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2018 BOSTON

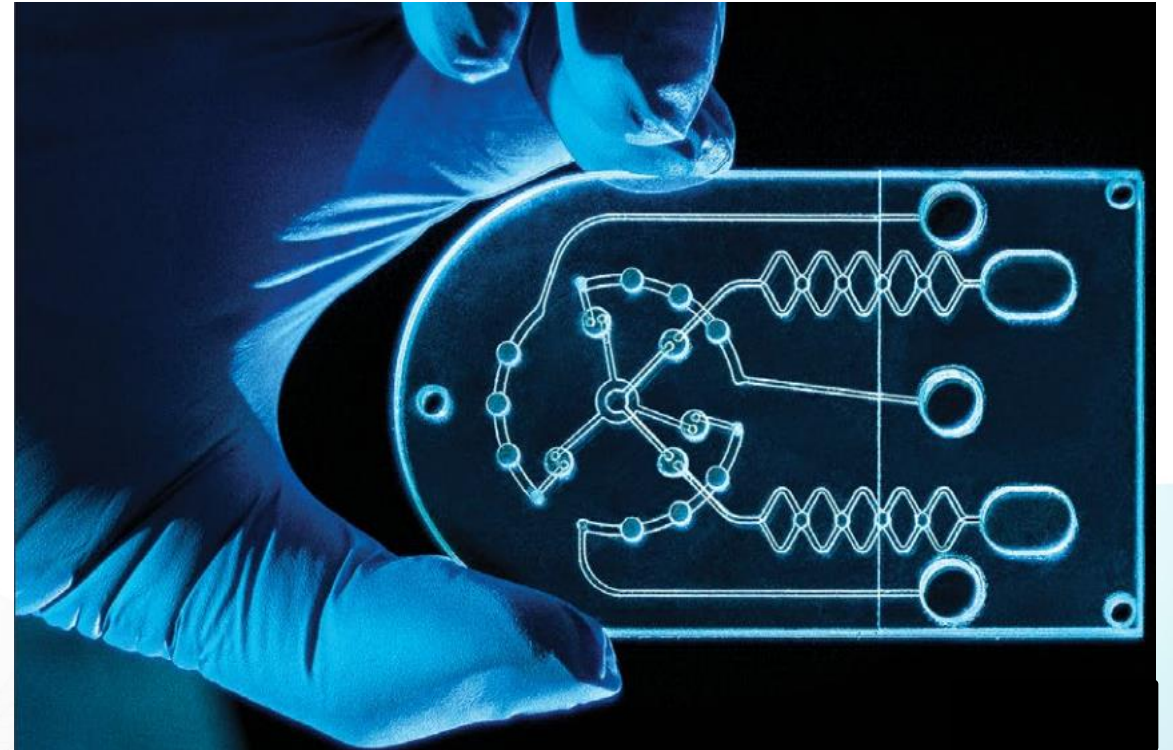
# Simulation of Magnetically Driven Peristaltic Pumps for Microfluidic Applications

