

WP6.2: Design of Surge Tanks



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CEDREN project: HydroPeak

Norwegian hydropower plants are subject to an increasing amount of hydro peaking. The surge tanks in existing hydropower plants are seldom designed for modern hydropeaking operation, which have caused damage and restrictions on operation in some hydropower plants as the surge tank capacity was exceeded.

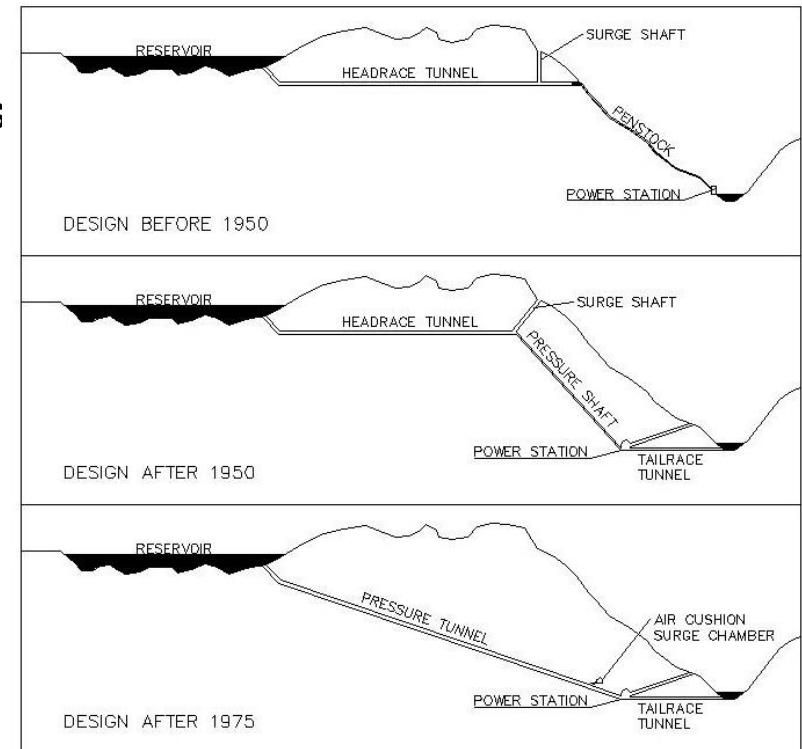
Design of existing surge tanks will be reviewed, and testing of new design will be conducted in the hydraulic laboratory at NTNU. In-situ measurements from existing surge tanks will be conducted, and used to develop, calibrate, and validate physical and numerical models for the research.



Photo: Sira-Kvina Kraftselskap

Motivation

- ▶ Possible construction of large pumped storage plants in Norway
- ▶ Surge tanks govern the hydraulic forces in hydropower waterways
- ▶ Better surge tank design means:
 - Increased regulation capabilities
 - Reduced design pressures
- ▶ Especially important for hydropeaking and pumped storage



Scope of Work

- ▶ Review of existing surge tank design
 - Norwegian and Alpine
- ▶ Gain better understanding of physics
- ▶ Further development of surge tank design



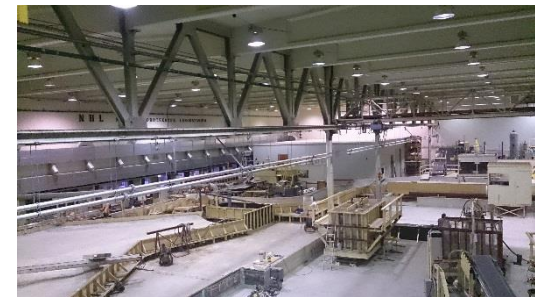
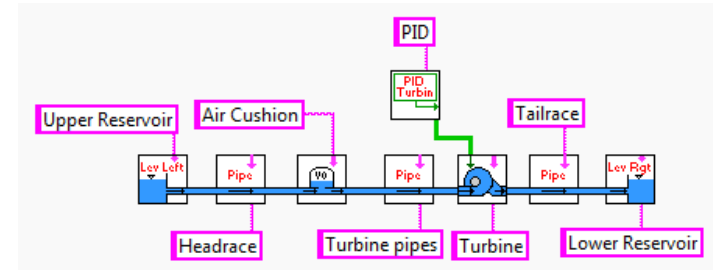
Work plan

