

WPI Lead Assay Chip

2017 iGEM Collaboration between WPI and BostonU_HW

Purpose

This chip is designed to perform a scaled-down version of the WPI Lead Assay. All volumes of the assay have been decreased 10-fold. This saves resources but requiring lower volumes.

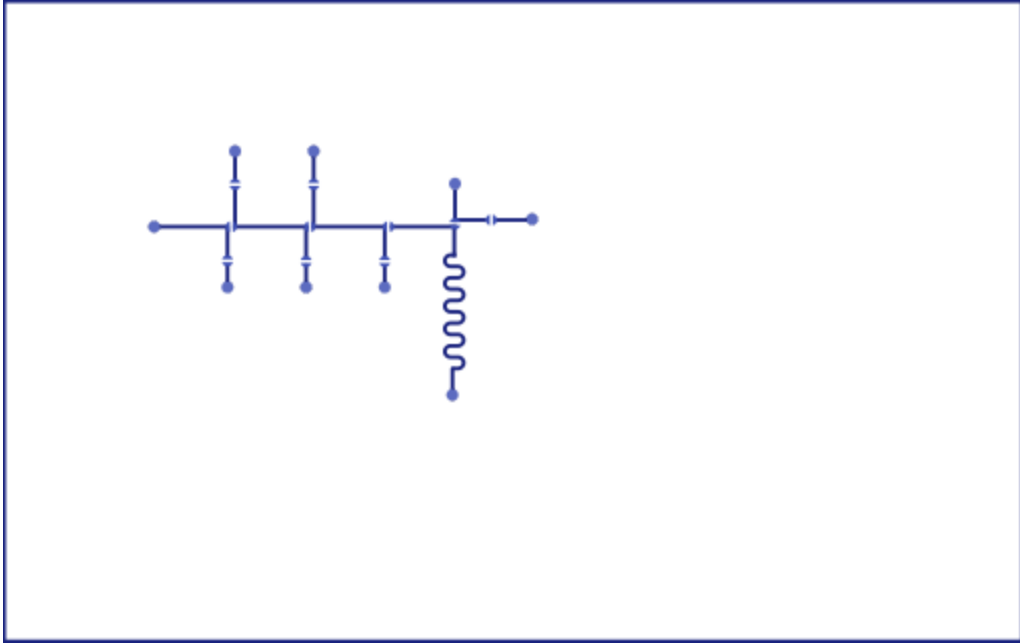
Due to the inherent scalable nature of microfluidics, this design could be scaled to perform the entire WPI Lead Assay with varying concentrations of lead.

Table Of Contents

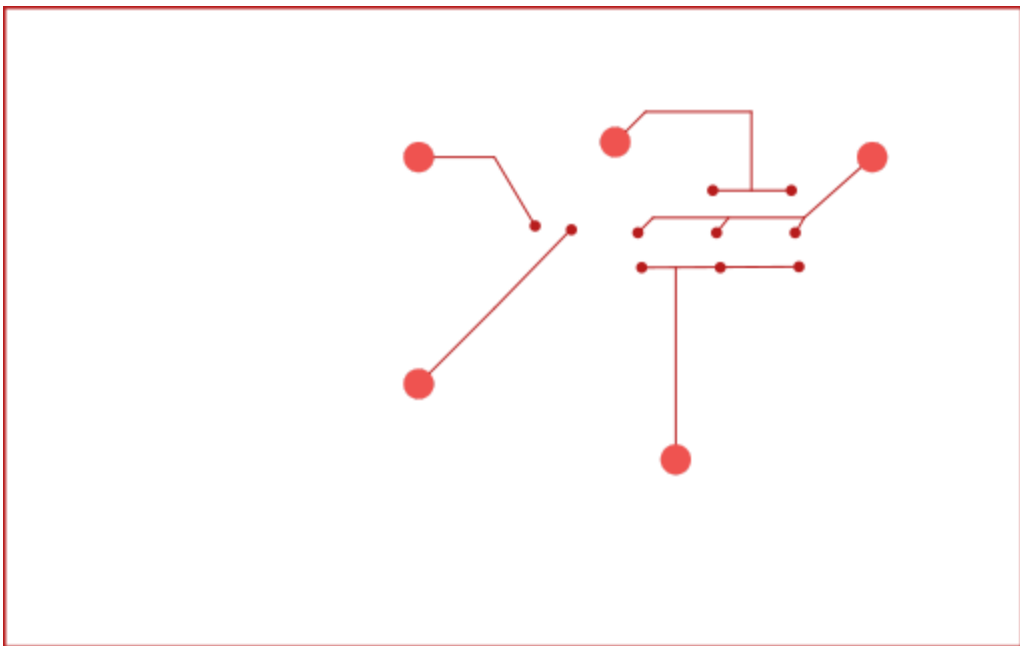
Purpose	1
Table Of Contents	1
Design	2
Flow Layer	2
Control Layer	2
Design Specifications	3
Chip Dimensions	3
Metering Dimensions	3
Mixing	4
How Does it Work	5

Design

Flow Layer



Control Layer



Design Specifications

Chip Dimensions

This chip has three layers: control, flow, PDMS membrane. The control and flow layers are milled polycarbonate, while the PDMS membrane is an elastic membrane of a specific thickness.

Chip

- Width: 135 mm
- Length: 85 mm
- Polycarbonate Thickness (1 side): 5.50 mm

PDMS

- Width: 135 mm
- Length: 85 mm
- Thickness: 254 μm

Metering Dimensions

Metering is the process of measuring out and dispensing accurate volumes of liquid of a microfluidic chip. This chip contains 4 metering sections. Oil and GSH are metered to remove air bubbles, and are then pushed into the chip. Lead Media and AuNPs are metered for accurate volumes that will be pushed and mixed by oil.

Oil

- Depth: 500 μm

Lead Media:

- Length: 10000 μm
- Width: 500 μm
- Depth: 830 μl
- Volume: 4.15 μl

AuNP

- Length: 10000 μm
- Width: 500 μm
- Depth: 692 μl
- Volume: 3.46 μl

GSH

- Depth: 500 μl
- Volume: 1.0 μl

Mixing

This chip allows for mixing in two separate instances. This mixing is time dependent as specified in the Lead Assay protocol provided by WPI. The timed mixing is determined using flow rate and volume moved over time.

Lead & AuNP Mixing

- 17.5 Seconds

GSH Mixing

- 18.0 Seconds

How Does it Work

1. Metering

- a. Oil: Oil is metered to remove air bubbles
- b. Lead: 4.15 ul of oil is metered out
- c. AuNP: 3.46 ul of oil is metered out
- d. GSH: GSH is metered to remove air bubbles

2. Mixing

- a. Oil pushes Lead into AuNP at a flow rate of 2.03 mL/hour; these liquids will mix during pushing. After 17.5 seconds of pushing...
- b. 1.0 ul of GSH is pushed into the main channel. This will mix with the Lead & AuNP mixture.
- c. Oil will continue to push the final mixture in the chip for 18 seconds.

3. Output

- a. Using an air-permeable membrane, the final solution can be removed using a pipette tip. This can then be dispensed into a plate and then put in a plate reader