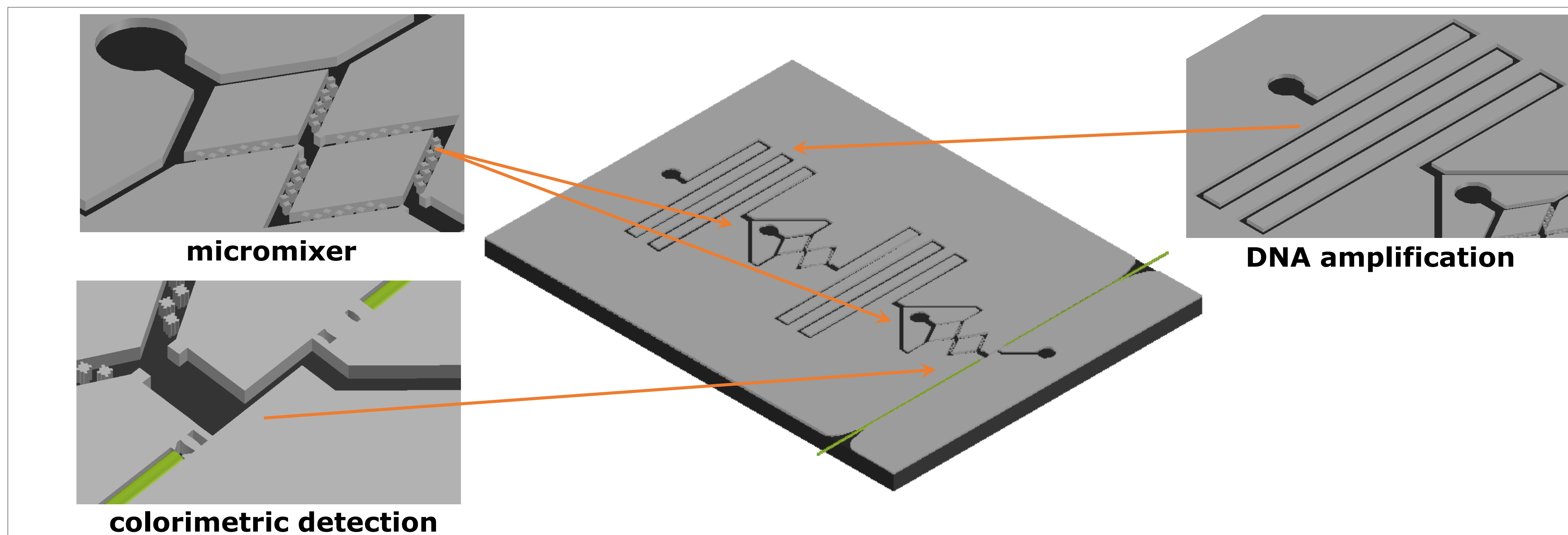


# Design and development of a microfluidic platform for use with colorimetric gold nanoprobe assays



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## Objectives

- develop bio-microfluidic platform for colorimetric DNA detection based on non-cross-linking Au-nanoprobes hybridisation;
- enable detection with much lower volume than in the state-of-the-art biosensor;
- clearly distinguish between positive and negative assays of various DNA targets with single mismatch sensitivity and low detection limit;
- good device sensitivity and reliability;
- develop micromixer to enable reagents mixing on chip

## Methods and techniques

1. Microfluidic chip: fabricated in polydimethylsiloxane (PDMS) by soft lithography; the mould for PDMS patterning fabricated by photolithography in SU-8; characterisation: confocal scanning microscopy, scanning electron microscopy, profilometry, spectrophotometry
2. Opto-electronic set-up: multimode optical fibres; green and red high-power LED; photodiode; operational amplifier
3. Assessment of mixing efficiency: mixing of water and a blue dye; characterisation by inverted microscope and CCD camera; analysis by Image J

## Results

- the combination of the unique optical properties of gold nanoprobes with microfluidic platform resulted in sensitive and accurate sensor;
- detection of single base mismatch using 10 × lower solution volume and target DNA concentration below the limit of the detection attained with a conventional microplate reader;
- development and optimisation of passive planar rhombic micromixer with obstacles;
- good fluid mixing with acceptable pressure drop values with a mixer length of 2.5 mm, being one of the shortest planar passive micromixers reported to date;
- the integration of microfluidic technology opens up the possibility of further integration aiming to provide a POC “bleed and read” device.

## Publications

1. Bernacka-Wojcik, I. et al., **2009**. Inkjet printed and “doctor blade” TiO<sub>2</sub> photodetectors for DNA biosensors. *Biosensors and Bioelectronics* 25, 1229-1234.
2. Bernacka-Wojcik, I. et al., **2013**. Bio-microfluidic platform for gold nanoprobe based DNA detection-application to Mycobacterium tuberculosis. *Biosensors and Bioelectronics* 48, 87-93.
3. Bernacka-Wojcik, I. et al., Single nucleotide polymorphism detection using gold nanoprobes and bio-microfluidic platform with embedded microlenses. **Submitted**.
4. Bernacka-Wojcik, I. et al., Experimental optimization of a passive planar rhombic micromixer with obstacles for effective mixing in a short length. **Submitted**.

