ORIFL190-3

190 Degree Field Of View Fisheye Lens
For 1/3" Format Cameras

Specifications:

- Field of View: 190 degrees
- Focal Plane Field Diameter: 3.4 mm
- Focal length: 1.24 mm
- F/number: 2.8
- Focus range: 0.5 inches to infinity
- MTF @ 70 cycles/mm (with 640x480 sensors):
  - 76% on symmetrical axis
  - >72% throughout 190 degree field
- MTF @ 150 cycles/mm (with 1280x1024 sensors):
  - 42% on symmetrical axis
  - >42% throughout field
- Maximum Image Height Distortion measured from F-theta condition, at edge of field: 17.3%
- Lens Housing Outer Diameter: 0.943" (23.95mm)
- Lens Length: 1.016": (25.82mm)
- Lens Mount: Micro 12mm x 0.5mm thread
- Back Focal Length 2.77 mm.
- Lens body to Image Sensor Dimension 2.25 mm.

F1: The ORIFL190-3 Lens

Introduction:

The ORIFL190-3 is a high quality fisheye lens that provides a 190 degree field of view. The circular image produced is 3.4 mm in diameter allowing 1/3 inch format cameras/sensors to capture a symmetrical hemispherical image. It is also compatible with 1/2" and 1/4" format cameras/sensors although the viewable field will vary. Designed and built exclusively by and for Omnitech Robotics, the ORIFL190-3 is optimized for small size and high image quality. The anodized aluminum lens body is only 24 mm in diameter, yet the optics have excellent sharpness, contrast, field compression linearity, and field luminance and color correctness throughout the field of view. The glass lens construction and coated optics provide a 1.24 mm focal length and F/2.8 speed for good low light capability. The large primary lens uses an O-ring seal to provide water and humidity resistance. Compatibility with most web-cam, circuit board and bullet style cameras is provided with the standard "micro mount" 12mm x 0.5mm pitch mounting thread.

F2: Example Image

F3: The ORIFL190-3 is compatible with a range of cameras

Overview

The ORIFL190-3 is a fisheye lens that provides a 190 degree field of view. A high quality 180 degree field of view can be reliably extracted using digital image processing of the digital image, or the entire image can be displayed in it's unaltered form. The circular image produced is 3.4 mm in diameter allowing 1/3 inch image sensor cameras to capture a symmetrical hemispherical image. Optimized for small size, the anodized aluminum lens body is only 24 mm in diameter, yet the optics have excellent field compression linearity, field luminance and color correctness throughout the field of view. The glass lens construction and coated optics provide a 1.24 mm focal length and F/2.8 aperture speed for good low light capability. The large primary lens uses an O-ring seal to provide water and humidity resistance. Compatibility with most web-cam, circuit board and bullet style cameras is provided with the standard "micro mount" 12mm x 0.5mm pitch mounting thread. It can also be adapted to most standard C lens mount cameras with an optional adapter. This lens can also be used on 1/4" image sensors, however the entire circular image will not be visible. Similarly, the lens can be used with 1/2" image sensors and the circular image will fall well within the image sensor active area.

F4: The ORIFL190-3 next to a US quarter dollar

The optical resolution and sharpness of the lens is superior to that of typical 1/3" image sensors (640x480) so resolution limits are governed by the image sensor, not the lens. This is supported by the Modulation Transfer Function (MTF) specifications shown. The lens uses coated glass optics, and has excellent color correction throughout the field of view. A spot diagram analysis shows visible light rays color convergence is within 10 microns 1 sigma CEP throughout the field of view.

Since this lens produces a circular image that is a fraction of the image sensor area, portions of the image sensor are dark as seen in some of the unaltered sample images. This may affect the automatic exposure control circuits of the camera, and manual exposure control setting or modification of the automatic exposure control algorithms may be necessary.

