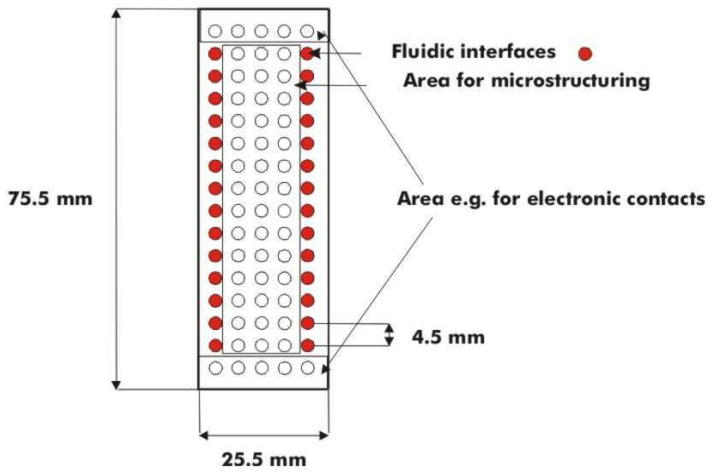
1 Formats

1.1 Microscopy Slide Format

The microscopy slide format (see Fig. 1) is meanwhile an accepted standard in the lab-on-a-chip community and it has several advantages: A handy format that makes manual manipulation easy – not too big and not too small, it is perfectly fitting on any microscope, and handling frames can be used in order to place the microscopy slide inside and to work with existing laboratory equipment systems e.g. for filling or read-out.



Length: 75.5 mm
Width: 25.5 mm
Thickness: 1.5 mm
Materials: PMMA, PC, PS, COC, COP
Transparent or colored.

Fig. 1: Principle drawing of *microfluidic* microscopy slide platform

The chip to world interface remains as issue – and standard solutions and microfluidic ones are directly at hand. This directly raises two questions that are promptly answered with this *Microfluidic Platform Catalogue*:

I. The kind of fluidic interface:

microfluidic microscopy slide formats are available with:

- Simple through holes
- Olives as tube interfaces
- Female Luer connectors (tapered)
- Female mini Luer connectors (tapered)

II. The position of the fluidic interface:

- Grouped along the long side with 9 mm spacing
- Grouped along the long side with 4.5 mm spacing
- Grouped along the short side with 4.5 mm spacing

1.2 Microscopy Slide Format – Fluidic interfaces

The range of fluidic interfaces offered with the microscopy slide format includes simple through holes, olives, tapered Luer and Mini Luer connectors. All connectors are spaced according to the well-spacing of a 384-well microtiterplate, e.g. with a center-center distance of 4.5 mm between connectors (exception are the full-size Luer connectors due to their size) in order to allow pipetting robots or other automated equipment to be used.

Chips with through holes have 16 holes with 4.5 mm spacing along the long side (allows two rows of 8 reagents from a microwell plate to be pipetted or the use of a conventional 8-times multipette). The through holes are frequently used with O-rings or membranes integrated in an instrument in order to give a proper sealing via press fittings. Also they are – if shaped accordingly – a good interface for pipettes. One additional advantage of this interface besides the ease of application is the potential storage of the chips after use, as the interfaces can be sealed with tape to prevent contamination or evaporation. Drawback of this kind of interface is the low pressure stability on the chip-side of the connection which has to be countered with a suitable counterpart on the instrument side. Standard diameter for the through holes is 0.8 mm (top) and 0.5 mm (bottom), other diameters are available upon request.

