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Building the DI Theater

Innovation is Relentless, and Margins for Error Non-Existent, in the High-End DI World

By Ed Heede
March 29, 2007 Source: Film & Video

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After the first film created with a full digital intermediate (DI) — *O Brother, Where Art Thou?* — debuted in 2000, the DI was an exclusive process, lavished only on the kind of Hollywood studio projects that demanded high-end finishing. As tools improved, and as filmmakers saw the kind of creative control that was possible, the DI spawned a new culture, changing cinema production as well as post. Creative decisions up and down the filmmaking pipeline began to be influenced by the technology and art of the DI, which has become the most flexible of final online tools. Along with digital cinematography, the DI is a watershed marking a transformation of old-line studio production that's also moving well into indie film culture.

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Santa Monica's FilmworksFX/Digital Film Lab knew that a DI theater would fit well into its existing film pipeline, which included acquisition, a film lab, high-end CGI, telecine and editorial as well as film scanning and recording. When owner and CEO Ken Locsmandi found a suitable site at an older Warner Brothers Studios/Hanna-Barbera screening theater — a bit larger than 20 by 27 feet and equipped with two 35mm projectors — the hands-on challenge was in adapting the space to meet the demands of a complete digital workflow. It wouldn't be a simple task, but getting it right would be essential to ensure the kind of results filmmakers would demand.

There were three major factors to consider for theatrical DI:

- A location central to the industry (in this case, Universal City) with a comfortable and effective DI presentation space. This is about hands-on digital projection as well as 35mm for A/B comparisons.
- A design that blends science and art. The DI theater is about space as filmmaking workflow. It is the practical arena where all incoming streams of the film process merge. Site planning is vital.
- Choosing technology for DI is crucial. Hardware and software must be state-of-the-art, durable and reliable. The DI stage is mission-critical and often time-critical, with film festivals and theatrical distribution all hinging on the process.

Choosing a Projector

First, FilmworksFX/DFL needed to qualify a digital projector of high enough quality for film work — ideally, the same class of projector used for digital theatrical exhibition. There are many reasons why Texas Instruments' DLP Cinema technology is used across the board for digital cinema projectors from Christie, Barco, Digital Projection, NEC and other brands, but chief among them is how closely TI matched the color space and dynamics of 35mm film through proprietary 15-bit internal DMDs (Digital Micro-Mirror Devices) designed for projected output at a 2000-to-1 contrast ratio at 12-bit color output. Good engineering is also mandatory. FilmworksFX/DFL considered only one candidate among the many TI-powered projectors viable: the NEC NC800C.

Aside from being one of the latest TI 12-bit DCI (Digital Cinema Initiative) projectors capable of delivering 2K film resolution, the NC800C's small footprint and light weight (150 lbs) made it the most practical option for the intimate theater. Also on the feature list were Lamp Memory and Lens Memory features that allow for calibration stability — meaning far fewer color calibrations are needed — and easy transitions via a motorized zoom lens from flat [1.85:1] to scope [2.39:1] aspect ratios. But the real decision was made on picture integrity: dynamic-range performance that was crisp down to deep blacks and brilliant whites across an expanded 12-bit color-depth spectrum. "The DLP image surpassed our 35mm theater projectors for visual clarity," said Locsmandi. A sturdy stand was built to accommodate the unit with its lens assembly.

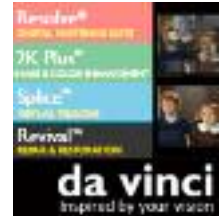
Pipeline, Process and Tools

Upon installation, the NEC NC800C unit was calibrated to a REC 709 spec look-up table (LUT) by way of an NEC software UI for the characteristics of the room. Calibration was done with a spectrometer.

Locsmandi outlined a process for global calibration of the DI theater. First, NEC calibrated the room to a REC 709 specification. The display devices were measured using the Gretag Mactheth Eye-One Beamer and Rising Sun Research (RSR) cineSpace software. The process yielded a profile for each display, the projection unit, and the LCD screen used for the Assimilate Scratch interface.

The print film was sent to RSR, which wrote a profile for that film stock. Combined with the display profiles, it was used to create a film LUT. RSR then re-wrote the film profile to conform to REC 709. "Now we had two LUTs: a true film LUT as well as a REC 709 LUT," Locsmandi explains. "Displayed through the NEC projector, both LUTs look identical in color. We color-grade using the film LUT and verify the color using the REC 709 LUT. This ensures what you see is what you get from the projector, while still getting the full range of film color and density."

