Customer Reference & Product Feedback

"We compared the Aries 16 with our existing EMCCD camera, and initial investigations observed no difference in signal to noise ratio between them"

Featured Customer - Dr. Joao Correia, University of Birmingham

Featured Product – Tucsen Photonics, Aries-16

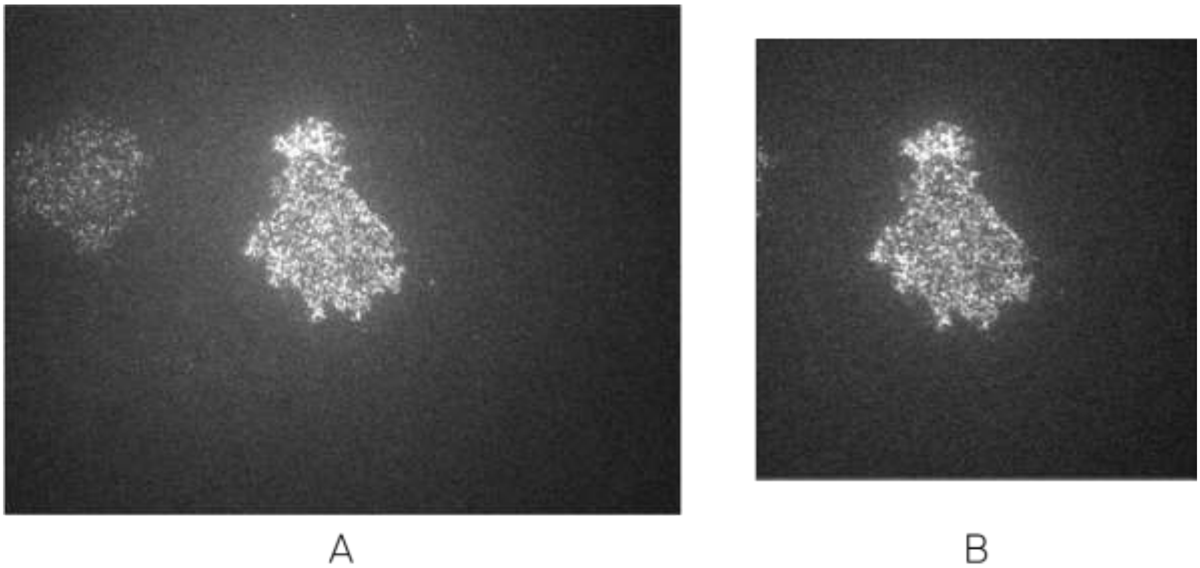

Figure 1: Sample: A fluorescently labelled expressed protein in a live cell illuminated using an annular Total Internal Reflection Resonance (TIRF) system with excitation at 488 nm, and absorbance at 530 nm. The image was simultaneously captured on an Aries 16 (Picture A, left, 16 µm pixel), and a EMCCD (Picture B, right, 16 µm pixel), an integration time of 30 ms and an objective of 60 x. Images were captured by Dr. Zsombor Koszegi, University of Birmingham Medical school.

Background: Dr. Correia is an advanced imaging specialist at the University of Birmingham. He specialises in live cell imaging for the purpose of metabolism and systems research. Dr. Correia was interested in trying the Aries 16 after he heard about their EMCCD level low light capability with an sCMOS sensor.

Experimental camera needs: One of the techniques that the team uses is TIRF to analyse and track the position of single fluorophore-tagged proteins in live cells. This requires not only detection at low light, but the ability to resolve them against other fluorescent species within a sample. The group currently uses EMCCD technology due to its ability to differentiate signals at low light, other technologies (Binned sCMOS) have been tried but don't appear to meet the requirements.

Experimental testing: The Aries-16 camera was compared against an existing installed EMCCD camera with a equivalent 16 micron pixel size. Comparison was carried using a c-mount connected TwinCam (Cairn Research Ltd) with a 50:50 signal splitter attached to a Nikon Ti-2 operating an iLAS annular TIRF system for illumination.

Customer conclusions:

Figure 1 above shows that an Aries 16 is able to produce an image with matching SNR but with significantly larger field of view giving more data points per image.

When asked about the sensitivity, Dr. Correia said "We compared the Aries 16 with our existing EMCCD camera, and initial investigations observed no difference in signal to noise ratio between them."

"The added benefit over the EMCDD, apart from the noted price, is the extra field of view I was able to achieve, helping me get more data in a single field of view"

Figure 2: Dr. Correia testing an EMCCD against an Aries 16.

Additional thoughts:

Comparison to classical 16 micron EMCCD

The Aries camera utilises an sCMOS architecture meaning we do not suffer from excess noise (F factor) which multiples the noise contribution by 1.41. This outweighs the benefits of the smaller read noise of the EMCCD running in high EMGain mode. Along with the Aries-16 retains the full well capacity (73,000 e-) which is reduced by the factor of applied Gain when using an EMCCD camera. Finally the Aries delivered 1.83 x larger area.

