# MPEG-4 Advanced Video Coding

*for the Astria® Content Processor – the world's leading solution for Telco TV*

## Key features and benefits:

✓ Highest quality video at the lowest peak bit rate in the industry

✓ Industry-leading rate control for efficient network utilization

✓ Flexible chip, board and chassis level architectures

✓ Patent-pending transcoding technology for the most cost effective digital turnaround solution on the market

✓ Designed for future upgrades to MPEG-4 AVC High Definition or VC-1

Tut Systems' MPEG-4 Advanced Video Codec (AVC/H.264) is designed to deliver high-quality, cost-effective video over broadband distribution networks including IP, ATM and DVB. Whether for an operator deploying an all MPEG-4 AVC digital headend system, or an existing service provider migrating a handful of premium and High Definition channels to lower bit rates, Tut Systems can help bring more services to more subscribers with a superior return on investment.

The Tut Systems implementation of the MPEG-4 AVC standard sets the benchmark in the marketplace with a unique system architecture designed specifically for service providers delivering digital video over telecommunications networks.

The Tut Systems MPEG-4 AVC solution distinguishes itself through:

· Ultra-Efficient, Standards-Compliant Compression;

· Flexible and Economical Architecture;

· Cost-Effective, Integrated Digital Turnaround; and

· Future encoding enhancements.

The MPEG-4 AVC solution for the Astria® Content Processor uses digital signal processors (DSPs) to provide video network operators an advanced compression solution that will grow and mature with their network over time.
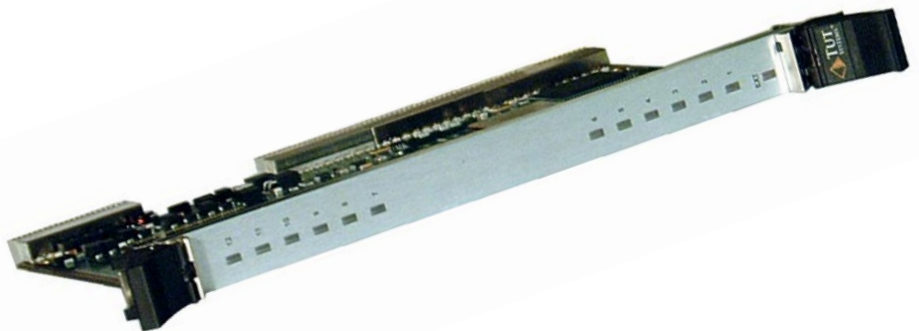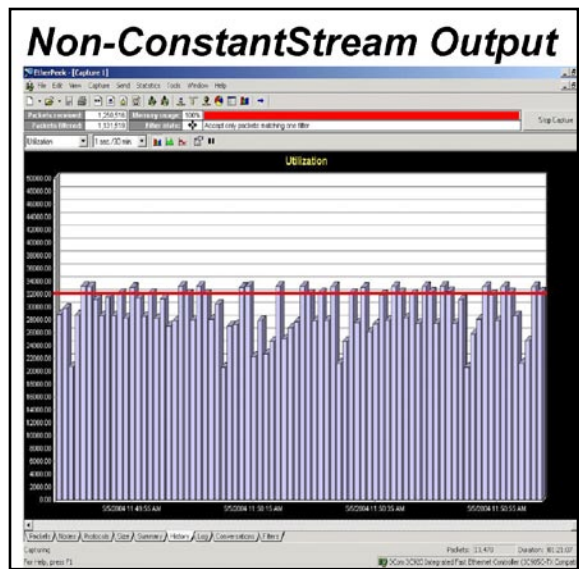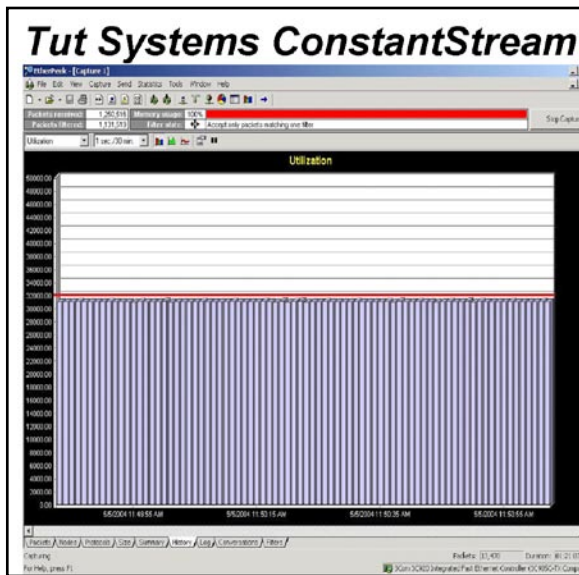



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*Transforming Broadband into Services*

## Ultra-Efficient, Standards-Compliant Compression

Tut Systems' industry-leading ConstantStream™ rate control technology provides the true constant bit rate performance required for efficient network utilization and extended customer reach. When combined with Tut's unique dual-pass, look-ahead compression techniques, ConstantStream™ provides customers an advanced compression solution that delivers optimal quality at the lowest peak bit rates in the industry.





