Data Analysis and Expected Results of the Tycho Mission

A.J. Wicenec, G. Bässgen, V. Großmann, M.A.J. Snijders, K. Wagner

Astronomisches Institut Tübingen Waldhäuserstr. 64, D-72076 Tübingen

U. Bastian, P. Schwekendiek

Astronomisches Rechen-Institut, Mönchhofstr. 14, D-69120 Heidelberg

D. Egret, J. Halbwachs

Centre de Données astronomiques de Strasbourg, Rue de Université 11, F-67000 Strasbourg

E. Høg, V.V. Makarov

Copenhagen University Observatory, Østervoldgade 3, DK-1350 Kopenhagen K

Abstract. The Tycho Data Analysis Consortium (TDAC) data reduction scheme is presented and the central parts in the reduction chain are described. Figures are shown to verify the photometric stability of the instrument and the rigidity of the astronomical parameters derived from several month of data of the nominal mission.

1. Introduction

In the Tycho project on-board the Hipparcos satellite (Høg et al. 1992) photometric and astrometric data of about 1 000 000 stars to a limit of $B = 12$ *mag* will be derived. The brightest 500 000 stars will obtain magnitudes in two colours B_T and V_T, the fainter 500 000 stars usually only either of the two and one broad-band magnitude T. The accuracy will be about 0.03 arcsec for positions and 0.03 mag for magnitudes, at $B = 10.5$ mag. The standard errors of positions and magnitudes will roughly increase by a factor of two per magnitude, at faint magnitudes. The results are obtained by the Hipparcos satellite's star mapper (which provides simultaneous measurements in two spectral channels), based on predicted star transits (Predicted Group Crossings, PGC's) using its own 'Tycho Input Catalogue' (TIC). The data treatment is carried out by the TDAC, using calibration and satellite attitude information from the two Hipparcos data reduction consortia.

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[1]Based on observations made with the ESA Hipparcos satellite

2. Data Analysis

2.1. Reduction Scheme

The TDAC data reduction is devided into two parts, the 'Main Processing' of the whole continuous data stream, i.e. every single countrate measured by the photoncounters of the star mapper, and the 'Reprocessing', where only parts of the data are reduced once again (see Fig. 3). During Reprocessing the data of the following objects will be reduced, using enhanced algorithms in order to improve the results for these objects:

- Stars brighter than 9 mag in either of the two bands
- Solar system objects
- Objects which are recognized in the Main Processing, but where not originally in the TIC
- Suspected double stars from the Main Processing
- Individually selected objects

This two-step procedure has been chosen in order to save processing time and to reduce the complexity of the Main Processing and to limit the amount of data in the Reprocessing, while treating the complete raw data collected by the satellite. On the other hand this procedure yields almost online results by using the 'Real Time Attitude Determination' (RTAD, Strada 1989) for the first steps of the Main Processing and the 'On Ground Attitude Reconstruction' (OGAR, Lindegren et al. 1992) for the down-stream tasks of the Main Processing and the complete Reprocessing. Thus the process uses the best attitude available at any stage of the reduction without the need of waiting for auxillary input data (i.e. from outside TDAC), but nevertheless yielding the highest accuracy for the output catalogue. At the expected start of the Reprocessing (beginning 1994) the final attitude will be available and will be used for this reduction step. The tasks of the Main Processing and their outputs are described in Høg et al. (1992), however the amount of data treated by the whole reduction chain and the Reprocessing scheme have not been presented up to now.

2.2. Reduction Status (Nov. 1993)

The Main Processing has been completed for all delivered data in the tasks Prediction and Detection. The task TIC production as a prelaunch task and the task Recognition uses only one year of data, thus these tasks are completed. The Photometric calibration has used almost all available data to produce calibration parameter sets. Prediction Updating, Transit Identification and Astrometry have used approximately 15% of the mission data. The latter tasks are much faster than the first ones and are expected to be ready by mid 1994. The Reprocessing is expected to be ready by the end of 1994. The catalogue production and verification phase is intended to be completed by the end of 1995 and the publication of the catalogues (Hipparcos and Tycho) is expected one year later.

3. Results

3.1. Astrometry

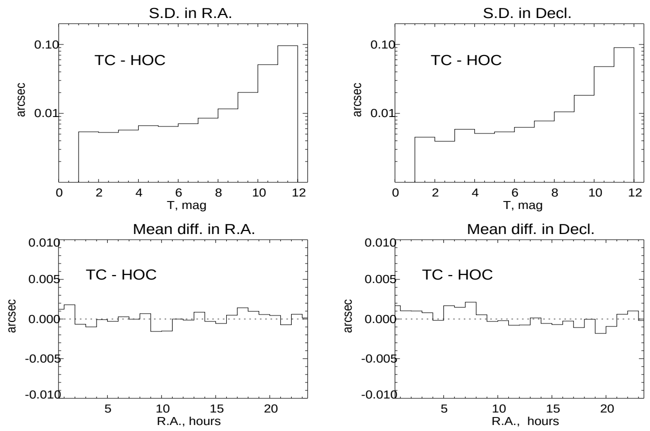

Figure 1. Standard deviation (upper) and mean difference (lower) of the Tycho positions from the Hipparcos positions from five month of mission data, in R.A. and Decl, respectively derived from 31889 stars having at least 30 observations.

