

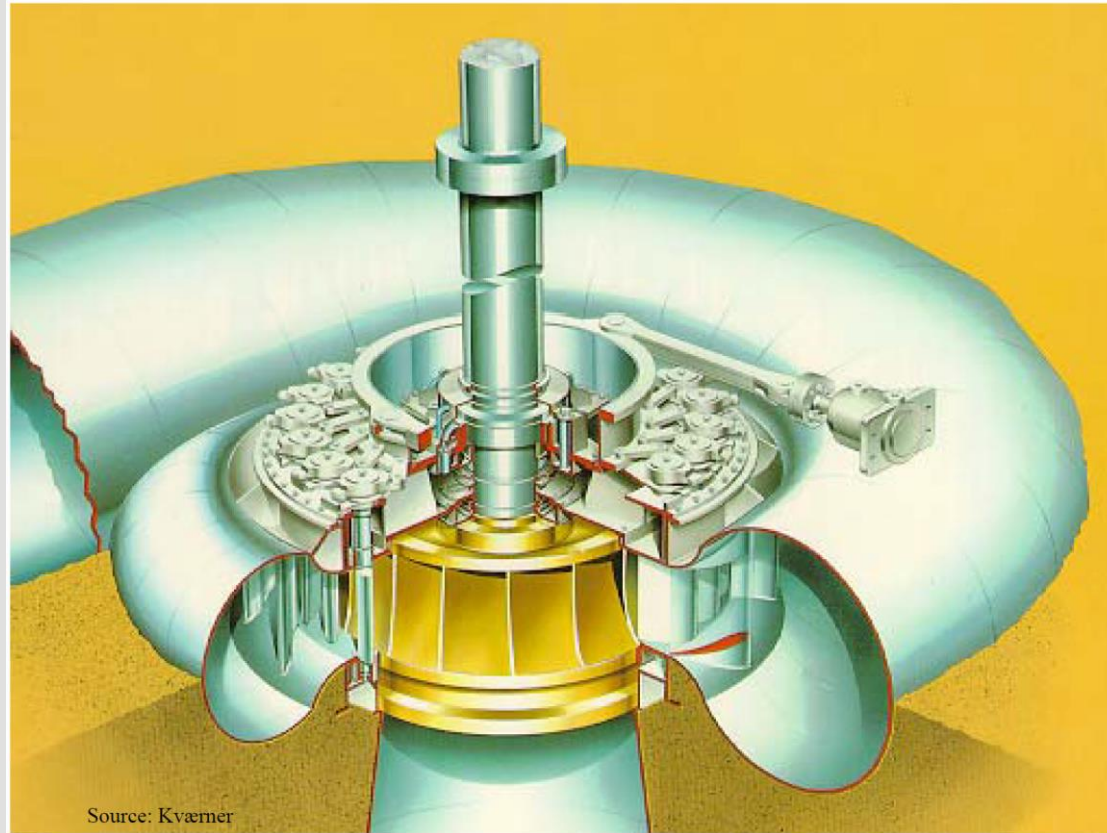
High Head Francis Turbines



Carl Bergan



Francis Turbine



Source: Kværner

Problems