And, as with today's MPEG-2 standard which has seen worldwide implementation, Tut Systems was instrumental in the MPEG-4 AVC standard committee. Company representatives chaired the Interlace Sub-Committee of the Joint Video Team (JVT) and actively participate in stream exchange forums to ensure conformance to the compression standard for an overall solution that is tested and certified in the Tut Systems interoperability lab.

## Flexible and Economical Architecture

The Tut Systems MPEG-4 AVC solution is propelled by an innovative multi-stream processor card housed in the Astria® content processor (CP) — the most widely-deployed TelcoTV platform on the market today.

The unique capabilities of the multi-stream processor allow it to adapt to the specific needs of each channel line up. The multi-stream processor varies its implementation based on the resolution and quality requirements of each channel. This ensures that the operator's technical and financial resources are focused on the content that needs the most resources.

And, the multi-stream processor is powered by the integrated Astria® content processor platform that combines all of the processing and network functions in a single, carrier-class chassis. The Astria® platform eliminates the need for separate decoding and encoding functions. With the variety of networking interfaces, there is no need for external converter boxes either. And with integrated Ad Insertion, Encryption, and Forward Error Correction applications, operators can be assured that the Astria CP will provide a single, high-density platform for all of their needs.



With software and hardware upgradeable stream, board, and chassis level architectures, the Astria® content processor and its new multi-stream processor cards properly optimize the tradeoff between performance and cost.

## Cost-Effective, Integrated Digital Turnaround

Unlike other offerings that require a number of boxes for turnaround of pre-encoded MPEG-2 satellite feeds, the Astria® content processor and its new multi-stream processor cards can transcode multiple streams of content from MPEG-2 to MPEG-4 AVC in a single card within a chassis.



**Tut Intelligent Transcode Example**

- ◆ Less Expensive Solution
- ◆ High Quality Solution
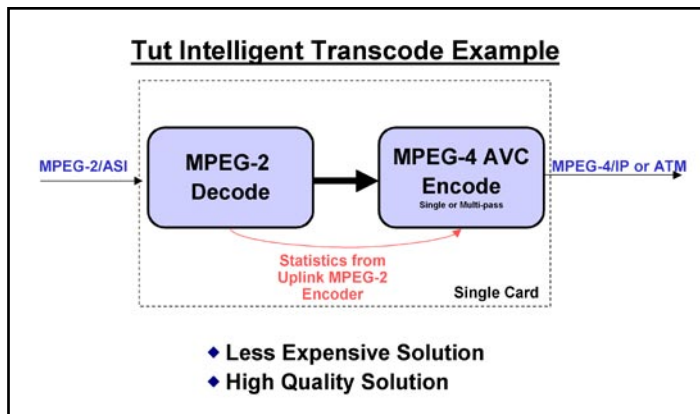
In some digital headends, more than 70% of the channels in the service provider's channel line up is pre-encoded, digital content coming from satellite feeds. These channels are pre-compressed using MPEG-2 to facilitate efficient transmission over today's satellite networks.

Using patent-pending transcoding technology that takes advantage of intelligent video processing decisions made at the content uplink source, Tut Systems provides the most cost-effective, high-quality digital turnaround technology on the market today. *The result is a solution that delivers all the benefits of converting content to MPEG-4 AVC without the cost and quality loss associated with a blind decode of MPEG-2 and full re-encode to MPEG-4 AVC.*

## Growth Path to the Future

Tut Systems has a history of migrating its customers seamlessly from one technology to the next. In recent years, the majority of our Telco TV deployments have migrated from MPEG over ATM to MPEG over IP. Tut Systems has consistently delivered additional video processing capabilities to the Astria® CP through its software re-programmable platform. These changes improved the service offerings for our customers through enhanced quality, more affordable networking options, and additional value-added features.

Tut Systems' innovation will not stop here. The new multi-service processor card is built with the future in mind. As MPEG-4 AVC HD solutions become available, rest assured that Tut Systems has the technology to help service providers grow both the subscriber base and revenue per subscriber by delivering unique service offerings.

## Application of Advanced Video Coding

Tut Systems MPEG-4 AVC compression sets the new benchmark for low bit-rate, high-quality video and audio encoding. This MPEG-4 AVC implementation is based on the ISO/IEC standard developed jointly by the Video Coding Experts Group (VCEG) and Moving Picture Experts Group (MPEG) committees. MPEG-4 AVC, also know as "Part 10" and H.264, is one of many operating points within the MPEG-4 standard.

