

The eStorage project

WP1 Presentation



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eStorage project : WP1



Objectives and organisation

Objectives :

- Demonstrate the feasibility and benefits of converting a large size unit into variable speed : Le Cheylas Unit 2
- Perform operational tests of the modified unit
- Measure the business model improvement
- Generalize results from the demonstration plant and provide data for WP3
- Develop various “standard “ solutions for conversion of most European fixed rotating speed pumped hydro storage units into variable speed units

Organization :

- EDF : Hydro & research & development Divisions
- ALSTOM Grenoble (turbine), ALSTOM Birr (DFIM)

eStorage
ambition :
« Deploy flexible
PSPs across the
EU and enhance
grid
management
systems to
support the
integration of
renewable
energy »

Upgrade of le Cheylas PSP



Presentation of Le Cheylas PSP

EDF power plant, located in the French Alps

- Commissioned in 1979
- 2 identical 235 MW reversible units

A plant with two purposes :

- Electricity generation (Arc river inflows)
- Electricity storage, on a daily cycle

Demonstration proposed : conversion of unit 2 to variable speed technology

- Increased efficiency in both turbine and pump mode
- +/- 40 MW regulation in pumping mode



Upgrade of le Cheylas PSP



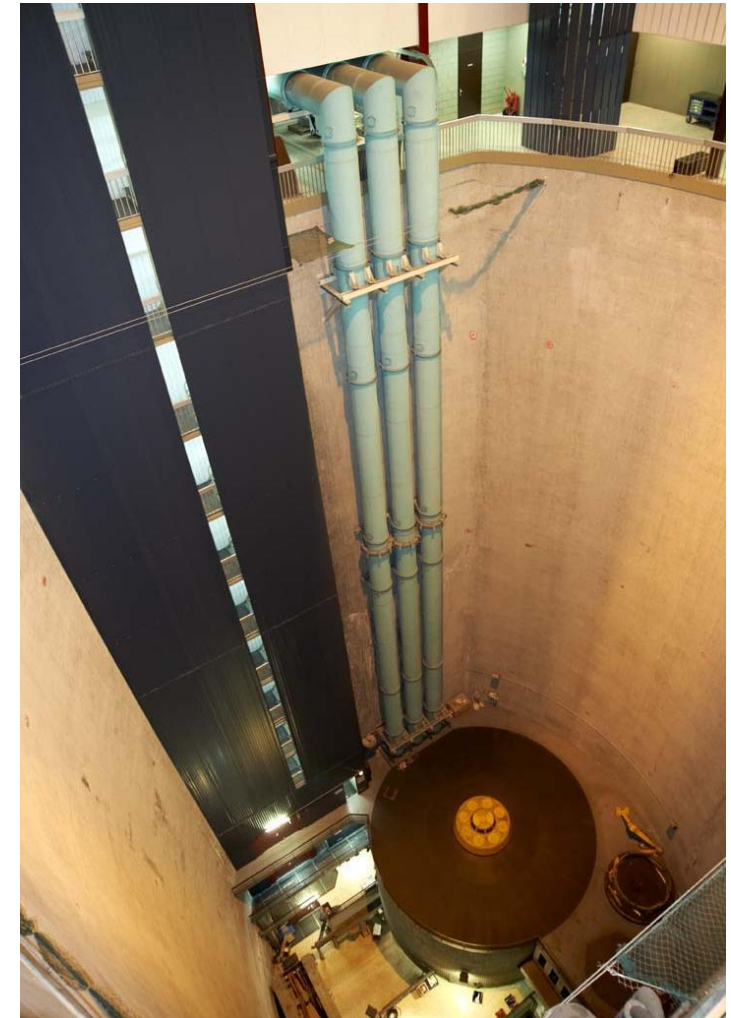
Main modifications and challenges

Modifications:

- Replacement of runner, wicket gates, and turbine head cover
- Replacement of Motor / generator
- Addition of electronic equipment (VSI)
- New SCADA

Challenges :

- Gain as much efficiency as possible with a fixed runner elevation
- Optimize size and weight of the new motor generator stator to reduce modifications of the generator supporting structure
- Define appropriate handling equipment for the varspeed rotor



WP1 Actions



Reminder of 2013 results

Performance targets

Set in early 2013.

