

# Cinecittà Digital

**Der Consultant Steve Shaw erläutert das Konzept des neu installierten Digital Lab bei Cinecittà Digital und berichtet über erste praktische Erfahrungen mit dem Digital-Intermediate-Prozess.**

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**D**ie Cinecittà-Filmstudios in Rom sind der Inbegriff italienischer Filmproduktion. Hier drehten Regisseure wie Fellini ihre erfolgreichen Spielfilme, und Schauspieler wie Sophia Loren und Marcello Mastroianni feierten mit Cinecittà-Produktionen ihre größten Erfolge. In den 70er und 80er Jahren hatten die italienischen Vorzeige-Filmstudios allerdings zu kämpfen, und erst nach der Privatisierung in den 90er Jahren kam die erhoffte Wende. Jetzt zieht es wieder Regisseure aus aller Welt nach Rom: Cinecittà ist für manchen eine Alternative zur Produktion in Hollywood geworden, denn die Produktionskosten sind im Vergleich deutlich günstiger.

Auch auf technischer Seite beschreitet Cinecittà neue Wege: So ist unter dem Dach von Cinecittà Digital das »Digital Lab« entstanden. Im »Digital Lab« hat Cinecittà Digital das umgesetzt, was in der Branche derzeit als Digital-Intermediate-Prozess umschrieben wird. Die Grundidee dahinter: Gedreht wird auf Film oder hoch auflösendem Video, dann wird die gesamte Nachbearbeitung digital durchgeführt und erst am Ende der Postproduktion wird wieder auf Film belichtet.

## Digital Lab: Aufbau und Workflows

Das Digital Lab bei Cinecittà Digital ist in der Lage, wahlweise mit SD-, HD- aber auch mit Filmmaterial zu arbeiten. Ist Film das Ausgangsmaterial, wird das Material mit Thomsons Spirit Datacine

### Digital Intermediate Prozess

In der klassischen Filmproduktion tut sich was: immer mehr Anwender experimentieren mit neuen digitalen Workflows und setzen digitale Technologien auch da ein, wo bislang ganz klassisch produziert wurde. Die Grundidee, die eigentlich beim derzeitigen Stand der Technik und der Marktsituation nahe liegt und die sich schleichend immer weiter entwickelte und verbreitete: Gedreht wird auf Film, dann wird die gesamte Nachbearbeitung digital durchgeführt und erst am Ende der Postproduktion wird wieder auf Film belichtet. Die Hersteller fassen die neuen Arbeitsweisen unter dem Begriff Digital-Intermediate-Prozess zusammen.

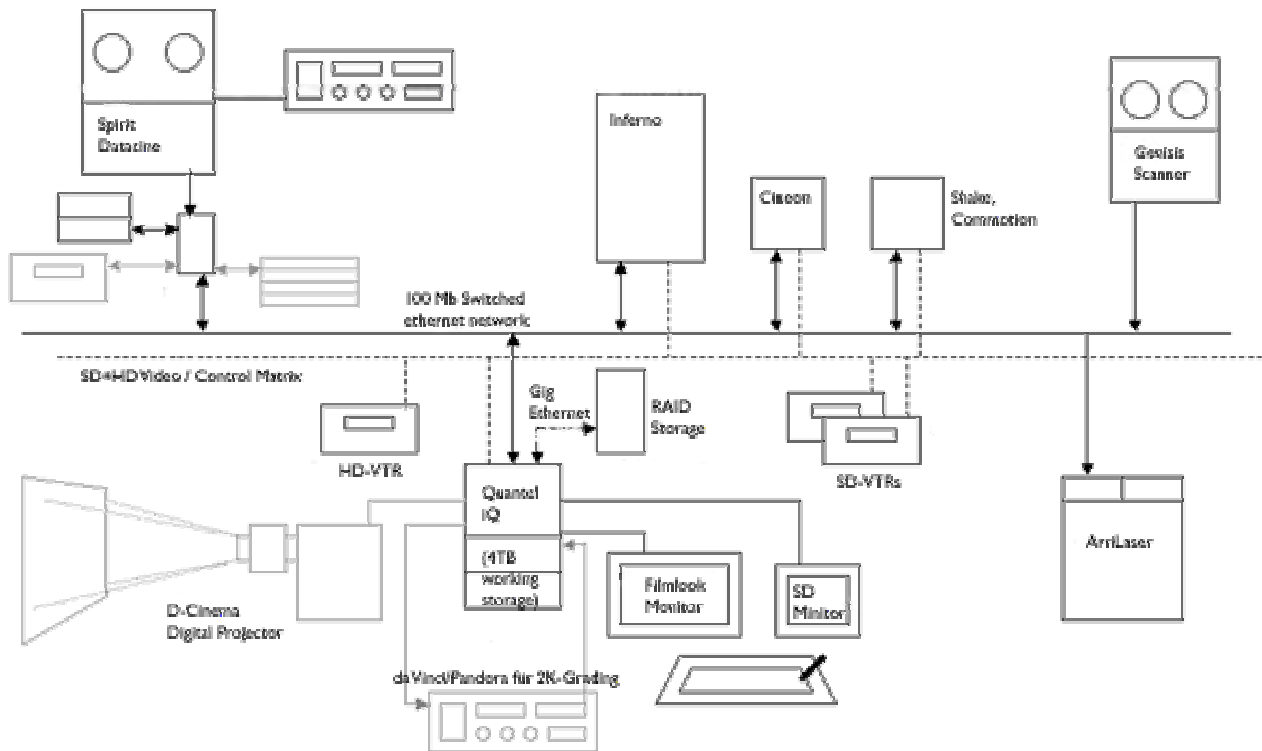
Die oben erwähnte Kurzform wird dem Digital-Intermediate-Prozess aber nicht ganz gerecht, denn es greifen etliche Arbeitsschritte ineinander: Gedreht wird auf Film, dann wird das Filmmaterial entwickelt und gescannt, so dass die Bilder als Datenbestände, also Files vorliegen. Statt des Drehs auf Film kommt, zwar immer noch selten, aber mit zunehmender Tendenz, auch der Dreh mit hoch auflösendem Video als Alternative vor. Interessiert blickt ein Teil der Filmwelt auf Thomsons Viper Filmstream-Kamera, die ein unkomprimiertes RGB-Datensignal abgibt, wie es eben auch vom Filmscanner oder Datacine kommt.