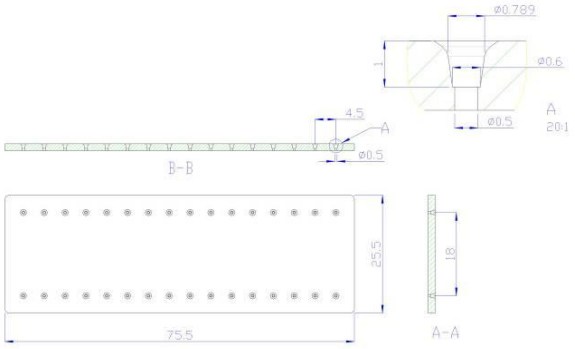


Fig. 2: Drawing of chip with through holes

Fig. 3: Example of an actual chip

Chips with olives (or nipple connectors) are available with 2, 14 or 16 olives along the long side. Olives are used anywhere where silicone is used as a connecting tubing material. The silicone tubing slides easily over the tapered olives and guarantees a hermetic seal up pressures of approx. 3 bars (42 psi). This connector is especially suited for non-automated experiments where syringe or other external pumps are to be connected to the chip. To minimize experimental variations due to the pressure-induced expansion of a longer silicone tube, short sections of silicone tubing can be used to connect stiff tubes (e.g. PTFE, PEEK or PE tubing) with either chip or pump. This interface results in a dead volume of approx. 2 µl due to the internal volume of the olives which is added to the dead volume of the tubing.

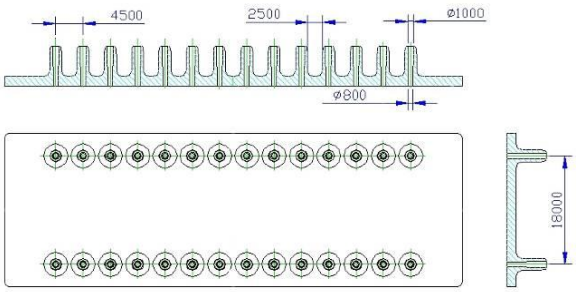


Fig. 4: Drawing of chip with olives

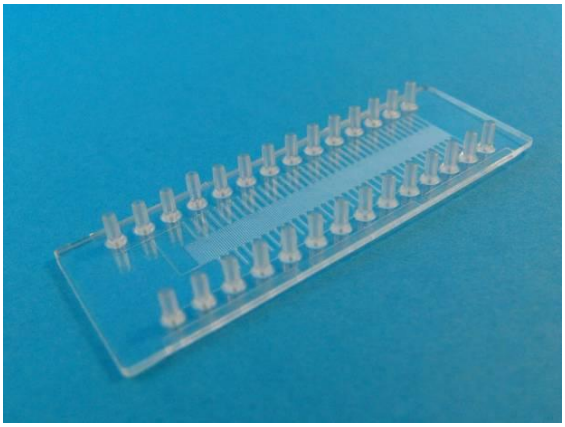


Fig. 5: Example of a fluidic chip with 28 olives

Tapered Luer-connectors are especially suited for operations involving automated liquid handling in an instrument, as a fitting counterplate with male Luer-cones can easily connect to the chip and transfer liquids. Additionally, for manual operations, standard syringes can be used for manual experiments, eliminating the need for any liquid-handling instrument. Chips are available with either 8 or 4 Luer connectors on either side with a symmetrical arrangement (4.5 mm spacing) with respect to the long axis or with 5 connectors (13.5 mm spacing = 3 × 4.5 mm) on either side with an offset of 2.5 mm from the center. The tapered walls ensure leak-tight connections up to pressures of several bar, enough for complex chips with comparatively high back-pressures. Depending on the internal shape of the male Luer-counterparts, added dead volumes due to the interface is of the order of 20 µl.

