

# Laser welded microfluidic plasma separation unit with on-chip pressure conversion

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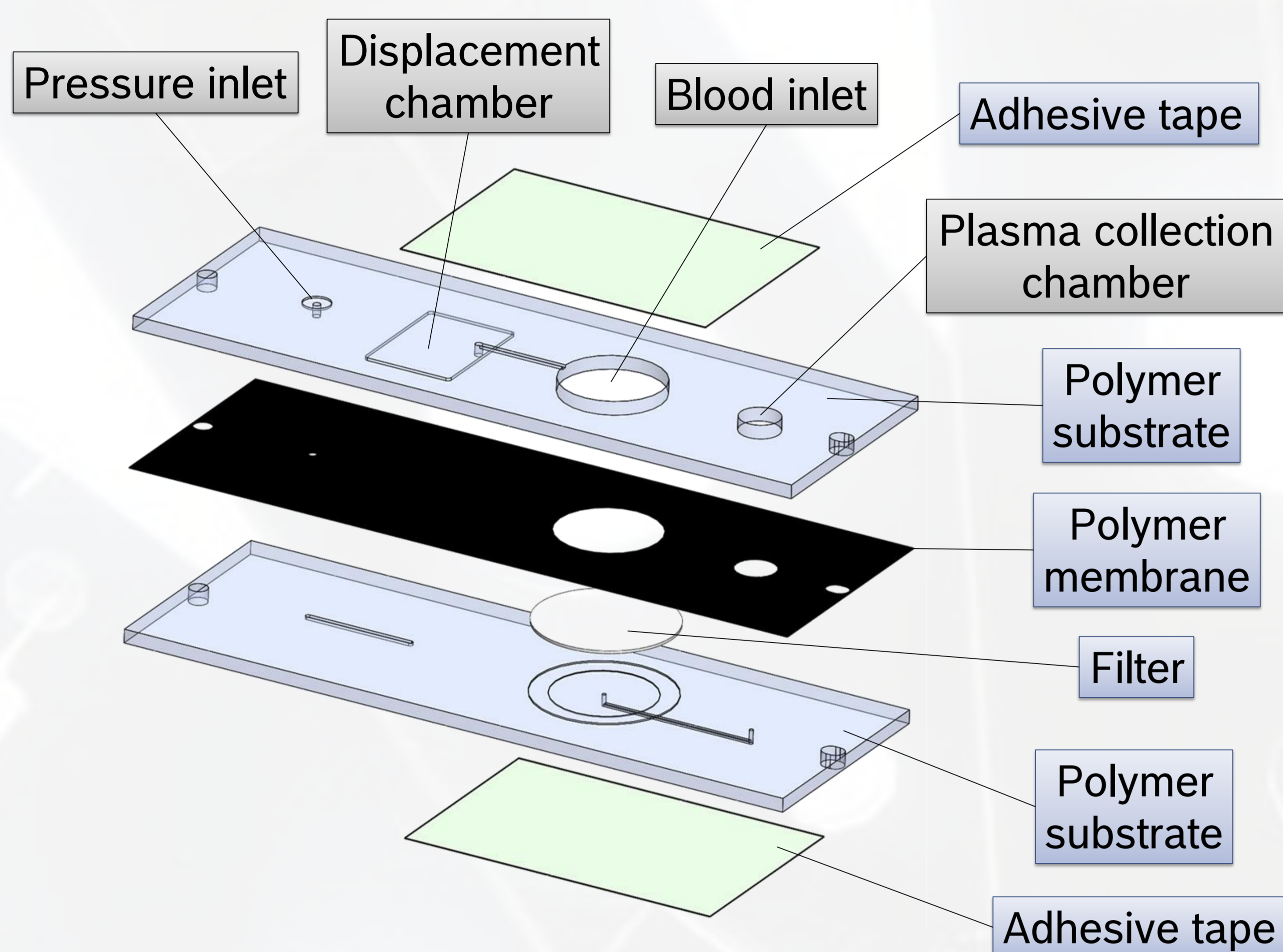
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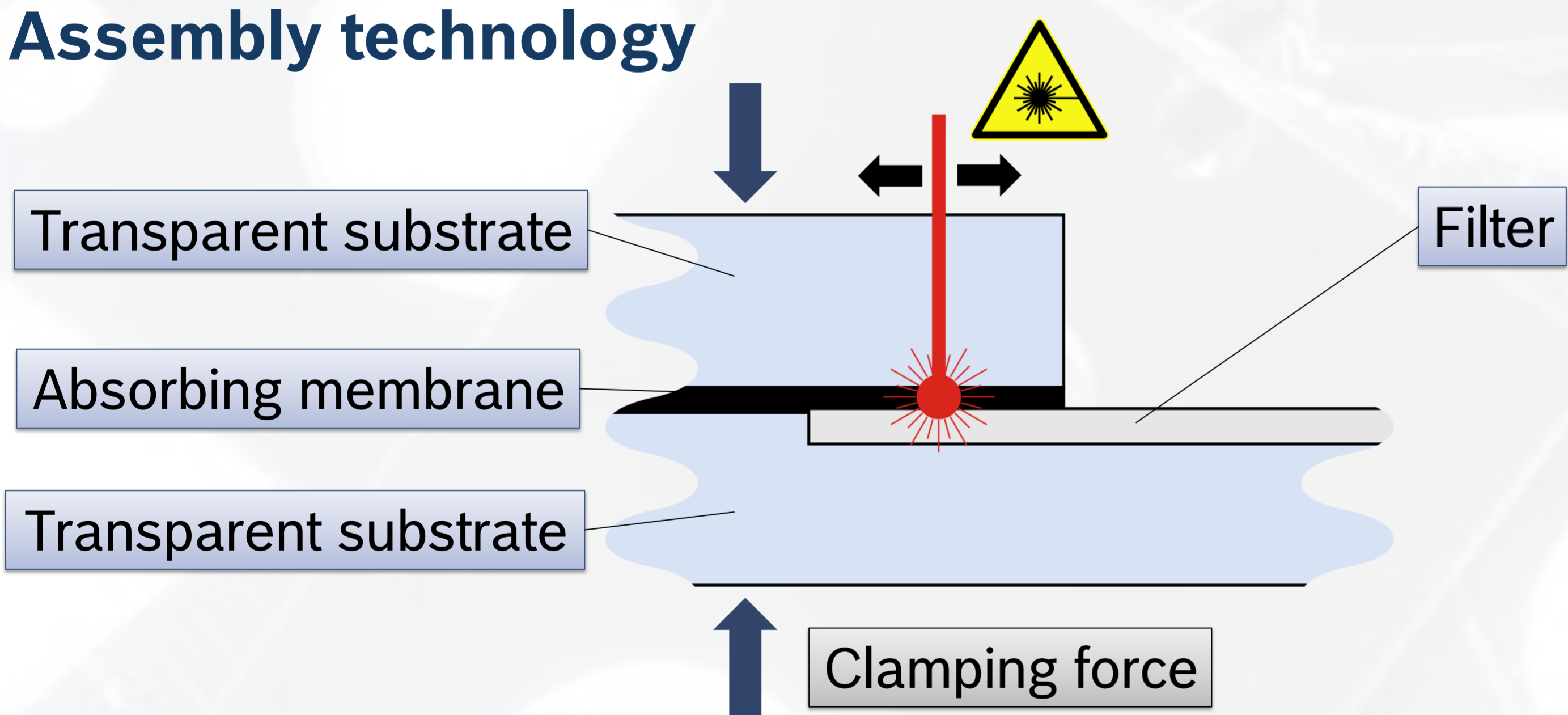
## Introduction

