u-Flux™ | Product Brochure

Laminar flow microfluidics for single-molecule experiments

LUMICKS
Capture Molecular Interactions

u-Flux™ Technology

Enabling high throughput single-molecule experiments

The u-Flux™ microfluidics system is an integrated solution to reliably perform single-molecule experiments in a laminar flow environment. The stand-alone microfluidics system consists of a laminar flow cell, a highly stable passive pressure system and multiple fluidic valves that can be operated manually or remotely using the automated fluidic valves system. The pressure system feeds multiple channels into the laminar flow cell where multiple adjacent flows are created. No physical barriers are separating the highly stable laminar flows, which have been optimized for the most sensitive single-molecule experiments.

u-Flux™ has been developed by scientists as an easy-to-use high throughput solution. The laminar flow cell's channel layout, outer dimensions and sample holder can be fully customized to seamlessly fit your specific single-molecule experiment and instrument.

Flow Cell

- Leak-free monolithic glass design
- Robust and Reusable
- Multiple laminar flow channels
- Customizable channel layout and dimensions*
- Customizable sample holder design*

Automated Fluidic Valves

- 6 individually switchable valves
- Remote operation
- No shock waves or temperature effects
- Stand-alone, expandable module

Pressure System

- Passive pressure driven flow
- Up to 6 flow channels
- Software controlled flow rate
- Individually removeable syringes
- Zero dead volume and flow disturbance
- FEP or fused silica connection tubings

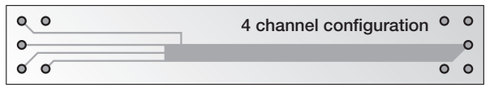
* *See page 3*

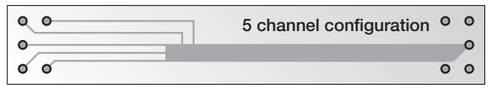
u-Flux™ laminar flow cell

The u-Flux™ standard flow cell is available in two different channel layouts that have been optimized for high throughput single-molecule experiments. It features:

- 4 or 5 channels
- Outer dimensions of 90 x 15 x 1.175 mm (L x W x H)
- 175 µm thick bottom layer, 1 mm thick top layer*
- 100 µm channel height

* Optional 175 thick µm top layer for use in double-objective optical tweezers set-ups





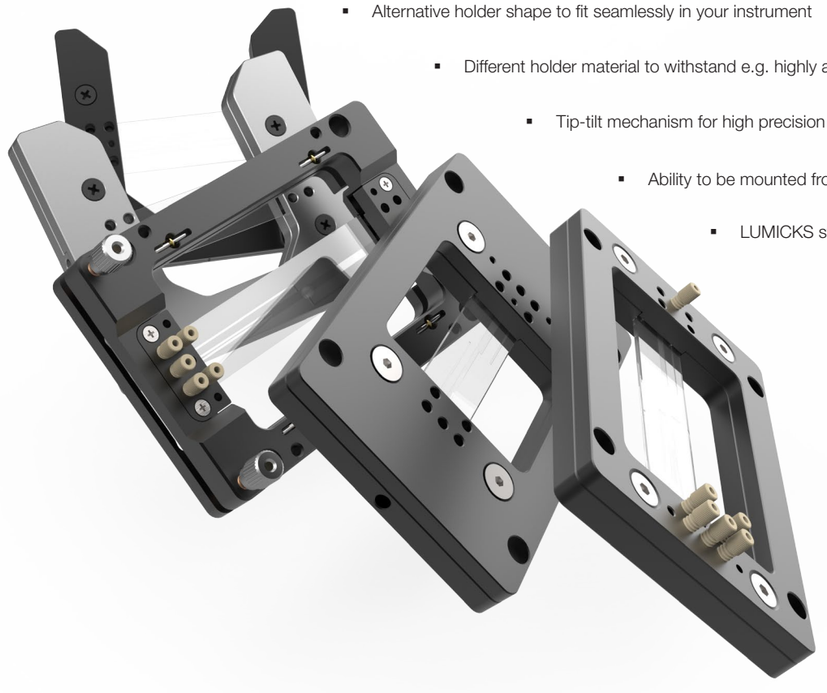
Custom laminar flow cell designs

LUMICKS is available to support you in finding the ideal flow cell layout for your applications. Dependent on your application the following features can be customized:

- Channel layout, height and width
- Flow cell length, width & thickness
- Integration of temperature sensing

Custom holder designs

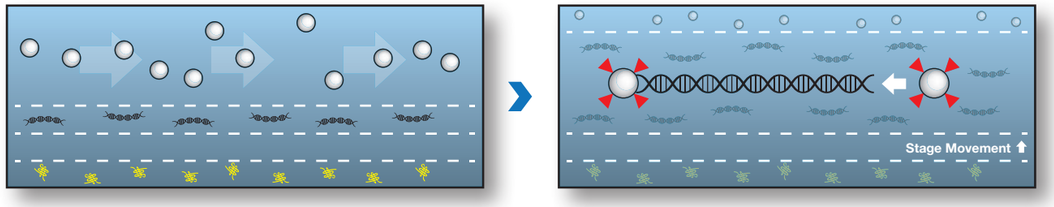
Whether you need extreme tip-tilt precision or require additional space for your imaging tools, LUMICKS can design and produce a custom holder based on your input that fits your microscope or single molecule instrument. There are many possibilities for customization, of which some are shown below:



- Alternative holder shape to fit seamlessly in your instrument
- Different holder material to withstand e.g. highly acidic solutions
- Tip-tilt mechanism for high precision flow cell alignment
- Ability to be mounted from the side
- LUMICKS standard flow cell holder

Applications

Single-molecule optical tweezers assay in laminar flow

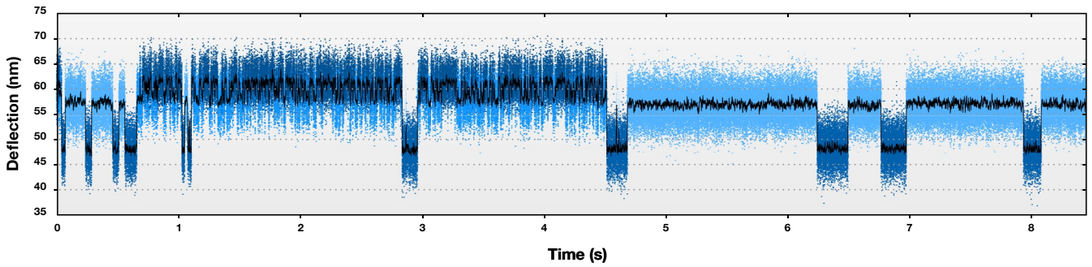


1. Sample loading

The microfluidic flow cell provides multiple adjacent laminar flow channels that do not mix (no physical barriers are involved). Samples (e.g. microspheres, biomolecules, proteins, dyes and buffers) are connected to a specific channel in the laminar flow cell and can be independently switched on and off through automated fluidic valves.

2. Moving through laminar flow

Rapid switching of buffers or fluidics is easily done by guiding the traps between those different channels through microscope stage movement: Picking up microspheres, biomolecules and different proteins with a simple click.



Protein unfolding in laminar flow

Calmodulin is the primary calcium binding protein in living cells. Force-spectroscopic measurements of unfolding/folding of single Calmodulin proteins using optical tweezers reveal information on the underlying energy landscape and Calcium-binding induced structural transition. Here, a high-resolution force-spectroscopy experiment on single Calmodulin proteins is demonstrated in the presence of laminar flow in u-Flux™ [1].

The ability to perform high-resolution measurements in a laminar flow environment allows to increase data throughput and to design novel experiments where ligands can be introduced by laminar flow and their effect on the folding/unfolding pathway studied in a single experiment.

[1] Courtesy of Prof. Matthias Rief and Marco Grison, Technical University Munich; further reading: Stigler *et al.* Science (2011)

Workflow

1. Load your samples

Sample loading is easily performed by pipetting your sample(s) into the syringes. The twist-and-go syringe adaptor with bayonet fitting allows for quick and easy refilling of individual syringes.

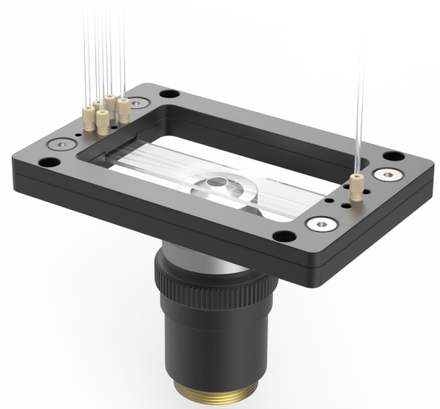
2. Regulate your fluidics

Automated flow control and valve switching allows for optimal control and remote operation of your u-Flux™ system. The flow rate is controlled through the software by regulating the pressure within the pressure box.

Individual flow channels can be switched on and off with simple clicks in the software, or using a software scripting plugin.

3. Measure

The passive pressure system allows for reliable single-molecule experiments as high resolution measurements are minimally altered by the laminar, pressure driven flow in combination with the glass monolithic flow cell. The laminar flow permits the sequential assembly of single-molecule assays and the controlled triggering of biochemical reactions by exposing the biomolecule of interest to different buffer environments at specific time-points.



4. Clean & repeat

The monolithic glass design is designed for re-use. Even highly chemical solutions can be cleaned effectively.

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History

The field of single-molecule biophysics has radically changed over the past decade, owing to major technological breakthroughs enabling landmark experiments. Now that the single-molecule methods have reached maturity, they are ready to make a long-lasting impact on the field of biological research.

Focusing on these new methods, LUMICKS brings to market the revolutionary C-Trap™ Correlative Tweezers-Fluorescence Microscope (CTFM) and the Acoustic Force Spectroscope (AFS™). LUMICKS is rooted in the research groups of Prof. Gijs Wuite and Prof. Erwin Peterman at the VU University Amsterdam, and its instruments for single-molecule studies allow the disruptive method of live measurement and imaging of interactions at the molecular level.

Mission

LUMICKS provides ready-to-use single-molecule instrumentation, allowing you to focus on the science. Understanding complex biological processes at the single-molecule level is key for prevention and cure of cancer and other diseases. To this purpose, live observation and measurement have proven game changing, and LUMICKS aims to make these enabling technologies available to biologists to create a better world.

The LUMICKS team is committed and proud to work on the world's leading instruments for live measurement and imaging of interactions at the single molecule level!

For more information visit
www.lumicks.com

LUMICKS BV

De Boelelaan 1085, 1081HV Amsterdam, The Netherlands
M: info@lumicks.com, T: +31 (0) 20 598 79 84