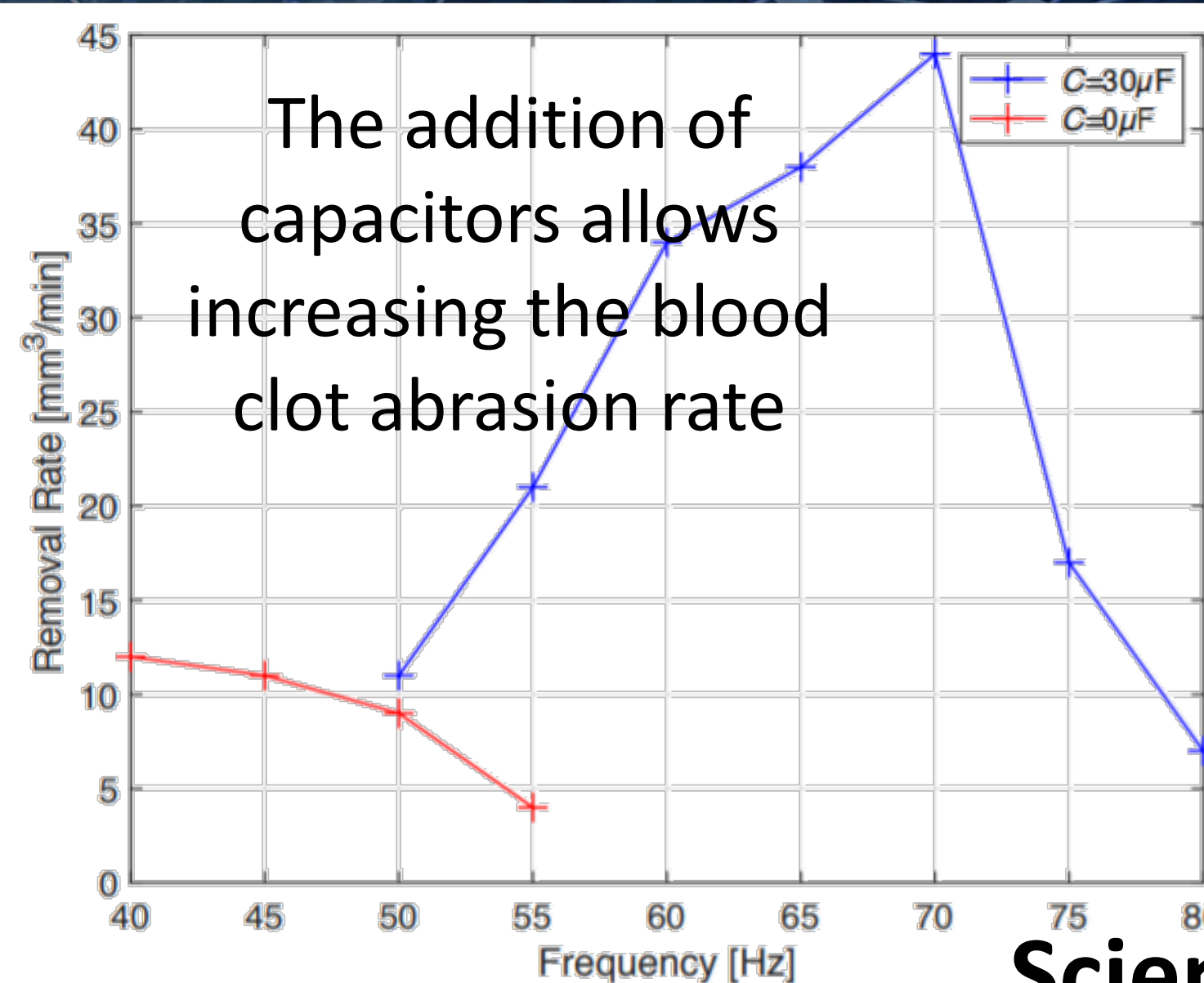
