

The Hipparcos and Tycho Catalogues

ESA SP1200 June 1997

Volume 3

Clicking on a highlighted section will open the relevant PDF document.

Contents listing and Foreword

Section A: Background

1. Introduction

- 1.1. The Purpose of this Volume
- 1.2. Pre-Launch Preparations
- 1.3. Preparation of the Observing Programme
- 1.4. Methodology and Organisation of the Data Analysis
- 1.5. Comparisons
- 1.6. The Final Results Data Base and the Final Mission Products
- 1.7. Astrophysical Exploitation
- 1.8. Data 'Rights' and Related Issues

2. Mission Operations Time-Line

- 2.1. Introduction
- 2.2. Activities Leading to Improvements of the Data Quality
- 2.3. Routine Operational Phase
- 2.4. Events and Failures Leading to Loss or Degradation of Data
- 2.5. Data Return

3. Observing Programme

- 3.1. Introduction
- 3.2. The Stellar Inputs
- 3.3. From Scientific Proposals to a Tentative Input Catalogue
- 3.4. Resulting Catalogue Content
- 3.5. Tests of the Hipparcos Input Catalogue by Satellite Observations

4. Overview of the Data Analysis

- 4.1. Main Stages of the Data Reduction
- 4.2. Organisation of the Data Reductions in FAST
- 4.3. Organisation of the Data Reductions in NDAC

Section B: Analysis Procedures: Main Astrometric Catalogue

5. Image Dissector Tube Data Processing

- 5.1. Description of the Measurements and Other Input Data
- 5.2. The Signal Model
- 5.3. Principles of the Image Dissector Tube Data Processing
- 5.4. Calculation of the Relative Phases
- 5.5. Binning Techniques
- 5.6. Solution of the Binned Equations
- 5.7. Statistical Tests of the Five-Parameter Solution
- 5.8. Veiling-Glare Correction by FAST
- 5.9. Optical Transfer Function Calibration and Three-Parameter Solution
- 5.10. Comparisons

6. Star Mapper Data Processing

- 6.1. The Measurement Principles
- 6.2. The Star Mapper Transit Signal
- 6.3. Signal Recognition and Background Determination by NDAC
- 6.4. Signal Recognition and Background Determination by FAST
- 6.5. Programme Star Detection by FAST
- 6.6. Transit Time and Intensity Determinations by NDAC
- 6.7. Transit Time and Intensity Estimation by FAST
- 6.8. Comparisons
- 6.9. Star Mapper Astrometry
- 6.10. Star Mapper Photometry

7. Attitude Reconstruction

- 7.1. The Attitude Reconstruction Problem
- 7.2. Physics of the Attitude of the Satellite
- 7.3. The Nominal Scanning Law and Real-Time Attitude Determination
- 7.4. Attitude Modelling and Estimation by NDAC
- 7.5. FAST Attitude Model
- 7.6. FAST Estimation Procedure
- 7.7. Performance Comparisons

8. Timing and Calibrations from the Attitude Reconstruction

- 8.1. Characteristics of the Orbit
- 8.2. The On-Board Time
- 8.3. Gyro Calibrations
- 8.4. Thruster Firings
- 8.5. Inertia Tensor and Torque Calibrations
- 8.6. Miscellaneous Effects
- 8.7. Conclusions

9. Great-Circle Reductions

- 9.1. Introduction
- 9.2. Great-Circle Reduction
- 9.3. Attitude Smoothing
- 9.4. Rank Deficiency and Minimum Norm Solution
- 9.5. Accuracy of the Great-Circle Solution
- 9.6. Instrument Parameters
- 9.7. Analysis of the Least-Squares Residuals
- 9.8. Intercomparisons
- 9.9. Conclusions

10. Evolution of Instrument Parameters

- 10.1. Introduction
- 10.2. Geometrical Instrument Parameters
- 10.3. Medium-Scale Distortion

11. Sphere Solution

- 11.1. Introduction
- 11.2. The Reference Great-Circle Frame
- 11.3. Observation Equation
- 11.4. The Sphere Solution Proper
- 11.5. Determination of Astrometric Parameters in NDAC
- 11.6. Determination of Astrometric Parameters in FAST
- 11.7. Rank Deficiency and Convergence Properties

