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# DESCRIPTION OF 4-ELEMENT INTERFEROMETER TELESCOPE PROGRAMS

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IREAD41 Prints amplitude and phase of fringes, along with several other quantities from data records. It also prints out the header and A-D record information from the interferometer Tape 1. One input card is required, giving the first and last wanted scans. Only 4th correlator data is output.

ISEE Gives a graphical display of interferometer output for any of the 4 correlators. It reads in Tape 1 and outputs a graph of fringe amplitude and phase versus LST and HA at 1 line per minute for every scan. One input card is required giving the first and last wanted scans, the polarization and the correlator number.

ICOMPARE Reads Tape 1 and plots out phase and amplitude for a given correlator and polarization (as does ISEE), along with hygrometer infrared output. Data from each hygrometer (at each of the 2 telescopes making up the correlator), as well as the difference in the two hygrometer outputs, is plotted in degrees. This allows a quick visual comparison of fringe and water vapor fluctuation. A water vapor interpolation table (in volts and cm) may be read in, or the equation of a calibration curve may be used. In addition to the table, one input card is needed, giving the first and last wanted scans, the correlator number and the polarization state. Special care must be taken to assure that subroutine DTA is modified to put the hygrometer data into appropriate DSTACK locations, and that these locations are properly transferred in subroutines WRITER and IRH.

IEDIT4 Reads Tape 1, edits bad data, makes several phase corrections, and writes Tape 2 (for all 4 correlators). Two sets of input cards are used. The first contains the range of scans to be written onto Tape 2, the maximum rms, clock corrections, Bessel correction, and which, if any, telescopes are out of action for these scans. The second set of cards are the edit cards for any scans in the range given on the first card. They contain the scan number to be edited, whether this scan is partly or entirely bad, the time range to be edited in a certain manner, which data is to be flagged bad, and 42' digiswitch editing. These card formats are extensively documented at the beginning of IEDIT4. Phases are corrected for clock and precession errors, for a change of path length in the local oscillator lines, for refraction due to altitude difference, for spherical term refraction, for fringe acceleration, for diurnal aberration, and for time constants. The large partition is required under multiprogramming.

IPRINT Prints out everything stored on interferometer Tape 2: headers, A-D records, data records and opnote records for all four correlators. One input card is required, giving the first and last wanted scans.

INSPECT4 Calculates and plots 1-minute averages of fringe amplitude and phase from interferometer Tape 2, after correcting the phase to given baselines. The ordinates are LST and HA. The first 4 input cards contain the best known values of the baseline parameters Bx, By and Bz for the 4 correlators. Next, one or more cards are read containing the source name (if a particular source is wanted), the first and last scans (where the first must be an observation of the wanted source), those telescopes (if any) which are out of action, the polarization (LL, RR or both) desired, and the correlator number (1,2,3 or 4) to be output. If the first scan number is zero, the tape rewinds, and the next series of scans are found and plotted.

SHAVE Prints out 1-minute vector averages and 5-minute arithmetic averages of fringe amplitude and phase from Tape 2, after correcting for baselines. In addition, the 5-minute amplitude and phase averages are punched out on cards, along with the source name, right ascension and declination, scan number and hour angle. The input cards and formats are exactly the same as those for INSPECT4.

ADPLOT Extracts the outside temperature, dew point temperature, barometric pressure and microwave link phase (and 85-1 average leg temperature if recorded) from the A-D records on Tape 2. These quantities are plotted out every 5 minutes (for good A-D records) as functions of LST and HA, in an effort to correlate their fluctuations with those of the fringes plotted out in INSPECT4. The A-D parameters, along with the source name, scan number, LST and HA are punched out on cards. The two temperatures are plotted and punched in degrees centigrade, the pressure in millibars, and the link phase in degrees. One or more cards are input, containing the source (if a particular one is desired), the first and last scan numbers, any telescopes out of action, polarization LL or RR (or both), and the correlator number. The first scan must be an observation of the wanted source; and if the first scan number is identically zero, the tape is rewound. The large partition is required under multiprogramming.

