BA(prog)III yr 11/04/2020

Analog Video

- In an analog system, the output of the **charge-coupled device (**CCD) is processed by the camera into three channels of color information and synchronization pulses (sync) and the signals are recorded onto magnetic tape.
- There are several video standards for managing analog CCD output, each dealing with the amount of separation between the components—the more separation of the color information, the higher the quality of the image (and the more expensive the equipment).
- If each channel of color information is transmitted as aseparate signal on its own conductor, the signal output is called **component** (separate red, green, and blue channels), which is the preferred method for higher-quality and professional video work.
- Lower in quality is the signal that makes up **Separate Video (S-Video)**, using two channels that carry luminance and chrominance information. The least separation (and thus the lowest quality for a video signal) is **composite**, when all the signalsare mixed together and carried on a single cable as a composite of the three color channels and the sync signal.
- The composite signal yields less-precise color definition, which cannot be manipulated or color-corrected as much as S-Video or component signals.
- The analog video and audio signals are written to tape by a spinning recording head that changes the local magnetic properties of the tape's surface in a series of long diagonal stripes.
- Because the head is canted or tilted at a slight angle compared with the path of the tape, it follows a helical (spiral) path, which is called **helical scan** recording.

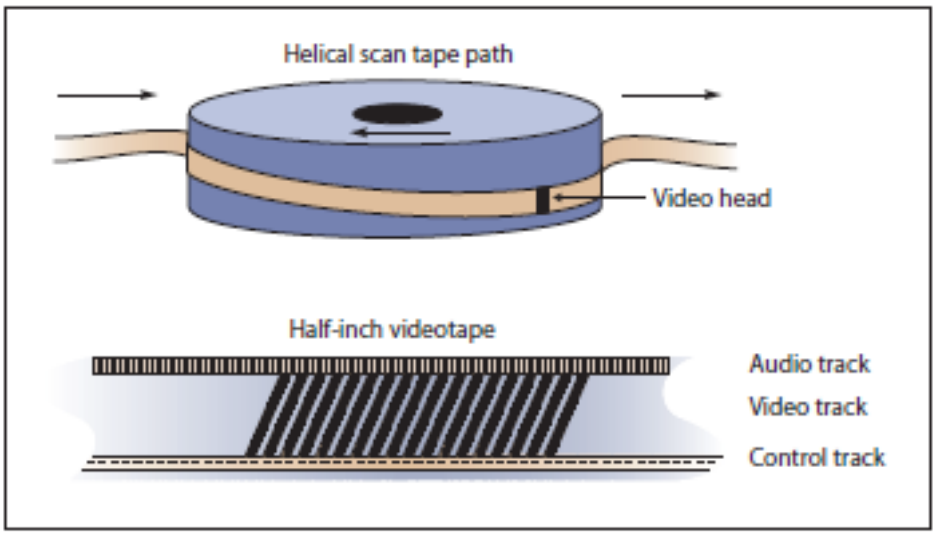

Figure 6-1 Diagram of tape path across the video head for analog recording

- Here, each stripe represents information for one field of a video frame.
- A single video frame is made up of two fields that are **interlaced.**
- Audio is recorded on a separate straight-line track at the top of the videotape, although with some recording systems (notably for ¾-inch tape and for ½-inch tape with high reliability audio), sound is recorded helically between the video tracks.
- At the bottom of the tape is a control track containing the pulses used to regulate speed.
- **Tracking** is the fine adjustment of the tape during playback so that the tracks are properly aligned as the tape moves across the playback head.
- Many consumer set-top devices like **video cassette recorders(VCRs)** and satellite receivers add the video and sound signals to a subcarrier and modulate them into a radio frequency (RF) in the FM broadcast band.
- This is the RF signal available at the Antenna Out connector of a VCR and depending on the geographical location, conforms to one of the three analog broadcast video standards commonly in use around the world: **National Television Standards Committee(NTSC), Phase Alternate Line(PAL), and Sequential Color and Memory(SECAM)**.
- Usually the signal is modulated on either Channel 3 or Channel 4, and the resulting signal is demodulated by the TV receiver and displayed on the selected channel.

