



## Proceedings

### SY07.02 | **Imaging Technology**

#### OPTIMIZING OPTICAL AND DIGITAL RESOLUTION FOR BRIGHTFIELD WHOLE SLIDE SCANNING

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#### *Introduction/ Background*

Whole slide imaging lacks standards for defining image resolution. Scanner vendors usually describe the image resolution according to the microscope objectives “20X” or “40X”. This has caused confusion, since scanning with a 20X objective lens may mean spatial resolution 0.25 to 0.5 microns per pixel, due to variable pixel size of the camera sensor and/or use of a magnifying relay lens.

#### *Aims*

Our aim was to compare image quality obtained by two digital cameras (with pixel sizes 5.5um and 3.1um combined with 10X, 20X, and 40X Plan Apo objective lenses).

#### *Methods*

As for image quality readouts we used standardized resolution charts, Peak-Signal-To-Noise Ratio, and evaluation by three pathologists who ranked the images by their “visually lossless quality”, when displayed with a 4K computer monitor. Lossless JPEG2000 was used as a reference.

#### *Results*

The differences in scanned image quality were significant. The image quality achieved with a CCD camera with 3.1 um pixels was superior in all tests. It was noteworthy that the camera with 3.1 um pixels (Lumenera 1265R) gave visually as good diagnostic image quality with 10X lens (0.31 um/pixel) as did the 5.5 um pixel camera (Lumenera LT425) with 20X lens (0.28 um/pixel). This gives a significant speed advantage in scanning of standard H&E slides, because the scanner needs to capture only one 10X field instead of four 20X fields. In higher resolution scanning tasks, such as cytology and in situ hybridization, we found 3.1 um pixel Lumenera 1265R camera and Plan-Apo 20X lens to give diagnostically satisfactory scanning results. We anticipate that in the future scanners will be equipped with cameras having small pixel size sensors (typically 2-3microns). This matches with the optical resolution of Plan-Apo objective lenses. Compared to current scanners, significant image quality and/or scanning speed improvement can be gained by upgrading the camera.