LUMICKS
Capture Molecular Interactions

Customer Case Story MPI-CBG

Read up on how MPI-CBG uses LUMICKS' C-Trap™ to combine optical tweezers and fluorescence imaging to investigate their single-molecule research questions.

LUMICKS - Capture Molecular Interactions
De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands

November 24th, 2016

Installation

In March 2016 LUMICKS delivered a C-Trap™ correlative optical tweezers – fluorescence microscopy instrument to the Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG) in Dresden. The instrument was acquired at the end of 2015 by a group of MPI-CBG principle investigators to fulfill a need for application of the single-molecule measurements combined with fluorescence imaging to their research questions.

Applications

At MPI-CBG the C-Trap™ is being used in three main application areas:

1

Studying the mechanical properties and fusion kinetics of protein droplets. The protein droplets are connected to trapped beads and brought towards each other. By watching the labeled proteins diffuse in real-time while measuring the force, the properties and kinetics can be measured.

2

Investigating the unfolding mechanisms of membrane proteins. In these experiments, the protein is connected to two optically trapped DNA handles. By moving the traps away from each other a force is applied on the protein, causing it to unfold. Simultaneous force measurements give insights in the unfolding mechanism of the protein.

3

Measuring the enzymatic activity of the molecular motor RNA polymerase. Here, a DNA-RNA polymerase complex is held between two optical traps with constant force, with the polymerase on one side and an end of the DNA on the other side. As the polymerase moves along the DNA the changes in trap-trap distance can be measured and thereby shows the kinetics of this molecular motor.

The correlation of force traces with fluorescence observation provides very powerful insights for our research. The team has been fighting over system time!

– Prof. Tony Hyman, Professor at Max Planck Institute of Molecular Cell Biology & Genetics

Configuration

The configuration includes four independent continuous optical traps, three-color fluorescence and automated valves for the microfluidics system, allowing quick and remote control of the channels.

The C-Trap™ is located in a dedicated high-stability room with a separately founded concrete block, and a 'room-in-room' including temperature control and cooling panels on the wall (see picture). This minimizes any acoustic vibrations and temperature fluctuations, making it a highly stable operating environment in a cost-effective way.

Conclusion

The broad set of applications means that the C-Trap™ is operated as a multi-user shared resource. Due to the instrument's flexibility, ease-of-use and ability to save experimental configurations it is possible to use the instrument with multiple researchers, working on different experiments.

The MPI-CBG use-case perfectly shows the diversity of the C-Trap™ for conducting different correlative optical tweezers-fluorescence microscopy experiments by multiple users. LUMICKS is proud with MPI-CBG as a user and looks forward to the development of new experiments and the publications of results.