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Laboratory Guide

April 15, 1999

Version 1.0

Dye Sound Tracks: A Laboratory Guide

Professional Motion Imaging

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Introduction

For many years the technical community of the motion picture industry has been searching for and evaluating methods of implementing "dye-only" analog soundtracks into release prints. The use of "dye-only" analog soundtracks would eliminate the need for soundtrack redevelopment, which is the historical means of reintroducing a variable silver image into analog soundtracks printed on color positive stock. The development and deployment of red L.E.D. (**l**ight **e**mitting **d**iode) sound track readers has now made it possible to chart an implementation path which can make this long awaited advancement a reality.

Industry Benefits of Silverless Soundtracks

The following list summarizes many of the reasons for moving the industry towards the elimination of the need to redevelop silver soundtracks for color positive prints. In addition to the general desire for insuring the future viability of the current film production/distribution/exhibition system, it is apparent that there are numerous benefits to be realized at the processing laboratory.

- **Reduced Waste**: Elimination of the need for replacement prints due to application errors
- **Safety**: Elimination of caustic and toxic soundtrack redeveloper solution
- **Environmental**: Reduced water and chemical usage; simplified disposal of used prints; need for a planned, orderly optimization of product/process should future environmental regulations preclude the use of silver soundtracks; indication that the industry is "environmentally conscious"
- **Film/Process**: Reduced complexity of the positive developing process; potential for simpler/improved film technology
- **Exhibition:** Much longer life of illuminating source; increased stereo separation

Technology Path Forward

Recently, the availability of high intensity LED arrays has led to the development of a new generation of exciter lamps for projector sound heads. These developments, combined with the laboratory and environmental concerns outlined in the previous section, have led participants in the motion picture industry to readdress the question of converting from applicated silver plus dye sound tracks to dye-only sound tracks. An informal industry group, the Dye Track Committee, was formed and has held a series of meetings aimed at promoting the transition of the motion picture industry to dye sound tracks. Original committee members included representatives of Dolby, Eastman Kodak, and Technicolor. Representatives of Deluxe, CFI, Foto-Kem, Fuji, and Ultrastereo have since joined the program. This committee has recommended a three-step conversion process:

1. Conversion of laboratory standard practice to the high-magenta print format
2. Near 100% conversion of theaters to red readers
3. Conversion of laboratory standard practice to non-applicated, dye-only prints

Step 1. Convert laboratories to high-magenta prints

High magenta prints are silver plus dye prints that have been made with filtration in the printer that puts most of the sound track image in the magenta dye layer. The advantage of this format is that it provides a single type of analog sound track that can be played, with low levels of sibilant (cross-modulation) distortion, on either standard IR sound readers, or the new red-light readers. It is thus a useful transition format. All laboratories are encouraged to convert to this format at their earliest convenience. More data on printer filtration and aim print densities are provided below. High-magenta prints continue to require sound track application.

Step 2. Convert theaters to red readers

According to the original three-step plan, once the laboratory conversion to the high magenta format began, theaters were to be encouraged to convert their sound readers to the new red-reader systems. During this transition stage, there would be some theaters that have converted and some that have not, but all would be able to obtain good sound quality from the high-magenta prints being produced by the laboratories. It has actually turned out that many theaters (30,000+ worldwide) have already converted to red readers. Therefore, timely laboratory conversion to the high-magenta print format is necessary to insure good sound quality in the theaters.

Since laboratories may have in-house projectors that will need to be converted to red readers, the following are some companies that manufacture and sell red-reader conversion kits for projectors:

