NATIONAL RADIO ASTRONOMY OBSERVATORY

Charlottesville, Virginia

April 19, 1973

VLA COMPUTER MEMORANDUM #102

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SPECIFICATION CONSIDERATIONS, DATA FLAGGING SYSTEM

The program which flags data good or bad is one of the parts of the synchronous system which we are least able to specify now, and which will be most often modified by experience with the actual receivers. For this reason, we propose a system which offers the maximum flexibility rather than specifying at this time what is to be checked. Although this approach is initially a great deal more work, I think it will save effort in the long run.

This system consists of two parts. First is the fault definition subsystem, which operates on terminal input during array operation, compiling tests to be executed. These definitions would be given in a synchronous manner, that is, at fixed times within the 10 second major cycle, to an interpreter, which operates in much the way a FORTH interpreter does.

A possible format for an error definition is given below, and is followed by an explanation of its parameter fields.

:F (fault reference number) (flagging level) (active time) (flag association) (fault definition) (fault description to be printed when error flag rises);

FAULT reference number - this is provided so that an error definition can conveniently be recalled and modified. If worse comes to worse, it is also an index entry for a code book like the one supplied with the 360.

Flagging level - I anticipate four flagging levels:

a) Warning message generation only - data is no way attainted.

b) Warning message also attaches to data, observers wanting exceptionally high stability or reliability may discard this data.

c) Data probably bad. Observers wanting maximum sensitivity with tolerance to large percentage errors may want to include this data.

d) Data certainly bad.

Active time - the array mode during which the error flag may be set or reset. Some flags will be set only during calibrator observations, some during receiver excercises, etc.

Flag association - flags may be associated with array (e.g. power line fluxuations), subarray (e.g. source elevation), arm (e.g. waveguide pressurization), antenna (e.g. coordinates), front end (e.g. LO multiplier power levels), preamp (e.g. bias current), IF groups (e.g. master LO bus power) IF (e.g. received power) or correlator (e.g. RMS or DC offset). An additional association could be made available for the spectral line receiver system, contingent upon its design.

Fault definition - all appropriate electronic monitor points and additional internally generated ones would be available by name. For some of these an averaged value will also be available, for detection of steps and slopes. Those points available would have the same indexing scheme as implied by the flag association, or those associations higher in the hiarchy. For instance, an IF associated flag could refer to elevation (a subarray associated variable), but an IF group associated flag may not. Also available would be the arithmetic (+ - * /) and logical operators (AND, OR, NOT, XOR), and constants.

Fault description - A single CRT terminal line could be supplied for display when the flagged condition arises.

The second half of the data flagging subsystem executes the definitions, and raises the associated flags. The scheduling subsystem will supply the connectivity diagram showing which associated flags are connected to the data (e.g. if we are observing at L band the K band front end associated flags are not connected to the data) and the data collection subsystem will use this connectivity diagram and the associated flags to derive the data flags. Each monitored point will have to have the following characteristics specified:

a) Association grouping.

b) Whether history is needed to detect slopes and jumps; if so the value of an exponential time constant to maintain the historical value, whether separate histories must be kept for observations, calibrators, system excercises, etc.

c) Averaging characteristics needed for logging purposes. In order to keep search time to a reasonable level, when the log is interograted, I propose to record about one or two million numbers per day only. Data would therefore be compressed before recording, especially those quantities

which are usually either slowly varying or are in a disaster mode, the archetype being waveguide pressurization.

For monitor points sampled more rapidly than once per ten seconds, such as the raw IF levels, I propose to preserve only average, maximum, minimum, and variance, and run error definitions on these only. Therefore, the error definitions need be interpreted only every ten seconds.

In addition to the electronic monitor points, I propose to generate internally the system temperature from calibrator observations, the antenna phase ibidem, and some sort of antenna associated variance, derived by attributing a fraction of each correlator variance to each antenna.

The direct variance on each correlator and other flags arising from an examination of individual correlators I propose to handle in a special way to minimize the storage required. They would be restricted to flags presently active; that is, the flag active descriptor would not apply.

The front end associated flags must also be handled a little differently than the others. The various front ends are not identical systems, in the sense that different points must be monitored to different tolerances for different front ends. The different antennas, for instance, can be handled in a DO loop stepping through all 27. The different front ends cannot be handled in a DO loop stepping through all 8 x 27 = 216.

An additional facility is needed for operator control of flags and messages. I suggest the following:

Acknowledge, which causes the real time messages to stop being printed, but continues flagging.

Disable, which completely disables a given fault definition on a given piece of equipment (used, for instance, to eliminate flags due to monitor system malfunction.).

Disconnect, which causes a given piece of equipment to be entirely removed from the flagging software system, used to eliminate messages from equipment being worked on.

It is anticipated that this system will consist mainly of table reference programs. To save core, the tables may be partly disk resident.