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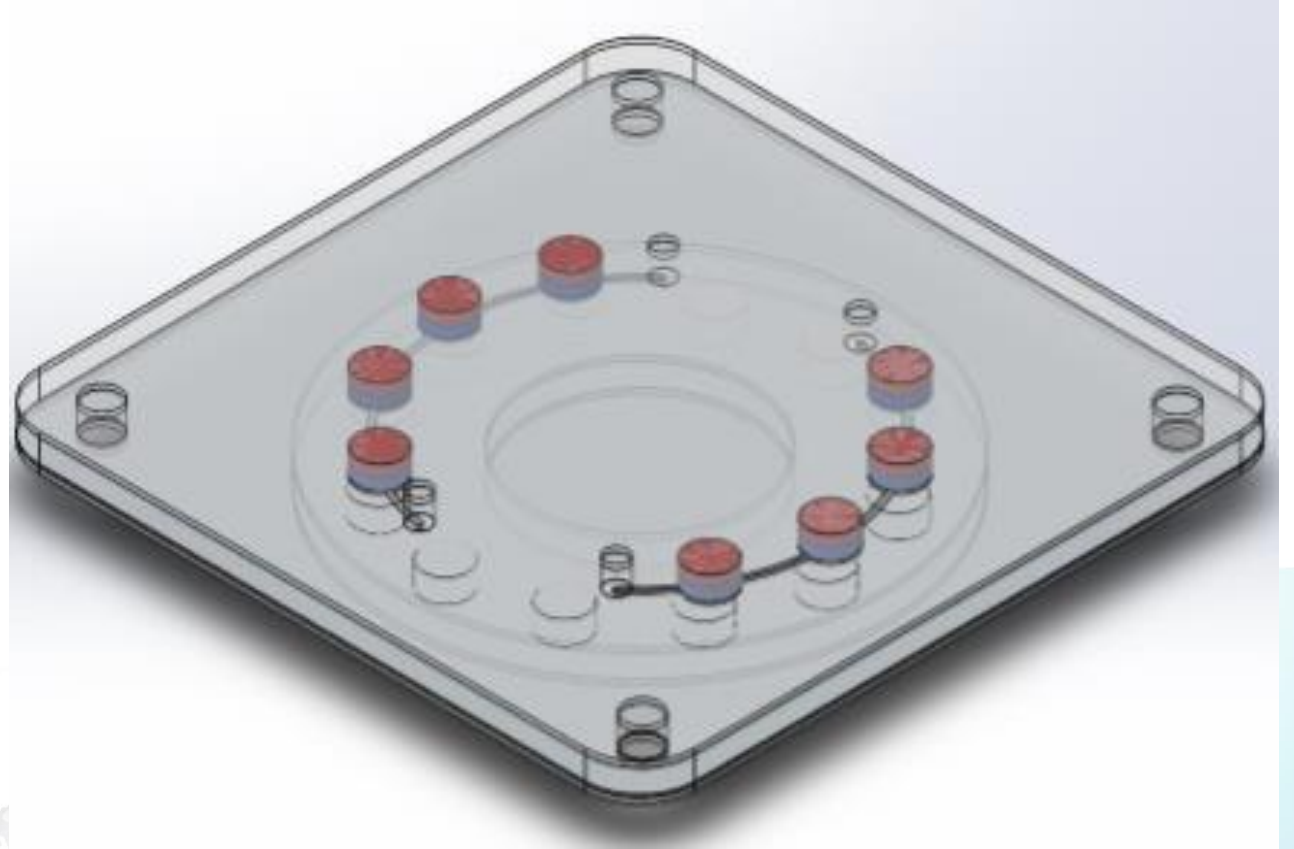
# Overview