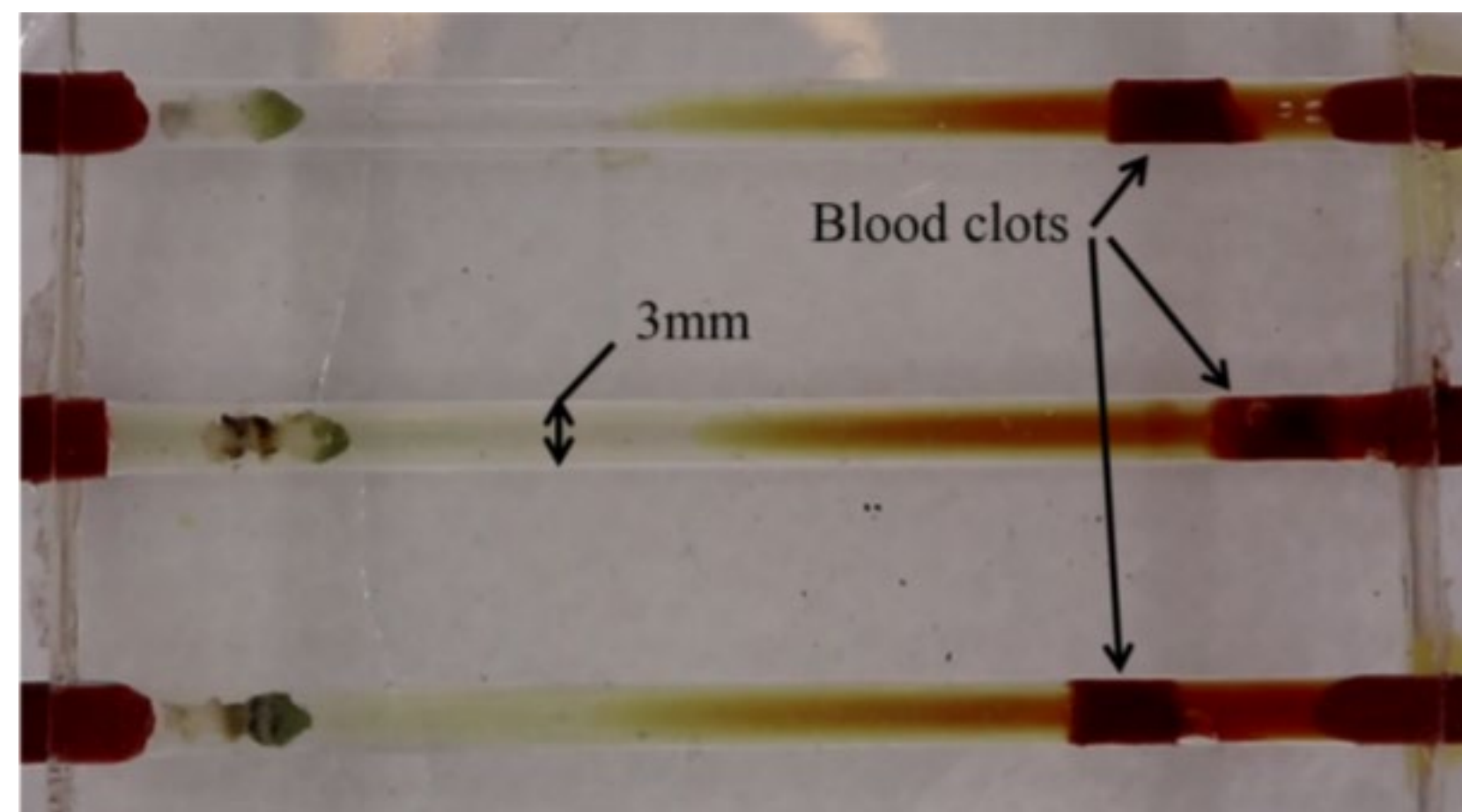


