Motivation & Objectives
Numerical flow simulation is a major tool for various industrial applications such as performance prediction for hydraulic turbines. This work is based on a CFD study performed on a low head Kaplan turbine. Simulations include the semi-spiral casing, the tandem cascade, and the runner. A comparison is made between the results obtained on the model test and the numerical computations for validation. The experimental measurements made on the model testing at Alstom Power Hydro R&D in Grenoble have given the hill chart for the turbine studied. The main goal is to understand the head losses occurred in each component of the turbine. The Kaplan turbine featuring a double control system, leads to numerous calculations for different guide vane openings and runner blade angles in order to understand the behavior in various configurations.

Geometry
The geometry of the domain is modeled in order to fit the different mesh generation software. Both software are used for the mesh generation: Ansys Iceorm release 13.0 and AutoGrid from Numeca. The pretreatment of the geometry is realized on Autocad, Scilab and Excel.

Meshing
The Mesh used for the simulation is unstructured for the spiral casing and structured for the tandem cascade, and the runner computation. The spiral case is composed of 6.5 mio nodes while the tandem cascade and the runner’s meshes feature around 2 mio nodes.

Computation parameters
Inlet conditions:
- Mass flow rate specified

Outlet conditions:
- Static pressure specified

The scheme is robust and convergence criteria is obtained

Results
The results of the simulation shows the flow behaviour in the turbine. The efficiency is thus computed and specific head losses are highlighted on particular regions.

Validation of the simulation
The draft tube losses are deduced from the model test results and the computed results. The overall results obtained by numerical flow simulation show close similitude to the model test. To complete the study a numerical flow simulation should be driven on the draft tube.