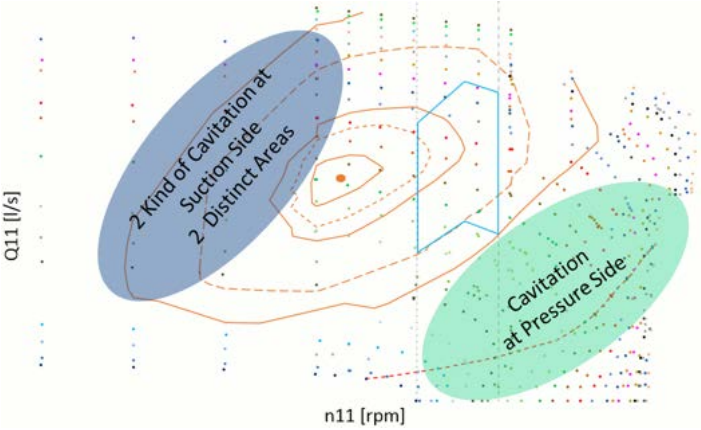
Cavitation at inner turbine runner

Innovative visualisation

CONTEXT

Cavitation is the phase change from a liquid state to a gas state. It happens when the instantaneous pressure locally in one liquid is lower than its vapor pressure. Cavitation has negative effects on hydraulic machines such as erosion, efficiency drop, vibration and noise. Cavitation is well known for reversible runner in pump mode. The varspeed technology makes it necessary to focus on inlet cavitation in turbine mode. In turbine mode, different types of cavitation can be observed depending on the position of the operating points. At the runner inlet in turbine mode, 2 kinds of cavitation can be observed: cavitation at pressure side and cavitation at suction side.



The cavitation at the runner exit has already been well studied for several years thanks to Plexiglas cones positioned below models. But cavitations at the runner inner are difficult visualise because of the difficulties of accessing this area. The few studies ever done generally had a very small viewing window size (endoscope) and did not allow for quality observation of these cavitations.

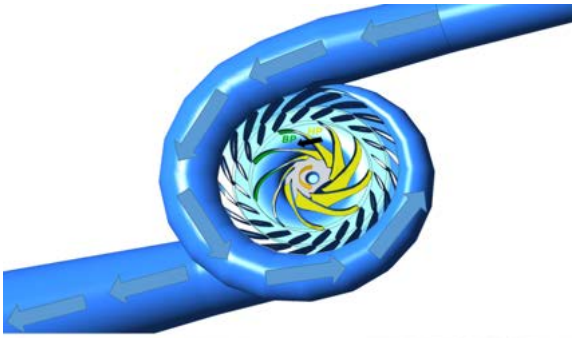
TECHNOLOGY DESCRIPTION

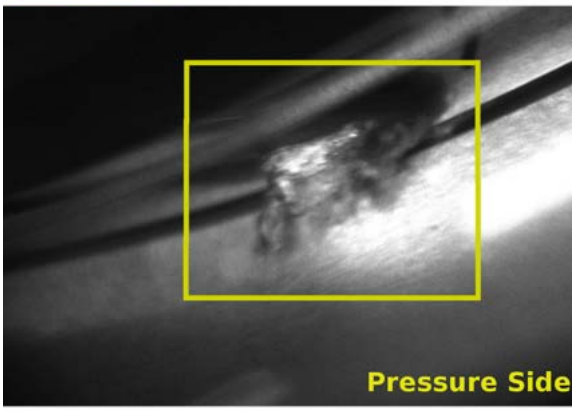
In this study, the design of the FL_SUP SGI TP001-31-001-01 head cover enables the observation of both the pressure and suction side cavitations in turbine mode thanks to its large viewing windows (SGI TP01 92-001-01). Users have a direct view of the region between the gate vane and the runner inner. Excellent pictures of the cavitations have been achieved by associating a high resolution camera with a lighting system. For cavitation at the runner suction side inner, 2 kinds of cavitation can be seen. A mapping of these cavitation limits was completed and Eta-sigma curves were performed at 2 operating points.

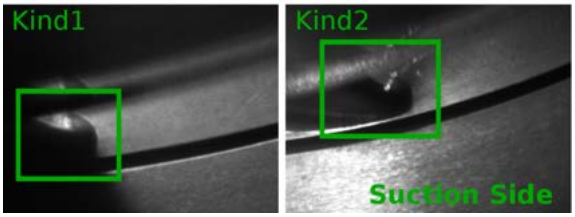
TRL SCALE

1 2 3 4 5 **6** 7 8 9

Tests on Platform TM1







APPLICATION DOMAIN

Design of pump-turbine runner

ADVANTAGES

Innovative study: first time observation

Reducing time for a next complete study

DELIVERABLES

Drawing and Creo model of :
- FL_SUP SGI TP001-31-001-01 head cover
- SGI TP01 92-001-01 standard windows

Technical and test report including:
- all observations
- all limits