

National Radio Astronomy Observatory
Tucson, Arizona

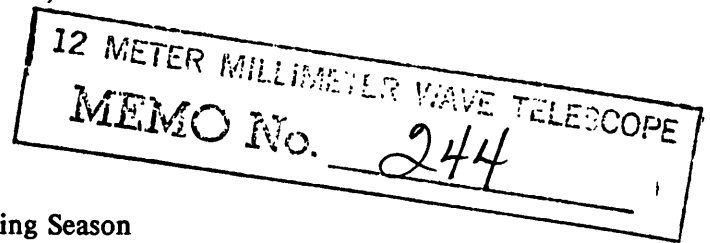
September 29, 1988

MEMORANDUM

To: 12 Meter Memo Series

From: P. R. Jewell

Subject: Changes for the 1988-89 Observing Season



This memo describes the many new features that have been added to 12 m systems during the 1988 Summer Shutdown; it is addressed to both operators and observers.

I. SOFTWARE CHANGES

1. Beam Throw Parameter

The way in which pointing offsets, reference positions, and subreflector beam throws are entered has been changed substantially. The AZ/EL pointing offsets, which are used to make corrections to the basic telescope pointing model, are now separate and distinct from the subreflector beam positions. This new convention offers several advantages over the old method:

- o Pointing offsets are entered only into the main beam position, not the main and reference; offsets for the reference beam are calculated automatically, i.e., no more mental calculations of angles!
- o For spectral line and continuum beam-switched ON/OFFs, the positions of the main and reference beams are calculated automatically. RA/DEC offsets entered into the main beam positions are applied to both the main and reference beams (i.e., there is no need to enter reference RA/DEC offsets).
- o The beam throw can be changed without altering telescope pointing, using the calibration curve of beam throw versus subreflector dial setting.
- o For dual-beam continuum maps, the map will now be automatically centered at the midpoint of the main and reference beams.
- o Once the pointing and reference offsets are initially configured, the observing mode can be alternated from position switching to beam switching without changing any offsets. Several new parameters now appear on the status monitor for both spectral line and continuum observations. These are:

	AZ	EL	
POINT	MM:SS	MM:SS	[telescope pointing corrections]
+BEAM	MM:SS	MM:SS	[subreflector main beam position]
-BEAM	MM:SS	MM:SS	[subreflector ref. beam position]
PSREF	MM:SS	MM:SS	[position switching ref. pos.]

For beam switching, **POINT**, **+BEAM**, and **-BEAM** are displayed and **PSREF** is not; for position switching, **POINT**, **+BEAM**, and **PSREF** are displayed and **-BEAM** is not.

The total pointing correction for beam-switched and position-switched observations is computed differently, but automatically. For normal operations in both observing modes, the subreflector beam positions will be set to a default value appropriate for the receiver in use. For example, the 3 mm receivers will have a **+BEAM** of 2:00 and a **-BEAM** of -2:00, which gives a 4' throw. The 1 mm receivers will be set for a **+BEAM** of 1:00 and a **-BEAM** of -1:00, for a 2' throw. For beam-switched observations, the total pointing offset which is added to the telescope pointing model will be the sum of **+BEAM** and **POINT** for the main beam position and **-BEAM** and **POINT** for the reference beam position. For position-switched observations, the total pointing correction for the main beam is the sum of **POINT** and **+BEAM**, and for the reference beam is the sum of **POINT** and **PSREF**. The total pointing correction is displayed by the label **OFFSETS** in the upper right quadrant of the status monitor. The telescope operators have more extensive documentation on the new beam throw and pointing offset conventions.

2. Spectral Line Mapping Procedures

A new spectral line mapping procedure, PSM, has been installed and an old one (PS-MAP) is now called by a new name, APM. *Note to operators: You no longer have to type any special load commands to run TPM or PSM maps; however, to run the automatic catalog generation mapping code, you must type NOTPM before loading SPECTRA.*

i) PSM

PSM is a position-switched RA-DEC grid map that uses a relative, not absolute, offset position. The offset position can be specified in either the AZ-EL or RA-DEC frames. The map is done on a rectangular grid that can have different X and Y cell sizes. A subset of the originally specified map can be observed, if desired. The control system set-up parameters for a PSM map are much the same as for total power (TPM) mapping:

MM:SS	XCELL	[the X (= RA) cell size in arc measure]
MM:SS	YCELL	[the Y (= DEC) cell size in arc measure]
n	SROW	[the number of rows to map]
m	SCLM	[the number of columns to map]
p	S/C !	[the number of scans per vane calibrate]
ss	SEC !	[the integration time in tenths of a second]

When the map is executed, the RA step size in time measure given by

$$\text{XCELL} / [15 * \cos(\text{DEC})]$$

i.e., the cosine declination factor is taken into account automatically so that all mapping grid offsets represent real angle on the sky.

The following optional commands allow you to observe a subset of the grid specified by SROW and SCLM. The defaults for each parameter are given in parentheses.

h	BROW	[the beginning row of the map (1)]
i	EROW	[the ending row of the map (SROW)]
j	BCLM	[the beginning column of the map (1)]
k	ECLM	[the ending column of the map (SCLM)]

ii) APM

APM stands for "absolute position-switched mapping" and is the same observing procedure that we previously called PS-MAP. This is the catalog generation method of mapping that is described in the Users' Manual and the Operators' Manual. In this technique, you build a catalog of RA-DEC or Galactic grid positions and switch between those positions and an absolute OFF position. Note that in this observing mode, the operator can automatically step through any catalog of source positions, regardless of whether the positions were generated manually or using the automatic catalog generation routine. Observers should note that with the new PC-based source catalog programs (see Item 4 below), they can construct their own catalogs of map points to be observed in the APM mode.

