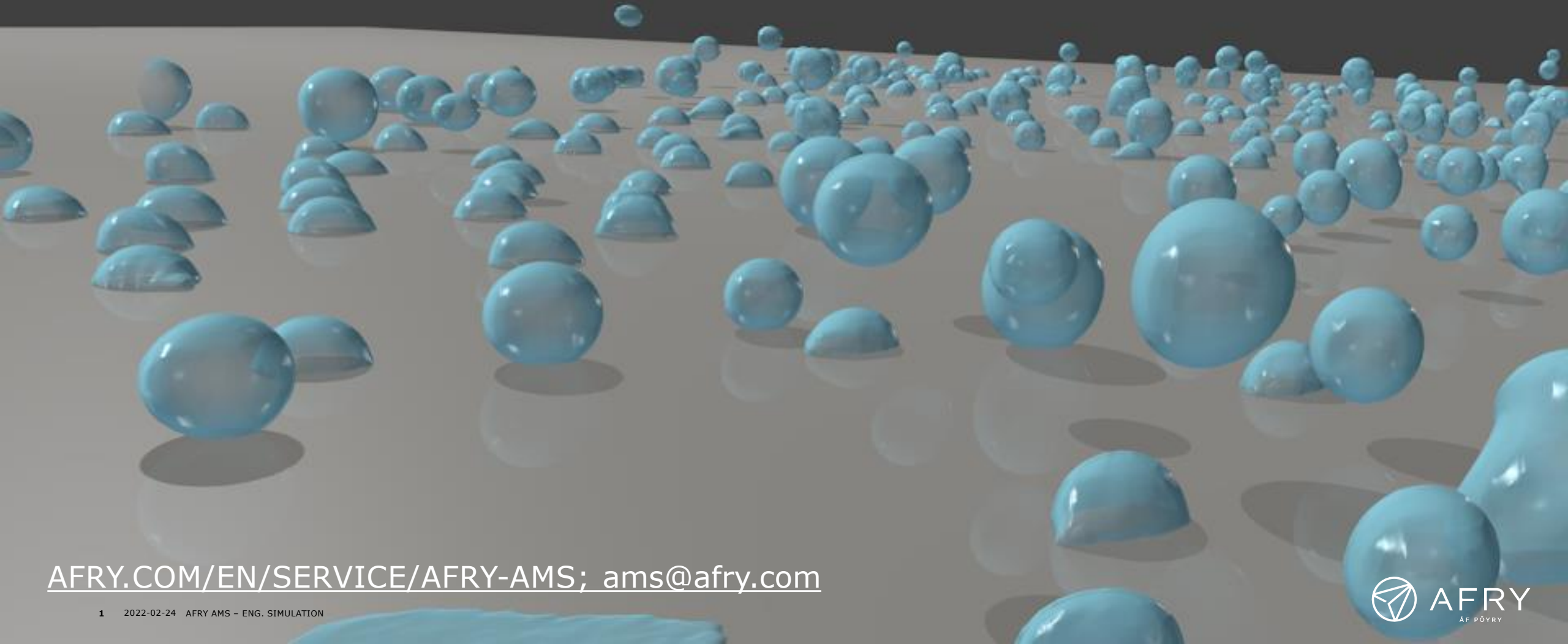


# Advanced Modelling & Simulation AMS

## I- ENGINEERING SIMULATION

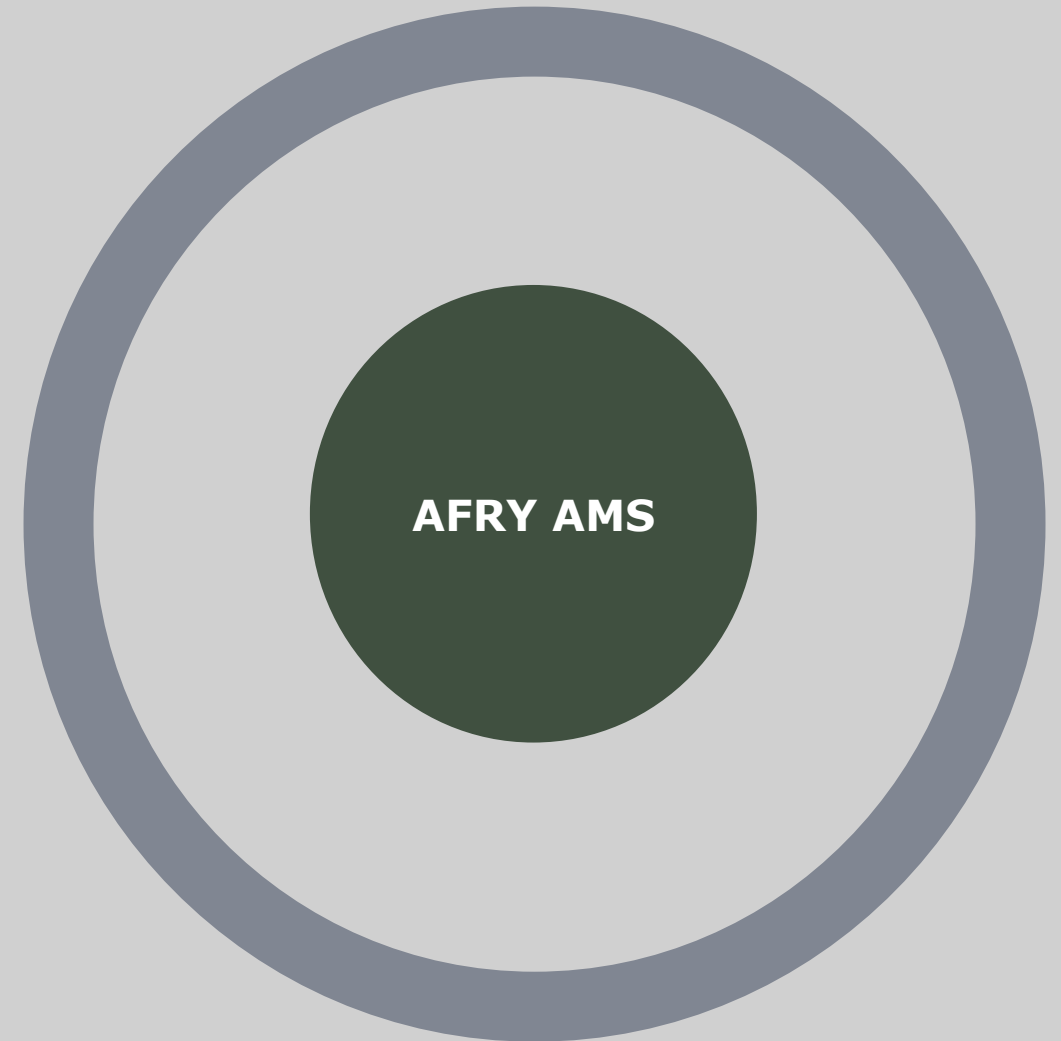


[AFRY.COM/EN/SERVICE/AFRY-AMS](https://afry.com/en/service/afry-ams); [ams@afry.com](mailto:ams@afry.com)

# AFRY AMS

harnessing the power of simulation

- AFRY's engineering simulation Hub, developing a product portfolio of innovative services for a wide range of industrial applications
- AMS Team specializes in engineering simulation (thermal & fluids processes)
- From product customization to application, we help our partners solve their most intricate problems
- We master various simulations packages
  - CFD & CMFD, (StarCCM+, TransAT, BASEMENT, Flow3D, AutoDesk)
  - Process Simulation (Aspen Hysys, DWSIM)
  - Fire Safety Analysis (FDS Pro, TransAT)
