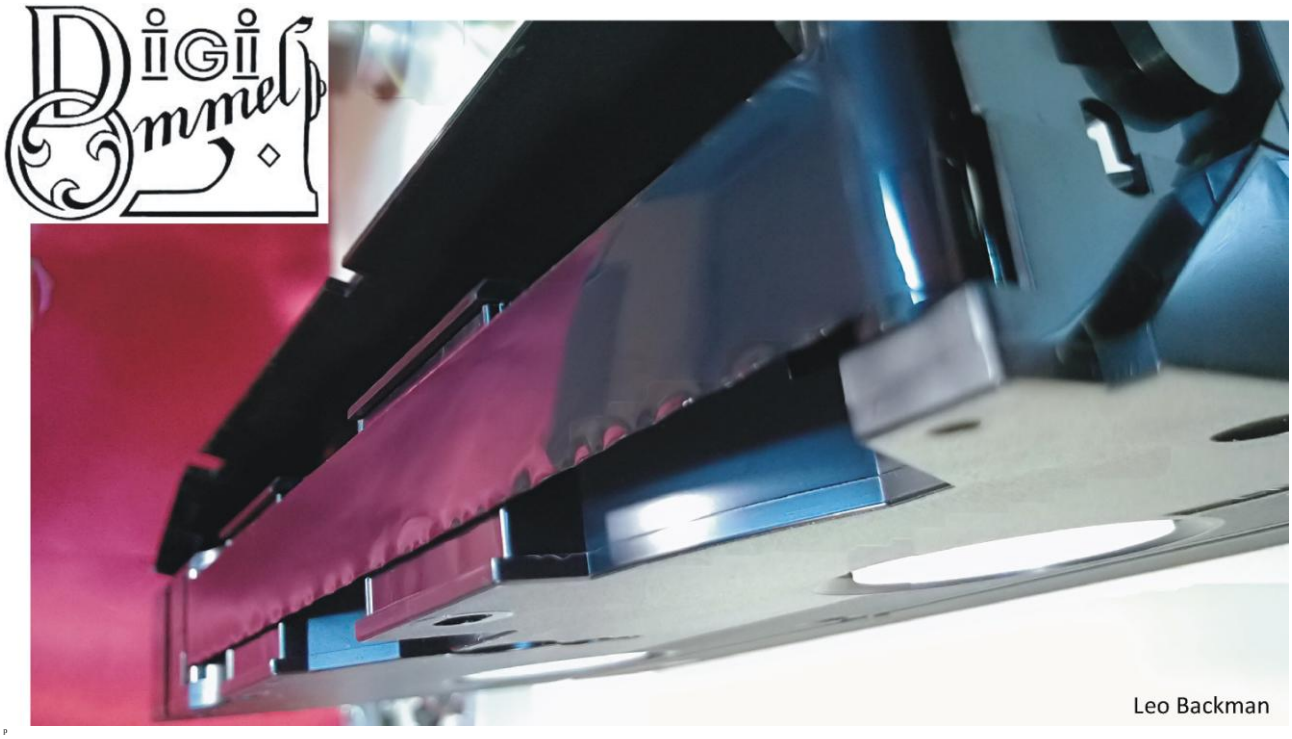

Stabilizing playback image of edge-damaged VHS tapes

Occasionally, we receive from our customers partially damaged VHS video tapes to process. Such tapes may have gotten mangled already in a misaligned camcorder or faulty table-top VCR used to play the tapes. We have recently applied a combination of mechanical and electrical countermeasure to stabilize the replay of edge-damaged VHS footage.

Restoring the playability of video tapes that have severe creases or undulating weaves along the edge is one of the most demanding task. Edge damages are particularly challenging with the replay of VHS format tapes, as the video head track-following system and capstan servo control are dependent on relatively stable off-tape control signal. The CTL signal is recoded and picked up from a 0.75-millimeter track laid at the lower edge of the tape.

Video head tracking is a high-precision business

The CTL signal is formed as a train of bipolar magnetic pulses at seemingly constant level and frequency. However, the timing between individual pulses is critical. The pulses are written on the tape in tight synchronism simultaneously with video signal tracks, at about 6-degree angle across the tape surface.

