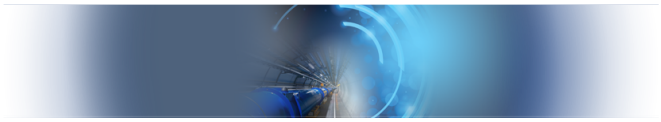

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Approach to modeling of the fast energy discharge in cryogenic systems in the form of an electric arc

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Superconducting magnets are supplied with a few kA of electric current and can store a large amount of energy. Therefore, cryogenic systems which are comprised of such magnets are subject to the risk of fast energy discharge from the magnets themselves in the form of an electric arc. The arcing can be a result of failure in the insulation of an electric circuit or in the connection between the magnet and its current lead. During the discharge, energy can be partially dissipated into the cryogen and partially into the cryogenic system metallic structure. The part of the energy that is transferred to the metallic structure will strongly heat up the metal surface, which can lead to material burning. In this case, the cryogen will flow through the perforation to the insulation vacuum space, which can trigger a rapid increase in pressure in the vacuum enclosure. However, the discharged energy that has been stored in the cryogen also causes a rapid increase in cryogenic pressure. Hence, the proper estimation of the amount of electric arc energy stored in the cryogen and in the metallic structure of the cryogenic system is a crucial issue in the sizing of the safety valves for the cryogenic system cold circuits and its vacuum vessel.

This talk will discuss issues concerning the conditions which result in electric arcing. This will include a theoretical approach in the determination of the electric arc energy discharge dynamics as well as offer an approach in the estimation of the amount of energy dissipation into the cryogen and the metallic structure of the cryogenic system. Details of a WUST cryogenic set-up for testing the energy discharge in the form of an electric arc and the test methodology will also be presented.

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