



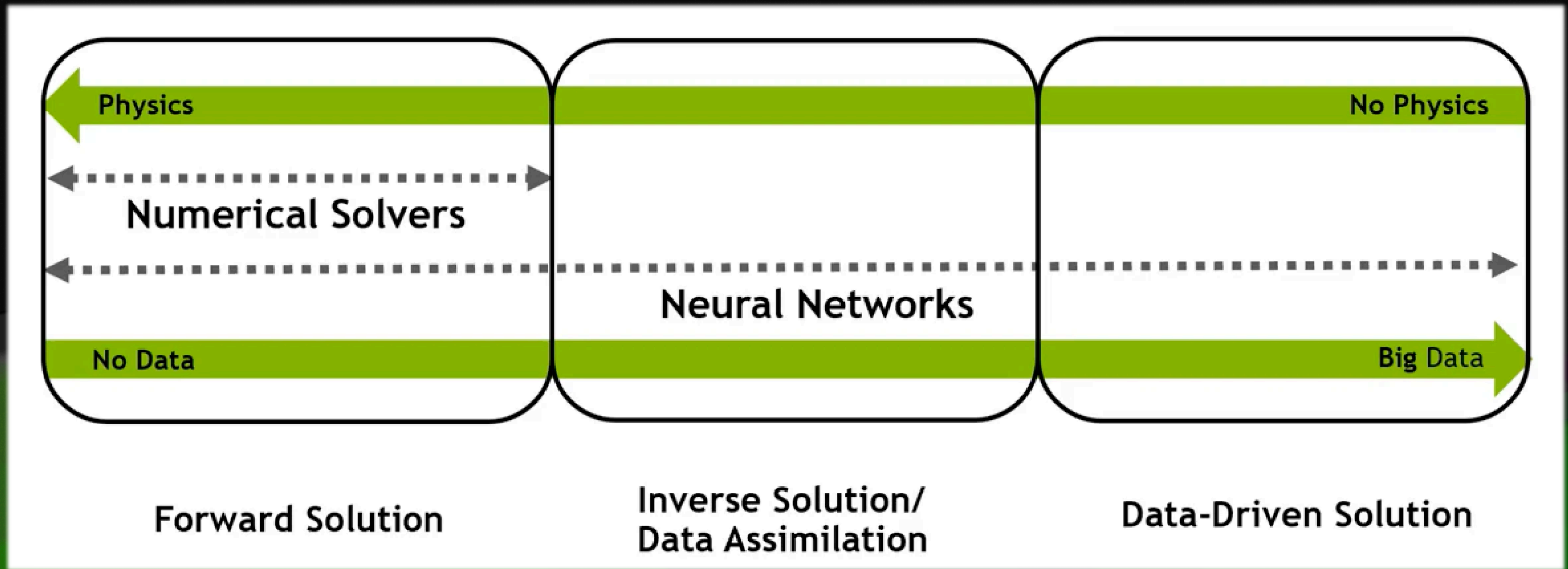
# NVIDIA Modulus

Physics Informed Neural Networks (PINNs)

