



# Inside EDIUS HD and the Canopus HD Codecs

White Paper

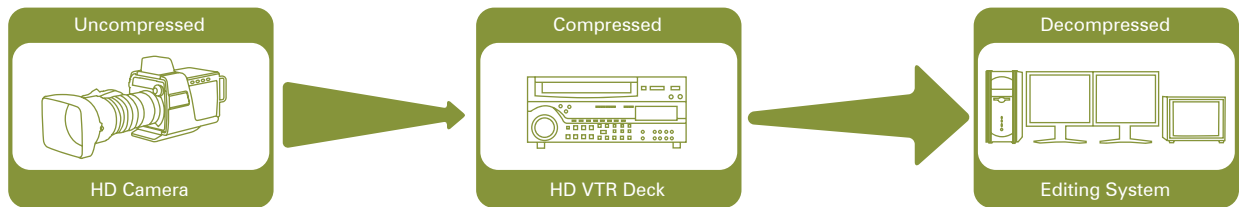
**Inside EDIUS HD and the Canopus HD codecs**

The new Canopus EDIUS HD editing system uses an industry-standard HD workflow which integrates seamlessly with HD VTRs, features an uncompressed HDSDI I/O capture board and uses Canopus HD compression codecs to make realtime HD editing and processing possible.

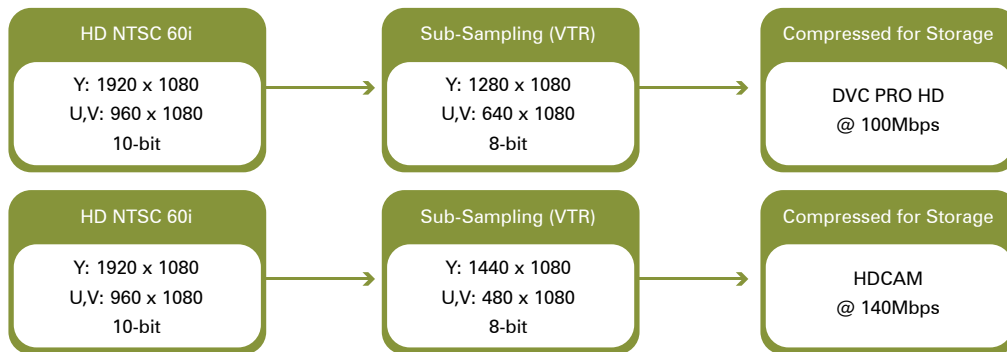
EDIUS HD uses Canopus Scalable Technology for maximum performance and flexibility to meet the user’s editing needs and system capabilities. Realtime HD processing abilities increase as CPU power increases. The variable-bitrate Canopus HQ codec allows higher datarates for increased quality that exceeds both HDCAM and DVCPRO HD quality as system storage increases or for shorter projects. Canopus Scalable Technology also makes it possible to handle increased sampling resolution as CPU power and storage performance increases.

**Industry-standard Workflow**

In a typical production workflow, an HD studio camera outputs uncompressed HD video via the HDSDI interface. In a typical 1080i transfer, the luma sampling is transferred at 1920 samples per horizontal line, and the chroma sampling is transferred at 960 samples per line at 10-bit precision. Next, a mainstream HD VTR receives the uncompressed video via the HDSDI interface, compresses it and records it to tape. HD data must be compressed in order to store it to tape or else HD would be impractical for day-to-day use. Semi-portable HD cameras are tape-based so they combine the functions of an HD camera and HD VTR. Without compression, only a few minutes of video could be recorded before needing a tape change or a large, non-portable storage medium would be required.



Compression involves a number of steps, starting with reduction of the luma and chroma sample data. HDCAM reduces the luma sampling data to 1440 samples and the chroma sampling data to 480 samples. DVCPRO HD reduces the luma sampling data to 1280 samples and the chroma sampling data to 640 samples. The data reduction process is a complex sample-reduction function that provides better quality than simple averaging. The data precision is then rounded to 8-bit and is further compressed by the hardware video encoder on the HD VTR. The compressed data is recorded to tape at 140Mbps for HDCAM and 100Mbps for DVCPRO HD.



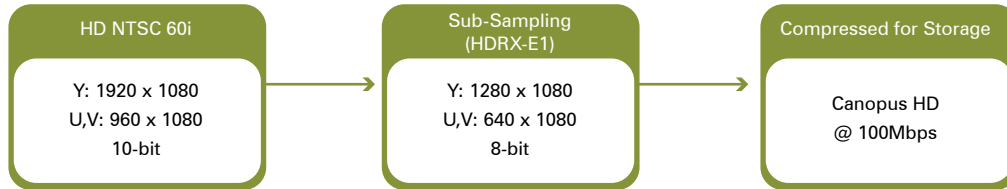
*Video Compression with VTRs*

On tape playback, the data is decompressed and output through the HDSDI interface. The tape data is decompressed back to 8-bit precision, and the luma and chroma sampling are returned to their respective 1920 samples and 960 samples through a mathematical expansion. Since the data was further compressed after the sample reduction, this decompression and expansion process does not yield the exact data that was originally input, meaning that there is some loss of resolution in going to tape. The decompressed video is then output through the HDSDI interface.

For editing, an HD switcher takes uncompressed HDSDI input from HD VTRs and provides uncompressed HDSDI output. The HDSDI output from the switcher is sent out to an HD VTR, which compresses the video and records it to tape once again.

