Personal
Cell Analysis

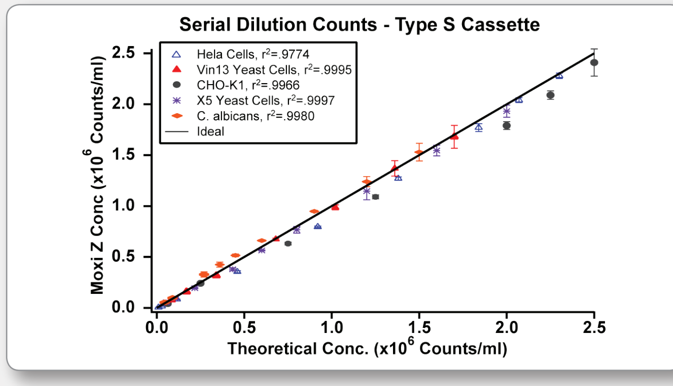
TECH NOTE | 11/2011

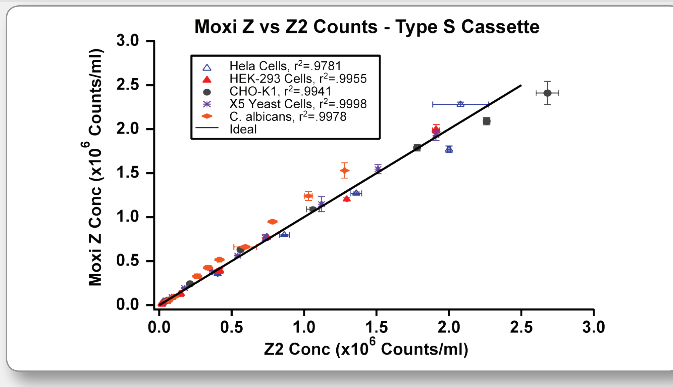
Moxi Z Performance – Precision and Accuracy that match the "Gold Standard" of Counting Technologies

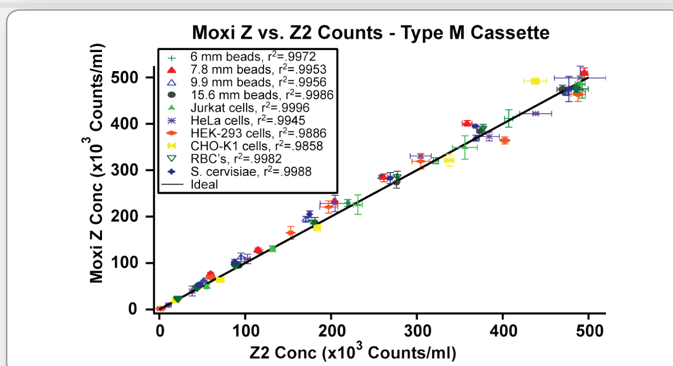
Count Precision and Accuracy

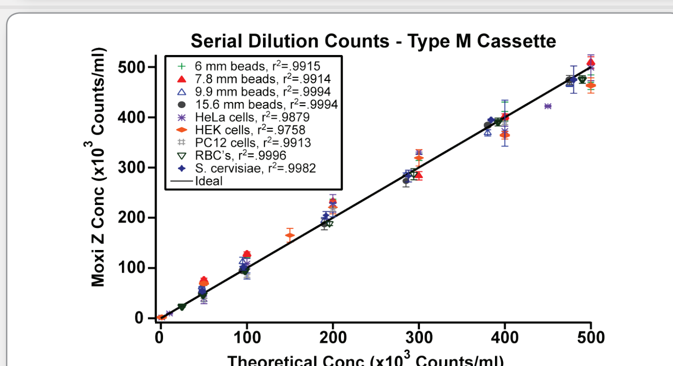
Precise and accurate results are requisites for any cell counting technology. Cell counts often serve as the foundation for experimental protocols including the determination of (costly) reagent quantities and cell seeding densities necessary for downstream processing. Additionally, because count information is often applied to the normalization of results in data analysis and presentation, a strict requirement for both consistency and accuracy is necessary. To achieve accuracy and precision, the Moxi Z cell counter utilizes the same Coulter Principle of cell counting found in high-end counting systems. This highly sensitive technology enables every cell within a sample to be counted individually, without the risk of "missing" counts, allowing the Moxi Z to provide very accurate cell counts for mammalian cells, yeast, algae, and other particles.

