Vannstrøm gjennom not og merd

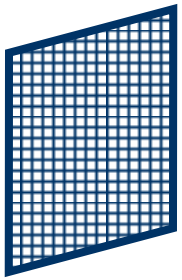
Flow through nets and cages

Merdmiljøkonferanse
Clarion airport hotell Flesland
04 November 2010

Pascal KLEBERT
Sintef Fiskeri og Havbruk

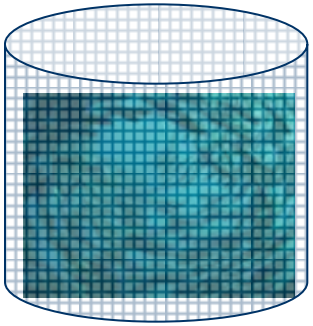
Research

1) Flow field : Velocity reduction through a net panel

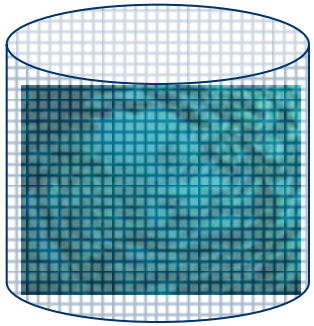


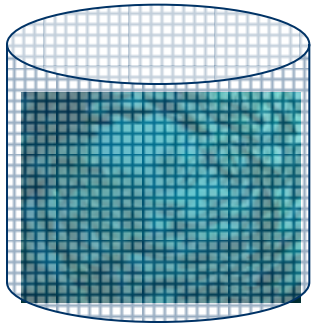
Parameters :
Solidity
Velocity

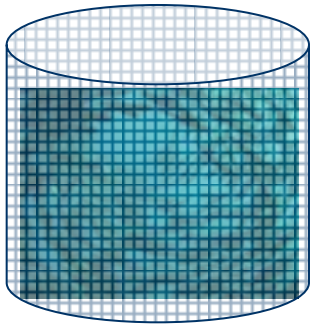
2) Flow field around and through a cage



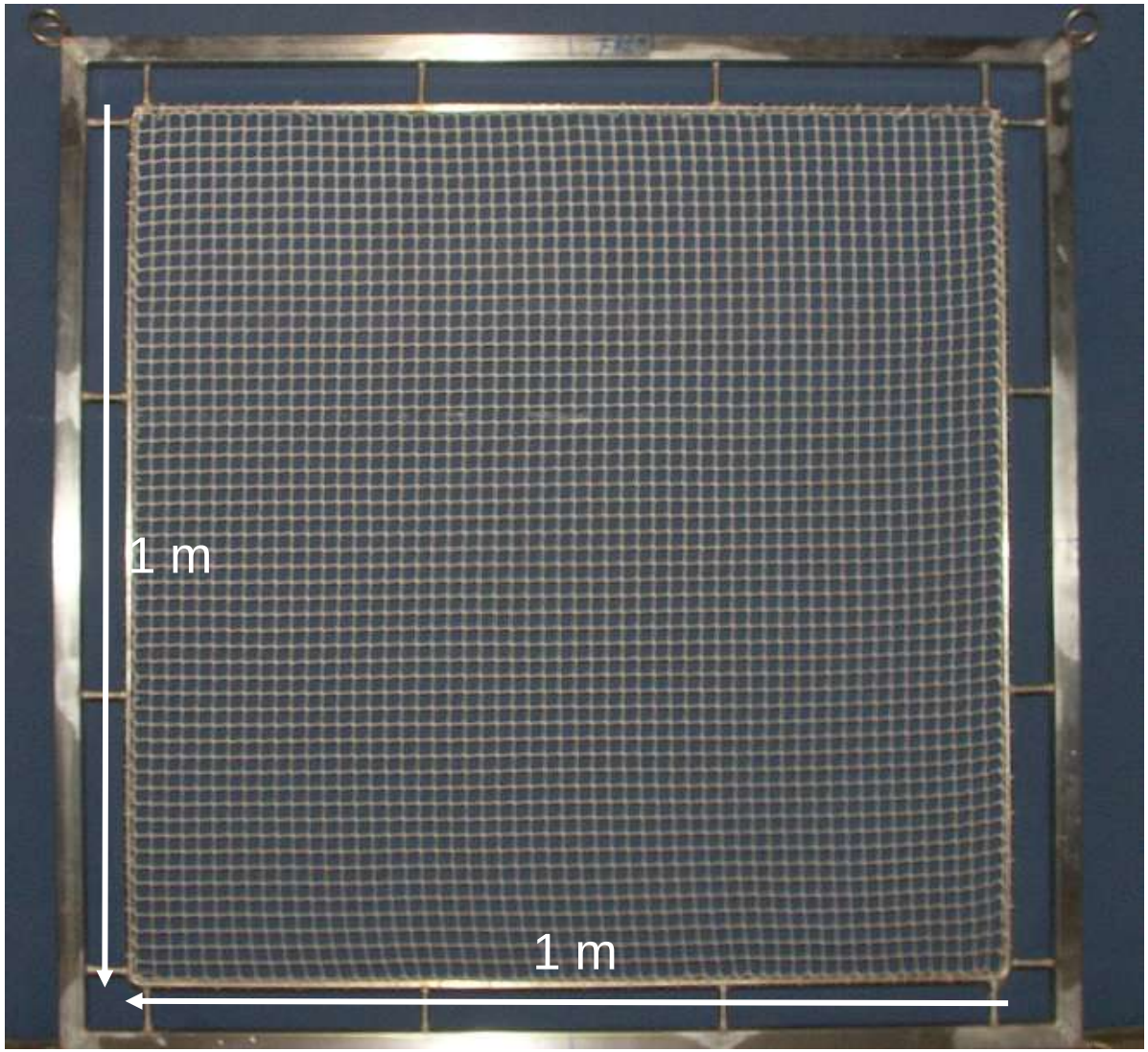
3) Flow field around and through a cages system



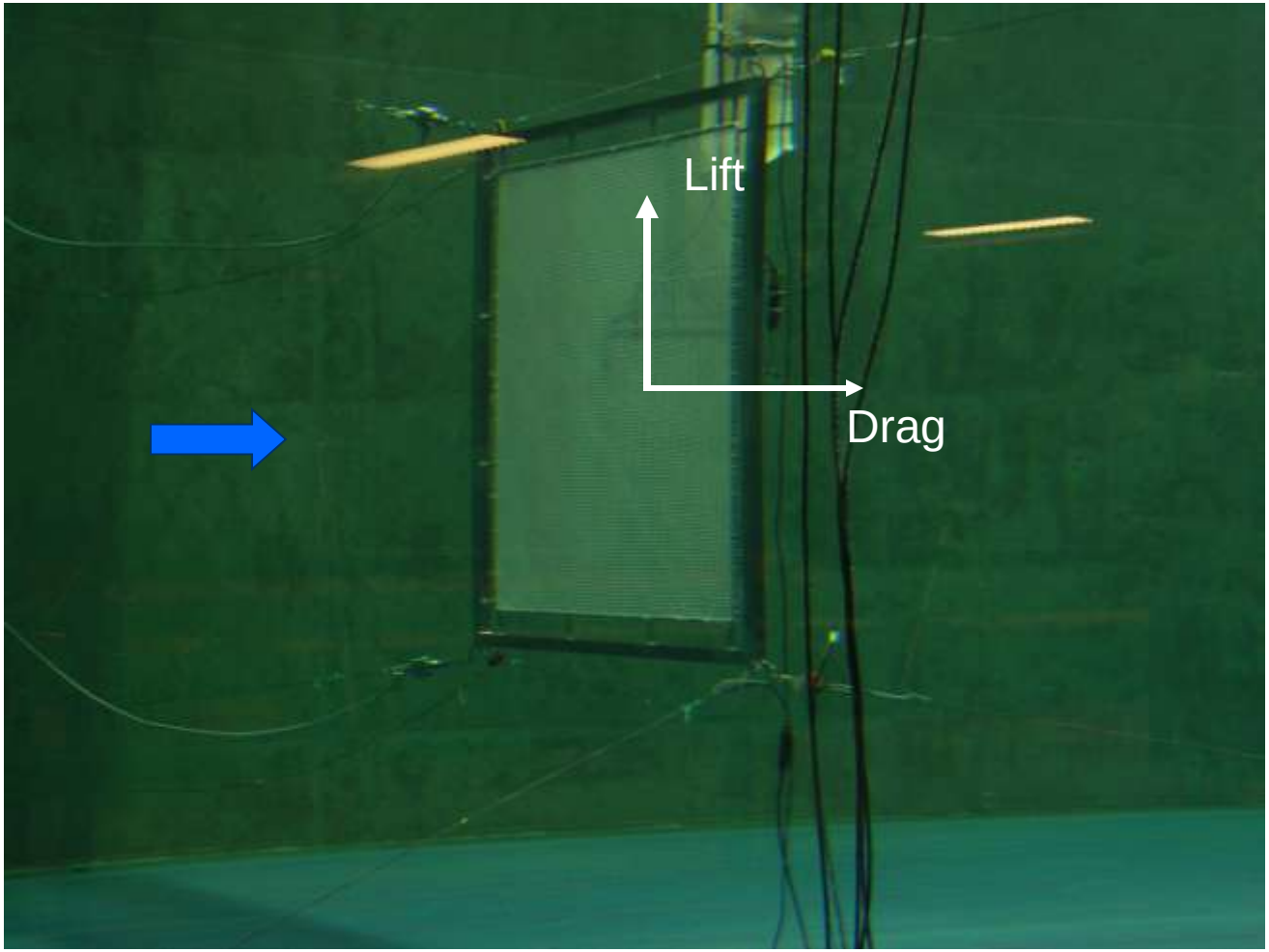




1) Flow field : Velocity reduction through a net panel - experiments



1) Flow field : Velocity reduction through a net panel - experiments



1) Flow field : Velocity reduction through a net panel

Experiments → Simulation

$$\Delta p = -\left(\frac{\mu}{\alpha}v + C_2\frac{1}{2}\rho v^2\right)\Delta m \longrightarrow \Delta P = a \cdot v^2 + b \cdot v$$

$$a = \frac{1}{2}\rho C_2 \Delta m \quad , \quad b = \frac{\mu \Delta m}{\alpha}$$