  - HSE Simulation & Modelling (Phast)





## PROCESSES

- Potential applications relate to chemicals, pulp & paper, bio-oil and tall-oil tranformation, novel reactor design.



## ENVIRONMENTAL

- Areas of interest include dam failure, water floods, land- & rock-sliding, snow avalanche and land erosion.



## ENERGY

- From conventional thermal & hydro, to renewables, through the thermal-hydraulics of LWR's nuclear power plants.



## FIRE SAFETY

- To evaluate risk assessment and quantify risk scenarios in the event of explosion and fire spreading in domestic and industrial buildings.



## WASTE WATER

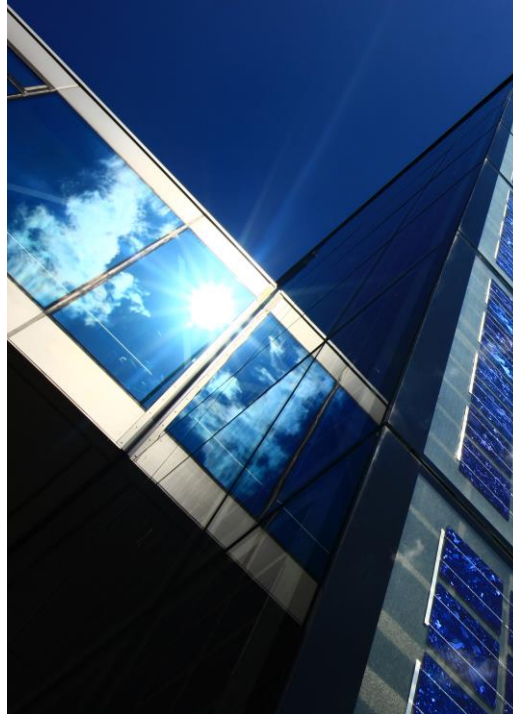
- We intervene in the design and operation of various types of plants : conventional secondary settling tanks, active particle flocculation, and ozonation systems.