Die Files lassen sich dann mit unterschiedlichsten Postproduktionssystemen bearbeiten, mit Special Effects versehen, digital farbkorrigieren und schließlich zu einem Datenmaster zusammenstellen, das sich am Ende der Bearbeitungskette wahlweise auf Film zurückbelichten oder auch für die digitale Projektion im Digital Cinema verwenden lässt.

Das klingt vernünftig und ist aus Sicht vieler Anwender und Hersteller der richtige Weg in die Zukunft der digitalen Filmproduktion. So steht der Begriff Digital Intermediate für den Bereich zwischen Digital Cinematography und Digital Cinema und nicht notwendigerweise nur für den Ersatz eines chemischen Intermediates durch eine digitale Zwischenstufe in der Filmproduktion.

## Aufbau Digital Lab Cinecittà Digital

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in 2K (10-Bit, logarithmisch, RGB) gescannt, wobei sich die 2K-Scans mit einer Geschwindigkeit von 4fps ins Netzwerk des Digital Lab übertragen lassen. Der Spirit wird bei einzelnen Effekt-Shots durch einen Genesis-Scanner von Kodak ergänzt. Ist hingegen hoch auflösendes Video das Ausgangsmaterial, belässt das Digital Lab das Material im nativen Format, das entweder von Sonys HDCAM-Camcorder, von Panasonics Varicam oder von Thomsons Viper kommt.

Im weiteren Verlauf der Bearbeitung im Digital Lab wird also mit Daten gearbeitet – unabhängig davon, welchen Ursprungs diese Daten sind. Herzstück des »Digital Lab« ist das Quantel Postproduktionssystem iQ. Dazu Steve Shaw, mitverantwortlich für das technische Konzept des Digital Lab bei Cinecittà Digital: »Wir haben uns deshalb für Quantels iQ entschieden, weil es mit diesem System möglich ist, digitales Material in 2K simultan und in Echtzeit einzuspielen, zu bearbeiten und wiederzugeben. Zudem verfügen wir mit dem System über nahezu vier Terabyte Random-Access-Speicher, auf den man in Echtzeit zugreifen kann. Diese

Leistungsfähigkeit bietet kein anderes System.«

Im Netzwerk des Digital Lab spielen aber auch noch andere Softwares und Systeme eine Rolle: »Wir arbeiten unter anderem mit Inferno von Discreet, mit Cineon von Kodak, Shake und Final Cut Pro von Apple, Commotion von Pinnacle und Symphony von Avid, um ganz spezielle Jobs außerhalb von iQ abzuwickeln. Die einzelnen Schritte laufen dann in iQ wieder zusammen«. Shaw hebt weiter hervor, dass auch fürs Grading eine Vielzahl an Möglichkeiten zur Verfügung stehe. Für »einfaches« Chemical-Film-Style-Grading etwa biete iQ eine Funktionalität, die alle Anforderungen erfülle. »Für komplexere Anforderungen beim Grading gibt es die Möglichkeit, iQ in Kombination mit einem Farbkorrektursystem von Pandora oder daVinci zu nutzen,« erklärt Steve Shaw weiter.

Am Ende der Bearbeitungskette ist wahlweise ein digitales Master vorgesehen, oder die Ausbelichtung auf Film mittels Arrilaser. Zudem bietet das Digital Lab die Möglichkeit, simultan HD- und SD-Kopien des Masters zu generieren, etwa für DVD-Auswer-

## Thomsons Viper-Filmstream-Kamera

Die Eckdaten der Viper Filmstream-Kamera im Überblick:

Viper ist mit drei 2/3-Zoll-CCDs bestückt (je 9,2 Millionen Pixel) und zeichnet im Filmstream-Modus ein unkomprimiertes Raw-Data-Image auf. Dieses unkomprimierte 4:4:4-RGB-Signal wird logarithmisch mit 10 Bit quantisiert und über zwei HD-SDI-Outputs ausgegeben. Es lässt sich in dieser Form auf Harddisk aufzeichnen, etwa auf die tragbaren Speichermedien des Herstellers Director's Friend. Die Datenmengen, die dabei entstehen, liegen nochmals deutlich über denen, die derzeit Sonys 24P-HD-Camcorder aufzeichnet.