- Dolby Laboratories, 100 Potrero Avenue, San Francisco, CA 94103-4813, Phone (415) 558-0200, Fax: 415-863-1373, e-mail: info@dolby.com
- Jaxlight, manufactured by USL Inc., 181 Bonetti Dr., San Luis Obispo CA 93401 USA, (805) 549-0161, fax (805) 549-0163, e-mail: usl@uslinc.com, http://www.uslinc.com.
- Component Engineering, 4237 24th Avenue West, Seattle Washington 98199-1214, Phone: (206)284-9171 Fax: (206)286-4462, e-mail: blong@componentengineering.com, http://www.componentengineering.com
- Kelmar, 284 Broadway, Huntington Station, NY, NY 11746 (516) 421-1230, http://www.kelmarsystems.com/
- Entertainment Equipment, 712 Main Street, Buffalo, NY, USA 14202, Phone: (716) 855-2162, Fax:(716) 852-4330, e-mail: entequip@aol.com, http://www.entequip.com/
- Christie, Inc., 10550 Camden Drive, Cypress, CA 90630, Phone: (714) 229-8610, Fax: (714) 229-3185
- Cinemeccanica U.S. Inc., 8753 Lion Street, Rancho Cucamonga, CA 91730, Phone: (909) 481-5842, Fax: (909) 481-5845
- Ernamann Cine Tec GmbH, D-24100, Kiel, Germany, Phone: +49-4 31-30-19-250, Fax: +49-4 31-3- 19-604, e-mail: cinema@raykiel.com, contact: Franz Kober
- Kinoton (US), Boston Light and Sound, Inc., 290 North Beacon Street, Boston, MA 02135, phone: (617) 787-3131, fax: (617) 787-4257, e-mail: kinoton@blsi.com, http://www.kinoton.com
- Kinoton GMBH, Industriestraße 20a, D-82110 Germering bei München, Germany, Phone: 49 0 89 / 8 94 44 6-0, Fax: 49 0 89 / 8 40 20 02, e-mail: sales@kinoton.de, http://kinoton.de
- Prevost SRL, Via Permi 8. Settimo Milanese. 220019, Prevost Paolo, ITALY, Phone: 39.02.3287660, Fax: 39.02.33502150
- Sondor Willy Hüngerbuhler AG, Gewerbezentrum, CH-8702, Zollikon B., Zürich, Switzerland, phone +41 1 391 31 22, fax: +41 1 391 84 52, e-mail: info@sondor.ch, http://www.sondor.ch/

Step 3. Convert laboratories to dye prints

The third and final step in the conversion is for laboratories to convert to dye only prints. It has been suggested that this could take place when at least 90% of the theaters in a distribution region have converted to red readers. However, the actual conversion will take place when distributors are confident that their film can be played in high quality in a sufficiently large number of theaters. Once this point is reached, the industry as a whole can reap the benefits of dye-only soundtracks.

(Note that this conversion from applicated silver soundtracks to non-applicated dye soundtracks applies to analog variable area sound tracks only. The three prominent digital sound systems can and do accommodate dye only images for their digital sound or control data.)

Laboratory Guidelines

High-Magenta Prints

When printing high-magenta prints, change the printing filters to:

- KODAK WRATTEN Gelatin Filter No.12, plus KODAK Color Compensating Filter 110 Cyan (Note: some "ND" filtration may also be needed for optimization.)

  Or

- Green dichroic filter (500 nm to 600 nm bandpass)

Print Film	Optimum Negative Density	Optimum Print Density Aims
EASTMAN EXR Color Print Film 2386	Determine with the Cross-Modulation Test	When using gelatin filters: IR (800 nm) Between 0.8 and 1.1 * Red: Between 2.0 and 2.2 ** Green: Between 3.6 and 4.0 ** Blue: Between 1.3 and 1.6 ** When using dichroic filter: IR (800 nm) Between 0.8 and 1.1 * Red: Between 0.8 and 1.0 ** Green: Between 3.6 and 4.0 ** Blue: Between 0.9 and 1.1 **
KODAK VISION Color Print Film 2383	Determine with the Cross-Modulation Test	When using gelatin filters: IR (800 nm) Between 0.8 and 1.1 * Red: Between 2.0 and 2.2 ** Green: Between 3.6 and 4.0 ** Blue: Between 1.3 and 1.6 ** When using dichroic filter: IR (800 nm) Between 0.8 and 1.1 * Red: Between 0.9 and 1.1 ** Green: Between 3.6 and 4.0 ** Blue: Between 1.0 and 1.2 **
KODAK VISION Premier Color Print Film 2393	Determine with the Cross-Modulation Test	When using gelatin filters: IR (800 nm) Between 0.8 and 1.1 * Red: Between 2.0 and 2.2 ** Green: Between 3.6 and 4.0 ** Blue: Between 1.3 and 1.6 ** When using dichroic filter: IR (800 nm) Between 0.8 and 1.1 * Red: Between 1.1 and 1.3 ** Green: Between 3.6 and 4.0 ** Blue: Between 1.2 and 1.4 **

* The IR density should be the primary quality control parameter

** Adjust the filter pack (if using gelatin filters) to obtain these red, green and blue status A densities. Once a filter pack is found that produces densities in this range, the IR density can be used as the primary quality control parameter.