- Many television sets today also provide a composite signal connector, a S-Video connector, and a **High-Definition Multimedia Interface (HDMI)** connector for purely digital input.
- Video displays for computers typically provide analog component (red, green, blue) input through a 15-pin **VGA connector** and also a purely digital **Digital Visual Interface (DVI)** and/or an HDMI connection.
- Three analog broadcast video standards are commonly in use around the world: NTSC, PAL, and SECAM. In the United States, the NTSC standard has been phased out, replaced by the **ATSC Digital Television Standard**. (Advanced)
- Because these standards and formats are not easily interchangeable, it is important to know where your multimedia project will be used.
- A video cassette recorded in the United States (which uses NTSC) will not play on a television set in any European country (which uses either PAL or SECAM), even though the recording method and style of the cassette is "VHS."
- Likewise, tapes recorded in European PAL or SECAM formats will not play back on an NTSC video cassette recorder. Each system is based on a different standard that defines the way information is encoded to produce the electronic signal that ultimately creates a television picture.
- Multiformat VCRs can play back all three standards but typically cannot dub from one standard to another.
- **Dubbing** between standards still requires high-end, specialized equipment.

NTSC

- The United States, Canada, Mexico, Japan, and many other countries used a system for broadcasting and displaying video that is based upon the specifications set forth by the 1952 **National Television Standards Committee (NTSC)**.
- These standards defined a method for encoding information into the electronic signal that ultimately created a television picture.
- As specified by the NTSC standard, a single frame of video was made up of 25 horizontal scan lines drawn onto the inside face of a phosphor-coated picture tube every 1/30th of a second by a fast-moving electron beam.
- The drawing occurred so fast that your eye would perceive the image as stable.

- The electron beam actually made two passes as it drew a single video frame—first it laid down all the odd-numbered lines, and then all the even-numbered lines.
- Each of these passes (which happen at a rate of 60 per second, or 60 Hz) painted a field, and the two fields were then combined to create a single frame at a rate of 30 frames per second (fps). (Technically, the speed is actually 29.97 Hz.)

PAL

- The **Phase Alternate Line (PAL)** system was used in the United Kingdom,Western Europe, Australia, South Africa, China, and South America.
- PAL increased the screen resolution to 625 horizontal lines, but slowed the scan rate to 25 frames per second. As with NTSC, the even and odd lines were interlaced, each field taking 1/50 of a second to draw (50 Hz).

SECAM

- The **Sequential Color and Memory (SECAM)** (taken from the French name, reported variously as Système Électronic pour Couleur Avec Mémoire or Séquentiel Couleur Avec Mémoire) system was used in France, Eastern Europe, the former USSR, and a few other countries.
- Although SECAM is a 625-line, 50 Hz system, it differed greatly from both the NTSC and the PAL color systems in its basic technology and broadcast method.
- TV sets sold in Europe utilized dual components and could handle both PAL and SECAM systems.

Digital Video

- In digital systems, the output of the CCD is digitized by the camera into a sequence of single frames, and the video and audio data are compressed before being written to a tape or digitally stored to disc or flash memory in one of several proprietary and competing formats.

- Digital video data formats, especially the codec used for compressing and decompressing video (and audio) data, are important.

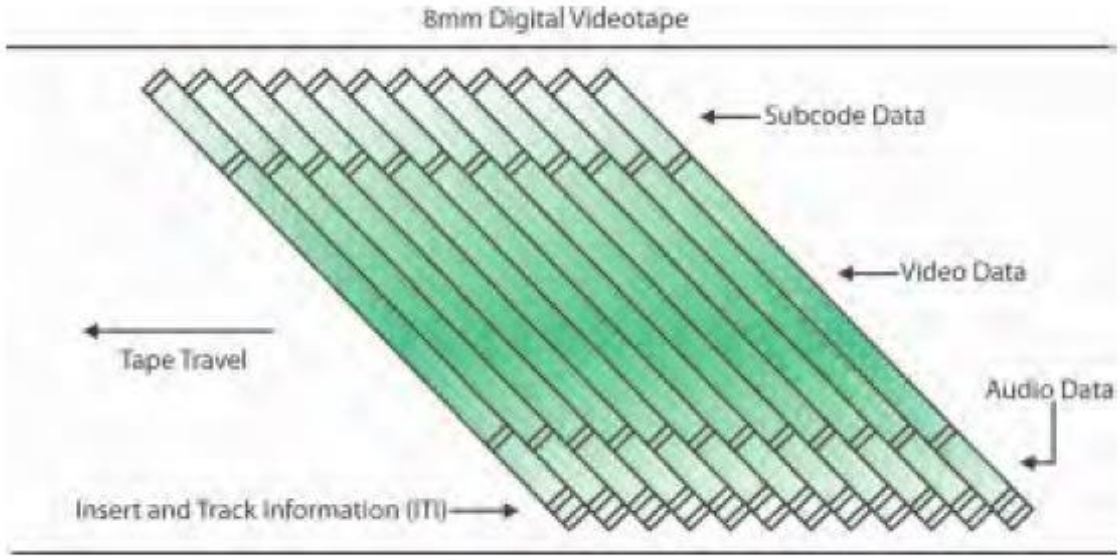

Figure 6-2 Diagram of tape path across the video head for digital recording

- FireWire and i.Link (and USB 2) cable connections allow a completely digital process, from the camera's CCD to the hard disk of a computer; and camcorders store the video and sound data on an onboard digital tape, writable mini-DVD, mini–hard disk, or flash memory.

