Dark Energy©
By Cinnafilm®

PixelStrings®

Advanced HDR by technicolor

YOUR ANSWER FOR TEXTURE/GRAIN MANAGEMENT

Combining Cinnafilm's leading degrain and noise removal technology with the most cutting-edge HDR conversion tools on the market, Dark Energy is the motion picture and broadcast industry's go-to solution for texture and grain management.

Dark Energy Professional Specifications

- DPX image sequences (highest throughput speed)
- TIFF, JPEG, GIF, BITMAP (lower throughput speed than DPX)
- Timeline control
  - Auto cut detection
  - EDL import/export
  - Segment naming
  - Segment merge/insert
  - Scrubbing
- SD – 8K resolution interchange
- Noise types removed
  - Film grain
  - Gaussian
  - Wavelet
  - Impulse
  - Chrominance
  - Luminance
- 32-bit per color channel processing
- Noise adjustment per RGB color channel
- Noise separated into 16 frequency ranges
  - Low 1-4
  - Medium Low 1-4
  - Medium 1-4
  - High 1-4
- Film simulation
  - Vary grain structure from 8mm – 100mm film
  - Control color correlation to the original pixel
  - Control RGB amounts
  - Control grain size (in microns)
  - Control grain amounts

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Dark Energy for Transcoders Specifications

- Simplified interface for enterprise volume applications
- Noise types removed
  - Film grain
  - Gaussian
  - Wavelet
  - Impulse
  - Chrominance
  - Luminance
- 32-bit per color channel processing
- Noise separated into 16 frequency ranges for analysis
  - Low 1-4
  - Medium Low 1-4
  - Medium 1-4
  - High 1-4
- Film simulation
- Vary grain structure from 8mm – 100mm film
  - Control grain size (in microns)
  - Control grain amounts

Xenon Specifications

- HDR, HDR10, HLG, SLog3 tone mapping (SLog3 released in Fall 2020)
- SLHDR1 – SDR stream encoded with HDR10 metadata
- SLHDR2 – HDR10 stream encoded with variable luminance adaptation to HDR set capabilities
- Technicolor JSON template compatibility
- Includes Dark Energy for Transcoders for proper operation
- Automatic bright spot control to prevent pixel blow-outs
- Adaptive light control to prevent diffuse white situations

Dark Energy Professional

As a premier spatial processing platform, Dark Energy Professional produces impeccable denoise results on image-sequence-based projects with scene-by-scene control and provides the most believable film grain texture ever to be generated by a computer-based process.

Starting with an intuitive, real-time feedback GUI, users can immediately see the results of their adjustments without waiting for a render and hoping the adjustments will be what they want.

- Precision noise and grain management for master-level image sequences (DPX, TIFF)
- Upres SD<->8K with full control of process filters to ensure the highest quality
- Any-to-any resolution interchange
- Leverage multiple GPUs for background rendering and farm-based rendering
- Add any desired film grain or broadcast texture
- Multiple sharpening options
- Faster than real-time performance for 2K images using a single GPU

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Dark Energy Professional *(Continued)*

- Utilizes seven filters for addressing nearly any kind of noise
  - Power Spatial – our spatial-temporal hybrid filter, which is our primary workhorse filter. Many assets can be fully restored without using any other filter
  - Dynamic Temporal – a temporal filtering solution which is tuned to minimize motion artifacting, which plagues most temporal-only noise reduction solutions
  - Basic Spatial – a wavelet-based filter that can remove pattern noise that is often seen in SD digital footage
  - Smooth Spatial - Used to smooth out harsh images without artifacting
  - Chroma Noise Removal – eliminates 95%+ of chroma spots/crawl that occur in older footage and poor 4:2:0/4:2:2 tape transfers
  - Dustbusting – our single event artifact removal filter that removes up to 90% of scratches, dust, and dropouts so long as the artifacts are not on adjacent frames. Running scratches and continuous dropouts will not be affected
  - Dead Pixel Healing – automatically identifies candidates that are presented for removal
- Upres/downres with the highest accuracy available
- Match any image texture —with the best-looking film grain on the market
- Dustbusting, Dead Pixel Healing
- Manipulate noise with independent control of RGB color channels, divided into 16 frequency ranges per channel
- Background/accelerated rendering capable with multi-GPU systems
- Batch processing logic, EDL import, timeline GUI, LUT import

Dark Energy for Transcoders

Designed for the processing of large libraries of compressed content, we have taken the essence of Dark Energy Professional and wrapped it into an automated/semi-automated plug-in for enterprise-grade transcoders, allowing broadcasters, OTT providers, and content distributors to have the GPU - based power of Cinnafilm's flagship Dark Energy Professional during the transcoding process.

The noise analysis brain of Dark Energy Professional was transplanted into a plug-in for many enterprise-grade transcoding solutions. Working in an automated, semi-automated, and even template-based fashion, users have the following at their fingertips:

- Same independent analysis per color channel and frequency ranges as Dark Energy Professional
- Removes film grain, chroma noise, wavelet noise, impulse noise, and luminance noise
- Noise is analyzed on a scene-by-scene basis and every 24 frames within a scene to ensure camera and lighting changes are always taken into account
- Upres from SD to UHD and beyond. Resolution limits are based solely on the capability of the encoder. If the encoder supports it, so does Dark Energy for Transcoders
- Upres sharpening tailored and adjusted automatically given source resolution and target resolution

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Dark Energy for Transcoders *(Continued)*

- Tailor the processing method to the type of footage being processed. Operators can choose from fully automated, semi-automated, or template-based modes to ensure the denoise meets customer expectations
- Single event artifact removal that eliminates 90% of dust, scratches, and dropouts that are not in the same location on adjacent frames
- Automated Dead Pixel Healing (Fall 2020 release)
- "Broadcast" image texture for crisp images at low, broadcast bitrates
- 35mm presets for cinematic material
- Dustbust
- Precise upres that is texture-aware – automatically adjusts grain structure based on target resolution
- Template-based processing for especially challenging projects (Templates created in Dark Energy Pro)

Xenon

Xenon combines Dark Energy for Transcoders with the machine learning-based Advanced HDR by Technicolor solution. What you get is an enterprise-grade HDR conversion system that provides an incomparable file-based solution for fully automated, high-quality HDR conversions from SDR source material and cross conversion between different HDR standards.

An automated solution for archived content to be optimally viewed on today's latest home theater technology has finally arrived. Xenon provides SDR-HDR upconversions using Technicolor's advanced Intelligent Tone Management technology to generate 2,000 nit assets from Standard Dynamic Range sources.

It is impossible to take an SDR 608/709 asset and tone-map it to the PQ curve of HDR10 without addressing noise. We've all seen HDR upconverts where the dark sections of the image are crawling, or the sky has a strange pattern or shimmer that just isn't natural. For this reason, we have added Technicolor's highly coveted advanced Intelligent Tone Management (ITM) algorithms as an option in Dark Energy. Using an automated process, users can take standard definition/dynamic range material, upres it to HD or UHD, and tone-map with Technicolor HDR ITM to 2,000 nits of HDR brilliance! The simplicity of the Technicolor advanced ITM process gives new options to efficiently convert your libraries of SDR into high-quality HDR content. Do your part to bring trillions of archived content hours into the millions of living rooms equipped with HDR televisions.

The automated Technicolor advanced ITM process will first be available in Dark Energy for Transcoders and quickly thereafter in Dark Energy Professional.