Unit Design and Model Test, AHF

- Model test (end 2013) : completed, efficiencies are slightly higher than assumed and pump operating range should be wider
- Simulations conducted by the VSI manufacturer : validate the compliance with the French grid code (harmonic studies, short circuit studies, drop in voltage, analysis of unit start-up and shut-down sequences)

WP1 Actions



2014 Results & progress

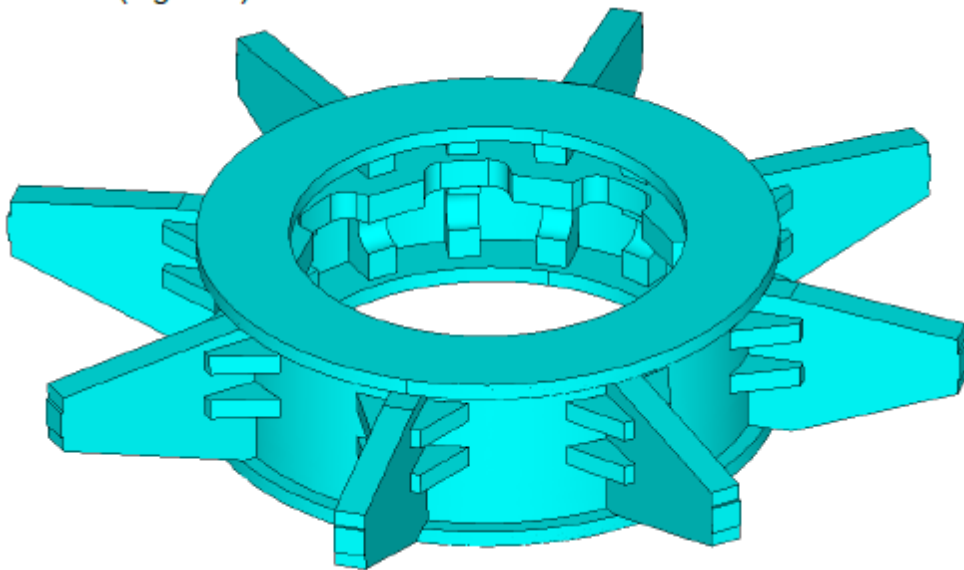
- Circuit breaker to be used for the DFIM : basic design completed,
- Main transformer : the ABB simulations show that no over specification is needed,
- Civil structures : The modifications to the generator supporting slab to take the load and torque created of the DFIM have been defined,
- Cooling system : can be modified to accommodate the cooling needs of the new equipment,
- Handling : specific temporary equipment will be required for lowering the rotor into the pit, and then maintenance of the rotor will be performed in place as the plant travelling cranes will be able to lift the new stator

Procurement of the pump-turbine new components, and of the new generator-motor is launched