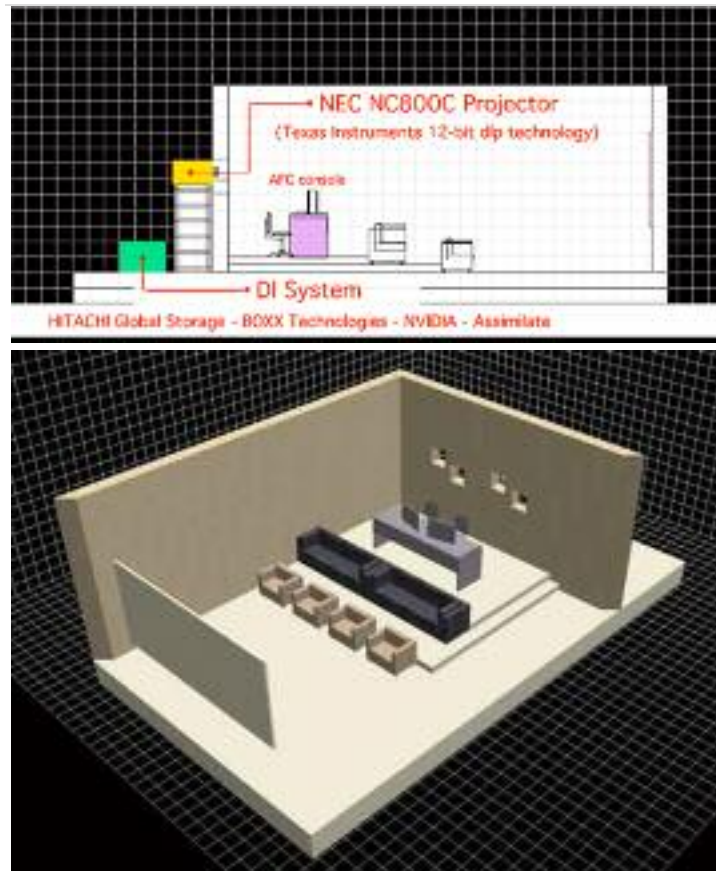
With the visual hardware linchpin of the DI room installed, the next step was incorporating DI software. FilmworksFX/DFL had already begun indie software DI work with Assimilate and RSR some months back. More recent work was done in collaboration with Nvidia through Hitachi Global Storage. A new BOXX Technologies solution that tied the system together with



color-calibration technology from RSR was also essential. All this made for bottom-line hardware and software for tuned delivery of 2K real-time film color correction, dust-busting and film pipeline management from film-in to film-out.

These technology choices were made based on the fact that each company offered reliable, proven technology that happened to be open, modular and freely accessed. These are significant issues because, historically, DI had been dominated by companies that called for elaborate and closed "magic box" high-maintenance systems. While such closed systems met high-end standards for quality, they were usually dependent on a crew of costly specialists to maintain. This was a deal-breaker when it came to Locsmandi's vision of a more light and agile theater. Broadly speaking, the task at hand was to square and engineer the NEC NC800C to the room as well as to the Hitachi/NVIDIA/Assimilate/BOXX Technologies/RSR systems for a well-integrated DI theater. On the heels of that effort, the issue would be to make sure the DI theater fit well into the existing film pipeline at FilmworksFX/DFL. No small feat.

The issues are complicated by the fact that all technology feeding into a DI pipeline is constantly being enhanced and upgraded. In what Hitachi describes as an industrial first, Global Storage hardware is coming online at terabyte size in a new Hitachi TB enterprise version. The new TB line enables real-time 2K DI from a central BOXX DI system networked to wider SAN and NAS solutions for rapid access to film data across visual effects, dust-busting and other operations. (Overall storage needs are likely to swell exponentially as post facilities go from telecine to full datacine and data-centric workflows.) FilmworksFX/DFL is relying on continued innovations from BOXX Technologies, which integrates its core DI solution with technology partners including Nvidia and Hitachi and I/O card makers such as AJA, Blackmagic Design, Bluefish444 and DVS. Likewise, software from RSR for system-wide color-calibration is constantly being advanced and refined, as is Assimilate's Scratch DI software.

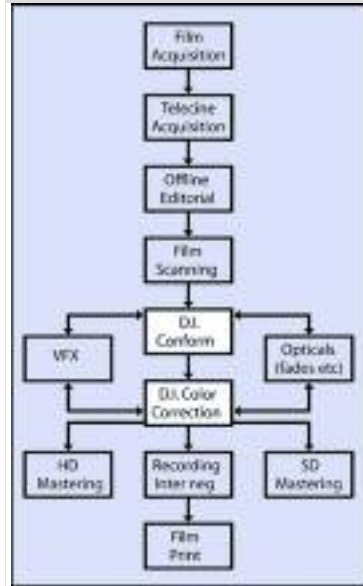


CAD perspectives on the FilmworksFX/DFL DI theater.

In the end, even items as ordinary-seeming as furniture take on great importance. This is particularly true of a DI console control desk, which will be manned by a variety of artists ranging from colorists to VFX artists and more. The decision here was to opt for a two-tier AFC Industries rig built from industrial-grade metal. Both tier levels are electronically height-adaptable via independent control switches for each, compensating for even large differences in height and reach for any given artist. Essential calibration desk screens, such as the Cine-tal Cinemage monitor, may be tucked down by foldaway and telescoping monitor arms. With a bit of Dolby Surround, carpet work, and some lighting over a number of cozy leather sofas and chairs, the FilmworksFX/DFL DI theater went from concept to reality.

Any DI theater has to be about satisfying client producers, directors and cinematographers. But as in most production environments, that goal can only be realized if the artist driving the process is able to work unfettered and to peak ability, with tools that deliver. As Locsmandi put it, "DI has clearly expanded the ability of the filmmaker to use color as story and to help guide the audience through that story. Our challenge was in the design of a DI

theatre to best serve the filmmaker's craft."



An overview of a standard DI workflow.

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