4K Remastering,
Restoration and Upconversion

Business Context

Film is a delicate medium and prone to scratches, collection of dirt, and deterioration with time. Video tape-based media types are not a reliable solution for long-term data storage either. With today's audiences demanding the highest possible picture quality from digital formats, many legacy content owners find themselves unable to showcase their content, despite there being a demand for it. In such a scenario, Restoration, Upconversion and 4K Remastering have become extremely important, as they help make legacy content presentable across a variety of devices and formats. Even for more recent films shot on 2K resolution, upconversion is the only solution to obtain a UHD version, as native ultra-high resolution originals often do not exist.

PFT Offerings

PFT offers the Academy® Award-winning proprietary Lowry Digital technology — one of the most advanced tools available for Remastering, Upconversion and Restoration. This unique technology helps content owners re-purpose their legacy content for high resolution viewing across all devices — VoD, OTT, and traditional linear television broadcasting up to 4K-UHD. Using complex algorithms based on motion estimation, the 'Lowry Process' effectively reduces visual noise in motion pictures. This makes it possible to carry out other forms of restoration on the content, such as removing dirt and scratches, reducing flickers, replacing lost details, and sharpening the quality of the existing images.

Here's what we offer:

Restoration

Digital repair of damaged films through a combination of software algorithms and manual in-painting by skilled restoration artists, while preserving the original aesthetics of the content:

- Reduce /repair as many artifacts as possible
- Ensure correct processing takes place, avoiding over processing
- Use different image processing operations to clean up issues like dirt/dust, grain, scratches, noise, scene splice, bumps, flickers, image stabilization
- Complete retention of source resolution, image information and image quality
- Enhance of overall viewing experience
- Process:
  - Comprehensive range of image processing software, including Academy® Award-Winning 'Lowry Digital'
  - Collaborative IT environment supporting 2K playback across a large number of workstations
  - Frame-by-frame manual repair and painting by highly trained digital image processing artists
  - Manual recovery of original image elements which are processed while applying automated parameters
  - Painting of missing information and reconstruction of images
  - Frame-by-frame QC by highly skilled QC experts
- Team:
  - Professionally trained digital image processing artists
  - Expert QC professionals with trained eyes

HDR Color Grading

- Archive HDR Color Grading enables films to be displayed with more color volume, brightness and contrast, creating a superior viewing experience. It includes:
  - Creating a new presentation master that exceeds the requirements of consumer HDR TVs and future proofs the film for presentation over the next 10-20 years
  - Creating 16 bit ACES archive masters that allow for addition color trim passes
  - Creating tone mapped metadata to target various HDR/SDR peak levels for TV and handheld devices
  - Grade the film in a way that is faithful to the filmmaker's original intent with enhanced color and contrast.
- Team:
  - Professional colorists using Davinci Resolve in Dolby certified workflows, equipment and studios
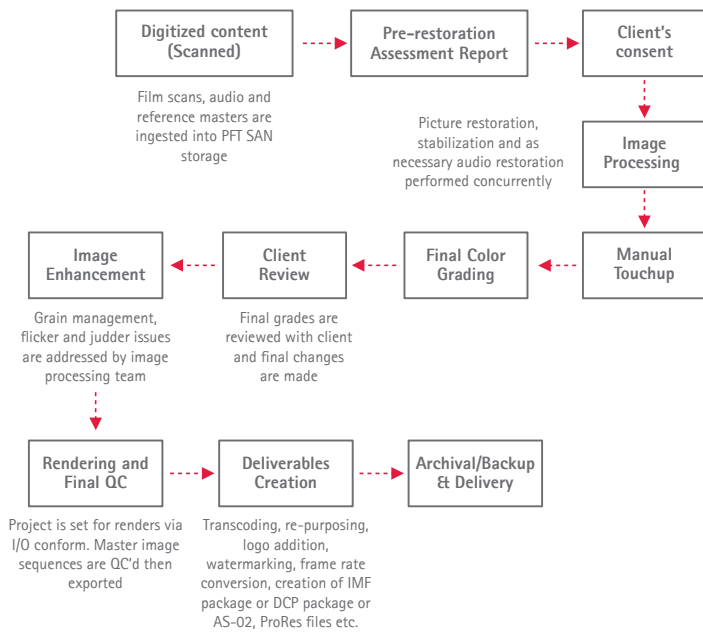 - 15+ years of experience in Remastering and color grading

Image Enhancement

- The Lowry Digital Process is the only process in the world that offers complete control of Grain (noise) and Sharpness Enhancement improve the visual experience, even for faded images.
- The process removes subtle and very minute details while increasing the sharpness in the image.
- This toolset can also extract visual data that was not immediately visible by combing through frames and combining the best information from each frame / range to provide the best output.

Deliverables Creation

This is the process of creating elements for distribution of the original remastered sources, including:

- Content transcoding, re-purposing, logo addition, watermarking etc.
- Frame rate conversion (NTSC to PAL, PAL to NTSC, 24fps to 25fps)
- Creation of Digital Cinema Package (DCP)
- Writing of digital files on to video tapes and film negative/positive (if required)

Digitized content (Scanned)	→	Pre-restoration Assessment Report	→	Client's consent

Film scans, audio and reference masters are ingested into PFT SAN storage

Picture restoration, stabilization and as necessary audio restoration performed concurrently

Image Enhancement	←	Client Review	←	Final Color Grading	←	Manual Touchup	←	Image Processing

Grain management, flicker and judder issues are addressed by image processing team

Final grades are reviewed with client and final changes are made

Rendering and Final QC	→	Deliverables Creation	→	Archival/Backup & Delivery

Project is set for renders via I/O conform. Master image sequences are QC'd then exported

Transcoding, re-purposing, logo addition, watermarking, frame rate conversion, creation of IMF package or DCP package or AS-02, ProRes files etc.