- ▶ State-of-the-art review
- ▶ Field measurements
- ▶ Physical and numerical modelling
- ▶ Testing of new technology
- ▶ Further development of surge tank design



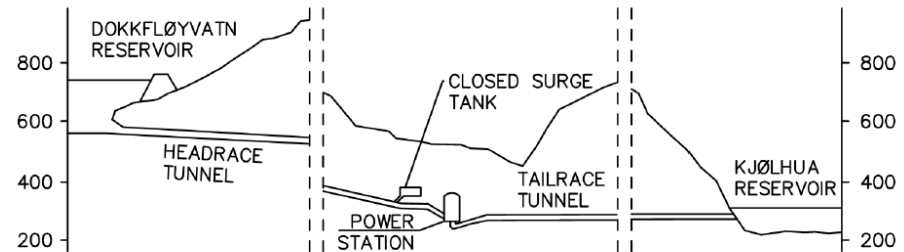
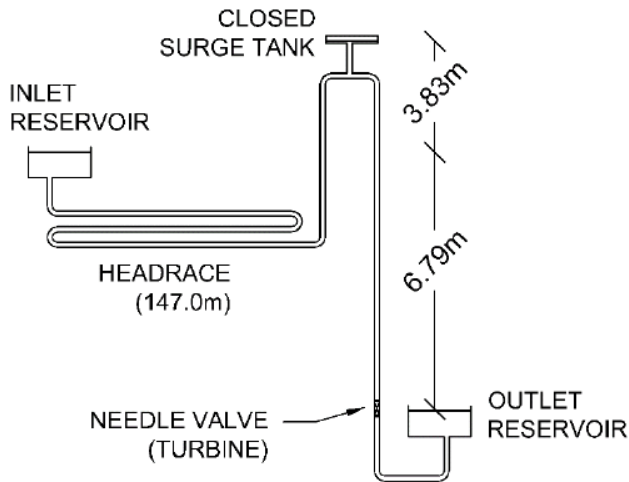
Current status

- ▶ State-of-the-art review
- ▶ Field measurements
- ▶ Physical and numerical modelling
- ▶ Testing of new technology
- ▶ Further development of surge chamber design