CTL pulses must coincide fairly accurately with the ends of video tracks that are about 0.05-mm wide – as thin as a single strand of human hair! In VHS PAL tape, running at SP speed of 23.39mm per second, there are 312.5 video tracks between each CTL pulse. Even a few missing or faded CTL pulses due to tape edge damage, can drive the capstan servo into rapid speed changes and cause serious misalignment between video heads and the recorded tracks.

Once the CTL pulse train continuity is lost by fades or wobbles in frequency, not only the luminance signal sync collapses (causing large jitter) but also the chrominance PB signal phase compensation circuit fails, muting the chroma output signal altogether. These errors are not correctable by any capture device or post-process filters, short of editing out twisted, noisy black-and-white portions of the footage.

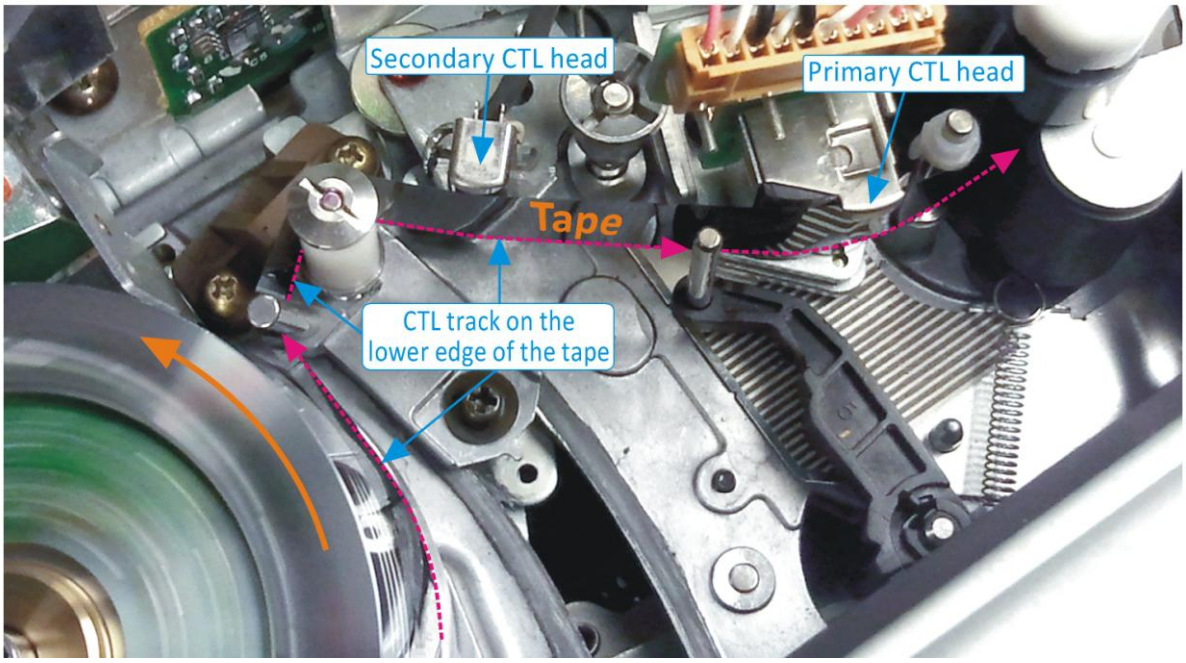

Figure 1. Secondary CTL head added to Panasonic AG-7330.

Securing CTL signal continuity

Since CTL signal is basically a repetition of equal amplitude pulses, we approached the problem by reinforcing the pulse train with by adding a secondary CTL head in the tape path. The head is spaced at about 40 millimeters before the standard CTL head.

The CTL signal picked up by the two heads is amplified and processed to form a single CTL pulse train. If a series of CTL pulses are missed at the regular CTL head, due to tape edge damage, the pulses some 4 cm before that part of the tape are likely to be less distorted. In cases where both heads read damaged part of the tape simultaneously, the two weakened pulse together can be processed to produce one sufficient pulse stream for keeping the capstan servo synchronized.

