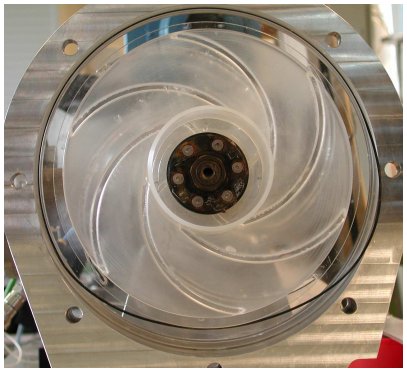
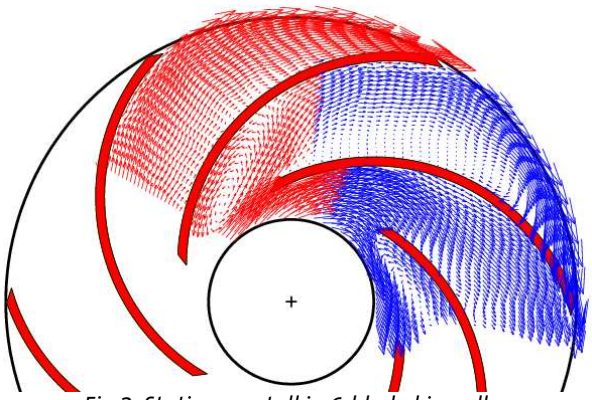
Task	Grundfos
Name	**Stall prediction model**
Description	Development of simple model to predict rotating stall phenomena based on phase-resolved velocity data acquired in the rotating passages of a centrifugal pump impeller
Purpose	**1) To develop a simple model that allows the prediction of the onset of stall phenomena based on reduced data sets of mean velocity or pressure data** **2) To reveal the influence of design parameters on stall phenomena.**
Background	At reduced flow rates, the performance of pumps is degraded by the inception of flow instabilities such as secondary flows and stall phenomena. Stall refer to zones of recirculating fluid which typically move in the circumferential direction but at a lower speed than the impeller. Phase-resolved velocity data were acquired within the rotating passages of a test impeller, see Fig. 1. Data acquired in a **6-bladed** impeller revealed the existence of a **stationary** stall phenomenon at part-load conditions [1-2].  *Fig 1: Impeller model.*  *Fig 2: Stationary stall in 6-bladed impeller.* Data acquired in a **7-bladed** impeller exhibited a flow very different from that in the 6-bladed impeller. It may be speculated that the uneven number of blades has caused the onset of a **rotating** stall, characterised by cells of stalled fluid rotating at subsynchronous speed in the impeller and/or diffuser. It is the purpose of this task to investigate this.
Data	Several gigabytes of raw data files with velocity data are available for the analysis. The LDV data were acquired at five different redial positions within the impeller. The sampling is phase-resolved, i.e. velocity samples were sorted into 360 angular bins based on their arrival time relative to a once-per-revolution pulse. In each bin, mean velocity vectors were calculated based on approximately 500 individual samples.
Tasks	- To develop methods for the detection of rotating stall based on non-equidistantly sampled time series of phase-resolved velocity data. - To establish simple models that that allows the prediction of the onset of stall phenomena based on reduced data sets of mean velocity or pressure data or global performance characteristics
References	[1] N. Pedersen, P.S. Larsen and C.B. Jacobsen, "Flow in a centrifugal pump impeller at design and off-design conditions. Part 1: PIV and LDV measurements", J. Fluids Engineering, Vol 125, pp 61-72, Jan 2003. [2] R.K. Byskov, N. Pedersen and C.B. Jacobsen, "Flow in a centrifugal pump impeller at design and off-design conditions. Part 2: Large Eddy Simulations", J. Fluids Engineering, Vol 125, pp 73-83, Jan 2003.