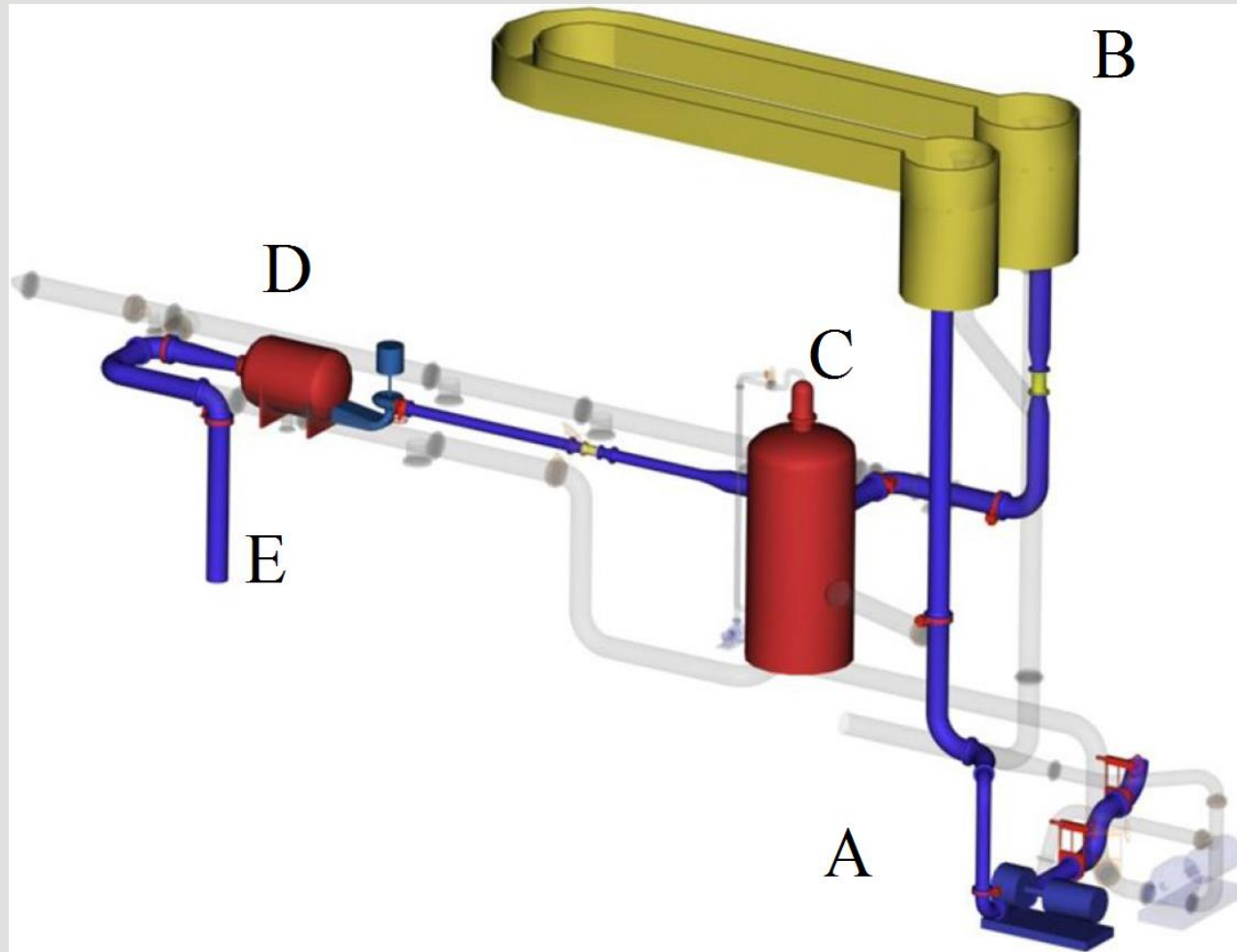
- Off-design + transient operation
 - Introduces bad flow conditions
 - Crack formation

