Case Study

Wind Farm MVUG cable fault
Northeast Region, Brazil
June 2018

Summary
On the 25th June, while performing a predictive maintenance at an aged Medium Voltage Under Ground (MVUG) cable, the SIMM's engineer team has detected a partial discharge (PD) phenomenon at a splice, right above the operating voltage. Besides the intense PD activity, the cable did not withstand the testing voltage and came to fail during the test. The cable was a 20/35 kV, XLPE, 6768 meters length.

Details
On 25th June 2018, during on site MVUG cables diagnostics, it was detected PD events at a splice (5141 m away from the Substation), with an inception voltage of 21 kV, U_o = 20 kV (see Figure 1).

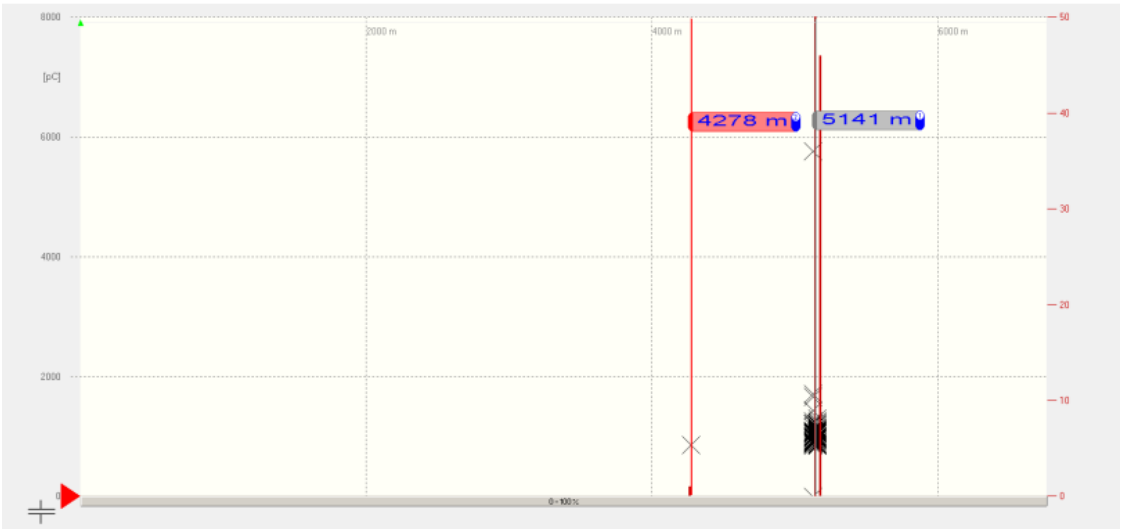

Figure 1: LOC Diagram showing PD at 5141m

Furthermore, a Tangent Delta (TD) measurement was performed on this cable, in parallel with partial discharge test. During TD 1.5*U_o stage (30 kV), the cable has failed. The figure 2 shows the tan delta behaviour before the flashover. Before the fault, the tangent delta amplified drastically!

