Background

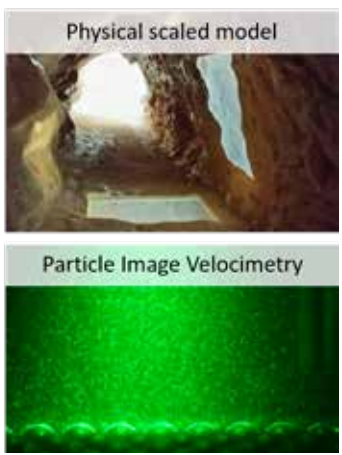
This project addresses the hydraulic resistance of unlined (rough) hydropower tunnels, essential both for power production and flood control. The determination of the hydraulic capacity of such tunnels requires the knowledge of friction factors whose determination is mostly based on empirical approaches. Thus, despite their significance, friction factors are considered as an uncertain component in the design of tunnel waterways.

Methodology and outcome

- Friction losses and the flow field measured in scale model studies with miniature versions of the tunnels constructed through computer-controlled milling.
- High resolution PIV measurements as a benchmark for numerical simulations.

The Tunnel Roughness project is a Knowledge-building Project for Industry funded by the Norwegian Research Council and a consortium including NVE, TrønderEnergi, BKK and NVKS. More information and updates can be found at www.ntnu.edu/nvks/tunnelroughness

Courtesy: Kari Bråtveit & Hibbard Inshore.



Courtesy: Pierre-Yves Henry & C. Ushanth Navaratnam

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Hydraulics of unlined tunnels: Experimental investigations

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