Figure 3 below shows a line profile comparison (uncorrected for bias or gain conversion) between the Aries-16 and an EMCCD. The Aries offers a peak signal of nearly 500 compared to a background of 200, 300 grey levels of signal. In contrast, the EMCCD offers a peak of 850 against a background of 580, resulting in 270 grey levels of signal.

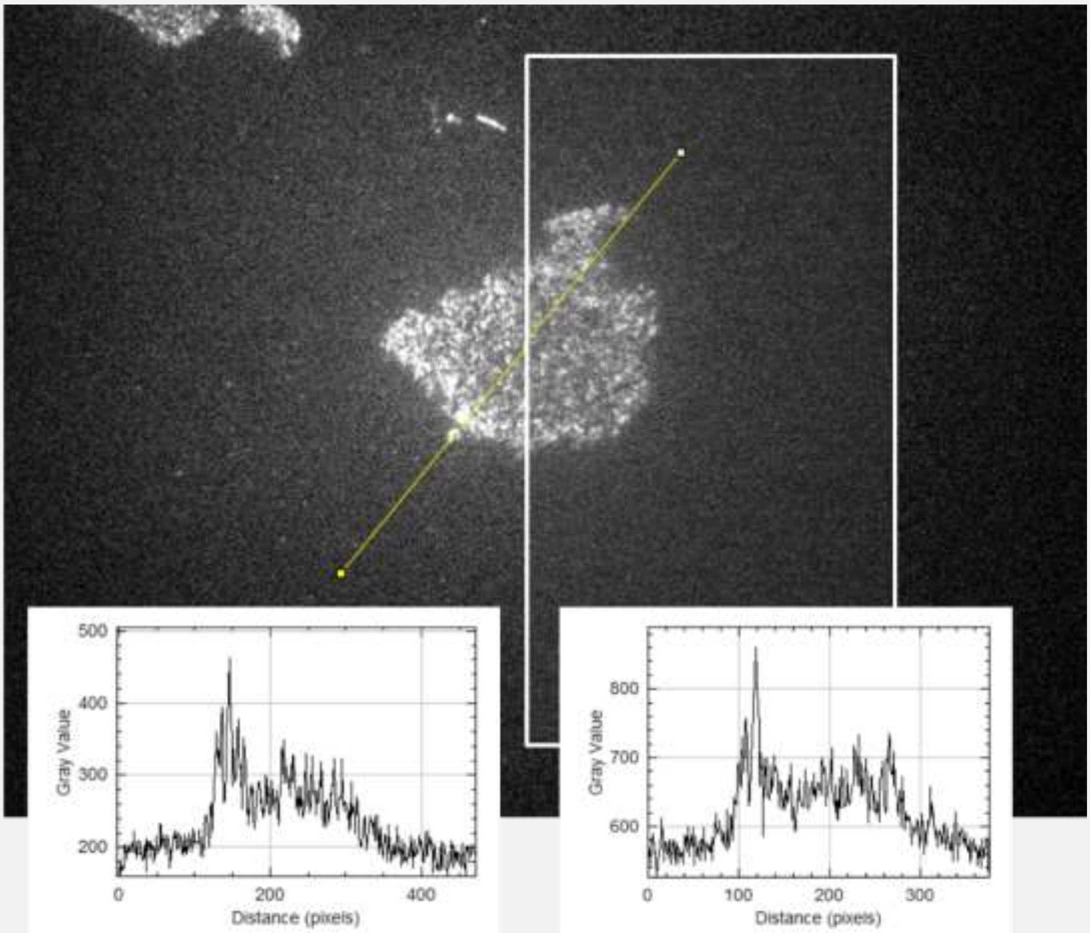

Figure 3: A comparison between the Aries-16 and an EMCCD (inset). Sample: A fluorescently labelled expressed protein in a live cell illuminated using an annular TIRF system with excitation at 488 nm, and absorbance at 530 nm. The image was simultaneously captured on an Aries 16 (outer image, 16 µm pixel) and a EMCCD (inset, 16 µm pixel), an integration time of 30 ms and an objective of 60 x. Histograms showing the greyscale values across the yellow line are displayed, Aries (left), and EMCCD (Right). Images were captured by Dr. Zsombor Koszegi, University of Birmingham Medical school.

It is also worth noting that, unlike EMCCD technology, there are no export controls or requirements to keep documentation of the physical location or users of the item for camera manufacturers or local governments.

Comparison to classical 6.5 micron sCMOS

Binning is often used to increase pixel size, however this comes with a read noise penalty; the increase stated read noise by the binning factor. For example, those operating in high dynamic range mode will see their 1.6 electrons double to 3.2 electrons in Bin 2. The Aries achieves 0.8 elections without needing to apply binning. For regular fluorescence applications this may not be applicable but when you are operating under very low light conditions such as with single molecules this increased contribution to read noise is significant.

Aries-16

- 16 µm x 16 µm pixels
- 0.8 e- readout noise
- 90 % Peak QE
- 800 (H) x 600 (V)
- CameraLink & USB3.0

Full specification link here