180x360 Degree Panorama Photography with the
Sunex 5.6mm Fisheye on Micro Four-Thirds Cameras

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The Sunex 5.6mm f/5.6 fixed-focus, fixed-aperture lens was designed for making 185 degree fisheye images on APS-C sized sensor cameras, creating a full image circle on the frame similar to what an 8mm lens does on a full-frame SLR. It is available in both Nikon and Canon EOS mounts. It is a desirable lens for making 180x360 degree panoramas because one can make a complete image using at most three images.

Several years ago, Olympus and Panasonic introduced the four-thirds sensor. This allowed the creation of much smaller SLR-type, interchangeable lens cameras with sensors that were about 70% as large as APS-C crop format sensors but nearly 9 times as large is the sensors on typical point and shoot cameras. More recently, **micro** four-thirds cameras were introduced that use the four-thirds format and also remove the SLR mirror for focusing and replace it with either an electronic viewfinder or an LCD on the back of the camera. This made possible much smaller interchangeable lens cameras and also reduced the distance from the lens to the sensor. To compose images, the Panasonic G1 and GH-1 use an electronic viewfinder that functions like an SLR viewfinder while the Olympus E-P1 uses an LCD on the back of the camera and functions more like a rangefinder camera.

E-P1 with Pancake 17mm Lens Showing Sensor

One consequence of reducing the distance from the lens to the sensor plane is that it becomes possible to fit lens adapters on micro four-thirds cameras that utilize third-party lens, including high quality SLR and rangefinder lenses from Leica, Canon, or Nikon. These lenses must be used in manual mode on micro four-thirds cameras. They do, however, retain infinity focus.   Third-party lenses that can be manually focused with manual aperture control work best.

A Canon EOS to Micro Four-Thirds Adapter

Making panoramas with very few images (e.g., 3-5 images) with micro four-thirds adapters is a challenging problem because these cameras have a 2X crop factor. Thus, a traditional 8mm fisheye lens becomes a 16mm lens, and because of the field of view of a 16mm fisheye, it takes *at least* 8 (6 around +1 zenith+1 nadir) and more likely 12 images (two rotations of 6 around at +/- 45 degrees to make a 180x360 degree panorama. To reduce the number of images needed so a single rotation of 3 images is possible requires a lens that has a focal length somewhat less than 6mm. There are only two commercial lenses meeting the 6mm criteria: the Sigma 4.5mm and the Sunex 5.6mm.

The Sigma 4.5mm lens is made to fit many crop frame SLRs, including Canon and Nikon. The difficulty with the Sigma is that the when it is used on a micro four-thirds camera, the aperture must be used wide open (f/2.8) as there is no way to control its aperture without carrying an EOS camera along to set the aperture. Then, after setting the aperture with the EOS camera, one must move the lens from the EOS camera to the micro four-thirds camera for the shot. This additional complexity seriously limits its usefulness.

The Sunex 5.6mm is a lens that is fixed at the hyperfocal distance (so everything from infinity to less than 1 foot is in focus) and is restricted to its optimal f-stop, f/5.6. This makes it perfect for use on a micro four-thirds camera, using either a Canon EOS adapter or a Nikon adapter, as it does not need to be focused nor have an aperture set. An additional benefit of the Sunex over the Sigma is that it makes a larger image circle, thus utilizing more of the sensor's pixels.

When used on an APS-C camera, such as a Canon XSi (a 12 megapixel camera) approximately 50% of the pixels, or about 6 MP, are within the image circle created by the Sunex lens. When the Sunex is used on an Olympus E-P1 (also a 12 megapixel camera) approximately 74% of the pixels, or about 9MP, are within the image circle created by the Sunex lens. Obviously this provides an advantage in the resolution of the image.   A comparison of a Sunex image circle on an APS-C camera and a micro four-thirds camera is shown below.