Reduced Lifetime

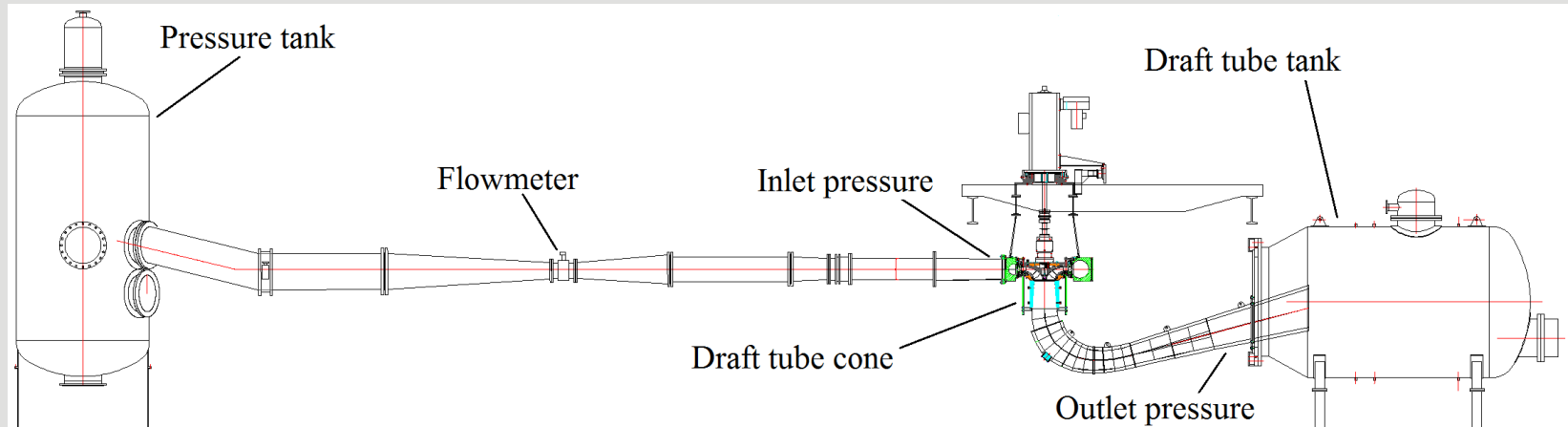
Possible Solutions

- CFD – predict problems
 - Need for validation
- Experimental – understanding the phenomena