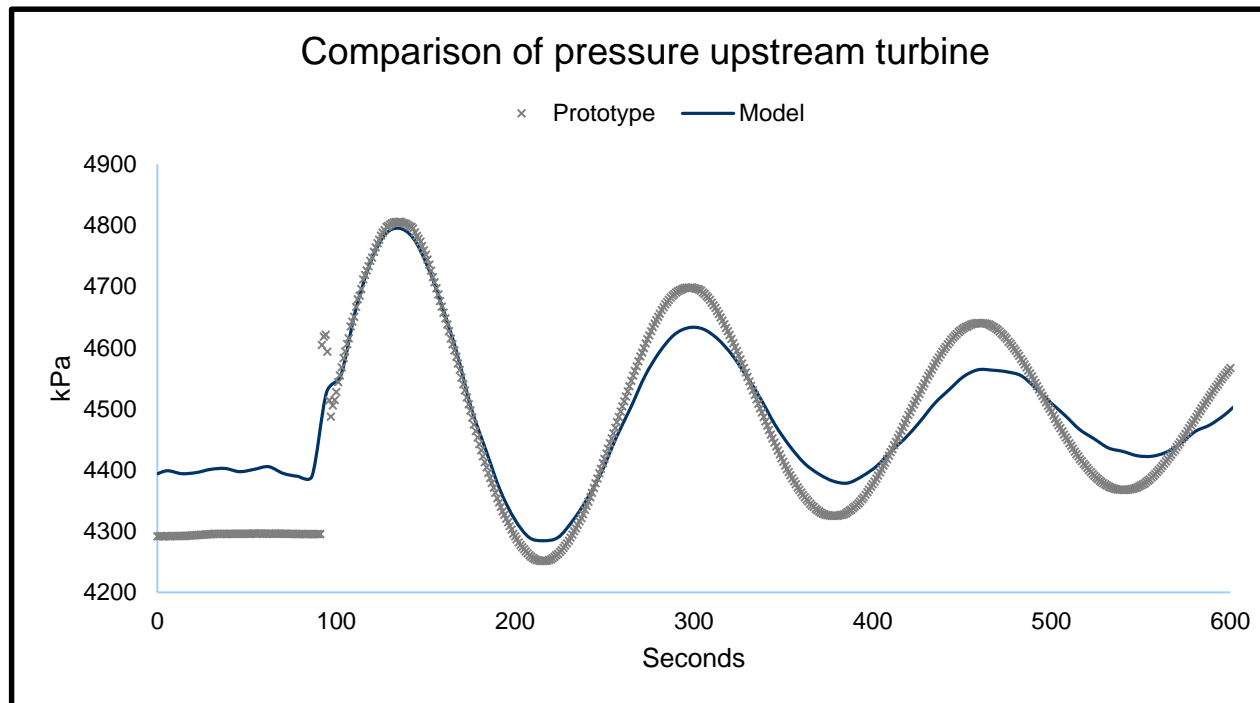
Ongoing research

► Physical modelling (financed by CEDREN!)



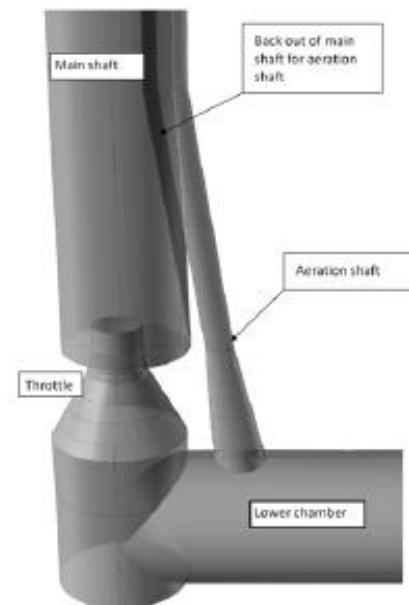
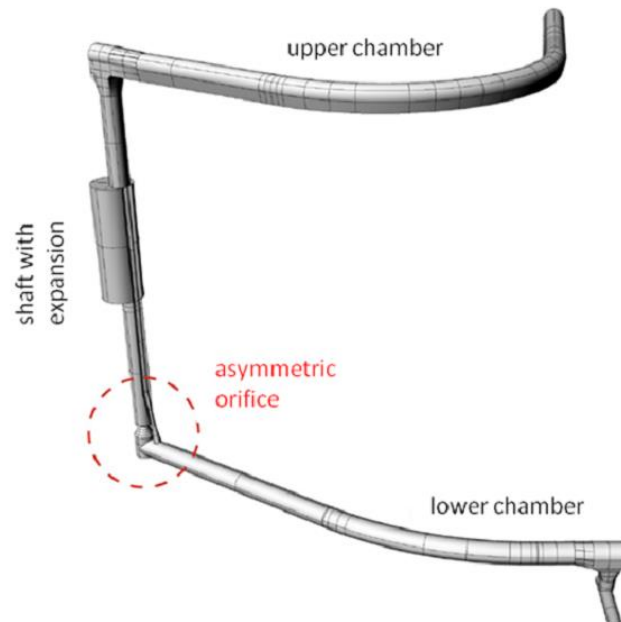
Ongoing research

