

Study of the cool down and the warm up of the LHC focalisation magnet by supercritical helium at 4 K

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PhD may follow: No

Summary :

The LHC (large hadron collider) at CERN has allowed the discovery of the famous "boson of Higgs". Its discovery is an essential step towards the confirmation of the most likely theories this day but it still remains to determine most finely its mass. The LHC in its current version would allow it but requires for several ten years, that is why the study of an upgrade of this tool is on-going to increase its luminosity. It would result from it a significant increase of the number of collisions and thus the statistics allowing the determination of the mass. To reach this objective certain elements must be replaced and in particular focusing magnets before the collision area. It is on the cooling of these superconducting magnets that we propose to work.

Full description :

With regard to actual focusing magnets, magnets currently under design will receive an energy deposited by the beam approximately 10 times superior. This significant increase of the heat flux to be evacuated asks the question of the means to reach this goal. Two solutions are envisaged: on one hand a cooling by means of superfluid helium below 2.17 K and on the other hand by some supercritical helium around 4 K. Each of these solutions has its advantages and drawbacks:

- Higher energy cost but very good thermal conductivity of the fluid in the first case
- Situation inverted in the second case

This work will be realized in association with the CERN in Geneva, the CEA / SBT taking care to study the second solution whereas the CERN will take care of the first one.

In previous studies, two cryogenic architectures have been identified for the cooling with supercritical helium. The proposed activity will work on the cool down and warm up phases with two objectives: estimate the time required for these operations and identify if some additional circuits are required.

Requested skills :

Thermodynamic, thermohydraulic, computation