INTERFEROMETER GROUP INTERNAL REPORT

AUTOMATED DATA REDUCTION PROGRAMS FOR
THE DUAL-FREQUENCY INTERFEROMETER

PRELIMINARY DESCRIPTION

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INTRODUCTION

New programs have been developed for the dual frequency inter-
ferometer system which are intended to facilitate data reduction.
That is, under most instrumental conditions, the output data can be
reasonably well edited and calibrated automatically. These programs
mimick the reduction procedures normally encountered in use of the
existing, less automated programs. The automated programs are meant
to augment, not replace, the existing programs, and full compatibility
with these programs is maintained.

The data reduction scheme is divided into three main areas; data
cleaning, data correction, and data centering. The first step involves
the automatic deletion of bad data through inspection of the information
in the tape records. Following this, standard corrections for atmospheric,
baseline, and clock error effects are applied. Lastly, the phases and
gains are "centered". In this context, gain centering means the same as
amplitude calibration to a standard ratio of 1000 amplitude counts per
amplitude flux unit (CPFU). Mistakes incurred through use of the pro-
grams can be corrected by use of the revised version of the INTEDIT pro-
gram.

A brief description of the programs and their usage follows. The
programs need not be run in any particular order; however, incomplete
editing of data may result in program errors. More about this later.

I. INTCLEAN inspects the records on tape for probable errors. A severity
for each type of error is assigned, and problems with sufficiently high

severity cause deletion of the affected information. The input consists of two parms, DELETE (default = 3) and MAXRMS (default = 1000); the former specifies the severity level for which deletion is to occur, and the latter is the maximum allowable RMS for high gain (MAXRMS/5 is used for medium and low gain). No INCLUDE/EXCLUDE facility is presently available. The output is a corrected version of the input tape along with a listing of the problems diagnosed and their severity. It is hoped that a minimum of good data is deleted, and that a minimum of bad data is passed on.

II.   INTCORR applies the same corrections as the PHASE, CLOCK, AMPCOR, and BASELINE verbs of INTEDIT. The predicted clock error is computed for each scan and applied. The constants for the amplitude corrections for low elevation observations are the standard values of 0.07 at S-band and 0.19 at X-band. Baseline corrections are applied only if new baselines are supplied; X-band baselines are assumed to be three times the corresponding S-band values. The phase, clock, and amplitude corrections are applied by default; to suppress them specify PARM = 'NOPHASE, NOCLOCK, and/or NOAMPCOR'. If baseline corrections are to be made, 3 cards in a file "//BASELINES DD *" (as in BASECAL) must be supplied with Bx, By, Bz, and K for each baseline in the order 1-2, 1-3, 2-3. Format per card is 4F15.0. No INCLUDE/EXCLUDE facility is presently available.

III.   INTCEN determines the phase and gain centers for a fully editted data set to which the standard corrections (e.g. PHASE, CLOCK, AMPCOR and BASELINE) have been applied. For obvious reasons the program is quite prone to errors if the input data has not been well edited. INTCEN reads the input data and stores the counts per flux unit and the phases of the

calibrators as a function of time. The calibrators are chosen from separate lists of amplitude and phase calibrators (taken from standard default lists or supplied by the user). Data up to 7 days can be accommodated in one pass; as a result, runs of longer periods must be broken in separate passes.

The calibrator CPFU and phases are stored and a smooth curve, evaluated at every sidereal half hour, is calculated using a weighted average of the calibrator observations. The weights are computed from relative weights of the calibrator reliability (supplied as input or by default) and the length of time which separates the calibrator observation from the current time. A default convolution time used in the averaging is four hours for the phase and gain. These values can be changed using the PARMS, PCONV or GCONV. Data in various modes can be freely mixed together. The corrections are graphically displayed and automatically applied to form a calibrated data set. Corrections which are applied to any 'LL' channel are also applied to the 'LR' and 'RL' channels of the same correlator and frequency if PARM = 'XPOL' is specified.

Input consists of the uncorrected data and INCLUDE/EXCLUDE cards. A list of phase calibrators (up to 100) and a list of gain calibrators (up to 30 with their S-band, X-band flux densities and relative weights) can be entered. Default lists are taken if none are specified. An optional list of times when discontinuities occur can also be read. Files and formats are given below.

FILE	SYSIN	DATA. AMPCALS	DATA. PHICALS	DATA .JUMPS
STATUS	required	optional*	optional*	optional
INFO	usual INCLUDE/ EXCLUDE cards	source name S-band flux X-band flux rel. weight	source name	correlator no.** no. jumps N≤5 julian date (N) LST (N)
MAX NO.	40 cards	30 sources	100 sources	12 cards
FORMAT	free	A10, 3F10.3	8A10	2I2, 5(I8, 1X, F5.2)

* if not user supplied, default files are used

** correlator no: 1-6   S-band 1R2R 1L2L 1R3R 1L3L 2R3R 2L3L

                     9-14   X-band 1R2R 1L2L 1R3R 1L3L 2R3R 2L3L

sample input card: 11 2 2448248 10.23 2448250 3.67

IV. Program execution. Standard dual-frequency file descriptions apply; that is, programs are executed in exactly the same manner as INTCOPY or IAVGER.

V. Examples: A. INTCLEAN

```
// EXEC INTCLEAN, INNAME=BTAPE, INTAPE=3386,
// OUTNAME=CLEAN, OUTUNIT=DISK, OUTDISP='(NEW,CATLG)'
```

B. INTCORR (with baselines)

```
// EXEC INTCORR, INNAME='&&DATA', INUNIT=DISK
//BASELINES DD *

    -6812.251     -21440.025     9115.655
    -4533.352     -14292.737     6083.593
    -2278.881      -7147.282     3032.062
```

(default output disk file &&OUTNAME)

C. INTCEN

```
// EXEC INTCEN, INNAME='&&H', INUNIT=DISK
```

```
//SYSIN DD *
INCLUDE    14898    15273
```

D. INTCEN (with amplitude calibrator list)

```
// EXEC INTCEN,OUTNAME=CENTER,OUTTAPE=978
// SYSIN DD *
INCLUDE
//DATA.AMPCALS DD *
3C48     9.0    3.3    1.0
3C418    3.9    3.1    0.5
BL.LAC   8.7    7.6    0.3
```

E. The entire system on two weeks worth of data (i.e. two passes of INTCEN).

```
// EXEC INTCLEAN, INNAME=TODAYDTA, INUNIT=DISK,
// OUTNAME='&&A', OUTUNIT=DISK
// EXEC INTCORR, INNAME='&&A', INUNIT=DISK,
// OUTNAME = '&&B', OUTUNIT=DISK
// EXEC INTCEN, INNAME = '&&B', INUNIT=DISK,
// OUTNAME = CALTAPE, OUTTAPE=3126
//SYAIN DD *
INCLUDE    29638    30135
// EXEC INTCEN, INNAME='&&B', INUNIT=DISK,
// OUTNAME=CALTAPE,OUTTAPE=3126, OUTDISP=MOD
//SYSIN DD *
INCLUDE    30136    32000
```

Note that INTSCRIB, INTINDEX, or other interferometer programs can be executed at any stage of the data reduction.