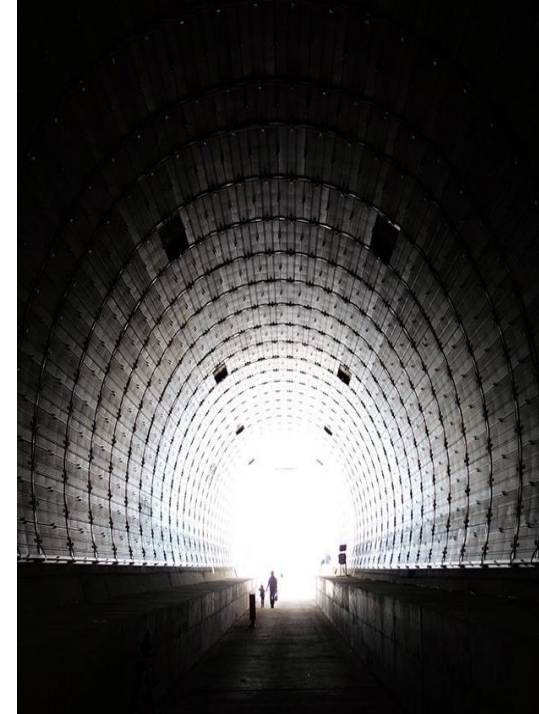
## FOOD & PHARMA

- Potential areas we tackle include medical devices, bio-pharma processes, thermal packaging, food and beverages, etc.



## HYDRAULICS

- Various segments are treated, incl. hydraulics, water technology, coastal engineering, spill-way design, recirculation analyses...



## OIL & GAS

- From flow assurance, oil production and transport, to surface operations, drilling & EOR, and contingency assessment of subsea oil spill.



## BUILDINGS

- for the design of industrial HVAC systems, urban physics design, incl. wind loads, pollution dispersion, indoor ventilation, passive energy management.

