An Open Architecture Analyzer for Flow Cytometry Technology Development

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Modern photonics is providing a wealth of new laser, detector and signal processing electronics technology that can be of great benefit to modern flow cytometry. While academic laboratories make contributions in this area, most rely on existing modified commercial cytometers as test platforms. In addition to the regulatory problems posed by this situation, most commercial cytometry platforms are relatively closed systems that can be modified only to a limited extent. A truly open architecture flow cytometer would be of great benefit to investigators working in the area of improved flow cytometer design.

An open architecture flow cytometry has been developed in a collaboration with the cytometry firm Kinetic River, Inc. that provides complete access to all cytometer systems, employing off-the shelf standard optical components. The Kinetic River Potomac is a basic two laser, seven detector flow cytometer constructed with 30 mm cage components, a design standard widely used in optical prototyping with parts available from many manufacturers. The instrument is built on a standard optical breadboard with removable covers to allow easy access. A solid state fiber-coupled 488 nm laser is used as a primary laser source; almost any laser can be used in the second position, with a portion of the instrument breadboard open for laser installation, steering and focus. The quartz cuvette flow cell is visualized using an LED illuminated camera to visualize stream dynamics and laser beam paths. The optical bench is populated with dichroics, filters, field and relay lenses and PMTs can be moved, removed and replaced as needed. The fluidics system is currently uses hydrostatic positive pressure for sheath flow and a syringe pump for sample delivery, but this too can be modified to test different systems for sheath and sample delivery. The acquisition electronics and software (currently the Azurite/Kytos system until recently produced by Darkling X, Los Alamos, NM) can similarly be removed and replaced. In short, this system is a flexible and truly open technology development tool for testing new optical, fluidic and electronic technologies for their applicability to flow cytometry.