[0079] Reader instrument **100** may be configured such that a user is protected from exposure to any potentially dangerous light that is emitted by laser illumination module **104** when a cartridge is fully inserted into an aperture or slot in housing **102**, partially inserted, or not inserted at all. Reader instrument **100** may include an interlock switch that electrically disengages light emitting circuitry when cartridge is not inserted or only partially inserted. Reader instrument **100** may be fitted with an opaque door that automatically closes when cartridge is fully extracted from actuator, providing a light tight enclosure. Additional baffles and light blocking elements incorporated into reader instrument **100** or cartridge **110** may further minimize the amount of stray light power that is emitted external to housing **102** when cartridge is inserted.

[0080] An imaging system **124** is used to capture images of light signal **126** emitted from assay region **122**. A sensor **128**, such as a two-dimensional sensor charge coupled device ("CCD") or complementary metal-oxide-semiconductor ("CMOS") sensor, as well as any imaging optics components may be rigidly mounted with respect to laser illumination module **104** and to housing **102**. Imaging system **124** may also include one or more imaging optics, such as lenses, refractive or reflective elements, phase-modifying elements, and spatial- or intensity-patterning elements having both sufficient field of view and depth of field to simultaneously image the entire assay region. Alternatively, a variable focus lens may be used so as to enable adjustable focusing on various regions. In certain embodiments, as shown in FIG. **2**, imaging system **124** may be oriented with its optical axis perpendicular to the plane of planar waveguide **121**. Furthermore, imaging system **124** may be configured so as to image assay region **122** through planar waveguide **121**. As later described, in certain embodiments, the field of view may be even larger than detection region **122**, allowing capture of fiducial markers, cartridge tracking information, or other desirable cartridge identification indicia (e.g., barcodes).

[0081] In the illustrated embodiment, planar waveguide **121** is capable of transmitting laser light directly, or through total internal reflection, to a detection region **122**. In one embodiment, cartridge **110** incorporates a microarray of biomarkers, such as printed proteins (e.g., natural, purified, or recombinant antigens, antibodies, and/or controls) in a fluidic channel, and is capable of providing multiple parallel fluorescence assay results from a single sample. Cartridge **110** may include a fluidic channel, optionally with an inlet port and an outlet port, and may be formed as a single piece or separate pieces that cooperate to define channel.

[0082] For portable or semi-portable operation, a lightweight, dimensionally small, and low material cost disposable cartridge is useful. The following describes various aspects of one embodiment of such a portable cartridge that is useful in conjunction with a reader instrument, such as that described in co-pending U.S. Patent Application Ser. No. 61/468,659, entitled "Improved Cartridge Reader", filed 29 Mar. 2011, which disclosure is incorporated herein by reference in its entirety. A smaller or larger cartridge or cartridges with other design elements may also be contemplated.

[0083] A cartridge **300** is illustrated in perspective view in FIG. **3**, top view in FIG. **4**, in cross side view in FIG. **5**, and in bottom view in FIG. **6**. As may be seen in FIGS. **3-5**, a cartridge **300** includes an upper piece **310** in snap-fit, press-fit, weld, glue, or other attachment with a matching lower piece **312**. Textured grooves **314** in both upper and lower pieces **310** and **312**, respectively, improve ease of handling. Cartridge **300** may be formed from a low cost moldable plastic that may be color coded or marked with tracking indicia. In certain embodiments, adhesive strips with alphanumeric labeling, one or two dimensional bar codes, or other tracking indicia may be affixed to cartridge **300**. Upper piece **310** may be further configured to accommodate an inlet port **328**. As seen in FIG. **6**, a window **320** in lower piece **312** allows imaging access therethrough.

[0084] A waveguide **322** with an integral lens **323**, as shown in FIG. **7**, is held within cartridge **300**. As visible in FIGS. **8** and **9**, a flow plate **324** with a sample inlet port **328**, rails **350** and an outlet port **352**, is mated with waveguide **322** using laser welding, chemical or adhesive attachment or other suitable, fluid-tight mating arrangement to form an assembly **360**. Assembly **360** may be positioned within cartridge **300**, and may further incorporate a wick pad **326** for waste containment, as seen in top and bottom exploded perspective views of FIGS. **10** and **11**. A planar surface of waveguide **322** and a groove **370** in flow plate **324** cooperate to define an empty fluidic channel for receiving sample therein. Advantageously, use of waveguide **322** that is separately manufactured from upper piece **310** and lower piece **312** may allow for reduced overall cost and/or increased design flexibility than embodiments in which the waveguide and peripherals (e.g., clamshell or equivalent protective elements) are fabricated together.

[0085] FIG. **10** shows an exploded perspective view of the components of cartridge **300**, including, from the top of the figure, upper piece **310**, wick pad **326**, flow plate **324**, waveguide **322**, and lower piece **312**. FIG. **11** is another exploded perspective view of the components of cartridge **300**, this time as viewed with lower piece **312** at the top of the figure, shown here to illustrate the features on the underside of the components, such as integral lens **323** on the underside of planar waveguide **322** and a groove **370** on the underside of flow plate **324**. Groove **370**, when positioned against planar waveguide **322**, defines an empty fluidic channel into which sample may be inserted from input port **328** and flows through the fluidic channel to outlet port **352**.

[0086] The components include a variety of features, such as notches and protrusions, to assist with the alignment of the components with respect to each other. These alignment features may be modified from those shown in FIGS. **10** and **11** while remaining within the spirit of the present disclosure.

[0087] In certain embodiments, the fluidic channel with inlet and outlet ports in the cartridge may be formed when molded components are bonded together. Exemplary bonding methods include, but are not limited to, laser welding, ultrasonic welding, solvent bonding, other chemical bonding methods, or adhesive bonding. In another embodiment, the fluidic channel may be formed when an appropriately cut adhesive gasket joins two cartridge components, as shown in FIGS. **10** and **11**. The size of the resulting fluidic channel may be partly determined, for example, by the width of a cut-out for sample containment made in the gasket, as well as the thickness of the gasket itself.

[0088] Usefulness and cost effectiveness of a cartridge may be improved by simplifying cartridge construction. In certain embodiments, the cartridge may be constructed by thermally fusing, adhesively attaching, welding or otherwise connecting a planar waveguide with a hermetically-sealed channel defining piece that allows a sample fluid into a channel through an inlet.