULA - MOST OF THE DOUBLE STARS ARE SUCH THAT $R < 10''$ ➡ THEY DO NOT PLAY A DETERMINANT ROLE FOR THE IFOV SIZE OPTIMIZATION

2.4 ERROR DUE TO PARASITIC STARS (CONT'D)

ORIGIN OF THE PERTURBATION



2.5 RESULTS

INPUTS : 3 DIFFERENT IFOV APERTURE SIZES HAVE BEEN CONSIDERED : 90 μm / 70 μm / 50 μm

SOFTWARE USED : – LINDEGREN'S IFOV DEPOINTING SOFTWARE
– MATRA "IFOV PROFILE LOCAL MODEL"

SUMMARY OF THE RESULTS

STAR MAG \ IFOV APERTURE Ø	90 μm	70 μm	50 μm	σ_α^2
5	0.016	0.226	0.435	26.75
9	1.224	1.001	2.384	34.3
12	11.791	11.354	27.95	132.5

OVERALL INCREASE IN THE STAR ABSCISSA ERROR VARIANCE (mas^2)

CONCLUSIONS

- THE OPTIMAL IFOV SIZE SEEMS TO LIE WITHIN THE RANGE [70 μm , 90 μm]
- THE OPTIMUM IS RATHER FLAT TOWARDS 90 μm ⟹ IT IS SAFER TO KEEP TO THE CURRENT VALUE Ø = 90 μm

3. TYCHO ASTROMETRIC SPECIFICATIONS

3.1 EVOLUTION OF THE SITUATION

	SM GRID CONFIGURATION	SPECIFICATION	TYCHO CATALOGUE
ORIGINALLY	INCLINED SLITS + VERTICAL SLITS	MAG : B = 10 / 11 COLOUR INDEX : B-V = -0.25/0.5/1.25 LONG. GRID COORDINATE SINGLE MEASUREMENT TARGET VALUES ONLY (0.1" RMS : B = 10 / B-V = 0.5	NO A-PRIORI CATALOGUE
AT SSDR	INCLINED SLITS ONLY		
PRESENTLY	INCLINED SLITS + VERTICAL SLITS	MAG: $\frac{B+V}{2}$ = 9.65/10.65 COL. INDEX: B-V = 0./0.7/1.5 LONG GRID COORD ALONG SCAN FULL CROSSING OF THE SM SLIT SYSTEM 0.1" RMS : (B+V)/2 = 9.65, B-V = 0.7 } (B=10)	A-PRIORI CATALOGUE

3.2 CRITICISMS ON PRESENT SPEC FORMULATION

- AMBIGUITY OF THE "ALONG SCAN FULL CROSSING" SPEC
(ESTEC INTERPRETATION → TIGHTENING OF THE SPEC)

- THE SPEC SHOULD PUT CONSTRAINTS ON THE SM GRID CONFIGURATION INASMUCH AS THE COMPLETE TYCHO DATA REDUCTION IS NOT ACCOUNTED FOR

3.3 MATRA'S PROPOSAL

- THE SPEC SHOULD MAKE AN APORTIONMENT, IN ACCORDANCE WITH THE ORIGINAL ACCURACY OBJECTIVE, BETWEEN VERTICAL AND INCLINED SLITS IN TERMS OF TRANSIT TIME DATATION ACCURACY
(EQUAL APORTIONMENT BETWEEN THE TWO GROUPS OF SLITS WOULD LEAD TO ABOUT 0.12" RMS FOR (B+V)/2 = 8.65 / B-V = 0.7)

- THE SPEC SHOULD IMPOSE THE FOLLOWING CONSTRAINTS ON SM GRID CONFIGURATION :

    * VERTICAL AND INCLINED SLITS MUST HAVE THE SAME HEIGHT H^*
    * THIS COMMON HEIGHT H^* MUST BE $\geq$ 40 ARCMIN

4. IN FLIGHT PHOTOMETRIC CALIBRATION

4.1 SPECIFICATION

THE SRD SHOULD INCORPORATE THE FOLLOWING SUPPLEMENTARY INFORMATION :

- AN APPLICABLE MODEL FOR SECONDARY PHOTOMETRIC STANDARD STARS DEFINING :
  * THE NUMBER OF THOSE STARS AND THEIR DISTRIBUTION IN POSITION, MAGNITUDE AND COLOUR OVER THE SKY
  * THE ACCURACY OF THE ASSOCIATED MULTICOLOUR PHOTOMETRIC DATA IN ANY GIVEN PHOTOMETRIC SYSTEM (E.G. GENEVA SYSTEM)

