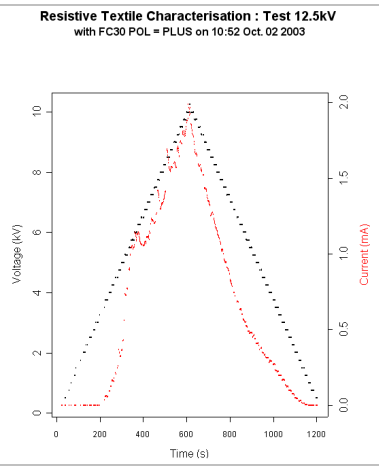
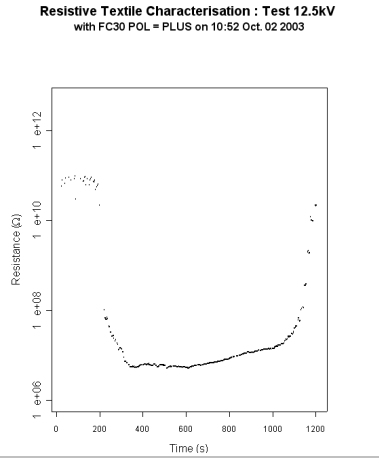
The Resistive Signature and its use for seam characterisation

The basic idea of the Resistive Signature is to apply increasing potential differences to a sample to stress the material globally and locally under higher and higher electric fields. Electrodes are used at two extremities of the sample to impose a high voltage difference between two fabric regions, for example across the diagonal of a A4-size sample.

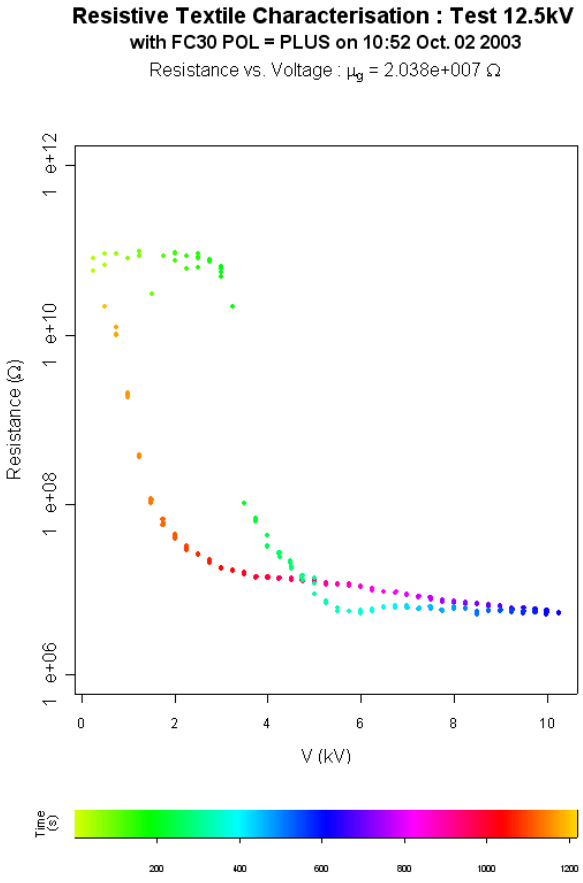
In our method, the potential difference is increased stepwise under control of a PC driven software that allows for choosing the voltage steps and their timing; moreover, the program records the resulting current through the sample. The software also monitors the climate inside the enclosure (Relative Humidity and Temperature). The climatic conditions as well as the maximum voltage, the number of steps, the delay between steps and the maximum allowed current can be chosen in function of the nature of the material. During the whole measurement, the instantaneous values of all the parameters can be displayed as well as graphical representation of either **V** (voltage) and **I** (current) in function of time, **R** (i.e. V/I) in function of time or **R** in function of **V**.



V and I function of time.



Resistance function of time.



