

# Kuipers Training Problem Part 1: Presentation

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CPFD Software  
1255 Enclave Parkway, Suite E  
Houston, TX 77077 USA  
+1 (713) 429-1252  
[www.cdfd-software.com](http://www.cdfd-software.com)

# Training Goals and Objectives

This training example is designed to provide a quick introduction to the overall problem set-up process and explanations are minimal. The purpose is to give the user an overall feel for the process and tools involved.

The training problem is based on a “2D” fluidized bed experiment reported by Kuipers, et. al (1992). We will simulate the experiment and observe the results.

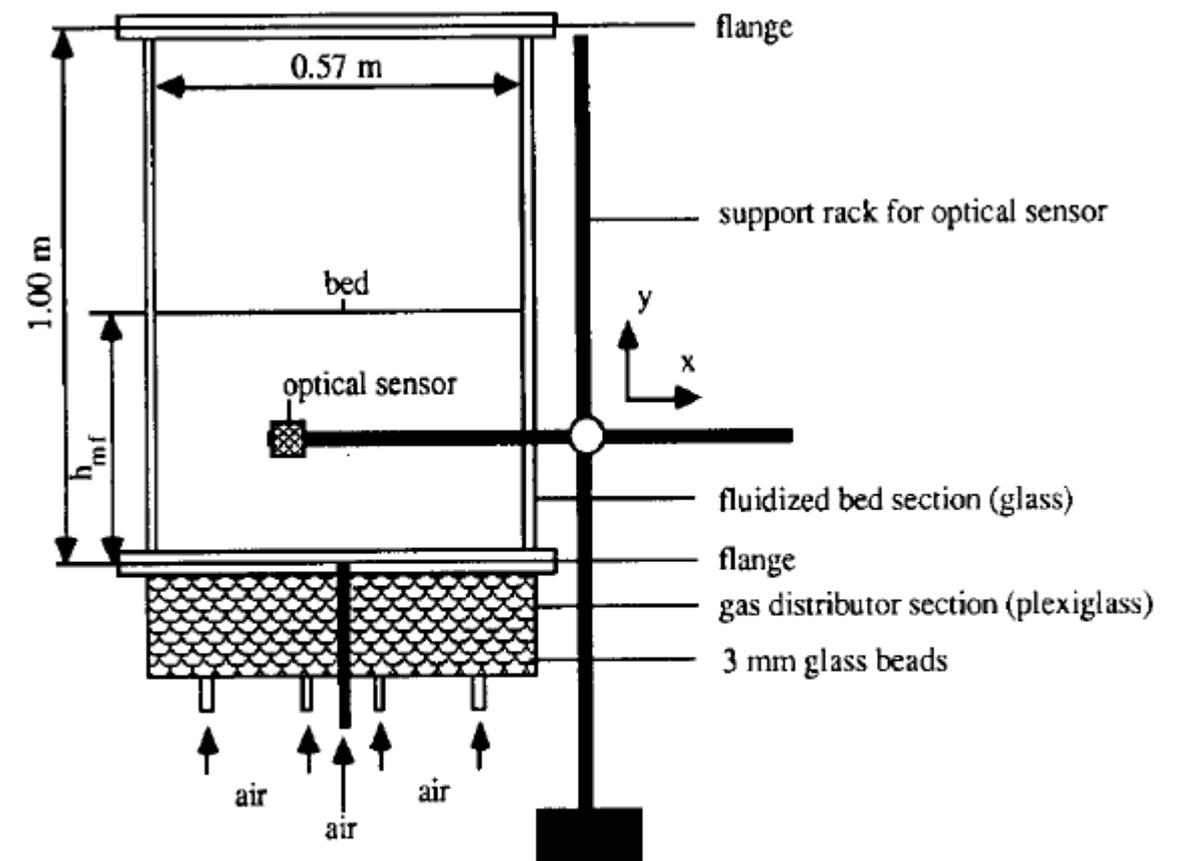
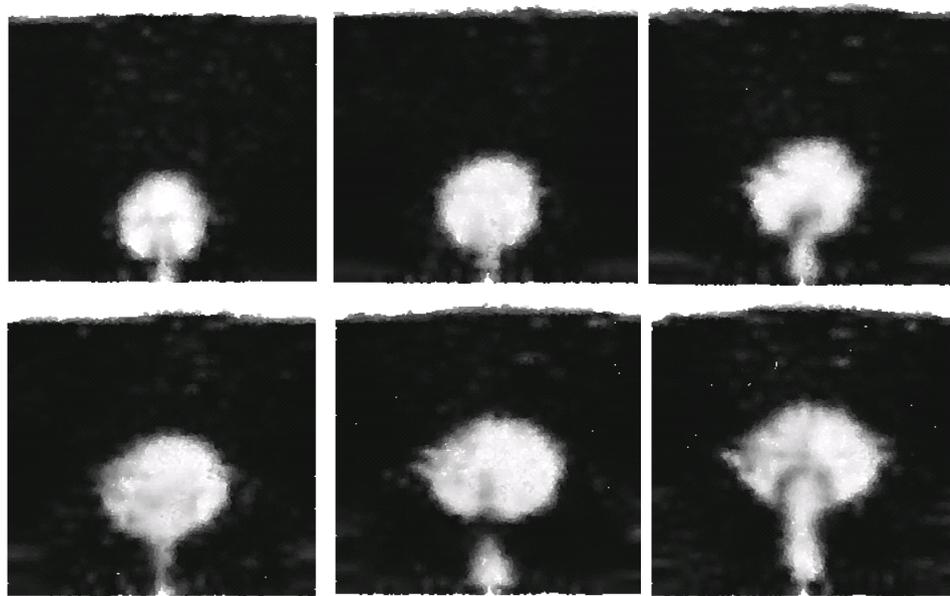