- Why lab on a chip



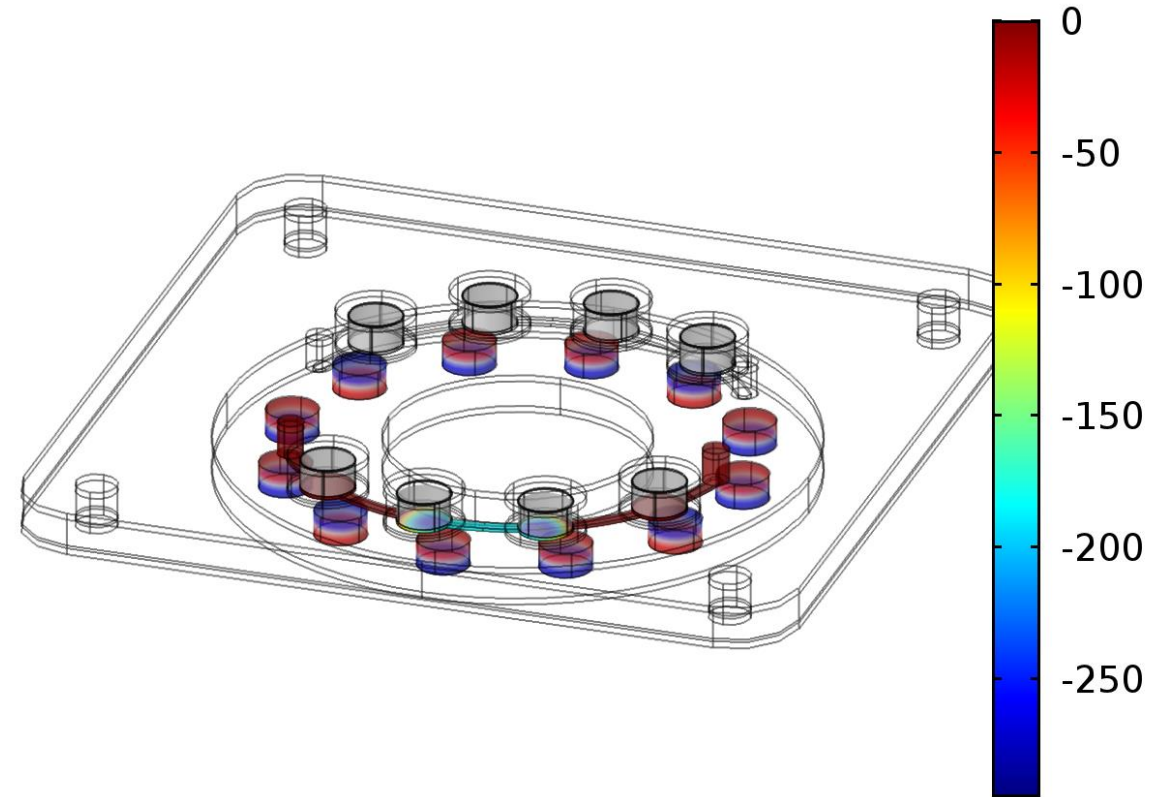
# Overview

- Why lab on a chip
- How to develop designs



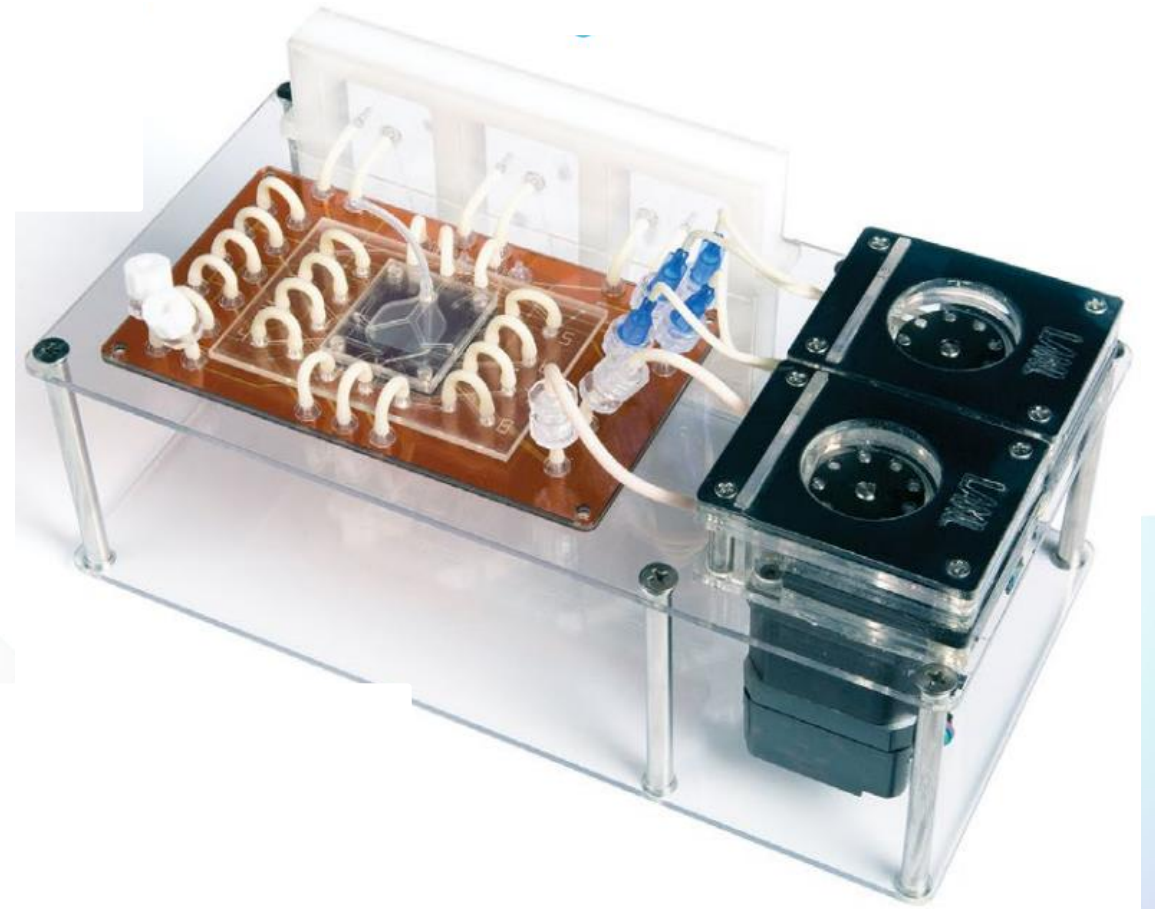
# Overview

- Why lab on a chip
- How to develop designs
- What can be done to simulate these devices



