PARTICLE-IN-CELL SIMULATIONS

- Particle-in-cell simulations are found in many applications in science and engineering
- Typically a system of equations needs to be solved:

$$\frac{d\boldsymbol{Y}}{dt} = \dot{\boldsymbol{Y}}$$

- Present applications need to solve billions of simultaneous, complex equations, requiring:
  - Scalability
  - Plug-and-play interface to existing code
  - Easy to define complex equations

PPICLF

A Parallel Particle-In-Cell Library in Fortran

- Unified, open-source framework for solving:

$$\frac{d\boldsymbol{Y}}{dt} = \dot{\boldsymbol{Y}}$$

- Proven scalability to 10^9 equations on 10^5 processors
- Plug-and-play interface to existing element-based particle-in-cell applications in Fortran and C++:
  - Cell-particle interactions
  - Particle-particle interactions
- Easily define complex equations:
  - User specified names and ordering of equations $\boldsymbol{Y}$
  - User specified forcing $\dot{\boldsymbol{Y}}$

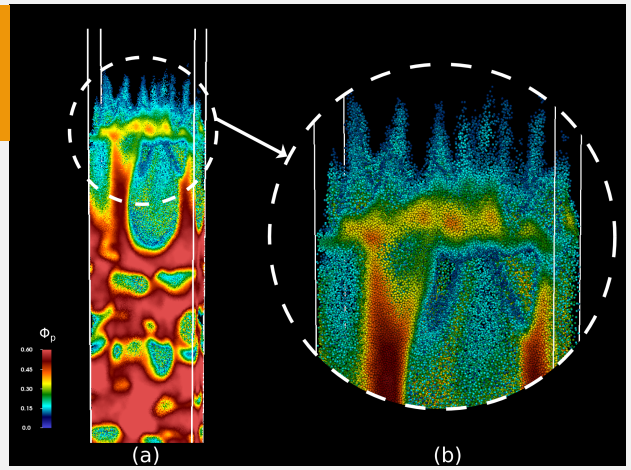
PPICLF

A Parallel Particle-In-Cell Library in Fortran

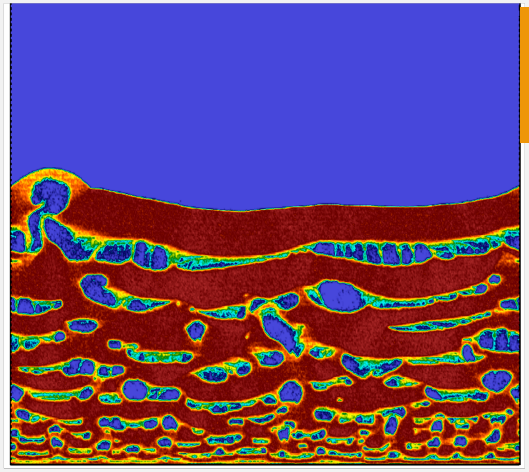
- Download: https://dpzwick.github.io/ppiclF-doc/
  - Documentation
  - Theory
  - Tutorials
  - Question Forum
- Applications:

Compressible Multiphase Flow

Multiphase Shock Tube (CMT-nek)



Incompressible Multiphase Flow



Fluidized Bed (Nek5000)

Other Possibilities: What will you simulate?