

Screen Brightness Measurement

Correspondence and presentations so far.

List of interested persons

Jerry Pierce Independant

Rod Bogart Pixar

Kevin Wines Independant

Dave Schnuelle Dolby

Harry Mathius Independant

Matt Cowan Real-D

Rafael Adame Panavision

Andrew Robinson Harkness

Max Bell Bell Theatre Services

Martin Parsons Independant

Outline

It is proposed that a simple but accepted by all process be defined for measuring the Brightness of 3D systems. Partly to make a system comparison to assess any particular systems suitability to a particular Cinema Auditorium and partly to assess long term operational costs.

Some systems use white screens and some systems use silver screens, light output and directionality are affected by the screen choice and it is necessary when carrying out a site survey to ascertain which kind of screen is most appropriate for the physical installation.

Peter Wilson

-----Original Message-----

From: Peter Wilson [mailto:peter.wilson@hddc.co.uk]

Sent: 09 February 2010 11:52

To: Max Bell

Subject: 3D Brightness

Hi Max,

I have been planning an EDCF guide to 3D exhibition for some time.

It has been somewhat slowed down by the competition between the 3D solutions vendors.

The sensitive issue is brightness claims with all the vendors making claims and discounting their competitors claims.

My approach to this is to make an independent measurement process which would allow exhibitors to set up their own tests with an "expert" and decide for themselves.

Then the vendors can write sections for the guide but not make claims as the guides are essentially factual documents not marketing docs.

Are you interested in participating in this?

I have buy in from Pixar, Harkness and Martin Parsons is interested in assisting and writing it up.

Best Regards,
Peter

Max Bell

Mildly Edited

Hi Peter,

Yes I am very interested. I am on an ISO committee that is supposed to be making a standard out of this mess. We had thought that everything was coming together with a general consensus of 4.5-5 fl max through the eyepiece. However this all fell apart due to Avatar. Now its being suggested that we should be 6 and above.

Lightstorm, James Cameron's company, they wanted 10fl and proposed this would be mandatory if you wanted to show the film!

In the end they decided to release the film in 4 different grades; 3.5, 5, 7,5 & 10 ftl. These were to be distributed according to what each cinema could attain and each cinema was to be checked to see what they had. At the same time cinemas were to be checked to see what ratio fitted the auditorium best. However due to time the UK worked with just one. Had all of this worked out there would have been 10 different DCPs issued, eight for 3D and two for 2D.

The premier ran in both the Empire and Odeon Leicester Square. The Empire has a 60ft screen with a gain of 1.4. To get a high light level with Dolby 3D they had four Barcos and got fl on a white screen with a gain of 1.4.

We did tests in the Odeon on their 48 ft white screen with a gain of 2.2 and two NEC projectors. We measured 5.5 fl in the middle of the front row of the circle but it was brighter in the stalls due to the 18 degree rake in that cinema. With one NEC and the silver screen in place for RealD we had 7fl in the middle of the screen, about 3 less at bottom and about 5 less at the top and worse at the sides but I will have to check my notes.

So how do we standardise any of that? Where do you select as the optimum measurement point? It's not so much the measurement technique here, most of these changes can be seen easily with the naked eye.

The problem is with a reasonably level throw on a white screen like most of the post production facilities we get a good, even light distribution; add gain such as 1.8 or 2.2 and it begins to fall off at the sides; tilt the screen and it gets worse. Make the screen silver and you have a hot spot in the middle and light falls off badly at the sides even with a level throw. Once you go outside the screen area at the sides and if the screen is curved, like most large ones are, the fall off reaches very high percentages. Silver screen 3D systems loose the 3D effect at the same time.

All post production facilities use a matt white screen with a gain of 1. That is unless a client specifies a silver screen 3D system.

With a shuttered glasses system the different eyes pass different light levels. The colour also measures differently; then select another pair and you get another two results. 6 pairs were measured with 12 results.

We have installed just about all of the post production facilities and keep most of them calibrated; before 3D this was relatively easy. Now its not.

I go to Russia for a plenary later this year and have no idea how we arrive at a standard. We shouldn't, I don't think it's possible, at least not yet.

There's also the problem of how you measure lumens from a projector.

