ANAMORPHIC

The Panamorph Lens

- An anamorphic lens, like the Panamorph UH480 or UV200, “unsqueezes” and expands anamorphic material so that 2.40:1 material displays with full resolution, brightness and width when paired with a digital front projection system.

ANAMORPHIC

- This is an anamorphic lens. You can see the oval shape of the optics, which permitted the lens to “squeeze” the light horizontally when coming into the camera. This results in an image that appears to be vertically stretched.

ANAMORPHIC

- When a motion picture is shot with a lens of this type, the resulting image on the film frame is distorted, with everything compressed horizontally and stretched vertically. People and objects appear unnaturally tall and skinny. However, the entire film frame is being utilized and no resolution is wasted.

ANAMORPHIC

Now here is the key to how the anamorphic process works:

- The image that was horizontally COMPRESSED by the anamorphic lens on the camera (resulting in a vertically stretched image) is now horizontally EXPANDED by an anamorphic lens mounted to the projector in the theater, eliminating the vertical stretch. The result is a properly displayed widescreen image.

ANAMORPHIC

Let's illustrate the process graphically:

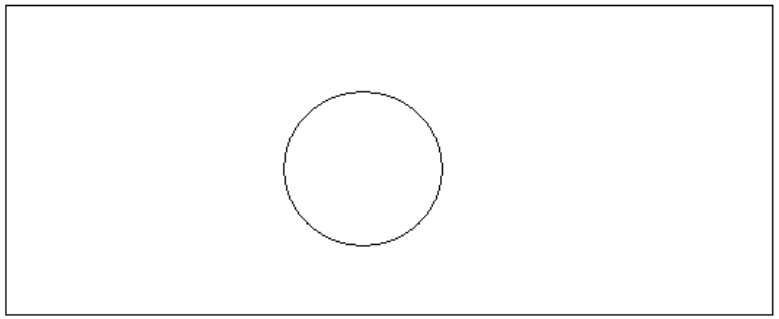


Image desired by Cinematographer and Director

Light passes Through the Camera Anamorphic Lens

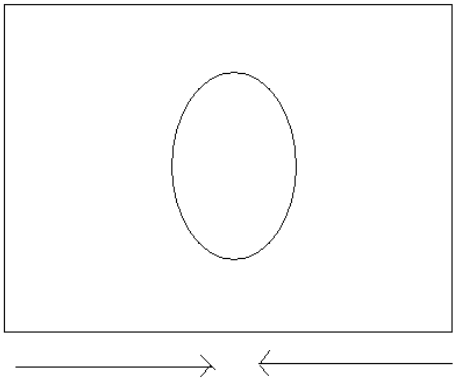
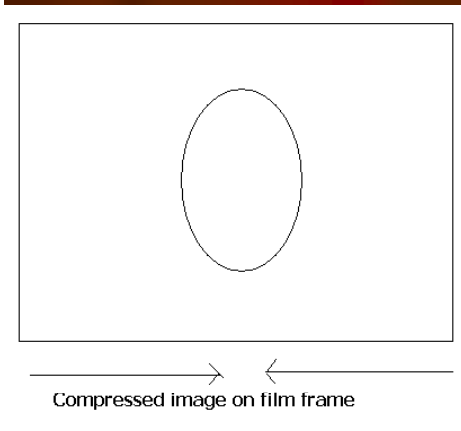


Image is compressed horizontally by the anamorphic lens on the camera

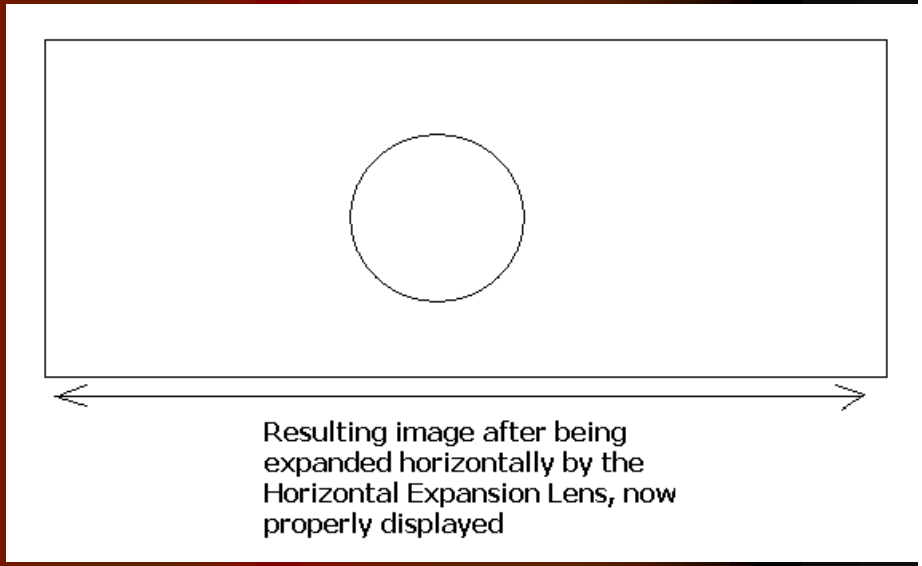
Resulting image appears vertically stretched, with people and objects appearing unnaturally tall and skinny

ANAMORPHIC

The compressed film frame is now projected at the movie theater through an Anamorphic Horizontal Expansion lens, which expands the image horizontally in the exact same proportion it was originally compressed. In this way, the original image desired by the director and cinematographer is now recreated on the theater screen.

