COMPUTERS AND PROCESSING
TECHNICAL NOTES & REPORTS
AT/25.1.1/021

A UV DATA FORMAT FOR THE AT

Ray Norris

8 May 1985

1.0 INTRODUCTION

It was originally proposed that AT data should be output and stored as standard FITS files (Greisen & Harten 1981). However, further deliberations have shown that a standard FITS format has two main disadvantages:

1. The block size of 2880 bytes prevents the use of fast i/o routines on the VAX.

2. The requirement of only one header (and hence only one source) per file means that data which contains many short scans on calibration sources as well as on the astrophysical source has to be output as many separate small files.

It has therefore been decided to use a format which is still closely related to FITS, and may therefore easily be translated to standard FITS where necessary, but overcomes the disadvantages listed above. In addition, it seems sensible, once the decision to depart from standard FITS has been made, to incorporate a couple of other deviations to maximise efficiency. This document proposes a definition of the new format, which I have called RPFITS. A diagram of the file structure is shown in Figure 1.

2.0 DIFFERENCES FROM FITS

RPFITS is a dialect of FITS which differs from standard FITS in the following respects ONLY:

1. The block size is 2560 bytes, in order to maximise i/o speed on a VAX.

2. Several scans can occur on one file. Each scan starts with a FITS header. The headers are discussed further in section 2.4 below.

3. All data (other than header information) are stored as REAL*4.

4. No extension tables are permitted. Antenna parameters may instead be entered by using keywords in the file header (as in early VLA FITS files).

There now follow brief notes on each of these changes.

2.1 Block Size

The block size has been changed from 2880 bytes (standard FITS) to 2560 bytes, which is 5 VAX blocks. This enables the fast i/o routines written by PTR to be used. A block length of five VAX block rather than one VAX block was chosen so that

1. For the header, an exact number of 80 byte card images would fit into one block.

2. The number of blocks over which a large data group would be spread is reduced, thus reducing overheads associated with reading visibilities split over two blocks.

2.2 Number Of Scans In A File

A scan is defined as a contiguous series of data on one source. Thus an observation consisting of half-hour runs on a source interleaved with 5 minute calibration observations would consist of a number of half-hour and 5-minute scans. It would clearly be inconvenient to have these data scattered over several files.

2.3 Data Type

All data are stored as REAL*4, rather than the standard FITS INTEGER format. This has the following advantages:

1. The load on the on-line VAX is reduced by eliminating the need for data conversion.

2. The need for predetermined scaling factors is obviated (often a cause of pain).

3. The data will be faster to load into AIPS.

2.4 Headers

A file starts with a full FITS header which contains the keyword SCANS. This keyword gives the number of scans in the file. This header (here called the file header) is followed immediately by the data from the first scan. Each subsequent scan also starts with a FITS header (here called the scan header), but the scan headers will not include the SCANS keyword, and need not duplicate any information given in the file header. If they do duplicate a keyword given in the file header, then the value associated with that keyword is overwritten by the value given in the scan header. Thus each scan 'looks' like a standard FITS file, except that unchanging header information is not unnecessarily duplicated in each scan.

2.5 Overwriting Of Keyword Parameters

The keywords NCOUNT and SCANS are intended to give the number of groups in a scan and the number of scans in a file respectively. In general these numbers will not be known until after the data have been taken. It is therefore suggested that these keywords be set initially to -1, and their values overwritten at the end of the scan or file. However, this latter action is not essential, and may be abandoned if the resulting head movement slows data transfer unduly. Thus, programs must be able to detect the end of a scan by recognising the start of the next header. An alternative to setting parameters to -1 would be to enter an estimate of NCOUNT or SCANS, so that a forward search for particular data may be optimised.

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The data will be organised into groups, each of which corresponds to one integration on one baseline. Each measured visibil ..y is recorded as a complex visibility plus a weight. Thus if NSTOK stokes parameters and NFREQ channels are being measured, each group will consist of 3*NSTOK*NFREQ REAL*4 words. In addition, each group is preceded by 5 parameters:

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U        (in light-seconds)
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W        (in light-seconds)
BASELINE (= (# of ant1)+256*(# of ant2))
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4.0 HEADER PARAMETERS

The header will contain most of the usual FITS parameters (DATE-OBS, OBSERVER, SOURCE, etc.). It will not, however, contain any SCALE or ZERO parameters, which are rendered redundant by the use of REAL*4 data. It will contain the following additional parameters (subject to debate):

SIMPLE .FALSE. (because non-standard FITS)

FORMAT RPFITS

CAL a keyword describing as a character string what calibration has been applied

ARRAY one of ATCA, ATLBA, ATLBAN, ATCAN (N for non-standard), or DUMMY

SCANS (in file header only) The number of scans in a file.

5.0 AVAILABLE SOFTWARE

I have written two routines (RPFITSIN and RPFITSOUT) for reading and writing the data. I will shortly write two AIPS routines RPIN and RPOUT to perform the same function. AIPS may then be used to translate between RPFITS and FITS. I will also write a program called RPLOOK for examining an RPFITS file. The RPFITS format will be used on the Parkes-Tidbinbilla interferometer, so that we will see quickly if there are any problems associated with its use.