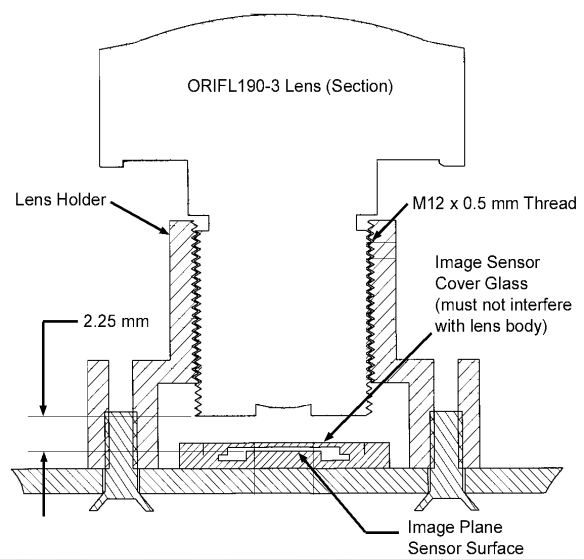
When selecting a compatible camera, several factors are important to consider. First, the alignment of the lens and the image sensor is more critical than usual with conventional lenses in order to center the circular image within the image sensors active detection area. The 3.40 mm diameter image produced allows a misalignment of approximately 0.1 mm (0.0039") when using typical 1/3" image sensors (3.60mm x 4.80 mm active region typically). Adjustment of the lens holder with respect to the image sensor may be necessary to center the circular image within the image sensors active area. On PCB format cameras, this is achieved by loosening the fasteners holding the lens mount, then adjusting the lens until a circular image is observed, then tightening the lens mount.

The second factor to consider when selecting a compatible camera is assuring that the lens can be mounted close enough to the image sensor, and that there are no obstructions like image sensor cover glass, filter glass, or lens mount body interferences. Close mounting of the lens element and the image sensor is necessary since the wide field of view requires a very short focal

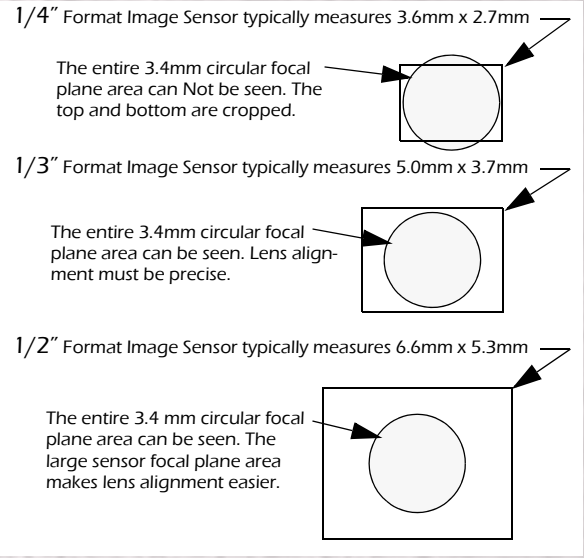
length. The gap between the final glass lens element and the image plane (Back Focal Length) is 2.77 mm when the lens is properly installed and in focus. The gap between the end of the lens housing and the image plane is 2.25 mm when the lens is properly installed and in focus. If the image sensor uses a cover glass or filter, it must be less than this dimension. Figure F5 illustrates nominal mounting dimensions for reference. If needed, ORI also sells a very thin (0.5 mm) visible bandpass filter that cuts IR and UV transmission to less than 3%, while passing the visible spectrum from 380 nm to 650 nm (94% typical), to provide improved color correctness of CMOS or CCD image sensors.

A third factor to consider is the electronic shutter capability of the camera, since there is not a mechanical aperture control or shutter on the lens. A fast electronic shutter (exposure time) may be necessary to obtain a proper exposure in bright light conditions. This is possible with most CMOS cameras, but may difficult be with older or high sensitivity CCD cameras and bright lighting conditions.

Figures F7 through F12 show sample images for the ORIFL190-3. Figures F13 through F17 illustrate design curves for the lens performance.