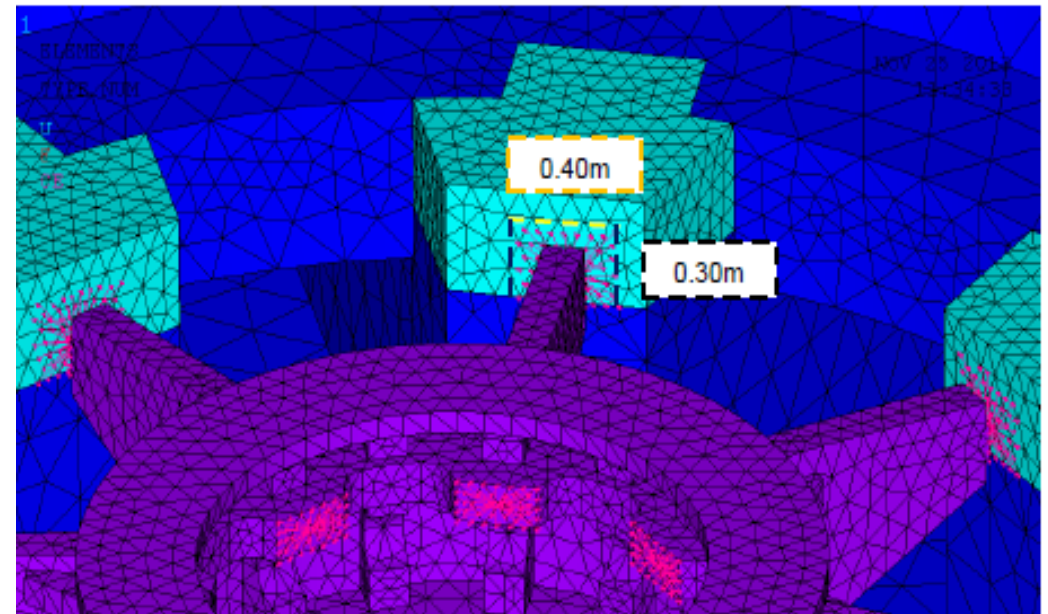
New intermediate bearing design



Geometry



Design of anchoring metallic plates

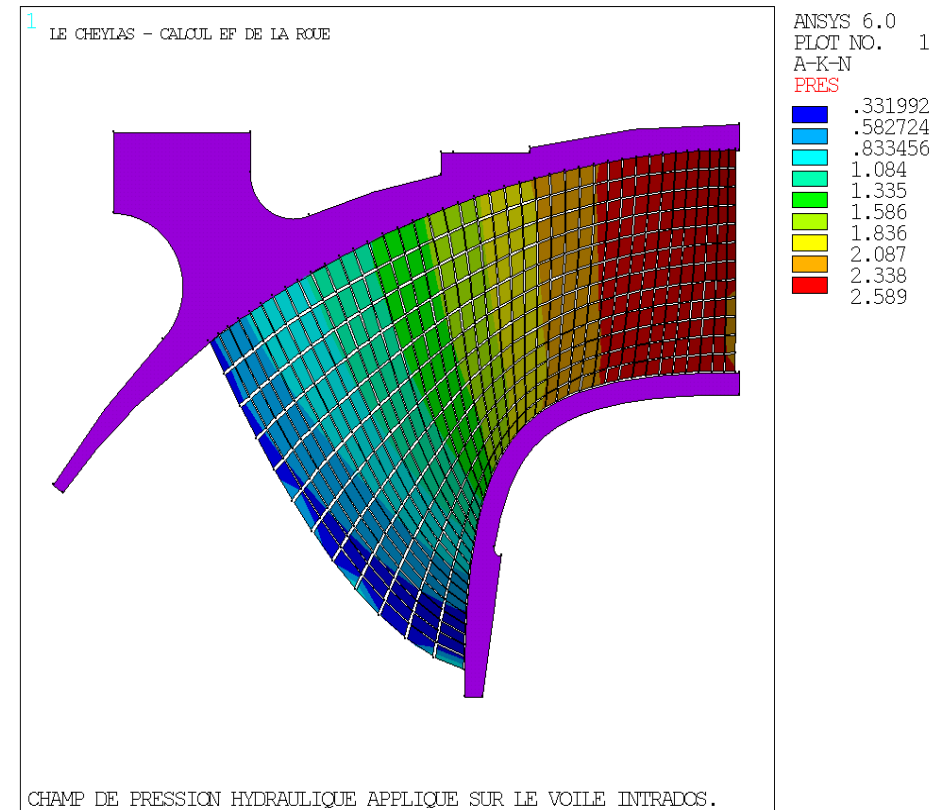
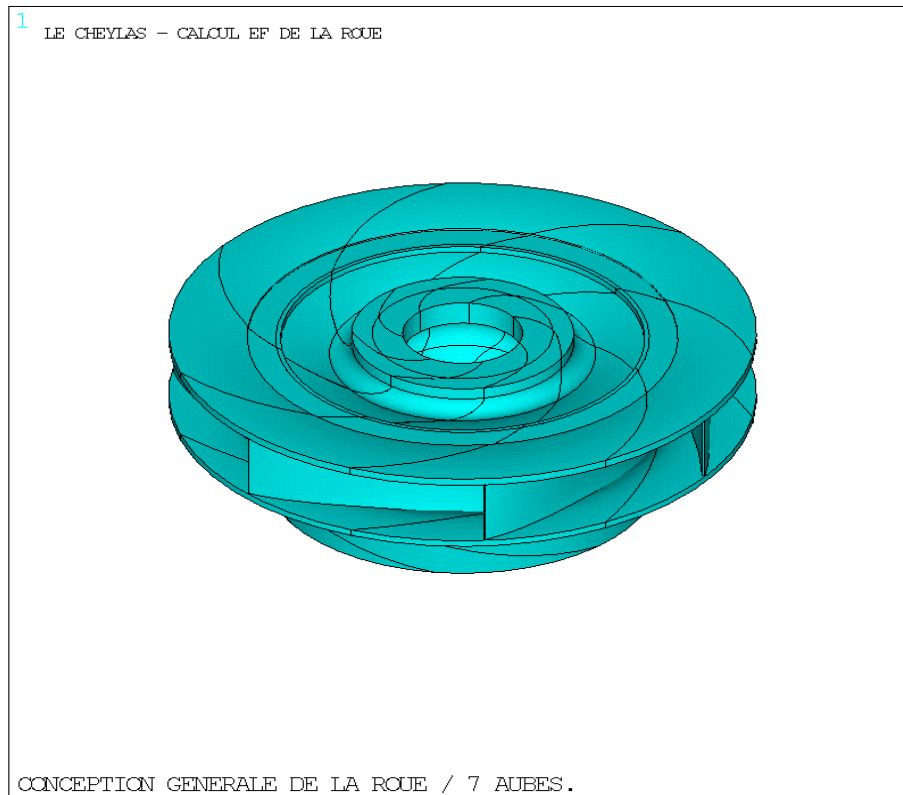


New runner design

7 blades



Analysis of pressure field



New rotor handling equipment

