

Technical Solutions

Conversion of Counts to Photoelectrons / Incoming Photons

Products Affected – All Camera Types

Description: SOLIS software (or similar control software) will present the data from the camera as digital counts. Here we discuss the conversion process for different camera types, and indeed provide further comment on an indication of the approximate number of incoming photos.

Please remember that there will be a DC offset applied to the baseline of each camera. This offset level will vary for various camera / sensor types, as well as a small variation from camera to camera. This will need to be subtracted from the signal level in order to ensure that only the actual signal is being measured.

As such, be aware the simplest way to determine this baseline is to acquire a dark image first. An average signal in counts can be subtracted from the count level of the image or Andor basic could be used to subtract the background image from the signal image directly.

Sensitivity information for your camera is reported in the performance sheets which accompany your camera. If these are not available, please contact your local Andor Product Support representatives to request to be re-issued these.

Please find below details of the conversion process for different camera types.

CCDs / EMCCDs

$(\text{Counts} - \text{Offset}) \times \text{Sensitivity} \div \text{EM Gain (if applicable)}$

= Photoelectrons generated on the sensor

ICCDs

$(\text{Counts} - \text{Offset}) \times \text{Sensitivity} \div \text{Relative MCP gain (if applicable)}$

= Photoelectrons which enter the Micro-Channel Plate

sCMOS

$(\text{Counts} - \text{Offset}) \times \text{Sensitivity}$

= Photoelectrons generated on the sensor

In order to then convert this number of photoelectrons to the number of incoming photons, this value should be multiplied by the QE of the sensor for CCD / EMCCD and sCMOS sensors, or the QE of the intensifier tube for ICCD cameras, at the wavelength of interest.

This QE data is available in the specification sheets for all camera types, which are freely available for download from the Andor website, (www.andor.com).

These details are summarised in the diagram below.

CCDs / EMCCDS	ICCDs	sCMOS
Counts	Counts	Counts
(- background offset)	(- background offset)	(- background offset)
x Sensitivity	x Sensitivity	x Sensitivity
÷ EM Gain	÷ MCP Gain	
Number of Photoelectrons generated on the sensor	Number of Photoelectrons which enter the micro-channel plate	Number of Photoelectrons generated on the sensor
x Sensor QE (%)	x Intensifier Tube QE (%)	x Sensor QE (%)
Number of Incoming Photons	Number of Incoming Photons	Number of Incoming Photons

If you require further information or assistance, please do not hesitate to contact your local Andor Product Support representatives