

NATIONAL RADIO ASTRONOMY OBSERVATORY

SOCORRO, NEW MEXICO

February 22, 1977

VLA COMPUTER MEMORANDUM NO. 135

VLA Monitor Data Formats
for the DEC-10 System

by C. Bignell

1. INTRODUCTION

A new data format for the VLA Correlator Data has been described in detail in the VLA Computer Memorandum no. 134. The present discussion uses the basic principles and ideas of this memorandum as a starting point in describing the structure and data format for the Monitor Data portion of the new database. The following outline incorporates the suggestions and takes into consideration the criticisms of many people.

2. PROCEDURES

At the end of each observing run the monitor data filler program will be run to transfer data from the synchronous tape to the Monitor Data portion of the new data base. These DEC-10 files will be part of the Public domain and will contain selected monitor points. Should the user wish to examine monitor points not part of the standard set transferred from tape he can request the VLA staff to add the specific points to the standard list.

Eventually, the data base will always be present and will contain the most recent data. Should the user wish to examine very old data then a special database can be created or restored. Creation of a large number of private data bases would be undesirable for obvious reasons.

3. DATA DESCRIPTION

The monitor data is presently recorded on magnetic tape in the MOD COMP. In order to gain a better perspective of the structure of the database, the nature and form of the data is briefly outlined.

There can be as many as 4096 monitor points. An example of one monitor point is the total power. The total power of each receiver is recorded at frequent intervals by the synchronous computers. Monitor points are uniquely identified by their Data Set number and Multiplex address(DS-MPX address).

For each monitor point there can be from 1 to 7 (6 for digital monitor points) different types of data recorded by the synchronous system. For example, two different types are the current value and the time average value. Most of the different types of data are stored on the tape in single MOD COMP words, however some data types of the digital kind span two MOD COMP words. The latter requires consideration of different formats and is described in more detail in the following sections.

4. DATA STRUCTURE

The data structure of the monitor portion of the database takes the form:

- 1 Monitor Data Table
 - 2 Monitor Definition
 - 3 Monitor Description [1:npoints]
 - 3 string bit desc [1:nstrings]
 - 2 Monitor Index [1:nblocks]
 - 2 Monitor Data Records [1:nrecs]

Each of the lowest level structures is a different file. The Monitor Definition is a description of the monitor point. These files need be updated only when a particular point has been redefined or added which hopefully will be very infrequent. The actual data will be stored in the Data Records and the sequential grouping of these records is described by entries in the Monitor Index file. Both the Index and Data files will have to be updated every time that data is to be transferred from the tape (and possibly more frequently).

4.1. MONITOR DEFINITION FILES

The structure of this file is:

```
1 Monitor Definition
  2 Monitor Description [1:npoints]
    3 name                char(10)
    3 DS-MPX address      integer
    3 module name         char(10)
    3 point desc          char(75)
    3 maxntype            integer
    3 subname [1:7]       char(10)
    3 timeconst           integer
    3 string bit ptr      integer
    3 logint              integer
    3 strlength           integer
  2 String Bit Desc [1:nstrings]
    3 nbits               integer
    3 string description [1:24]
      4 bit#              integer
      4 bit description   char(75)
```

The level 2 structures are separate files. The string bit ptr in the Monitor Description file points to the record in the Sting Bit Desc file when a string exists. The Description file describes all points which are in principle recorded and available on the synchronous data tape.

The data element definitions are:

name	- mnemonic for monitor point
DS-MPX address	- data set number and multiplex address that uniquely define the monitor point
module name	- name of hardware module which produces monitor data
point desc	- description of particular monitor point
maxntype	- the number of different data types recorded on the synchronous tape-it is the maximum number of data types stored on the DEC-10 Monitor database
string bit ptr	- record position of the string bit description record in the String Bit Desc file
subname	- mnemonic for the different data types
timeconst	- time constants for averaged values
logint	- logging interval(secs)
strlength	- string length (in bits) of the string portion of the digital monitor points
nbits	- number of used bits in the string portion of the digital monitor points

bit # - bit number in the string portion of the monitor point (digital)
bit description - description of the particular bit

The length of one Monitor Description entry is 49 words. The length of one String Bit Description entry is 409 words. Appendix 1 lists possible mnemonics for the different data types(i.e. subname).