Die Aufzeichnung ist möglich in 16:9, aber auch in 2,37:1 (im 1080p Mode). Viper ermöglicht folgende Frame-Raten:

1080p: 23.98, 24, 25, 29.97, and 30 Hz (internal 3:2 pulldown verfügbar @ 59.94)

1080i: 50, 59.94, and 60 Hz

720p: 23.98, 24, 25, 29.97, 30, 50, and 60 Hz

Beim Dreh mit Viper gilt es einige Faktoren zu beachten. Die Kamera führt im Filmstream-Modus keinerlei Bild-Processing durch. Es wird weder ein Weißabgleich ausgeführt, noch werden Gain oder Gamma korrigiert. Das Bild, das am Set zu sehen ist, wirkt daher sehr ungewohnt: Es ist leicht grünstichig, die Farben sind entsättigt und wegen des größeren Dynamikumfangs etwas kontrastarm.

Alle genannten Bildparameter sollen beim Dreh mit Viper erst in der Postproduktion korrigiert werden, so die Idee. Am Set muss man sich nur um die annähernd richtige Belichtung und die Schärfe kümmern, ganz wie wir vom drehen auf chemischem Film gewohnt.

Dieses Konzept fasst Thomson-Kamera-Spezialist Klaus Weber so zusammen: »Am Filmset muss das Kamerateam mit einer Videokamera so arbeiten können, wie das von der Filmproduktion her bekannt ist. Deshalb ergibt es wenig Sinn, eine Kamera zu bauen, bei der schon während des Drehs das Bild bearbeitet und manipuliert werden muss. Die Viper Filmstream-Kamera zeichnet statt dessen ein qualitativ möglichst hochwertiges und auflösungsreiches Bild auf. Dabei muss die Viper am Set überhaupt nicht speziell eingestellt werden, denn das Bild wird erst in der weiteren Verarbeitung, also in der Post, mittels Farbkorrektur seinen eigentlichen Look bekommen. Das ist aus unserer Sicht ein entscheidender Punkt, denn den speziellen und viel zitierten Filmlook machen nicht nur Korn oder Ruckeln oder irgendeine spezielle Materialeigenschaft aus. Film ist vielmehr Licht, Farbe und Komposition. Und genau das wird heutzutage zum Großteil erst in der Postproduktion realisiert, also muss man auch mit einer neuen Kamera wie der Viper die Film-Workflows beibehalten, wenn man wirklichen Filmlook erreichen möchte.«

Damit es am Set dennoch möglich ist, einen ungefähr realistischen Bildeindruck zu bekommen, ist bei der Viper Filmstream-Kamera ein Viewing-Channel vorgesehen. Hier lassen sich Parameter wie etwa Gain oder Weißabgleich individuell einstellen, wobei diese Einstellung nur diesen Viewing-Kanal betrifft, nicht aber die eigentliche Aufzeichnung.

Für die richtige Beleuchtung gibt Thomson an, dass Viper unter »normalen« Bedingungen etwa mit einer Empfindlichkeit von 400 ASA anzusetzen sei und dann ganz normal mit einem Belichtungsmesser gearbeitet werden könne. Um richtig zu belichten empfiehlt Thomson weiter, die Zebrafunktion als optische Belichtungskontrolle zu nutzen, die im Sucher jene Bildbereiche markiert, die in einem kritischen Signalbereich liegen.

tungen oder auch für Digital-Cinema-Applikationen.

## Digital Lab: Erfahrungen mit Thomsons Viper Filmstream-Kamera

Thomson gelang es mit der Viper Filmstream-Kamera, eine interessante Alternative für den Dreh auf Film einzuführen. David Bush, Gründer von Cinecittà Digital, verfolgt diese Entwicklung mit großem Interesse: »Wir stellen fest, dass zunehmend elektronisch aufgezeichnet wird. Auch wir

bei Cinecittà arbeiten mit einer Thomson Viper Kamera und spielen diese Footage direkt in iQ ein. Dabei wird das komplette 10-Bit-Log-File mit vollem Dynamikumfang im Dual-Stream-HD-Mode aufgezeichnet. Sehr viele Kameraleute stellen dabei fest, dass sie damit einen Belichtungsspielraum erzielen, der nahezu dem von Film entspricht. Auch gegenüber anderen HD-Formaten hat dieses Format Vorteile und bietet eine höhere Auflösung. Auf der großen Leinwand sind die Ergebnisse bei der Projektion sehr beeindruckend, und mancher An-



**Bildbeispiele der Cinecittà-Produktion: Oben das Originalbild von Thomsons Viper Filmstream-Kamera, unten das farbkorrigierte Bild.**



wender spielt bereits mit dem Gedanken, bei zukünftigen Projekten das Shooting und die Nachbearbeitung gleichzeitig ab zu wickeln. In diesem Umfeld ist die Koexistenz verschiedener Auflösungen unabdingbar, und mit iQ sind wir dafür gerüstet.