F5: Nominal mounting dimensions for the ORIFL190-3 fisheye lens with a PCB camera image sensor



F6: Comparison of the ORIFL190-3 focal plane area to different image sensor sizes

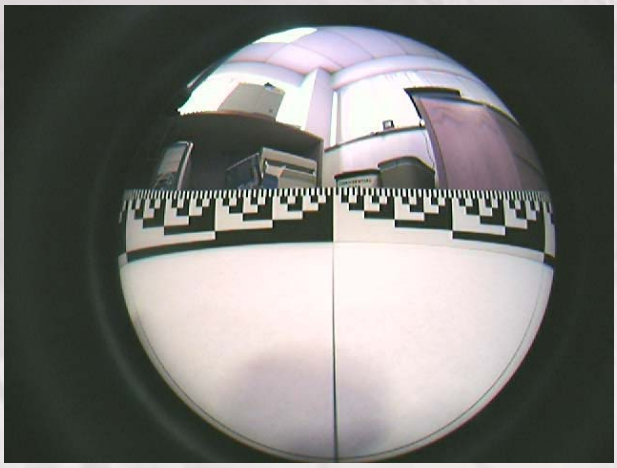
Potential Applications

- Wide Field Of View Robotic Vehicle Image Sensing
- Wide Field Of View Security Cameras
- Wide Field Of View Astronomy Applications: All sky imaging, cloud cover measurement, light pollution measurement.

Sample Images

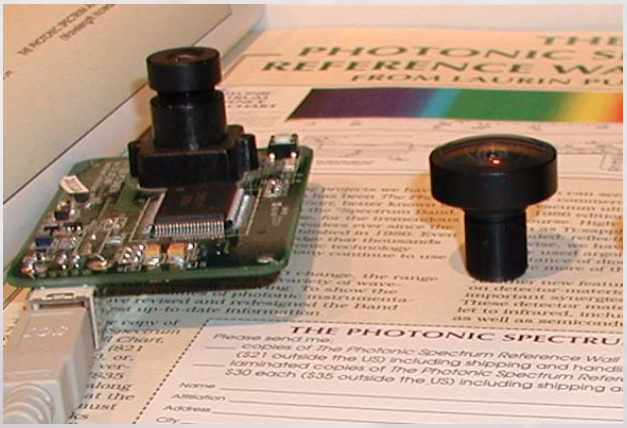
F7: Typical Indoor Image, CMOS 640x480

F8: Digitally Orthorectified Image

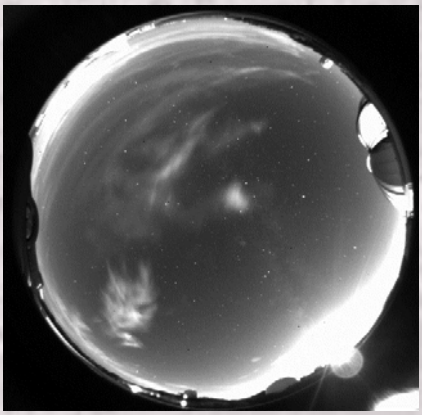


F9: Example of a lens calibration test image showing multiple resolution line pairs plotted on a cylinder. This image used a 640x480 image sensor.