- Separation of plasma from full blood is necessary for many diagnostic assays, e.g. ELISA
- Existing microfluidic solutions [1-3] usually require well-defined flow rates and pressure drops provided by external driving unit
- Here, a low-cost, polymer-based system for the separation of plasma is presented. This system contains a membrane and a microfluidic component for generating a defined driving pressure on chip.

## Polymer stack details



## Assembly technology



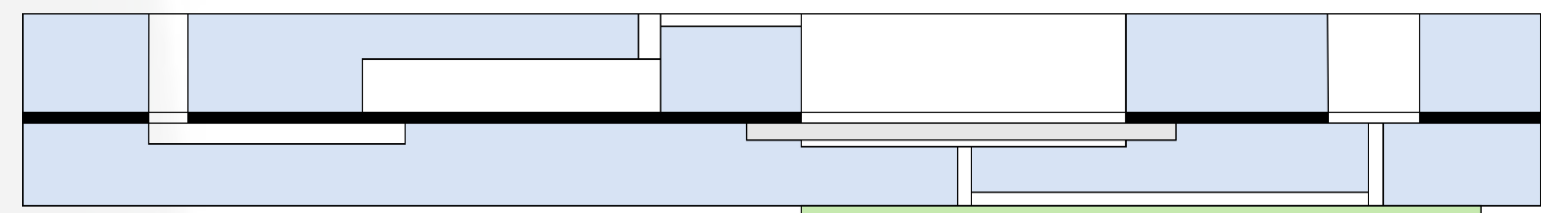
- Single-step laser welding process (cw@1064nm) for joining of polymer layers and sealing of filter membrane

## Conclusions

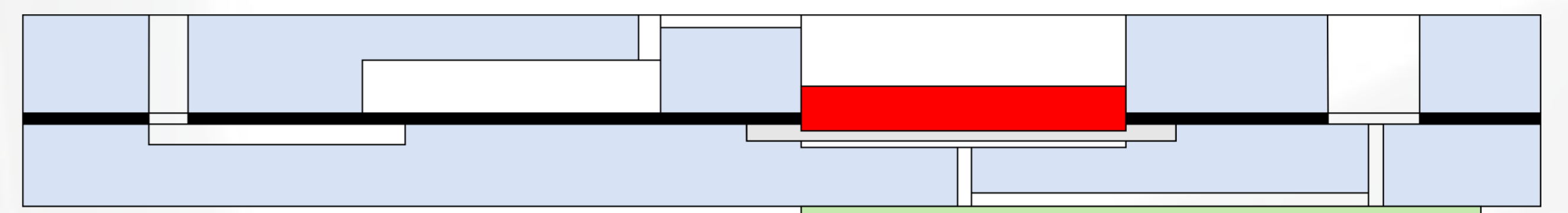
- Microfluidic component for separation of plasma from full blood in a lab-on-a-chip:
  - **Cost-effective:** Laser-based assembly process with single-step welding of polymer substrates, membrane and filter
  - **Reliable processing:** Well-defined pressure drop over filter independent of externally applied pressure
  - **Plasma quality:** No residual cellular components and low hemolysis

## Plasma generation process flow

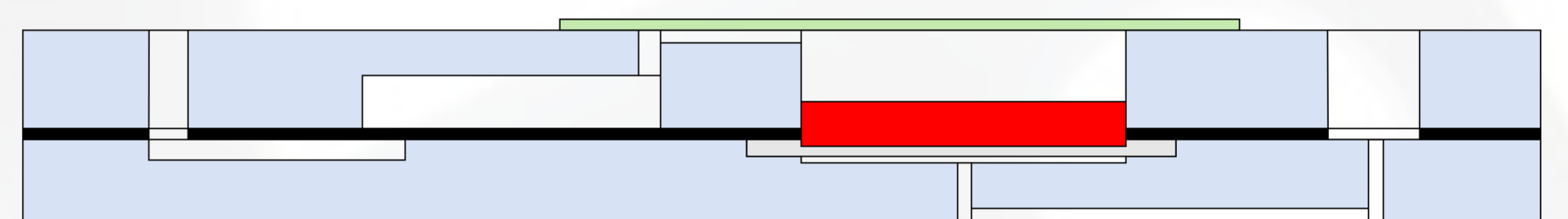
- **Initial: No inlet pressure, membrane not deflected**



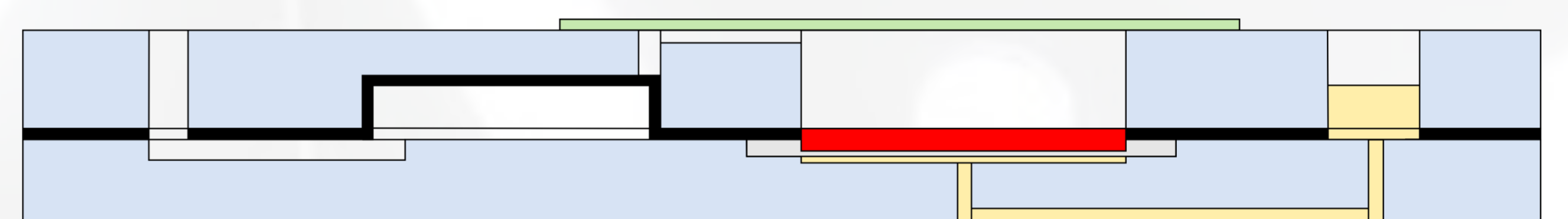
- **Introduction of blood sample through sample port**