μ : fluid viscosity

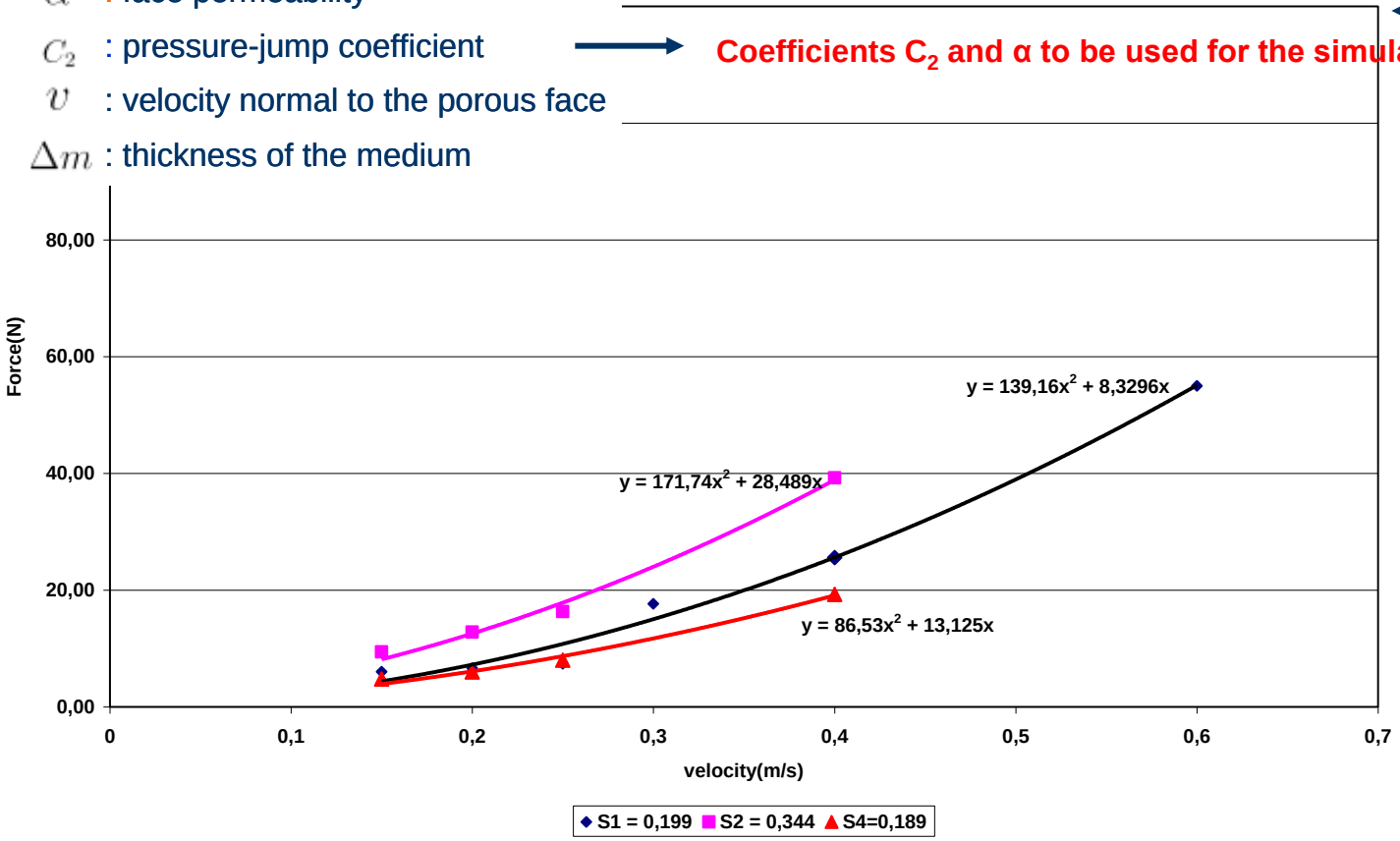
α : face permeability

C_2 : pressure-jump coefficient

v : velocity normal to the porous face

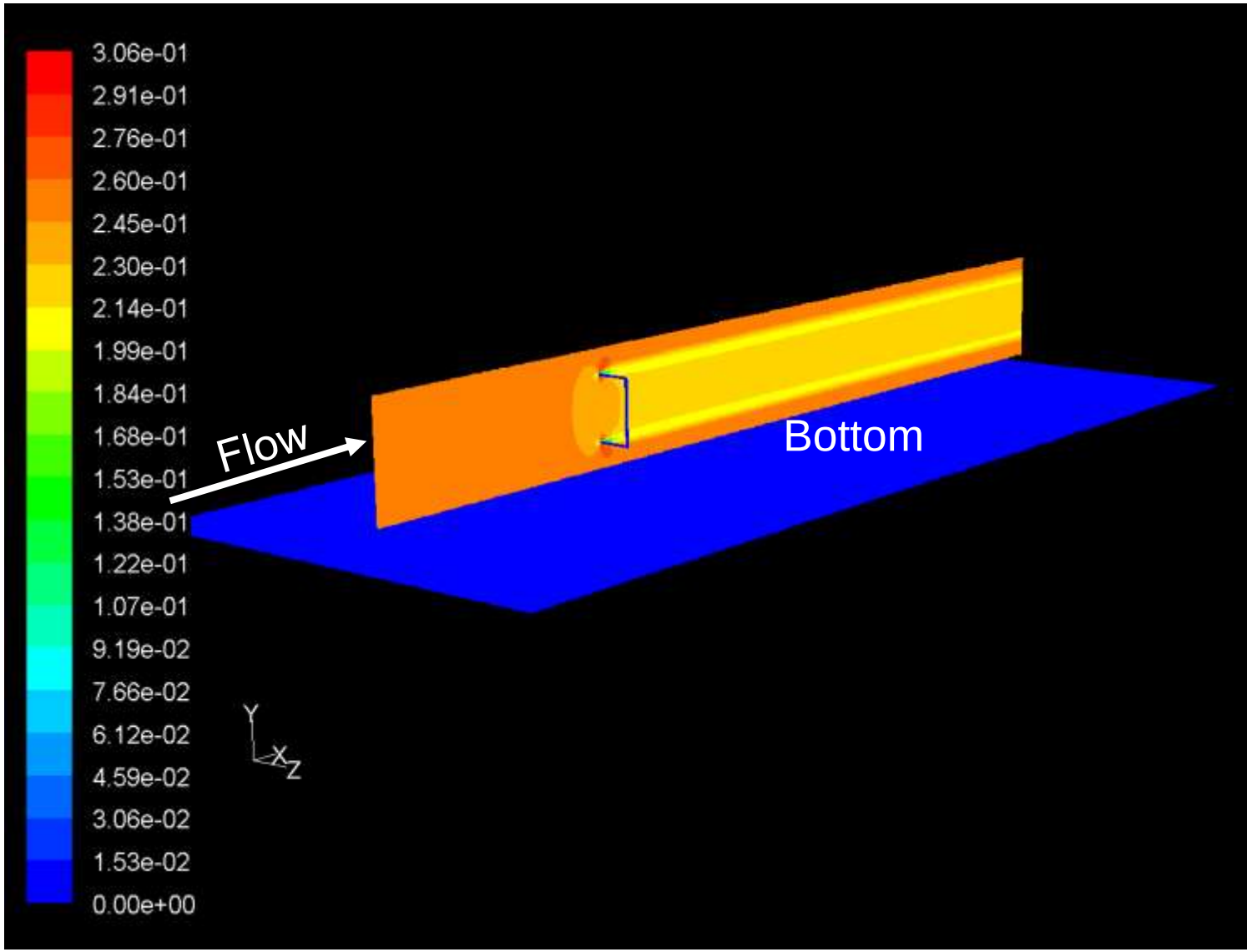
Δm : thickness of the medium

Coefficients C_2 and α to be used for the simulation

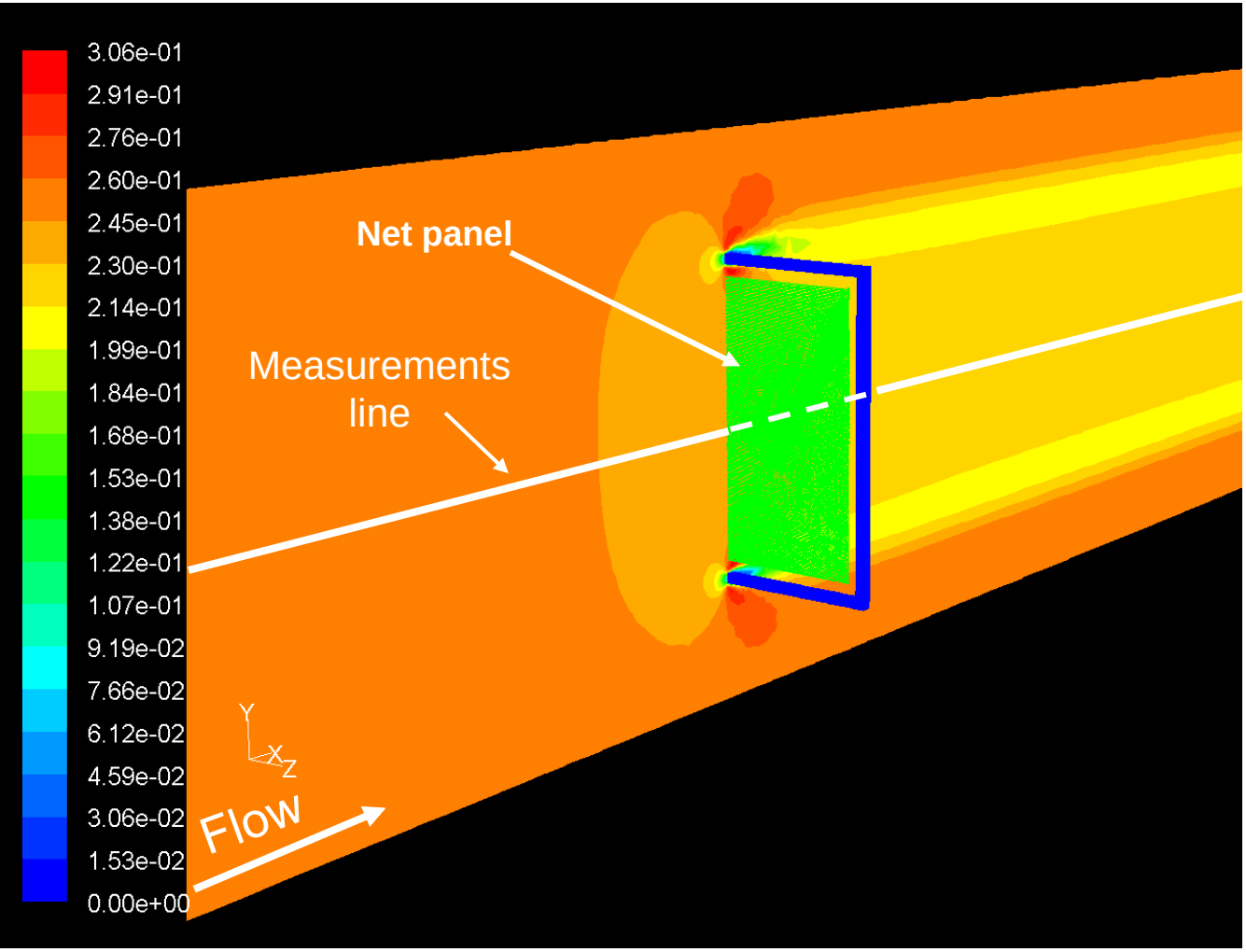


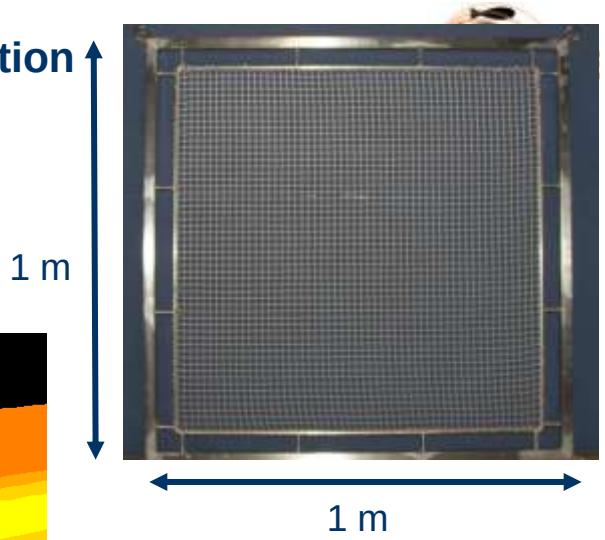
1) Flow field : Velocity reduction through a net panel - simulation

