Astro-Physics Telecompressors - 27TVPH & CCDT67
Compression and Coverage

A telecompressor, as its name implies, compresses a given photographic field into a smaller area effectively lowering the focal ratio of an instrument and giving it a wider field for any given sensor chip or film size while making it faster for photography. In general, the amount of compression varies with the distance from the telecompressor's optic to the focal plane. To calculate the compression, take the focal length of the telecompressor; subtract the distance from the center of the telecompressor's optic to the focal plane; and then divide the difference by the telecompressor's focal length. Astro-Physics offers two telecompressors: the 2.7" Photographic-Visual Telecompressor (27TVPH) and the CCD Telecompressor (CCDT67). We actually offer a third set of telecompressors, the 155TCC and 160TCC, but since they are also correctors (field flatteners), their required distance and therefore their compression ratios are NOT variable.

The 2.7" Photographic-Visual Telecompressor (27TVPH)

The focal length of the 27TVPH Photo-Visual Telecompressor is 700mm or 27.6". Using the formula above, a distance of 175 mm or 6.9" gives the stated 0.75X compression. (700 - 175) / 700 = 0.75 A shorter distance of 140 mm would give a compression factor of 0.80X. (700-140) / 700 = 0.80.

For your calculations, the 27TVPH takes up about 57 mm or 2.25" of that distance. The rest is made up of extensions, adapters, camera backfocus etc. To achieve 0.75X compression then, you would need a total distance of 118 mm (175 - 57) or 4.6" from the back edge of the telecompressor body to the focal plane.

The 27TVPH also has a clear aperture of 56 mm. To get the size of the fully illuminated (non-vignetted) circle, simply multiply the clear aperture times the compression ratio that you ended up with in the calculation above. 56 mm x 0.75 = 42 mm at 0.75X compression; 56 mm x 0.80 = 45 mm at 0.80X compression. Remember, however, that other parts of your light path like T-rings or filters may restrict the clear aperture further.

As a further example, let's assume a digital SLR is being used. The distance from the camera's bayonet mount to the sensor chip is 44 mm. The least amount of compression you can expect would be to use the following: Start with the 27TVPH @ 57 mm; no extensions; the ADA20132 - 2" thin adapter @ 11 mm; the AP16T - 2" / T2 nosepiece @ 3 mm; the appropriate T-ring at 10 mm; and finally your digital SLR @ 44 mm. 57+11+3+10+44=125 mm. (700-125) / 700 = 0.82X of compression. 56 x 0.82 = 45.9 mm - the fully illuminated circle. Adding extensions or using longer components like the regular 2" adapter (ADA2003) or the PFCT camera adapter instead of the AP16T will increase the amount of compression and decrease the fully illuminated circle accordingly. *(Note, the example uses the newer ADA20132 with the AP16T. We do not recommend using the older style ADA2013 with the AP16T nosepiece, but instead suggest the equivalent Baader BP16 nosepiece.)*

The CCD Telecompressor (CCDT67)

The focal length of the CCDT67 CCD Telecompressor is 305 mm or 12.0" Again, using the formula introduced above, a distance of 101 mm or 4.0 inches gives the stated 0.67X compression. (305 - 101) / 305 = 0.67 Because the CCDT67's focal length is much shorter than the 27TVPH's, an equal change in distance will have a greater effect on the compression. If we shorten the distance by 35 mm as we did above for the 27TVPH, the compression factor becomes 0.78X. (305 - 66) / 305 = 0.78 Changing from 0.67X to 0.78X is certainly more drastic than changing from 0.75X to 0.80X as was the case for the 27TVPH. The CCDT67 takes up 16 mm of the distance in your calculations. The rest of the distance is in the nosepiece, filter wheel, CCD camera and any extensions you may use. Note also that, unlike the above example with the 27TVPH, the entire nosepiece length is a part of the light path with the CCDT67 since the nosepiece does not get buried inside another adapter relative to the telecompressor.

The CCDT67 has a clear aperture of 44 mm or 1.75". At 0.67X compression, it will fully illuminate a 29 mm circle - 44 mm x 0.67 = 29 mm.

To give a real world example, let's assume the following: We will set up a system with the CCDT67 @ 16 mm; our AP16T - 2"/T2 nosepiece @ 29 mm; a color filter wheel @ 25 mm; and a CCD camera @ 25 mm. 16+29+25+25 = 95 mm. (305 - 95) / 305 = 0.69X 44 mm x 0.69 = 30 mm - the fully illuminated circle.

For All Telecompressors in General

Here are a few more things to keep in mind: The calculation for compression is only valid for systems with fixed focal lengths. Moving mirror systems like SCT's change the native focal length as they are backfocused resulting in somewhat less compression. There is no way to calculate the actual compression for an SCT, so the formula only yields an approximation that will indicate more compresssion than will actually be realized. An accurate compression factor must be measured in practice.

Also, there are limits to how much compression you can achieve with any system: fixed focal length or moving mirror. Compression increases the backfocus or focuser in-travel requirements of any instrument. Your maximum achievable compression will be determined by the amount of backfocus your telescope has. You can't simply add extensions ad infinitum.

Finally, the 27TVPH and CCDT67 do not add any field curvature. In fact, they have a little bit of a flattening effect. However, the telecompressor takes a larger field and compresses it into a smaller area. If you have a 20 mm square CCD chip, and you are compressing at 0.75X, you are effectively taking a 27 mm square field (20 / 0.75) and compressing it onto your 20 mm square chip. The question to ask yourself is this: Would I show field curvature on a 27 mm square without the telecompressor? If so, then you may show some on the 20 mm square at 0.75X compression. It won't be caused by the telecompressor, but will simply be your instrument's curvature squeezed into a smaller area. To calculate an equivalent uncompressed chip size, take each chip dimension and divide by the compression factor.