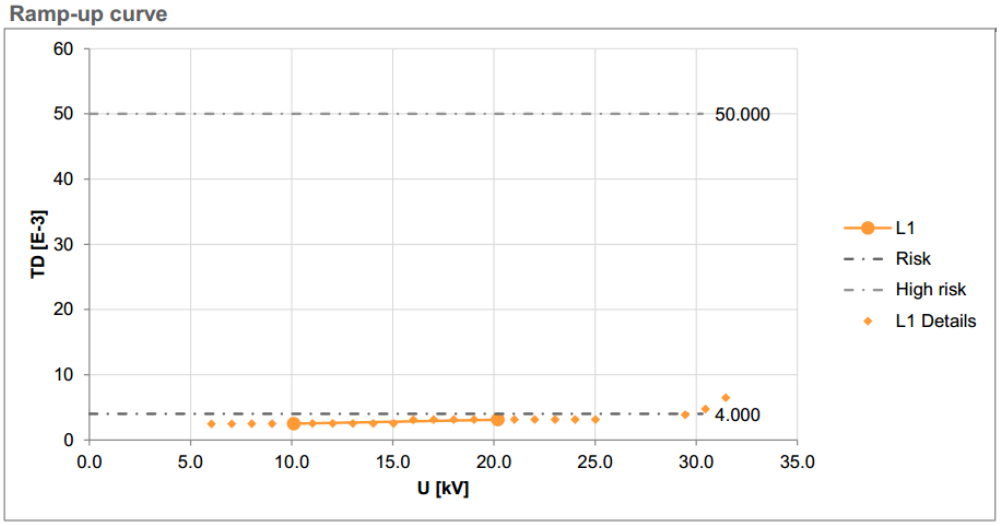

Figure 2: Tan delta ramp-up curve

After the fault, a VLF 0.1 Hz withstand test voltage of 23 kV was applied successfully across the insulation, to check if the cable could return to service and then a corrective maintenance could be scheduled at the damaged splice.
One week after the tests, the splice was replaced and a new PD and tangent delta measurements were done. At this time, no PD was observed in the new splice, and all tangent delta parameters were at the NO ACTION REQUIRED category, according to the IEEE Guide For Field Testing Shielded Power Cable Systems Using Very Low Frequency (IEEE 400.2-2013). The cable was tested at $0.5*U_o$, $1.0*U_o$, $1.5*U_o$ and also 15 minutes of measurements at 33 kV testing.

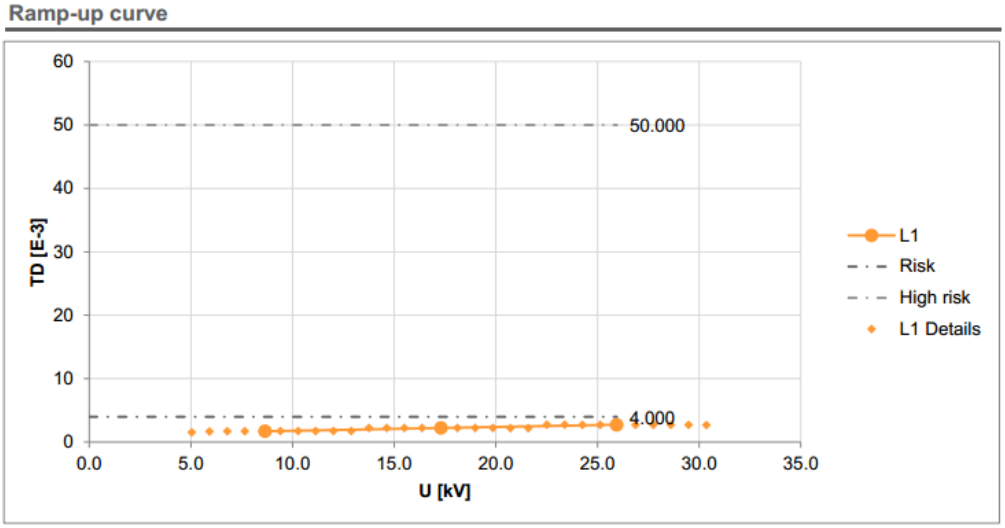

Figure 3: Ramp-up curve after the repair

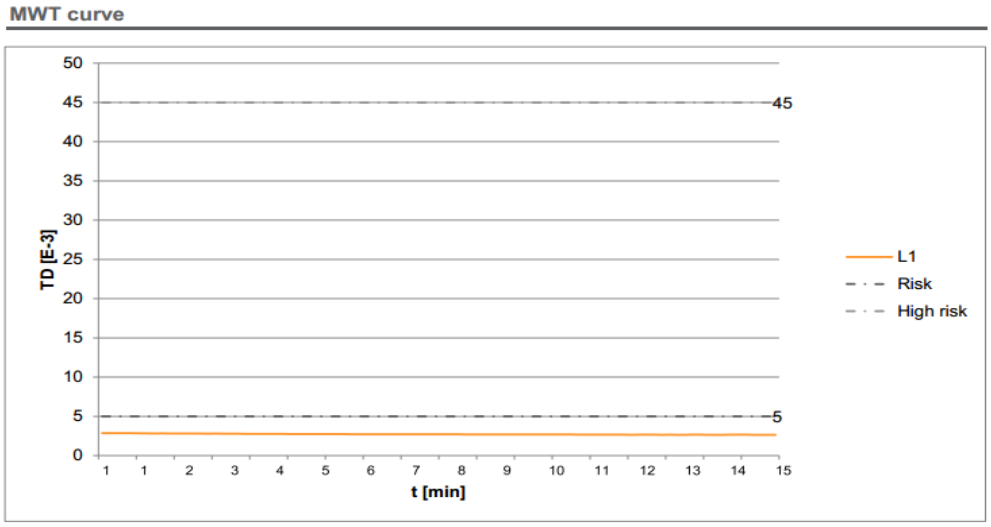

Figure 4: 33 kV MWT curve after repair

Conclusions

SIMM' engineers identified and located a source of PD on a 35kV splice. The combination of withstand VLF test voltage, Tangent Delta and Partial Discharge measurements are powerful tools in the field of cable testing and diagnostics, being able to prevent long system outages as well as electrical stresses.