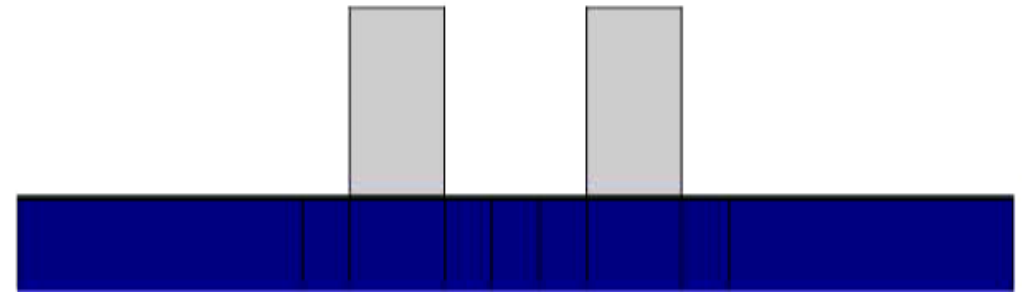
# Lab on a chip

- Reduce room-sized labs to handheld devices
- Microfluidic devices
- Wide range of applications
  - Biological
  - Chemical
  - Medical
  - Environmental
  - Energy



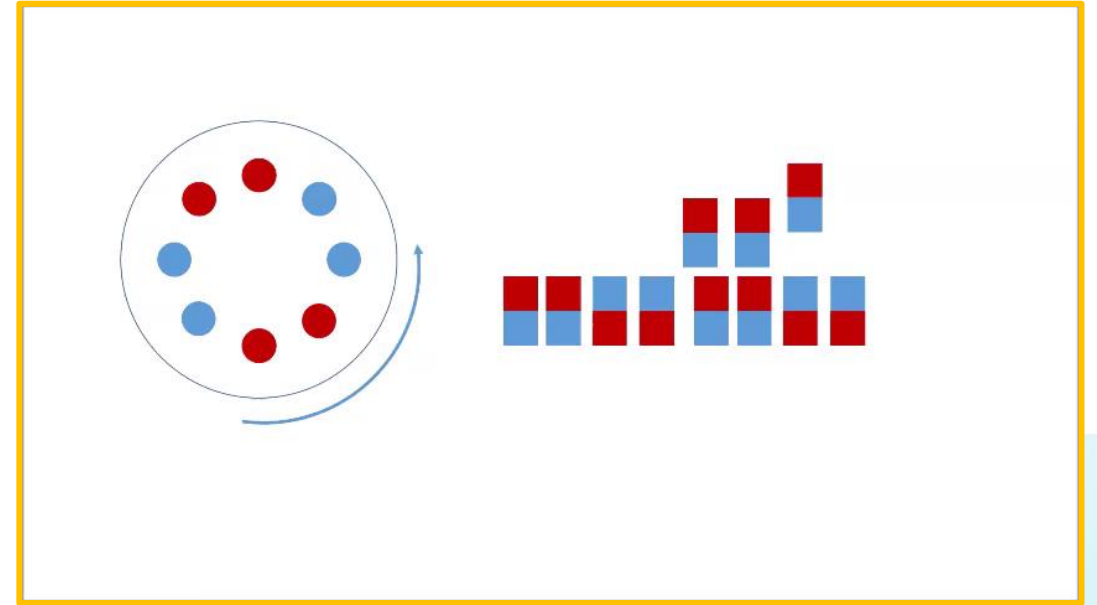
# Lab on a chip - Peristaltic Pumps

- What is a peristaltic pump?
- Typical design
- New design uses magnetics to constrict tubing



# Lab on a chip - Peristaltic Pumps

- What is a peristaltic pump?
- Typical design
- New design uses magnetics to constrict tubing
- Magnetics arranged in circle



