



Design: Optimisation of a pump tank



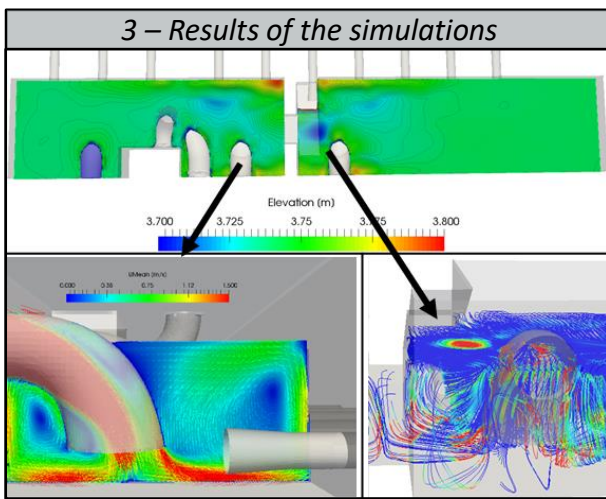
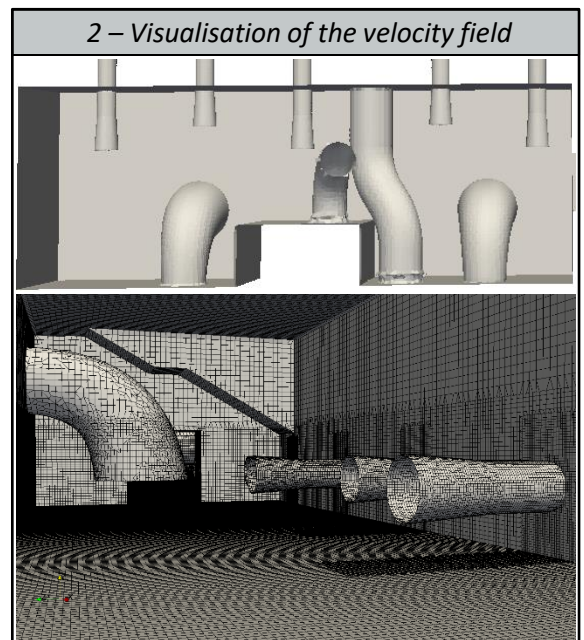
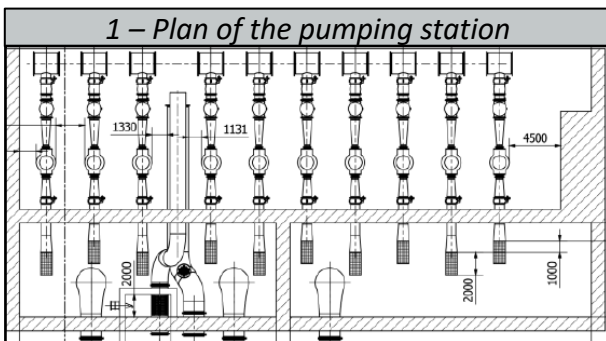
Challenge

Ensuring the proper operation of a planned structure and optimising the implementation costs for the project owner by guaranteeing compliance with the criteria of the ANSI-HI9.8-1998 standard.



The 3D EAU solution

- **Visualising the structure operating** in its hydraulic environment
- **Evaluation of the risk** of vortex formation and calculation of the angle of pre-rotation at the intake of the pumps
- **Assessing the operation** and proposing improvements
- **Simulating scenarios** to optimise the structure





Details of the proposed solution

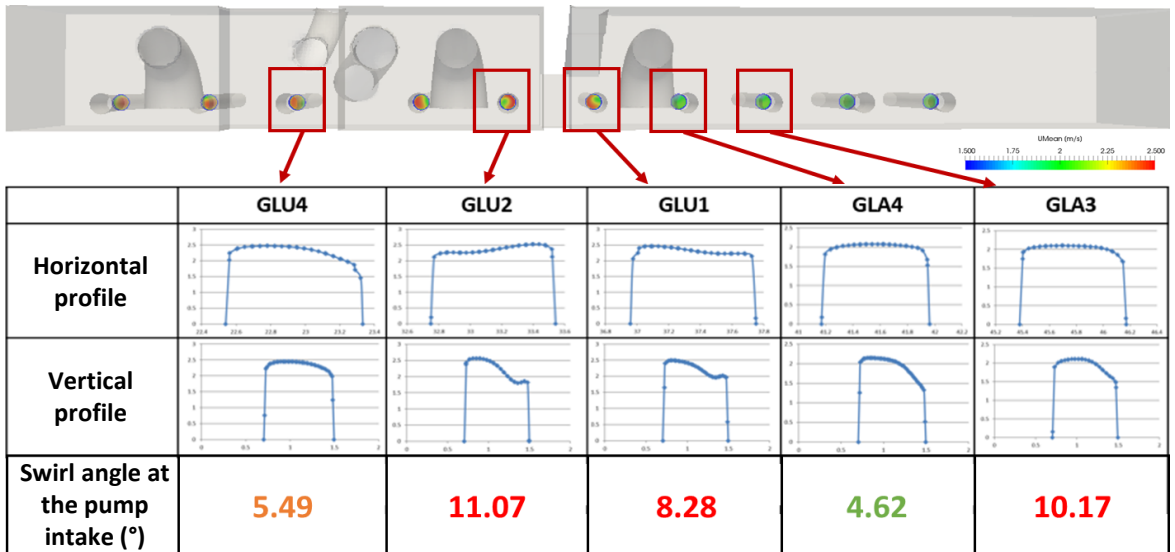
3DEAU has its own software solution for special applications, and develops and uses open-source software such as **Openfoam®** in order to solve Navier-Stokes equations for fluid mechanics.

The setup of the model leverages the **3D hydraulic modelling expertise** developed at the ICube laboratory (University of Strasbourg) and ENGEES¹, to which 3DEAU holds an exclusive licence. In pumping stations studies, the flow is considered **turbulent** (RANS or VLES equation, depending on the case), **incompressible** and **without heat transfer**, subject to **gravity**, **transitory** (transient solution) and **one or two-phase** (just water, or water + air, depending of the case).

¹ : - Guibu Pereira G. (2019). **Numerical modelling of turbulent flows with air entrainment in hydraulic structures**. PhD dissertation, Strasbourg University, p. 226.

Example:

The criteria of the ANSI-HI9.8-1998 standard are calculated, in particular the velocity profiles and the angle of pre-rotation at the pump intake (calculated for 20 seconds). This angle is then compared with the limit value of the standard, which is 5°, in order to be validated without any special conditions.



Advantages

- **Assessment of the pumping station's operation**, in order to better understand its operation
- **Evaluation of the risk of vortex formation** and calculation of the angle of pre-rotation at the intake of the pumps and of the other criteria of the ANSI-HI 9.8-1998 standard.
- **A flexible model**, making it possible to simulate scenarios for flow optimisation and for cost optimization by making simple structural modifications that are validated by the company responsible for the work.



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