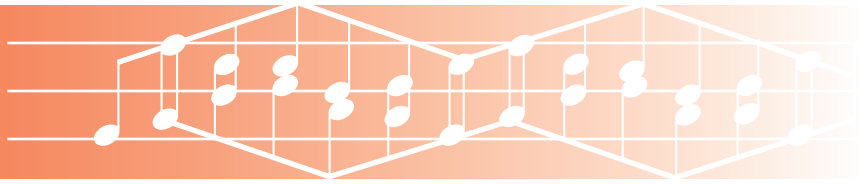


Sound



## Committed to Cyan

### Analog Dye Soundtracks Find Wider Acceptance

By Joe Hull  
Dolby Laboratories

The ShoWest convention in Las Vegas in March 2004 proved a milestone in the history of motion-picture soundtrack technology. It was at this show that MGM announced they would switch to cyan-dye analog tracks on all U.S. releases beginning in late May 2004, and Buena Vista announced that by January 2005 all Walt Disney and Touchstone titles worldwide would be released exclusively with cyan tracks.

These first across-the-board commitments are the culmination of a revolution in soundtrack technology that was a long time coming. In spite of all the many advances in film production and exhibition over the years, the silver-applied analog soundtrack on release prints had remained essentially unchanged for more than 50 years. And for all that time, many in the industry were unhappy with it.

Silver-applied soundtracks require toxic redeveloper solutions that use 10 chemicals on the EPA watch list. As much water is used in the print-washing process as would serve the drinking water needs of a city of 100,000. Soundtrack application errors are a major cause of print rejection. Their silver content complicates the disposal of the more than 10 billion feet of used film stock annually. All in all, this old technology had become ever more costly, in environmental impact as well as in dollars and cents.

Why is it that in spite of so many drawbacks, the silver-applied soundtrack is only now facing much-deserved extinction? The use of silver goes back to the 1930s, when color film was introduced, and it was dis-

covered that optical soundtracks based purely on color dyes wouldn't work. The problem was that tungsten exciter lamps emit considerable infrared energy as well as visible light. While a dye track could block visible light, infrared passed right through the visibly opaque area to the photocell. As photocells are sensitive to infrared, they couldn't "see" a clearly defined soundtrack, even though to the eye a varying-width track was clearly visible. The result was little or no sound.

The solution was to apply a layer of silver to the soundtrack area of the color film. Since silver blocks infrared light, the photocell would respond to the varying amount of infrared light making it through the clear, varying-width soundtrack. The solution worked well, at least with respect to audio performance. Print manufacturing, however, was another matter, as we have seen.

### RED LIGHT GETS THE GREEN LIGHT

Anticipating environmental legislation that might affect the film industry in the future, John Pytlak of Kodak approached Ioan Allen of Dolby Laboratories in the early 1990s. He thought there might be an electronic solution, and that Dolby's soundtrack expertise could help find it. He was mostly right on both counts, but neither Pytlak nor Allen anticipated the scale of the task they were starting.

Dolby engineers Paul Goldberg and Marty Richards realized that reading a dye soundtrack would require a new light source, one that, unlike a tungsten lamp, would emit little or no infrared. They began investigating LED technology, which in the early 1990s was moving forward swiftly, partly in response to the automotive industry's interest in longer-lasting alternatives to incandescent taillights. The high-output red LEDs that were becoming available proved to be the solution.

The advantage of red LEDs is that they put out a single color, and nothing else, especially no infrared. The Dolby team confirmed that their

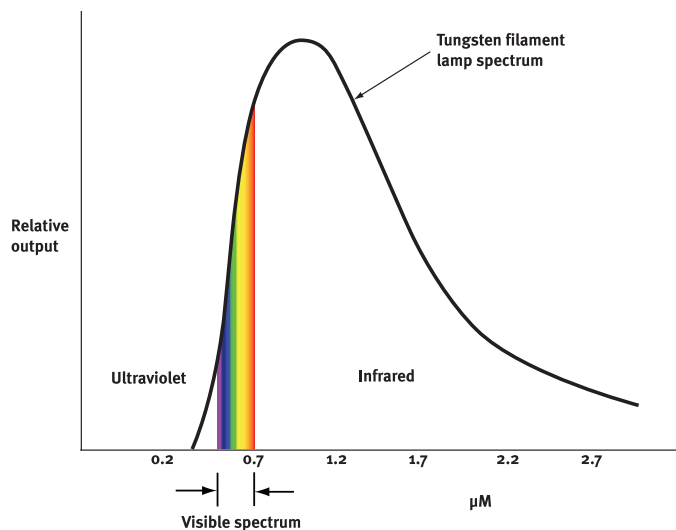


FIG. 1: MOST OF THE ENERGY FROM A CONVENTIONAL FILAMENT LAMP COMES FROM THE INFRARED.