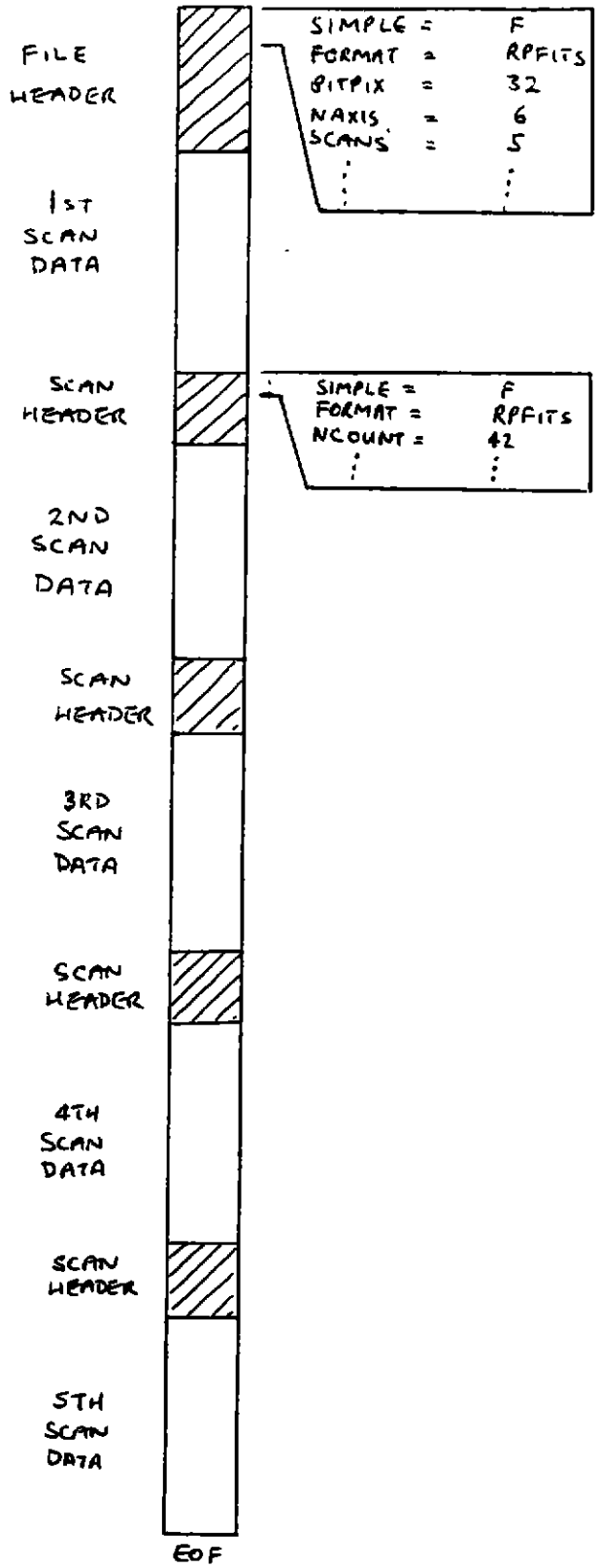

FIGURE 1: A TYPICAL RPFITS FILE STRUCTURE

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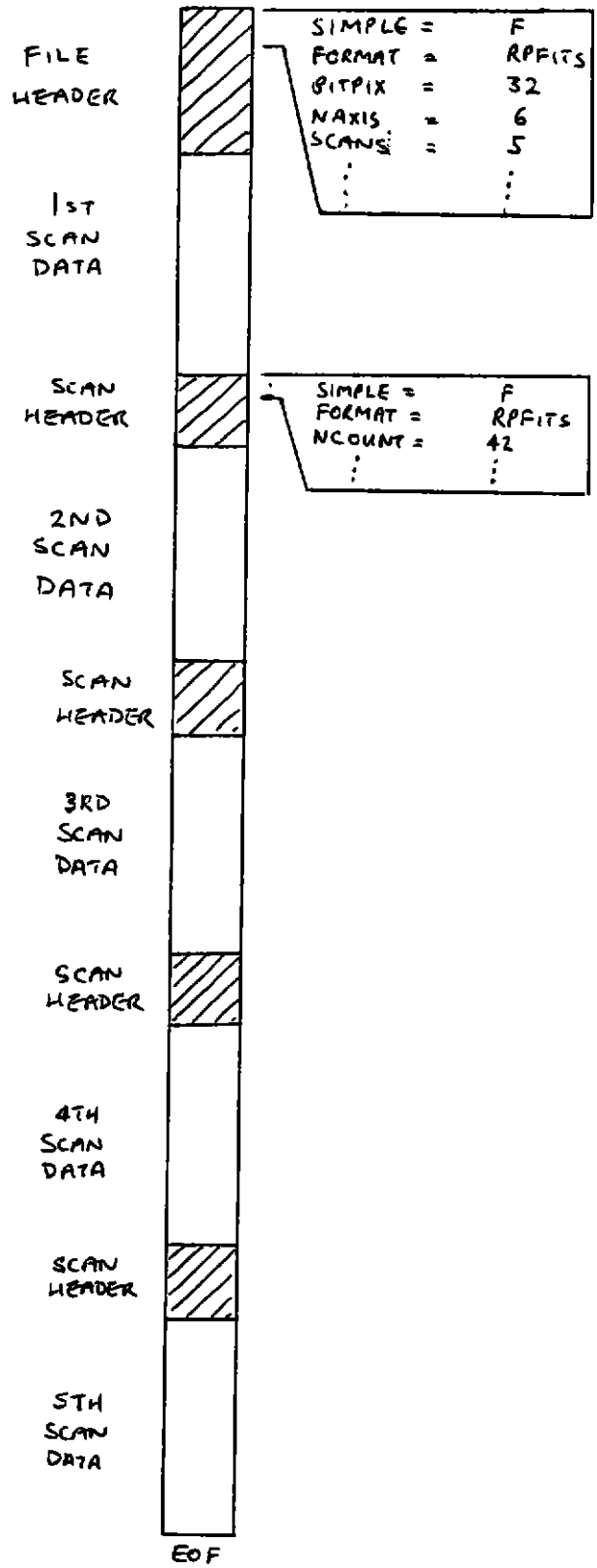

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