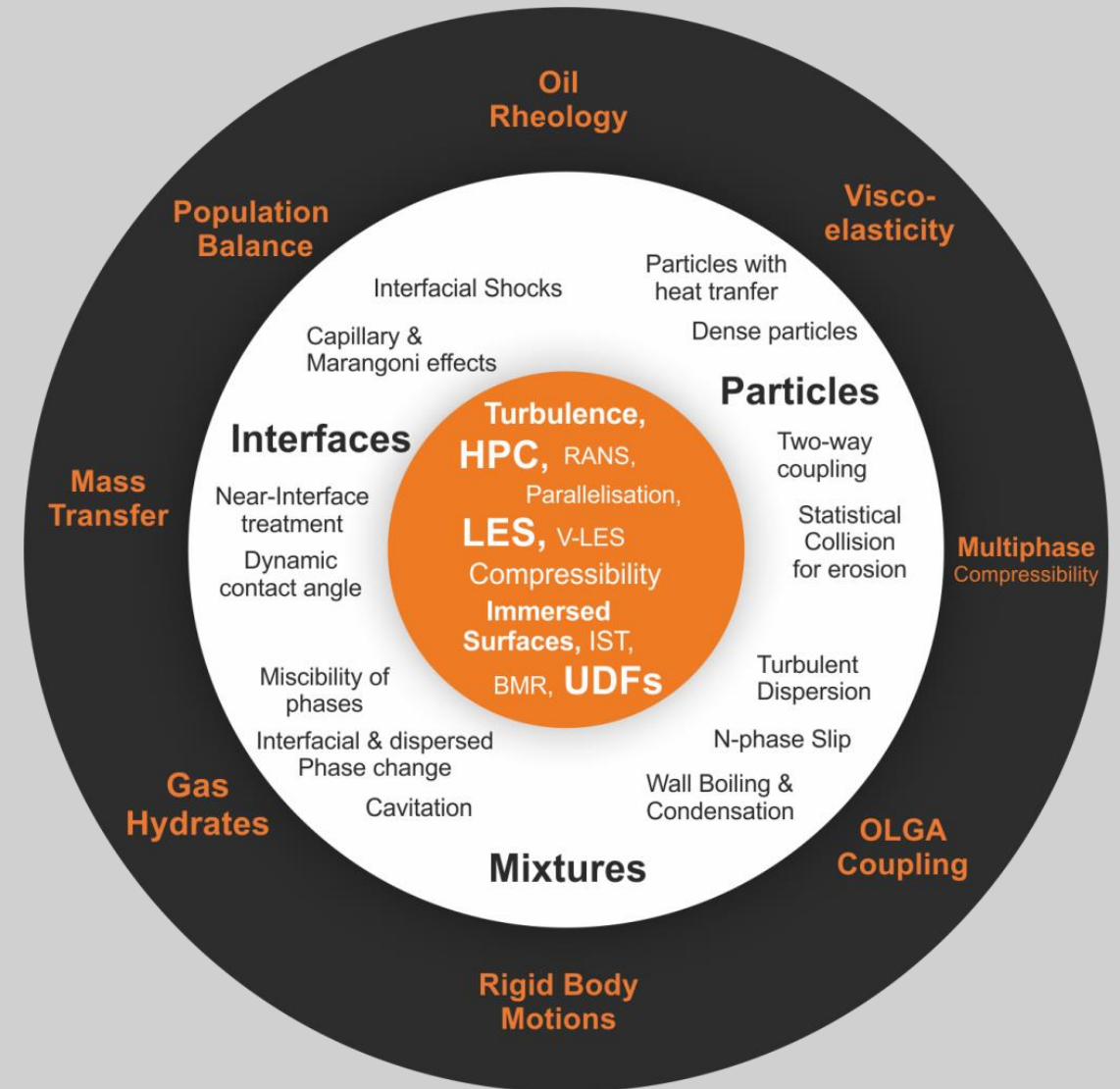


## TRANSPORTATION

- Our competences encompass, ventilation and transportation in underground facilities such as metro systems, rail and road tunnels.

# TransAT CFD

- TransAT© is a versatile fluid-flow simulation platform using the Immersed Surfaces Technology for multi-dimensional meshing.
- The platform is particularly suitable for multiphase flows using tailored predictive techniques augmented by a wide-range of models accounting for complex physics.
- TransAT can be deployed under Linux and Windows OS and is parallelized using MPI parallel protocol for HPC infiniband systems.
- TransAT can be employed in oil & gas, energy systems, chemical and process engineering, hydraulics, wastewater, transportation, wind and environment

