ProDrop™ Technology — A Novel Approach to Automated Drop Delay Measurement and Monitoring

**Abstract**

Proper determination of the distance between the laser interrogation point and the last connected drop on an electrostatic cell sorter is critical to obtaining optimal sort purity. ProDrop technology measures the drop delay directly and accurately on the S3™ cell sorter using a novel method. The S3 cell sorter uses a laser to interrogate the waste stream while running ProLine™ calibration beads. The fluorescence signal from this laser is routed by a fiber to an existing photomultiplier tube (PMT), which accurately determines the exact number of beads in the waste stream. With deflection enabled, the drop delay setting is automatically adjusted through a set range, first coarsely, then a second time more precisely over a shorter range within the first coarse range for verification. A graph displays the number of beads detected at each setting. When the correct drop delay setting is found, the ProLine calibration beads are no longer detected in the waste stream because they are all being deflected. This is the exact drop delay value. ProDrop technology allows accurate measuring of the drop delay without requiring user intervention or counting of beads under a microscope for confirmation. The S3 cell sorter continues to monitor the position of the break-off point and the length of the satellite drop and adjusts voltage, if necessary, during the sort to maintain precise sort stability. This ensures optimal sort performance and purity.

**S3 Cell Sorter**

ProDrop’s novel waste bead detection module serves as a “cytometer within a cytometer.” The fluorescence is collected, focused, and directed by a fiber optic cable to one of the existing PMTs for detection. FEP, fluorinated ethylene propylene; PMT, photomultiplier tube.

**Figure**

Schematic of sort stream.

**Figure**

Waste bead detection module serving as a “cytometer within a cytometer.” The fluorescence is collected, focused, and directed by a fiber optic cable to one of the existing PMTs for detection. FEP tubing (into the screen) and two fiber optic collection plates are shared.

**Figure**

Schematic depicting the mechanism by which events are sorted. Events are hydrodynamically focused by the sheath fluid before exiting the nozzle tip. With jet-in-air technology, events are interrogated in the stream where the sort decision is made. The stream is then charged at the break-off point prior to electrostatic deflection. Droplets can be deflected in two directions based on predefined sort logic conditions.

**Figure**

Peripheral Blood Mononuclear Cell Sorting

**Summary**

ProDrop technology automates and determines an accurate measurement of the drop delay in the S3™ cell sorter. With this feature, high purity and recovery of sorted cells can be obtained, providing confidence and reliability in sorting experiments.

Key features and benefits of the automated S3 cell sorter include:

- Automated monitoring of the drop delay setting during the sort with automatic adjustments to any changes during the run
- Automated removal of collection tubes to preserve sorted samples in cases such as clogs, if drop delay is unrecoverable or is not maintained
- Bubble detector in the sample line allows samples to be run completely dry and automatically triggers end of sample in the ProSort software
- Automated monitoring of the drop delay setting during the sort with automatic adjustments to any changes during the run