



# Tan Delta Testing: Effect of Terminations

Ralph Patterson Nigel Hampton



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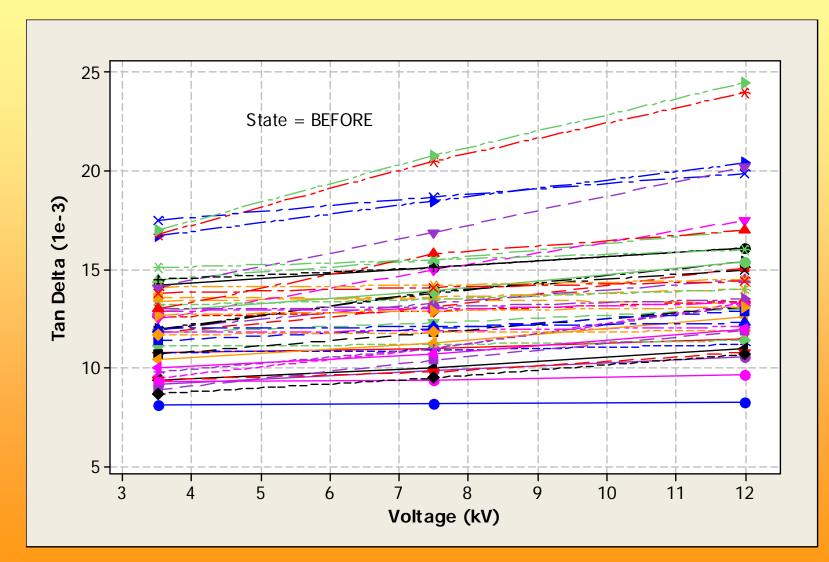
## **Effect of Terminations**

- The effect of terminations on Tan Delta measurements has been discussed many times.
- Little measured data has been presented on this effect
- Here we will present
  - Effect of changing terminations
  - Loss ascribed to termination types

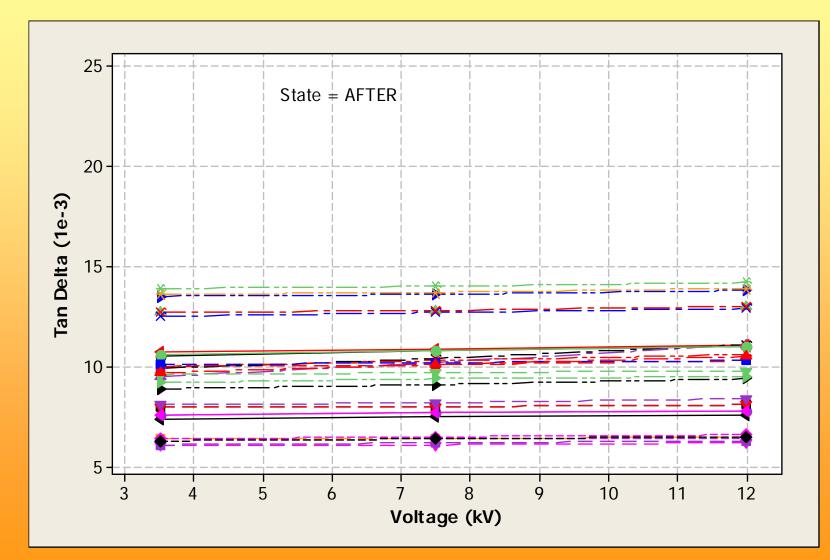
## **System Info**

- EPR Cable
- Semiconducting Shields
- 45 sections measured (15 three phase sections)
- Tan Delta measured before as function of voltage
- 30 sets of terminations replaced
- Tan Delta measured after as function of voltage
- Goal was to minimise voltage dependence Tip Up