I would love to have a chat about this with you; it's a real mess with no easy answers as it depends on so many outside influences. It needs a lot of work and most people don't understand what's happening.

Sorry to ramble on so much but this is a real issue now especially as one of the circuit CEOs say he couldn't care less about standards and wants a long bulb life!

Best Regards

Max

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Jerry Pierce

I wrote this up a few weeks ago and have had some comments on problems with this approach, but there was not sufficient interest into trying to revise/improve the approach. So for interest of discussion in our meeting next week, here is a already flawed approach to measuring 3D luminance:

> Background: At the March ISDCF meeting Peter Wilson asked about recommended practice for measuring the Luminance of a 3D presentation. My impression of the response was: nope, nothing written down. I had a brief conversation with Rod at Pixar and he inspired me to begin a white paper on the topic. I am certain this is wrong in so many ways. But I hope it will inspire edits or total rewrites of the approach.

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> There are three applications of 3D screen luminance measurements:

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> 1) Qualify a screen / theater for 3D presentations

> 2) To set the luminance of a screen to meet expectations

> 3) For scientific investigations.

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> My belief is that we are targeting application 2) to allow a theater owner to appropriately set the luminance of a 3D presentation to meet studio expectations. However, Peter responded that his interest was more for 1) qualifying screens...

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> 3D Screen Luminance Measurement recommended practice - version 1 (in desperate need of revision)

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> 1) Use 3D luminance file with left eye only pattern. With full bright in center and at right side of the screen. (See figure below). Others feel strongly that the image be in both eyes.

> 2) Use light meter with appropriate left eye filter in front of meter (optical quality filter - in a pinch use left eye of glasses.)

> 3) Position at optimum sweet spot in theater - 2 screen heights back, center of screen, the center spot should be in the "hot spot" of the silver screen (if it is silver)

> 4) Measure the center point luminance and the right point luminance. The right point is designed to be at 22 degrees off center and should be at 50% fall off point.

> 5) Adjust the projector output until the center point + right point = $1.5 \times \text{target luminance}$

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> So if the center point luminance is 4 ftL and the right point luminance is 2 ftL and the target luminance is 4 ftL $[(4+2)=4 \times 1.5]$ the luminance has been adjusted correctly.

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> ONLY left eye image.

Kevin Vines

-----Original Message-----

From: Kevin Wines [mailto:kevin@winesco.com]
Sent: Wednesday, April 28, 2010 10:14 AM
To: 'Jerry A Pierce'; 'Main ISDCF'
Subject: RE: [ISDCF] 3D luminance measurement

Jerry,

I don't quite know how to start this...

Gain screens are tricky.

Using the chart you drew doesn't work properly without also taking the radius of the screen into account - most are curved. And you have to know the incident angle of the light hitting the center of the spot, and the angle at which you are measuring to know if your reading is accurate. And you need the 1/2-gain angle of the screen - either from the manufacturer, or determine it by measurement.

Gain, by definition is the tendency of the object to reflect light back to the source, not reflect like a mirror.

A method Matt Cowan and I used several years ago teaches you much more about the performance of a gain screen in any given setting. It makes finding the 1/2-gain angle - and the area of "good" seats very easy.

All your work has to be "centered" on the center projection line, so if the projector is not on center line of the theatre, you have to work from the center of projection, not center of theatre. Even with lens shift, if the projector is not centered, the hot spot is not actually on the center of the screen, but on center to the angular line from the lens to the screen.

>From this center point, you lay out lines at 10 degree increments -
>with 2

people, it is actually easier than it sounds. Typically you don't need to go out more than 30 degrees. I will usually go to 20, 25, 30, & 35 degrees to help me hone in on the point I am looking for.

Measure the center dot from each point. When the light falls to 1/2 the original measurement, you are now in the "lousy" seats.

If the projector is actually on center, you only need to do this in one direction, if it is off-center, you have to go both left & right to find the edge of the 1/2-gain angle. It will surprise you how many seats are outside this area in a modern theatre.

This works on any gain screen (silver or white), whether or not you are looking through polarizing filters, and is remarkably accurate. It makes theatre seating layouts fairly straightforward to design.