Jenny Wong | RSG Demos | 11 May 2023

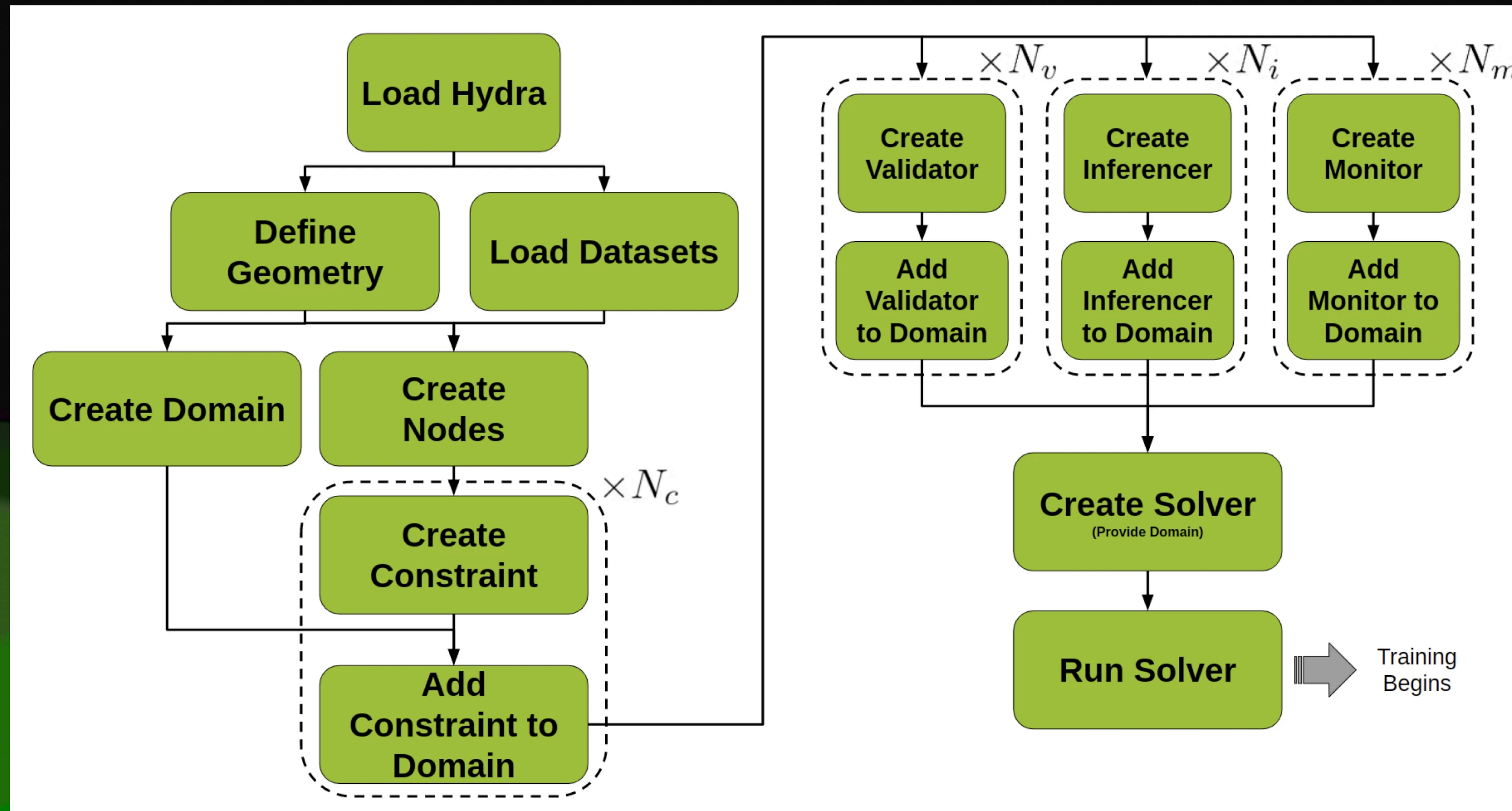
# What is Modulus?