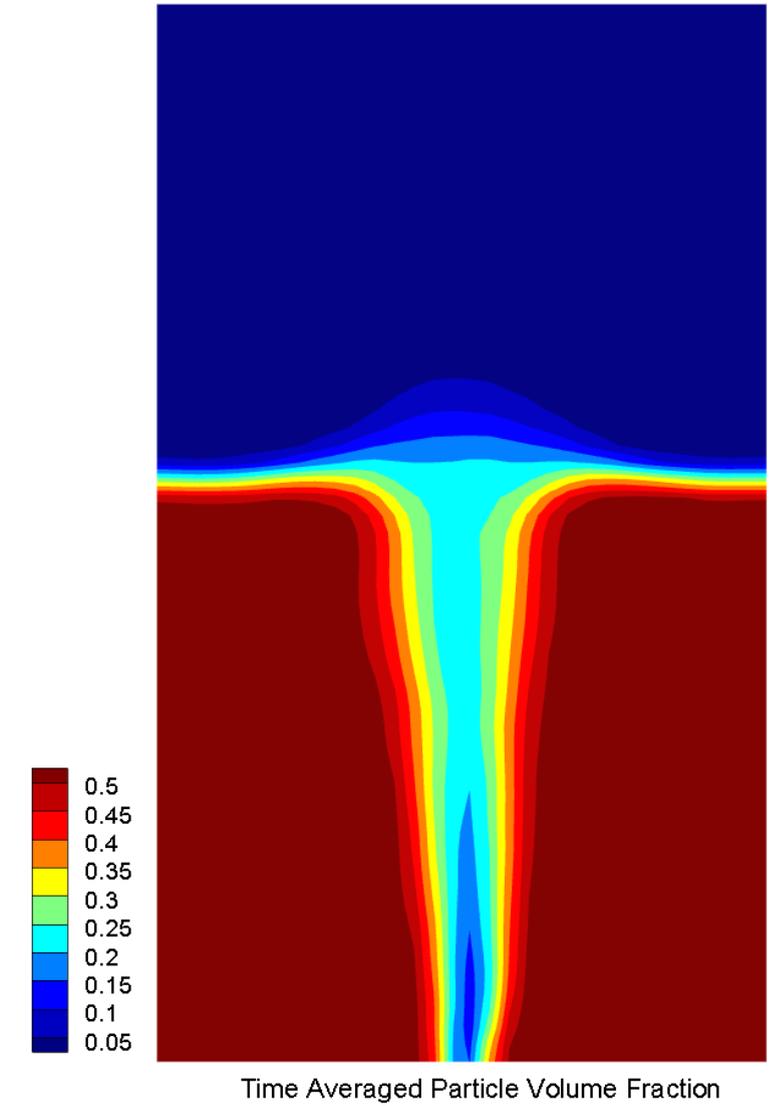
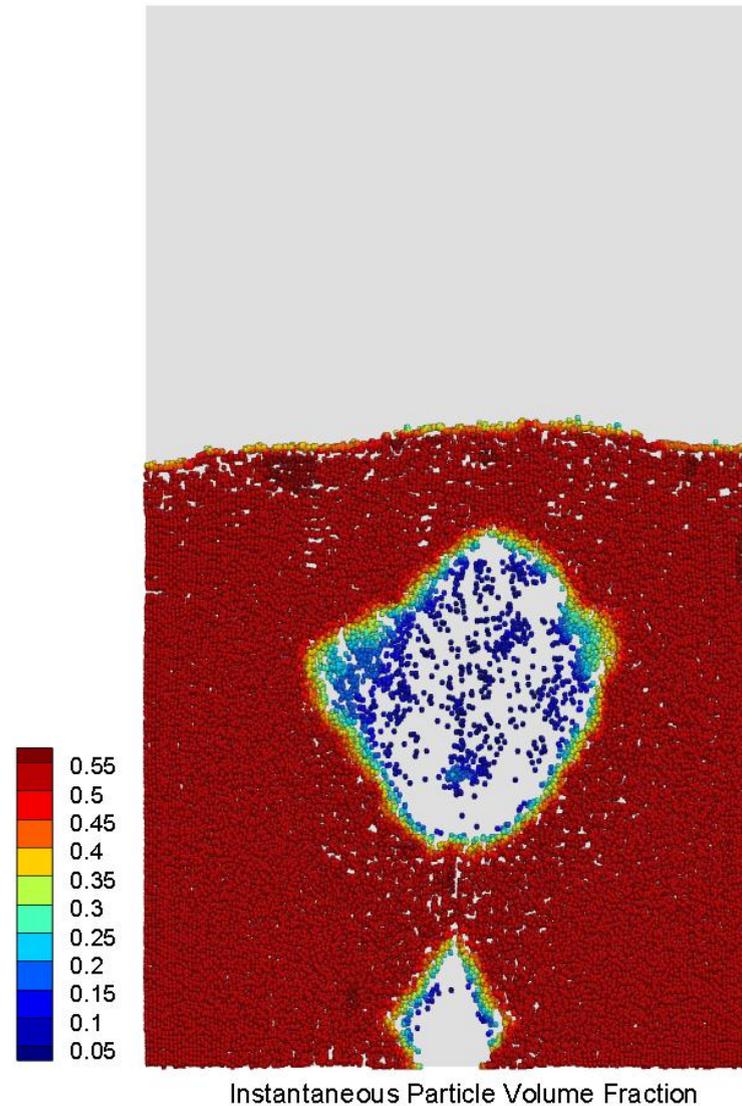
Fig. 1. Schematic representation of the experimental set-up used for the porosity measurements.