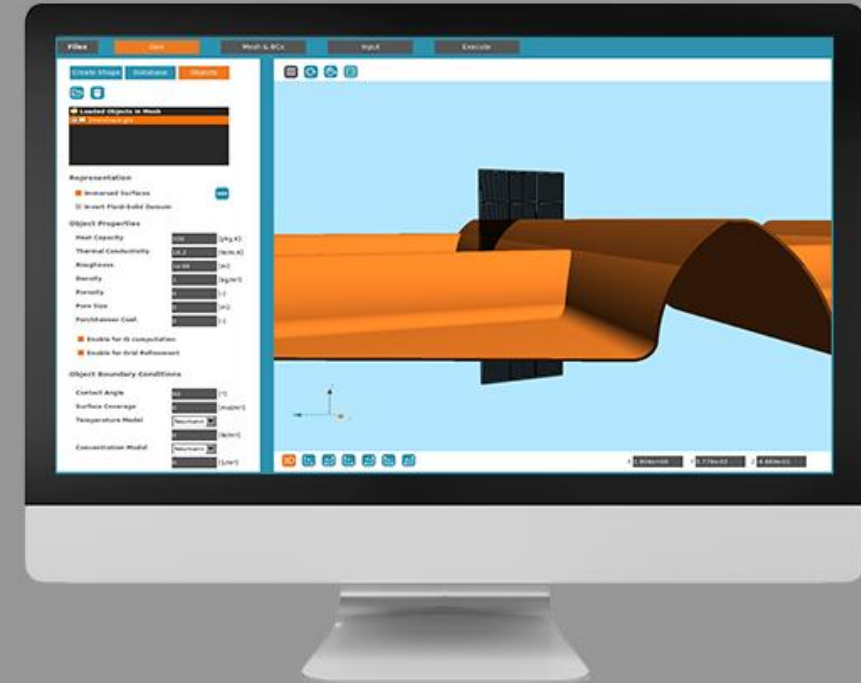


WHY TRANSAT ?

# Key features

- 2D & 3D incompressible & compressible flows
- Immersed surfaces technique for 3D meshing
- Laminar and turbulent flows
  - RANS modelling
  - V-LES, LES & DNS
- Parallelized to run on HPC systems
- Multiphase flows with phase change
  - Interfaces
  - Mixtures
  - Particles & Droplets
  - Emulsions
- Heat & mass transfer and reaction chemistry
- Non-Newtonian & complex fluids
- Rigid body motion

# TransAT





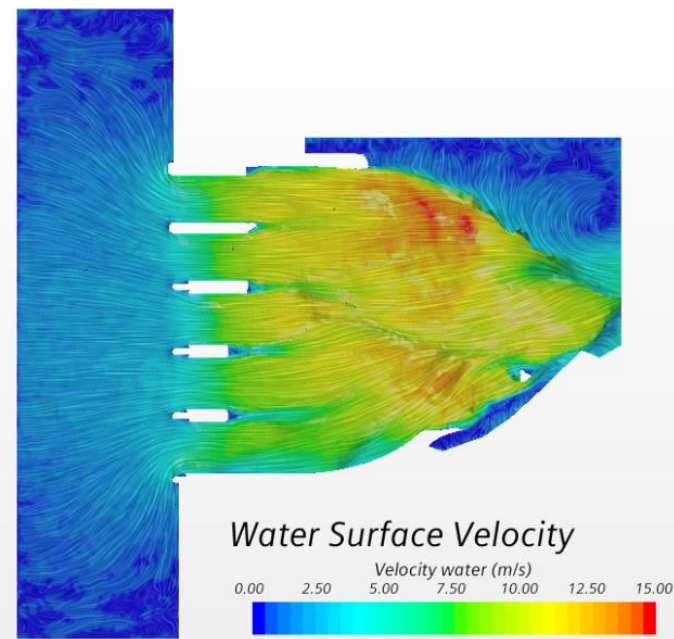
# Use case : Hydro

## Client's Issues

- Renovation the Hammarforsen spillway at hydropower plant on the Indalsälven river in Sweden required design consideration for a flooding scenario.
- Estimate the maximum spillway capacity.