# DESIGN DEVELOPMENT



**ALTASIM**<sup>®</sup>  
TECHNOLOGIES  
REALIZING TOMORROW'S TECHNOLOGY

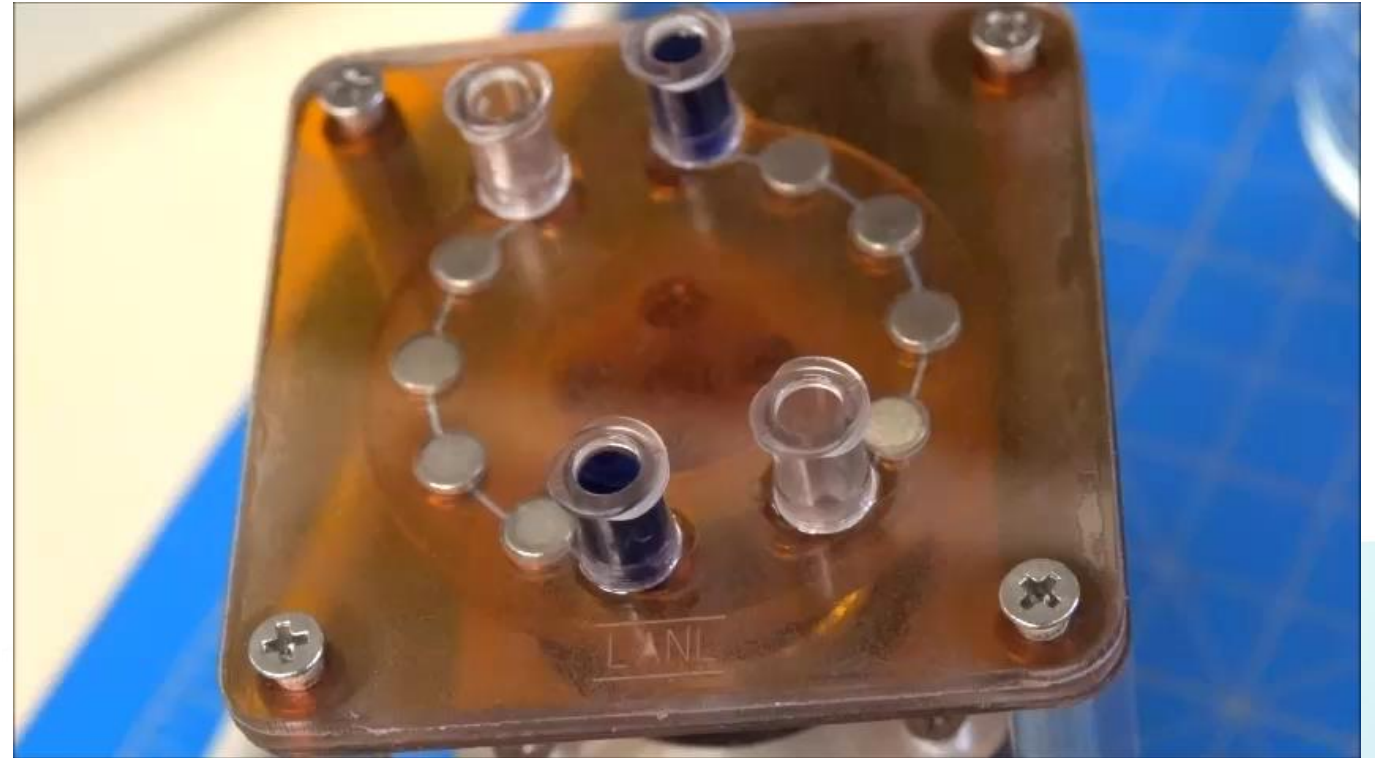