## Physics-informed and Data-driven Deep Learning



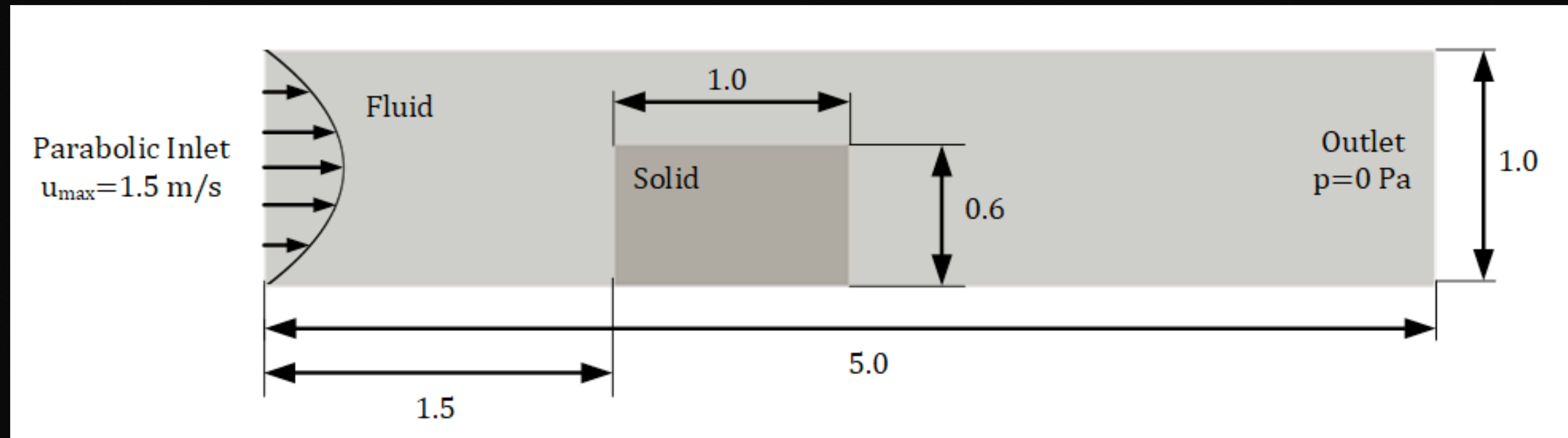
# General Workflow

## User-friendly API



# 2D Flow over a Chip

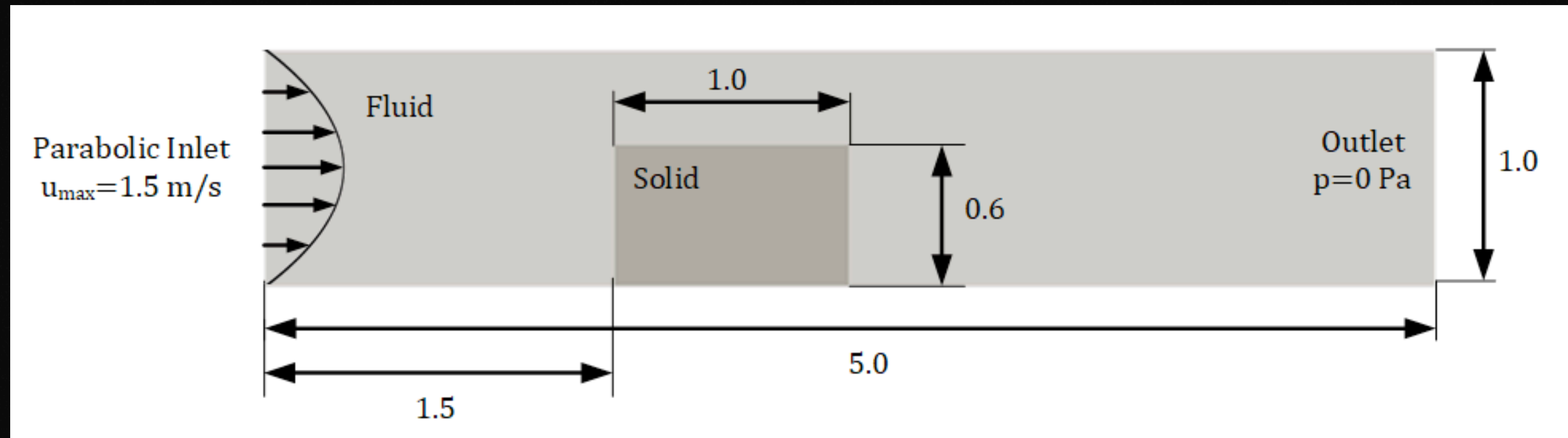
## Setup



- Solid chip, with size  $1.0 \times 0.6$  and position  $(-1.0, -0.5)$ , is placed in a 2D channel (domain  $x \in [-2.5, 5]$ ,  $y \in [-0.5, 0.5]$ )
- Flow enters inlet with speed  $u_{\max} = 1.5 \text{ m/s}$
- Flow exits outlet with pressure  $p = 0 \text{ Pa}$

