mhylab Our passion, your solution.

Pelton Turbines

Operation range

Net head between 60 and ~1000 meters Design flow between 0.1 and 5.0 m^3/s

An optimal solution for small, high-head hydropower plants

Since 1997, Mhylab has developed a large range of hydraulic profiles for Pelton turbines dedicated to small hydro, for heads between 60 and up to 1000 meters.
On the basis of model test, and applying the laws of similarity defined by international standards, Mhylab can offer hydraulic designs perfectly adapted to each site, with guarantees of high performances and optimal hydraulic operation. Available in configurations of one to 5 nozzles, with either vertical or horizontal axis, with or without back-pressure, Mhylab's design allows for multiple implementations.

Performance – Reliability – Profitability

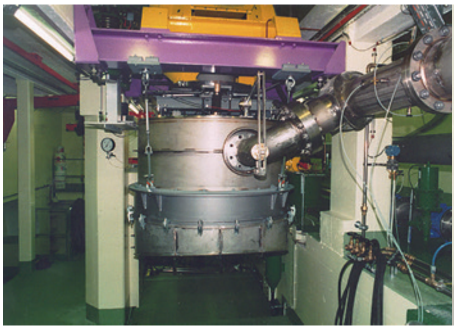
A solution suitable for:

- Storage power plants
- Run of river hydro-projects
- Water networks
- High-head site-refurbishments

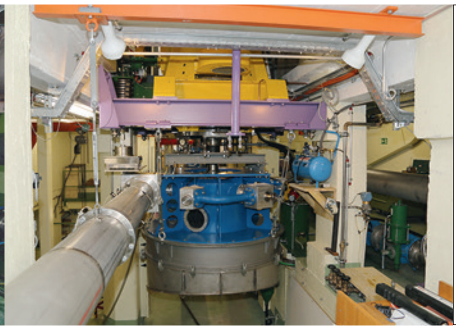
Scale model developments

The design offered is based on the results obtained from scale model developments performed on our test bench.

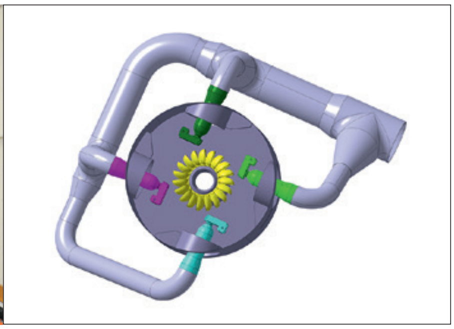
- Mechanical and hydraulic design of the scale model
- Turbine bucket design and CFD calculations
- Model tests (efficiency, cavitation, runaway)
- Performance optimisation



Two-nozzle Pelton turbine on the test bench



6-nozzle Pelton turbine on the test bench



Bottom view of the hydraulic design of a 4-nozzle turbine

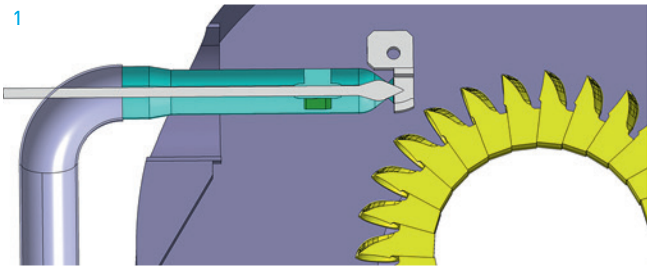
These developments have had the support of the Swiss Federal Office for Energy (OFEN), and of the Fund for projects and studies of the electric economy (PSEL).

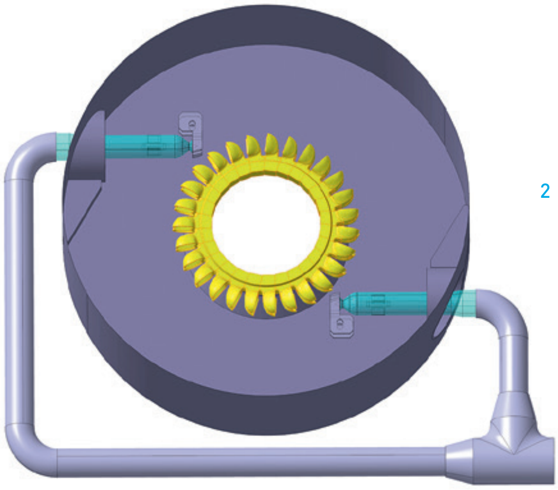
Definition of a systemised hydraulic profile

In order to adapt to the specificities of small hydro, Mhylab developed a so-called systemised hydraulic profile (as opposed to “standardised”) for vertical axis turbines, characterized by:

- A runner built so as to be homologous with the tested profile, and fitted with buckets specially designed according to the site’s characteristics.
- Nozzles designed specifically to fit the site’s characteristics, adjusted according to the turbine’s flow and head, equipped with deflectors.
- A circular housing enables optimal water discharge by avoiding splashing and limiting ventilation losses.
- A manifold designed with standard pipe elements so as to simplify construction, and reduce manufacturing costs while warranting high performances.