3. Continuum Observing Procedures

The command words for several continuum observing procedures were changed over the summer:

i) DBMAP and SBMAP

DBMAP is the dual-beam mapping procedure used at the 12 m for some years. SBMAP is essentially the same procedure except that the map is centered on the main beam instead of the mid-point of the main and reference beams. Two things have changed about DBMAP: first, the command words have been changed to agree with spectral line mapping (the old GRID, ACELL, AROW, etc., have been replaced); second, the map is now centered automatically by the beam throw parameters described in Section 1 above. Keep in mind that the continuum mapping procedure scans in the AZ-EL frame rather than the RA-DEC frame used by the spectral line procedures. The new command words are

MM:SS	XCELL	[the azimuth cell size in arc-measure]
MM:SS	YCELL	[the elevation cell size in arc-measure]
m	SROW	[the number of rows]
n	SCLM	[the number of columns]
p	SEC !	[the integration time in tenths of a second]

A subset of the map can be observed with the commands

i	BROW
j	EROW
k	BCLM
l	ECLM

which have the same meaning as for spectral line PSM maps described above. The direction of scanning can be changed with the following commands:

SCANUP	[the default; scans in azimuth from negative to positive elevation offset]
--------	--

SCANDOWN [optional; scans in azimuth from positive to negative elevation offset]

The map data-taking is started by typing either

DBMAP

or SBMAP

ii) Observing Modes

The continuum observing procedures have been qualified by a new definition of the observing modes BS and PS. Almost all continuum observations will be done in the BS mode, which signifies beam-switching. In some circumstances, usually for telescope testing, the subreflector will be locked and an observation will be taken in position-switching (PS) mode. The difference between these two modes is whether the subreflector is nutating and whether the reference position is given by -BEAM (BS) or PSREF (PS).

iii) New Names for other Procedures

Because of a vocabulary conflict, the continuum commands SON, SOFF, and SON-OFF have been changed to DON, DOFF, and DON-OFF.

4. Source Catalog Entry

A new capability for creating and editing source catalogs has been developed. Observers can now bring their source catalogs on an IBM PC-compatible floppy disk or a VAX magnetic tape and load them into the control system via an IBM-PC. The source catalog can be brought in free format and a utility program on the PC will parse the records and reformat them for control system input. With this capability, the old card reader has now been retired, and punched card catalog entry will no longer be supported in any form. All existing source cards at the telescope have been converted into floppy disk format. This new system is described in detail in a *12 Meter Computing Report* by Chris Biemesderfer.

5. Miscellaneous

A) Miscellaneous FORTH Changes

i) For spectral line observing, the FORTH command

n S/C !

which sets the number of scans between each vane calibration, now works in MANUAL as well as in AUTOMATIC mode observing.

ii) The FORTH command

NOCAL

sets S/C to zero and will inhibit all vane calibrations until S/C is set to a nonzero value.

- iii) The spectral line mapping routines TPM and PSM should now be run in MANUAL, *not* AUTOMATIC mode.

B) Additional New FORTH and Analysis Documentation

Other changes to FORTH and data analysis programs are described in the following *12 Meter Computing Report* entries.

1. *New Spectral Line Mapping Analysis Routines*, by E. B. Stobie and P. R. Jewell
2. *New FORTH Header Format*, by E. B. Stobie
3. *Revised POPS Internal Disk Format*, by E. B. Stobie
4. *New FITS Keywords for Header Access*, by E. B. Stobie

II. OTHER CHANGES TO TELESCOPE SYSTEMS

Several other projects were completed during Shutdown. Many of these will not have an immediate effect on the way we take data, but should have long-term benefit to the observatory. In particular, the first four entries listed below are intended to improve the telescope pointing accuracy.

i) New Insulation and Fans on the Feedlegs

Air circulation fans and new insulation were installed on the feedlegs. We expect these additions to make the telescope pointing much more stable, particularly during the daytime.

ii) Optical Pointing Telescope

An optical pointing telescope and measurement system was completed over the summer. We expect this system to allow us to monitor and adjust the telescope pointing model more frequently and more accurately than ever before.

iii) Laser Quadrant Detector

A laser measurement system was installed that will allow us to monitor movements in the apex of the telescope with respect to the vertex. We expect this system to allow us to monitor and correct for any pointing excursions caused by thermal expansion and contraction of the feedlegs.

iv) Improved Focus-Translation (Sterling) Mount

The Sterling Mount was rebuilt to improve its positioning tolerances. This should provide more accurate focus and subreflector positioning for high-frequency observations.

v) New Service Platform

A big job for the summer was the replacement of the old lower service platform with one about 3 times as big. This platform will make it easier for us to service our receivers and I.F. boxes and will give us a place to mount new chassis, compressors, etc.

vi) Improved Cryogenic Monitoring

A new digital cryogenic monitoring system was completed. This system has readouts in the control room and will make it easier for the staff to spot cryogenic problems before they become critical.

vii) New Work Areas for Observers

New work tables have been installed in the breezeway adjacent to the control room and in the observer's work room. These tables make more efficient use of the available work space. A light table has also been installed in the breezeway.

III. Acknowledgements

Most of our employees work long hours during Summer Shutdown to squeeze in as many improvements to the systems as they can in the 6-8 week period. The people deserving credit are too numerous to mention, but observers may wish to thank, in particular, Betty Stobie for software improvements, Dennis Chase for operational improvements, and Bob Freund for electronics improvements; these people can, in turn, relay the thanks to the rest of the staff who put in many extra hours this summer.