Simulation

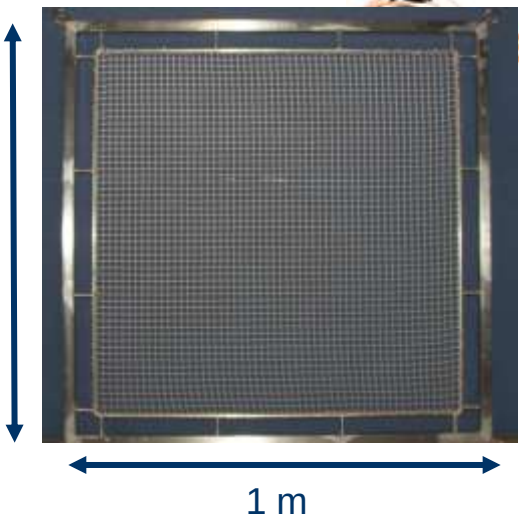


1) Flow field : Velocity reduction through a net panel - Simulation

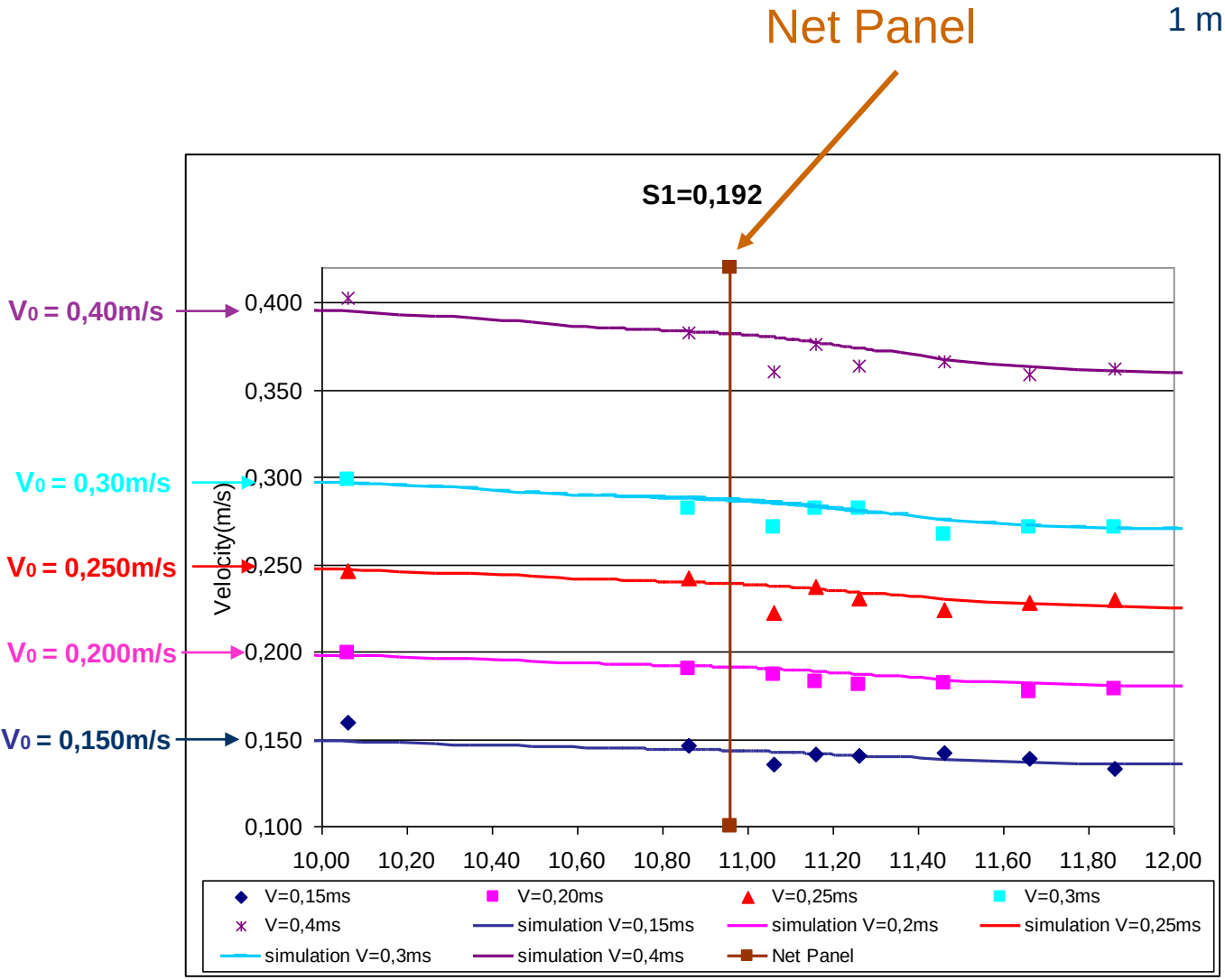




1) Flow field : Velocity reduction through a net panel

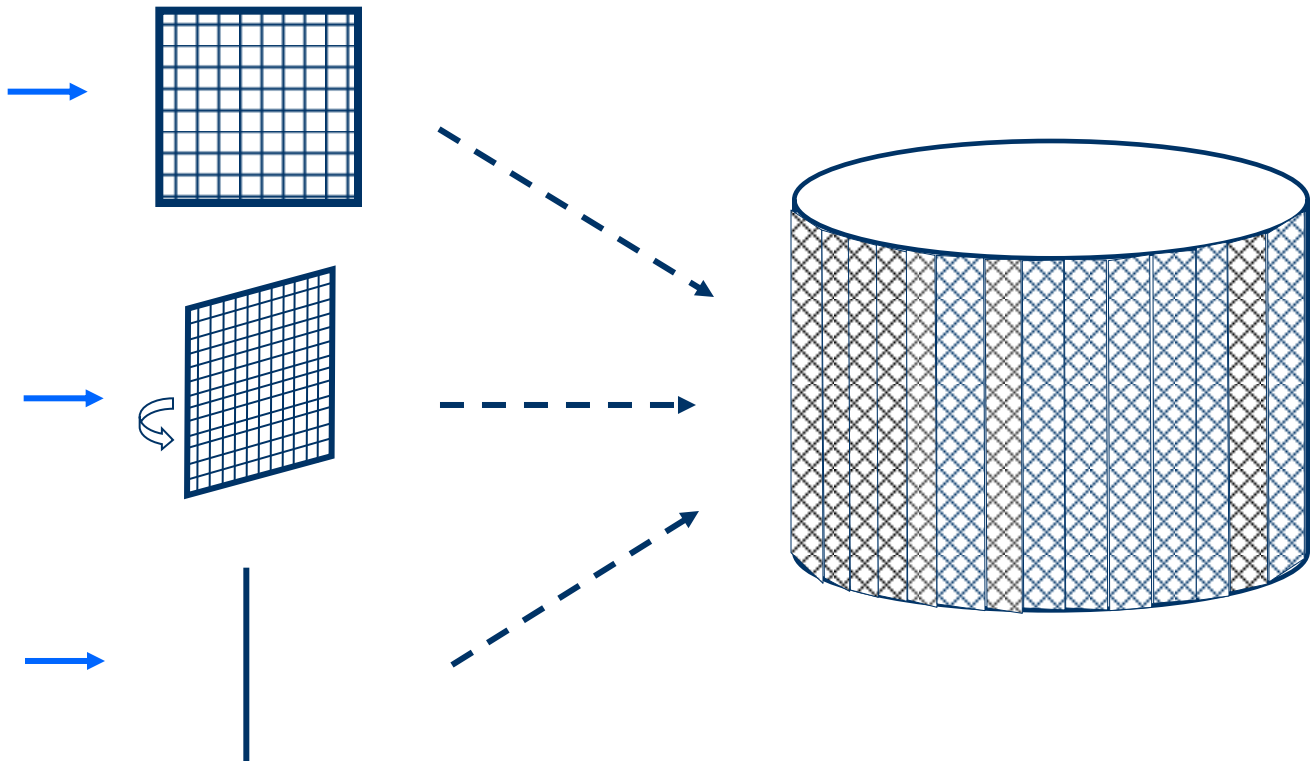


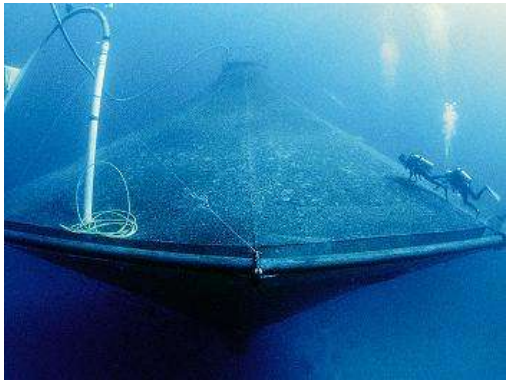
Comparison Experiments & Simulation

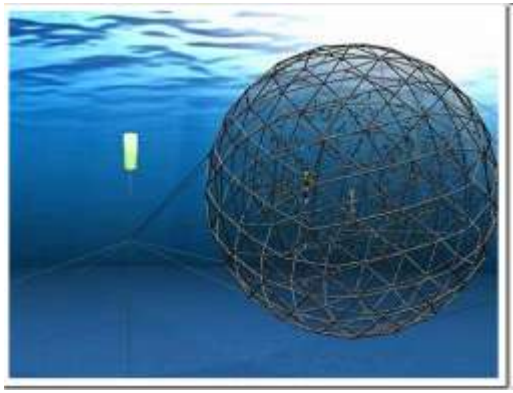


1) Flow field : Velocity reduction through a net panel–simulation/experiments