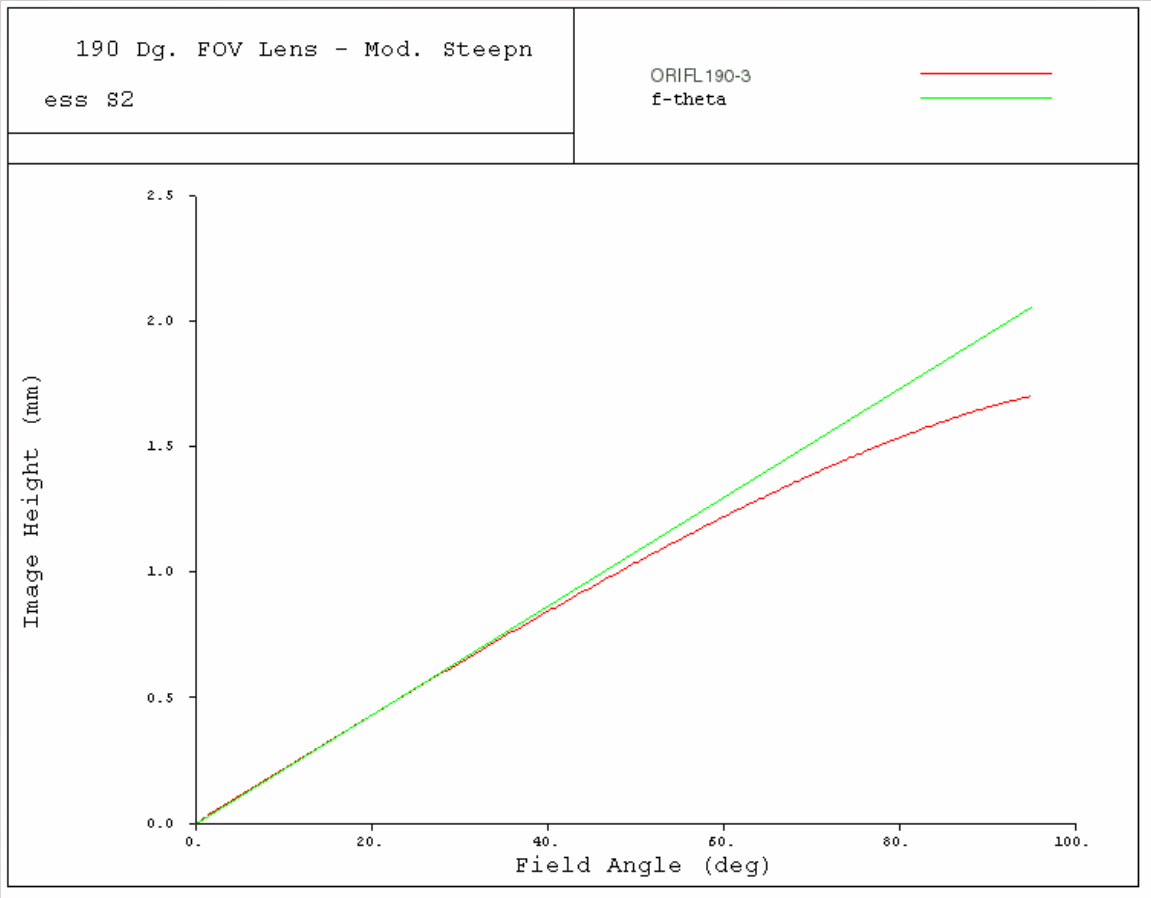
F10: Focal Range Example: Nearfield 12 point Text & Background



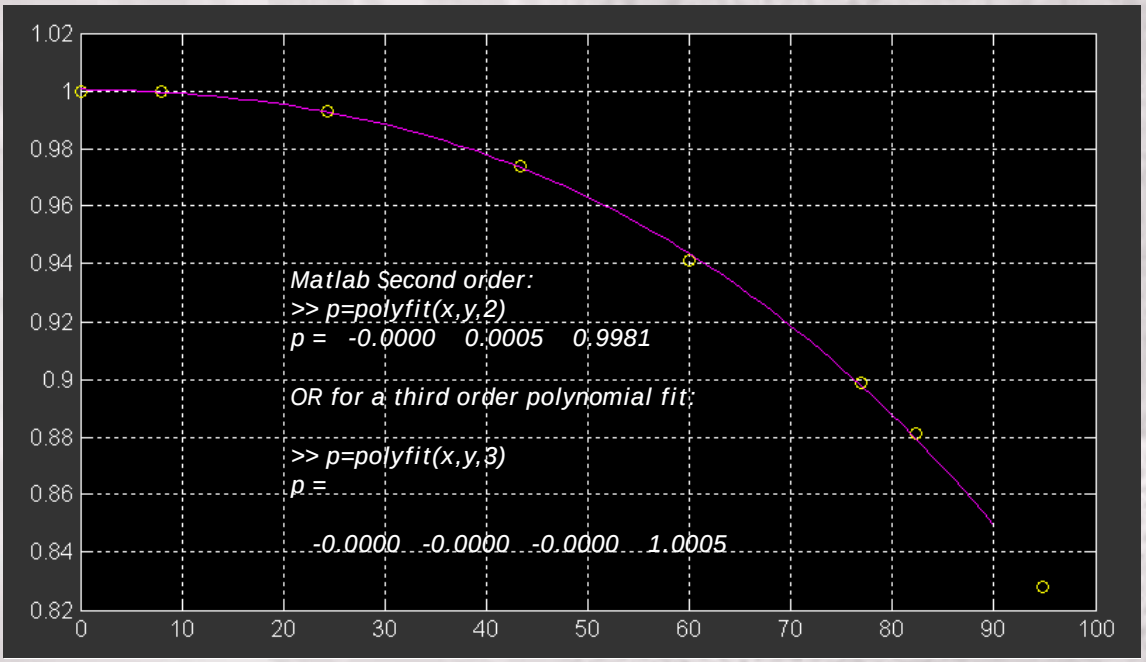
F11: Fisheye lens on right, next to OV7620, 640x480 CMOS USB camera used to acquire images above.



