

Tech Notes

Touptek cameras are designed for both for *planetary* and for *deep sky imaging*.

For these applications the biggest the telescope's aperture the more light will reach the camera's sensor. So aperture plays the outmost role in imaging acquisition.

For **planetary imaging**, focal length is also important. Long focal lengths are usually required (the exception might be the Moon). If your telescope has a short native focal length you can increase it using a *Barlow lens*. On the other hand for **deep-sky imaging** you may want to use a *focal reducer*, to reduce total focal length, because many objects have a wide angular size and may not completely fit in the camera's sensor (you will get a cropped view of a galaxy for example).

So choosing the right camera depends on what kind of work you want to do.

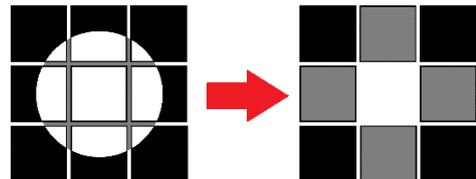
- 1) For **planetary imaging** you should prioritize **FPS** (frames per second), this is the "speed" that the camera sends the images through the USB cable to the computer. The size of the camera's sensor is not important. Small sensors will work just fine. Remember that even at high magnification the planet's discs are usually relatively small. But planets such as Jupiter show a high dynamic atmosphere - i.e. one that changes rapidly. Also turbulence (and atmospheric stability) plays a major role. To get around these problems the more FPS the better results.
- 2) For **deep sky imaging** you should prioritize **sensitivity, and chip size**. The more sensitive the camera the more light it captures. Some deep sky objects are so dim that only will long exposures and high sensitivities can be seen.

Sampling plays a major role either for planetary or deep sky astrophotography. And by definitions sampling is the number of pixels that cover an angular area of the sky.

For **planetary imaging** the planet's disc is usually small but with a lot of detail so, in order to get an appropriate sampling, extreme magnification is required. But there is a catch, if there is atmospheric turbulence the camera will "see" this turbulence and the images will be blurred. So, to avoid this problem, the camera should read and send the image to the computer as fast as possible. The camera records a video, either .AVI or .SER format that can be partitioned in several frames. Only a few of these frames will be sharp enough to be used. Small sensors are usually faster than big sensors, so for planetary image one should look at speed in detriment of sensor size.

Usually a focal length of 3000 to 5000mm is used for planetary imaging

For **deep sky** one of the common mistakes, for beginners, is trying to use very low magnifications to capture a big portion of the sky or to avoid tracking errors due to mount's limitations. But there is also a limit on how low magnification you can get for imaging. Why? Because too low means you will get square stars. Yes, instead of round the stars, these will be seen as a pixelated star squares. Here is a short explanation – diagram below. On the left, the star image as seen by the camera: only a few pixels cover the star's disc. On the right the result as seen on the screen is pixelization of the star. The opposite is also true, this is, too many pixels covering the star's disc mean you are wasting potential field of view (over-sampling). Calculating the right amount of pixels per angular size is called **sampling** and it is of the outmost importance for good results. Notice also that the bigger the pixel size the more sensitive the camera will be. For most deep sky objects a focal length between 500mm and 1000mm is required.



Using filters

Touptek Cameras are very sensitive and capture a portion of the invisible spectrum such as UV and IR radiation. This is interesting especially when using Monochromatic cameras as specialty filters can be used (methane, ultra-violet etc...). For normal work however an IR-UV cut filter should be used as most telescopes are design to focus all wave lengths in the visible spectrum only. Without this IR-UV filter stars will show up with blobs around it (like a strong halo cast around its center)

