

## Conversion of Counts to Photoelectrons / Incoming Photons

**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 incident photons.

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 System Performance Sheet which accompanies your camera. If these are not available, contact your local Andor Product Support representatives <sup>[1]</sup> to request a copy of this.

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

### CCD / EMCCD

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

= Photoelectrons generated on the sensor

### ICCD

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

= 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 divided 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 of all camera types, which are freely available for download from the Andor website, ([www.andor.com](http://www.andor.com)).

The methodology to convert back to incident photons is summarised below.

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

If you require further information or assistance, please contact your local Andor Product Support representatives <sup>[1]</sup>.

## Useful links

<sup>[1]</sup> Product Support - <http://www.andor.com/ContactSupport>