Comparison of Sunex Image on an APS-C Sensor and a Micro Four-Thirds Sensor
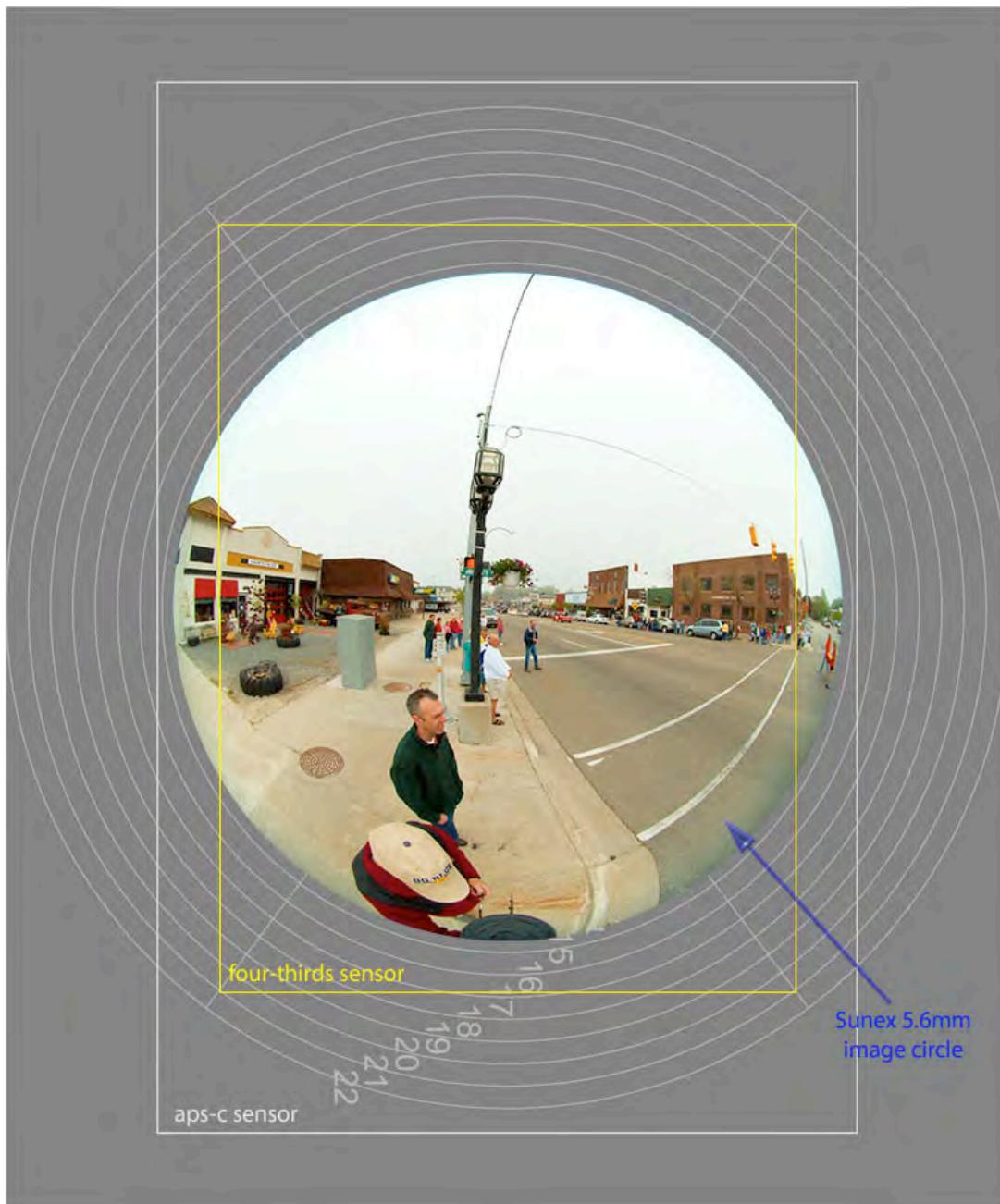
On an Olympus E-P1 in portrait mode, each Sunex fisheye image is approximately 185 degrees top-to-bottom and 166 degrees side-to-side. Thus, when making a 180x360 degree panorama a single row of three images provide complete coverage top to bottom and allows an approximately 38 % overlap side-to-side for ease in stitching and blending.

Sunex Lens on Sunex Rotator on EOS Adapter on E-P1

Sample *Sunex on E-P1* Images

A zip file of these three images in jpg format can be downloaded from:
www.sytsma.com/sunextest/testimages.zip

These three images when stitched in PTGui form the panorama. The stitching procedure used is precisely the one suggested by Dr. Alex Ning in a paper available at the superfisheye.com website (see link below). The stitching process produces the following equirectangular image:

Equirectangular *Sunex on E-P1* Image

A zip file of this equirectangular image can be downloaded from:
www.sytsma.com/sunextest/equirect.zip

This equirectangular image was translated into a Flash 9 file with supporting html code using the Pano2VR software from Garden Gnome Software (see link below).

The completed Flash 9 panorama can be viewed at:
www.sytsma.com/sunextest/sunexonep1.html

Some Additional Comments:
Making panoramas on micro four-thirds cameras is certainly not restricted to using the Olympus E-P1. Similar results could have easily obtained on other micro four-thirds cameras such as the Panasonic G1, or the Panasonic GH1. However, since I own the E-P1, I used it.

Likewise, it is not necessary to use the Canon version of the Sunex fisheye. The Nikon version could have been used as easily with a Nikon to micro four-thirds adapter. I chose the Canon adapter because I have Canon EOS lenses and thus bought the EOS adapter.

You should note that the custom rotator for the Sunex fisheye is better rotator solution for using the Sunex on the E-P1 than other potential rotator solutions for three important reasons:

(1) The nodal point as is predetermined with the Sunex rotator. With other rotator solutions, for example, the Nodal Nijna, the nodal point/entrance pupil must be determined and the rotator system adjusted so panoramas can be properly stitched.

(2) Using the Sunex rotator, the Sunex rotator and lens support the camera. This is important because with other rotator solutions the camera supports the lens and lens adapter. The E-P1 is a very small camera with a small lens flange and it would seem likely that a relatively heavy lens, such as the Sunex, cantilevered out on the adapter could strain the E-P1 lens mount.

(3) Rotator solutions other than the Sunex require the camera to be mounted to the rotator using the tripod mount on the bottom of the camera or with a quick release plate attached to the tripod mount. The tripod mount is centered on base the E-P1 (not aligned longitudinally with the lens), and even the smallest Arca-Swiss quick release plate covers the access door to the battery and SDHC card. Thus, the user would have to remove the camera or the quick release plate to get access to either the SDHC card or the battery. When the Sunex rotator is used, this problem is eliminated because the camera is supported by the lens and access to the SDHC card and battery is not restricted.

Links:
E-P1 camera: http://www.olympusamerica.com/cpg_section/product.asp?product=1461

Sunex 5.6mm f/5.6 fisheye lens and rotator: http://www.superfisheye.com/

PTGui stitching software: http://www.ptgui.com/

Suggestions for stitching Sunex lens in PTGui:
http://www.superfisheye.com/Support/Download

Pano2VR Software for Making Flash 180°x360° Panoramas Viewable on the Web:
http://gardengnomesoftware.com/

EOS to micro four-thirds adapter from jinfinance on ebay:
http://cgi.ebay.com/ws/eBayISAPI.dll?ViewItem&item=350201470018&ssPageName=STRK:
MEWNX:IT

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