Serial dilution experiments were performed with a range of cell types and precision calibrated bead sizes using both the Type M cassettes (effective cell diameter range: 4 - 25 µm and concentration range: 3,000 – 500,000 cells/ml) and the Type S cassettes (effective cell diameter range: 3 – 20 µm and concentration range: 3,000 – 2,500,000 cells/ml). Initial concentrations of various cell types and bead sizes were established using both a Coulter Z2 cell counter and the Moxi Z. Subsequent theoretical concentrations were created through ratiometric, serial dilutions using isotonic media (Orflo Diluent) measured with calibrated pipettes (Eppendorf). Counts of each sample were measured and compared with both systems. Plots (right column) of the Moxi Z concentrations vs. analogous theoretical values (linear correlation coefficients of Type M: r^2>.9758, Type S: r^2>.9774) as well as the Coulter Z2 system measurements (Type M: r^2>.9858, Type S: r^2>.9774) highlight the precision and accuracy of the Moxi Z measurements across a broad dynamic range. In fact, the performance of the Moxi Z matches that of the significantly more expensive "gold standard" in cell counting and far exceeds the performance of highly variable and error-prone imaging systems. This data demonstrates that the Moxi Z offers researchers a high level of confidence in the reliability of each and every cell count for their experimental protocols.





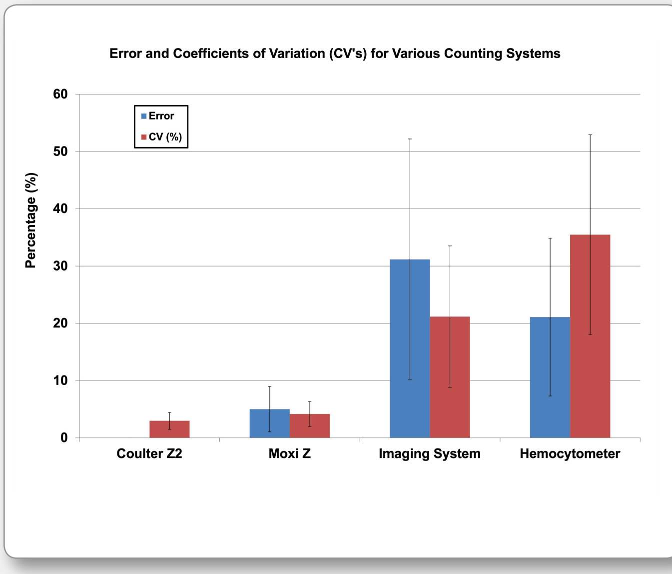




Error and Variability

At the core of the Moxi Z counting technology is a precise, volumetric (3-D) electrical measurement of cells as they pass through an aperture (Coulter Principle). In contrast, imaging systems take an image (2-D) of a cell sample and apply software algorithms to "extract" cell profiles and corresponding counts. Unlike the Moxi Z, the interpretive approach of imaging systems is subject to errors in focusing, debris contamination and overall processing limitations, all of which are ultimately reflected in the quality of the corresponding count results.

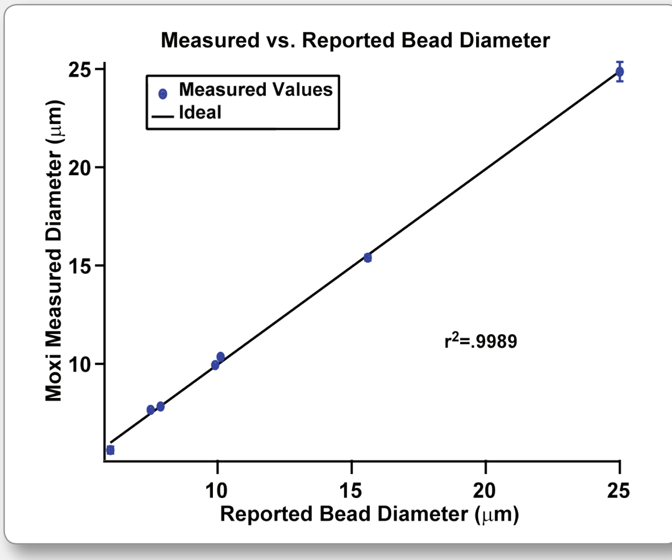
Differences in the performance of various counting technologies were evaluated through serial dilution experiments of CHO-K1 and Jurkat E6-1 cells measured on a Moxi Z, a Coulter Z2, a Biorad TC10 and a hemocytometer. For each system, error values were calculated as a percentage of the Coulter system count result and an overall variability (coefficient of variation, CV %) of the counts for each system was determined. Results (top right) show the Moxi Z achieved similar performance to the reference standard with an error of just 5% and a CV of only 4%, whereas the imaging systems mirrored the less reliable performance of the hemocytometer approach from which they are adapted.



Precise Sizing information

Because the Moxi Z makes a volumetric or 3-D measurement of cell size, the quality of the particle sizing information is far more precise and accurate than those provided by the 2-D estimates made by image-based systems.

Precision calibrated beads of various sizes (concentrations of ~50,000 beads/ml) were evaluated using the Moxi Z, Type M cassette and compared to manufacturer reported sizes (middle right figure). The high linearity (r^2=.9989) demonstrates the high precision of the Moxi Z size measurements.



Count Speed

With an average test time of a mere eight seconds, the Moxi Z yields the fastest cell counts of any other available system or technique.