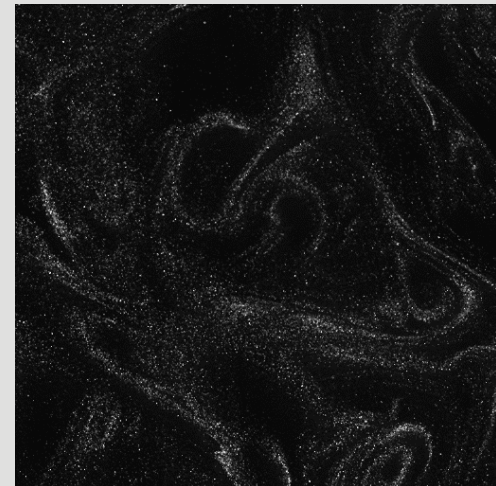
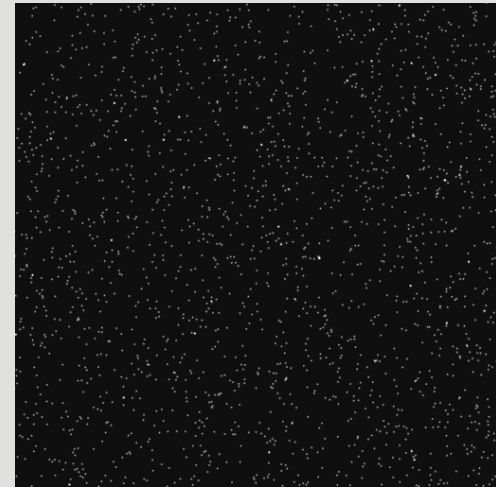
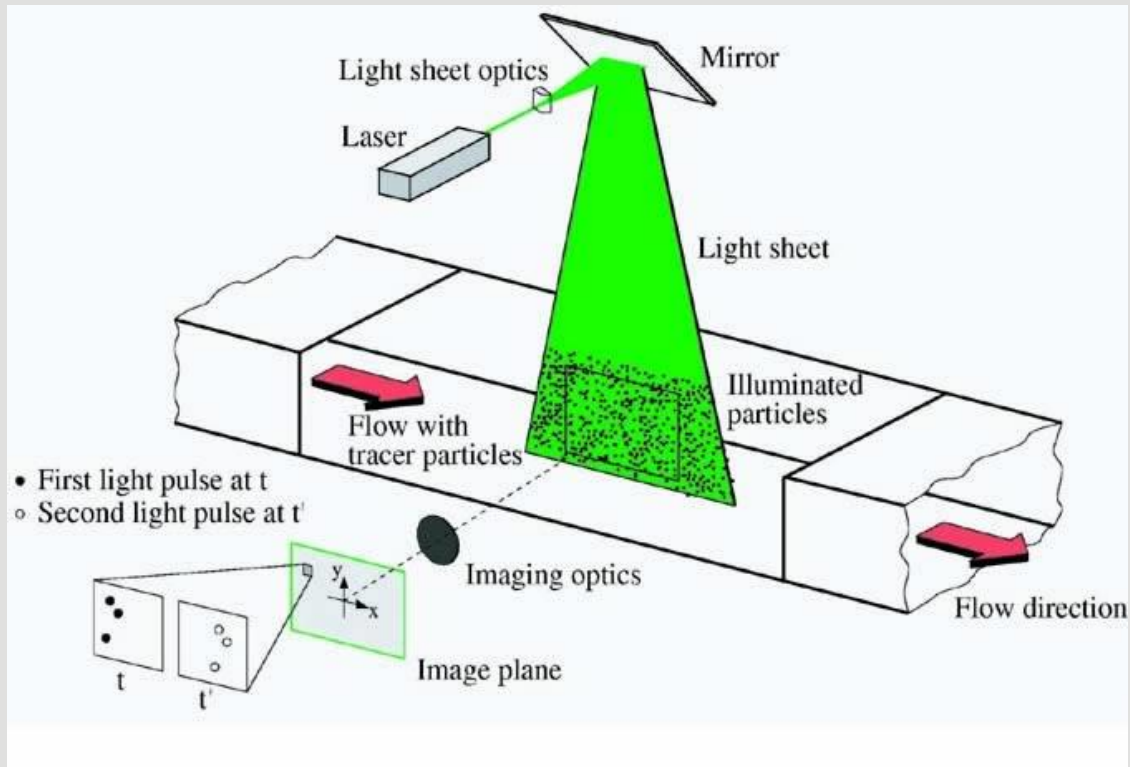
Experimental Setup