12. Ephemerides, Timing, and Calculation of Celestial Directions

- 12.1. Ephemerides
- 12.2. Timing of the Observational Data
- 12.3. Coordinates for Stars and Solar System Objects
- 12.4. Formulae for Gravitational Deflection and Aberration

Section C: Analysis Procedures: Independent Tasks

13. Double and Multiple Star Treatment

- 13.1. Introduction
- 13.2. Double Star Detection
- 13.3. The Astrometric and Photometric Solution: FAST Method
- 13.4. The Astrometric and Photometric Solution: NDAC Method
- 13.5. NDAC Implementation and Results
- 13.6. NDAC/FAST Comparisons
- 13.7. Merging of the Results for Resolved Double and Multiple Stars
- 13.8. Conclusions

14. Photometric Treatment

- 14.1. Introduction
- 14.2. The Photometric System
- 14.3. The Photometric Data
- 14.4. The Calibration
- 14.5. Final Corrections
- 14.6. Parasitic Transit Detections
- 14.7. Merging
- 14.8. Properties of the Photometric Data

15. Minor Planets and Planetary Satellites

- 15.1. Introduction
- 15.2. Hipparcos Observations of an Extended Source
- 15.3. Astrometry on the Circle
- 15.4. Astrometry Final Output
- 15.5. Photometry of the Solar System Objects

Section D: Sphere Solution and the Final Catalogue

16. Successive Sphere Solutions

- 16.1. Introduction
- 16.2. Principles of Iterations
- 16.3. NDAC Sphere Solutions
- 16.4. FAST Sphere Solutions
- 16.5. Evolution of Standard Errors
- 16.6. Intercomparisons
- 16.7. Conclusions

17. Astrometric Catalogue Merging

- 17.1. Introduction
- 17.2. Astrometric Parameters and Abscissa Residuals
- 17.3. Scaling Corrections of Consortia Formal Errors
- 17.4. Correlation Between Abscissae
- 17.5. The Least-Squares Solutions
- 17.6. Merged Solutions of Non-Single Stars
- 17.7. Comparison with a Weighted Mean
- 17.8. Correlations Between Different Stars on the Same Great Circle
- 17.9. Conclusions

18. The Link to an Extragalactic System

- 18.1. Motivation for the Link
- 18.2. Reference System for the Hipparcos Catalogue
- 18.3. Link Equations
- 18.4. Results of the Different Link Programmes
- 18.5. Discussion of the Individual Solutions
- 18.6. Synthesis of the Link Solutions: General Methods
- 18.7. Synthesis of the Link Solutions: Results
- 18.8. Verification and Conclusions
- 18.9. Organisation of the Work

Section E: Properties of the Final Hipparcos Catalogue

19. Comparisons with Ground-Based Astrometry

- 19.1. Introduction
- 19.2. Comparison with the FK5 Catalogue
- 19.3. Comparison with the PPM Catalogue
- 19.4. Comparison with the Mark III Interferometer Results
- 19.5. Astrometric Reductions of Schmidt Plates
- 19.6. Analysis of Recent Meridian Circle Observations
- 19.7. Analysis of Recent Astrolabe Observations

20. Verification of Parallaxes

- 20.1. Introduction
- 20.2. Assessment of Possible Errors
- 20.3. Comparison with Ground-Based Data
- 20.4. Systematic Errors of the Hipparcos Astrometric Parameters
- 20.5. The Zero-Point and Unit-Weight Error of the Parallaxes
- 20.6. Conclusions

21. Validation of Photometric Results

- 21.1. Introduction
- 21.2. Evaluation of the Calibrations
- 21.3. Distribution of the Unit-Weight Variance
- 21.4. Analysis of the Periods of Variable Stars
- 21.5. Stability of the Photometric System
- 21.6. Comparison with the Walraven Photometric System
- 21.7. Additional Comparisons with Ground-Based Systems
- 21.8. Conclusions

22. Analysis of Double Star Results

- 22.1. Introduction**
- 22.2. Relative Astrometry**
- 22.3. Relative Photometry**
- 22.4. Conclusions**

23. Future Prospects

- 23.1. The Merits of a Scanning Astrometric Mission**
- 23.2. The Space Astrometry Problem Revisited**
- 23.3. An Attempted Global Iterative Solution**
- 23.4. The Challenges for the Future**

Appendices

Appendix A. Glossary

Appendix B. Notations

Appendix C. References

Index