PHASECOR Inputs the 5-minute phase average cards punched from SHAVE, arranged according to source, scan number and HA, in that order. This information is then written onto disk and read off and stored in two arrays in preparation for plotting. The program checks for change of source, for the onset of a new observing week for a source, and for the onset of a new scan number for a source. Phase versus HA plots are made for each

calibration source. These plots consist of a plot for each observing period (one week out of each month for the 4th correlator), and a summary plot of all the scans in the several periods (arbitrary number) for each source.

METCOR First inputs the phase average cards from SHAVE, then inputs the meteorological data cards from ADPLOT. Each group of cards is arranged according to source, scan number and HA. The SHAVE cards are written onto disk (1) and the ADPLOT cards onto disk (2). First the SHAVE data is read off, and then the meteorological data. When the source, scan and HA (within 3 minutes) match, corrections may be made to the SHAVE phase (such as that due to temperature structure expansion in the telescopes). The corrected phases are then plotted out in weekly and summary plots for each source, just as the uncorrected phases are plotted in PHASECOR. Outputs from METCOR and PHASECOR may then be compared and correlated in any manner. Typically, a combined total of 2000 SHAVE and ADPLOT data cards input into program METCOR will result in the program running for 1 hour.

TELCOR Calculates coefficients of equations that fit the correction curves for the 42' telescope position. The input consists of one card for each pair of corrections in hour angle and declination. Since the telescope readouts are in degrees, this program is written to accept both HA and declination corrections in this form. Cards are punched with the coefficients which are input into the TELPOS program.

TELPOS Outputs tables for use in pointing the 42' telescope. The table columns consist of sidereal time, HA in degrees, and declination in degrees. Three types of cards are input into program TELPOS: (1) The correction coefficient cards output from TELCOR; (2) A card specifying the length of the table to be output, in time, and the frequency of the entries; (3) The source cards in 1950.0 coordinates (in the format accepted

by the interferometer computer). The coordinates are precessed to a current date. If the declination on a source card is less than 0.5 degrees, then the program passes over this card and goes on to the next one.

PHFIT4 — Computes either baseline parameters or source positions (RA and dec) for all 4 correlators from interferometer data on Tape 2. In the first case, the program obtains an estimate of the baseline corrections by trying to resolve lobe ambiguities by the phase drift method. Then the best fit to the actual phases is obtained by the method of least squares. An input card is required for each source, giving source name, the first and last wanted scan numbers, the telescope or telescopes out of action (only good, operative correlators are treated), and a key word of 0 or 1 for baseline calibration or position reduction, respectively. For a position determination, four additional cards are input, with the best values of the baseline parameters for each of the 4 correlators. The following conventions are used to pick out correlator number and polarization desired: (1) K = 1,2,3,4 means the correlator 85-1/2, 1/3, 2/3, 1/42', respectively; and (2) M = 1,2,3,4 denotes left hand polarization, and M = 5,6,7,8 denotes right hand polarization, each for K = 1,2,3,4, respectively. The first scan must be an observation of the wanted source; and if the first scan number is identically zero, the tape is rewound. The large partition is required under multiprogramming.

BZCAL1 and BZCAL2 — Both take the phases from interferometer Tape 2, correct them for errors in baselines (and, if desired, for errors in source positions), and then average these resultant phases. BZCAL1 averages over a scan length (which may be as long as 160 minutes), while BZCAL2 averages over 30 minutes (and thus breaks the longer scans into smaller intervals). BZCAL1 requires the large partition under multiprogramming; BZCAL2 does not. Output consists of the mean phase, its rms value, and

the sine of the declination - for every interval of a scan length or of 30 minutes. Plotting the mean phase versus sin (DEC) should yield a determination of Bz and $B_o$. If the phases are to be corrected for errors in RA and dec, then the first input cards contain a calibration source name, along with its position errors (in seconds of arc). Then four cards are read with the best known values of the baseline parameters for the 4 correlators. Finally, one or more cards are read in, each containing a description of the program (such as correlator number or baseline), the first and last wanted scans, the polarization (LL, RR or both), the correlator number, and the telescopes which are out of action. Setting the first scan equal to zero allows the tape to be rewound during the run of the program.