Experimental Setup



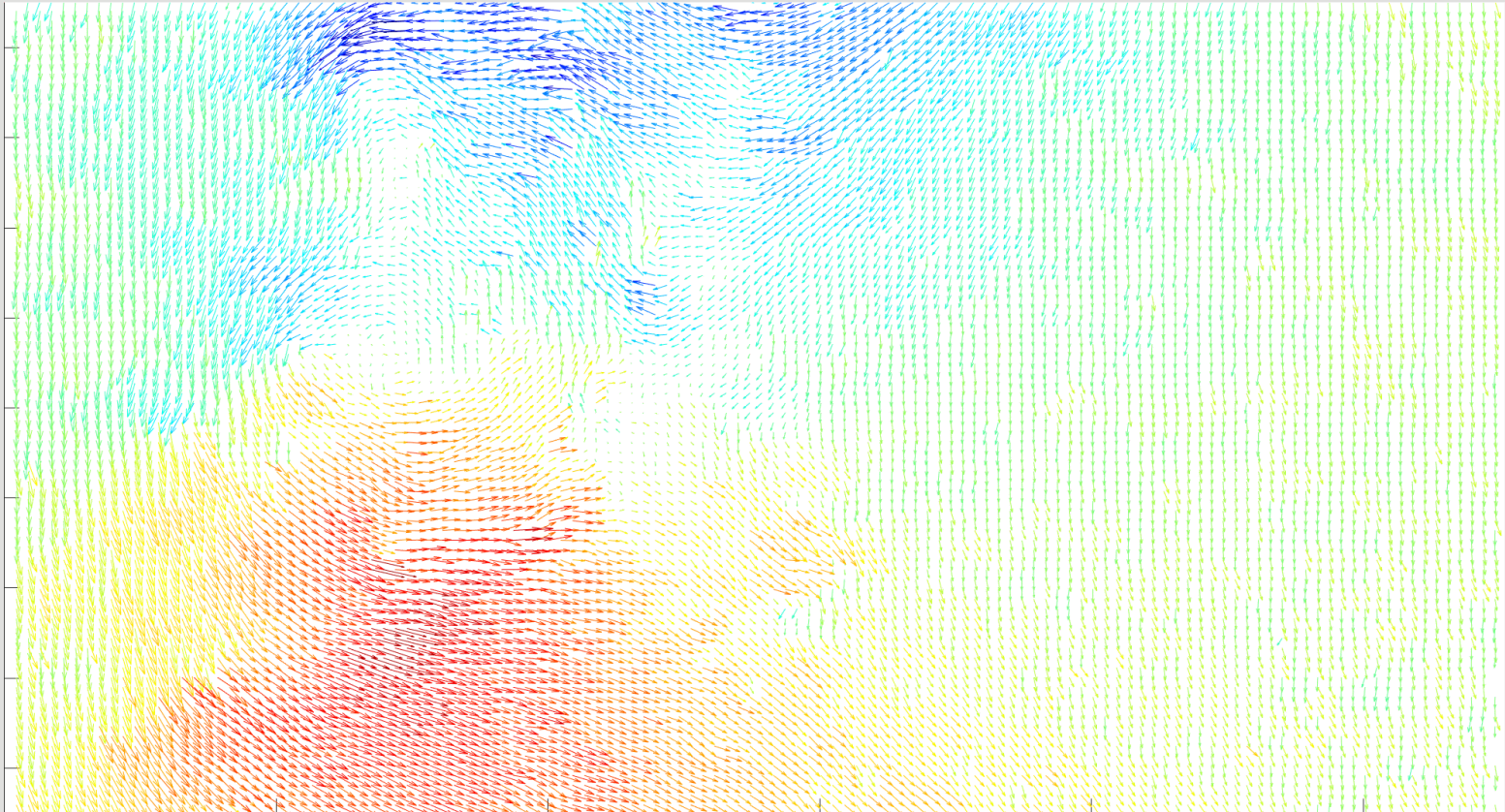
Velocity Measurements



Experimental Setup

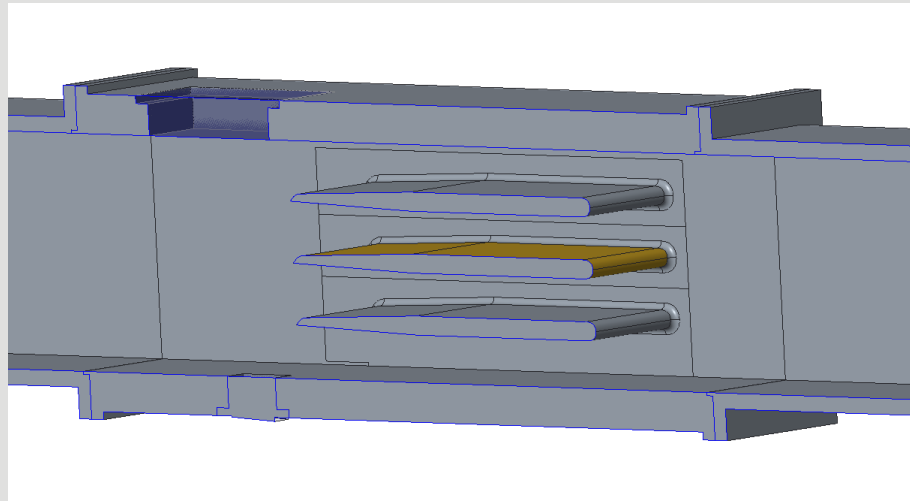


Velocity Results

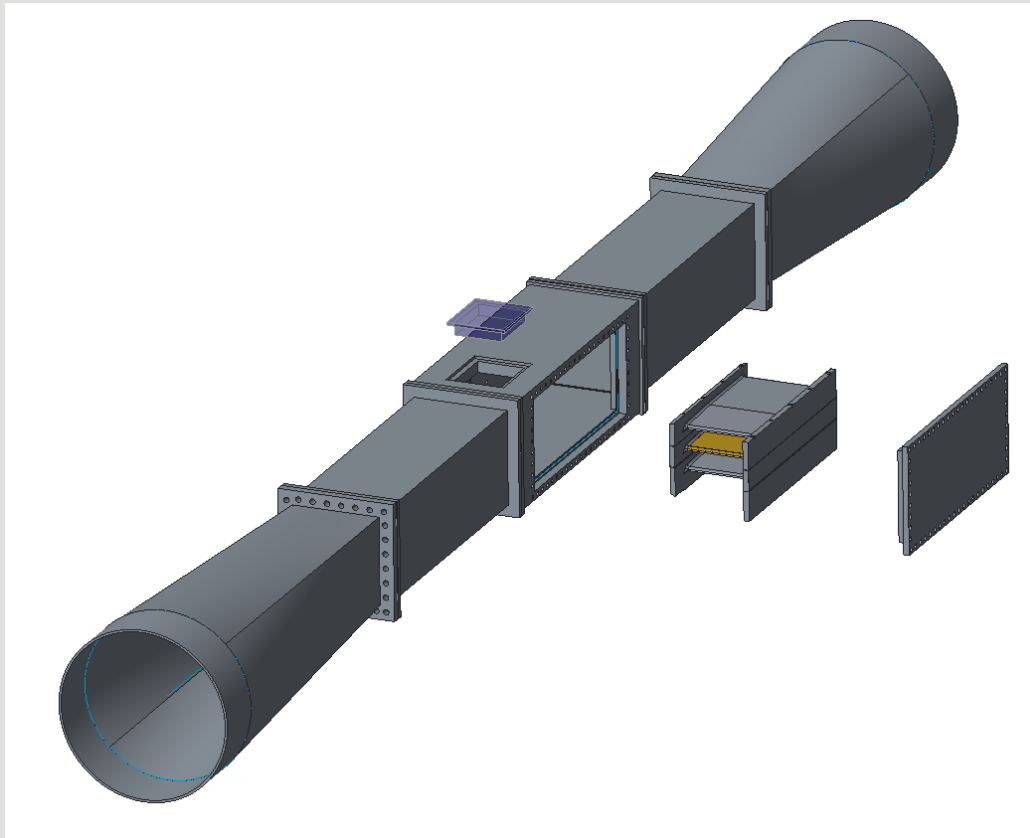


Blade Cascade

- Simplified turbine setup