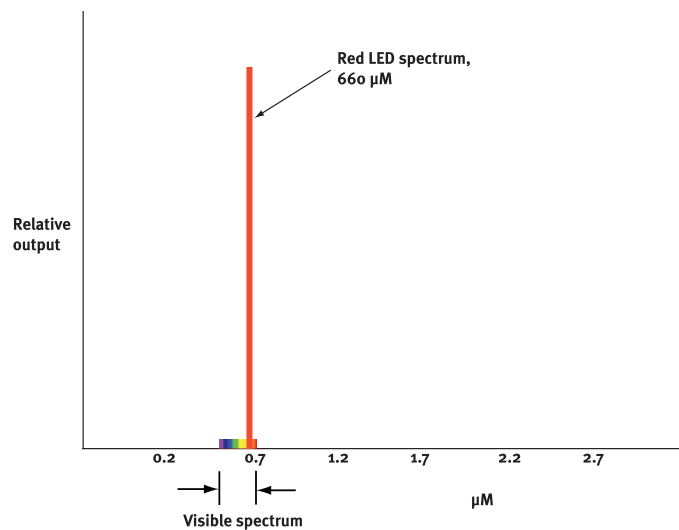


FIG. 2: ALMOST ALL THE ENERGY FROM AN LED COMES AT A SINGLE FREQUENCY.

output would be completely blocked by the color cyan, red's spectral opposite. In other words, the opaque area of a cyan-dye optical soundtrack blocks the output of a red LED light source as effectively as a silver-applied track blocks the output of a conventional exciter lamp. (See Figures 1 and 2.) Substituting red LEDs for conventional tungsten exciter lamps would have further benefits as well. Tungsten white lights have a filament which can suddenly fail, even in the middle of a show. In contrast, an LED has a longer life and a gradual aging process that provides ample warning when replacement is needed. The research led to a U.S. patent on the combination of a red-light reader in conjunction with a cyan-dye track, which Dolby decided to donate to the industry to encourage adoption of the new technology. (See Figure 3.)

After discussions among Dolby, Kodak and Technicolor, other industry leaders joined in. The result was the formation in 1998 of the Dye Track Committee ([www.dyetracks.org](http://www.dyetracks.org)) that today includes motion picture distributors, exhibitors, film stock manufacturers and film laboratories, all dedicated to replacing silver-applied analog 35mm soundtracks with pure cyan-dye tracks. That year also saw the beginning of extensive testing, spearheaded by Dolby, Kodak, Fuji, Agfa, Technicolor and Deluxe.

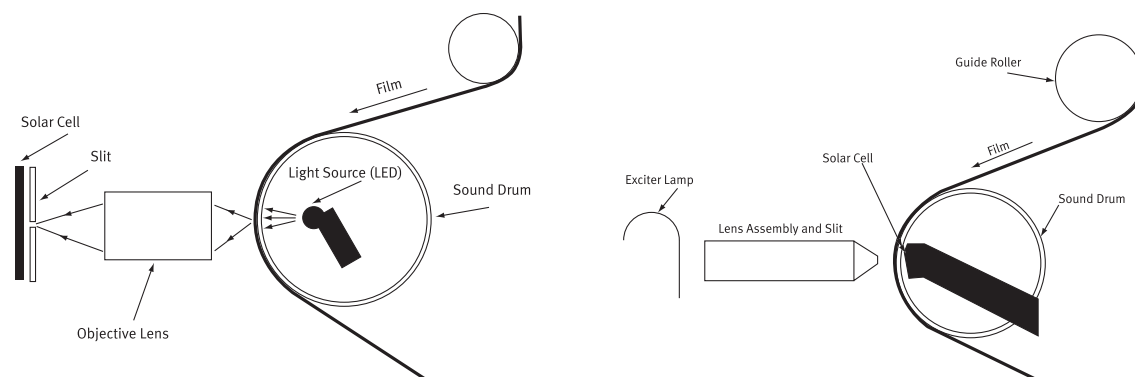


FIG. 4: FORWARD-SCAN SOUNDHEAD CONFIGURATION AND (RIGHT) REVERSE-SCAN SOUNDHEAD CONFIGURATION.

