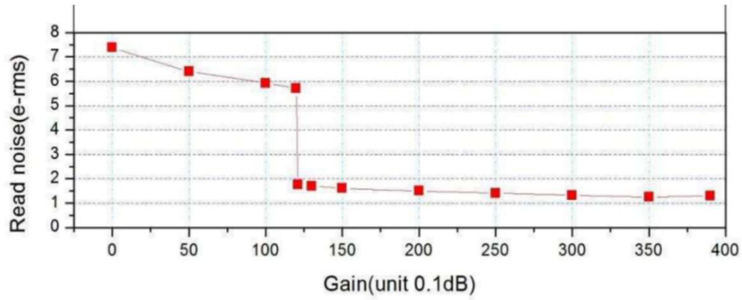
Example calculation for optimal exposure time

It applies *(Source: https://www.youtube.com/watch?v=3RH93UvP358)*:

$$optimal\ single\ exposure\ time = C * \frac{R^2}{P} \qquad whereby\ \ C = \frac{1}{\left(\frac{100+E}{100}\right)^2 - 1}$$

R – readout noise of the camera
P – light pollution rate (electrons extracted by sky glow per pixel per second. [e/pixel/s])
E – percentage deviation from unavoidable smallest possible noise

From the data sheet of the camera the following diagram for the readout noise **R** is available:

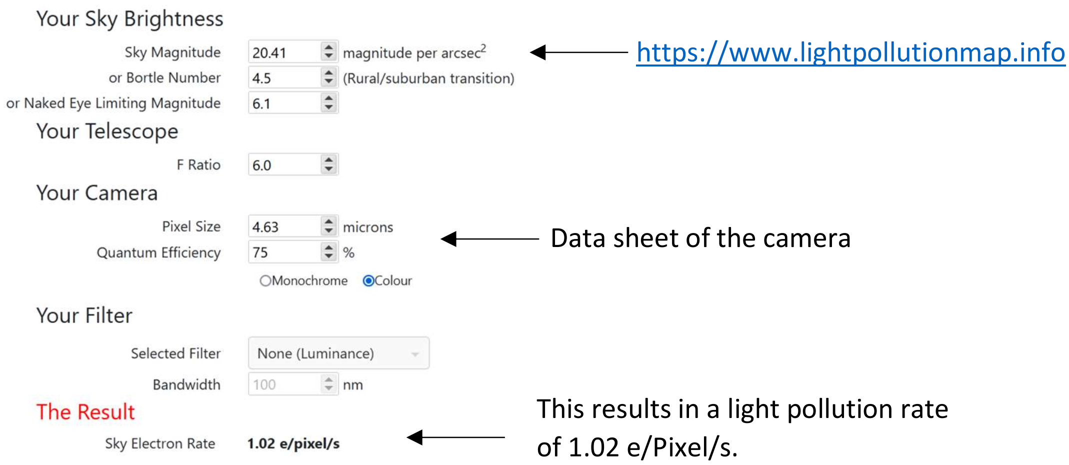


Source: https://astronomy-imaging-camera.com/product/asi294mc-pro-color

Since a low readout noise is useful, but the gain should not be set so high (see section (ISO/Gain), a gain of about 120 is used and it results in a readout noise of about 1.9. The quantum efficiency of the camera is over 75 %.

On the page https://tools.sharpcap.co.uk/ the light pollution rate is calculated and it is also entered at the same time which focal ratio the telescope setup has, whether it is a mono or color camera and which filter is used.

On the page https://www.lightpollutionmap.info you can also check the required light quality (SQM - Sky Quality Meter) for your own region.



If a deviation of 5 % noise from the optimum is allowed, the following formula results:

$$optimal\ single\ exposure\ time = \frac{1}{\left(\frac{100+5}{100}\right)^2 - 1} * \frac{1{,}9^2}{1{,}02} = 34{,}5s$$