Appendix C

CHEF

Brief Guide to Data Reduction at the SMT with CHEF

After starting up a **CHEF**session, execute the following macro:

```
CHEF> @proc:chefinit aos
```

This will setup some default parameters for spectral line data reduction. If you are going to be doing continuum data reduction, at the beginning of or during a **CHEF**session execute the CHEFINIT macro with the "drum" qualifier:

```
CHEF> @proc:chefinit drum
\begin{verbatim}

\section{ Spectral line Processing:}
The CHEFINIT macro assumes that you are going to
use cold-load calibration. It has setup many of the parameters given in
Chapter \ref{chef}. You need only set the following:

\begin{verbatim}
LAS> supply line CO(3-2)/fe 1 ! to set the line name
LAS> file out mydata.smt new ! to open an output file
```

Say that you have acquired a calibration scan (scan number 1234) and have done a position-switched measurement of your source (scan number 1235) with a repeat count of 5 (so that you end up with 10 subscans). To calibrate your spectra, do the following:

```
LAS> calibrate 1234                ! derive the calibration
                                   ! parameters from the cal
LAS> @proc:dosuball 1235 10        ! This will process the 10
                                   ! subscans from 1235 using
                                   ! the calibration from 1234
                                   ! and plot the result.
LAS> write                         ! This will write the result
                                   ! to the output file mydata.smt
```

C.1 Continuum Processing:

The CHEFINIT macro, when run with the DRUM qualifier, makes a number of assignments to other macros which you can use to process continuum cross measurements (like pointing). For example, if you have made a continuum cross scan with two subscans per arm (i.e. two subscans in azimuth and elevation), then the following will display those four subscans for you:

```
CAS> scan 3456                       ! gets scan 3456
CAS> pl4                             ! displays 4 subscans from 3456
CAS> pf                              ! does overlapped fit to
                                     ! pointing measurement and
                                     ! derives new COL* and NULE.
```

If you have just two subscans in your measurement, instead of "pl4" use "pl2".

C.2 Example Procedures

As an example, we list the DOSUBALL, pl4, and pf procedures.

C.2.1 DOSUBALL

```
!
!  DOSUBALL.PRO
!
!  CHEF macro to process all subscans for a given measurement.
!
!  INPUTS: &1 = scan number
!          &2 = number of subscans
!          &3 = AOS: A, B, or C
!
!  Jeff Mangum 04/95
!
define integer scano subs
define character which*4
let scano = &1
let subs = &2
let which = AOS&3
if which.eq."AOS" then
  let which = AOSA
endif
say 'which'
scan scano
for i 1 to subs by 2
  say "Processing subscans "'i'" and "'i+1'
```

```
  dosubscan i
  dosubscan i+1
  store 'which'
next
smo bo 2
plot
```

C.2.2 pl4

```
!
!  pl4.class
!
define char dtype*4
let dtype = &1
SUBSCAN
STORE 'dtype'
SUBSCAN
STORE 'dtype'
SUBSCAN
STORE 'dtype'
SUBSCAN
STORE 'dtype'
```

C.2.3 pf

```
!
! pf.class
!
POINTFIT
```

Appendix D

TOOLBOX CONT2 Software

It is possible to do quick continuum reduction using the TOOLBOX CONT2 software package. This package provides a quick way to process the ON_OFF scans taken with **OBST**. Currently, there is an ONLINE version of TOOLBOX which comes up automatically. It will automatically reduce and display individual scans taken in CONTINUUM mode. However, you can also use TOOLBOX in OFFLINE mode. to process ON_OFF scans.

CONT2, the TOOLBOX continuum reduction package, should be run from the [OBS.INI] directory (where "INI" are your initials).

Enter CONT2 by typing "cont2" at the DCL prompt (<FRANKE:OBS:INI>).

```
<FRANKE:OBS:JPM> cont2
```

At this point, you will get a prompt "cont2?", indicating that you are in the CONT2 program.

D.1 To Get Help:

Help for CONT2 commands plus on-line documentation can be obtained by:

```
cont2? help                    - this will alphabetically list
                                 available commands.
cont2? help=b                  - this will list available commands
                                 beginning with the letter 'b'.
cont2? help='commandname'      - this will print the documentation
                                 for the commandname.
```

D.2 An Example Reduction:

We illustrate how you can use CONT2 to reduce data with an example:

```
cont2? co=[obs]onoffd.c44      - this determines which file
                                 to read commands from.
                                 (ONOFFD.C44 is at the end of
                                  this appendix)
cont2? read                    - read the commands. Each command
                                 within onoffd.c44 will be listed.
                                 For a record of all the commands
                                 you've entered, type 'show'.
cont2? on=scan#                - Enter the scan number to be
                                 processed.
                       -or-
cont2? on=scan#1 scan#2 etc    - Enter a series of scan numbers to
                                 be processed.
                       -or-
cont2? on=scan#1 to scan#2 by n - Enter a series of scan numbers to
                                  be processed by step n.

cont2? end                     - End entering commands; do reduction.
```