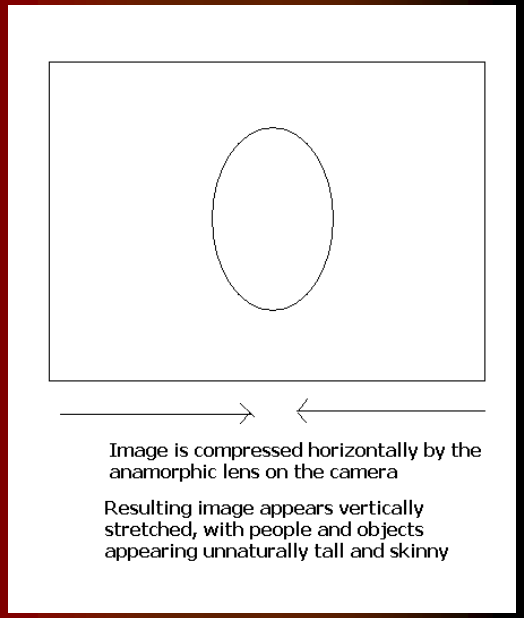


Light passes through an Anamorphic Horizontal Expansion Lens and is expanded out horizontally (to the sides), creating a wide image.

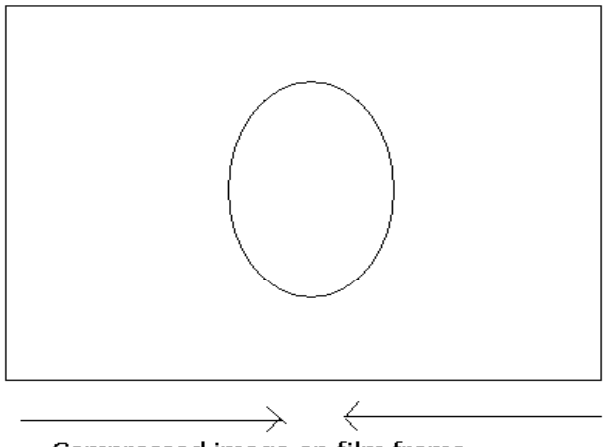


ANAMORPHIC

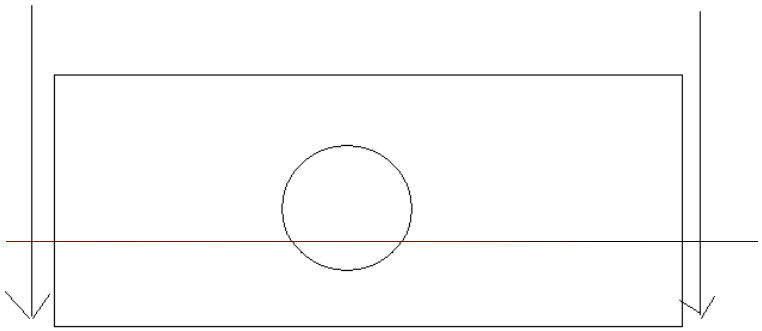
- Here is how a Vertical Compression lens works:



ANAMORPHIC



Light passes through the Anamorphic Vertical Compression Lens, where it is compressed vertically to compensate for the vertically stretched image on the film frame



Resulting image after being compressed vertically by the Vertical Compression lens, now properly displayed.

Since the Vertical Compression lens works by “squashing” the image vertically, it adds no additional width to the image. In this way, the full resolution of the anamorphic image on the film frame is retained and the 2.40:1 image is able to be projected and displayed properly.

SCALING MODE I

- **Scaling Mode I (Vertical Stretch)** : 2.40:1 movies are displayed by the projector **vertically stretched by 33%**. This mode is the minimum necessary mode for all anamorphic lens systems regardless of whether the lens is moveable or permanently positioned. This is because the 2.40:1 ratio is 33% WIDER than the 16:9 native ratio of the projector. The result is that people and objects appear unnaturally tall and skinny, just like with motion picture production. However, this eliminates the black bars and enables the full resolution and brightness of the projector.