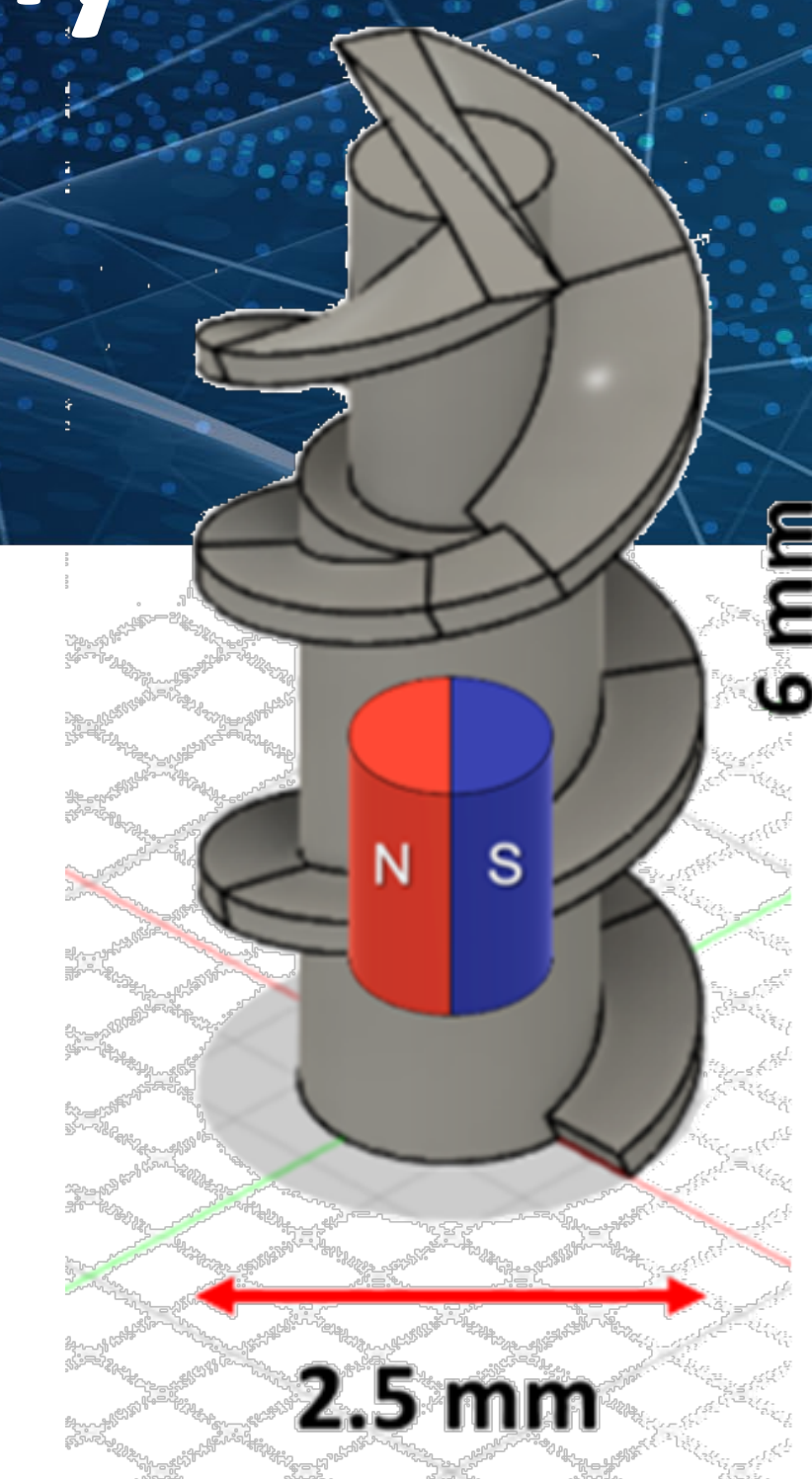
Wireless Magnetic Millibot Blood Clot Removal and Navigation in 3-D Printed Patient-Specific Phantoms using Echocardiography