HDTV

- The Federal Communications Commission in the 1980s introduced the Advanced Television (ATV) initiative and then finished as the **Digital Television (DTV)** initiative by the time the FCC announced the change in 1996 as **High Definition Television (HDTV)** initiative.
- This standard, which was slightly modified from both the Digital Television Standard (ATSC Doc. A/53) and the Digital Audio Compression Standard (ATSC Doc. A/52), moved U.S. television from an analog to a digital standard.
- It also provided TV stations with sufficient bandwidth to present four or five Standard Television (STV, providing the NTSC's resolution of 525 lines with a 3:4 aspect ratio, but in a digital signal) signals or one HDTV signal (providing 1,080 lines of resolution with a movie screen's 16:9 aspect ratio).

- HDTV provides high resolution in a **16:9** aspect ratio.

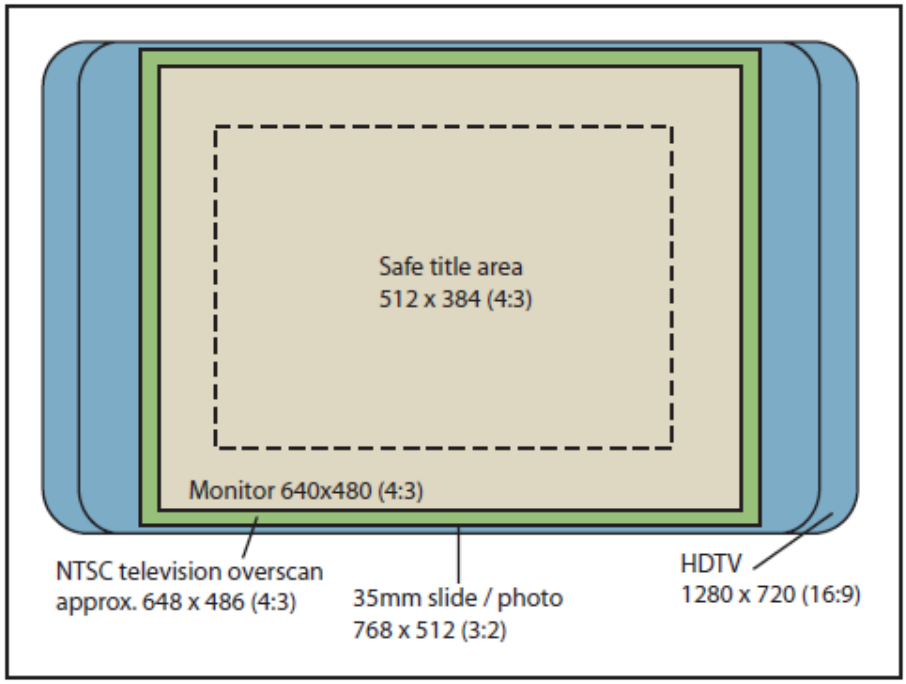

Figure 6-3 Here you can see the difference between VGA and HDTV aspect ratios.

- This aspect ratio allows the viewing of Cinemascope and Panavision movies.
- There was contention between the broadcast and computer industries about whether to use interlacing or progressive-scan technologies.
- The broadcast industry broadcasted an ultra-high-resolution,1920 × 1080 interlaced format (1080i) to become the foundation of the new generation of high-end entertainment centers, but the computer industry wanted a 1280 × 720 progressive-scan system (720p) for HDTV.
- While the 1920 × 1080 format provides more pixels than the 1280 × 720 standard, the refresh rates are quite different. The higher resolution interlaced format delivers only half the picture every 1/60 of a second, and because of the interlacing, on highly detailed images there is a great deal of screen flicker at 30 Hz.
- The computer people argue that the picture quality at 1280 × 720 is superior and steady. Both formats have been included in the HDTV standard by the Advanced Television Systems Committee (ATSC).