# 2D Flow over a Chip

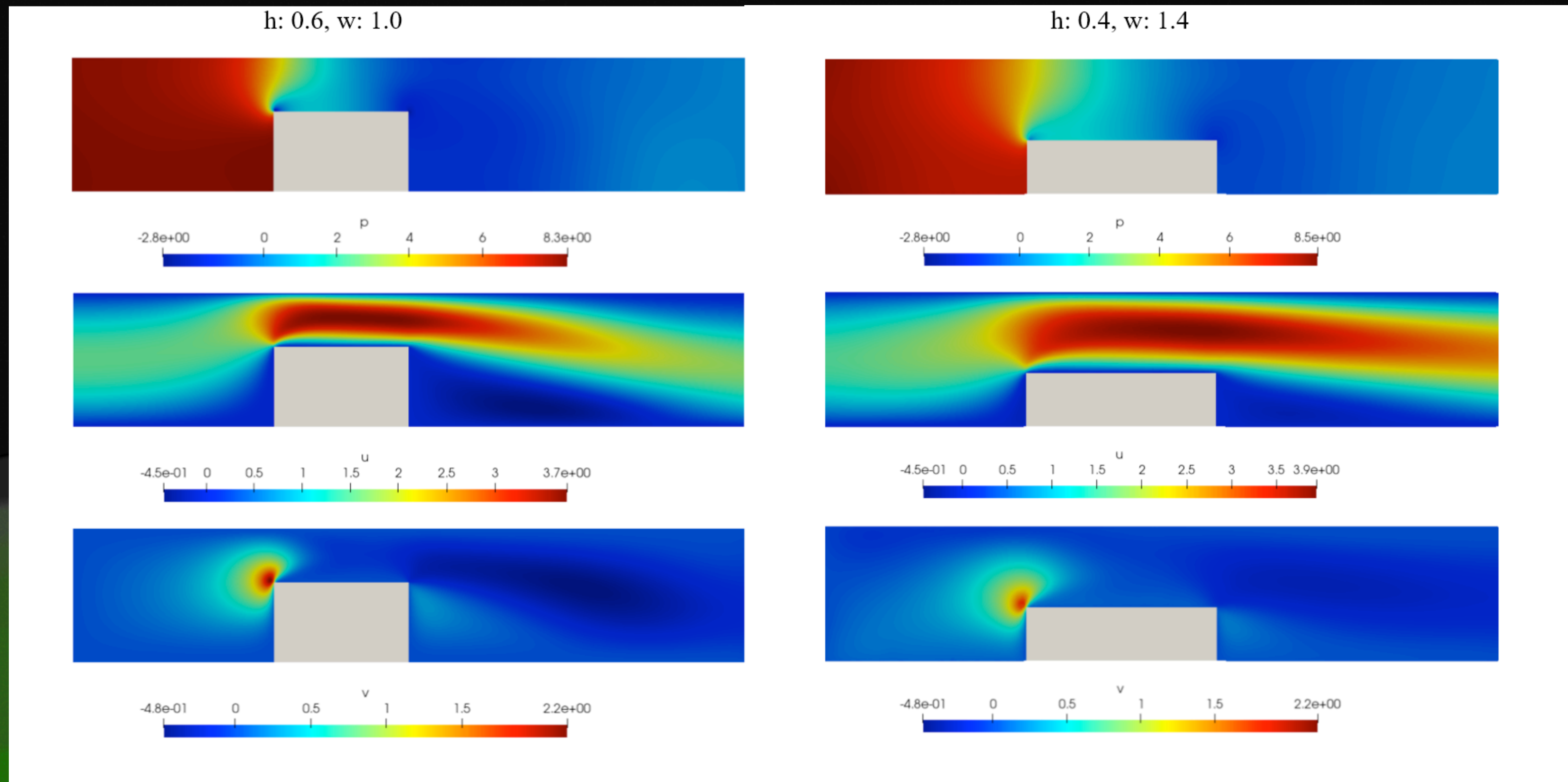
## Setup



- Top and bottom walls are no-slip
- Kinematic viscosity  $\nu = 0.2 \text{ m/s}^2$
- Density  $\rho = 1 \text{ kg/m}^3$

# 2D Flow over a Chip

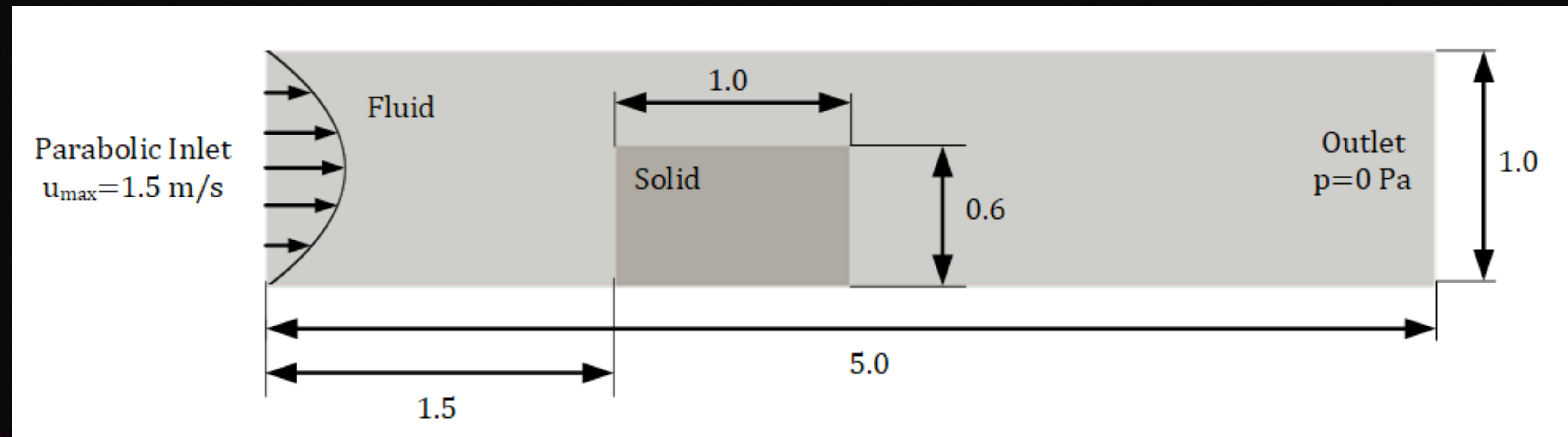
## Solving parameterised geometries



- Parameterise chip dimensions
- Train on OpenFOAM simulations (“ground truth”)
- Infer flow for any geometry combination

# 2D Flow over a Chip

## Inverse Problem



## Objectives

- Assimilate data from OpenFOAM simulations
- Infer the viscosity given the flow field data (original value  $\nu = 0.2 \text{ m/s}^2$ )