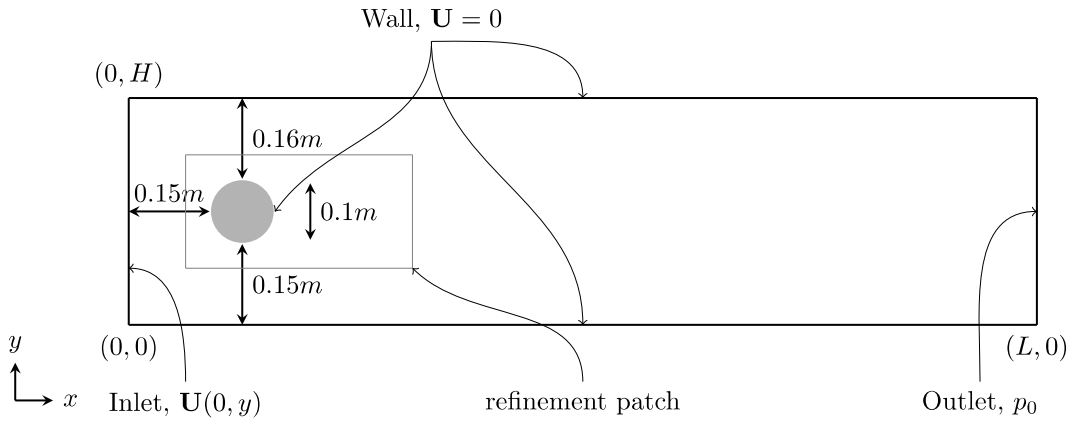
Exercise: LBM Simulation with Musubi

Outline

- Generate a mesh with Seeder
  - Definition of the geometrical layout
  - Running Seeder
- Run a simulation with Musubi
  - Have a look at the solver configuration
  - Submit computation jobs
- Evaluate results

Problem setup

- Flow in a channel around a cylinder (2D simulation)



- The channel has an inlet on the left (west) and an outlet boundary on the right (east) in the other directions there are wall boundaries.
- Away from the inlet we place a cylinder

Exercise files

- The files for this exercise can be found in **`$KURS/exercises/hpcfdx6/musubi`**
- If you have copied the hpcfdx6 directory already, you find the musubi directory within that
- Otherwise: copy this directory into your workspace:
  - `cp -r $KURS/exercises/hpcfdx6/musubi $MYWS/lbm_channel`
- Then change to that directory and work there:
  - `cd $MYWS/lbm_channel`

Generating a mesh

- Look into the seeder.lua configuration file and change it according to your liking

- Note specifically:
  - **`nHeight`** parameter to prescribe the number of elements in the height of the channel
  - **`refinePatch`** to activate the predefined refinement patch
  - **`refinelevel`** to define how resolution in the refinement around the cylinder should be
  - **`qVal`** to compute the distances for LBM boundaries
  - **`cylLevel`** to define the refinement level of the cylinder

- Use **`seed.job`** to submit a job that generates the mesh with the given configuration
  - The job also produces a visualization of the mesh in the *`harvest`* subdirectory

  (you can copy this to your local computer and look at it with: `scp -r $MYWS/lbm_channel/harvest`)

Run the LBM simulation with Musubi

- Check the solver configuration in **`musubi.lua`**
- Note specifically the Re number setting and the boundary condition definition with their reference to the definition in the generated mesh
- Run the simulation (after mesh was generated beforehand) by submitting the **`run.job`**
- The simulation produces visualization files in the subdirectory vtkfiles
- Copy those files to your local computer once the simulation succeeded:
  - `scp -r training:$MYWS/lbm_channel/vtkfiles .`
- Look at the results using Paraview

Tracking evaluation with Gleaner

- Some data is extracted using tracking objects, which allows the investigation of specific features in the flow
- These can be evaluated with the python script plot_track.py:
  - `module load python3/3.9`
  - python3 plot_track.py
- Produces three PNG files
  - PressureDrop_overTime.png
  - VelX_overTime.png
  - VelY_overTime.png