channel **1610** in which four wells **1612**, **1614**, **1616**, and **1618** are disposed. The mixed plug **1620** is shown downstream. For **FIG. 16B**, r_{EOM} is set to 2.00.

[**0070**] **FIG. 17** illustrates the results of a computational analysis of the flow of the embodiments of **FIGS. 16A and 16B**. The curves **1702** and **1704** illustrate the average concentration of the plug as it passes the outlet of the mixing channel over time. Curve **1702** represents the plug of fluid from **FIG. 16A** and curve **1704** represents the plug of fluid from **FIG. 16B**, with r_{EOM} equal to 2.00.

[**0071**] The cross section **1706** represents the analysis results for the point **1708** and cross section **1710** represents the analysis for the point **1712**. Both cross sections are the approximate high point of the concentration. For cross section **1706**, the plug flow with no wells, the average concentration of the reagent is approximately 28% higher than the cross section **1710**. However, the standard deviation, an approximate measure of the degree of mixing, is approximately 3.6 times higher for cross section **1706** wherein no wells were present. The lower standard deviation of the mixture that passed through the inventive wells indicates that the plug of reagent was very well mixed. Further, from the curve **1712**, the plug of fluid is still intact, although slightly elongated when compared to the reagent that was not passed over the inventive wells.

[**0072**] The present invention is a passive device that greatly enhances the mixing of reagents under electrokinetic flow, and to a lesser degree, under pressure driven flow. The present invention significantly decreases the channel length required for mixing reagents by placing wells in the flow channel at oblique angles to the axis of flow. The wells may be of various depths, however, for a given set of reagents, flowrates, and channel geometries, there may be an optimum depth of a well wherein an increased depth may not increase the mixing effectiveness.

[**0073**] Electroosmotic flow is a surface driven mechanism that may be enhanced to change the performance of the present invention. For example, increasing the electroosmotic mobility of selective surfaces such as the wells has been shown to increase the effectiveness of the mixer.

[**0074**] The manufacturing process and equipment used in the experiments referenced in this specification are herein defined.

[**0075**] Reagents and Materials. Laser Grade Rhodamine B was used as supplied by Acros Organics (Belgium) and dissolved in 20 mM, pH 9.4 carbonate buffer to a final concentration of 0.11 mM Rhodamine B. The buffer solution was made using deionized water from a Millipore Milli-Q system (Bedford, Mass.), and was filtered before use with a syringe filter (pore size 0.22 μm).

[**0076**] Microchannels were made using polycarbonate sheet (PC; Lexan, GE Co., Mt. Vernon, Ind.). Poly(ethylene terephthalate glycol) (PETG; Vivak, DMS Engineering Plastic Products, Sheffield, Mass.) was used to cover and seal the microchannel substrate. The glass transition temperature of PC and PETG are approximately 150° C. and 81° C., respectively. Polycarbonate was chosen as the substrate material because it has a high absorption cross section to 248 nm light (the wavelength of the excimer laser), therefore ablated structures have minimal surface roughness (<5 nm). PETG was chosen to seal the microchannels because its glass transition temperature is well below that of PC. Therefore, thermal sealing can be performed at a temperature that does not cause distortion of the PC microchannel.

[**0077**] Hot Imprinting Method. Prior to imprinting, the PC substrate was blown clean with ionized air. Channels were hot imprinted in the substrate material using a silicon stamp with a trapezoidal-shaped raised T-channel. The PC was place over the silicon stamp, the two items were then placed between two aluminum heating blocks, and then the temperature was raised to 155° C. Next, the assembly was placed in a hydraulic press and a pressure of 13.8 MPa (2000 psi) was applied for 1.5 hours. The imprinted substrate was then removed from the template and allowed to cool to room temperature. Channel dimensions were measured by optical profilometry.

[**0078**] Laser Ablation Method. A 248 nm excimer laser system (LMT-4000, Potomac Photonics, Inc., Lanham, Mad.) was used to ablate microstructures within the preformed PC microchannel. The excimer laser system, **FIG. 18**, contains a laser light source **1**, a round aperture (200 μm diameter) **2** for delimiting the size and shape of the beam **3**, a focusing lens (10× compound) **4**, a visible light source **5**, a CCD camera to image the ablation process **6**, and a controllable X-Y stage **7** with a vacuum chuck **8** to hold the substrate **9** in place. Also, a nozzle **10** was present to sweep nitrogen over the substrate **9** during processing, and a vacuum nozzle **11** was located on the opposite side of the stage to remove debris. For the experiments conducted here, the size-delimiting aperture was chosen such that the ablated features would be smaller than the dimensions of the channel. Also, the X-Y stage was moved linearly at a rate of 1 mm/s, and the ablated wells were at a 45° angle relative to the axis of the main channel. The average power level per pulse was set to 2.04 μJ+/−0.14 μJ. The frequency of pulses was set to 200 Hz, with a constant pulse width of 7 ns. The light after being focused exposed a circular area of 1.90×10^{-6} cm^2.

[**0079**] Measuring Well Depth and Profile. The depth of the ablated wells was measured by cutting the substrate with a microtome (Microm HM335 E, Walldorf, Germany) either perpendicular to the axis of the outlet channel or parallel to the slanted wells. The substrate was cut so that the edge of the substrate was within a few microns of the wells. The wells were then imaged and measured using white light microscopy.

[**0080**] Microchannel Sealing Procedure. The pre-formed microchannels were covered and thermally sealed with a flat piece of PETG (referred to as the 'lid' throughout the rest of the text) of similar dimensions to the PC. Prior to bonding, the lid and the channel were cleaned with compressed nitrogen gas. The lid was then placed on top of the channel, and the two pieces were clamped together between microscope glass slides and bonded by heating in a circulating air over at 90.0° C.+/−0.5° C. for 13 minutes. It is important to keep the time and temperature as low as possible in the sealing process to avoid physical alteration of the microchannel.

[**0081**] For the electroosmotic flow studies, 3 mm diameter circular holes in the lid provided access to the channels and served as fluid reservoirs. For the pressure driven flow studies, 0.8 mm diameter circular holes in the lid, located at the ends of each inlet channel, provided access to insert a