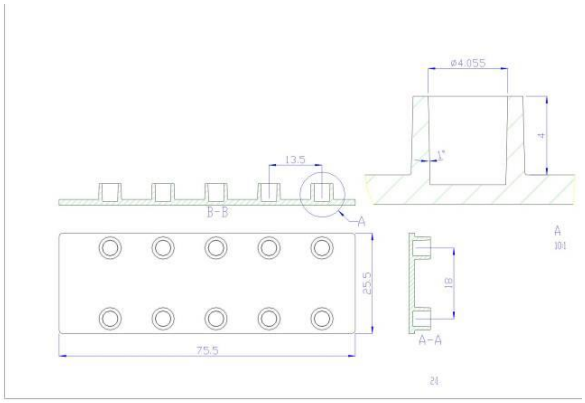


Fig. 6: Drawing of chip with 2×5 tapered Luers

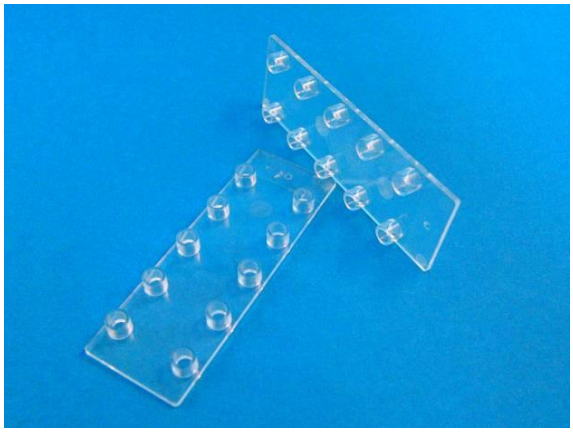


Fig. 7: Example of an actual chip

Tapered mini-Luer connectors have the same applications as their larger counterparts, with reduced dimensions (outer diameter x mm instead of 6 mm), thus allowing more connectors on the chip. Up to 16 ports along the long side of a microscopy slide can thus be realized. Plugs for closing unused connectors and adapter pins to connect silicone tubing to these chips are available to increase versatility of this platform.