- **Sealing of sample port with adhesive tape**



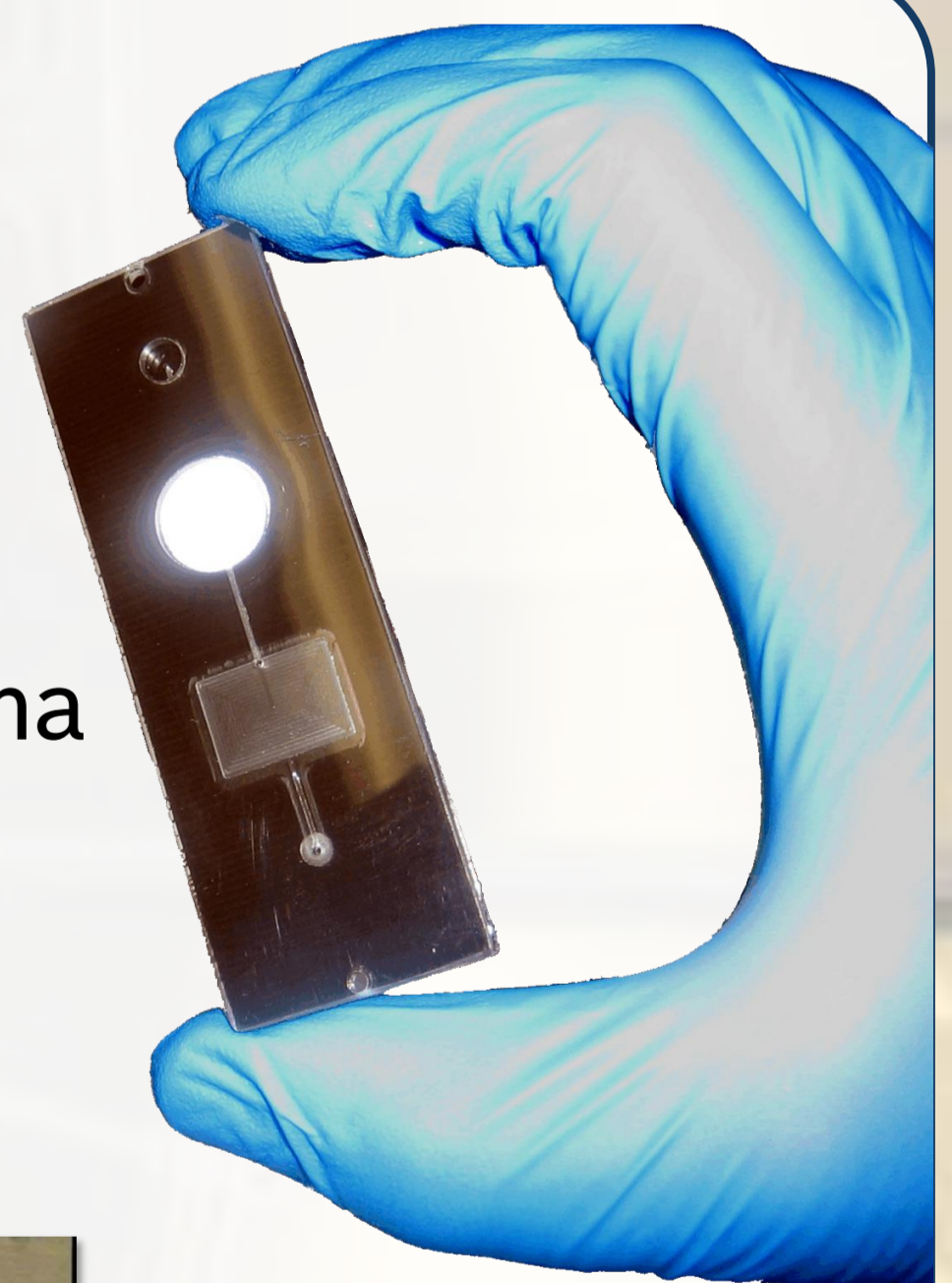
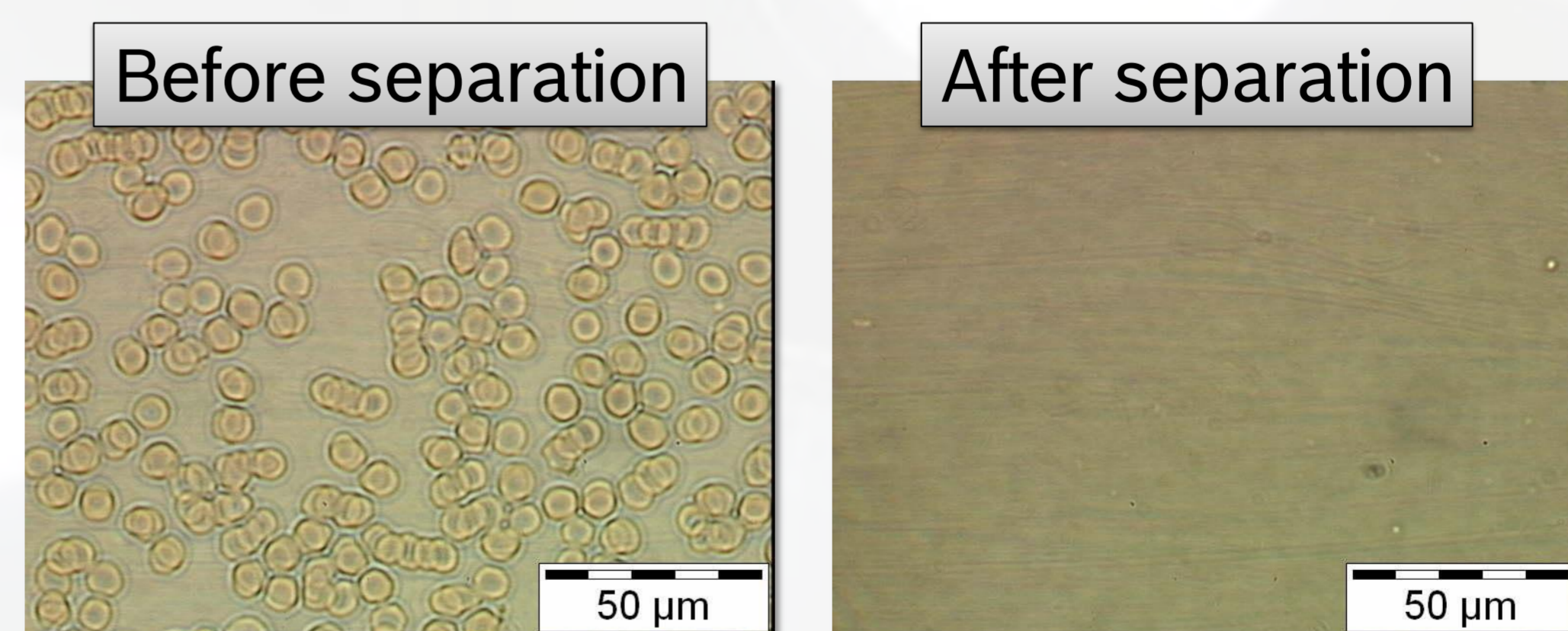
- **Application of external pressure**



- Polymer membrane deflection provides on-chip generated pressure drop over filter independent of external pressure

## Results

- Extracted 17  $\mu$ l plasma from 50  $\mu$ l full blood: **Separation efficiency: ~70%**
- Hemocytometer: **No cellular components** in extracted plasma
- **Low hemolysis: 1.6% of RBCs lysed** (based on hemoglobin concentration)



[1] Sollier et al., Biomed Microdevices 12 (2010) 485

[2] Fekete et al. Sensors and Actuators B 162 (2012) 89

[3] Becker et. al, Proceedings  $\mu$ TAS (2010), 133



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