## Afry's Solution

- Results demonstrated that the overall design capacity was not achievable.
- To estimate the expected total head, other total head elevations were run.
- The results were used to determine the elevation capable to discharge the required design capacity.



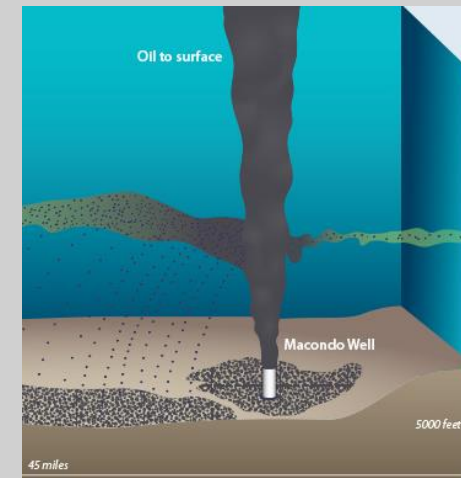
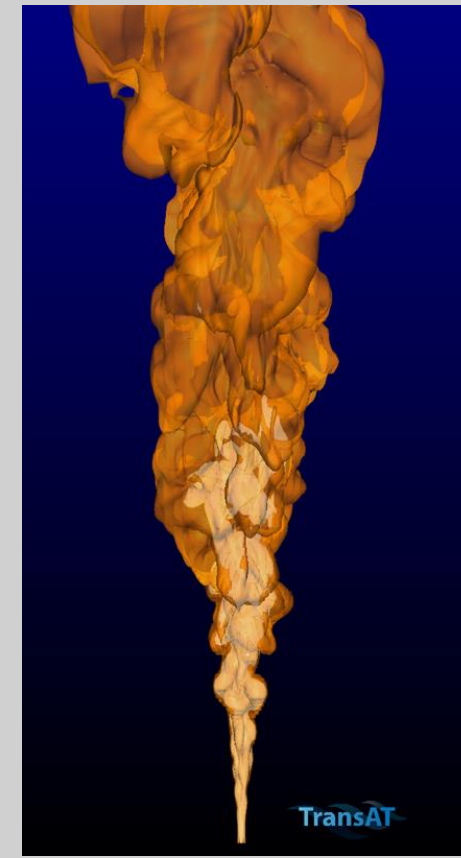
# Use case : Oil & Gas

## Client's Issues

- A subsea oil spill can cause irreversible environmental damages, with high costs (\$ billions) and litigation issues
- Lesson learnt from BP spill motivated efforts to create a robot-deployable, safety passive containment system.

## Afry's Solution

- Understand the complex subsea flow behaviour near spill (results shown)
- Screen various simple passive safety containment systems
- Optimize the design and robot deployment of containment.





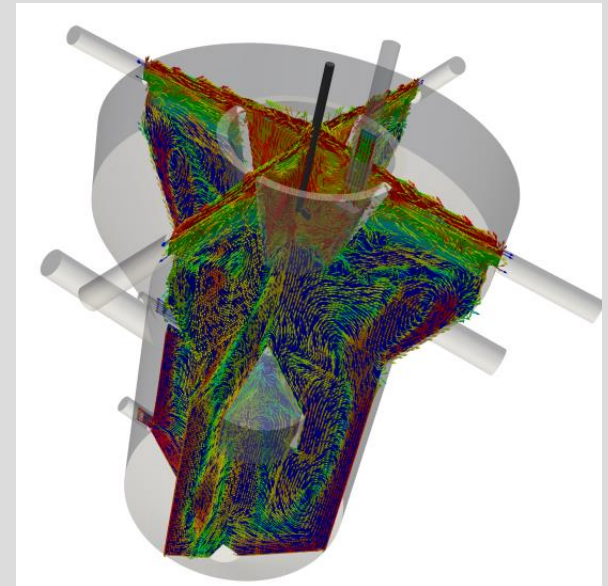
# Use case : Processes

## Client's Issues

- For the design of a novel tall-oil reactor, the optimal configuration of the internals is sought. Objective is to help client maximize the production of tall oil.

## Afry's Solution

- 3D simulation of the pertinent physics was undertaken, accounting for the presence of the various phases: acid, soap, spent acid, tall oil, lignin and gas..
- Reaction & separation were accounted for too.
- Results helped dimension the internals, the cone position and the feed pipes, based on the operational conditions.



