QUANTITATIVE EVALUTATION OF A NEXT GENERATION SCIENTIFIC CMOS (sCMOS) CAMERA FOR HIGH FIDELITY IMAGING

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Since the release of "Scientific" CMOS (sCMOS) camera, sCMOS camera has become the standard imaging technology for microscopy and advanced imaging. However the read noise characteristics, including non-uniformity of pixel read noise[1] prevented use in some applications.

Therefore we designed the new sCMOS sensor chip and developed the next generation sCMOS camera. The sensor chip used in this camera has extremely low read noise, CCD-like homogeneous noise uniformity, reliable linearity at all light levels, more pixels and faster pixel throughput. To evaluate the next generation sCMOS camera, we measured the *distributions* and *spatial maps* of individual pixel offset, dark current, read noise, linearity, photoresponse non-uniformity (PRNU). Measurements are taken with highly uniform and controlled illumination over a several light conditions from dark conditions and at multiple light levels.

In this presentation we report that the next generation sCMOS camera (ORCA-Fusion) using the new sensor has extremely low read noise and high uniformity of read noise distribution (Figure 1). The higher SNR by extremely low read noise at low light level makes it possible to use lower excitation light levels and/or extend the observation time by reducing photo bleaching and photo toxicity. Additionally the high uniformity of read noise not only increases the image quality at low light level but also makes the image correction for irregular noise unnecessary providing the signal which is more close to the true data.

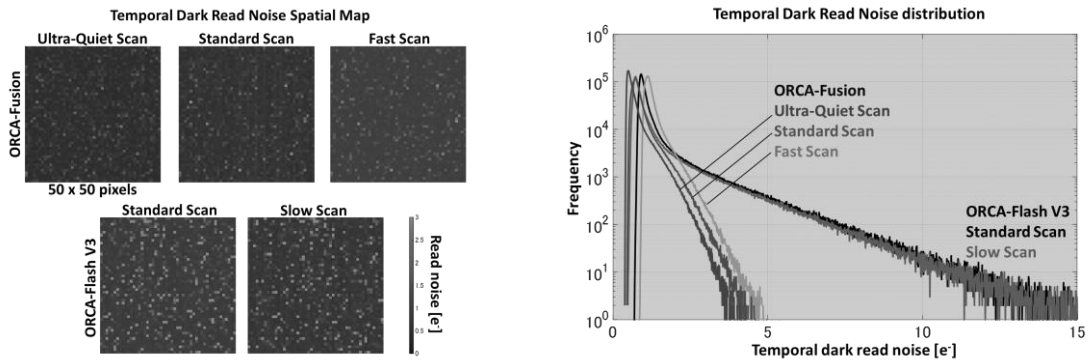

Figure 1: Spatial map and histogram comparison of temporal dark read noise between the next generation sCMOS camera (ORCA-Fusion) and the previous sCMOS camera (ORCA-Flash V3).

[1] S.Watanabe, T. Takahashi and K. Bennett, *Proceedings of the SPIE*, Volume 10071, id. 100710Z 8 pp. (2017).