

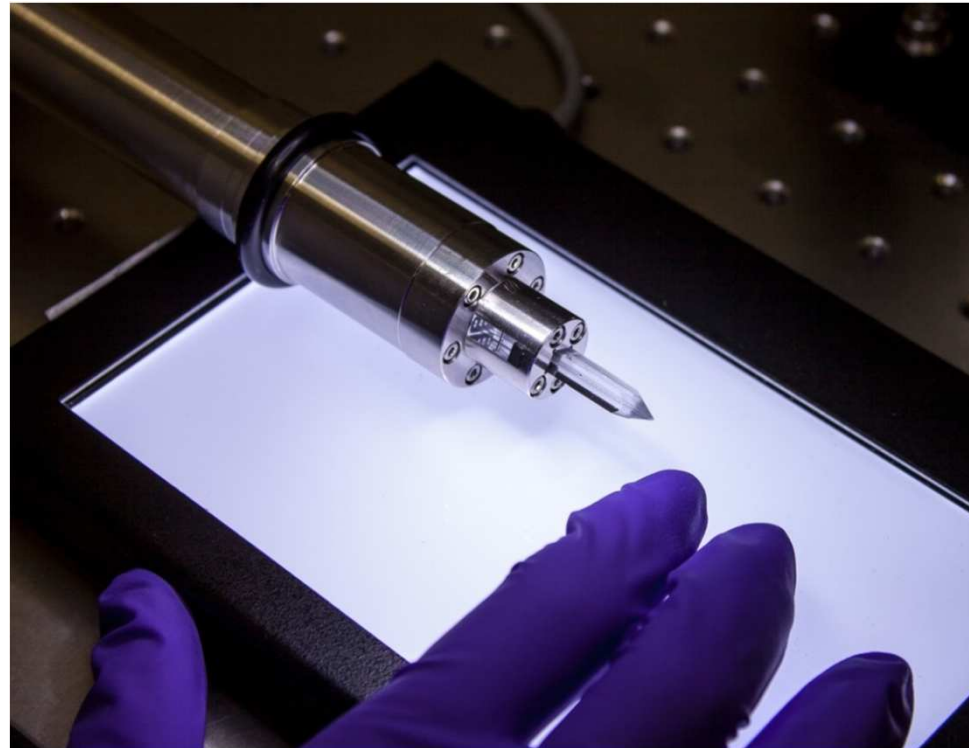
# Microfluidics at European XFEL: current state and future perspectives



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Opportunities for microfluidic devices  
at Free-Electron Lasers Workshop

