[0075] Turning now to configurations of the sorting station, certain buffer switching designs will now be described. As explained, buffer switching employs separate streams of buffer and sample that are delivered to a sorting region. The force exerted on magnetic particles in the sorting region guides those particles out of the sample stream and into the buffer stream. Due to the low Reynolds number, the flow streams within the sorting region of a CMACS device are generally uniaxial and laminar (e.g., Re is approximately 2000 or less). Buffer switching regions may be designed such that in the absence of an external magnetic field, only the buffer medium arrives at a collection channel (see FIG. **1**). When an external field is applied, the MFG elements become magnetized and the magnetically labeled components are selectively transported across the stream boundary, from the inlet stream into the buffer medium, resulting in a high purity of the target species in the collection channel. On the other hand, the unlabeled components (typically the majority of the components in the sample) are not deflected by the magnetic field and will enter the waste channels.

[0076] In buffer switching devices, the separate buffer and sample streams may be provided to the sorting region via one, two or more separate channels. Typically, though not necessarily, a sorting region will have at least one inlet channel dedicated to delivering buffer and another channel dedicated to delivering sample. In certain embodiments, at least one inlet channel to the separation region provides both the sample stream and the buffer stream. Because these streams are provided as laminar flows, they can be combined into an inlet channel upstream from the sorting region. They will then flow into the sorting region separated from one another as separate streams.

[0077] FIGS. **4**A-**4**E present various buffer switching configurations. Each figure shows a distinct sorting region with at least one inlet channel and at least one outlet channel. Further each sorting region has at least one MFG, sometimes shown.

[0078] FIG. **4**A shows a simple configuration in which a buffer switching configuration **401** includes one inlet channel **405**, one outlet channel **407** and a sorting region **403**. The inlet channel **405** includes two laminar streams, a buffer stream shown in the lower portion of channel **405** and a sample stream shown in the lower portion of channel **405**. The streams maintain their uniaxial flow trajectory through sorting region **403**. At least one MFG (not shown) within region **403** imparts a "rightward" velocity component to magnetic particles entering through the sample stream in inlet channel **405**. As a consequence, the magnetic particles are directed into the buffer stream and then exit through a buffer stream portion **411** of outlet channel **407**. The non-magnetic components of the input sample remain in the sample stream and exit the sorting region **403** via a sample stream portion **409** of outlet channel **407**.

[0079] FIG. **4**B shows a similar buffer switching configuration **413** but with two separate outlet channels: a dedicated waste or sample channel **419** and a dedicated buffer channel **421**. In this embodiment, separate sample and buffer streams enter the lower and upper portions of an inlet channel **417**. Together they flow into a sorting region **415** where at least one MFG (not shown) diverts any magnetic particles in the sample stream "rightward" into the buffer stream. The buffer stream, with diverted magnetic particles, exits the sorting region via a dedicated buffer exit channel **421**. The sample stream, which has been depleted of magnetic particles, exists the sorting region via a dedicated waste exit channel **419**.

[0080] FIG. **4**C shows another buffer switching configuration **423**, this time with two inlet channels and a single outlet channel. In this embodiment, a sample stream is provided via a dedicated sample inlet channel **427**. Similarly, a buffer stream is provided via a dedicated buffer inlet channel **429**. The sample and buffer streams from the two inlets enter a sorting region **425** together, but remain as distinct uniaxial streams. Within the sorting region, at least one MFG imparts a downward velocity component to the magnetic particles in the sample stream. As a consequence, some or all magnetic particles in the sample stream cross the boundary between the sample and buffer streams and enter the buffer stream. The two streams exit the sorting region **425** together through an outlet channel **431**. Within this channel a waste stream portion **433** carries the remainder of the sample stream, which has been depleted of magnetic particles. Also within outlet channel **431**, a buffer stream portion **435** carries the buffer with the magnetic particles. As should be apparent, the contents of the outlet channels in the embodiments of FIGS. **4**A and **4**C must be separately treated downstream from the depicted sorting configurations. This may be accomplished, for example, via a downstream divide in the flow path or a chamber having separate treatment regions for the sample and buffer streams (e.g., a capture region for magnetic particles in the buffer stream).

[0081] FIG. **4**D shows a microfluidic sorting channel configuration **437** having three separate inlet channels and two outlet channels. Sample is provided via an inlet channel **441**, while buffer is provided via two separate inlet channels **443** and **445** located below the sample inlet channel. Sample enters a sorting region **439** having two separate MFGs **447** and **449** arranged in series. Other MFG arrangements are possible in similar multi-channel sorting configurations. The MFGs in FIG. **4**D divert magnetic particles from the sample stream (provided via inlet channel **441**) toward and into the buffer stream(s) from inlet channels **443** and **445**. The buffer stream(s) exit the sorting region via an outlet channel **453**, while the sample stream (with a diminished or depleted concentration of magnetic particles) exits via a waste outlet channel **451**. Note that the embodiment depicted in FIG. **4**D allows for multiple buffer streams having potentially different compositions. In other embodiments, more buffer and/or sample inlet channels may be employed; e.g., three buffer inlet channels and two sample inlet channels may be employed. Further, in some embodiments, the number of sample inlet channels may be the same or greater than the number of buffer inlet channels; e.g., three buffer inlet channels and three sample inlet channels. Similar variations on the arrangement of outlet channels may be realized.

[0082] FIG. **4**E depicts yet another arrangement **455** of channels for sorting. This embodiment provides a generic version of the sorting station depicted in FIG. **1**. In the arrangement of FIG. **4**E, two sample streams enter a sorting region **457** via inlet sample channels **459** and **461**. These inlet channels straddle a buffer inlet channel **463**. Thus, a buffer stream flows uniaxially through the sorting region along with sample streams on either side. In this embodiment, a first MFG **465** exerts a magnetophoretic force on magnetic particles entering from sample inlet channel **459**, directing them downward into the central buffer stream provided via inlet **463**. A second MFG **467** exerts a magnetophoretic force in the opposite direction, deflecting magnetic particles entering from sample inlet channel **461** upward into the central buffer stream. Thus, two parallel acting MFGs provide a high