Steve Shaw bestätigt diese Einschätzung und geht ebenfalls davon aus, dass sich mit der Verfügbarkeit von Thomsons Viper die Filmproduktion und –nachbearbeitung ändern wird. Mit etlichen Pilotprojekten hat sich das

Digital Lab in diesem Bereich schon sehr viel Knowhow angeeignet. So wickelte Cinecittà Digital schon im vergangenen Jahr mit dem Vorläufer der Viper-Kamera komplette Filmproduktionen ab, die auf hoch auflösendem Video gedreht wurden. Die Endprodukte dieser Tests waren unter anderem bei den Festivals in Venedig und Berlin zu sehen und stießen auf große Resonanz.

In diesem Jahr setzte Cinecittà Digital diesen erfolgreichen Test mit der Viper fort. Im

Rahmen eines Wettbewerbs erhielten junge Filmschaffende die Möglichkeit, ein Drehbuch für einen Kurzfilm einzureichen.

Drei davon wurden verfilmt, und zwar mit Thomsons Filmstream-Kamera. Die Nachbearbeitung der Beiträge erfolgte dabei mit Quantels iQ-System. Schon im Verlauf der Produktion zeigte sich, dass durch

das neue Equipment auch die Arbeitsabläufe beeinflusst werden: »Wir konnten das Material der Viper schon während des Drehs nachbearbeiten, was für die Regisseure neue Möglichkeiten eröffnete, denn das Feedback auf die Arbeit am Set war auf diese Weise direkter und unmittelbarer als je zuvor,« berichtet Steve Shaw. Überrascht zeigt er sich von der Qualität

der Aufnahmen: »Die Bildqualität ist natürlich nicht so makellos wie bei 35-mm-Film, und der Dynamikumfang reicht nicht an den

von 35-mm-Film heran, aber die Ergebnisse sind dennoch sehr überzeugend. Aus meiner Sicht ist die Aufzeichnung mit Viper ein guter Kompromiss aus Film- und Videoaufz



**Thomson hat die Viper Filmstream Kamera zur IBC nochmals überarbeitet und mit einigen neuen Features versehen. So lässt sich die Kamera jetzt mit einem flexibleren Kabel mit dem Director's-Friend-Medium verbinden.**

eichnung, denn man hat die Vorteile eines traditionellen Videoformats, gleichzeitig aber eine Qualität, die sehr nahe an die von 35-mm-Film herankommt. Und das ist schon eine ganze Menge«.

Es folgt ein von Steve Shaw verfasster Artikel in englischer Sprache, der das technische Konzept des Digital Lab bei Cinecittà Digital detaillierter erläutert.

## Cinecittà Digital – The Digital Lab

VON STEVE SHAW, DIGITAL PRAXIS

### Creatively Expressive

#### To start...

Cinecittà Digital's Digital Film Lab enables entire film projects, whether shot on traditional celluloid film or a digital medium such as HD, to be post-produced in an ultrahigh-resolution digital intermediate form. This process mimics the traditional chemical based process of film post-production workflow but without the associated restrictions and compromises.

As with its chemical equivalent the Digital Lab can perform traditional opticals such as dissolves and wipes between scenes. It can produce title sequences, text sub-titles and end credits combined with full colour timing and grading as well as the more obvious visual special effects digital systems have become known for. Indeed, it is advanced special effects technology that Cinecittà Digital has built its foundation upon, using concepts and techniques that have proven their worth in blockbuster movies the world over. The difference is that with Cinecittà Digital's Digital Film Lab such technology and capability is being made available to non-effects based movies and does not require the multi-million dollar budgets previously associated with such technology. With the evolution of The Digital Lab the benefits of digital intermediate processing are available to all movie projects, at budgets comparable with traditional chemical lab costs but with infinitely more possibilities.

#### Without specialised requirements...

The beauty of the digital intermediate process is that it requires no specialised pre-processes preparation, with the entire production operation occurring as for traditional chemical lab processing. This enables projects to choose to adopt the digital intermediate route at the very final stage

of production, without the need to prepare for the Digital Lab in advance.

If a project is shot on film the dailies are telecined as normal to generate video rushes for offline editing. This offline then forms the basis for subsequent online editing, as for the traditional film editing process. The difference is that via the offline edl the selected takes are scanned via a film transfer engine, such as the Spirit Datacine, from the original negative, complete with matching timecode information. This scanned information, which comprises the raw material for the entire project, is now held

#### Über den Autor

Steve Shaw, der Autor dieses Beitrags, ist als Consultant mit dem Spezialgebiet Digital Filmproduktion tätig. Der gebürtige Engländer berät unter anderem Cinecittà Digital und ist zudem für zahlreiche weitere Kunden in den USA, Australien und Neuseeland tätig.