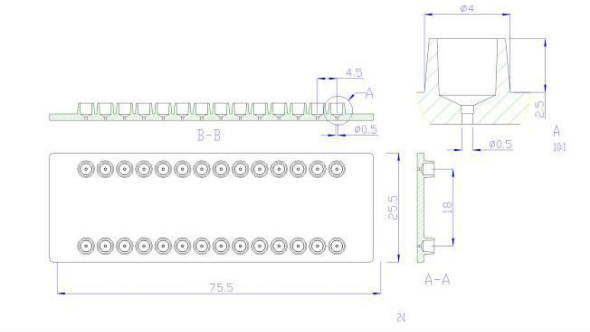


Fig. 8: Drawing of chip with 2×14 mini-Luers

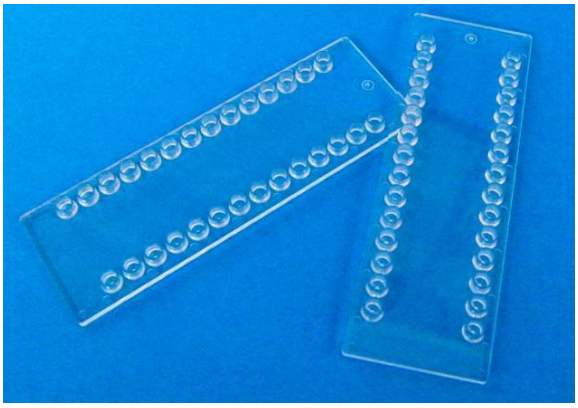


Fig. 9: Unstructured platform with 2×14 mini-Luers

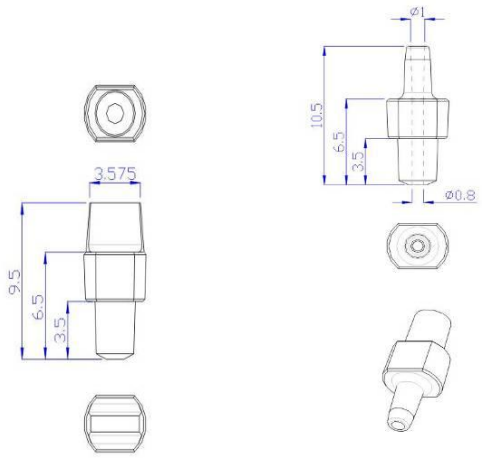


Fig. 10: Plug and connector for the mini-Luer platform

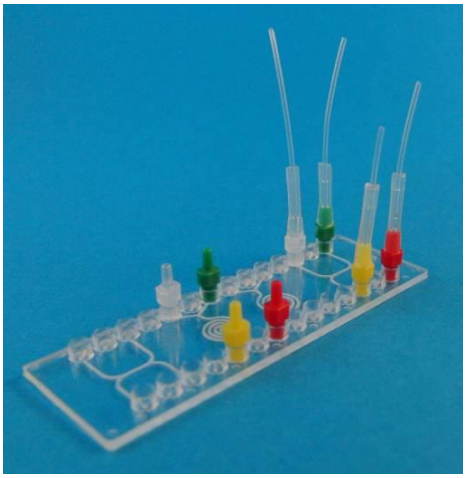


Fig. 11: Example of a fluidic design on the mini-Luer platform with plugs and connectors

1.3 Microtiter Plate

The SBS microtiterplate format is a worldwide standard used by almost any piece of equipment in laboratory environment. To easily integrate microfluidics development in existing lab environments, we have developed a microfluidic platform with the outer dimensions of a standard microtiter plate. As a design example, the plate is equipped with four labelled sets of 16 microchannels each, with dimensions 2 mm width, 150 µm height and 18 mm length. Fluidic access is easily provided by conical openings of 2.5 mm diameter at either channel end. The well spacing for the chip-to-world-interface is compatible with the laboratory automation systems as well as e.g. multipipettes. The plate is available in a variety of polymer materials like PC, PS, PMMA or COP (Zeonor), either in its native state or hydrophilically primed for self-filling of the microchannels with aqueous solutions. It is possible to include surface

functionalization in the channels like the spotting of DNA probes etc. (see Fig. 14). Applications include cell based assays, hybridization assays or small volume chemical synthesis.

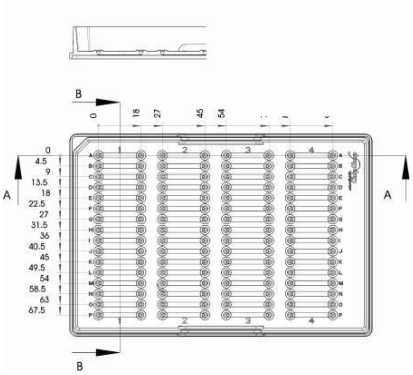


Fig. 12: Schematic drawing of the microfluidic wellplate

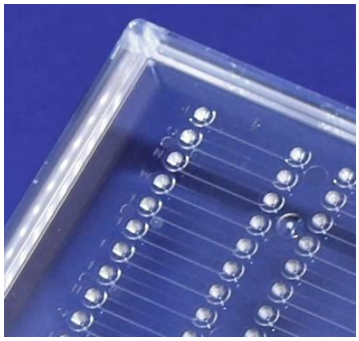


Fig. 13: Microfluidic wellplate

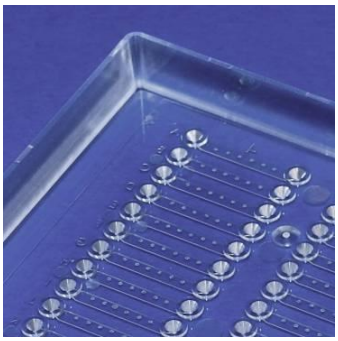


Fig. 14: Microfluidic-wellplate with spotted DNA probes

1.4 1/4 Microtiter Plate Format

For those applications which do not require the full size of a microtiterplate, a variation of with a footprint of ¼ of the titerplate is also available. This is particularly relevant for instruments with tighter size restrictions.

