FIG. 2B is an image of the fluorescence of Rhodamine B introduced in the first inlet **202** mixed with the buffer solution introduced in the second inlet **204**, producing a mixed stream **206**. The flowrate is 0.06 cm/s. **FIG. 2C** is a similar image as **FIG. 2B**, except the flow is 0.81 cm/s.

[**0046**] **FIG. 3** illustrates the degree of mixing of the embodiment **100**, wherein an electroosmotic flow of 0.06 cm/s was achieved. The horizontal axis is the position across the width of the outlet **108** and the vertical axis is the normalized intensity of the fluorescence of the Rhodamine B. The curve **302** represents the results of the measurement taken with no mixing wells present. The curve **304** represents perfect mixing. Curve **304** is trapezoidal in shape, following the profile of the trapezoidal outlet **108**. The curve **306** represents the actual experimental results. The details concerning the experimental procedure and equipment used to perform all of the experiments referenced in this specification are given elsewhere in this specification.

[**0047**] **FIG. 4** is a graph that illustrates the same experimental set up as **FIG. 3**, with the electroosmotic flowrate of 0.81 cm/s. The line **402** represents the results of the measurement taken with no mixing wells present. The line **404** represents perfect mixing. The line **406** represents the actual experimental results.

[**0048**] From the results illustrated in **FIGS. 2B, 2C, 3**, and **4**, the degree of mixing exiting the mixer was 87.2% and 80.5% respectively, for the flowrates of 0.06 cm/s and 0.81 cm/s. To achieve the same degree of mixing, theoretical predictions state that a channel length of 0.2 cm and 2.3 cm for electroosmotic flowrates would be required if no mixer were present and based on diffusional mixing, assuming that the diffusion coefficient of the fluorescent material, Rhodamine B, is 2.8×10^{-6} cm^2/s. These results indicate that the length of the present embodiment is 22% and 2% of the length of a comparable diffusive mixer for the present application.

[**0049**] **FIG. 5** is a graph that illustrates the results of the same experimental set up of **FIGS. 2, 3**, and **4**, with a pressure driven flow. The measurements were taken at 443 μm from the beginning of the confluence region. The curve **502** represents the perfect mixing results. The curve **504** represents the experimental results with a pressure driven flow at 0.21 cm/s. The curve **506** represents the experimental results with a pressure driven flow at 1.25 cm/s. Since the pressure driven flow is not a wall driven phenomenon and therefore the fluid is not forced to enter the wells like electroosmotic flow, the effects of the mixing are not as great with pressure driven flow as with electroosmotic flow. However, the presence of the wells does introduce some lateral transport across the channel. This suggests that a series of wells could be optimized for mixing under pressure driven flow.

[**0050**] **FIG. 6** illustrates a second embodiment **600** of the present invention. Two inlet streams **602** and **604** are combined and mixed in the mixing region **606** to produce a mixed flow that exhausts out of the outlet **608**. The mixing region **606** comprises several wells **610**, **612**, **614**, and **616** that are recessed into outlet **608**. The measurement region **618** is 183 μm from the point of confluence of the inlets **602** and **604**. The shape and dimensions of the channels and wells are the same as with embodiment **100** of **FIG. 1**. The wells **610**, **612**, **614**, and **616** are parallel to each other.

[**0051**] **FIG. 7** is a white light microscopy image of an example of embodiment **600**.

[**0052**] **FIG. 8** is a graph that illustrates the degree of mixing of two reagents using embodiment **600** and an embodiment similar to embodiment **600** but with three wells instead of four. The experimental results of **FIG. 8** show results for electroosmotic flow of 0.06 cm/s taken 183 μm from the point of confluence of the inlet flows. The horizontal axis is the position across the width of the outlet stream **608** and the vertical axis is the normalized intensity of Rhodamine B. The same experimental setup was used for the results of **FIG. 3** as **FIG. 8**, with the differences being the configuration of the mixing region and the position of the measurements.

[**0053**] The curve **802** represents the mixing profile of the two inlet streams when no mixing wells are present. The curve **804** represents the perfect mixing of the two streams. The curve **806** represents the mixing profile for the electroosmotic flowrate of 0.06 cm/s and a three well mixer. The curve **808** represents the mixing profile for the same flowrate and a four well mixer. The three well mixer is the embodiment **600** with well **616** removed.

[**0054**] **FIG. 9** illustrates the results of the same experimental set up as **FIG. 8** with a higher electroosmotic flowrate of 0.81 cm/s. The curve **902** represents the mixing profile of the two inlet streams when no mixing wells are present. The curve **904** represents the perfect mixing of the two streams. The curve **906** represents the mixing profile for a three well mixer. The curve **908** represents the mixing profile for a four well mixer. The three well mixer is the embodiment **600** with well **616** removed.

[**0055**] The curve **908** forms two distinct humps, **910** and **912**, indicating that the four well mixer may be able to split the incoming streams into two streams of similar concentrations. The number of wells, the shape, dimension, and placement of the wells may be adapted to provide different dilutions of the incoming fluid. Such adaptations may depend on the reagents and the diffusivity constants of the various components of the confluent streams. As such, the particular result desired, such as splitting a stream or mixing a pair of confluent streams may be obtained by adjusting the quantity and position of the various wells.

[**0056**] **FIG. 10** illustrates an embodiment **1000** of a stream splitter wherein inlet port **1002** and inlet port **1003** form a confluent stream wherein the fluid that is on one half of the channel is split into two streams due to the presence of the slanted wells, where the split streams are located on opposite sides of the channel that then exit through outlet **1004** and outlet **1006**. The flow of the microfluidic stream passes over three wells **1008**, **1010**, and **1012** of similar design and construction as those of other embodiments described in the present specification.

[**0057**] In lab-on-a-chip or μ-TAS (micro Total Analysis Systems), the use of a series of wells within a microchannel may greatly enhance the effectiveness of the entire system, especially when the system is limited to the laminar flow regime. The present invention is effective for low flowrates (<1 cm/s) as well as high flowrates (>1 cm/s). The present invention is further able to effectively mix flows that are driven electrokinetically, electroosmotically, or by pressure.

[**0058**] The present invention may be used to divide or split a stream into non-equal or equal analyte concentrations.