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in a digital ultrahigh-resolution form enabling unlimited process to be performed without further image degradation. This is one of the major benefits of the Digital Lab. Once transferred into digital data, the film images are immune to resolution or detail loss, regardless of the number of processes, effects or layers involved.

#### With quality...

Original film negative is scanned or transferred to data as 2K-resolution 10bit-



log RGB information. This maintains an image data quality higher than an equivalent interpositive struck from the camera original negative, maintaining the full nuance of the original including the negative's full dynamic or density range as well as resolution. This 2K data is transferred as part of the scanning process to the heart of the Digital Lab which is based around Quantel's iQ system. A system that can hold entire movies in digital form and process numerous variants and effects as well as playing back its entire 2K data contents in real-time, on demand. In this way every stage of the digital intermediate process performed within The Digital Lab can be monitored and any necessary adjustments or amendments made. The Digital Lab is also able to work simultaneously with audio, playing back work in process complete with associated sound, further guaranteeing the perfect end result by bringing together elements and processes throughout a production that are usually disjointed until the final viewing.

If a project is being shot on a digital format, such as Sony's 1080p HD-cam, Panasonic's HD 720p or the new Thomson Viper data camera, the full resolution dailies are transferred directly into iQ. With standard HD cameras this is usually via a HD vtr, and with the Viper data camera from an on-set disc recorder such as Director's Friend. It is usual to generate SD video rushes for offline editing, either via vtr or from iQ. However, as iQ is a full editing system it is possible to leapfrog the offline stage and edit the daily rushes directly at full resolution and detail, performing a simultaneous offline/online, allowing creative time for different sequences to be edited and not locked until final mastering, offering effects and colour grading within the edit, viewable to the DoP, editor, director, etc immediately. This flexibility also allows for simultaneous dual edits, for a Director's cut or foreign language version for example.

## **Within the Digital Lab...**

Once the material is held within the Digital Lab, regardless of its origination, it is treated as data and can be manipulated as easily as

standard video, but with the benefit of ultra-high-resolution and detail. Film originated material is held as 2K (2048x1556/1536) 10bit-log RGB information while HD originated material is held in its native form, usually 1920x1080 10bit-lin YUV for Sony HD-cam, 1280x720 10bit-lin YUV for Panasonic cameras and 1920x1080 10bit-log RGB for Thomson's viper. Material can be worked at any frame rate from 23.98fps, through 24fps to 30fps, either in progressive or interlaced forms. The choice of digital HD camera format and frame rates used is one that must be made by the production team based on the project's requirements. The Digital Lab works with all HD formats (and all SD formats too) as well as data generated from film originated material. The source material, not the digital intermediary process, dictates the quality of the final result. The Digital Film Lab can not improve on the quality and resolution of the source, but neither does it degrade the image or lose detail in any way. Using wide dynamic range film based information does provide for additional flexibility during the digital intermediary process. As good as the linear HD cameras are they perform a WYSIWYG operation (What-You-See-Is-What-You-Get) meaning that there is less room for manoeuvre during the digital intermediate process. However, controlled production and lighting can easily overcome these limitations.

For film shot material, the full dynamic range of the negative (nominally 9 to 12 stops of information) is transferred via the film transfer engine into the Digital Lab as log based information, enabling image manipulation identical to that performed within a traditional chemical film lab. From Thomson's Viper data camera its full 8 stops of information is transferred directly into the Digital Lab, enabling a large range of manipulation. But what all this technical specification says is that what ever is thrown at the Digital Lab the results are without compromise.

If required, technical personnel from The Digital Lab are happy to discuss the merits and otherwise of the various capture formats.



## **Anything is possible...**

Within the Digital Lab, the digital negative can be arranged, edited, compared, have optical transitions applied, perform visual effects shots, be graded and manipulated to produce a final conformed and graded digital film, in full. The entire film lab process available as an interactive operation, ensuring exactly the correct final result, with the ability to multi-version output to film, HD video, SD video, AVI and web files, DVD masters, produce a simultaneous 'making-of' special and generate necessary advertising trailers as well as foreign language versions, Director's cut, etc.

## **Creatively...**

Although digital film technology has grown up and matured through the visual effects arena the same technology has evolved to such a point that now not only can heavy special effects shots benefit from the possibilities of digital manipulation. All films, no matter their pedigree or budget constraints, can use The Digital Lab to maximise the end result and guarantee a level of perfection previously unobtainable. Being able to interactively work with full quality images, from the entire project, through selected sequences, down to individual scenes and even to specific frames enables the full creativity of the project to be realised. If a wipe or cross dissolve would work better a few frames longer or shorter, change it. Immediately. And review the result in context, also immediately. If the grading between scenes or sequences is out of balance, a re-grade is a simple real-time process. And through the use of a film colour calibrated grading monitor scene colourimetry can be guaranteed to high levels, ensuring the final film output is as perceived during work within The Digital Lab.

## **With benefits...**

Simple crossfades performed optically via the chemical film process require the generation of a duped result. Once performed, the process must be repeated if changes are required and is often not an option due to the probable need to perform negative cutting to generate a result in the first place.