THE UH480 AND UV200

- Our Horizontal Expansion lens, the UH480, then expands the image optically by the same 33%, while our Vertical Compression lens (the UV200) compress the image optically by the same 33%. The result in both cases is an image displayed with the correct geometry and aspect ratio.

UH480 Lens

UV200 Lens

MOVEABLE LENS

- The UH480 Lens is used primarily in a "moveable" lens configuration. The lens moves out of the way when displaying 16:9 or 4:3 material, and is moved into place when displaying 2.40:1 material. In this way, full brightness and resolution is maintained with all picture sources regardless of aspect ratio.
- To create a Moveable Lens assembly, the UH480 needs to be paired with the ATH1 motorized transport. This is a motorized sled that can be triggered to move the lens via IR command or 12 volt trigger.
- It is also possible to use our MTH1 manual transport system to move the lens out of the way.

FIXED LENS

- For Fixed Lens configurations, the lens remains in place and is paired with a 2.40:1 screen. This is true with both the UH480 Horizontal Expansion and UV200 Vertical Compression lenses.
- With the lens in place and the proper 33% vertical stretch, 2.40:1 movies display properly on 2.40:1 screens with either the UV200 or UH480 lens systems
- The problem is that standard 16:9 material is not displayed properly, since the lens is improperly stretching the image.
- We need an additional scaling mode to correct this problem.

SCALING MODE II

- **Scaling Mode II**: Content is **horizontally squeezed by 25%**. This mode is only necessary if the lens is permanently positioned in front of the projector lens. It is not needed if the lens is moved away from the beam for non-2.40:1 content.
- When we do this, we also reduce the horizontal resolution of the image by the same 25%. In the case of a 1080P projector, we reduce the native 1920 x 1080 resolution of the projector to 1440 (horizontal) x 1080 (vertical). Although the horizontal resolution is reduced, the vertical resolution remains the same (1080).

SCALING MODE II

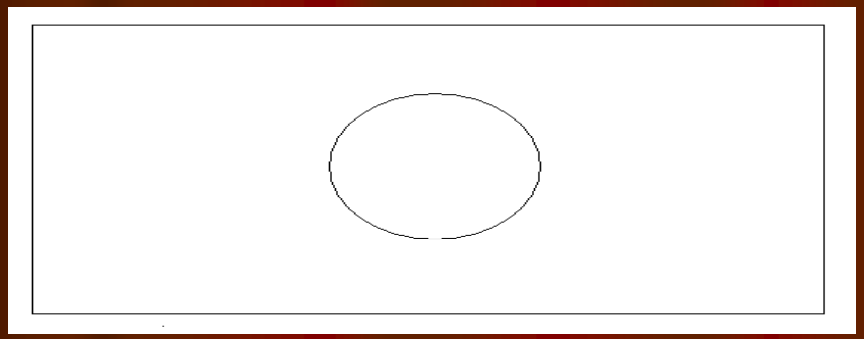
- Here's how it works:

Native 16:9 image improperly stretched by the anamorphic lens on a 2.40:1 screen

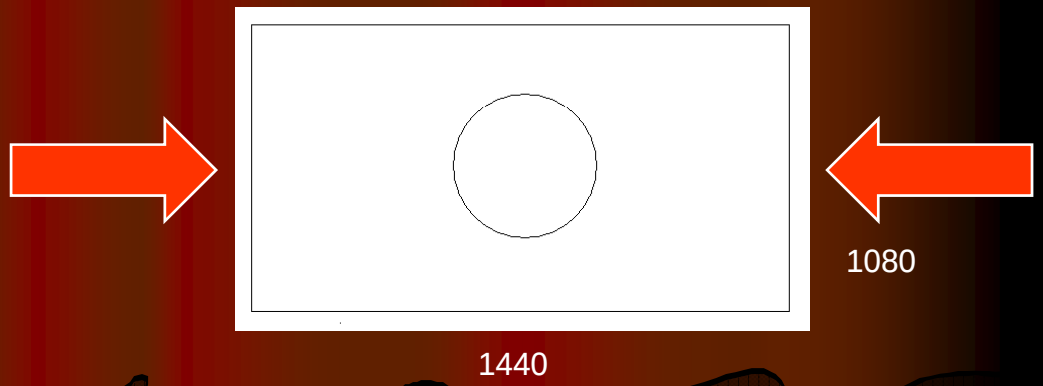
Image is horizontally "squeezed" 25% by the projector or electronic scaler

16:9 image is now properly displayed

SCALING MODE II

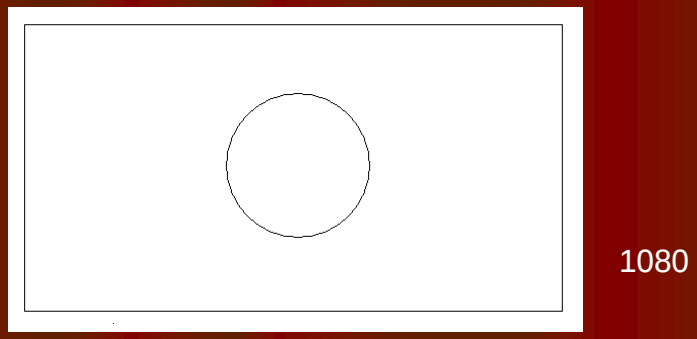


- On most projectors / scalers, this is known as the “4:3” or “Normal” scaling mode. Ironically enough, the 4:3 scaling mode accomplishes the exact amount of vertical compression we need for fixed lens systems.