Houston Methodist Hospital, PI: Dr. Dipan Shah, CO-PI: Dr. Mohamad Ghosn

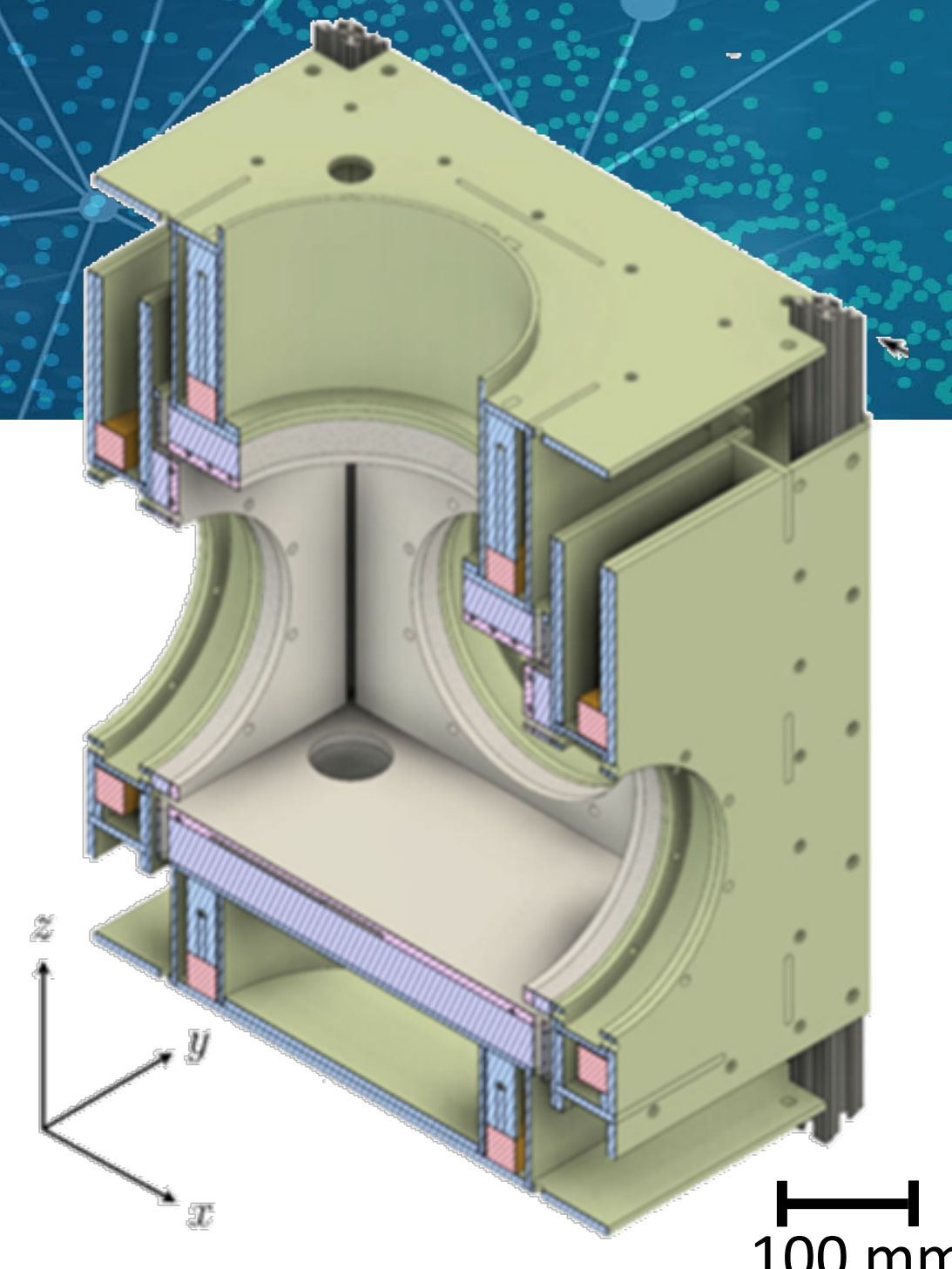
University of Houston, PI: Dr. Aaron Becker, CO-PI: Dr. Julien Leclerc



3D printed patient-specific phantom



Magnetic swimmer



Magnetic manipulator

Challenges:

- How to design Miniature Magnetic Rotating Swimmers (MMRS) optimized for navigation within the vascular system and blood clot disruption?
- How to control and track magnetic swimmers during the navigation?