CONT2 will then process the scan and subscans. Eventually, the following prompt will appear:

```
to HIST scan# 1 1 enter -RETURN-,HC,HT,GI,!!,NO, or OUT
```

For each scan, type 'ht' at the prompt to produce a hardcopy plot upon exit from CONT2. The bottom line of the header will give the values for the mean difference between the ON-OFF values, the rms per point, and the number of ON-OFF pairs. To obtain an overall rms, divide the rms-per-point by sqrt(number of ON-OFF pairs-1).

At this point, you are ready to exit CONT2.

```
cont2? finis                  - all plots are sent to the queue
                                after exiting from CONT2.
```

D.3 Useful CONT2 Commands:

D.3.1 To Remove Spikes:

A valuable diagnostic for eliminating spikes is to look for a subscan with an anomolously large/small value. If there are spikes in the data or corrupted subscans, these data can be edited out of the reduction using the command "deletesubscans".

For example, if scan 8500 has a spike in subscan 96, this subscan can be removed by typing:

```
cont2? print=yes              - enables printing of the average
                                value for each subscan.
```

```
 *enter all the commands to be used on the scan as above*

cont2? on=8500
cont2? deletesubscans=8500 96
cont2? end
```

D.3.2 To Average Several Scans:

If you desire an average of several scans, follow the procedure outlined in the "Example Reduction", then type:

```
cont2? average                 - this will average all entered scans.
cont2? end                     - execute as normal. 'ht' will again
                                    produce a hardcopy plot.
```

Don't be alarmed by the header information which will mostly reflect the first scan of the list. The mean and rms will be correct for the sum (check the value of P.TIME; it should reflect the sum of the times for the scans).

D.4 ONOFFD.C44:

As an illustration of a onoff reduction macro, we present the macro ONOFFD.C44.

"*" marks a comment line in the macro.

```
* onoffd.c44  onoff reduction macro for cont2 (AVK,JPM) 08-01-96
*
rxn=1                          - take data from receiver 1
obs.mode=ON_OFF                - observing mode is ON-OFF scans.
integration=7777               -
sig1=b1;cal1=no;calcounts=1000 - b1: is the second channel and
                                  first phase which corresponds
                                  to the bolometer data.
                               - no: no calibration will be provided.
                               - 1000: scale data by a factor of 1000.
tcal=1.0                       - noise tube temperature. Just use 1.
x-caption=channels             - write 'channels' as the x label.
plot=no;histo=1                - disable hardcopy plotting.Use
                                   histogram
baseline=no                    - don't baseline the data.
diffon_off=1
diffon_offdata=-0.5 +0.5       - setup for an OFF-ON pair; multiply
                                  by 0.5 to yield source flux.
y-length=4                     - defines the length of y axis in cm.
plotformat=no                  - plot headers.
```

```
ndec=3                        - specifies number of decimal places
                                  for the axes.
onscans=no                    - no scans are specified yet.
end=no
end=no                        -there may be more commands don't
                                  proceed with reduction yet.
```

This macro is found on FRANKE$DKA100:[OBS].

Appendix E

MOPSI

A Mini-guide to Continuum Data Reduction with MOPSI

This document is based on a mini-guide by Robert Zylka & Albrecht Sievers 25/03/96. The program **MOPSI** is an update of the program MOPS. It was installed at the SMTO December 1996 by Robert Zylka.

There are four main programs to reduce continuum data:

```
SKYDIP - fits & displays the skydips
ONOFF  - reduces the ON-OFFs
TOTDN  - transforms the 'raw'-data of [dual-beam] maps into TD format.
         These files can be reduced with MOPSI. TOTD can also grid
         the data, i.e. produce maps in NOD2 format.
         These gridded maps can be reduced either with MOPSI
         or any other software able to handle NOD2 data.
         BUT: the gridded data will not give as good results as the
              non-gridded, i.e. TD, data (especially for
              receiver-arrays) and the data reduction is not as easy.
 MOPSI   - general data reduction program for maps etc.
```

The first three programs run only under VMS, **MOPSI** runs under VMS & UNIX. For more detailed information see "A Small Guide to NOD2 at the 30-m Telescope" and "Pocket Coockbook for the MOPSI software". To make your own copy of these documents, print the .ps files located in

```
fdata:[rzylka.dir.prog.doc]guide.ps
fdata:[rzylka.dir.prog.doc]pockcoo.ps
```

The **MOPSI** software should be available by default when you log in as OBS. If not, execute the following command file:

```
@ fdata:[rzylka]zylka
```

In order not to slow down the KRONEN, the data reduction should be performed on FRANKE !!