- TRANSFORMATION FORMULAE ALLOWING TO DERIVE THE HIPPARCOS MAGNITUDE AND MODULATION FACTORS FROM THE ABOVE-MENTIONED MULTICOLOUR PHOTOMETRIC DATA FOR A STANDARD HIPPARCOS INSTRUMENTAL RESPONSE

- GOODNESS OF FIT OF THOSE TRANSFORMATION FORMULAE

4.2 PROPOSED PHOTOMETRIC CALIBRATION APPROACH

A PRIORI INFORMATION :

TRANSFORMATION FORMULAE AS DERIVED FROM ON-GROUND CALIBRATION OF THE HIPPARCOS INSTRUMENT
TAKE FOR EXAMPLE A POLYNOMIAL ADJUSTMENT OF THE FORM (GRANES-MIGNARD):

$$H-V = 0.485\ (B-V) - 0.219\ (B-V)^2 + 0.022\ (B-V)^3$$

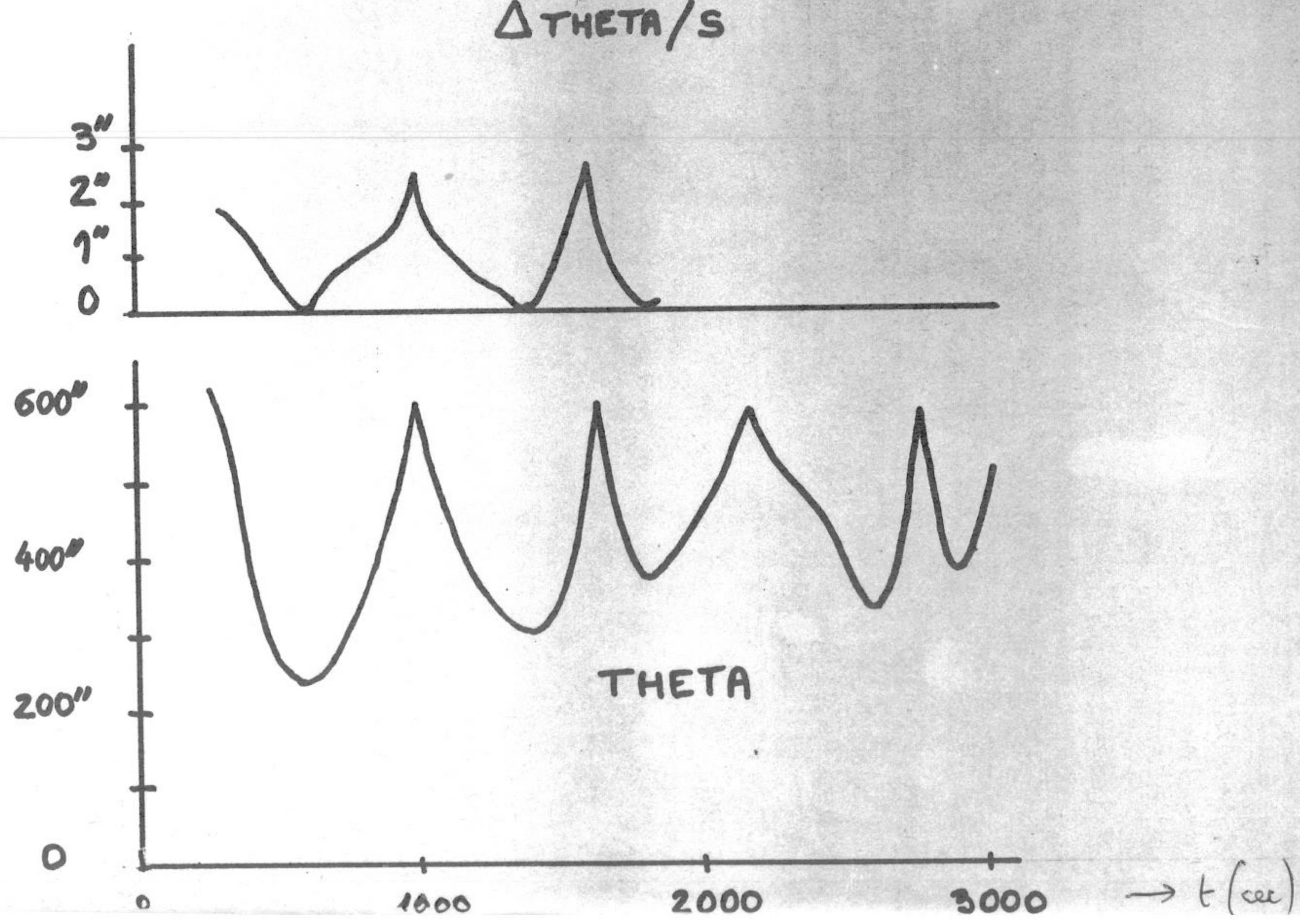
IN FLIGHT CALIBRATION :