This silver plus magenta dye sound track can be read by both an IR reader and a red reader, with about the same cross-modulation distortion. However, use the red reader for final cross modulation tests.

Future conversion to Dye Sound Tracks

The following are tentative recommendations on printing cyan-dye sound tracks. As the time approaches for industry conversion, the data sheets for the print films will be updated with dye soundtrack printing recommendations.

When printing cyan dye prints, change the printing filters to:

- Red dichroic filter (600 nm high pass)

  Or

- KODAK WRATTEN Gelatin Filter No. 29 (Note: Some "ND" filtration may also be needed for optimization.)

Do ***not*** applicate with soundtrack redeveloper solution.

Print Film	Optimum Negative Density	Optimum Print Density Aims	
EASTMAN EXR Color Print Film 2386	Determine with the Cross-Modulation Test	Red: Green: Blue:	Between 2.0 and 2.2 * Between 0.2 and 0.4 ** Between 0.2 and 0.4 **
KODAK VISION Color Print Film 2383	Determine with the Cross-Modulation Test	Red: Green: Blue:	Between 2.0 and 2.2 * Between 0.2 and 0.4 ** Between 0.2 and 0.4 **
KODAK VISION Premier Color Print Film 2393	Determine with the Cross-Modulation Test	Red: Green: Blue:	Between 2.0 and 2.2 * Between 0.2 and 0.4 ** Between 0.2 and 0.4 **

* The Red status A density should be the primary quality control parameter

** Adjust the filter pack (if using gelatin filters) to obtain these green and blue status A densities. Once a filter pack is found that produces densities in this range, use the red density as the primary quality control parameter.

Use a red reader to play sound tracks.

Use cross-modulation test to determine negative density.

Order Dichroic Filters from:

OCLI (Optical Coating Laboratory, Inc)

US: Santa Rosa, CA 95405, phone: 707 538-2661, fax: 707 538-9539

SOUTHEAST ASIA: Singapore 238873, phone: 011 65 334-7027, fax: 011 65 732-0292

FRANCE, Courtaboeuf Cedex, France, phone: 011 33 1 6907-0761, fax: 011 33 1 6907-6958

ITALY: Milan, Italy, phone: 011 39 2 269-50227, fax: 011 39 2 213-9951

SPAIN: Madrid, Spain, phone: 011 34 91 565-0528, fax: 011 34 91 565-1783

Part Numbers

Green filter: OCLI Additive Green Dichroic Filter

Red filter: OCLI Additive Red Dichroic Filter

See http://www.ocli.com and http://www.ocli.com/about10.htm

Soundtrack Negative Densities

Although no specific recommendations have been offered with regard to soundtrack negative density, the optimum negative density will typically be higher for both the high magenta and cyan dye formats than for traditional silver plus dye prints. As always, optimum negative density should be determined using the cross-modulation test.

16-mm Prints

We've had no discussions with manufacturers of 16-mm projectors. We do believe, however, that 16-mm projectors are probably more difficult to convert to red readers that 35-mm sound tracks. We do not recommend moving to cyan dye sound tracks for 16-mm at this time. High Magenta prints are probably ok, but have not been tested.

Sound Quality

High magenta tracks have the same frequency response and SNR as standard silver tracks. Cyan dye tracks played on red readers have much better SNR than when played on standard IR readers. However, cyan dye tracks played on red readers have about 2dB lower SNR than silver tracks on red readers. Thus Dolby recommends the use of Dolby SR noise reduction, which will eliminate the noted 2 dB lower SNR.

For More Information:

Region	Contact	Phone	E-mail
Hollywood Region (California, Oregon and Washington)	Alan Masson	(323) 468-1517 Fax: (323) 468-1568 or: (323) 468-2124	amasson@kodak.com
Americas Region (US outside of Hollywood Region, Canada, Latin America)	Megan O'Malley	(212) 631-3458 FAX (212) 631-2662	momalley@kodak.com
Europe, Africa, Asia	Jean-Pierre Vitton	33 (0)3 85 43 7158 Fax: 33 (0)3 85 43 7404	vitton@kodak.com
Asian Pacific Region	Yin Onn Chee	61 3 03 9353 3023 Fax: 61 3 03 9353 3543	yochee@kodak.com

Revision History

Date	Revision	Description	Author
04/15/1999	1	Initial Version	Ricotta and Uhlig