As for the inconsistency of the 3D glasses and filters, they are irrelevant to this part of the testing because all measurements are relative, not absolute.

What to do about the filters? Well, mathematically we already know what to expect (in polarized systems anyway). The reason we are all stuck at 3.5 FtL is because of the known behavior of polarizing filters. By the time the light hits one of our eyes, we have about 1/2 of 1/2 of the original light exiting the projector (the RealD XL panel excepted, of course). So I generally start at 14 FtL unfiltered and measured on the center line described above. Put the filters in place and measure again. If I am at or near 3.5 FtL, I am good. Sometimes I have to go through a few pairs of glasses to find one "centered" at the right passivity. I then use this set to calibrate for light level and chromaticity.

Since you have no control over the variances of all the pairs of glasses, you need to find a sort of "reference" set that you consistently use for the measurements. All of the polarized filters skew a little purple, so you really do need to use them to set the colors/white point.

This has worked for me in theatres as small as the Clarity room and as large as the Nokia Theatre in LA. Often compared against the CAD drawings to confirm the angles used for measurement.

Now, if you are unsure of the screen gain, there is a consistent way to determine that as well (this is fun). Believe it or not, the little "brightness" rating on a ream of Xerox paper is actually a gain rating. 92 means 0.92 gain. And they are quite consistent. So I will tape a few sheets to a poster board and carefully place it at the screen. Sample (simple) math:

For ease, I will work to 10 FtL. If I measure 9.2 FtL on the paper, $9.2 / 0.92 = 10$. That is what I would get on a matte screen. Now, I will measure the screen. If I measure 14 FtL, the gain is 1.4.

Strange, mostly scientific, and it helps to create a consistency.

If this helps.

Kevin

In fact, I can give Peter a real-life example I observed close to home for him - the Odeon in Leicester Square London. A large, balconied theatre with the projectors very high above the balcony and a gain screen - a 1.8 white the last time I was there. You don't even need to measure it to observe the behavior of the gain.

Looks bright (and a little milky) from the balcony. And it get apparently brighter as you walk up toward the projection ports - walking AWAY from the screen. Go to the lower section, and even on center line, it is significantly darker - though more apparent contrast. And from the lower section, carefully observe where the hot spot appears - near the top of the screen! In the "best" seats in the house, you are already outside the gain angle of the screen due to the steep projection angle.

For what it's worth.

Kevin

Presentation by Dave Schnuelle Dolby



Effective Screen Gain
4-18-09 NAB2009 print

Rod Bogart Pixar

The most important item in measuring brightness of a 3d system is that it be done from a DCP, not from an internal test pattern.

There is a specific X'Y'Z' value (3794 3960 3890) that is called Calibration White. I believe the Dolby system has one on their player by default and they call it FS_White (for full screen white). Assuming a DCP exists, it can be distributed to others, and they can take it apart to prove it has the right numbers in the J2K. I would suggest something other than full screen white; perhaps a framing chart with the calibration target in the center. Even better would be a Stereoscopic package that demonstrates that the 3d system is engaged during this measurement.

As you are aware, the measurement is easy, but needs to be done with the 3d system functioning. The glasses can be used in front of the meter, provided they are held without any rotation (some systems still use linear polarizers). We used a PR650, but many folks simply use a light meter. We confirmed our measurement with a light meter, and the two values were quite close. We took these measurements from a "prime" seat rather than the booth, due to silver screen hot spot considerations, and because what matters is what the audience sees.

One of the strong impacts on brightness that is not widely known is the dark time adjustment of the projector. Since most 3d is shown with triple flash, there is a collection of settings that attempt to reduce the flicker and crosstalk during playback with different systems. So almost all of them (except two projector systems) require a dark period where the image is "off" while the 3d hardware is transitioning. This "off" period affects brightness, because, well, the light is off. So it is important that the exact setup that will be used for exhibition is used during calibration/characterization.

Good luck with your specification. Fight the good fight...

RGB

Harry Mathius Screen Geometry



ScreenGeometry
2007 Final.ppt

This is the story so far

Do we agree with each other?

If desirable how do we turn this into a readable document and how should it be distributed?

Any new suggestions who to invite in, without being exclusive its probably better to keep the group small.

Peter Wilson 26/05/10