Offline dissolves are also becoming increasingly complex with 3 layer cross fades one example that are difficult to reproduce in a chemical lab Colour balance between the two shots is also difficult to perform, requiring a compromise in colourimetry during the final grade. Within the Digital Lab such edit transitions are a simple process to perform and even after they have been generated the separate incoming and outgoing shots can be graded fully independently, ensuring the correct balance between the two. Should a change in transition position, duration or style be required, it can be performed immediately. The Digital Lab obtaining any additional frame material automatically, even if a virtual 'neg-cut' had been performed previously. More complex edit transitions can be treated in exactly the same way, with wipes and complex reveals being built, modified and graded exactly as for cut edits and cross dissolves and undone just as easily, without the need to return to the original negative.

With the ability to review an entire project at any time; with temp shots and the original offline included as necessary; with the ability to adjust and modify continually; with direct reference to each and every event and shot as they are included within the final film edit, the end result is guaranteed.

## **Without restriction...**

The Digital Lab enables multi-media imagery to be combined without restriction, enabling 35mm film, 16mm film, HD video, SD video, graphic images and more to be combined at will. It also enables multiple format outputs to be generated simultaneously, with 35mm film, HD video, SD video and even AVI outputs from the same high-resolution project. The production makes the demands, The Digital Lab produces the results.

## **Technically Speaking**

### **Quality from the start...**

Assuming film shot material, the offline edl, if available, is used to transfer selected takes into heart of The Digital Lab -Quantel's iQ- as ultrahigh-resolution data frames. The sys-



tem understands and can cope with any 35mm or 16mm film format, including 3 and 2 perf. as well as any aspect ratio.

However, there are recommendations that are suggested by The Digital Lab to maximise all possibilities, including quality, and these can be found at the end of this document. Please note that these are just suggested recommendations and if for other creative or technical reasons a production chooses alternatives it is unlikely any serious problems will arise. Each prospective project is looked at on a job-by-job basis, following basic guidelines.

Film is scanned at 2048x1556/1536 (2K) resolution 10bit-log or lin RGB in either SMPTE ratified DPX form or Kodak's CIN form and is transferred via a data network directly into iQ for immediate review and appraisal. The frames are scanned at 4fps to maintain maximum quality and through the use of primary grading tools during the transfer process can be pre-balanced to remove unwanted colour biases and maximise the true detail of the image on a frame/scene basis.

Using the metadata headers of the DPX or CIN files source timecode linked to the original film keycode information is also transferred into The Digital Lab as AAF information, enabling frame accurate EDL controlled edits and subsequent changes. If HD video is the source the scenes are transferred directly into The Digital Lab via vtr control, again with accurate timecode information and under the control of an offline edl if available.

### **Fully linked to the offline...**

If the offline edl is to be the basis for the film resolution online all selected takes are loaded into iQ with matching source timecode and the edit autconformed. If for any reason some source material is not immediately available iQ simply inserts a blank clip as a place holder, or can even use the low-resolution offline material, to ensure creative continuity until the correct clip is available.

This ability to use the offline simultaneously with the online is one of the unique capabilities of iQ and The Digital Lab, allowing the

offline to be used as a digital cutting copy and played -split screened- with the full resolution online. Ideal when matching complex edits to the offline, ensuring 100% frame accuracy at all times.

### **Full quality online...**

The power of The Digital Lab and iQ shows in its speed of operation. No other system can playback full resolution 2K digital film files in real-time. This means no working with proxy images, ensuring that each and every process, edit, grade and change performed is the real thing. No chances for later surprises when set-ups performed on a low-resolution preview image are applied to the full-resolution data. Confidence comes as standard with The Digital Lab.

### **Operating interactively with DoP, editor, director, producer...**

Because iQ, which is the heart of The Digital Lab, is an intuitive system to operate the creative talent involved in the production can react interactively with the digital film process, following the digital post-production operation as closely as the previous production. This allows for late decision making, when unexpected things come to light during the online stage.

### **Grading with traditional colour timers...**

Cinecitta's traditional film lab has a wealth of skills at its disposal, and highly qualified colour timers are but one of them. When grading commences within The Digital Lab it is common for a production to use their favourite colour timer to oversee the process. Because The Digital Lab uses film colour balanced display monitors, similar to a traditional timing bench, colour graders are able to direct the grading process using skills honed to perfection in the chemical environment. Sometimes the old ways are best, especially when combined with the best of the new ways.

Grading, as a key part of any film project regardless of acquisition medium, holds a major position within The Digital Lab. By using film colour balanced monitoring, adjustable for final output medium, including



print film stock (e.g. vision or primetime), video for DVD or transmission or D-cinema projection, colour can be guaranteed. But monitoring the look is only part of the process. The tools available to perform the grading are equally important. And through the use of iQ as the heart of The Digital Lab the tools available are impressive indeed. For 'simple' chemical film style grading the iQ has in-built colourimetry controls capable of mastering all requirements: all interactive and real-time. From gain to gamma to printer lights to balance, all can be performed and reviewed immediately, with dynamic keyframe effects applied to enhance the result.