1





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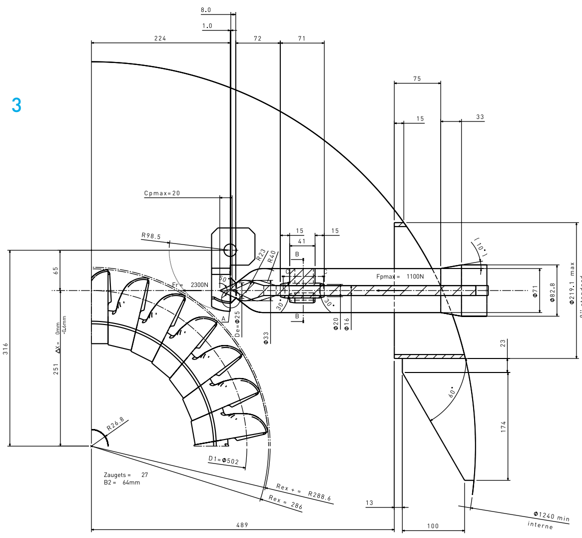


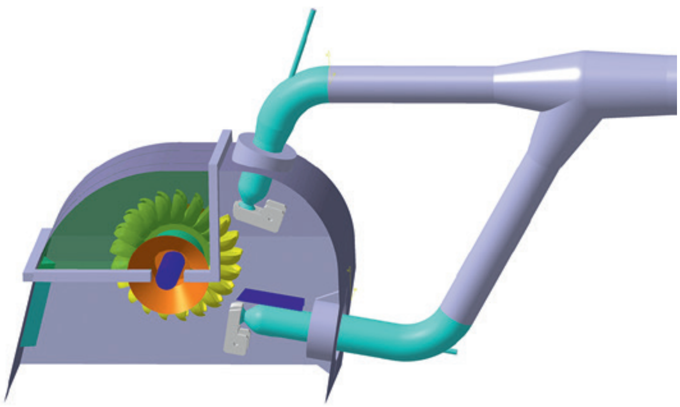
1 Side-view of the nozzle’s hydraulic profile, needle-valve closed and the deflector in high position (jet not deflected)

2 Bottom view of the hydraulic profile of a 2-nozzle Pelton turbine

3 Example of 2D drawing of the nozzle hydraulic profile (rod, needle and nozzle guide-vane)

Horizontal-axis turbines are designed along the same principles. If the nozzle elbows can be considered as standard, the tee of the manifold will be replaced by a wye junction specially designed for each turbine.

The systemisation approach allows a specific turbine to be designed, perfectly adapted to the characteristics of each site.



Example of the hydraulic profile of a horizontal-axis turbine, with two nozzles, water baffles, protection screens and water boxes

Various configurations and settings

The Pelton turbine can be set up in to the following configurations:

- With either a vertical or a horizontal axis, according to the size of the powerhouse, and the position of the penstock

- With a number of nozzles which allows optimisation according to turbine flow, speed of rotation and investment.
Mhylab offers configurations with up to 2 nozzle for horizontal axis turbines, and up to 5 nozzles for those with a vertical axis.

- With a manifold adapted to the project's constraints. Mhylab offers a manifold equipped with standard parts, as well as the option of an optimal hydro-dynamic profile, which allows turbine performance to be maximised, and the space occupied to be reduced.

- With a runner operating within a housing at atmospheric or at back-pressure, a useful option when the turbine is set up below downstream-level, as when it is integrated in a drinking-water network.

Examples of turbines built on the basis of a Mhylab's hydraulic profile

Icogne (CH) 4-nozzle turbine, used in an irrigation system (Q = 0.473 m^3/s, Hn = 479 m, Dext= 1018 mm, 1000 rpm, Pm = 1996 kW)

Lafarge (France) 4-nozzle turbine set up with a manifold in the runner's plane (Q = 0.590 m^3/s, Hn = 85 m, Dext = 838 mm, 600 rpm, Pm = 435 kW)

Profray, 2-nozzle turbine, running on raw wastewater (Q = 0.100 m^3/s, Hn = 430 m, Dext = 648 mm, 1500 rpm, Pm = 380 kW)

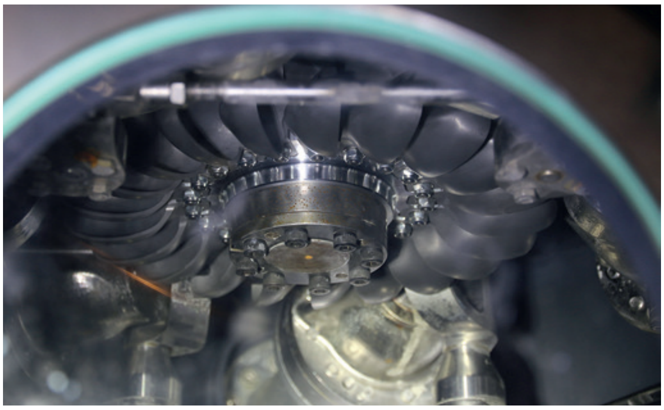
Haute-Pierre (CH) back-pressure turbine, integrated in a drinking-water network (Q = 0.083 m^3/s, Hn = 104 m, Dext = 654 mm, 765 rpm, Pm = 76 kW)