4.2. MONITOR INDEX FILE

The structure of this file is:

```

1 Monitor Index [1:nblocks]
  2 DS-MPX address           integer
  2 nantennas                integer
  2 start mjad               integer
  2 start iat                real
  2 end mjad                 integer
  2 end iat                  real
  2 start ptr                integer
  2 end ptr                  integer
  2 link ptr                 integer
  2 logging inter            integer
  2 ntypes                   integer
  2 data type desc [1:7]
    3 subname                 char(10)
    3 format                   integer half word
    3 subposition              integer half word

```

The data records in the Monitor Data File will be ordered by increasing time within one particular monitor point (DS-MPX address). A contiguous set of records will belong to one monitor point and the description of this set is recorded in one Monitor Index entry. The data elements have the following meaning:

```

DS-MPX address - data set number and multiplex address
                which uniquely define the monitor point
nantennas      - number of antennas for which data has been recorded
                in the database
start mjad, iat - day(mjad) and time(seconds of iat) of first data
                record in group
end mjad, iat   - day(mjad) and time(seconds of iat) of last record
                in group
start ptr       - record position of the first data record of the
                group in the monitor data file
end ptr         - record position of the first data record of the
                group in the monitor data file

```

- link ptr - position of the next Monitor Index entry with the same DS-MPX address
- logging inter - sampling interval of data points (seconds)
- n types - the number of different data types stored in the database
- subname - name of different data types stored
- format - number of data records required to store one sample of this data type (format = 1 or 2)
- subposition - position of the particular data type within the subgroup of records

The size of each Monitor Index entry is 39 words. The observing frequency for a particular data sample can be established by searching the band selection monitor points or the visibility part of the database.

4.3. MONITOR DATA FILE

The structure of this file is:

- 1 Monitor Data Records [1:nrecs]
 - 2 mjad integer
 - 2 iat real
 - 2 telescope value [1:28] integer half word

One data record contains the data for one data type of one monitor point for all (or nantennas) telescopes. The data records will be ordered such that monitor point is the least varying parameter and telescope is the most rapidly varying parameter. The records are also ordered by time within each monitor point and have the following format:

