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## The Design & Analysis of a low NPSH Centrifugal Pump Featuring a Radial Inlet & an Axial Inducer using STAR-CCM+



The design of low Net Positive Suction Head (NPSH) pumps requires special attention. The subject pump stage is part of a two stage pump. The pump is required to possess a very large range of operation at very low inlet pressures. The pump also has a very large shaft that restricts the inlet bladed flowpath area, thus raising inlet flow velocities and decreasing local static pressures.

Compounding difficulties, this pump requires a radial inlet that will quickly transition the flow from radial to axial. Radial inlets have a unique problem of creating a circumferentially uniform flow at the inlet to the bladed flowpath. The combination of the four issues (low NPSH, large shaft, radial inlet, and large operating flow range) demands very careful calculations to ensure success. The flow analysis will have to be able to account for cavitating flows over the entire operating flow range. The components of the pump stage (radial inlet, axial inducer, radial impeller, vaneless diffuser, crossover, and de-swirl cascade) will have to be coupled together and be able to assess the steady and unsteady interactions. The flow analysis will also need to assess the effects of cavitation on the local components, as well as the overall performance of the stage.

STAR-CCM+ was selected to perform the flow analysis. This presentation will demonstrate the effectiveness of the design to achieve all of its hydraulic goals, and how STAR-CCM+ was able to solve this extremely complex problem.

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**Industries:**

**Products:**

**Conference:**

[STAR Global Conference 2013](#)<sup>[2]</sup>

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