► Physical model validation



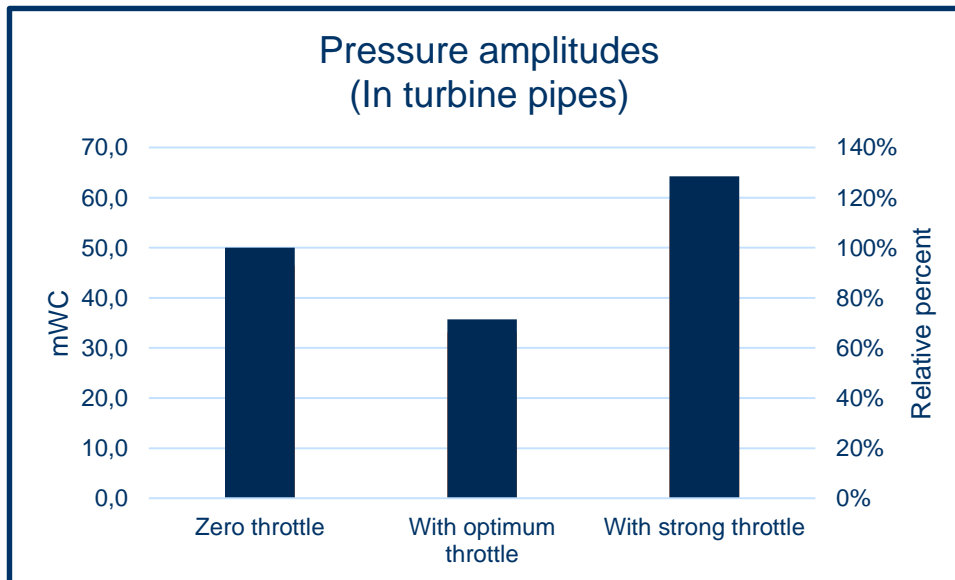
Ongoing research

- ▶ Test of surge tank throttling
 - Example from Reisseck II (430 MW)



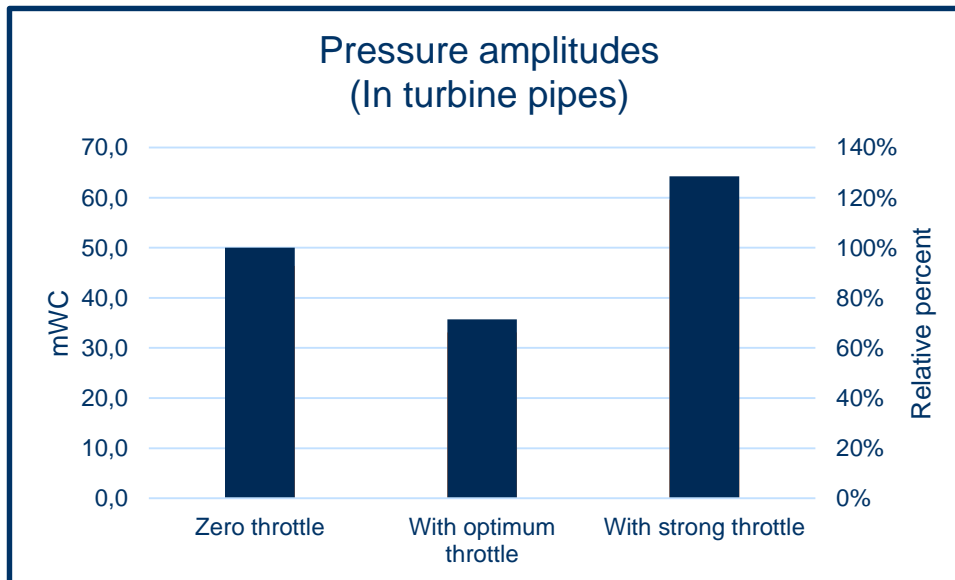
Ongoing research

- ▶ Testing in physical model
- ▶ Determine optimum throttle



Relevance for CEDREN users

- ▶ Allow more “aggressive” operation
- ▶ Reduce size and cost for new surge tanks
- ▶ Improve grid frequency



“Side” Projects

- ▶ Throttling of Surge Tanks in Tonstad power plant
- ▶ Steel tank air cushion for Usma power plant

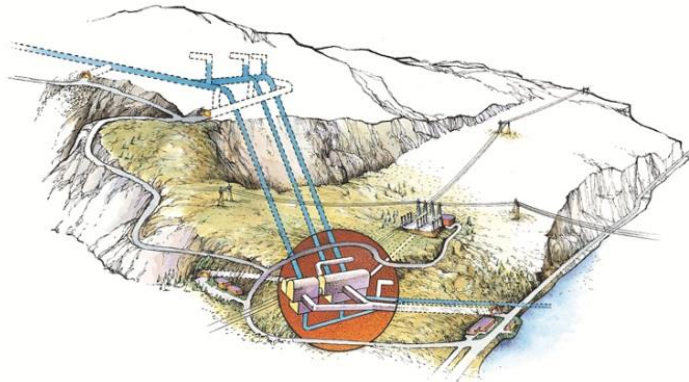


Figure: Sira-Kvina Kraftselskap