The performance advantage of MPEG-4 AVC delivers high-quality, low bit rate encoding of standard and high definition video and audio that achieves 40% to 50% bit rate reductions over today's MPEG-2 streams. The reduction in bit rates results in the service provider achieving significantly increased reach in their broadband delivery networks. The bottom line for operators is lower bandwidth requirements and lower video transport costs.
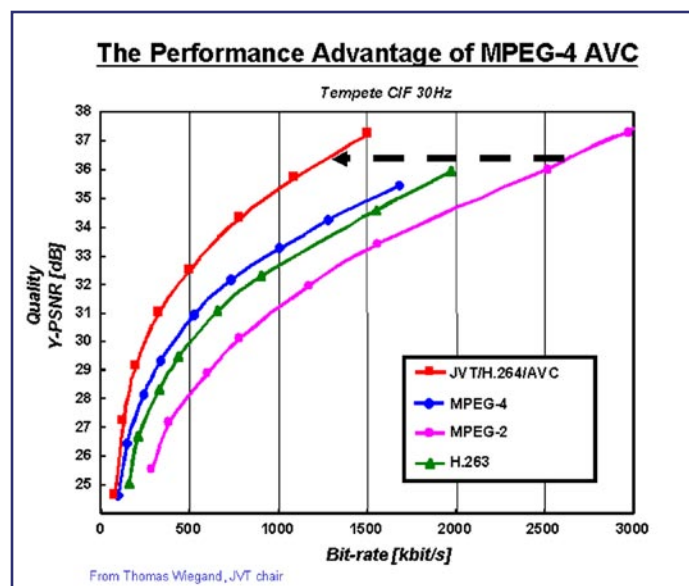


Tut Systems' MPEG-4 AVC solution supports the following video processing applications for your video headend:

- · MPEG-4 AVC encoding (standard definition)
- · MPEG-2 to MPEG-4 AVC transcoding (standard definition)
- · MPEG-2 to MPEG-4 AVC transcoding (high definition)

Tut Systems MPEG-4 AVC processing resides on a new DSP-based board known as the multi-stream processor (nomenclated SP-B1). It supports, and will require, the appropriate QualView Software depending on the particular application.

## Specifications

### AVC Encoder Specification
(Ref. ITU-T Rec. H.264 also known as ISO/IEC 14496-10)

### Bit Rates Supported
- 700k to 4.0 mbps

### Resolutions Supported (user selectable):
- 352 x 480 (29.97 frames per second)
- 352 x 576 (25 frames per second)
- 480 x 480 (29.97 frames per second)
- 480 x 576 (25 frames per second)
- 528 x 480 (29.97 frames per second)
- 528 x 576 (25 frames per second)

### Main Profile (automatic)
- Level 2.1 (352 horizontal resolution)
- Level 3 (horizontal resolution greater than 352)

### GOP Pattern (automatic)
- 15 frames for 480 vertical resolution: IBBPBBPBBPBBPBB
- 12 frames for 576 vertical resolution: IBBPBBPBBPBB

### Loop Filter Parameters (user selectable)
- alpha: -6 ≤ alpha ≤ 6 or off (default is on with value 0)
- beta: -6 ≤ beta ≤ 6  or off (default is on with value 0)

### Entropy Coding Mode (automatic)
- CABAC (arithmetic coding)
- CAVLC (variable length coding)

### Frame or Field Encoding
- Either frame or field encoding (user selectable)
- Field-frame adaptive
- MBAFF
- 3:2 PD inversion

### Resolution for Motion Vectors
- ¼ pel (finest resolution afforded by standard)

### Encapsulated in MPEG TS as defined in ITU-T Rec.
H.222.0 (ISO/IEC 13818-1) per Amendment 3.

### Audio Encoder (Ref ISO/IEC 14496-3)
MPEG-4 AAC LC Profile Stereo (Ref ISO/IEC 14496-3)

MPEG-4 and MPEG-2 AAC audio bit rates:
8kbps to 192 kbps

MPEG-1 Layer 2 and MP3
64, 96, 112, 128, 160, 192, 224, 256, 320 kbps

Audio sampling is 48, 44.1 and 32 kHz

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## Ordering Information

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|---|---|
| SP-B1 | Multi Stream Processor Card |
| ENC-T2 | Encoder Transition Card |
| QVL-AVC-E1 | QualView® Advanced Encoder License for H.264 (MPEG-4 AVC) |
| QVL-AVC-T1 | QualView® Advanced Transcoder License for H.264 (MPEG-4 AVC) |

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About Tut Systems, Inc.