Using Software to get the best setup settings

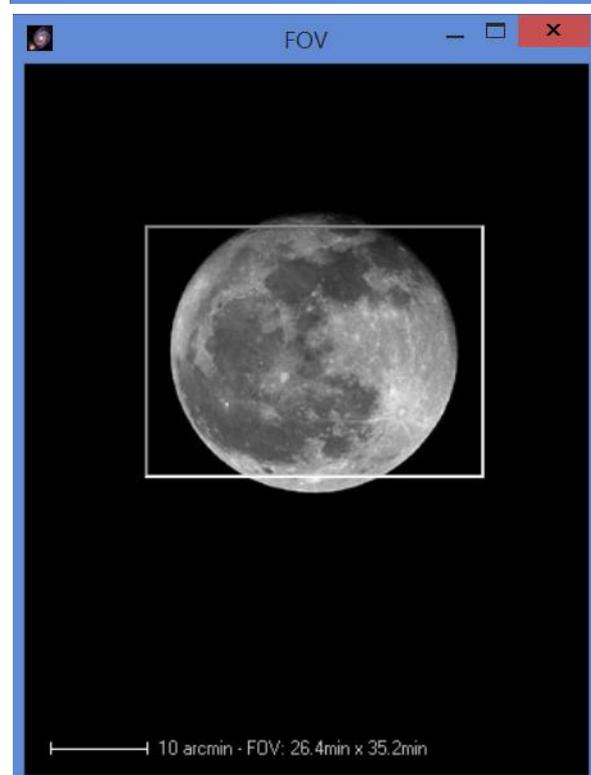
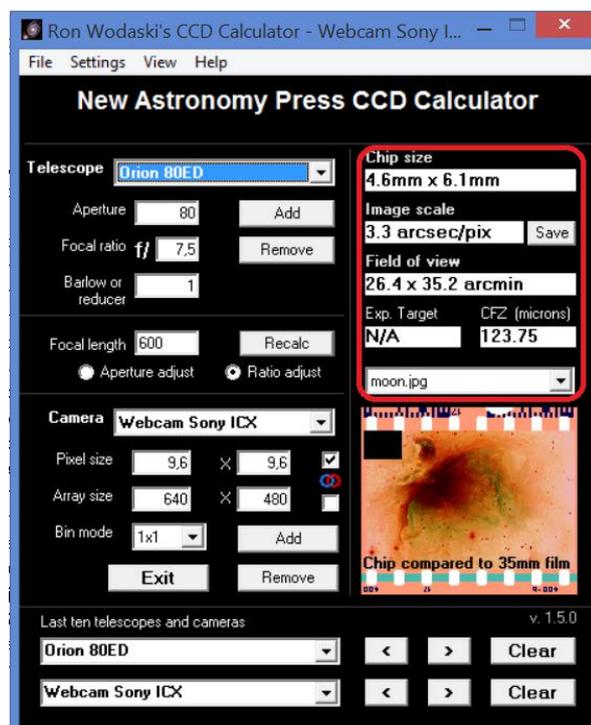
So, as everything in life we recommend ponderation. A great tool to help you decide on your **sampling** decisions is Ron Wodaski's CCD Calculator. This is a free PC software that we strongly recommend. It allows to choose from a list of telescopes and cameras and get precise data to decide on a certain setup. If the telescope or camera is not listed one can simply insert manually all required data. Here are some screen shots. Important is the output data (marked red).

Image scale is related to sampling. It tells us the number of pixels that cover a certain area of the sky. In this case one can see that this telescope with this camera provides 3.3 arcsec/pix. On a good night (stable with good seeing) one might reach in Europe between 2 to 3 arcsec/pix (arc-second per pixel). If our sampling matches the sky's stability then stars will show as round points

Field of view (FOV) is the amount of sky as seen by the camera. This is really important for deep sky objects. One can actually get a glimpse of what to expect to see (image of the Moon on the right). Just click on one of the listed objects and compare (we chose moon.jpg). Usually by using a reducer or Barlow one can adjust the FOV easily.

CFZ (microns) or critical focus zone, is the region around the focus point where the image will look like focused. A big CFS means basically achieving focus is easier than a small CFZ. A longer CFZ is obtained by having a longer F ratio. So a telescope having f/8 has a longer CFZ than a telescope with f/4 only (with the same aperture for both cases).

So when preparing a setup it is important to consider not only the camera, but also the telescope's characteristics such as the focal length and f/ratio, the object being imaged and the quality of the skies. Trial and error is also part of the learning process, the more you work with this software the more you will understand how each of these components affects the performance and final results of your astrophotography setup.



Here some examples of recommended setups

1) For **Saturn**:

Omegon Advanced 203
 Achromatic Barlow 5x
 IR-UV blocking filter
 Touptek EXCCD00300KMA



2) For **M13**:

Orion 80ED
 IR-UV blocking filter
 Touptek EXCCD00440KMA



Images for size comparison purposes only.

Summary of features and camera recommendations

Camera	Chip	Pixel size	Pixel Array	Type	FPS	Deep Sky	Planetary
EXCCD00440KMA	Sony ICX429AL	8.6x8.3 microns	748x578	Mono	42@748x578	Recommended	Recommended
EXCCD00330KMA	Sony ICX618AL	5.6x5.6 microns	640x480	Mono	72@640x480	Not really, but it can be used	Highly Recommended
E3CMOS02300KPA	Sony IMX226	3.75x3.75 microns	1920x1200	Colour	45@1920x1200 90@960x600	Highly recommended	Highly Recommended
GCMOS01200KPB	Aptina AR0130	3.75x3.75 microns	1280x960	Colour	28@1280x960 or 30@640x480	Not recommended	Recommended
GCMOS01200KMA	Aptina AR0130	3.75x3.75 microns	1280x960	Mono	28@1280x960 or 30@640x480	Not recommended	Recommended

Questions?

Email us or call us for professional advice