n-OTDR - High resolution OTDR

Application note 1: Distance measurement

The first application of the ν-OTDR is for distance measurements, especially for relatively short fibers. The measurement is as follows:

1. Prepare the Fiber Under Test, connect it to the OTDR and press the START button.
2. Using the zoom features (see the manual for the various options), select the scale to display the required section.
3. If necessary, the zero adjust feature can be used to set the front panel reflection (FC/APC connector) at zero. This is best done by bringing a cursor on the reflection, reading the distance in the corresponding display, and subtracting this value to the zero adjust.
4. You can use the MEASUREMENT menu, PEAK LOCATION option to find the most important peaks automatically. However, this option may not find the smaller peaks. So you can also manually move the cursors to any peak. The position of the cursor is indicated in the cursor boxes. In addition, using the MEASUREMENT menu, DISTANCE option, you obtain the distance between the various peaks.

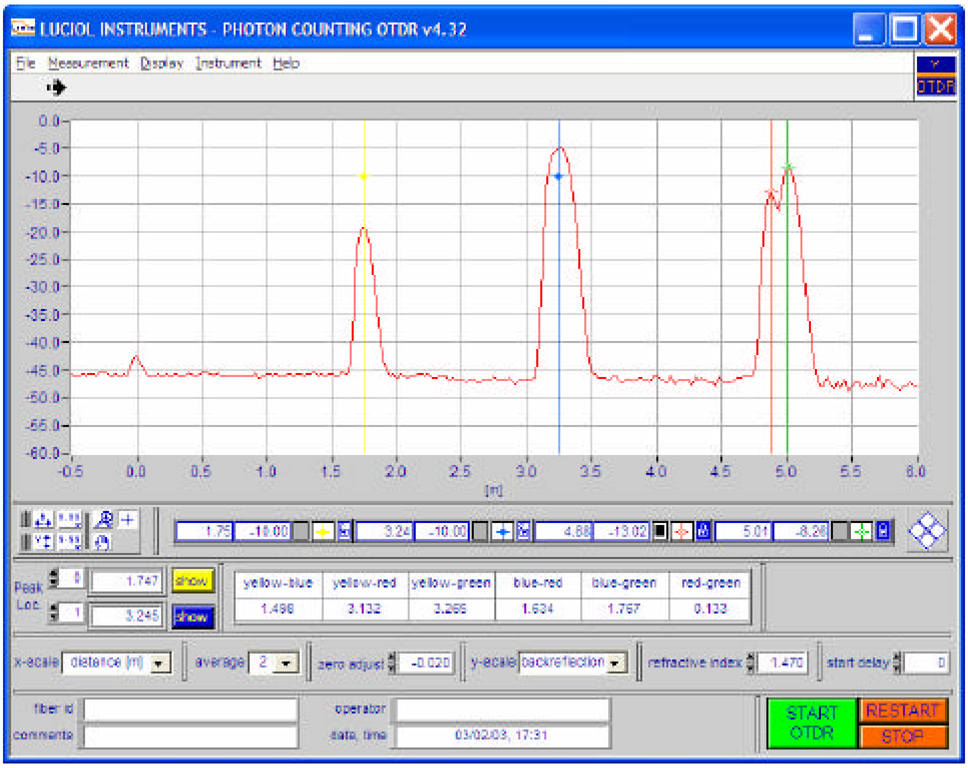

Figure 1: Various reflection peaks, including two reflections separated by 13 cm

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Figure 1 shows an artefact with one coupler and two end reflections separated by only 13 cm. The first peak at 0 m is the front panel, with an FC/APC connector. The yellow cursor at 1.747 m is the FC/PC reflection at the input of the coupler. The blue cursor at 3.245 m corresponds to the two connectors at the output of the coupler. Note that there are in fact two reflections, separated by only a few cms (the reflection peak is a bit broader). These cannot be distinguished by the instrument. The red and green cursors are on the end face of the fibers, separated by 13 cm. These can be clearly distinguished. The highest precision that can be achieved by the instrument is obtained with the automatic peak detection feature, which fits the trace with a gaussian curve, and interpolates between points.

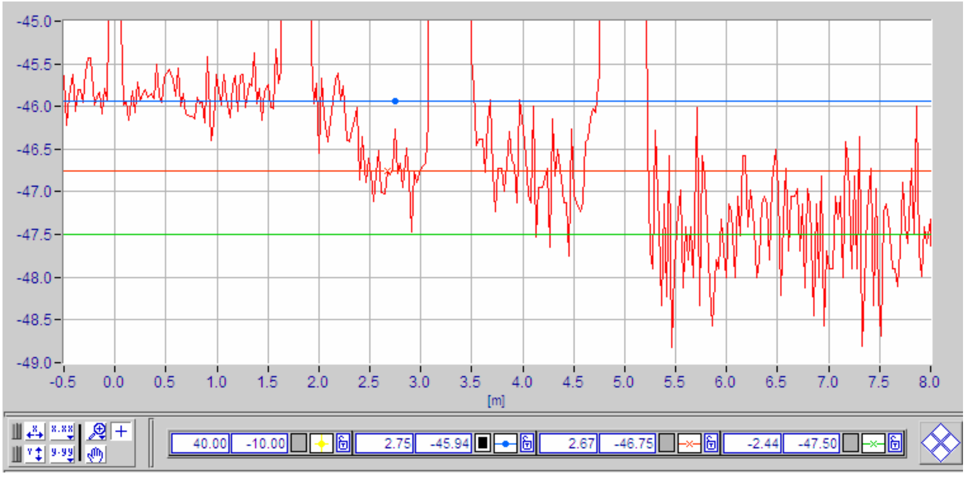

Figure 2: Zoom on the vertical scale to show the coupler at 2.3 m

A zoom on the vertical scale, as presented in Figure 2 (half a dB per graduation), allows distinguishing also the position of the coupler itself, at about 2.3 m (first drop in the RBS level). Here, it is useful to transform the cursors to horizontal lines, which can be used to measure the exact intensity level. This can be done by selecting the proper CURSOR STYLE, in the cursor boxes (see User's Manual for details). On this trace, the noise level, given by the dark counts of the detector, is at -47.5 dB (trace after the end of the fiber at 5 m and green cursor), only marginally below the RBS in the fiber. This is due to the dynamic range of about 40 dB, and the strong reflection at the coupler output at -5 dB. Note that these values are only relative. The correct value of the RBS inside a standard SMF can be measured, using a special artefact. This is presented in the Application Note 2: RBS calibration. The value obtained with the present OTDR was -81 dB. In addition, the drop at the coupler is seen here as 0.8 dB (distance between blue and red cursors). As the signal value is contaminated by noise, this value is not correct. In order to get the real value of the drop at the coupler, it should be corrected for the dark counts. The calculation is presented in the Application Note 5: dark counts correction. The corrected value is 3.6 dB loss at the coupler, in backreflection measurement mode, which is fully consistent with a 3 dB coupler.