### A NEW SCANNING METHOD

Research also showed that the new LED light source provided the opportunity to develop new soundheads with a reverse-scan configuration, rather than the conventional forward-scan system, providing better sound in addition to the dye track's other practical benefits.

Installing an LED array in a reverse-scan configuration requires no critical alignment, because light is focused onto the solar cell after it passes through the soundtrack, rather than being focused directly from the light source onto the film as with forward scan. As a result, with reverse scan the distance between the light source and the film is nowhere near as critical. Moreover, the soundtrack is more evenly illuminated across its full width, resulting in lower distortion and better response on high-level, high-frequency content.

In addition, light from the left and right tracks is more tightly confined to the respective solar cell elements, resulting in improved stereo separation. As a lower-cost alternative, the tungsten lamp in some forward-scan soundheads can be replaced with a single red light to read cyan tracks acceptably, but without the benefits of reverse scan. (See Figure 4.)

Dolby worked closely with several projector and soundhead accessory manufacturers as they developed new reverse-scan soundheads and red-light readers, and continues to be a supplier of red LED arrays to the manufacturers. (Dolby does not make the scanners themselves.) New scanning methods incorporating red lasers that can read cyan tracks have also been developed in recent years.

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### MILESTONES ALONG THE WAY

The first major test of release prints with cyan tracks in actual exhibition took place in March 2001, when a limited number of prints of the Miramax film *Get Over It*, specially manufactured by Deluxe Laboratories with pure cyan-dye tracks, were shown in selected cinemas equipped with red-light readers. A similar test was conducted later that year with cyan prints of the Miramax film *Jay and Silent Bob Strike Back*. (The Dye Track Committee acknowledged the support of Roni Olivarez and Brad Rohrer of Miramax in these early tests). With both releases, the prints with cyan tracks performed perfectly in day-in/day-out exhibition, and showed no unusual wear patterns or other side effects upon examination after many plays. In fact, the only tradeoff of cyan tracks is a slightly higher noise level, which has proved to be of no practical significance given the wide dynamic range imparted to analog soundtracks by the Dolby SR process.

The next key event occurred in May 2002 when the board of NATO, in great part due to efforts of Mary Ann Grasso (Anderson) and John Fithian, recommended that all member theatres be equipped with red readers by July 2003. Obviously, it takes time to convert an entire industry, but in 2002 virtually all new projector models were equipped with

red readers as standard, and by September 2003 the majority of projectors in U.S. theatres were equipped. After discussions with Ioan Allen and Ted Costas of Dolby Laboratories, this was sufficient for DreamWorks' Mark Christiansen and Marty Cohen to release the first film with cyan analog soundtracks on all 1,200 prints, the Woody Allen comedy *Anything Else*. DreamWorks made sure that cinema owners were aware of the decision, so

they would play the prints only on red-light-equipped projectors. The successful release of *Anything Else*, combined with the ever-increasing number of equipped projectors, paved the way for Bruce Markoe and Chris Aronson of MGM and Jeff Miller and Chuck Viane of Disney to announce their commitments to the cyan track.

### ANALOG SOUND IN THE DIGITAL AGE

Internationally, the dye soundtrack is also gaining momentum, as Disney's commitment to use the new technology worldwide attests. Theatres are equipping with red-light readers at an accelerating pace, much as happened in the U.S. Laboratories in particular, in both Europe and Asia, are enthusiastic about the environmental and economic benefits of the cyan track. This is a prime example of how different sections of the industry can come together for the greater good. Ioan Allen is convener of the Dye Track Committee in the U.S., a group comprised of theatre operators, the studios, stock manufacturers and the laboratories. He gives full credit to the participation of Kodak, Agfa and Fuji, along with Technicolor and Deluxe, in the dye track program. Additionally, mention should be made of the efforts of Ted Costas, who, as president of the InterSociety committee, has also been instrumental in the project.

It is likely that in the foreseeable future digital cinema will have a big impact on the film-based motion picture industry. In the meantime, the analog soundtrack remains a vital necessity throughout the world, backing up the digital tracks on 35mm release prints and providing excellent sound in smaller theatres. It will be with us for years to come, and the conversion to dye technology is both good for business and for the environment. **FJI**