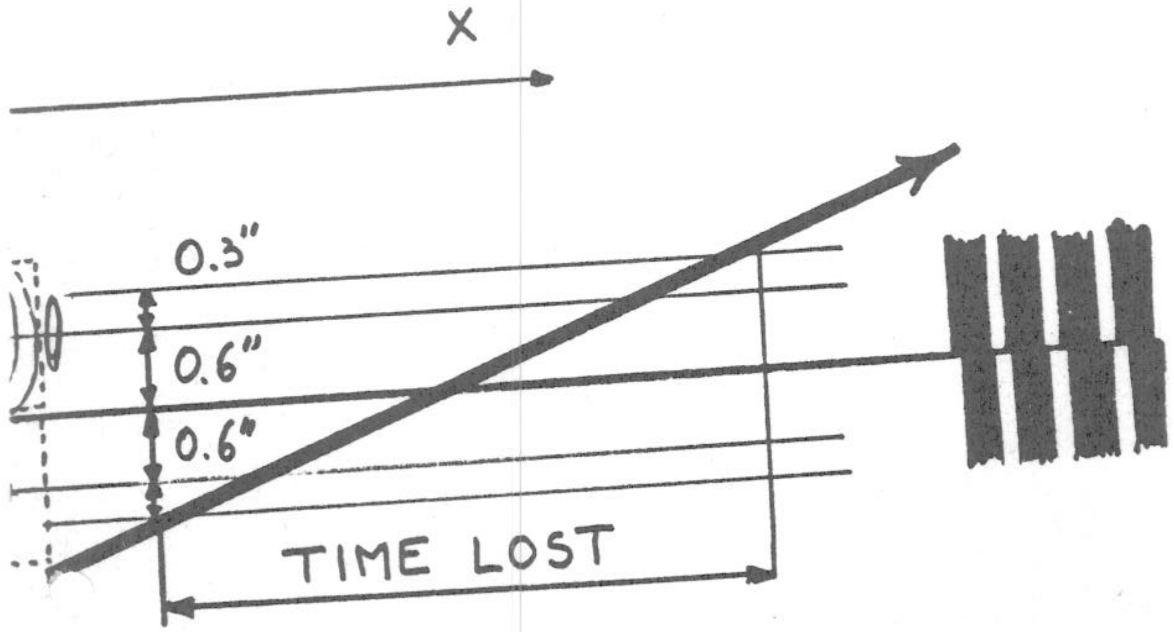
AFTER LAUNCH, THE ABOVE TRANSFORMATION WILL HAVE CHANGED BUT ITS GENERAL FORM WILL REMAIN VALID :

$$H-V = (0.485 + \varepsilon_1)\ (B-V) - (0.219 + \varepsilon_2)\ (B-V)^2 + (0.022 + \varepsilon_3)\ (B-V)^3$$

THE OBSERVATION OF ANY SECONDARY STANDARD STAR WILL PROVIDE A RELIABLE EQUATION OF OBSERVATION (B-V IS ACCURATELY KNOWN FOR THOSE STARS) AND ANY REGRESSION METHOD SUCH AS WEIGHTED LEAST SQUARES ALLOWS TO DETERMINE THE VALUES OF $\varepsilon_1, \varepsilon_2, \varepsilon_3$ FROM A SET OF SUCH OBSERVATIONS