Experiments with net panels → Simulation of a cage

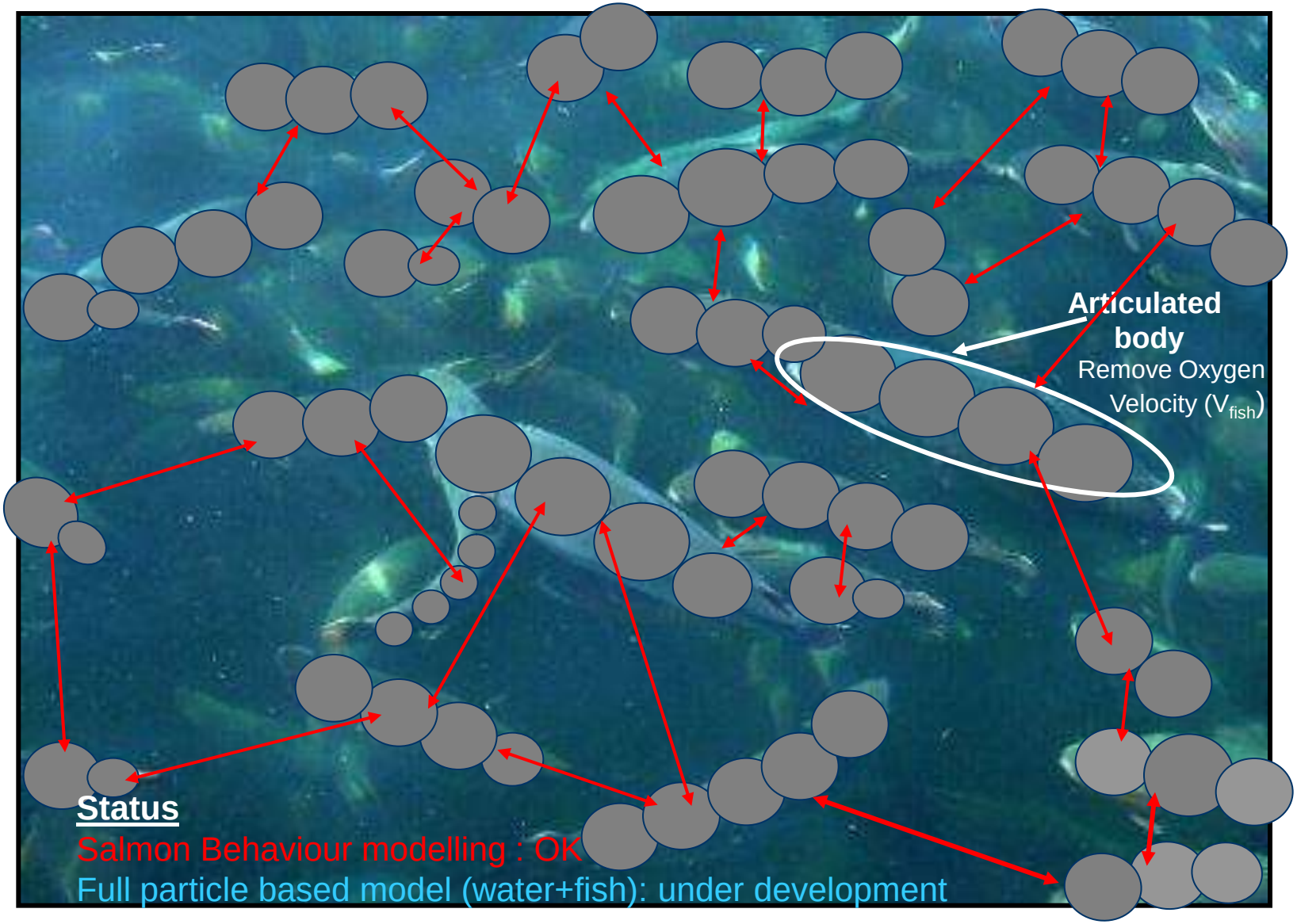






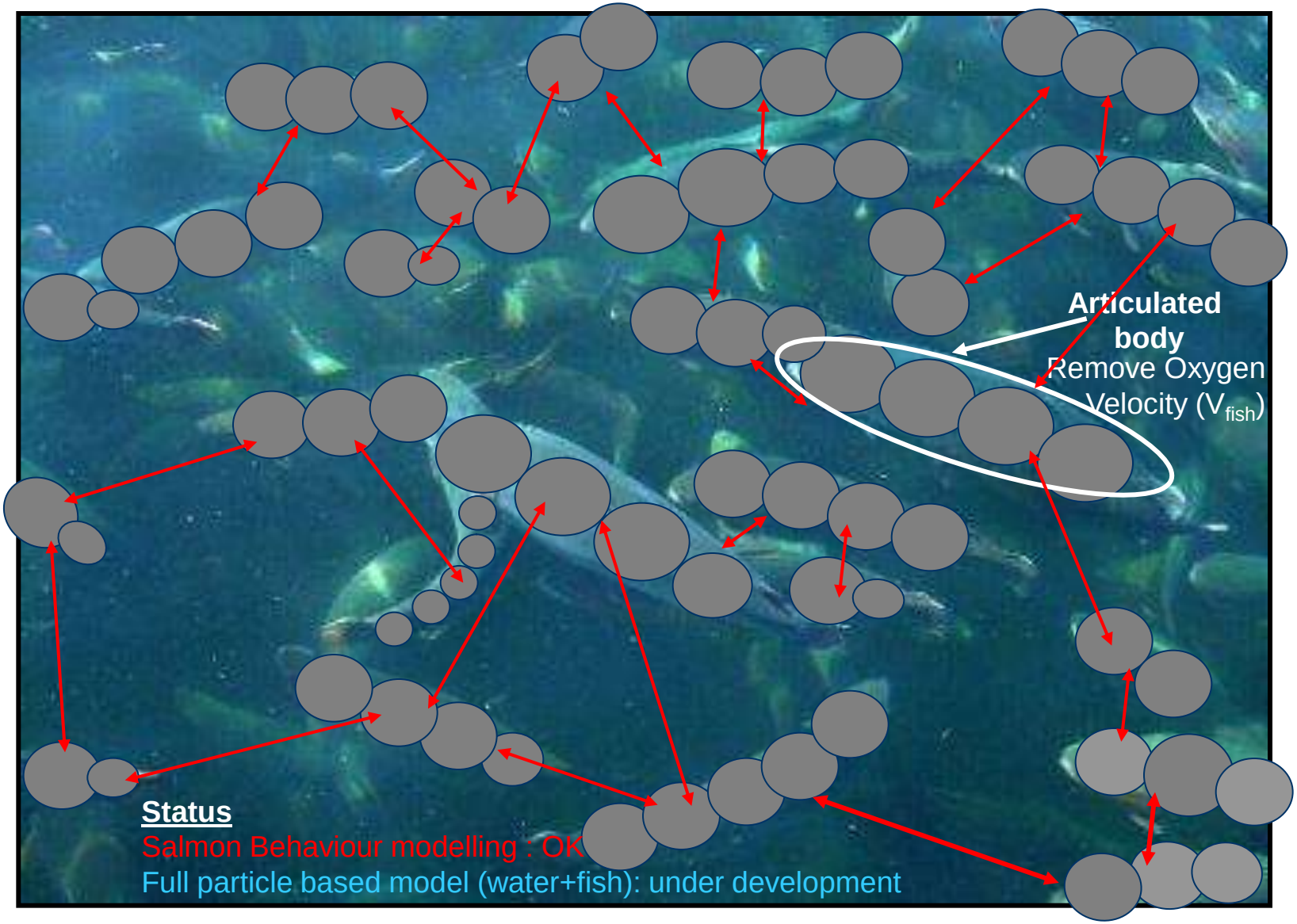
2) Flow field around and through the cage : How to model a school of fish ?

Particles based method



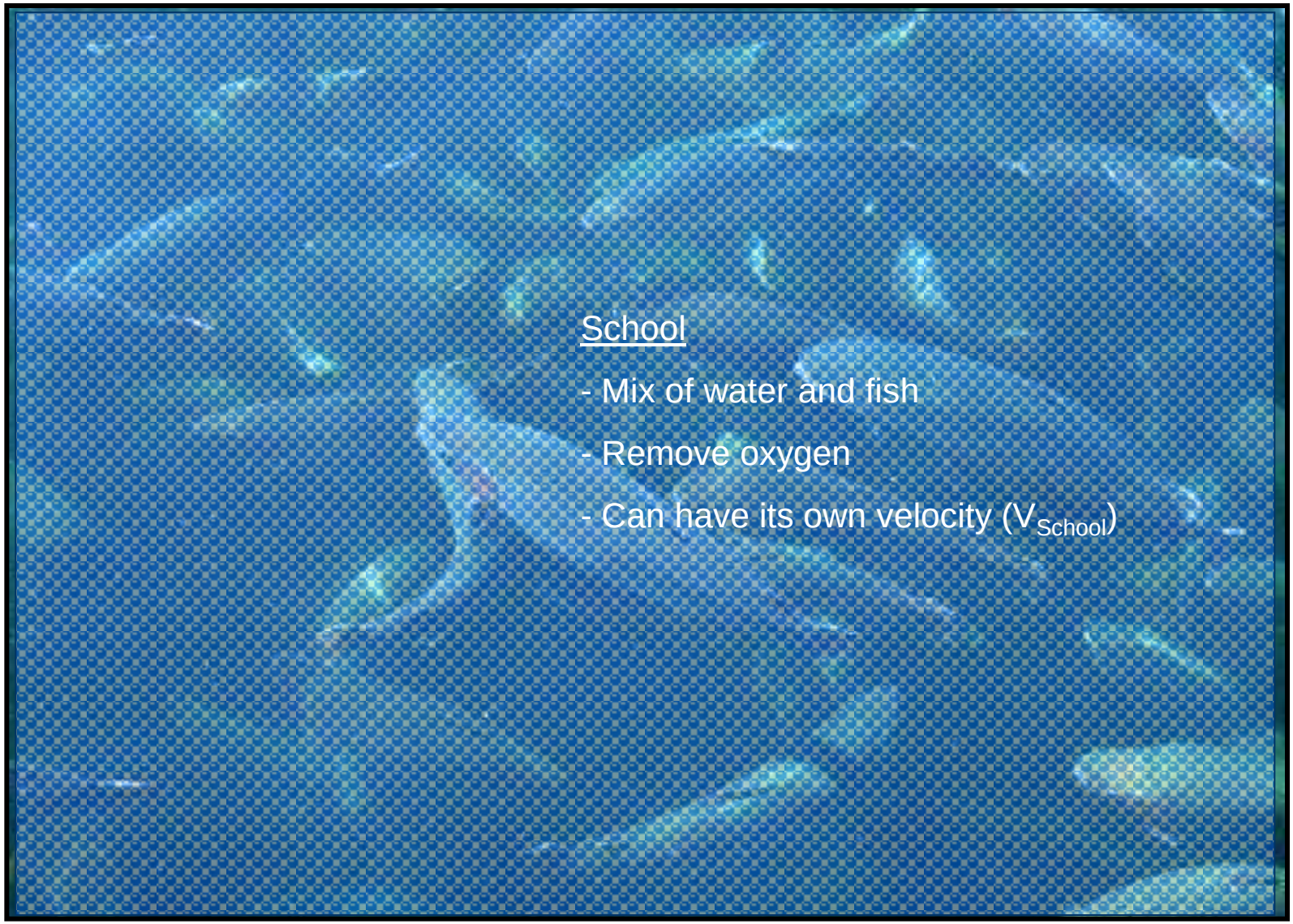
2) Flow field around and through the cage : How to model a school of fish

Particles based method



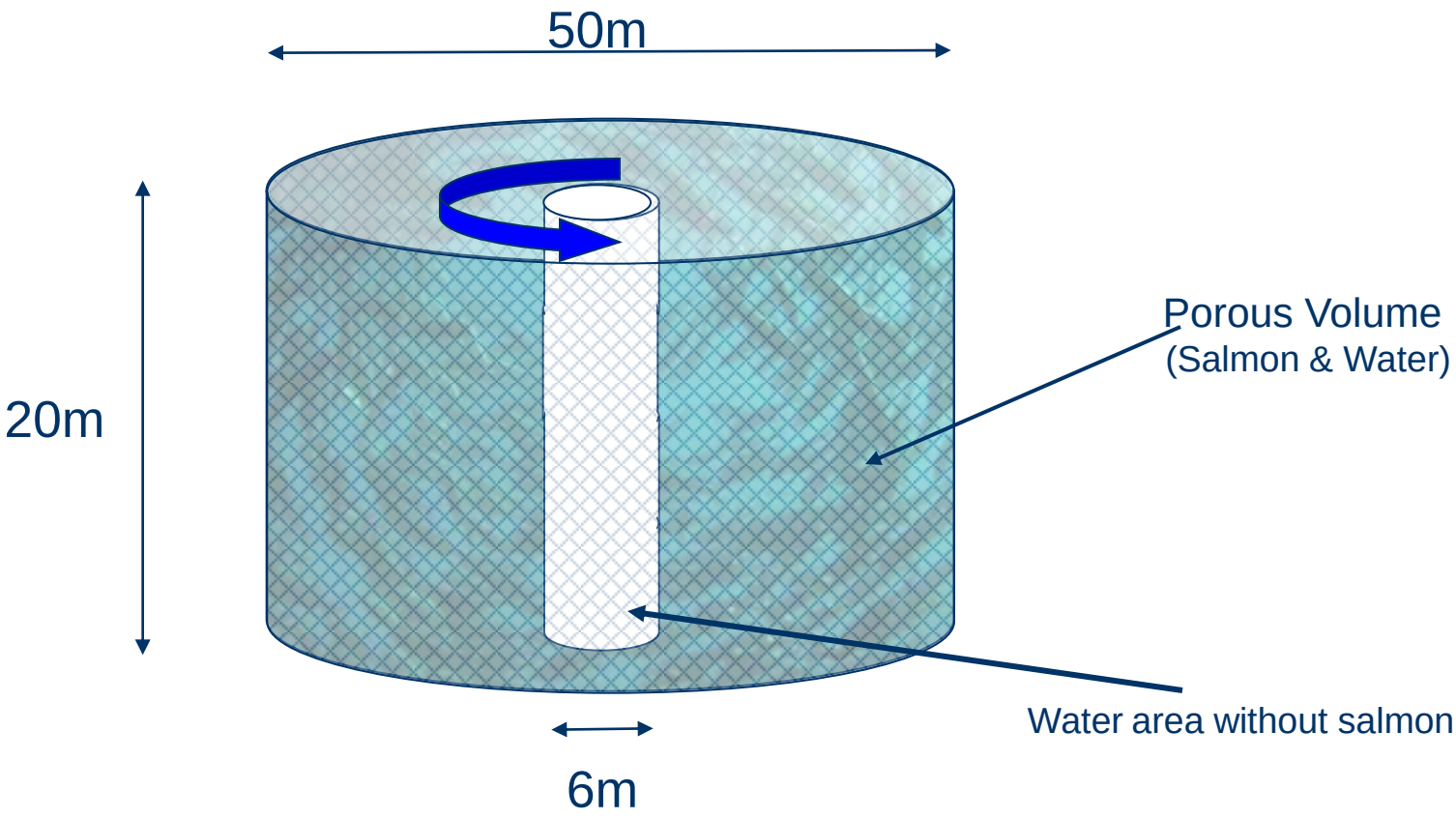
2) Flow field around and through the cage : How to model a school of fish