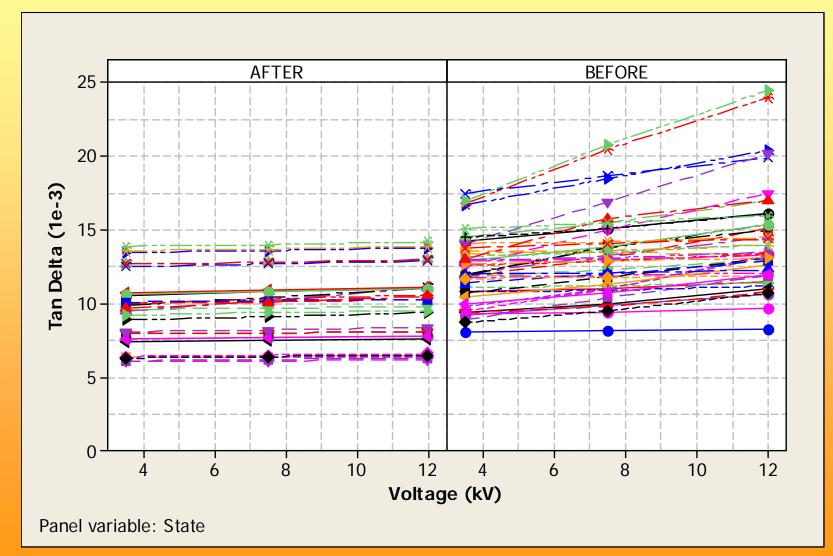
#### **Initial Tan Delta**



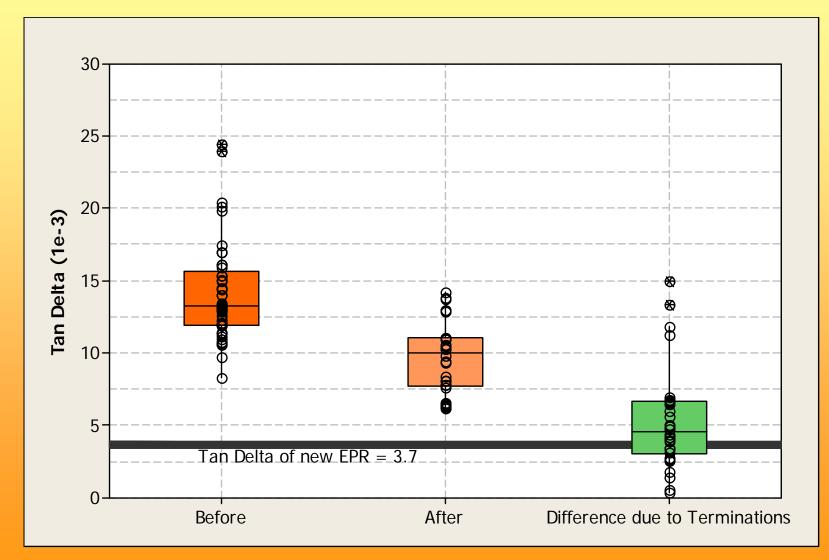
#### Tan Delta after changing terminations



#### **Before and After**



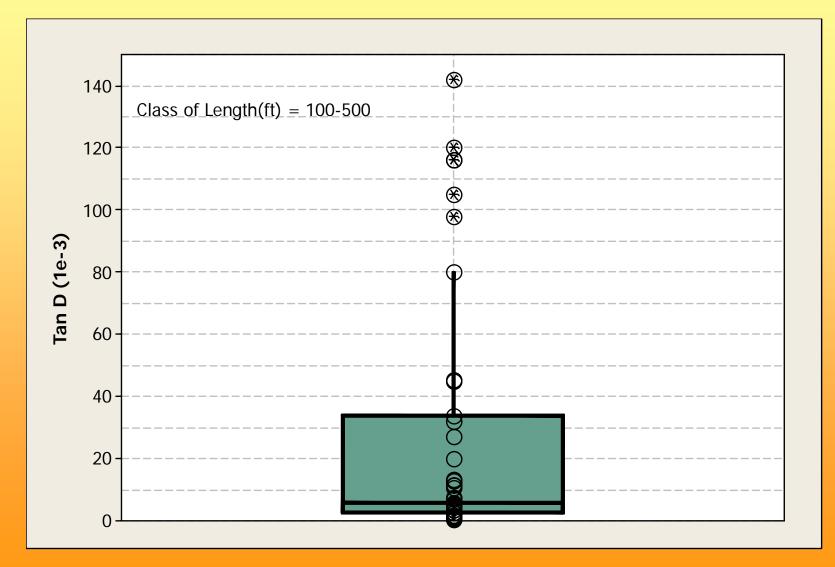
### Effect at 12 kV



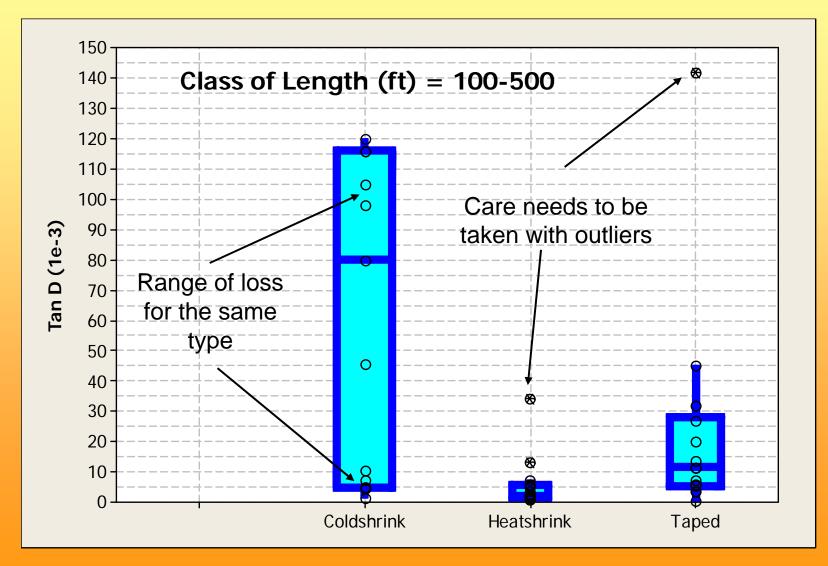
### Large Study Analysis

- Field results from > 100 miles of testing
- Type of termination was noted
- Analysis of this data set (one length class to avoid length effects) allows us to look at how much of the variation might be ascribed to the different types of terminations.
- Note this is a forensic analysis of a real data set rather than a designed experiment

### **Whole Distribution**



#### **Tan Delta Split by Termination Type**



# Summary

- Terminations can contribute to the Tan Delta level and the Tip Up
- Changing terminations improves the situation
- We would infer that similar effects would be seen in Splices as well
- Age and Poor installation likely to have larger influence than termination type

## Acknowledgements

- NETA
- Power Products Inc
- CDFI Cable Diagnostic Focused initiative