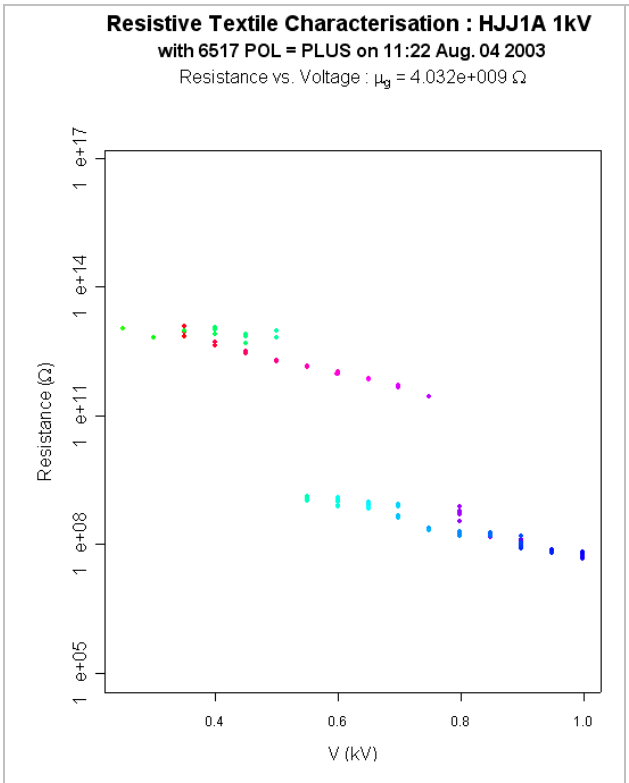
Resistive Signature (see overleaf).

The measurement can proceed with the potential difference reverting to 0 V or not. Moreover, the software stops of increasing the voltage as soon as a maximum current is reached, in a tentative way not to modify the material under test.

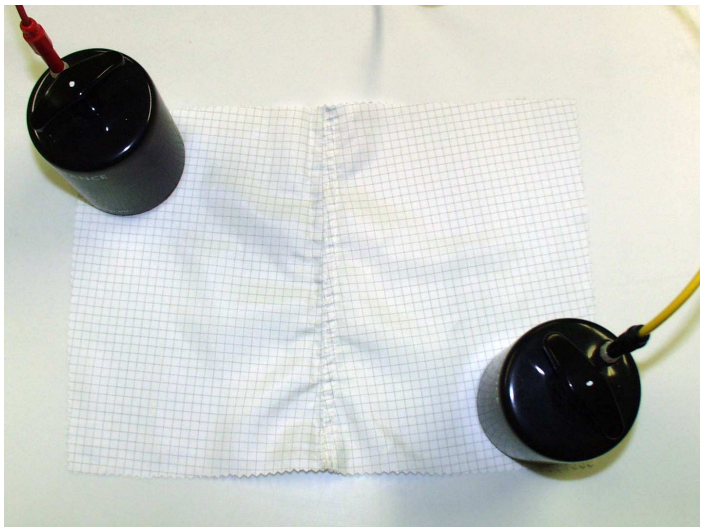
The results most interesting presentation is the **Resistive Signature** of the sample. This is a coloured plot of **R** in function of **V** where the colouring scheme allows to recover the chronological aspect of the measurement : a **R** value recorded at time **0** will get a green colour and a value recorded at the end time (normally back to a **0** potential difference) will get a yellow colour; **R** values in between go through a cyan, blue, magenta, red and orange gamut. For example, when a measure takes a total time of 1200s, the resistance value for the voltage at time 0s is displayed in light green, 200s in green, 400s in cyan, 600s in blue, 600s in magenta, 1000s in red and 1200s in yellow.

For fabric samples, the measurement uses two 5 lbs. electrodes with 2.5 in. (∅) carbon conducting pads, placed diagonally across A4-size rectangles. In this way, we prevent direct conduction between electrodes due to lone conductive fibres, a phenomenon that is not representative of the global behaviour of the material, and that excludes the use of classical concentric electrodes for resistivity measurement of this type of material.

When the method is used for seams conductivity evaluation, the sample includes a seam parallel to the small edge of the A4-size sample, roughly dividing it into two A5-size fabric pieces. In case of less than perfect seams, the resistive signature starts at high resistance values for suddenly dropping to lower values at some threshold voltage.



Seam signature.



Seam set-up.

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