La Gorge (France) horizontal axis, 2-nozzle turbine. (Q = 0.900 m^3/s, Hn = 440 m, Dext = 1120 mm, 1000 rpm, Pm = 3487 kW)

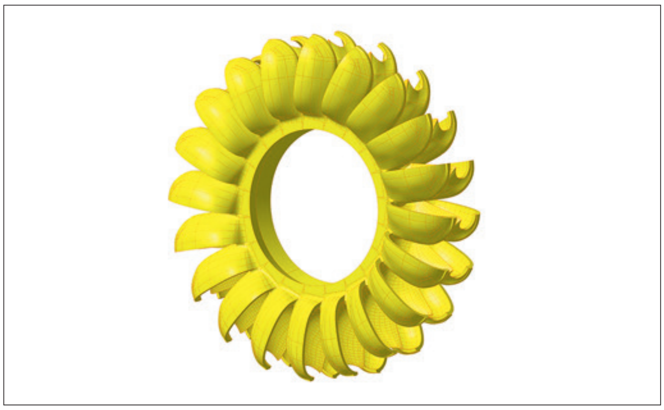
Various types of runners

Mhylab can offer 3D-format hydraulic profiles of runners, be they casted, entirely machined, or with mounted buckets.

This process insures homology between the runner's tested profile, and the one actually built.

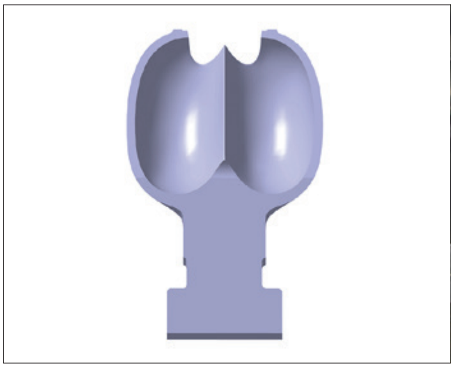


Scale model of runner and attached buckets, tested on Mhylab's test bench

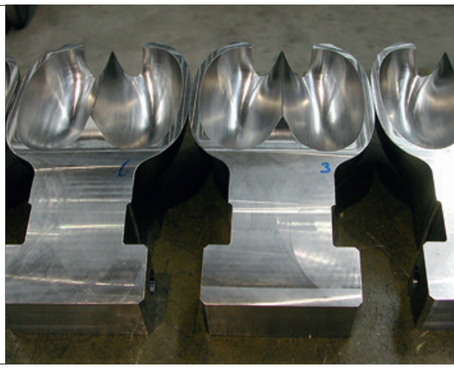


3D view of the single block runner of Montsapey (France)
(Q = 0.350 m³/s, Hn = 260 m, Dext = 1026 mm, 750 rpm, Pm = 791 kW)

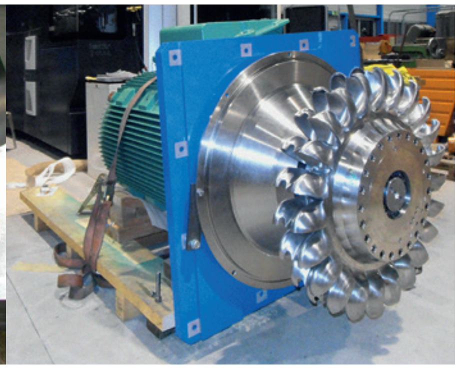
Turbine buckets of SITSE (CH), which uses treated waste water
(Q = 0.170 m³/s, Hn = 83 m, Dext = 622 mm , 742 rpm, Pm=115 kW)



3D view of the hydraulic profile

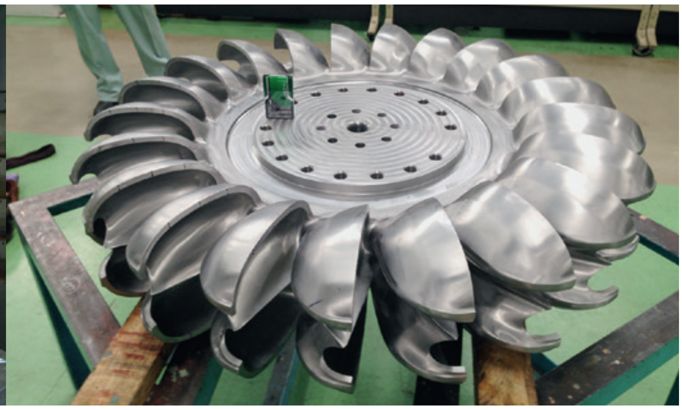


In the workshop, after machining



In the workshop, after assembly

CNC Machining of the whole runner



Entirely CNC machined turbine runner of Funama (Japan)
(Q = 0.586 m³/s, Hn = 205 m, Dext = 1026 mm, 720 rpm, Pm = 1170 kW)

Q= design flow, Hn = net head at that flow, Dext = runner external diameter, Pm = mechanical power

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