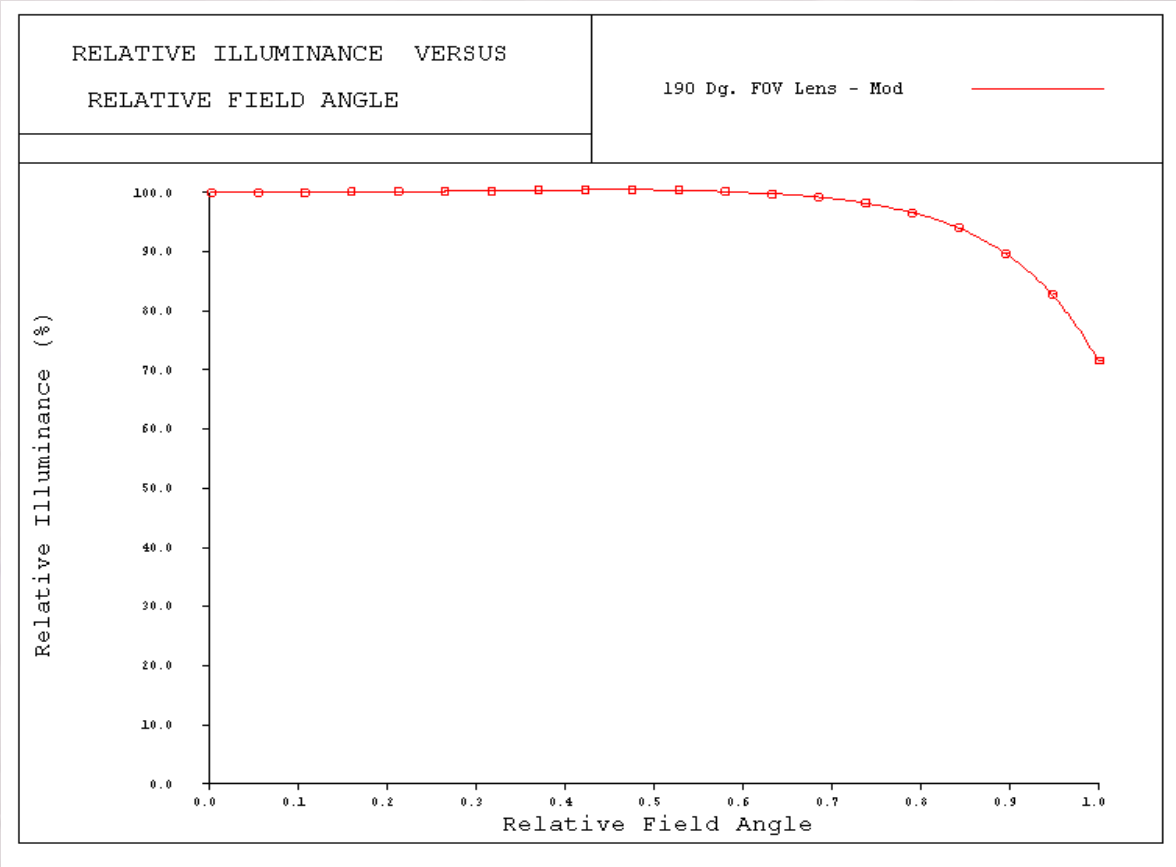
F12: All-Sky imaging example, taken with a high sensitivity 320x240 camera