3.2. Photometric Calibration

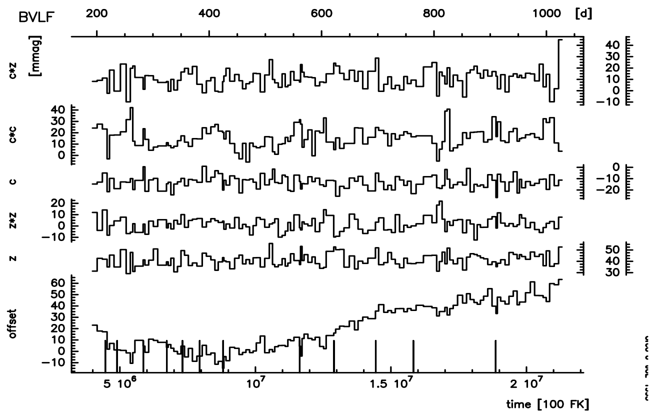

Figure 2. The six photometric calibration parameters calculated for 833 days as a function of time in the combination BVLF (B_T channel, vertical slit system, lower part of grid and following field of view). All parameters in mmag. Lower time axis in filingkey units (1 filingkey = 1/24 s), upper axis days since launch of Hipparcos satellite.

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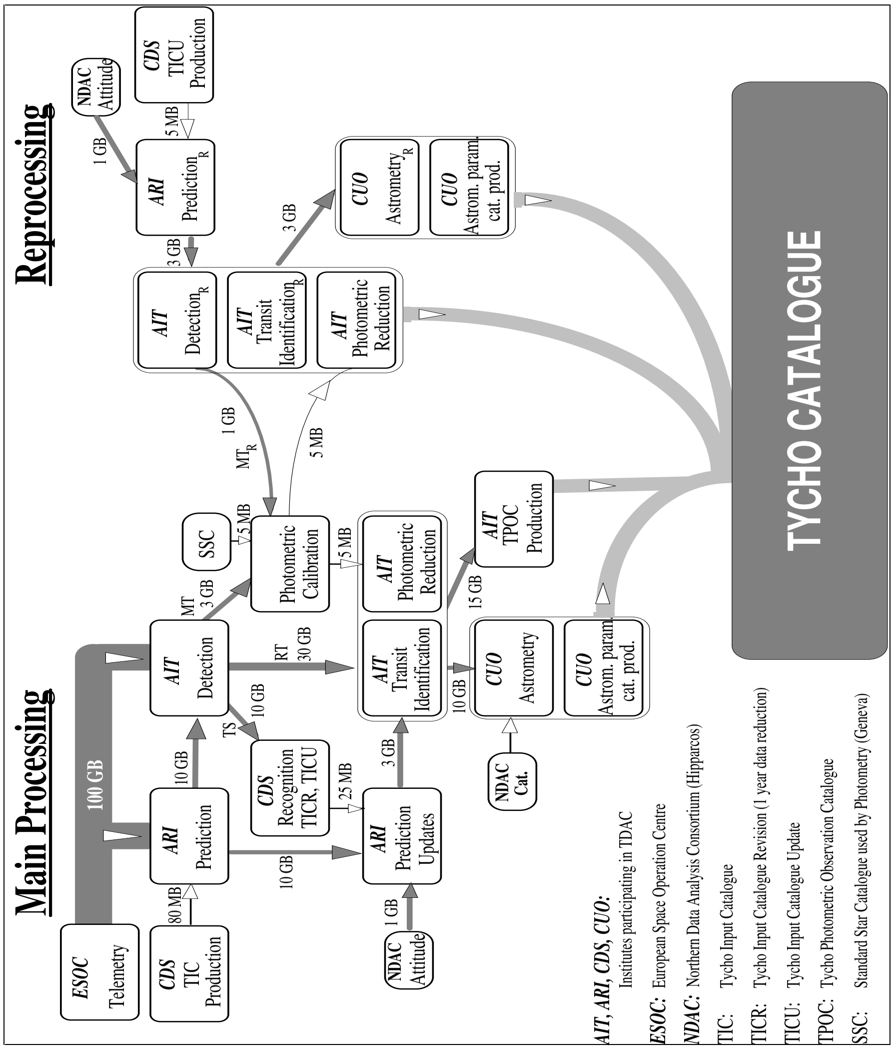

Figure 3. Data flow plan of the complete TDAC reduction chain. The NDAC catalogue used in Astrometry is the preliminary Hipparcos output catalogue from the 1.6 year solution of Hipparcos data. The width of the arrows indicate the amount of data exchange in addition to the written numbers.

References

Høg, E. et al. 1992, A&A, 258, 177

Strada, P. 1989, esa SP-1111/I, 165

Lindegren, L. et al. 1992, A&A, 258, 18