Kuipers, J, Tammes, Prins, and Swaaij (1992). Powder Technology 71: 87-99

# Results: Experimental vs. Simulation



Kuipers, J, Tammes, Prins, and Swaaij (1992). Powder Technology 71: 87-99



# Training Goals and Objectives

## The following objectives will be covered:

- Setup
  - Launch Barracuda
  - Open project file with pre-setup grid
  - Set up calculation with the information provided
- Run Solver
  - Run Solver Setup (1 time step)
  - Interact with solver to change time-step
- Post processing
  - Overview of Tecplot shortcut buttons
  - Tecplot Basic interactions
  - Setting data limits
  - Creating and viewing images
  - Creating and viewing animations
- Using layout files
- Plotting xy data in Tecplot
- Building vectors (arrow plot)
- Creating isovolume views
- Make observations regarding:
  - Fluidization behavior
  - Particle Volume Fraction
  - Particle mixing in time
  - Velocity data
    - Fluid
    - Particle

# Process Sheet

## Geometry

- 0.57m x 1.0m x 1.5cm
- 50 cm initial bed height
- 1.5cm x 1.5cm jet centered at bottom

## Particles

- Material density 2.66 g/cm<sup>3</sup> (glass beads)
- Diameter: 440μm - 560μm. This is 500 μm ±12%
- Use two identical particle species to view mixing behavior