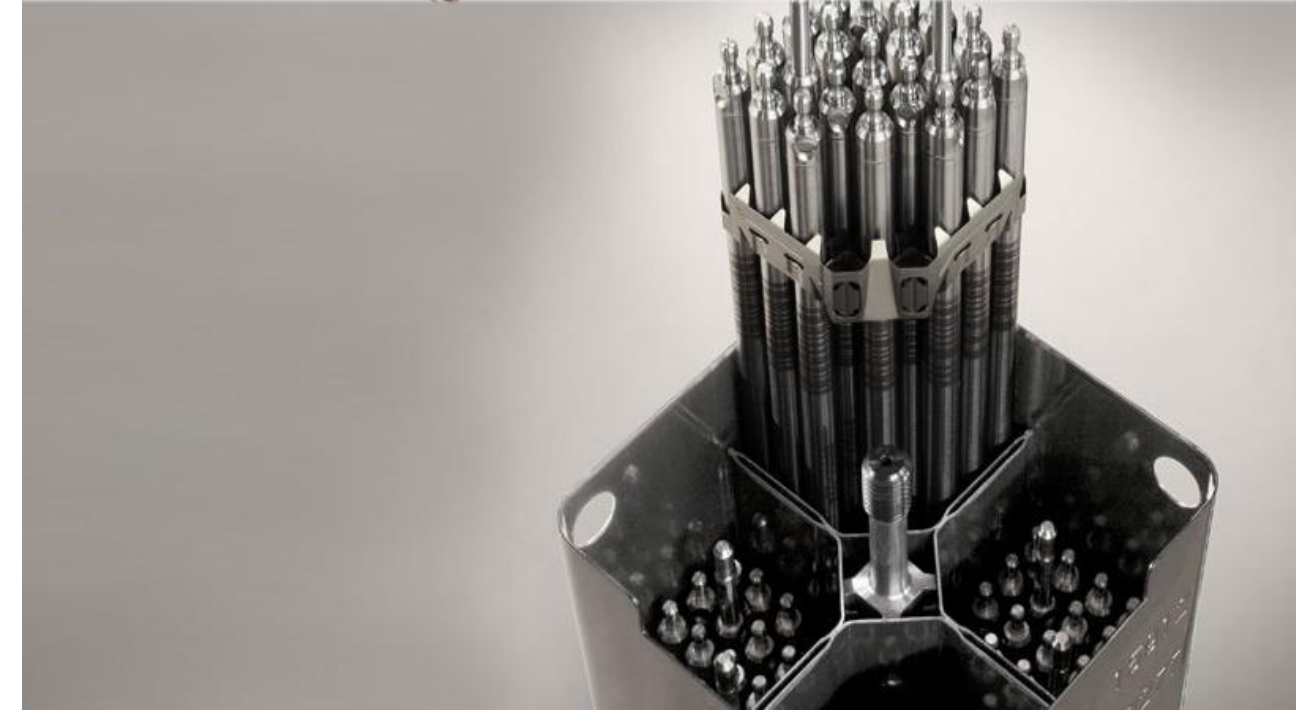
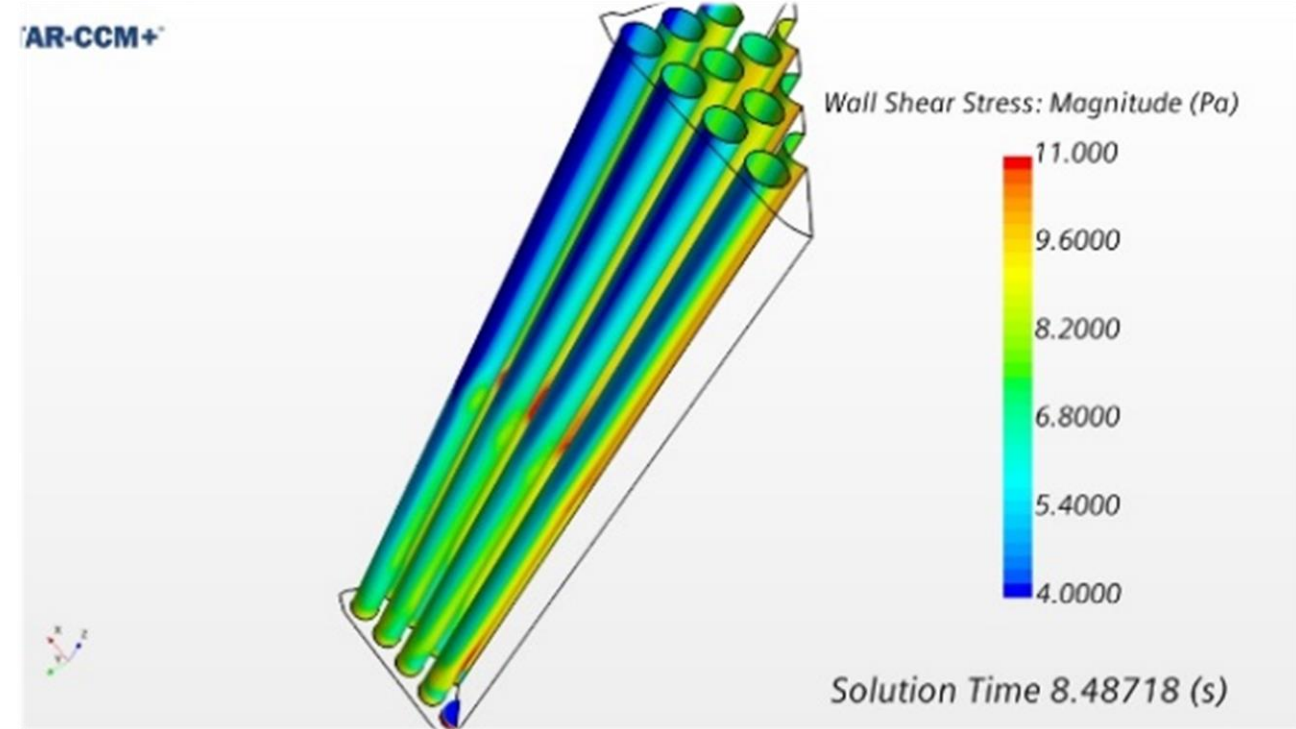
# Use case : Energy