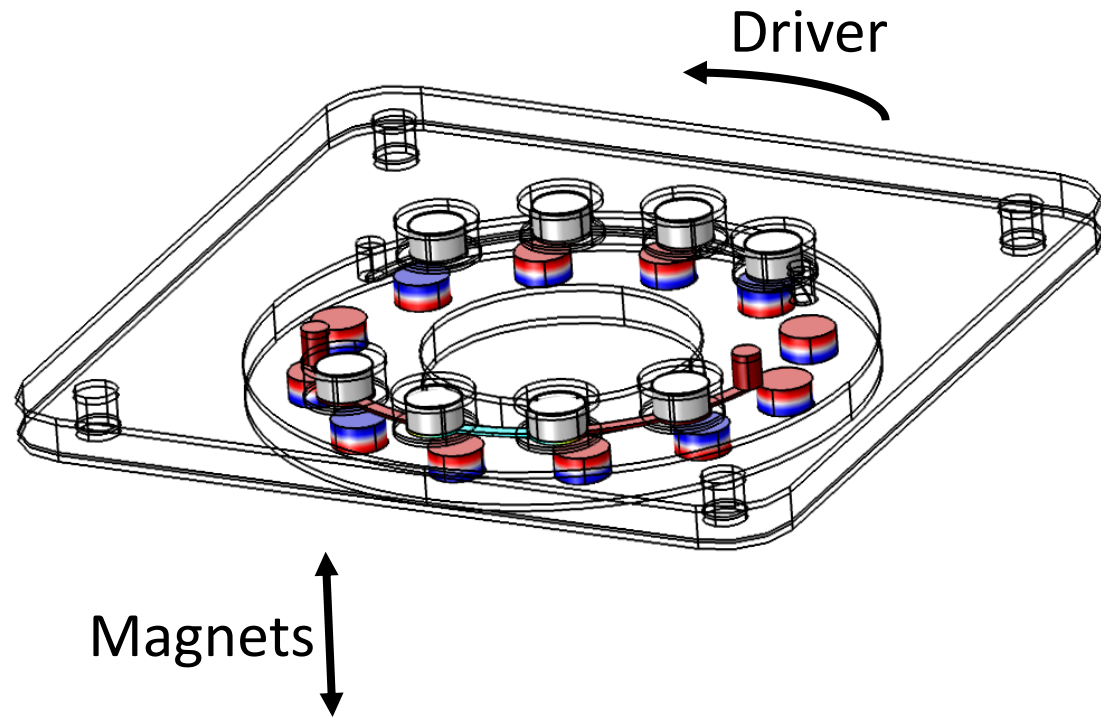
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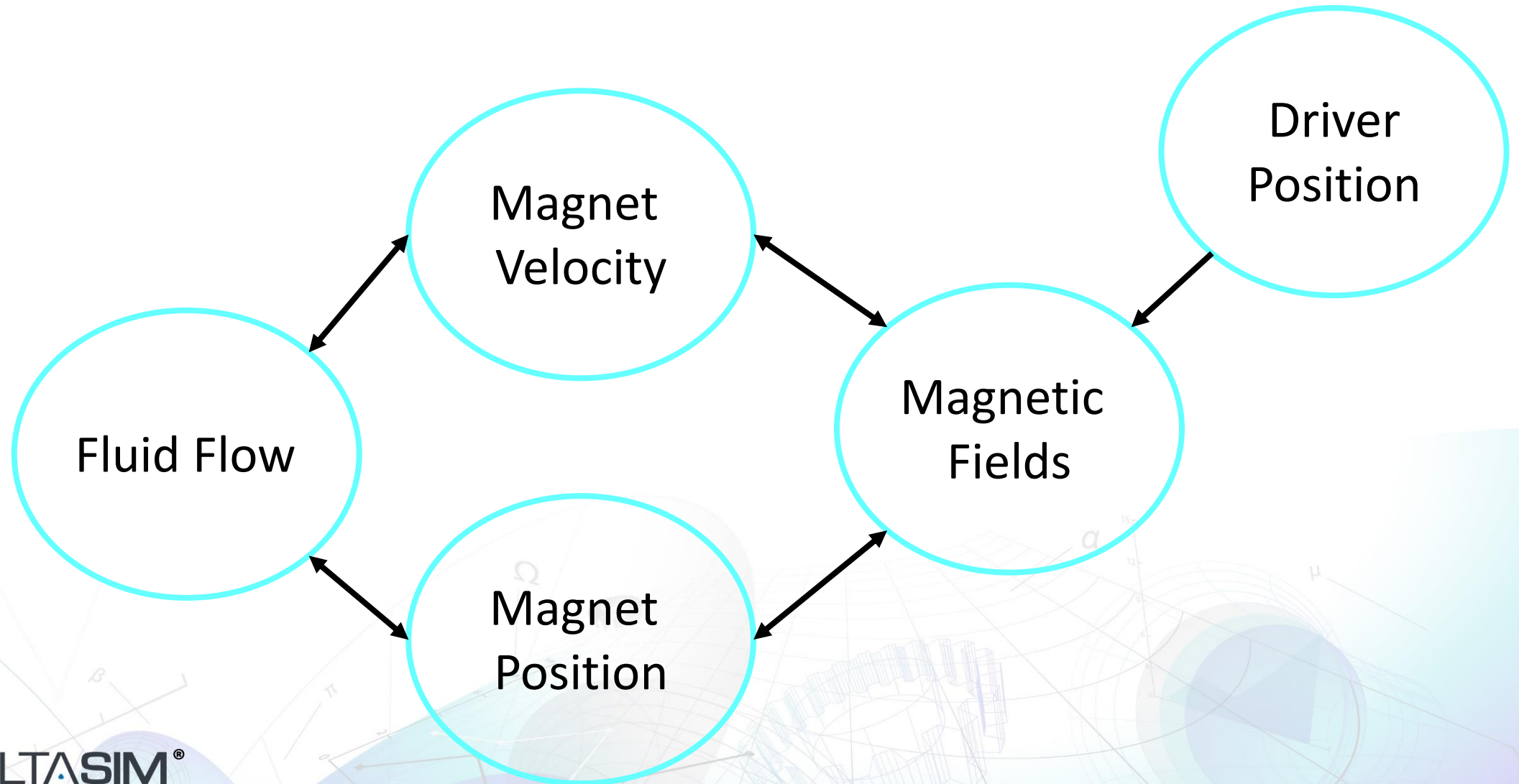
# Design Development