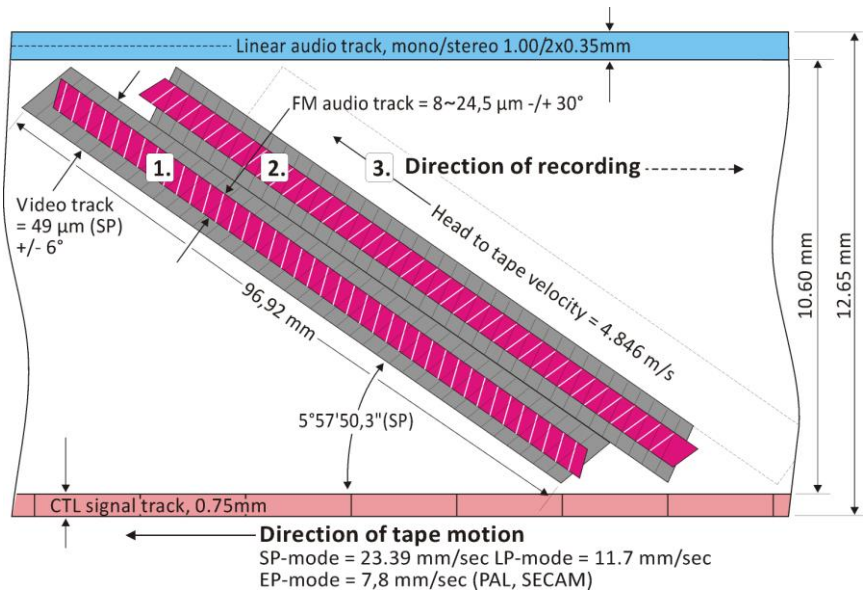

Figure2. VHS PAL track dimensions.

Multi-point CTL signal retrieval can be developed

More developed VCR formats like Video8/Hi-8 and all the digital DV derivatives are based on tracking and sync signals being interleaved or embedded into the audio and video signal tracks. In those VCRs, the physical conditions of tape edge regions are not vital to synchronized, error-free replay of the recorded program.

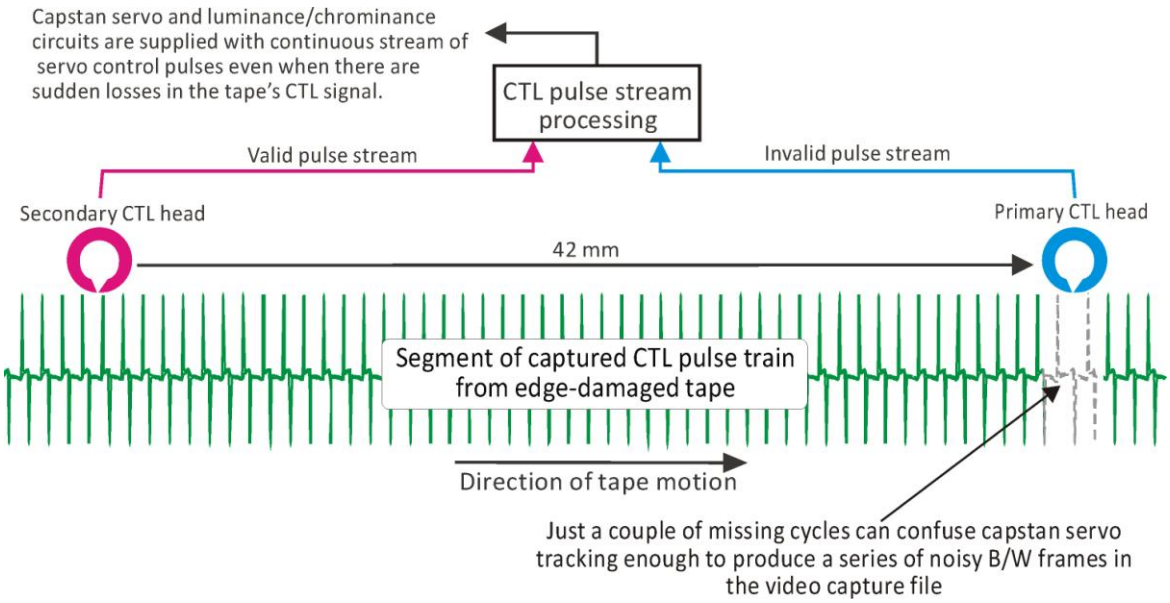

Figure2. Principle of two-point CTL signal pick-up.

This kind of multi-point control signal pickup system can be expanded. But since the stability problems of the tapes at hand were solved, we will develop the concept at some later date.

See the animated frame sequence comparison of edge-damaged capture.

Leo Backman/DigiOmmel & Co.