## Client's Issues

- Corrosion marks were observed on fuel rod cladding at KKL.
- The focus was on understanding the behaviour of liquid film in the fuel assembly at the corrosion location.

## Afry's Solution

- 3D annular-flow simulations were conducted, showing that the location of interest has the largest variation in wall shear stress.
- Variations in film thickness and velocity were provided supporting the findings.





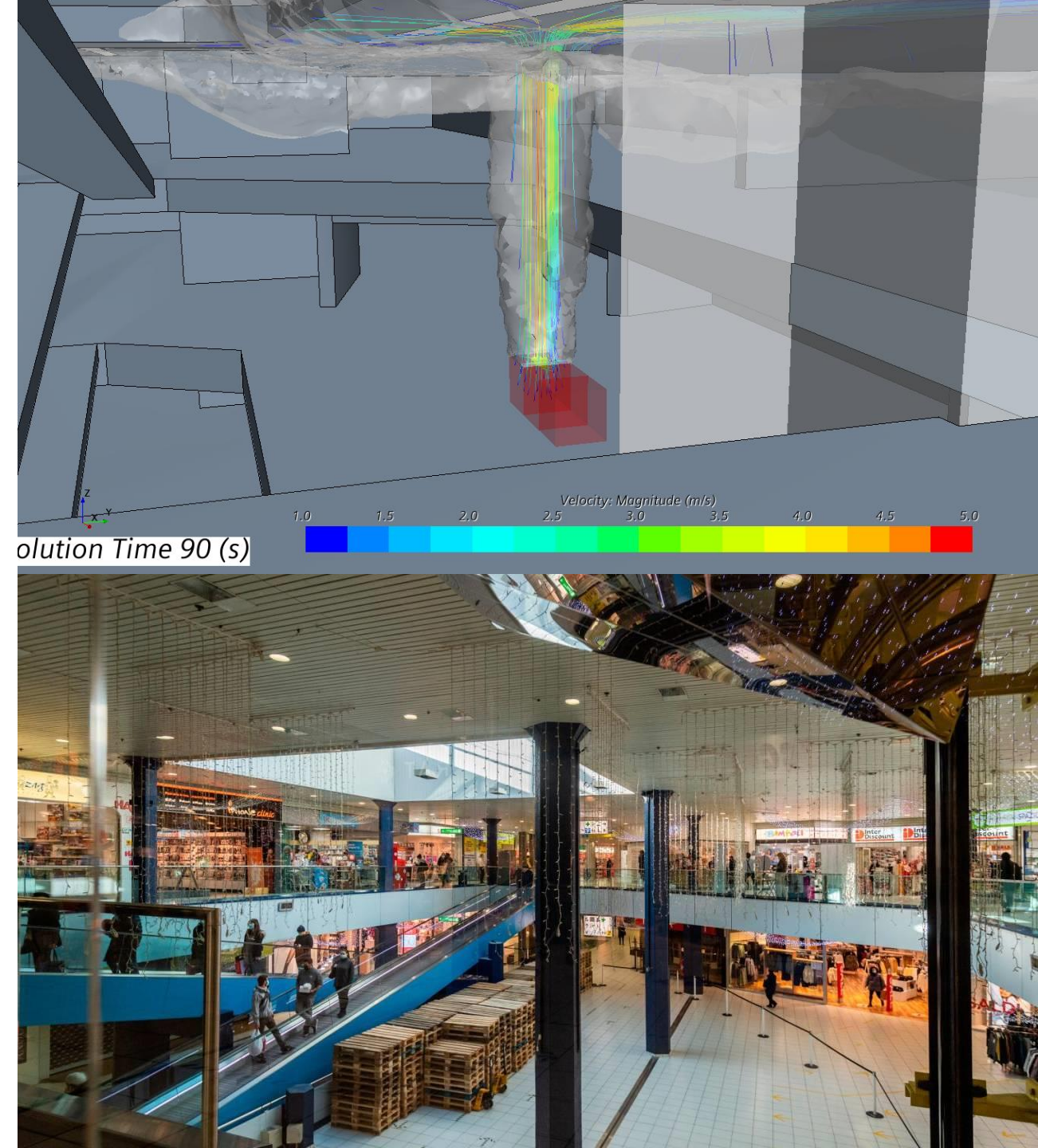
# Use case : Fire Safety

## Client's Issues

- Renovation to the Serfontana TC shopping mall required POC for a smoke removal ventilation system used in case of fire.
- The system must guarantee to remove the smoke to maintain safe evacuation routes and conditions for fighting the fire.

## Afry's Solution

- 3D simulations were carried out to investigate the smoke removal system, considering various fire scenarios.
- The study aided in reducing the associated costs of the smoke removal system. The overall size of the ventilation system could be confirmed adequate.





## PRACTICAL EXAMPLES

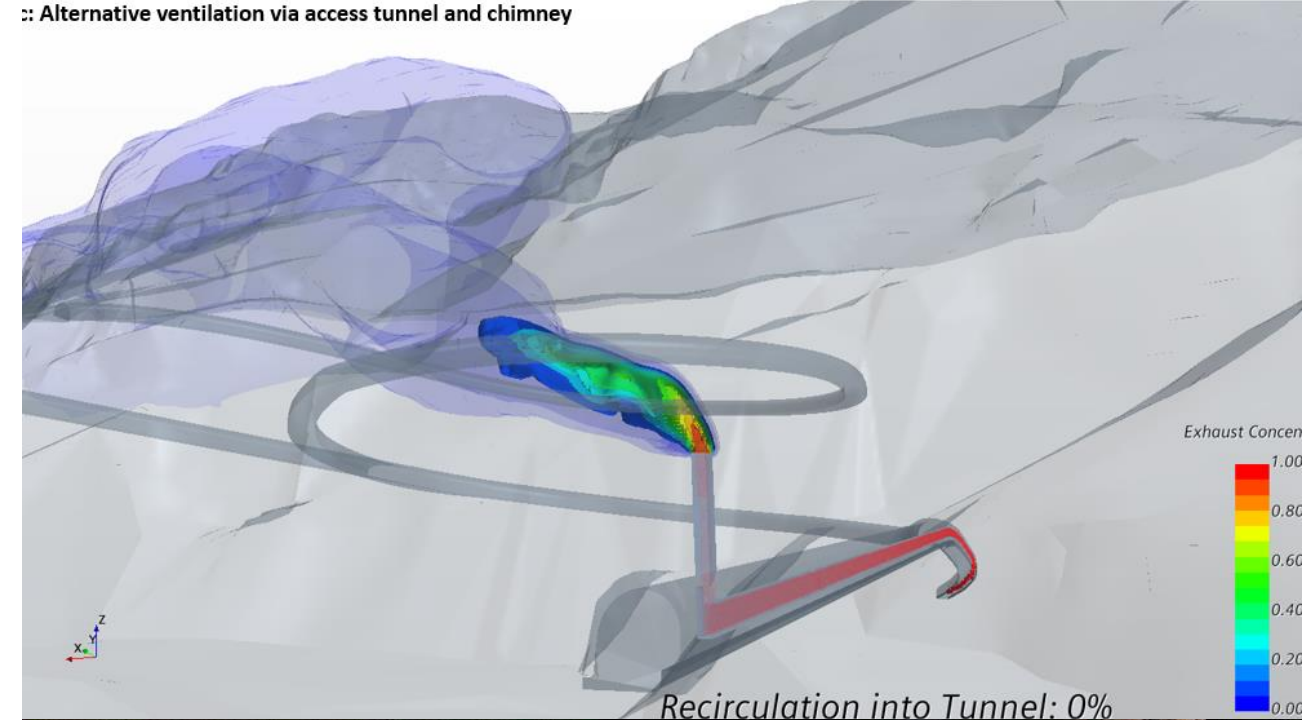
# Use case : Ventilation

## Client's Issues

- The ventilation of a new hydropower plant in Alto Maipo turned out to be particularly complex due to the geographical location.
- A new ventilation concept was to be found for the underground powerhouse and transformer caverns for air supply & exhaust.

## Afry's Solution

- We proposed an alternative ventilation system to be placed inside the main access tunnel.
- 3D CFD proved that there is no severe air recirculation issues from the point of exhaust.
- Temperature variations due to the ventilation duct do not cause adverse effect on the main heating, cooling & ventilation demands.



# Contact persons @ AFRY AMS

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