Porous volume method



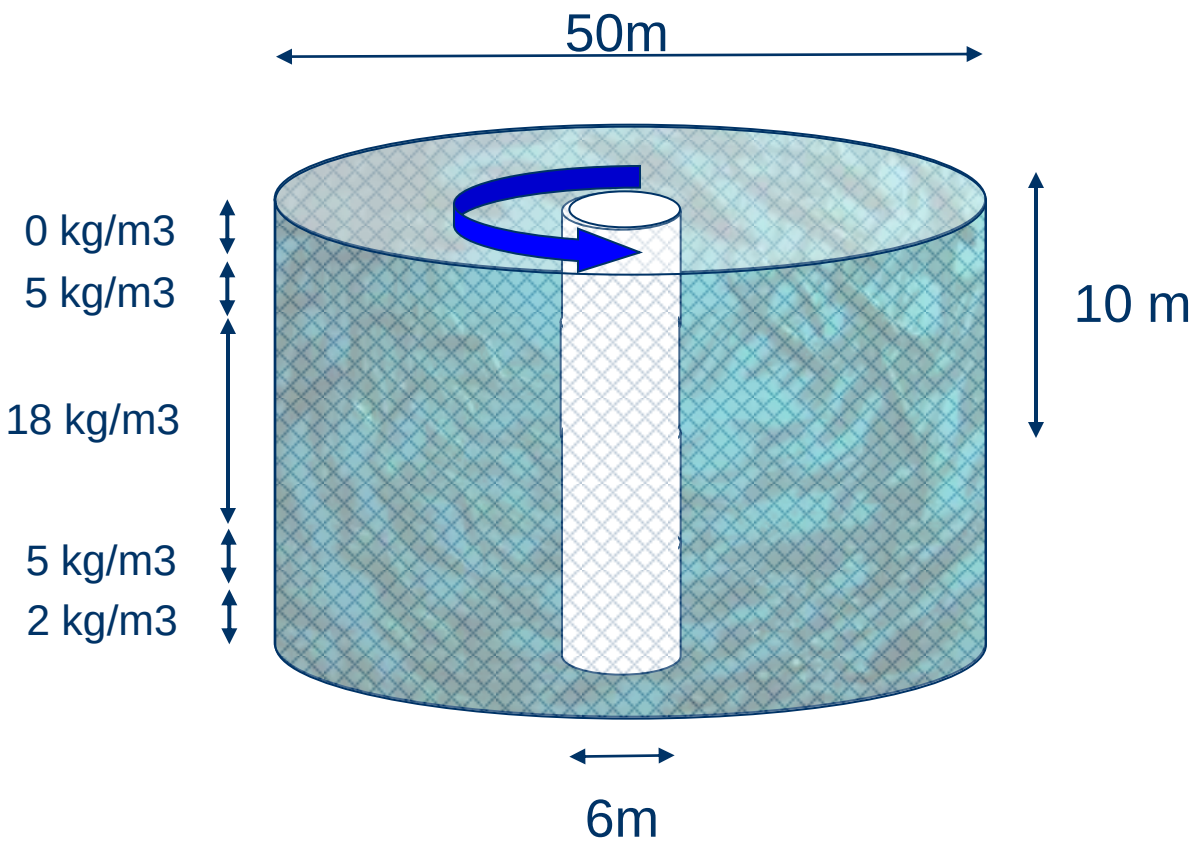
2) Flow field around and through the cage : How to model a school of fish

Porous volume method



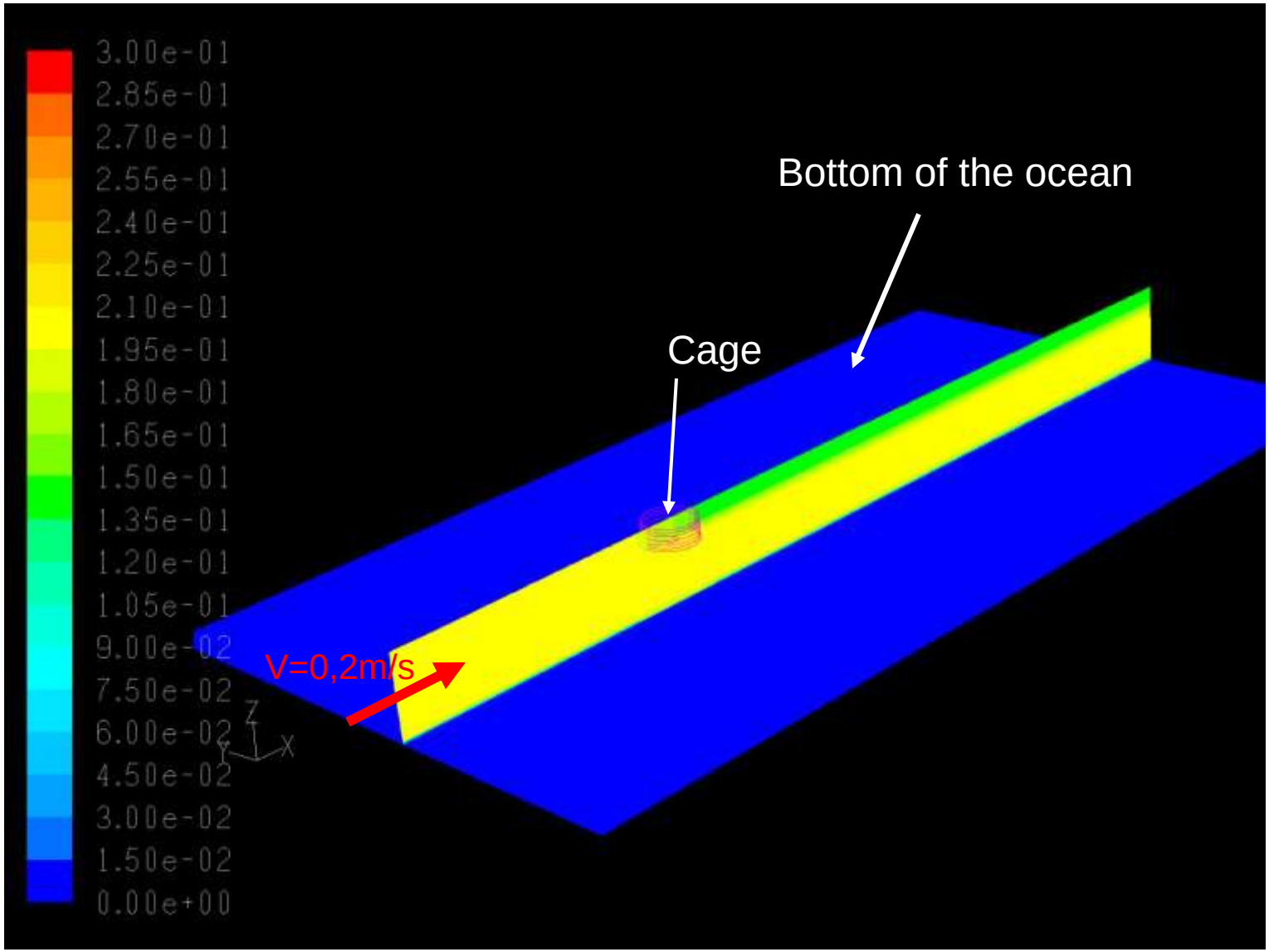
2) Flow field around and through the cage : How to model a school of fish

Porous volume method : density of fish



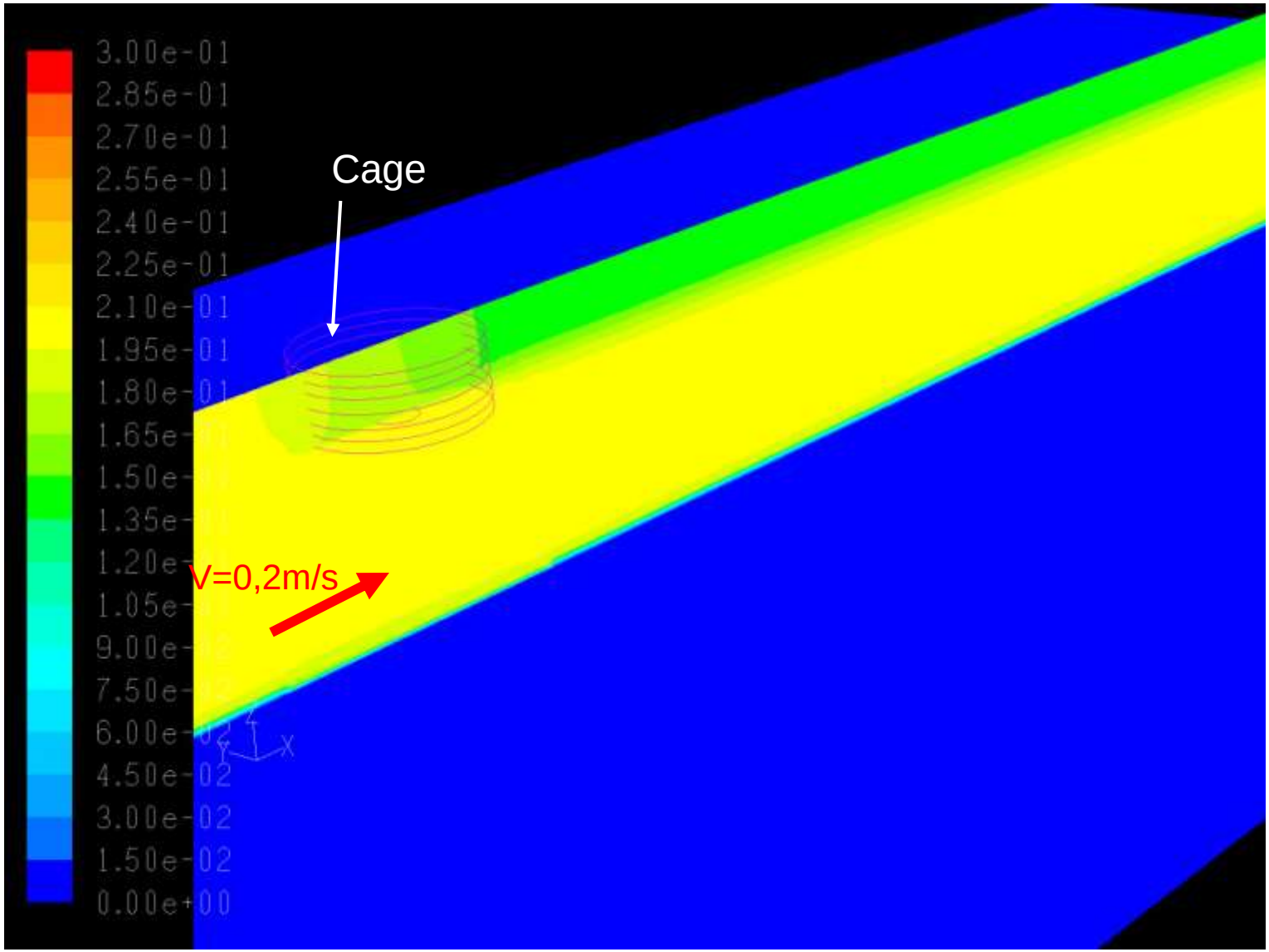
2) Flow field around and through the cage :

