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Aspects and implications of on-line PD detection and localization of MV cable systems

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When developing a system capable of detecting and localizing PDs in a MV cable system on-line, several aspects require special attention, compared to off-line measurements.

In the first place, the (dis)advantages of "continuous" on-line PD monitoring compared to single off-line PD diagnostics will be discussed.

Apart from that, there are also some technical differences that need attention.

First of all, the choice of PD sensor is crucial, taking into account the coupling method and safety aspects. Besides the sensor itself, the different possible and preferable (in respect to signal detection) sensor positions in substations should be considered. For instance, from the PD point of view the cable is loaded by a substation which in the frequency range of interest has a complex impedance formed by other cables, transformers, etc., thereby determining the amplitude of the measured signal.

Furthermore, the measured signal will be troubled with a considerable amount of noise, appearing either through conduction from adjacent systems or through radiation. This requires advanced filtering techniques.

Especially in belted cables, PDs measured with an off-line method or an on-line method may differ with respect to their "visibility". The sensitivity of the measured signals becomes dependent on the location in the cross-section, its direction and thereby the phase-angle of the applied voltage. This is due to the difference in electric stresses in both methods.

If localization is included by means of simultaneous signal detection at both cable ends, the problem arises of time-synchronizing the measuring systems at both sites accurately enough. One can think of several methods to accomplish this of which the use of GPS (patented) and pulse injection into the cable are probably the most applicable ones.

Additionally these measuring systems should have some communication link in order to e.g. draw conclusions from the measured data. This communication could be done over the medium voltage network itself by injecting signals into the cable under test.

In this paper the implications of the various aspects mentioned above will be discussed.