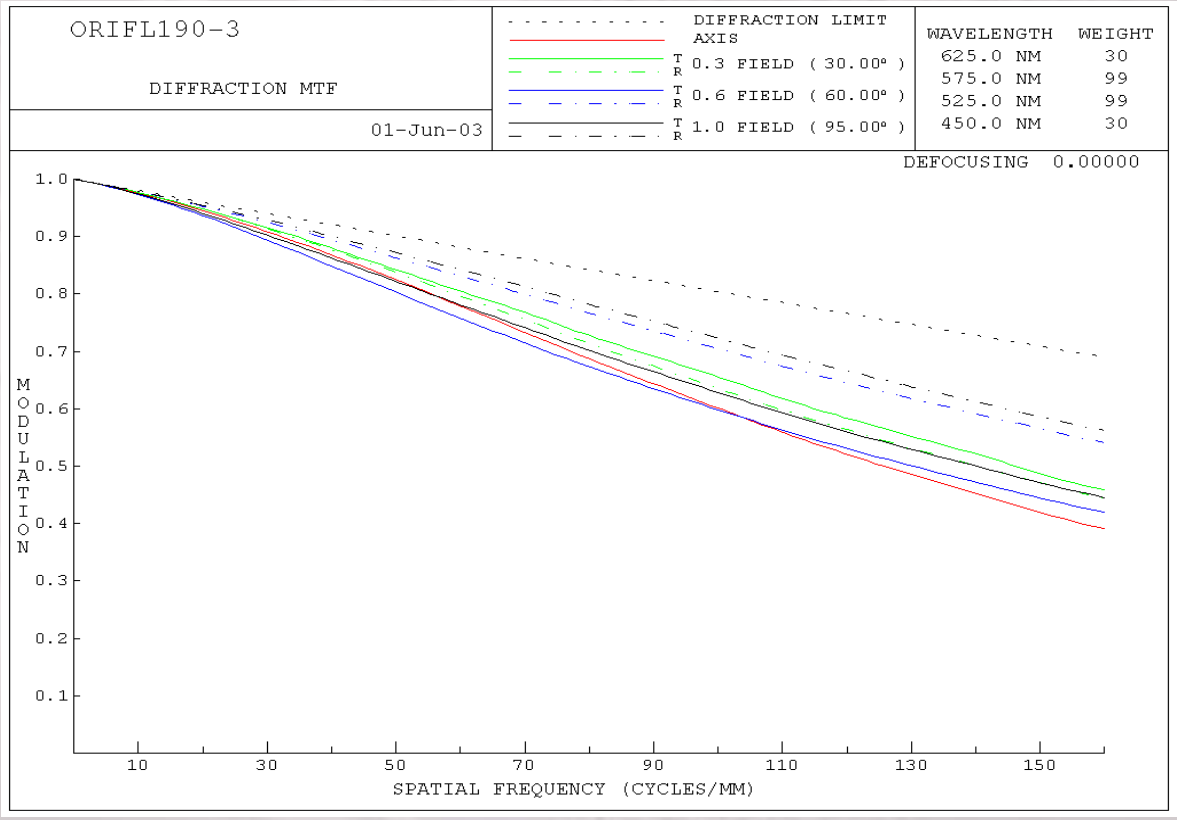
F13: Image height versus Field Angle. Note nonlinear relationship approaching edge of field.



