PROCESSING OF THE RADIATION INTENSITY DISTRIBUTION AND ELECTIRCAL DATA OF HIGH-CURRENT VACUUM ARCS BETWEEN TRANSVERSAL MAGNETIC FIELD CONTACTS FOR SOFTWARE-BASED EVALUATION

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ABSTRACT

Vacuum circuit breakers (VCB) in medium voltage grids are known for their environmental-friendliness and their long durability. This durability is strongly reduced by breaking operations with high-currents. During a breaking operation, a vacuum arc ignites between the switching contacts, which erodes the contact surface, thereby lowering the durability of VCBs. The scale of this erosion is depended on strength and movement of the vacuum arcs. These arcs consisting of metal vapor are an intense radiation source. The radiation distribution of the arc provides information about arc strength, position and movement. This distribution could be investigated optically in a demountable vacuum chamber with a rectangular mirror arrangement. Based on this radiation information about the position and mode of vacuum arcs are identified. Typical modes are diffuse, constricted or jet modes.

A high-speed camera records the radiation intensity of high-current switching tests with transversal magnetic field (TMF) contacts from two perspectives. The recorded images include the arc information about the mode, the position and the velocity. Additionally the electric data of current, voltage and contact gap is recorded. In regard to the comparability to other images of high-current vacuum arcs the influencing parameters of the utilized camera are investigated.

For comparison of varying parameters all recorded data and images, have to be taken in consideration. To achieve reliable results independently from the individual observer within a reasonable time out of a high number of switching tests, a software-based solution is required. For this purpose an automated evaluation routine using LabVIEW has been developed.

In a first step, the recorded radiation intensity from an average switching test with a 10 ms sinusoidal half-wave is been digitized. All measured data like video images, current flow and arc voltage, contact stroke are digitally synchronized to a common timeline.

In a further steps, images a processed and improved for an automated recognition. In this context specific features are extracted. With the improved images and the features an machine learning algorithm will be trained.

This evaluation aims for the focusing of complex information to describe specific aspects of switching operations in VCBs. The individual aspects can be adapted as required, as a general basis of information is created. Originating from this basis, objective methods for statistical comparisons of plasma behaviour in vacuum interrupters can be developed, which are essential for further progress in VCB technology.