Solutions:

- CFD is used to compute the swimming characteristics of MMRS.
- Echocardiography imaging is a safe potential solution for tracking a MMRS inside a patient.
- AI can be used to estimate the position of the swimmer from ultrasound data.
- New control methods for rotating swimmer were designed and experimentally validated.
- Capacitors connected in series with the electromagnets improve energy efficiency and reduce the size of the CPS.

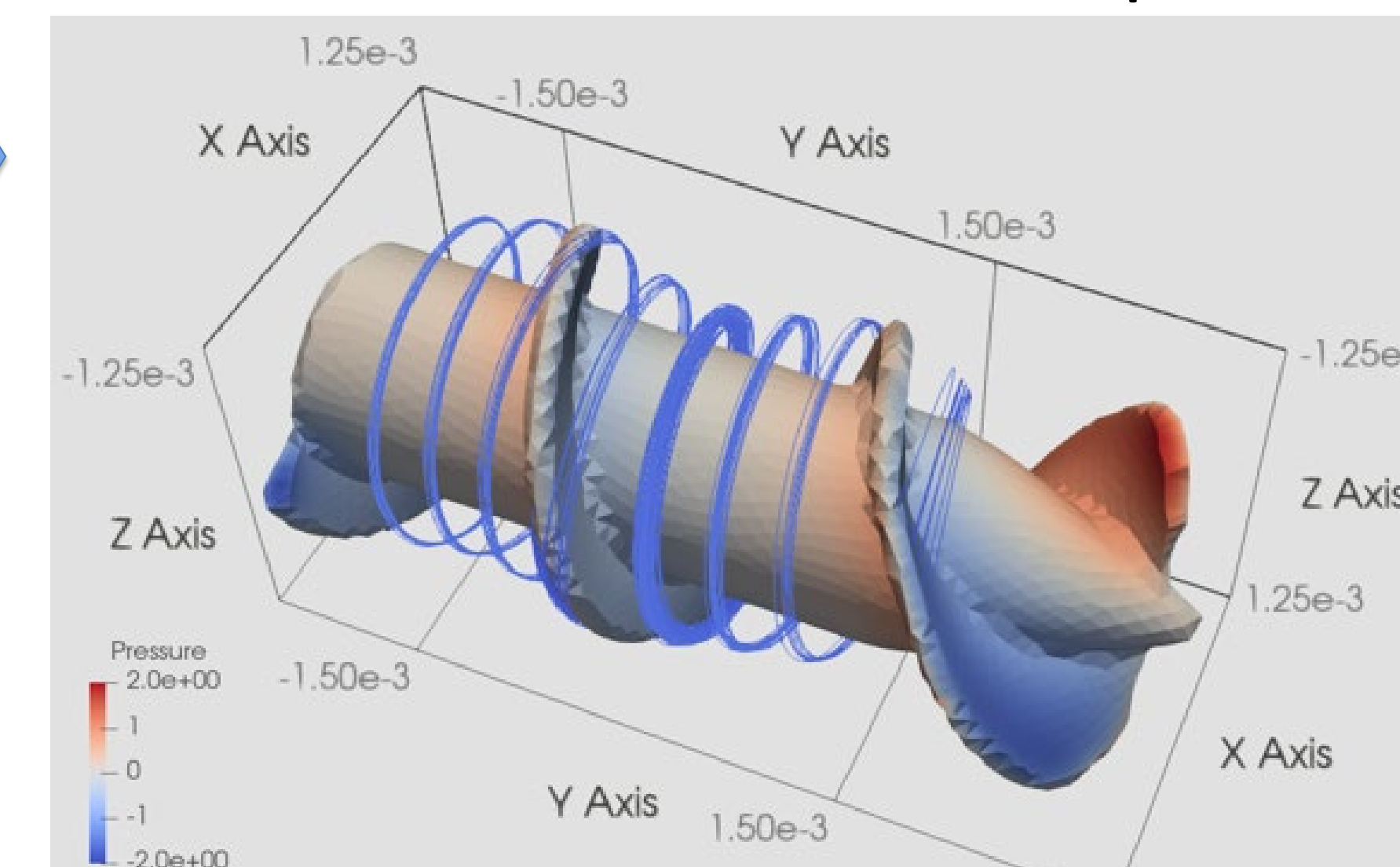
Broader Impact:

- MMRS steered by a CPS that combines precision control, high fidelity imaging and surgeon-in-the-loop could transform the practice and outcomes for a variety of disorders.