For more complex colour grading iQ can be partnered with one of the industry standard colour correctors such as Pandora's Mega-def or Da Vinci's 2K operating in full 2K data mode, acting as a 'virtual datacine', providing powerful levels of colour control. If your project depends on colour to impart mood and feeling, this is a process that cannot be bettered for creative flair and control.

## **With Sound...**

Sound can equally easily be imported into iQ and The Digital Lab, either as a digital audio stream, from Dat or vtr, or as a digital audio file such as WAV. Linking the audio and image information together allows simultaneous playback, and with 8 channels available full 5.1 surround can be reproduced to enhance the digital intermediate process. Nothing helps decision making better than having all the senses stimulated simultaneously. Popcorn smells on request. And if changes are being made after the audio dub is complete, there is no better way to guarantee continuity.

## **The Final Curtain**

### **To end on a high...**

Once the post-production process is complete, or during if checks and comparisons need to be made, the digital film information is sent via network to the ArriLaser film recorder for writing back onto intermediate 35mm film stock. Calibrated to The

Digital Lab, the ArriLaser exposes each digital film frame in turn, generating a new film master ready for the chemical duplication process.

For digital cinema applications and for tv broadcast use as well as later DVD releases HD and SD vtr copies of the same information can be simultaneously generated, either with or without film colourimetry applied to the video information. For web marketing AVI clips can be generated from the same material. The real benefit is that there is no need to perform a re-grade for video copies, as has to be performed with film produced through the traditional chemical lab process. This ensures the video releases really do match the cinema original, with no quality loss through numerous film dubs and telecine transfers.

## **Until We Meet Again**

### **What goes around...**

The Digital Lab is also a powerful restoration tool, being able to take damaged film material from a variety of sources (negative, intermediate, print, video copies) and generate the best possible restored final and output back to a new negative or digital master.

### **Releases revenue...**

With so much material held in archive around the world, and contact being in demand buy all manner of distribution mediums (cinema, tv, DVD) the call for restoration is growing daily. The Digital Lab uses a combination of automated restoration software and manual tools to generate the best possible result, including audio.

## **The Boring Tech. Bits**

### **The heart...**

The Digital Lab exists as network of systems, all focused on Quantel's impressive iQ digital intermediate system. The iQ has been chosen as no other system can simultaneously hold, process and playback in real-time entire movies at full film resolution. Containing



near 4 terabytes of real-time random access disc storage with enough processing power to perform most functions as speed normally associated with low quality compressed video information, iQ is peerless in its field.

## **The mouth...**

Data ingest is via a Thomson Datacine (Spirit) capable of 2K data scans to The Digital Lab's network at 4fps. With Pandora/Da Vinci controller and grading station numerous options are available from the start. Also available is a Kodak Genesis scanner, although its operation is more suited to specific one-off effects shots rather than full digital intermediate work.

## **The arteries...**

The Digital Film Lab runs an Ethernet network through its building, enabling any frame of digital film information to be directed to where ever is required, as a background task to the primary digital lab functions, preventing wasted time and bottlenecks.

## **The limbs...**

As well as iQ, The Digital Lab has numerous additional tools at its disposal, required for specific functions and processes outside the scope of iQ. These include software packages such as Cineon, Shake, Commotion, Final Cut Pro and Avid Symphony, to name a few. There are also 3D environments available as well as a lot of vtr formats.

## **The bit at the end...**

And when its time to output the results to film the ArriLaser can work 24/7 outputting one full resolution 35mm frame every 4.5 seconds.

## **Workflow description – for the real anoraks...**

The beauty of The Digital Lab set-up is its simplicity. It would be just as viable to have a SAN or complex network environment, but iQ's ability to data i/o as a background task with zero effect on its operational performance means a more simple approach can be used without the usual restrictions. Starting with Spirit Datacine scans, the data files are transferred to the 2Tb of Ciprico

discs via the Phantom Transfer Engine. This is set to scan at 4fps, allowing overhead for simultaneous access to the Ciprico discs for data file retrieval or save via any other system on the network.

The iQ, as the usual first stop for scanned material, starts to load the scanned material as soon as it is ready. This is always while a previous job is being finalised on iQ allowing limited down time. If necessary, as soon as the first frame has transferred to iQ work may begin, while the remaining frames belonging to the clip continue to load. Using a standard 100Mb network (as is used for all network requirements) frame transfer times average sub 1 second per 2K 10bit RGB frame.

Material is immediately assessed at 2K on iQ in real-time and work begins with some sections being transferred to Inferno, Shake, or alternative tools for simultaneous processing. The material may be imported directly from the original scan data, from the Ciprico discs or exported from iQ, again via the Ciprico discs if preliminary work has been performed on iQ.

The Ciprico discs are used as a temporary way point as most other systems cannot blithely import and export without some interference to their primary processing function. Therefore the Ciprico discs act as a buffer between system timescale requirements.

When the secondary parallel processing has completed the clips are placed back on the Ciprico discs for iQ to load and insert into the full project which is always held within iQ, including temporary (offline) shots until the real ones are available. This is possible as AVI, SD, HD and 2K material can be freely mixed within one project, and even used as a split screen cutting copy, with wild abandon. Therefore the whole project can always be available for review regardless of the status of any given shot.