Schenefeld, June 15<sup>th</sup> 2017



## Microfluidics

*There is plenty of space at the bottom.*

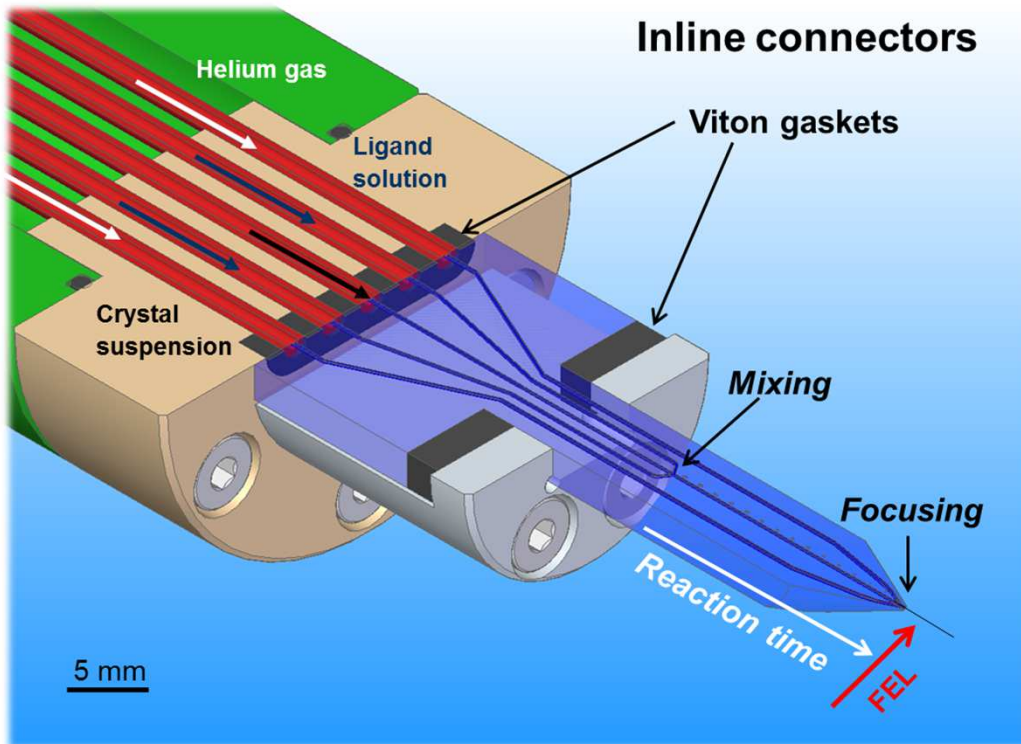
Feynman, 1959

### What can microfluidics do for XFEL experiments?

- Sample preparation
- Sample sorting and characterization
- Sample delivery: nozzles, valves, in-line filters, ...

# Where are we now at European XFEL?

## Glass microfluidics



### Advantages

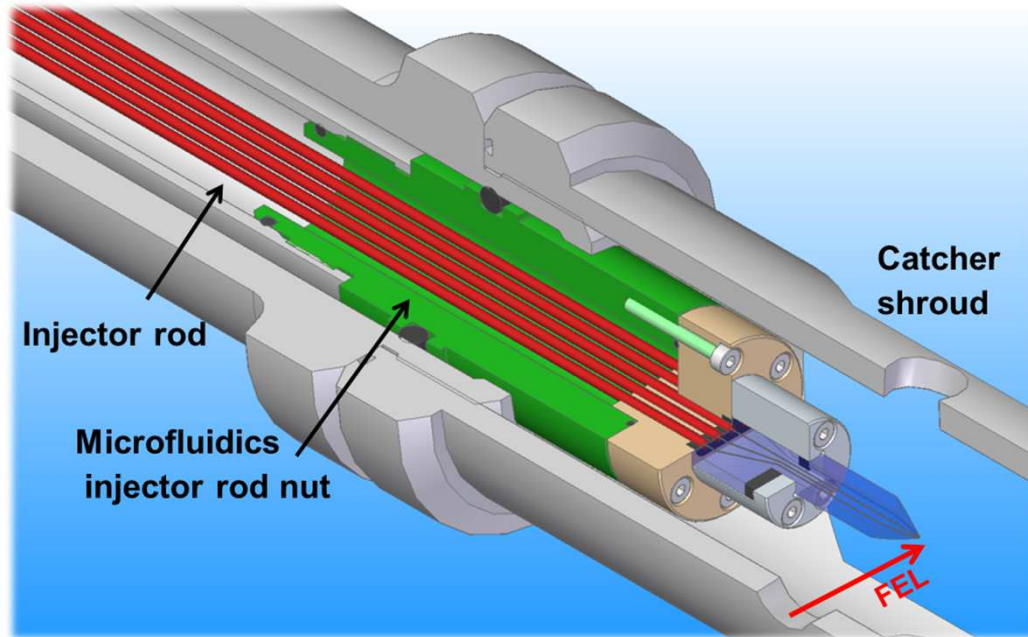
- In-line connectors
- Inert transparent material
- Reproducibility, standardization

### Limitations

- Fabrication cost and time
- Standardization
- Sample consumption
- Jet speed

# Where are we now at European XFEL?

## Microfluidics - beamline integration



- Larger sample road
- Accommodate larger device
- Accommodate more tubing
- Standardization:  
*users can bring their own device and connect with their injector rod nut*
- Flexibility

## Workshop outlook

### Workshop aim

Bringing together developers of liquid sample delivery that use **diverse microfabrication techniques and sample delivery approaches.**

- Glass, PDMS, photoresist material, kapton, COC
- Droplets, continuous jet
- Double flow focusing jet, mixing experiments
- Laser etching, wet etching, lithography, glass tapering, 3d printing
- Combined assembly, monolithic piece

## Points of discussion

- Standardization of sample delivery set-up, also within different facilities
- High repetition rate of European XFEL requires fast sample exchange and fast jets
- Fast exchange between samples
- Sample reservoirs close to the interaction point
- Poor reproducibility of manual fabricated devices
- Flexibility to change channels geometry, adapting the device to particular experiment conditions
- Characterization of fluid properties of the device
- Sample amount reduction
- Synchronization of droplets and X-rays
- Complementary spectroscopic techniques
- Comparison between devices made of different materials and fabrication processes

## Workshop outlook

- *Where do we want to go next?*
- *What are your “wishes”?*
- *Possible collaborations?*