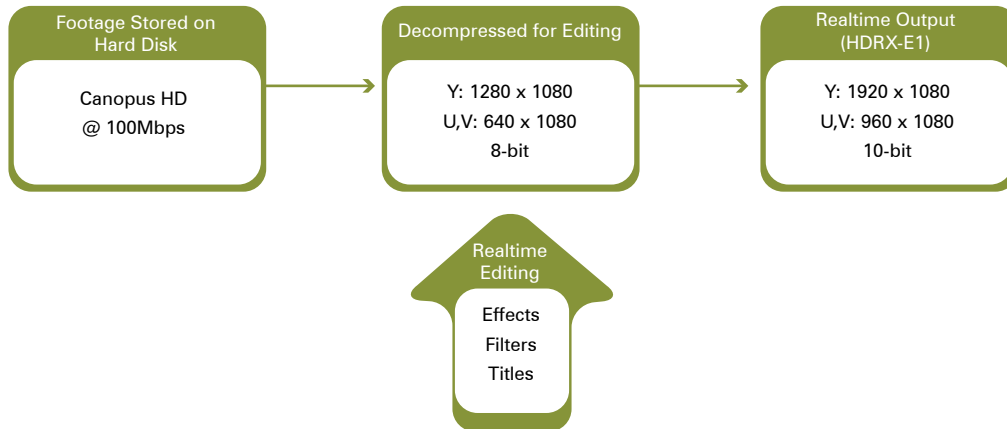
**Canopus HD Workflow**

By adhering to industry-standard workflows, EDIUS HD is easy to incorporate into current production setups. For HD capture, the EDIUS HD system behaves like a DVCPRO HD VTR using the Canopus HD codec. Uncompressed HD video comes into the system via the HDSDI I/O board and EDIUS HD compresses the video and writes it to the hard drive. Luma sampling is data-reduced to 1280 samples and chroma sampling is data-reduced to 640 samples. This complex sample-reduction process is performed in the Canopus HDSDI I/O board's hardware and provides quality on par or better than an HD deck-to-deck transfer. Data precision is reduced to 8-bit and is then compressed with the Canopus HD codec before it is written to the hard drive.



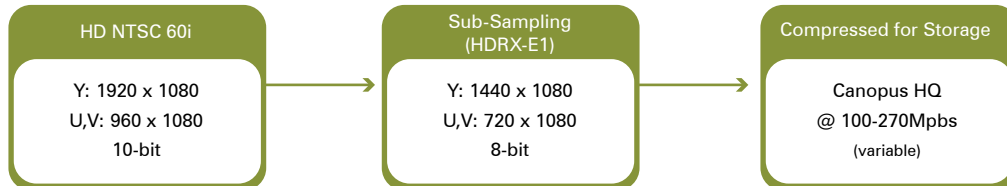
*Video Compression with Canopus HD*

For HD editing, EDIUS HD acts like an HD switcher. Data from the hard drive is decompressed back to a luma sampling resolution of 1280 samples and chroma sampling resolution of 640 samples with 8-bit precision and any effects are applied. For realtime output, the luma and chroma sampling are expanded back to their respective 1920 samples and 960 samples through a mathematical expansion performed on the HDSDI I/O board and the uncompressed video is output through HDSDI for capture by the HD VTR.



*Canopus HD Video Editing Workflow*

In addition to the Canopus HD codec, EDIUS HD also includes the Canopus HQ codec, which surpasses both DVCPRO HD and HDCAM in image quality. The Canopus HQ codec is capable of variable bitrate compression from 100 – 270Mbps. It also performs luma sampling at 1440 samples, which is the same as HDCAM, and chroma sampling at 720 samples, which is better than both DVCPRO HD and HDCAM. With the Canopus HQ codec, HD editors with shorter projects or large storage capacity can get better-quality HD video at higher bitrates. In this manner the EDIUS HD system can operate with better quality than both DVCPRO HD and HDCAM.



*Video Compression with Canopus HQ*

## Why 8-bit editing is superior to 10-bit editing

A widely held misconception about HD editing is that systems processing uncompressed or 10-bit precision data provide better quality. However, it is important to note that during the HD VTR recording process, video data is already reduced to 8-bit precision before it is compressed and written to tape. Since the original input to the HD compressor is at 8-bit precision, the decompressed output from the HD decompressor is also at 8-bit precision, which means there is no improvement in quality by processing it at 10-bit precision. Furthermore, the realtime functionality of a 10-bit system is significantly reduced since the editing system must do twice as much work to retrieve the data, and a significant amount of additional storage is required to effectively store the higher-precision data. The quality of the HD compression itself, not the extra 2 bits of precision, make the biggest difference in an HD editing system – especially for realtime HD editing.

With the Canopus HQ codec's variable bitrate encoding, EDIUS HD can achieve better video quality than both DVCPRO HD and HDCAM. Since its video quality is superior to that used in the HD VTRs themselves, there is no fear of degradation while editing in realtime with EDIUS HD.

## Canopus Scalable Technology

Pioneered by Canopus in 1995, the principles of Canopus Scalable Technology now extend to HD editing as demonstrated by the HQ codec. As CPU power increases and storage becomes larger, the Canopus HD editor can increase video quality by reducing the amount of compression while still enjoying true realtime HD editing. Soon Canopus will introduce an HQ+ codec that bypasses the luma sample reduction providing full luma processing at 1920 samples. As storage performance and CPU power increase in the future, EDIUS HD will be able to eliminate the chroma sample reduction, utilise higher-bitrate (lower) compression schemes or even edit uncompressed HD footage in realtime - all through simple software updates. Only the power of Canopus Scalable Technology can provide these benefits.

