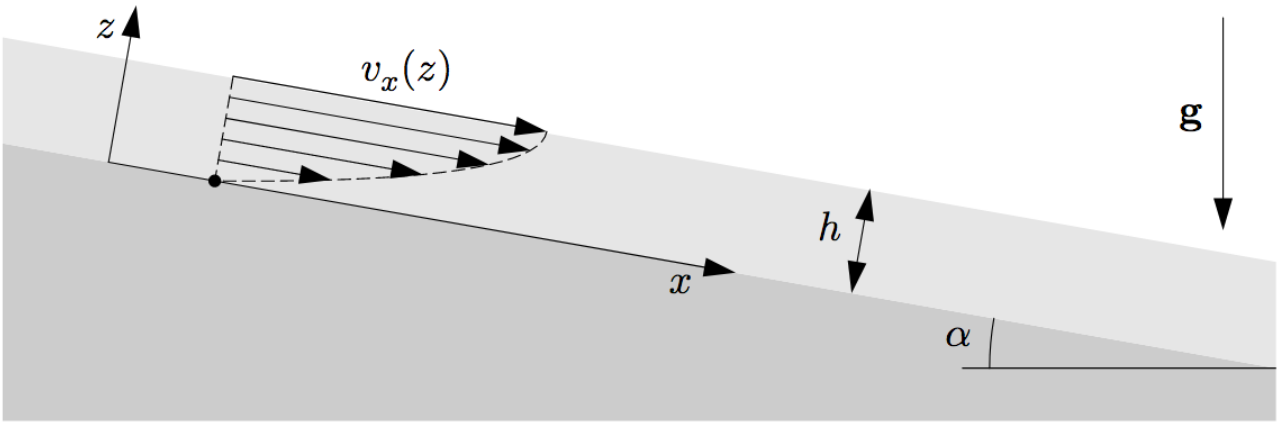
Tutorial 4

Please hand in your solution before the tutorial on 25.5.2021.

Question 1



- Derive the Navier Stokes Solution to the steady flow of a film of liquid of uniform thickness h that flows done an incline (dark gray) under an angle α. Use the fact that there is no pressure gradient driving the flow (why?). Also set the x-axis parallel to the incline and choose a suitable body force.
- Let the liquid be water and calculate the speed $v_x(h)$ of the free surface of the film in the case $h = 100\,\mu$m und angle $\alpha = 30°$.

Question 2

- Generate a fine spray, e.g. by spray bottle, in front of a dark background and illuminate the mist of droplets from the side with a lamp. Record the droplets that scatter this light with a camerea/handphonse and measure their sink velocity. Determine the size of the droplets using Stokes settling velocity.

Question 3

- Aerosols are fine droplets in the air that may contain viral load. In the current pandemic researcher are trying to understand the transport of these droplets. In a quiestence room with no drift (net flow) of the air, droplets may fall by gravity. Calculate and plot the fall time of an aequous droplet from 100 nm to $10\,\mu$m spherical droplet in air for a distance of 30 cm. Check and compare your findings with a recent paper

(https://www.pnas.org/content/early/2020/05/12/2006874117). Comment critically this paper.