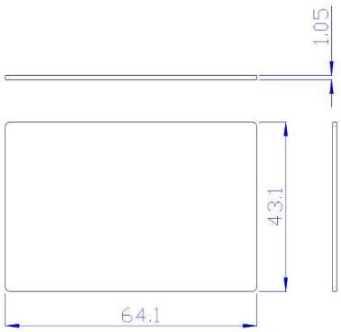


Fig. 15: Dimensions of ¼ titerplate platform

1.5 CE-Chip Format

This platform is for those who require chips in a long and narrow format (95 mm x 16 mm) with channel structures that differ from either our standard chips with electrodes or our *ChipGenie® edition E* capillary electrophoresis chips.

The chips are available with a simple fluidic interface (through holes) or with directly molded reservoirs and as either unstructured devices without cover lid or as microstructured devices with cover lid, that is, a thin polymer foil of the same material as the microstructured part.

Note: The dimensions of the platforms may vary by up to 0.5% depending on the material.

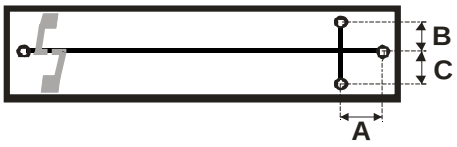


Fig. 16: Chip layout

Fig. 17: Actual image of the CE-chip with screen-printed electrodes

1.6 CD Format

For applications making use of liquid transport by centrifugal forces, a CD-sized tool is available. Please note that for this format, the central hole with a diameter of 15 mm is required plus the CD clamping region with diameter of 25 mm centered around the hole which cannot be used for structuring. Only open hole fluidic access is possible in this format.

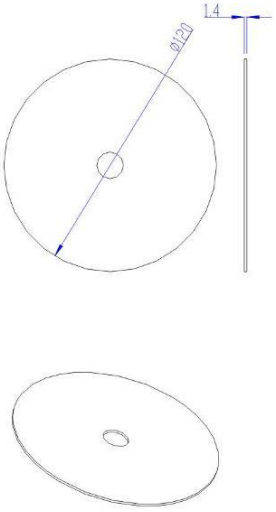


Fig. 18: Geometrical layout of the CD platform

1.7 "Pie-slice" Plate

A variation of the centrifugal platform is the pie-slice plate. It is a 60 degree sector of a circle and allows the modular assembly of different functions in different sectors of a disc. This format allows for higher fluidic volume applications than the CD-format as it has a maximum thickness of 4 mm.

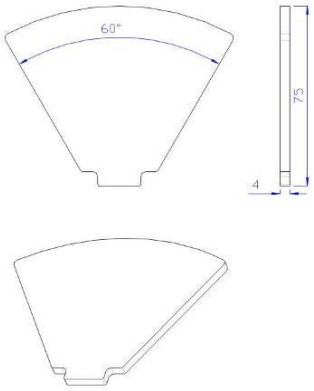


Fig. 19: Geometrical layout of the pie slice plate

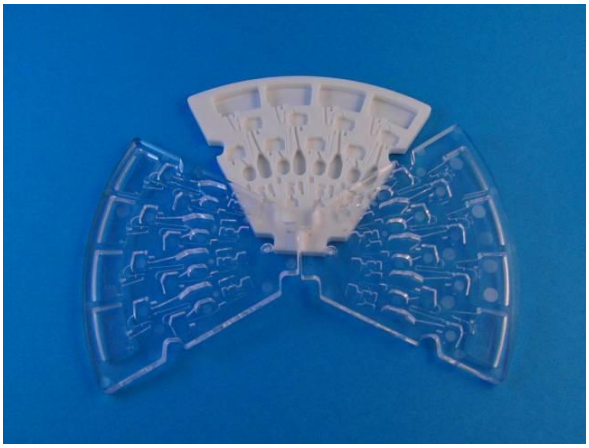


Fig. 20: Example of actual chips in transparent and white materials