The CinemaScope® Challenge:

Anamorphic Lens vs. VariScope™ Methods

A Comparative Discussion

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Over the past few years I've run across a number of misconceptions [plus quite a few downright inaccuracies] when discussing the 'pros and cons' of how to best fire a 2.35:1/2.40:1 image, on an appropriate ultra-wide, constant height home theater screen. We all despise the top/bottom "black bars" as delivered by our various media providers [broadcast, Blu-ray, DVD, streaming]. Getting rid of those unwanted black bars – however you do it – is a great experience for the home theater enthusiast, and we at Wolf Cinema wholeheartedly encourage the sale and installation of CinemaScope® type screens and matching projectors, by whichever methodology you chose to deploy.

The initial 'Scope solution brought to the consumer market – developed a number of years ago and popularized by Sam Runco and Stewart Filmscreen – requires the use of an external anamorphic lens to fill a constant height 2.35:1 screen. The second method – the precision zoom/focus method as popularized by Wolf Cinema approximately 5 years ago, termed VariScope™ by our company – is the technique whereby the primary optics include precision stepper motors for sizing/zoom and focus, and are linked to the projector's system memories for recall of various aspect ratios.

A leading anamorphic lens company [with obvious self interests involved] recently made a number of claims purporting the advantage of the external anamorphic lens based methodology. I'd like us to compare both methods in greater detail, especially their claim which stated, "The zoom method has some fairly drastic drawbacks…" A closer inspection here makes that statement far less definitive, indeed somewhat dubious, and thus a much more balanced assessment is appropriate.

CLAIM #1

Anamorphic Lens Company: *"Decreased pixel density, detail and contrast levels [Ed - for the zoom method]. Zooming the image to fill the screen, takes the 810 vertical lines available on 2.35:1 widescreen Blu-rays and spreads that limited number of pixels over a large screen reducing the clarity and "pop" of the image."*

Jim's Commentary: This initial statement leans heavily toward the FALSE side of my truth-o-meter. First, with the zoom method there is no decrease in pixel density, image detail or CR levels – in fact, just the opposite might be true. The content is the content, and the available pixel density is derived directly from the source. Either method will display what IS available in the original 1080p digital source material. A 2.35:1 image is comprised of 1920 vertical columns by ~810 lines of information, and that's all there is to work with in either methodology.

What confuses folks is that the idea that we somehow GAIN resolution by repurposing the ~810 lines to 1080. We do not, of course, and this technique doesn't take into consideration the rather extensive video processing required to "remap" the available 'Scope content onto the HD digital imaging device. You may indeed gain a tad more light output, but you don't add resolution.

When using the external anamorphic lens method, the video source must be processed, “stretched” and remapped to fill the entire chip set. This can improve peak white performance slightly [i.e. more light output, by a net factor of ~20%... see below…]. But this comes at a significant cost: such video processing can add unwanted artifacts such as video aliasing, increased macro blocking and undesired time base errors – processing errors that reduce image fidelity, image reality, depth of field. A video purist may indeed *prefer* the precision zoom method, in that it presents the available content *as close to its original source as possible*, and with minimal processing. Contrast levels should remain consistent in either method [with the exception of a slight reduction in peak white], but that may not even be noticed or measurable because we are always viewing the ***inter-scene*** CR and the resulting dynamics of the moving image. Peak white to black transitions are quite similar in both methods, with little reduction [apparent or measured] in “pop” or “clarity”.

And we note that with forthcoming 4K imaging solutions, the 1920 columns by 810 lines are displayed in a visible pixel density of 3840 columns x ~1620 lines, more than enough structure to retain a razor sharp, clear image.

It should also be stated here that there can be significant problems achieving accurate image geometry and sharp focus when using external anamorphic lenses. The required fixed or moving sled assemblies add additional cost and complexity to any given home theater installation. Anamorphic optics can easily fall out of adjustment and may require periodic touch ups by the system owner, projector installer or calibrator.

The VariScope zoom methodology is simple, repeatable, and highly reliable. It requires very little maintenance once set and calibrated. A minor drawback we’ve seen is that, depending on the precision of your primary stepper motors, the optical travel can “drift” slightly [often due to thermal issues] and not return to the exact starting position, or may defocus slightly. A simple quick touch up of the zoom/focus memory is all that is required to remedy this situation, should it ever occur.

CLAIM #2

Anamorphic Lens Company: *Distracting Light Spill. The zoom method projects the black letterbox bars off the top and bottom of the screen. Since the pixels contained in the black letterbox bars are never fully “off”, the light spill is projected on your client’s wall and is particularly noticeable if their screen is on a lighter colored wall.*

Jim’s Commentary: This can be true but it is rarely experienced in today’s higher performance, ultra-high-contrast projectors. The black levels in today’s projectors are so deep that one is hard pressed to see ANY of the black bar images, when properly calibrated – this black information typically falls in the ~7.5 to 10 IRE range. Proper black level setting makes this a non-issue. Lastly, simple and low-cost room treatments [darker wall paint, curtains, fabrics] can easily correct any of these anomalies, if they become a visible distraction.

CLAIM #3

Anamorphic Lens Company: *Light Loss. 33% of light output is lost when zooming, which causes a flat looking and lifeless image.*

Jim’s Commentary: A 33% light loss is the *theoretical* number but rarely that dramatic: it’s actually a bit less than that in real world installations. All lenses affect light output. Anamorphic lenses typically reduce light output by approximately 5-10%, so the effective peak white reduction can more accurately be said to be in the ~20% range.

