

# Pump Cavitation Characteristic & Performance Maps

## Summary

### Goals:

Verify cavitation prediction in a centrifugal pump through AxSTREAM's 1D code, and compare the performance maps obtained using 3D CFD and AxSTREAM.

### Requirements:

Determine cavitation characteristic of the pump using 3D CFD, including critical points:

- 1) Cavitation inception ( $h_i$ )
- 2) Head drop appearance ( $h_1$ )
- 3) Drop in pressure of 3% ( $h_{3\%}$ )
- 4) Critical cavitation ( $h_s$ )

Compare AxSTREAM's  $NPSH_R$  prediction with the 3D CFD results.

### Parameters:

Study Object = Centrifugal Water Pump  
 Impeller Diameter = 328 mm  
 Rated Mass Flow Rate = 287 kg/s  
 Rated Shaft Speed = 6000 RPM  
 Rated Total-Total Head = 424 m

### Constraints:

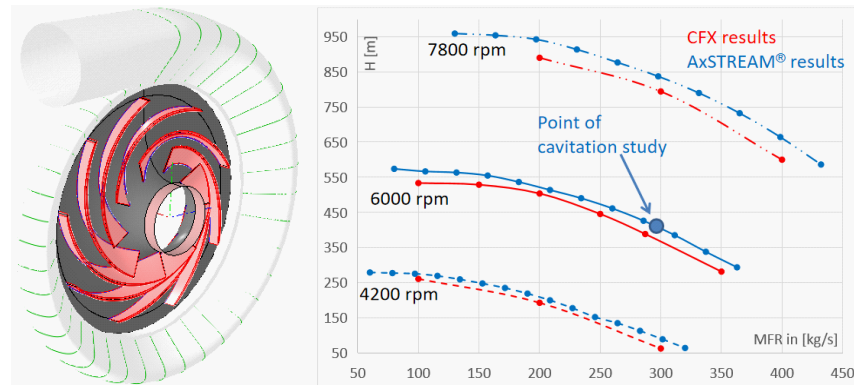
The inlet pressure is varied as means to obtain a cavitation characteristic. MFR and shaft speed are constant.

### Results of the Study:

The point of  $NPSH_R$  determined by AxSTREAM lies to the right of the drop in head (3%). This provides a margin for cavitation and ensures that the  $NPSH_R$  point does not lie in the proximity of the critical cavitation point. The performance map obtained from the AxSTREAM results is in good agreement with the 3D CFD results.

## Pump Analysis

Comparison of the pump performance map is based on the rapid results from AxSTREAM's 1D models and a 3D CFD method. Results are in close agreement.



Based on the results of the 3D CFD calculation, the cavitation characteristic is plotted, and the critical points are determined. The AxSTREAM  $NPSH_R$  prediction is also shown.