Simulation with a single empty cage



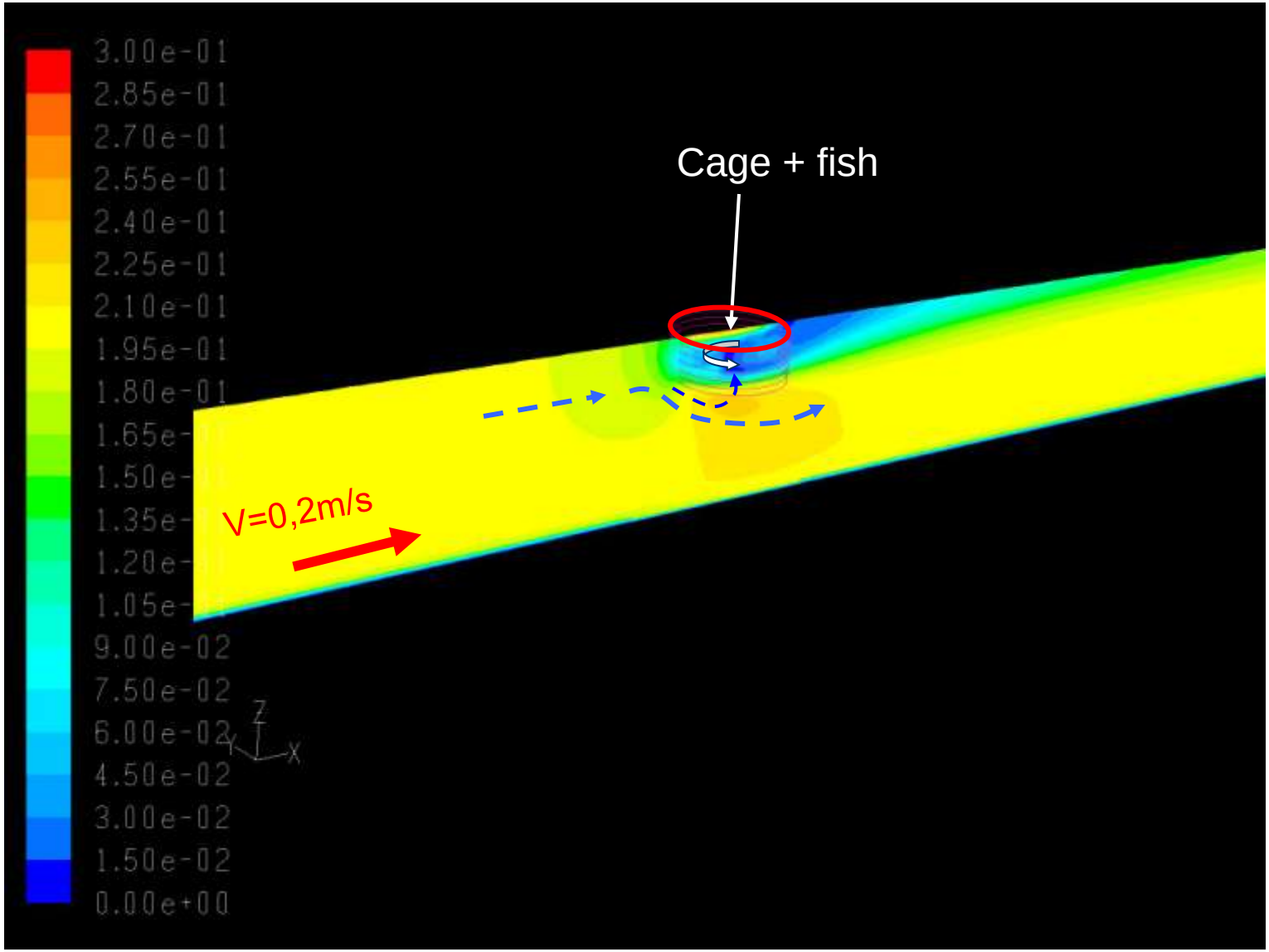
2) Flow field around and through the cage :

Simulation with a single empty cage



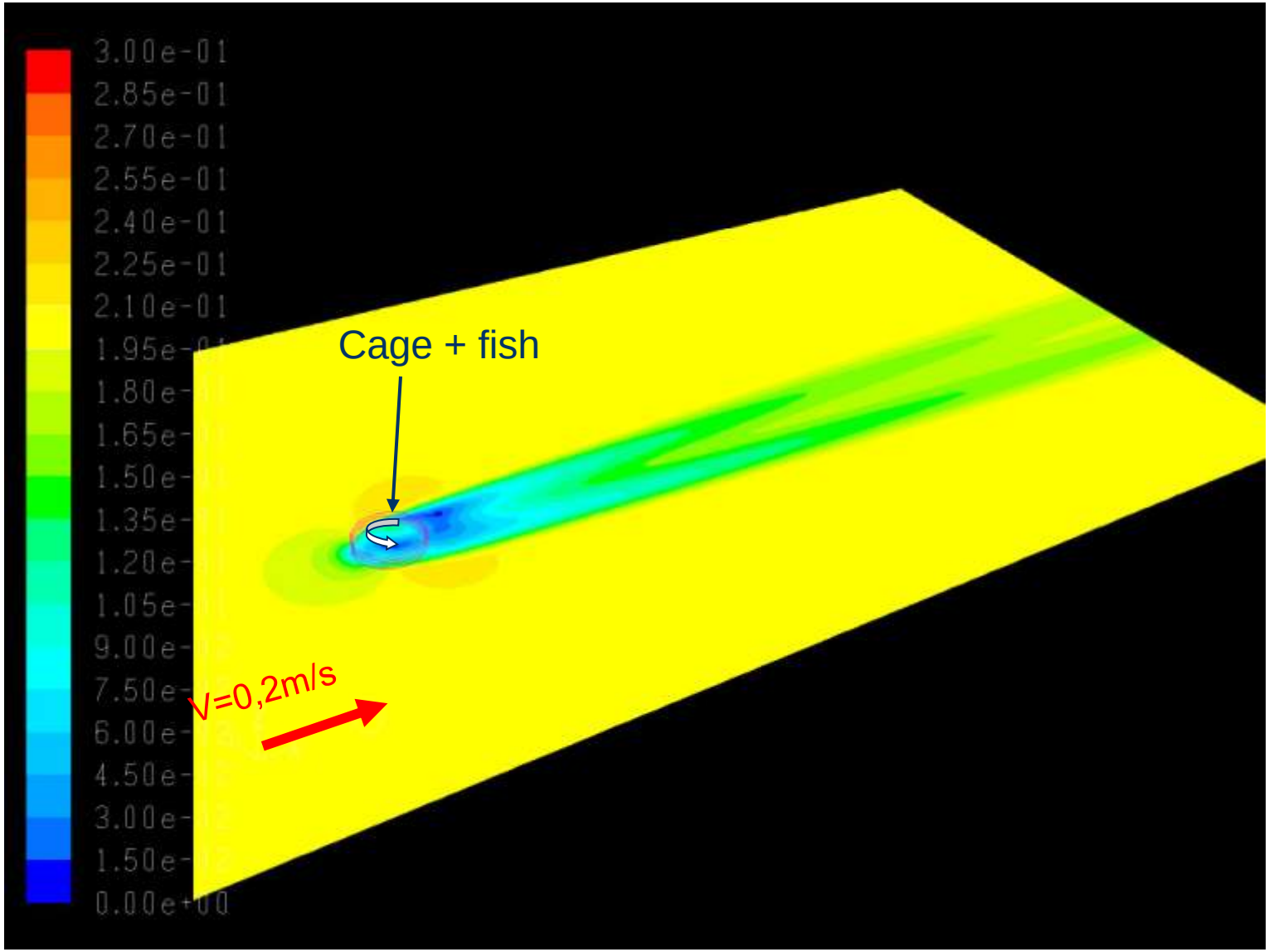
2) Flow field around and through the cage :

Simulation with a single cage with fish

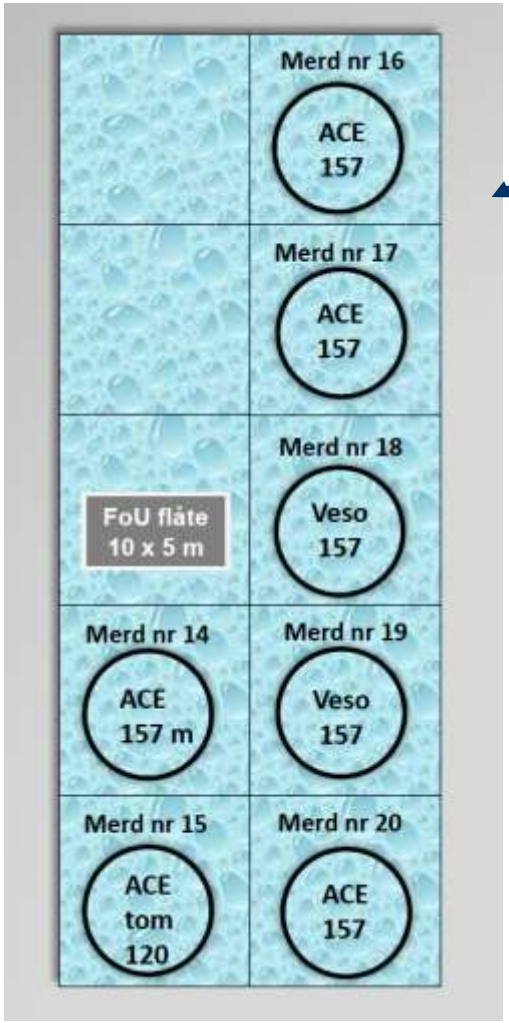


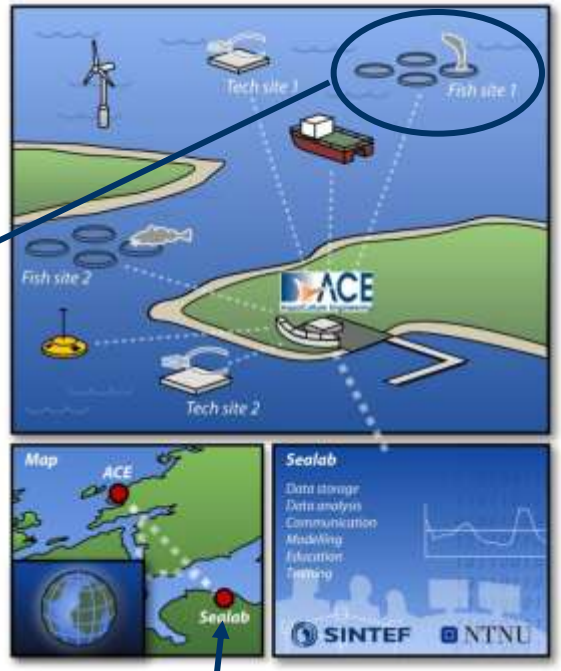
2) Flow field around and through the cage :

