SET UP AND TESTING OF A SOFTWARE PACKAGE FOR THE GEODETIC ANALYSIS OF VLBI DATA +

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1. INTRODUCTION

The need for centimetric accuracies set by the application of the VLBI technique to geodesy implies a considerable computational effort, because of the intrinsic complexity of the model and because there is an increasingly large number of calibrations and corrections which can be accounted for only via software. The program VLBI 3 (Robertson, 1975) has been developed for the geodetic and astrometric analysis of VLBI data. It includes an accurate theoretical model of the observables and is supported by a number of routines for parameter fitting and input/output operations with data and results. The original VAX version of VLBI 3,due to N. Bartel and M.I.Ratner, runs in batch mode and requires routines which are in general unavailable in standard VAX systems. We have prepared (Caporali and Sylos Labini, 1982) a modified VAX version of VLBI 3. This version runs on our standard VAX/VMS computers and contains a number of changes in the FORTRAN source which allow to the user a real time interaction with the program. In addition, having a Tektronix graphic station at our disposal, we decided to replace the existing plot package - which used the line printer - with a "ad hoc" graphic program which permits interactive display of the results of each run of VLBI 3. Our work was mostly concerned with the input/output sections of VLBI 3. The theorical model of the VLBI observables has, for the moment, been left unchanged. We have, however, noticed that the theorical model could be updated and made more precise, e.g. in the computation of the nutation terms and of the aberration. This updating and a more extensive geodetic and astrometric analysis of VLBI data are planned to be done next.

2. DESCRIPTION OF THE PROGRAM AND OF THE RESULTS

The flow diagram of VLBI 3 is given in Fig. 1. The first three modules (SETUP, INPUT and NRMSET) initialize the program by reading the input data and control flags. FERMTR computes the theoreticals and partial derivatives. NORMAL formes and solves the normal equations. ADJUST computes and prints the adjustments to the a priori values of the "solve for" parameters. If requested, VLBI 3 produces a plot file which serves as input to the graphic program to display the results. We analyzed data taken on May 17-19, 1978 with the Haystack (Mass.), Onsala (Sweden),Owens Valley (Calif.), NRAO (W. Wirginia) radiotelescopes, and ten radio sources with declinations ranging from -5° 31' (3C278) to 50° 49' (NRAO 150).

R. Fanti et al. (eds.), VLBI and Compact Radio Sources, 375–376.

Because the data were taken at only one frequency (7850 MHz), the baseline estimates are affected by the systematic errors due to the charged component of the propagation medium. Fig. 2, obtained with our graphic package, shows that systematic effects are present in the residuals, but also indicates that the self consistency of the adopted solution is at the subdecimeter level.

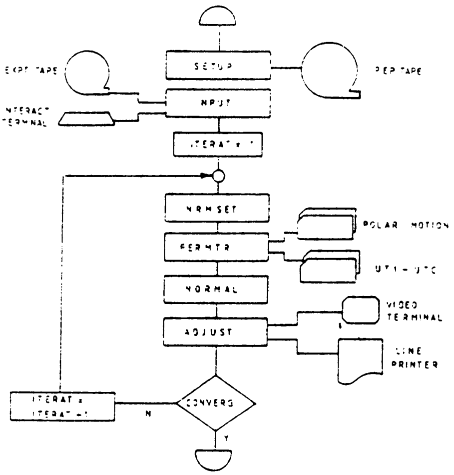

FIG.1 - BLOCK DIAGRAM OF VLBI 3

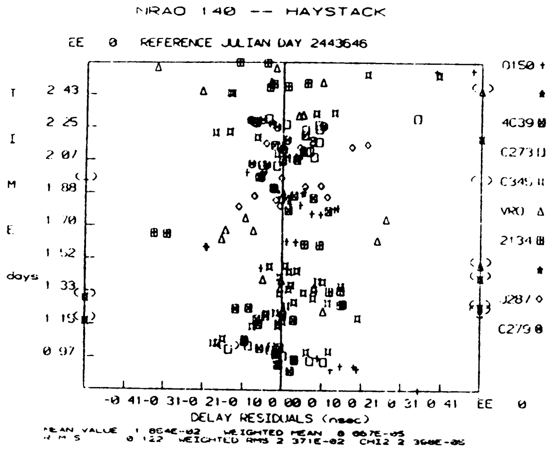

FIG.2 - SPREAD OF POSTFIT RESIDUALS

Table 1 summarizes our baseline estimates:

	OWENS VALLEY	ONSALA	NRAO
HAYSTACK	3 928 881.67 ± 0.02	5 599 714.66 ± 0.03	845 129.94 ± 0.01
OWENS VALLEY		7 914 131.17 ± 0.04	3 324 244.18 ± 0.02
ONSALA			6 319 317.76 ± 0.04

TABLE 1 - BASELINE RESULTS IN METERS WITH 1σ FORMAL ERROR

They are consistent with the results obtained by Herring and coworkers (Herring, 1981) from the analysis of the same data set.

A. CAPORALI and G. SYLOS LABINI (1982): Telespazio Internal Report.

T.A. HERRING and 16 co-workers (1981) : J.G.R. 86 1647 - 1651.

D.S. ROBERTSON (1975): Ph. D. Thesis NASA GSFC X-922-77-228.

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