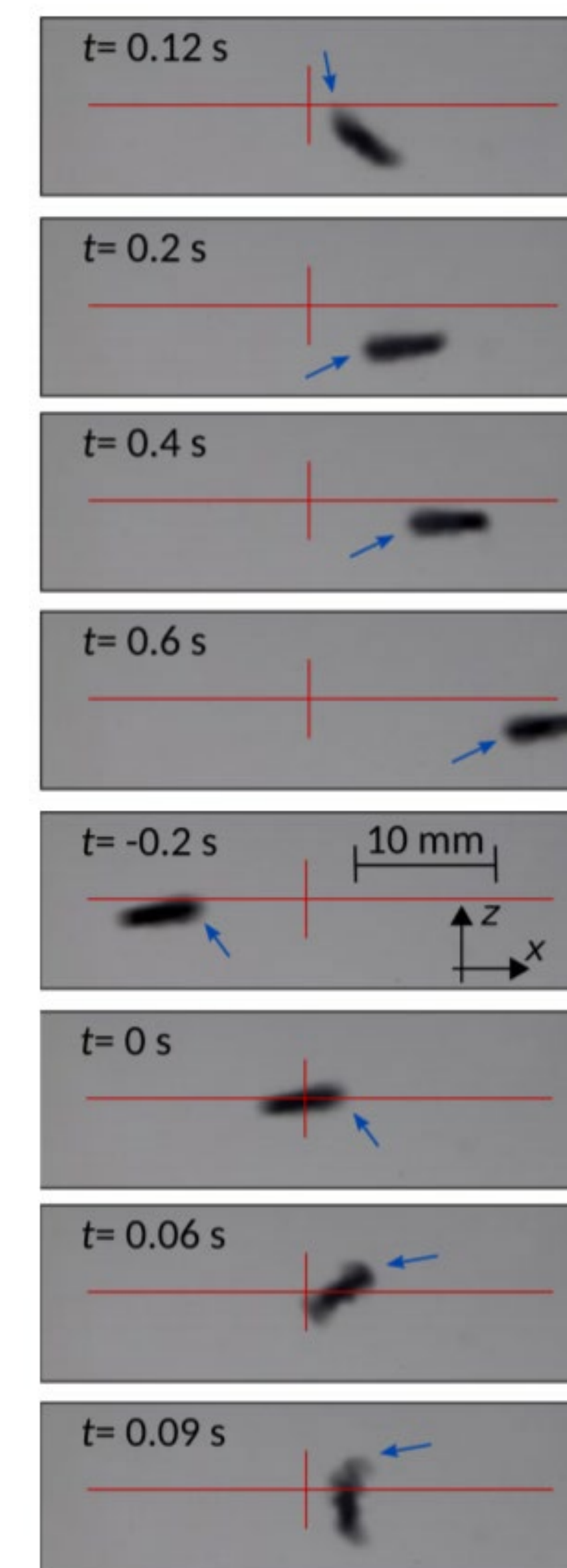
Scientific Impact:

- This project aims to replace a catheter by a unique cyber-physical system.
- This project will provide technical solutions to design and control MMRS for the treatment of pulmonary embolisms.
- The effectiveness of this new device is tested via in-vitro experiments.

CFD simulation



MMRS performing a rapid agile maneuver



- Funding is used to increase participation of women and minorities in science and engineering, mentor summer interns, conduct K-12 outreach.

- Funding is used to help STEM high school teachers design curriculum through our ongoing participation in Pumps & Pipes with Houston ISD.