- Prototype and test
  - Expensive
  - Time consuming
  - Limited data
  - Demonstrates success
- Simulate and iterate
  - Reduces time and expense of developing prototypes
  - Extensive data
  - Increased understanding
  - Increased opportunity to iterate

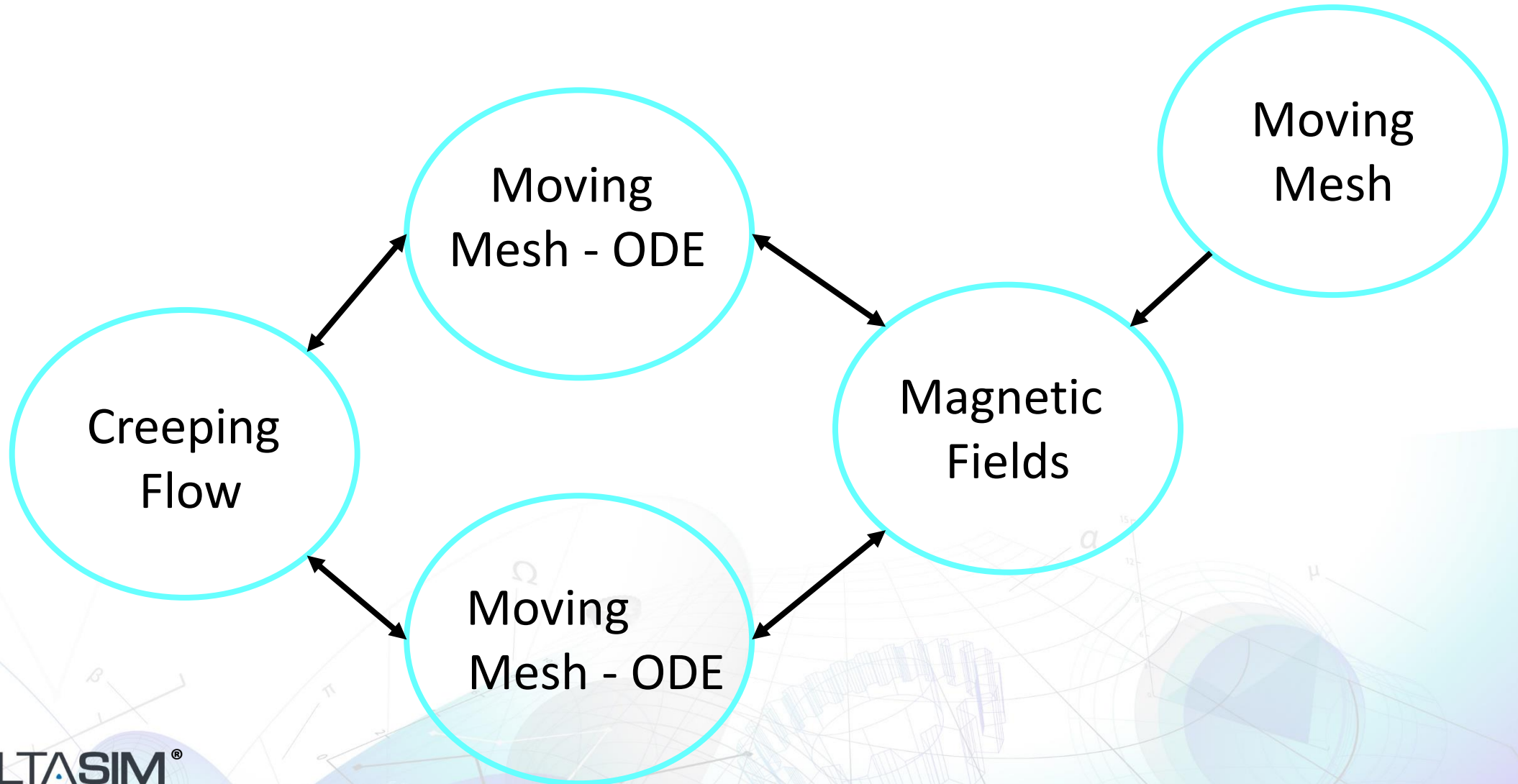
# Pump Concept



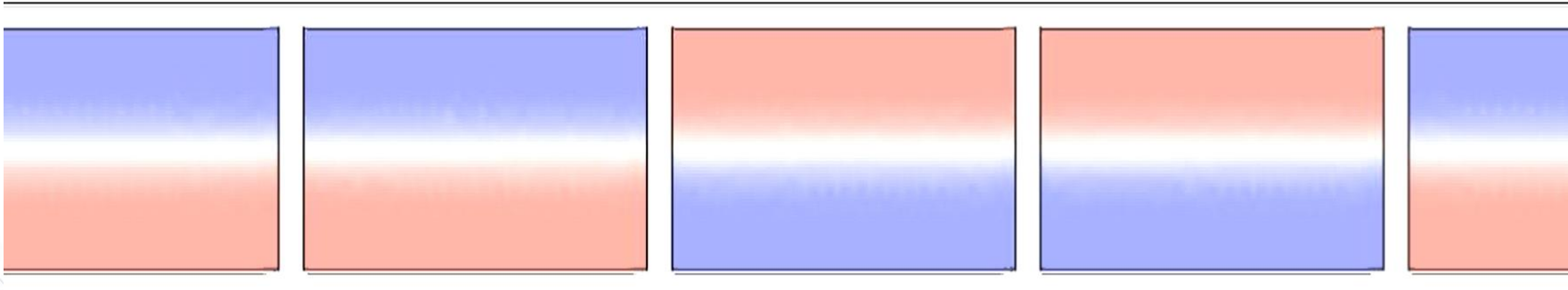
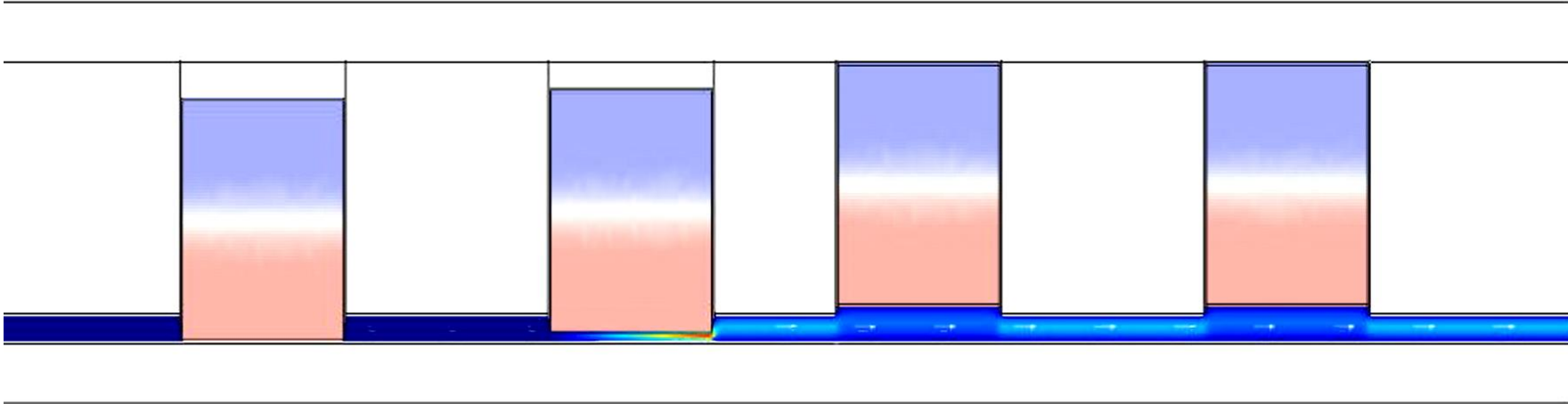
# Multiphysics Analysis



# Multiphysics Analysis – COMSOL Implementation



# Results – Pumping of Fluid



# Conclusions

- Simulation is critical to developing effective prototype of pump
- Analysis of pump requires Multiphysics coupling
- Unique capabilities of COMSOL Multiphysics enable analysis of full coupling
- Using two-dimensional analysis increases speed of design iterations
- Full three-dimensional analysis is possible