Simulation with a single cage with fish

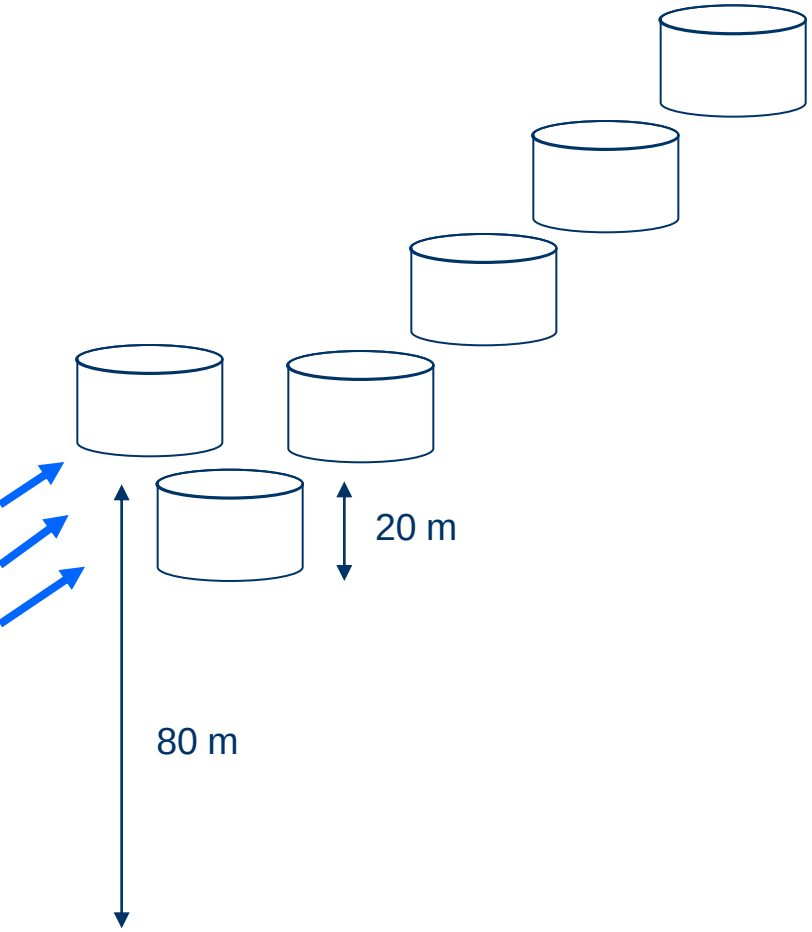


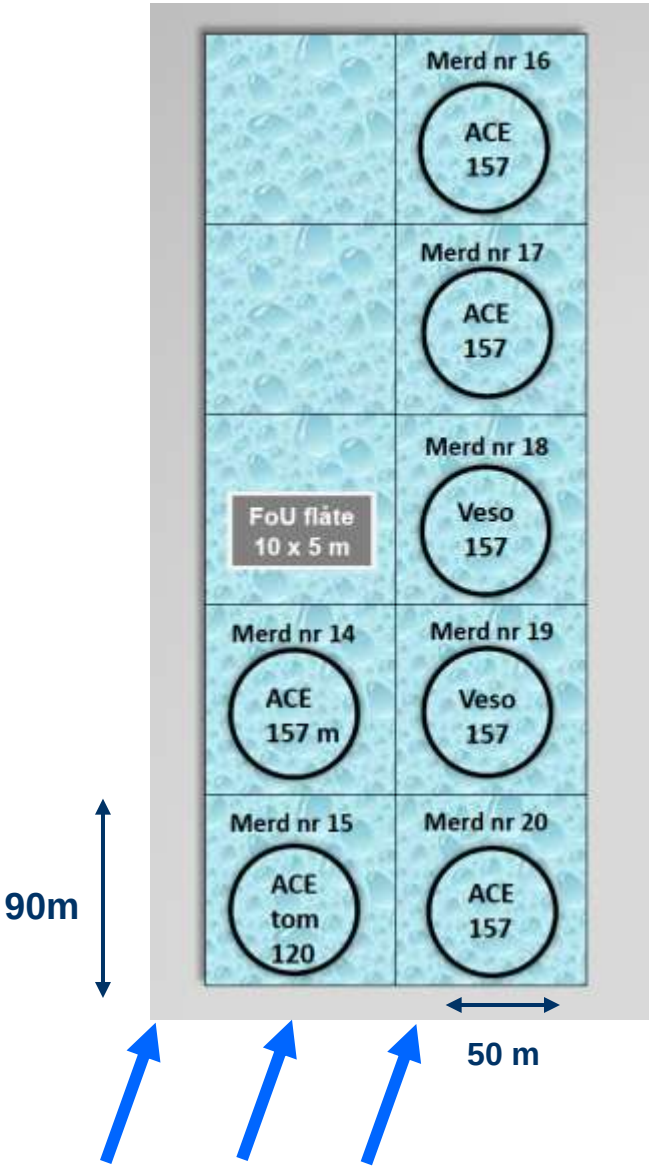
3) Flow field around and through cages :





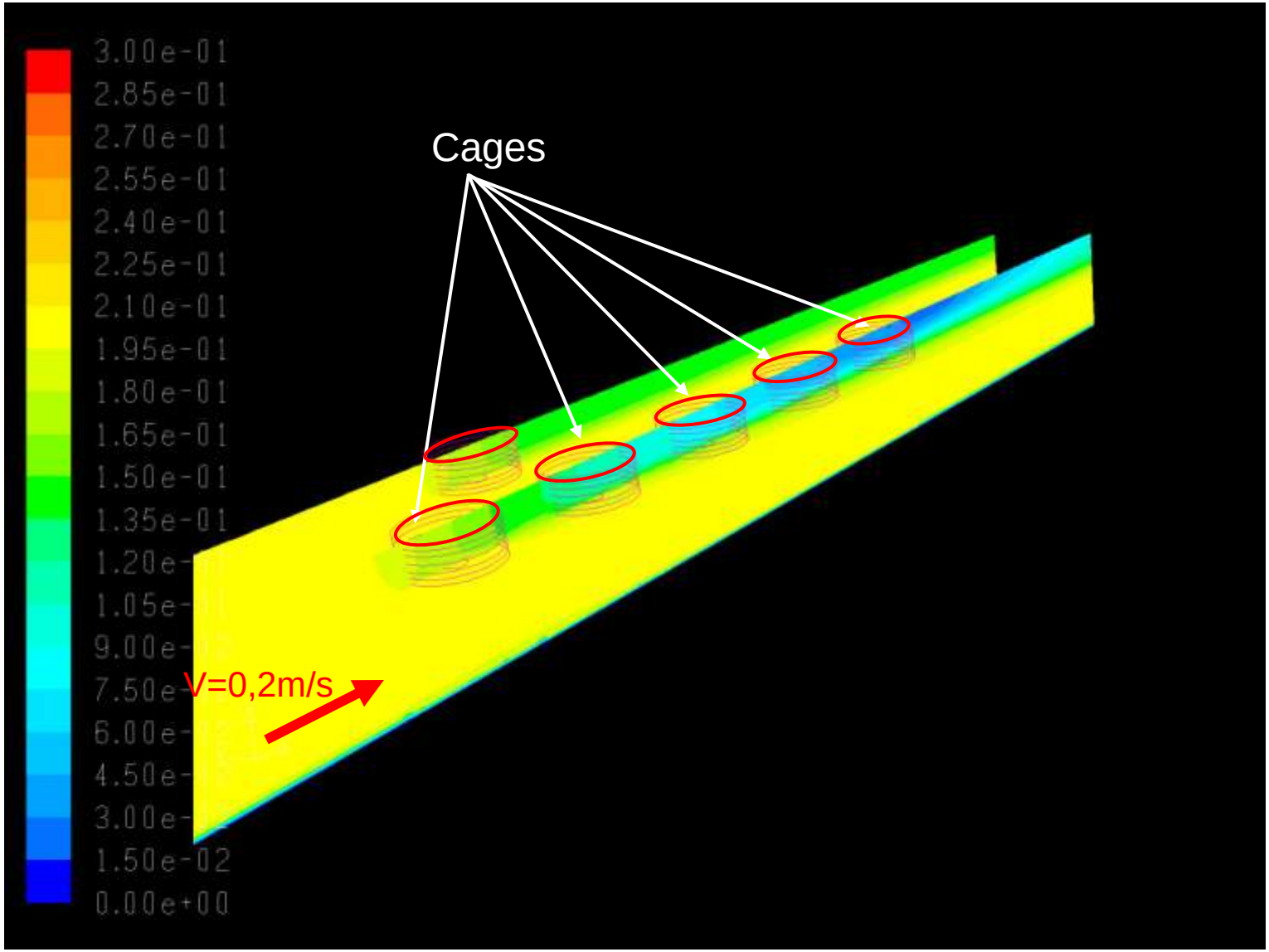
3) Flow field around and through cages :





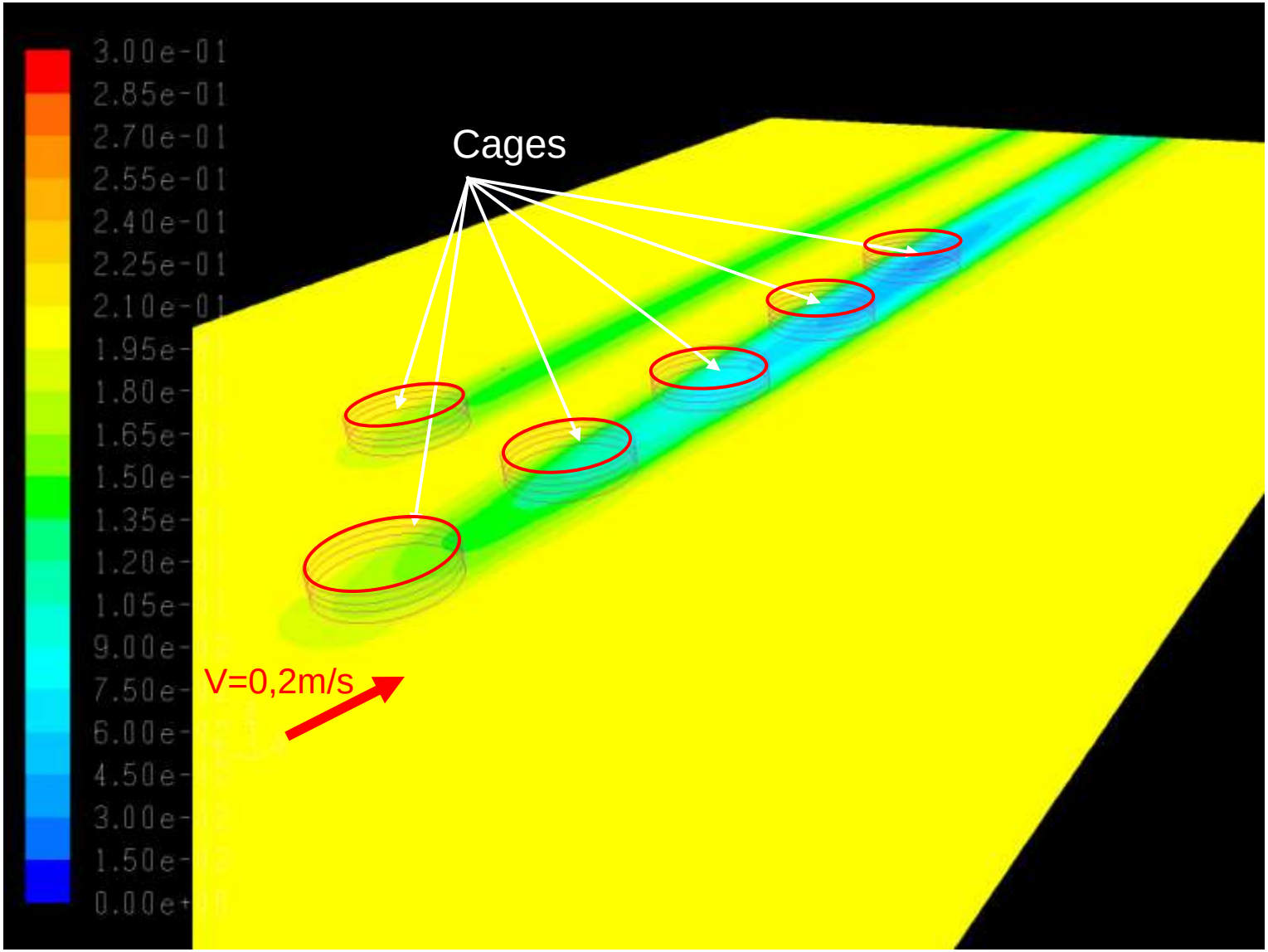
3) Flow field around and through cages :