The monitors and digital projector driven from iQ can be fully colour calibrated via user controlled LUTs, for example to match the final film output, ensuring the image being worked on is always accurate to the final output format.

The tool set within iQ is well advanced, especially for digital film lab operations. iQ can freely mix any resolution up to 2K (greater resolutions are possible for the future) and can provide in real-time SD, HD and 2K versions for output, with specific output colour grades applied through the output LUTs for the colour requirements of each version. Internally the usual Paint, DVE,



**Steve Shaw (links) hat das technische Konzept des Digital Lab bei Cinecitta Digital mitentwickelt.**

Colour, Blur, Editing, Tracking, etc tools are supplemented by plugins to enhance the system capabilities.

One of the major operational ideas is the ability to use iQ as a source and destination for Pandora/Da Vinci colour grading, at and resolution supported by the colour corrector, including 2K. This enables iQ to edit full work film projects prior to grading, including compositing, etc, and then be graded, complete with uncommitted edits, so that even after grading changes can be made. This is because the integration of the colour correctors is deeper than simple server control and they have the ability to work with 'tails' and unresolved dissolves and wipes as if the material had never left iQ.

We scan most of our material either in log or in low contrast best-light lin scans to

maintain highlight and lowlight (black) detail entering iQ. We normally use the colour correction tools built into iQ rather than an external Da Vinci/Pandora as the extra cost seem unnecessary for most clients. Using these tools we then grade as if we were working from the telecine direct (using

10bit RGB information), editing as we go, often matching to an offline cutting copy (low-res Avid) after having used an edit to initiate the edit.

At any time we may send shots to other equipment for parallel processing and are always exporting something to the Ciprico discs for output to the ArriLaser.

When we are not scanning data via Spirit we use the Phantom Transfer Engine Octane for s/w based restoration. As this is a growing requirement we are looking to expand this into a dedicated operation and are in the process of assessing Da Vinci's Revival tools for the job.

When work is complete and has been signed off on iQ the material is output. Usually to the ArriLaser with SD and/or HD copies also be produced from the same material. We have even been known to supply AVI outputs direct from iQ for web use.

We also used the same workflow for DVD pre-mastering. The workflow here is to scan HD data files (but 4x3 10bit RGB) and not drop to true HD until the final output to tape. The clients then use this HD master to generate the DVDs locally.

Interestingly, we have limited HD equipment other than VTRs as we do all work above SD in data. This way we can work RGB uncompressed and are not restricted to the 16:9 aspect ratio until the HD tape master is made. Great flexibility this way.

The local raid storage attached to iQ is simply for short term backup. Usually after a job is finished in case problems are found shortly after delivery. We can backup to tape but this is slow so we provide short term disc backup. This raid is on a Gig link for speed as you cannot access this local network at the same time as the main 100Mb network.

## Technical Suggestions

### For shooting...

There are little in the way of technical requirements for The Digital Lab as the realities that have held true for years with traditional film techniques still hold true for the digital intermediate world.



Quality comes from the beginning and shooting on the highest quality format available ensures any compromises made are minimal. Obviously creative considerations come first, and if a production style demands grainy, less stable imagery to put across the emotion of the story then that consideration outweighs technical quality. But creativity aside, there are some simple rules-of-thumb to follow for best quality:

- For effects based projects, especially those using invisible effects to enhance a story-line, such as period drama, compression, especially as part of HD shooting, is to be avoided. The compression process introduced low-level artefacts that while not obvious to the naked eye under normal viewing conditions become obvious when performing effects work such as chroma keying and possible during grading if large changes are involved.
- Full bandwidth RGB image information (4:4:4 or 8:8:8) is preferable to half chroma bandwidth YUV (4:2:2 or even worse) for similar reasons given above.
- The availability of a large dynamic range is always desirable to maximise the grading process. And as the grading process is at the heart of any film project, chemical or digital, its importance is difficult to over stress. Film has the widest dynamic range available (a possible 9 to 12 stops) with the Thomson Viper data camera having an equally impres-

sive range (a nominal 8 stops) with standard video HD cameras all being WYSIWYG to standard tv monitor viewable dynamic ranges (a nominal 5 stops).

It should be noted that careful set-up of standard HD cameras can enhance their dynamic range, by changing the camera's knee point. Refer to the camera manufacturer for further information after discussing the technique with The Digital Lab.

## The benefits...

With a large dynamic range the grading process can shift colour, contrast, gamma and brightness without fear of producing clipping or crushing. In the chemical film domain this is assisted by film natural transfer characteristics that produce a 'soft-start' and 'roll-off' to density information. Film's D-log-E curve. Video cameras use CCD technology that is inherently linear in its response, causing the familiar white clipping and black crushing associated with video images. However, the use of a wide dynamic range camera, such as the Thomson Viper data camera, enables 'soft-start' and 'roll-off' to be added as part of the digital intermediate process; either electronically for final output back to a digital format or as part of the process of being written back to celluloid film.