E.1 Skydips:

To run the program SKYDIP, just type skydip and answer the questions. After the starting-mode, SKYDIP enters the command-mode. See the internal help for a list of commands. Try to find such value for the parameter RATIO, that gives the best fit (smallest error).

WARNING: If the optical depths are very high (¿ 1.0), SKYDIP will not give correct fits, because the model used by this program is to simple to describe the optically thick atmosphere.

E.2 ON-OFFs:

Can be reduced with the programs ONOFF and ONOFF_CAL. These are basically the same as ONOFF7 and ONOFF7_CAL described in the "Small Users Guide...". Currently only "non-symmetric" ON-OFF's can be done at the HHT. A Setup file for ONOFF can be found at ZYLKA$ONOFF:ONOFF_SETUP.DAT.

E.3 Double-beam maps

E.3.1 Creating the TD files:

To run TOTDN, just type "totdn". Than you have to specify the scan, channel number and the zig-zag parameter (IMPORTANT !!!). (Prompt is TOTD, not TOTDN).

```
TOTD> scan #/dir kdata:[smt.data]  - tells which scan to reduce and
                                     where to find it.
TOTD> chan #                       - the new 4 color bolometer data
                                     are in the following channels:
                                        4  1.25mm
                                        5  0.87mm
                                        1  0.45mm
                                        2  0.35mm
                                     for data of other receivers,
                                     see the corresponding manuals

TOTD> ZIG VALUE (in arcsec)     - THIS IS A VERY IMPORTANT PARAMETER,
                                  BUT CURRENTLY CAN'T BE CALCULATED BY
                                  TOTDN.

where
zig-zag = -0.5*WOBBLER_PERIOD*AZIMUTH_SCAN_VELOCITY*HARDWARE_INTEGR
                           The HARDWARE_INTEGRATION should be 1.
                           Check within OBSINP !
                           ('sho be1', the parameter HWI1)
```

See Figure 4.3

```
                              The correct zig-zag value equals
                              -0.5*xinc in the TD files. Check it
                              after reading the data within MOPSI.

TOTD> run                     - executes TOTDN
TOTD> exit
```

WARNING: If you have not specified the frequency within **OBST**, you should define some additional parameters, e.g the HPBW [arc sec], frequency [GHz], ...

E.3.2 Data reduction:

To run **MOPSI**, just type mopsi.

You can reduce the double-beam maps in the quickest & easiest way (but not necessarily the best) using the internal **MOPSI**-procedure BASIC (see 4.2 of "Cookbook"):

```
MOPSI> atd #                 - TOTDN created by default a BINARY TD file
                               with a name=scan#. The command td,
                               (or atd or btd) reads the data.

(at this point, the prompt changes)

MAP> proc basic             - procedure BASIC corrects the base-level
                              offsets, restores the map converts the
                              coordinates into equatorial system.
                              Using single commands:
                              MAP> base_r 1 last
                              MAP> base_s 0
                              MAP> res [beam_throw] [!]
                              MAP> conv
```

E.4 Displaying the data:

MOPSI uses the **GreG** graphic library for displaying, so in many cases the command language is the same as within GreG (device, levels, rgm, draw, ha/pl, ...). The command PLOT within **MOPSI** has the combined action of:

```
limits/rgd
set box match
box
plot[/...]
rgm[/...]
```

You can display the data between any of the data reduction steps. Within the main program (prompt MOPSI¿ or MAP¿) the maps can be displayed as color-image (not possible at the HHT, because the GAG version is very old) or contour maps. The subprogram STRIP plots columns and rows and can perform many operations on them.

```
MAP> device x b         - defines the plotting device.
                          If you are not directly logged-in onto the
                          computer on which you perform the data
                          reduction, remember to define the display:

                          set display/create/node=franke
                                    or
                          set display/create/node=kronen.
```

```
MAP> lev -1000 to 1000 by 100   - sets the levels for the plot
MAP> plot                       - displays the map.
       or
MAP> lev 4 8 16 to 96 by 10
MAP> plo/percent 1
MAP> rgm/per -1
```

To get a hardcopy of any plot, just type:

```
MAP> hard/pl
```

To clear a plot, type:

```
MAP> cl p
```

E.5 Using GreG:

By typing greg (or sic) you enter the **GreG** program. You can also send any **GreG** command by typing:

```
greg greg_command.
```