	mjad	word 0

	iat	word 1

	tel #1 tel # 2	word 2

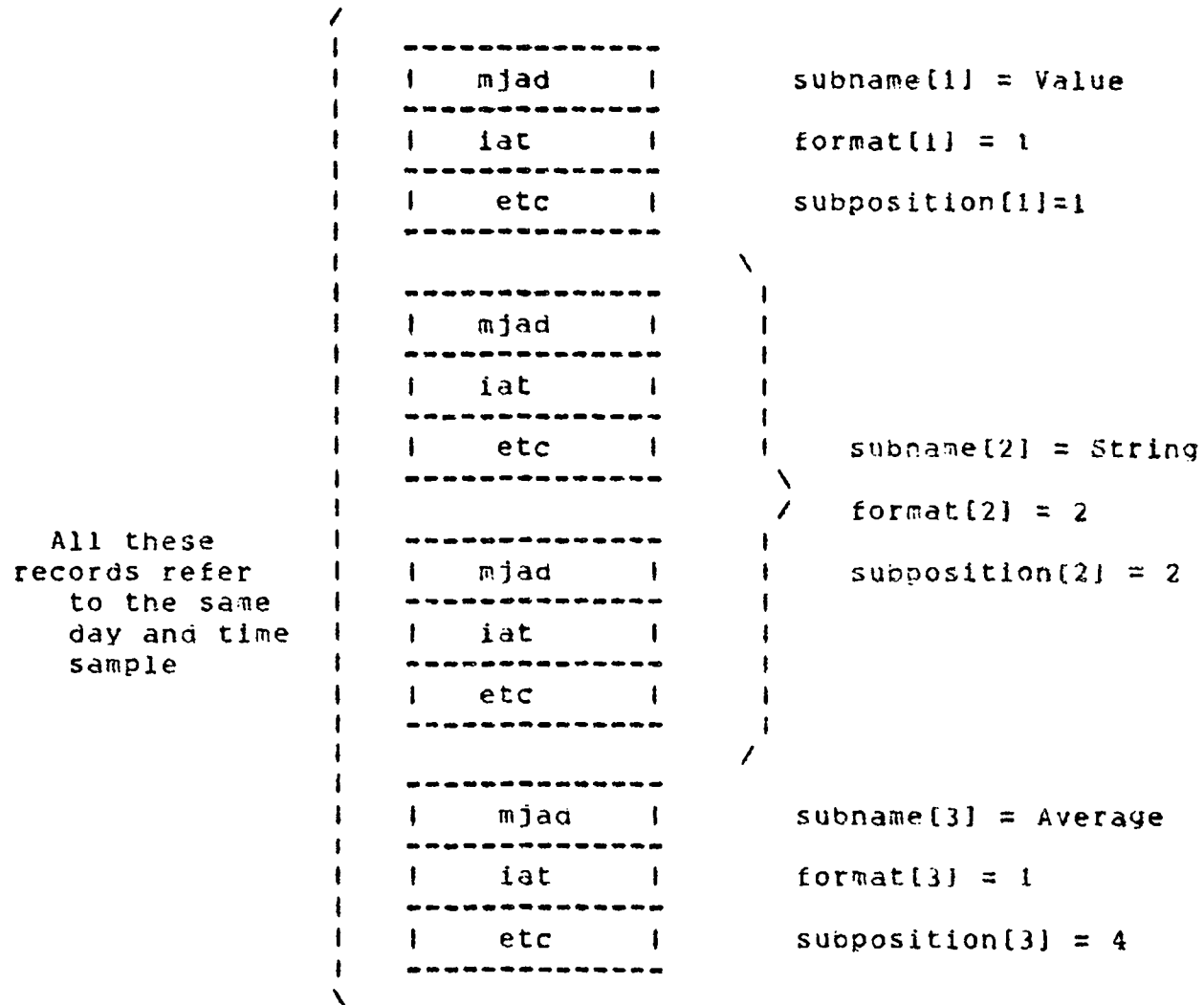
	etc	
	
	tel # 27	word 15

Each telescope value is stored in the rightmost 16 bits of a DEC-10 half word. Strings are left justified within the 16 bits and values are right justified. The length of one record is therefore 16 words.

Multi-valued monitor points will have as many records as necessary to store all values. For example a two valued point would have two records for each time sample; the first record holds the first data type and the second record holds the second data type.

The data types which span one DEC-10 word (format = 2) would be stored in two records. The first record contains the first half word of the data type and the second record, the second half word of the data type.

As an example of the sequential ordering of data records taking into account all these different possibilities, let us consider a monitor point with three different data types (say Value, String, Average). The order of these records would be:



5. FILE SIZES

Let us assume we want to store data for 16 monitor points each with five types of data and each recorded at 20 minutes intervals. If 60 data records (20 hours of data of a single data type monitor point) are referenced by one index entry (i.e. Monitor Index file), then a total of 107,520 words (or 840 physical blocks) are required. For one week of observations this amounts to 903k words (or 7,056 physical blocks).

6. PROGRAMS

The following programs should be written as soon as possible:

MDBFIL- This program will read the monitor data tape and create or add to an existing database. In order to save time and reduce the number of tape reads, many monitor points should be stored in memory simultaneously before transferring them to the database. As many as 16 monitor points could be stored with as little as 16k memory being used for array storage if up to 60 data records per monitor point are held in memory before writing the database.

Ultimately, the filler program would probably be changed to add or delete particular monitor points from the database rather than requesting of the user the ones to be stored. A later refinement might include the option of deleting older data (up to some date) before adding new data.

MDBDEF- This program will read and list the contents of the Monitor Description File. It will also be capable of updating (deleting, modifying or adding new definitions) the file.

MDBLST- This program will read the Monitor Data File and display the contents for a particular monitor point on the CRT and/or line printer.

MDBPLT- This program will plot data from the monitor database on the CRT and have as an option a hard copy of the plots.

MDBCAL- This program will generate pseudo monitor points from other monitor points for the purpose of calibration. For example one could calculate the system temperature from the total power and noise tube monitor points.

APPENDIX A

Mnemonics for Monitor Point Data Types

Monitor Point	Mnemonic	Description	MOD COMP CODE
digital	error.cnt	error counter	8
	string	string portion	0
	value	value portion	1
	ored	ored result	2
	comp.ored	ored complement result	3
	average	average value	4
analogue	error.cnt	error counter	8
	peak.hi	high value of past history	4
	peak.lo	low value of past history	5
	average	first average value	1
	average2	second average value	2
	counter	counter for second average value	3
		average value	
	value	current value	0