ANNEX III





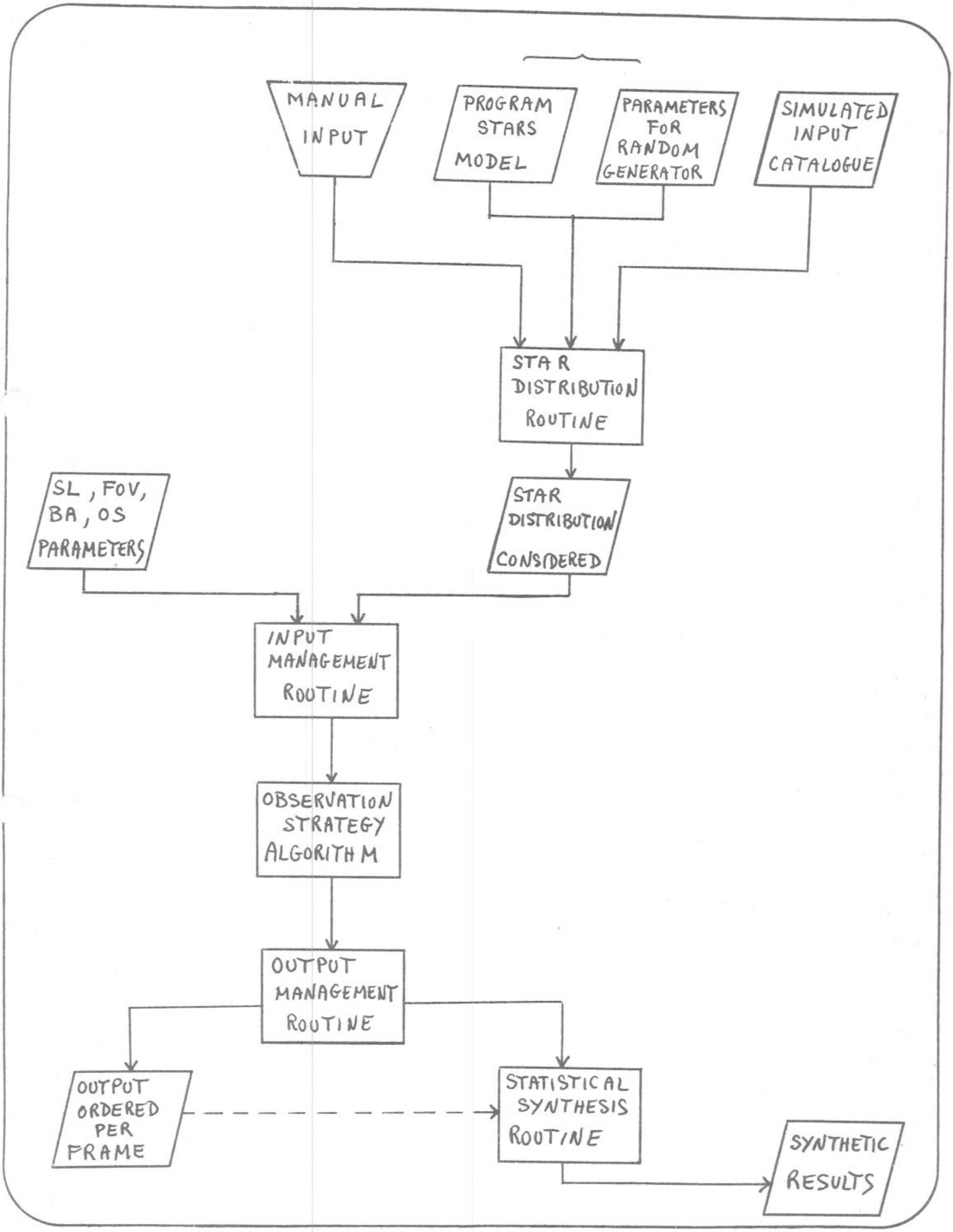
DIFFRACTION PATTERN IN Y ≃ 1.2"
ATTITUDE ERREUR ≃ 0.3"
(STAR MAPPER ONLY)

TOTAL LOST 1.8"

LEMENTARY PATTERN OF THE GRID 38.4"

ΔTHETA/s	TIME LOST 1 CROSSING FIELD OF VIEW	%	PROBABILITY	TOTAL
0	18 s	100%	4.7 %	4,7 %
1	1.8 s	10 %	46.7 %	4,7 %
2	0.9 s	5%	94. %	4,7 %
3	0.6 s 0.6 s	3.3 % 3.3%	100 % 40.6 %	4.7 %

ANNEX IV


MANUAL INPUT
PROGRAM STARS MODEL
PARAMETERS FOR RANDOM GENERATOR
SIMULATED INPUT CATALOGUE
STAR DISTRIBUTION ROUTINE
SL, FOV, BA, OS PARAMETERS
STAR DISTRIBUTION CONSIDERED
INPUT MANAGEMENT ROUTINE
OBSERVATION STRATEGY ALGORITHM
OUTPUT MANAGEMENT ROUTINE
OUTPUT ORDERED PER FRAME
STATISTICAL SYNTHESIS ROUTINE
SYNTHETIC RESULTS