RESOLUTION

- Reducing the resolution to 1440 x 1080 sounds like it would result in a fairly large reduction in image quality, but it does not! The human eye is very sensitive to vertical resolution but much less sensitive to horizontal resolution. This is why resolution is always referred to using the vertical “1080,” or “720.” We almost never refer to the horizontal resolution of “1920” or “1280,” respectively, since it is much less important to how the human eye perceives image detail and sharpness.



THE UV200

- The model UV200 lens will accept a **beam size** of up to 1.5" high x 2.25" wide. For this reason, projectors with recessed lenses or very wide output beams may not work with the UV200 lens, or only at very high throw ratios.
- In general, The UV200 lens is ideal for creating 2.40:1 images at longer throw distances because projector beams are typically smaller in these cases. Since the UV200 takes advantage of Vertical Compression (VC) technology, using the UV200 lens means that the final 2.40:1 image will have the same width as the 16:9 image before the lens is used.
- We recommend a minimum throw ratio of 1.8x the projector's native 16x9 image width for the UV200.
- NOTE: The UV200 lens is NOT recommended for use with curved screens.

THE UV200

- IMPORTANT. As we mentioned previously, using the UV200 lens means that the final 2.40:1 image will have the same width as the 16:9 image before the lens is used. Since the image is compressed vertically when the lens is in place, you calculate your screen size using the native 16:9 image width of the projector. This now becomes your 2.40:1 width, and 16:9 images display properly within that space using the Mode II scaling described previously. This is illustrated graphically on the next slide.

UV200

Native 16:9 image of the projector, stretched vertically using Mode I scaling

Light passes through the UV200, where it is compressed vertically.

Resulting 2.40:1 image has the same width as the original 16:9 image, but now compressed vertically to create a full resolution, full brightness 2.40:1 image

16:9 image created using Mode II scaling now displays properly on a 2.40:1 screen.

UV200

- If the UV200 were removed from the light path, the resulting image would overshoot the top and bottom of the 2.40:1 screen. Obviously, this is not desirable.
- For this reason, the UV200 is almost exclusively used in a “fixed” configuration and paired with a 2.40:1 screen. Rather than move the lens in and out of the light path, the image width is changed using the scaling modes built into the projector or scaler.
- The UV200 is occasionally paired with a 16:9 screen in a moveable configuration. This allows for higher performance 2.40.1 images on a 16:9 screen, since all of the projector’s resolution and brightness are being utilized for both formats. The resulting 2.40:1 image is no bigger than the original letterboxed 16:9 image, but it is considerably brighter and sharper.

FIXED LENS

- Essentially, what you do with a fixed lens is to convert a 16:9 projector into a 2.40:1 projector - it projects a 2.40:1 image at all times. The Mode II scaling is used to restore 16:9 image geometry.
- Remember, the UH480 can also be used in a fixed lens configuration using the exact same method. The difference here is that the UH480 will expand the image where the UV200 compresses it. This allows the fixed UH480 to be used in shorter throw configurations or where a larger screen is desired.
- In both cases, the lens is paired with a 2.40:1 screen and 16:9 or 4:3 images are created using Mode II scaling.

UH480 Lens

UV200 Lens

THE UH480

- The UH480 will accept a beam up to 3.1”, making it more suitable for a broader range of throw distances due to its larger apertures. Since the UH480 uses Horizontal Expansion (HE) optical technology, the final 2.40:1 image is 33% wider than the 16:9 image before the lens is used (see previous slide).
- We recommend a minimum throw ratio of 1.6x the projector’s native 16x9 image width for the UH480.

FIXED LENS PROS AND CONS

- The most common objection to a fixed lens solution is that smaller formats like 1.85:1 and 16:9 are shown with a lower number of pixels. It is instantly obvious that with a moveable lens you get it all - full performance for 16:9 AND 2.40:1. On the other hand, you can save your customer money and complexity of setup by never having to move the lens. Advantages of a fixed lens:
  1. Brightness and resolution **per unit area** is the same for ALL content.
  2. Calibration never changes.
  3. Vertical resolution is the same for all formats - just like having a moveable lens.
  4. Cost.

THE SOLUTION

FOR ADDITIONAL INFORMATION,
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