Simulation with several empty cages



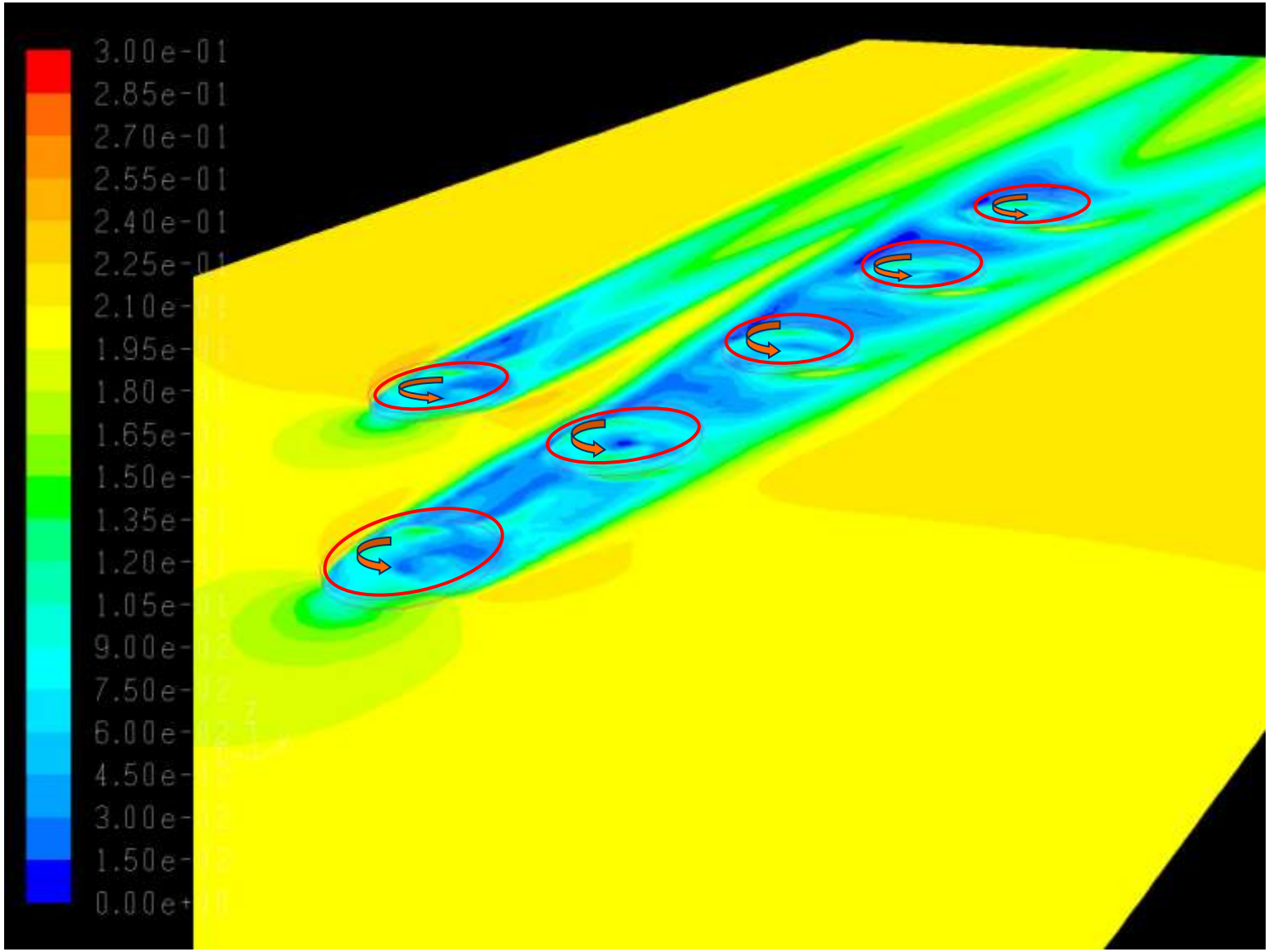
3) Flow field around and through cages :

Simulation with several empty cages



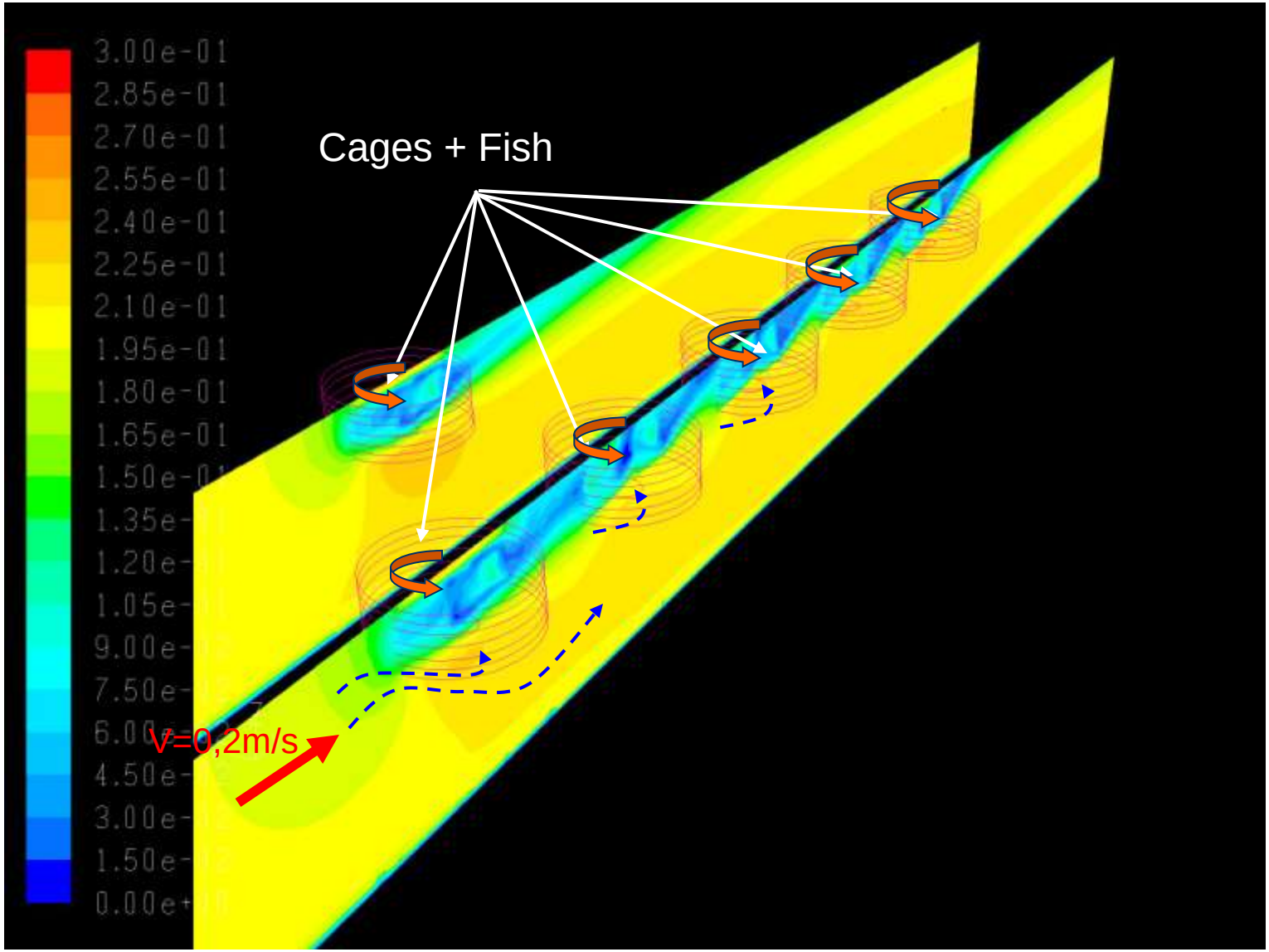
3) Flow field around and through cages :

Simulation with several cages with Fish



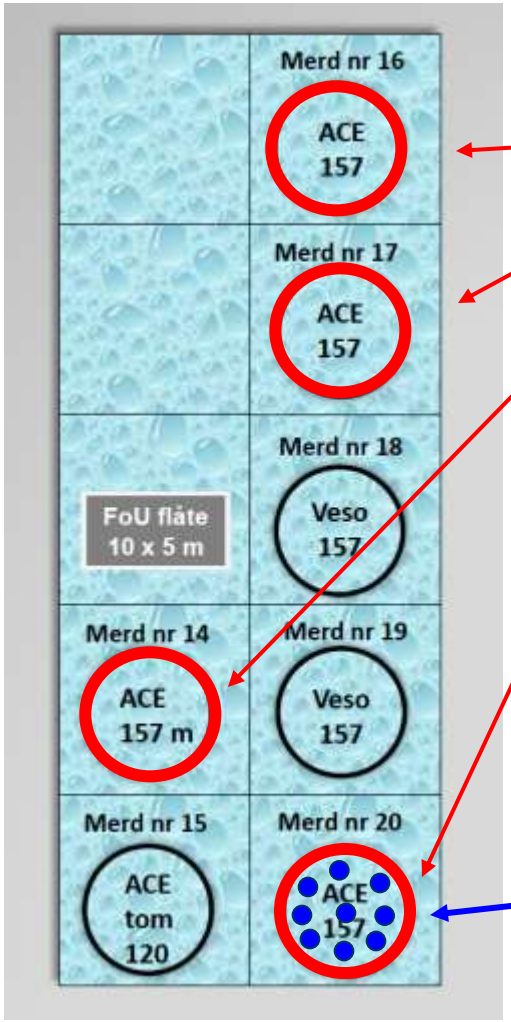
3) Flow field around and through cages :

Simulation with a several cages with Fish



3) Flow field around and through cages :

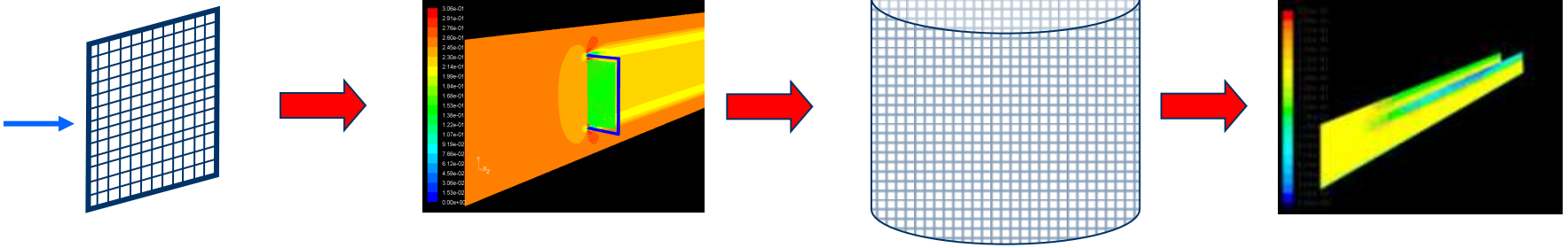
Planned Experiments and data acquisition

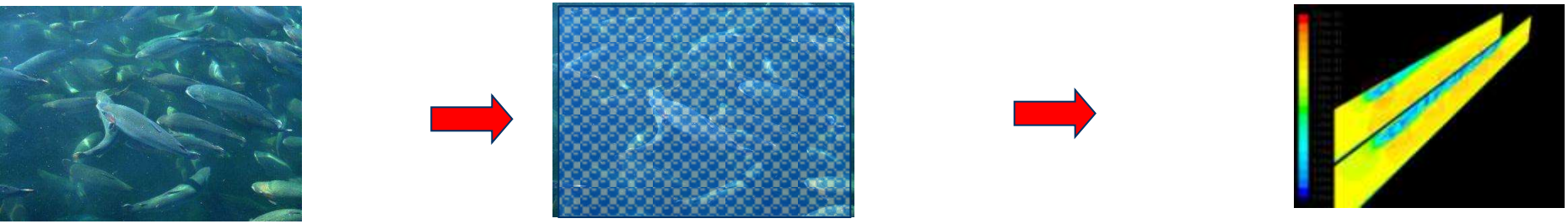


Continuous monitoring at 3,5,10 m:
- Oxygen
- Flow velocity
- Temperature

Monitoring of
-Oxygen
-Flow velocity
-School density

4) Summary





<u>Next :</u> Plan Large Scale Experiments to validate the model

- Velocity of a school of Salmon
- Salmon distribution in a school
- Exact 3D distribution of velocity field in a cage
- Exact 3D distribution of Oxygen field in a cage

Thank you for your attention