The issue of geometric errors as induced by anamorphic lenses is not addressed here, and that remains a major disadvantage of external lenses in general. Pin cushioning, "barrel" distortion and skewed images are quite common and require high attention to installation details. And a "flat looking" or "lifeless" image has nothing to do with the respective 2.35:1 techniques in play: this is more commonly caused by improper calibrations, i.e. too high a brightness setting [black level], too low a contrast setting [white level] or reduced color saturation settings.

CLAIM #4

Anamorphic Lens Company: *Barely useable 3D. The light loss with 3D images is even more obvious due to 3D's demands on a projector's brightness as 3D effectively halves light output! 3D movies may be nearly unusable making for unhappy clients.*

Jim's Commentary: While 3D glasses or cinema polarizers indeed reduce light output [by as much as 75%, depending on the technology deployed], today's home theater 3D projectors and screens are quite advanced and developed specifically to help compensate for this issue. Most of today's HD projectors have more than enough light output to properly display 2D and 3D content onto appropriately-sized 2.35:1 screens. And the technologies found in new screen surfaces with increased gain characteristics provide for highly effective solutions to counter any such undesirable light loss.

In our experience the practical differences in peak white reduction are not enough to significantly impair any 3D performance. Typically it's the environmental issues – room ambient light, room treatments, the undesired wall and ceiling flashback – that can drastically reduce the overall system's dynamic range, and not the mere choice of either using an anamorphic lens or not.

CLAIM #5

Anamorphic Lens Company*:* *Several projector companies are beginning to offer 2.35:1 projectors. Currently these projectors are fairly rare and quite expensive. 2.35:1 projectors are mostly single chip DLP, which are readily out performed by less expensive 3-Chip 16:9 projectors. You can provide your customer better value by pairing a 3-Chip projector and an anamorphic lens system than selling a 2.35:1 single chip projector. So with a little creative mixing and matching it is possible to have the best of both worlds and achieve some very attractive margins as well as providing your clients with the ultimate picture and performance!*

Jim's Commentary: This is partially true: however both types of projectors described here are expensive, and value may be relative. But there is no truly "native 2.35 home theater projector" in either single chip or three-chip editions. There are no native 2.35:1 chips in anywhere production or available for purchase – they simply don't exist!

Currently on the market today one can find single chip DLP home theater light engines that originate from 1.6:1 aspect ratio, graphics-oriented 2560 x1600 WQXGA DLP chips… with lines and/or columns "turned off" in the various viewing modes. These engines can indeed display 2.35:1 and 16/9 images, but again they are not "native" 2.35:1 projectors. The primary advantage here would be the retention of the original pixel size and the benefits of greater pixel density: appx. 2540 vertical columns x 1080 lines in the 2.35:1 viewing mode. However these advantages are further offset by the processing required to remap to 2540 columns, plus one cannot ignore the visible rainbow artifacts commonly experienced in single-chip, color-wheel based DLP solutions.

It is true that a three-chip light engine plus anamorphic lens might be the better performer in their particular comparison. We also note that many excellent three-chip projectors are now offering our VariScope [or similar] zoom methods, which can eliminate the need for any external anamorphic assembly.

The emergence of 4K "Ultra HD" projectors [whether native or upscaling] further pushes this debate toward obscurity: for example our lowest cost V4K™ projector, the model SDC-12, at just $12K retail delivers a true 3840 x 2160 on-screen image from standard HD sources. [Note that 3840 x 2160, whether achieved via native panels or up-sampling, is an exact 2X multiple of the original 1080p resolution and thus much easier to accomplish, with respect to video processing…]. With the VariScope optics deployed, a CinemaScope image is now displayed at 3840 columns x ~1620 lines: far greater vertical and horizontal density than from any of the so-called "2.35:1 native" projectors.

CLAIM #7

Jim's Commentary: One of the most exciting things about the zoom/focus method called VariScope, is that ALL of your favorite film and TV aspect ratios can be stored into memory for proper viewing on constant height CinemaScope screens. For example, our new SDC-15 [2013 edition] provides for 10 VariScope lens memories. This means that every image starting with the 1.33:1 shape [our old friend 4x3, usually embedded within the 16/9 frame], to 1.78:1 [16/9] images, the hundreds of movies released in 1.85:1, 2.20:1, 2.35:1 and 2.40:1 film content can now be properly presented in its original shape, unaltered, properly filling the constant height 'Scope screen. The anamorphic lens methodology provides for just two aspect ratios – 16/9 and 2.35:1/2.40.1. [Three actually, if you consider that 1.33:1 typically fits within the 16/8 frame].

Anamorphic Lens Company*:* No comment.

CONCLUSION

Both methods are able to properly display 2.35:1 images onto CinemaScope® wide aspect ratio screens. Both methods have certain advantages and drawbacks and need to be carefully reviewed when making the right choice for you and your client's home theater.

Projectors with anamorphic lenses can typically be positioned in a wider range of distances from the screen, thus making this a more flexible choice for installing in any given environment. Price is an important consideration: anamorphic lenses and mounting assemblies can typically cost between $5,000 to $15,000 at retail, and will require careful attention to installation issues.

The effective throw distance of a VariScope zoom/focus/memory method is shorter than when using an external anamorphic lens. Such throw distances are typically restricted to approximately 50% of the primary optics TD, as the remaining optical travel must be used to fill the available screen width [or reduce taller images to properly fit the available screen height].

Lastly the as-yet-unstated advantage of the VariScope method: it's ***free*** and comes as a user-selectable feature in today's next-gen HD projectors. As long as the projector can be mounted in the pre-defined installation range, the zoom/focus method is quite valid and has become a popular choice for today's home theater enthusiasts.