JET PROPULSION LAB. JAN.24,1984
VLBA MEMORANDUM

To: M. Ewing (CIT), Alan Rogers (MIT)

From: B. Rayhrer

Subject: Recording with Error - Correction.

It is proposed here to equip the VLBA recording system with an effective error-detection and correction (EDAC) scheme. Besides improving biterror rates an EDAC would significantly effect playback circuitry at the processor since correlator-blanking during invalid data can be eliminated. A saving of 10% for delay-line hardware and 10% for correlator hardware and a saving of 50% of interface hardware between recorder and delayline and between delayline and correlator will be achieved.

EDAC's have been used very successfully by the recorder industry for some time. Even the simplest schemes such as simple parity requiring only trivial amounts of circuitry will produce amazing improvements in error rates. Consider a longitudinal parity bit every byte fo data and a transversal parity bit recorded on one track. This simple scheme will already produce error-rates of <10**-8 on good quality non hi-energy tapes. I'm however proposing a more elaborate scheme with a longitudinal EDAC and tranversal parity. The longitudinal EDAC would consist of a 32-bit polonomial code which is recorded on each track every 1000 bits. This code will be able to correct multiple bit-error of up to 12 bits within 1000 bit intervals. A tranversal parity-bit calculated for 10 to 16 track would be ecorded on an extra track. This parity can correct any one track that is in error assuming that all other tracks have no raw errors or if they have errors the longitudinal EDAC can correct. Note that a completely dead track can be reconstructed even if the others have some errors. An overhead of approx. 13 % is required. This compares to the present MKIII overhead of 12.5 % which only provides detection (and that not toowell) and no correction.

The EDAC will fail when there are more than 12 biterrors in more than 1 track within the same 1000 bit interval. This is a rather unlikely event for a well adjusted recorder system. When quality of the data gets so bad that this EDAC cannot correct it likely is not worth processing. We therefore can eliminate correlator-blanking as long as the observer is notified when data cannot be corrected.

If data is so bad that EDAC cannot correct and the observer desires to process anyway there are two options: Either bad data is simply averaged together with good data resulting in no loss of SNR but in loss of amplitude calibration, or the correlator output which contains bad data is eliminated during post-processing which will result in additional, but known loss in SNR. Amplitude-calibration is preserved.

This EDAC scheme may be implemented for either VLBA recording system. Even though I used the term "track" referring to a MKIII recorder, a track may very well be a video recorder in a multi-video recorder sytem.