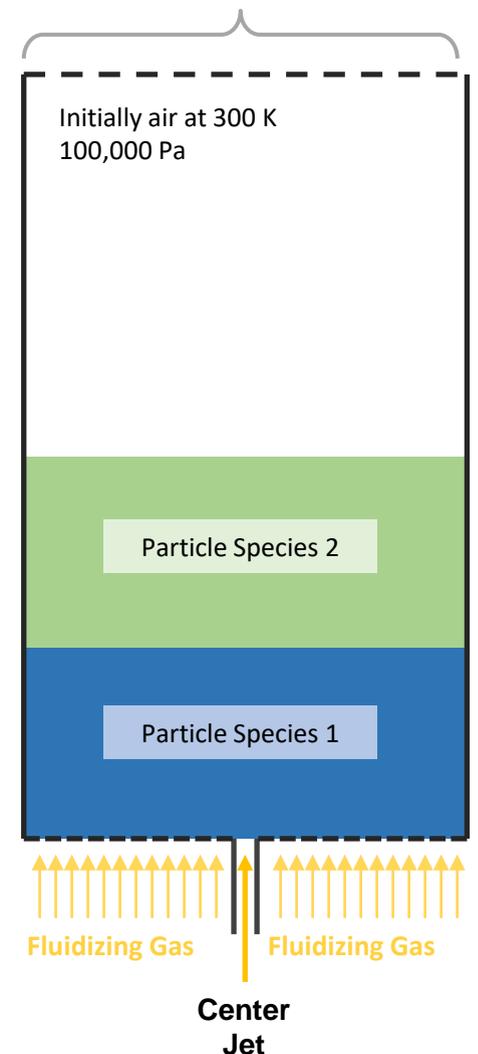
## Initial conditions

- Fluid phase: air at atmospheric pressure
- Solid phase: particles in bottom ½ of bed at close-pack ( $\theta_{cp} = 0.55$ )

## Boundary conditions

- Fluid
  - Grid velocity: 0.25 m/s
  - Center jet velocity: 10 m/s
  - Top open to atmosphere
- Particles
  - Cannot enter or leave

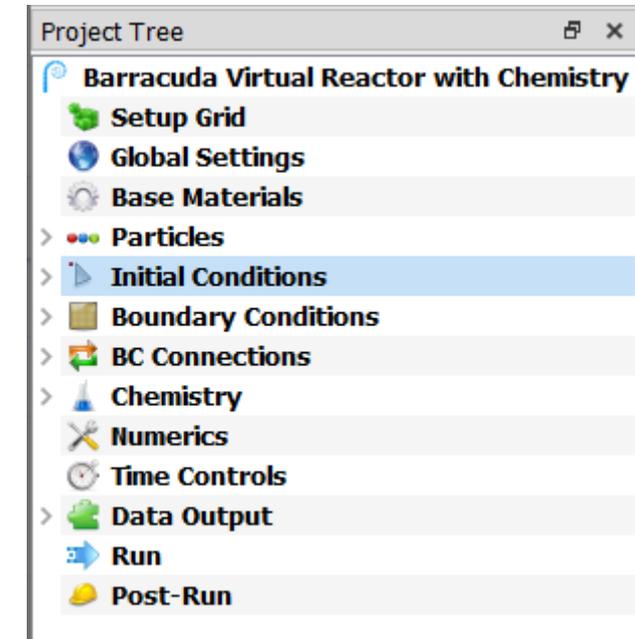
Pressure at outlet: 100,000 Pa



# Setting up the Kuipers Bed Simulation

The Barracuda GUI Project Tree allows for convenient setup of the Kuipers bed simulation:

1. Setup Grid – Create the computational grid from a CAD file of the physical geometry
2. Global Settings – Set gravity and select isothermal calculations
3. Base Materials - Add materials to simulation and edit physical properties
4. Particles - Specify materials and particle size distributions for the particles in the model
5. Initial Conditions - Specify initial fluid and particle conditions. Specify initial particle locations
6. Boundary condition - Specify fluid velocities and pressures at model boundaries
7. Time Controls - Specify simulation time, time step and restart interval
8. Data Output - Select data to be written during simulation for later analysis
9. Run - Check the model setup and run the simulation



# How to get more information

This presentation has a limited amount of information about Barracuda and the GUI.

If you want to learn more, click on the Help button in the relevant dialog. This brings up the corresponding section of the User Manual.