Re-Mastering Workflow

Up-Conversion

- SD to HD, HD to UHD, 2K to 4K
- De-interlacing – An interlaced video frame consists of two sub-fields taken in sequence, each sequentially scanned at odd, and then even, lines of the image sensor. This was meant for CRT Display, and can't be consumed on flat panel screens (PCs, LCD, tablets etc.). De-interlacing converts an interlaced analog television signals into a non-interlaced form.
- Performed using high-end software & hardware:
  - **Lowry Digital:** Offers custom filters for scaling images, uses spatial frames to fill in detail and re-interpolates to avoid aliasing (jagged lines or ringing)
  - **Digital Vision Phoenix:** Provides motion-compensated frame rate conversion and high-quality upscaling
  - **Alchemist:** Automatically corrects and coverts video images to provide high quality output
  - **Tachyon:** Enables unrivalled motion compensated image transformation

PFT Advantage

- Academy® Award-winning Lowry Digital, one of the most advanced tools in the world for Remastering, Up-conversion, and Restoration
- Global pipeline significantly reduces Restoration and Remastering costs, while enabling scalability and shorter turn-around-times
  - Vast talent bank of experienced colorists and senior Remastering colorists

- 4K film Restoration workstations with scalable pool of Restoration artists
- Consistent Sony HDR monitoring at all global locations
- More than 30 years of experience in Restoration and Remastering
- Team of experts well versed with industry standard formats and broadcast guidelines
- Global delivery supported by a worldwide network of in-house studios
- Robust SLA driven deliveries
- Top-notch security: ISO 27001 certified and SOC 2 compliant
- Dedicated project management support for each client
- Scalability – we can easily and quickly scale operations up or down as needed
- Advanced Restoration capabilities to tackle nagging errors in content
- The only company with a dedicated Research & Development (R&D) wing for image & video signal processing.
- Superior storage systems to work directly with SAN and avoid the push/pull method of processing content from SD to 4K resolution
- Davinci Resolve V15, Clipster and Transkoder for packaging and QC
- High end color grading system: Baselight – the world's premium color grading system
- Stringent QC process, Dolby certified QC rooms
- End-to-end supporting services: Cataloging of physical assets, Bulk digitization, Audio and Video correction, Restoration, Metadata services, Archiving and File accessibility, Mastering, and delivery

Business Benefits

- Preserve content for posterity
- Easily re-use of legacy content for increased ROI
- Deliver high resolution viewing experiences across multiple platforms and devices
- Create UHD versions of previously released films with ease

A History of Success

The proprietary 'Lowry Process' software has been used successfully by various prestigious content owners for over 500 landmark projects across the globe.

- Restored **1800+** feature films, documentaries, and news reels
- Restored **500+** classic films from Hollywood and across the globe

The Simpsons: 20th Century Fox: For 'The Simpsons', 'Lowry Process' was used for Upconversion from SD to HD in 4:3 and 16:9 with tilt and pan for 342 episodes of this epic animation series.

NASA: The original video footage of the missing Apollo moon landing tapes was restored using 'Lowry Process' in time for the 40th anniversary of the moon landing on 16th July 2009.

Prometheus: Ridley Scott's 'Prometheus': In addition to grain reduction and image processing, all 3D related issues were fixed, and the Z axis was made acceptable for theatrical release.

Star Wars: The legendary first three 'Star Wars' feature films were all scanned at 4K with full restoration including stabilization, grain reduction, and dust and dirt removal.

Avatar and Titanic: James Cameron's 'Avatar' and 'Titanic': In addition to image processing and grain reduction, Z axis issues that had occurred during the original 3D shooting were fixed.

Star Wars: The legendary first three 'Star Wars' feature films were all scanned at 4K with full restoration including stabilization, grain reduction, and dust and dirt removal.

Disney: Short films and feature films like 'Dumbo', 'Snow White', 'Cinderella', 'Sleeping Beauty' and several others were scanned at 4K, color corrected and restored according to fixed specifications. Dirt and dust were removed from each of these films, and scratches and grains were cleaned up.

Several of Hollywood's most renowned films have been restored using Lowry Digital technology

About Prime Focus Technologies

Prime Focus Technologies (PFT) is the creator of Enterprise Resource Planning (ERP) software, CLEAR®, for the Media & Entertainment (M&E) industry. It offers streaming platforms, studios, and broadcasters transformational AI-led technology and media services powered by the Cloud that help them lower their Total Cost of Operations (TCOP) by automating their content supply chain. PFT works with major companies like Walt Disney-owned Star TV, Channel 4, ITV, Sinclair Broadcast Group, A&E Networks, Hearst Television, Warner Media, PBS, CBS Television Studios, 20th Century Fox Television Studios, Lionsgate, Showtime, HBO, NBCU, TERN International, Disney+ Hotstar, BCCI, Indian Premier League, and more.

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