- Experimental investigation
- CFD validation

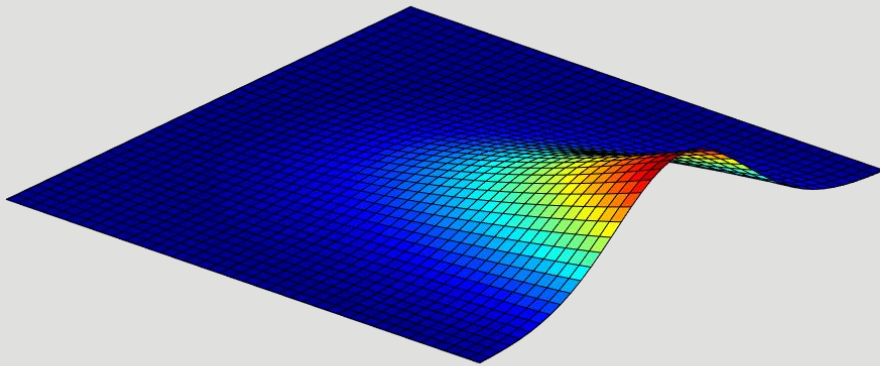


Blade Cascade Test Rig



Goals

- Blade behaviour in flowing water
- Available results ('Open Source')
- Pave the way for complex measurements



Thank You