

Mandate for the Optimization and Quality of the Electrical Circuits for the HL-LHC Magnet System (Mr/Ms Magnet Circuits)

In the HL-LHC project, a number of magnets and of magnetic circuits have been deeply modified. The main modifications are:

1. Q1-Q2-Q3 (Inner Triplet) in IP1 and IP5
2. D1 and D2 (Separation/Recombination dipole pair) in IP1/5
3. Q4 and Q5 (matching sections) in IP1/5
4. All corrector magnets of the Inner Triplets in IP1 and IP5, and most of corrector magnets of the MS in IP1/5
5. A number (to be determined) of 11 T dipoles in the DS right and left of IP7 and of IP2.
6. Small modifications may involve other magnets in IP6

Most of the magnets are completely new design, with different technology than the present one in LHC, based on Nb₃Sn superconductor. In many cases, the current is much larger than for the LHC correspondent elements, however various options could be adopted and the optimization of the performance and of costs depends on a variety of parameters:

- Magnet design and performance;
- Magnet and circuit protection
- Optics and operations constraints and optimization
- Cold and warm powering options and optimization.

Other parameters may also be influential for the optimization process.

A global optimization having in mind performance, operation and cost (both construction and operation cost over the 10-15 years of HL-LHC) is not trivial and has to consider the level of operating currents, the number of circuits and the different powering and protection configurations that are possible within the LHC and HL-LHC constraints.

The mandated person (Mr/Ms Magnet Circuits) will investigate various solutions with the concerned WP leaders (WP2-Accelerator Physics and Performance, WP3-IR Magnets, WP6A-B Cold-Warm Powering, WP7- Machine Protection, WP9-Cryogenics, WP-11 11T dipole, WP15-Integration and Installation, and any other relevant WPs) and will report to the Project Leader. Final decision will be taken by the Project Management and validated by the Parameter & Lay-out Committee.

He/she may decide the best configuration to carry out the work (for example a WG group, or a task force). A first proposal is expected by August 2015, and a final proposal for validation in PLC by 2015.

The mandate includes also the monitoring of the quality of the electrical circuits during construction, test and HWC for all circuit components mentioned above, including the warm DC distribution elements. To this aim, the tests and the voltage levels will be defined as soon as possible, in agreement with the equipment owner. The mandate includes also a review of the design of electric parts, joints and interfaces. This work of monitoring and permanent review of electrical quality will be integrated as task of WP7 (Machine Protection).