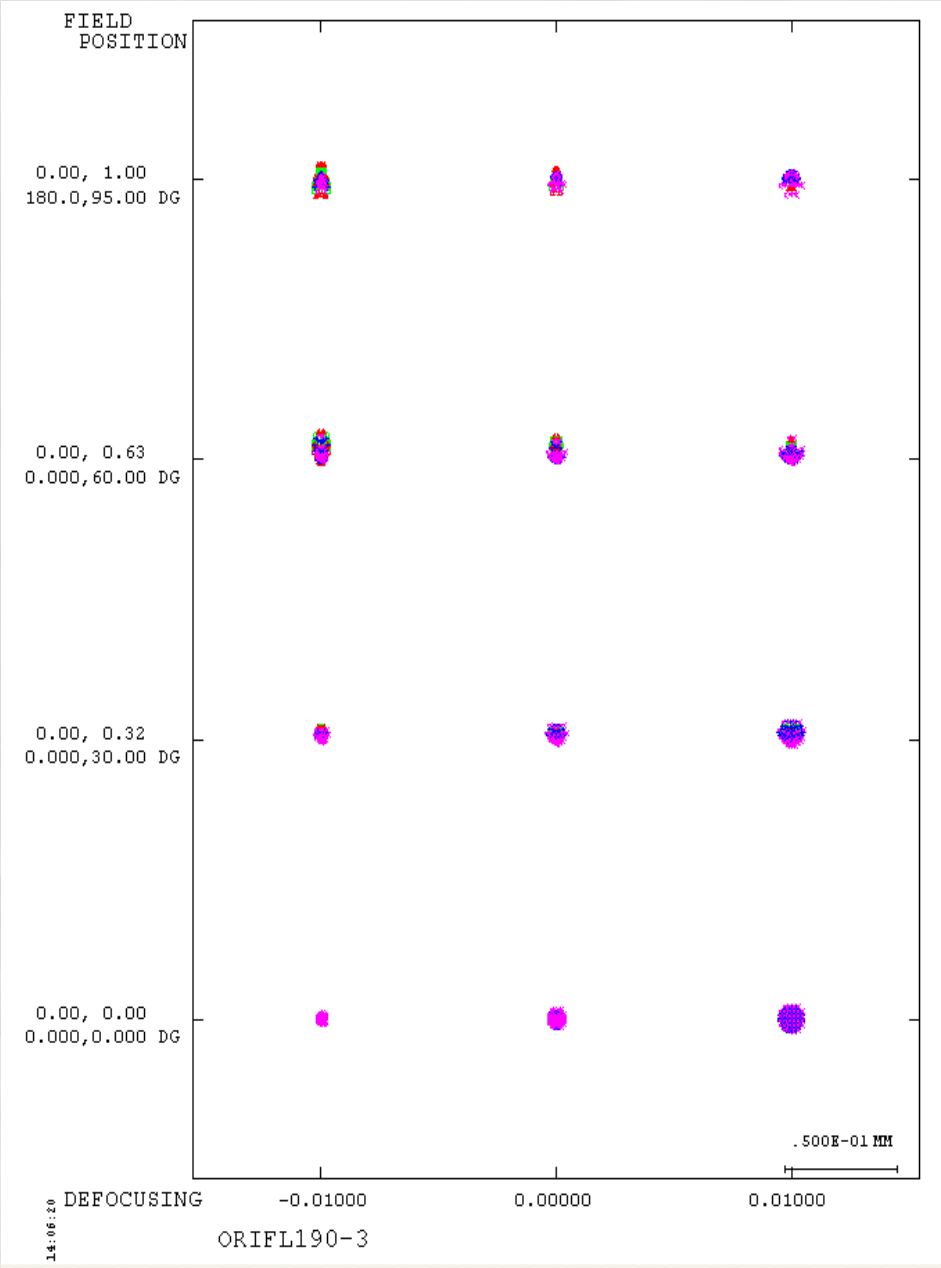
F14: Non-linearity of Image height as a function of Field Angle (degrees), with polynomial curve parameters.



F15:NonLinearity of Illumination as a function of Field Angle



F16: Modulation Transfer Function (MTF) for multiple field positions



F17: Spot diagram illustrating color correctness for multiple field positions and focus positions

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Ordering Information:
Model: ORIFL190-3
PN: 00109200
List Price: $250.00 USD
Discount Schedule:

1 - 4:	List Price
5 - 9:	5% discount
10 - 24:	10% discount
25 - 49:	15% discount
50 - 99:	20% discount