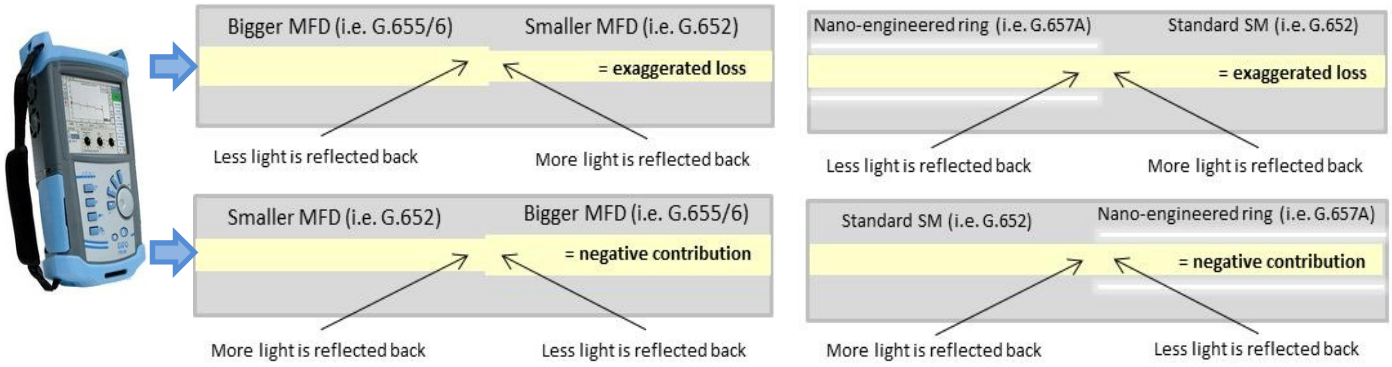
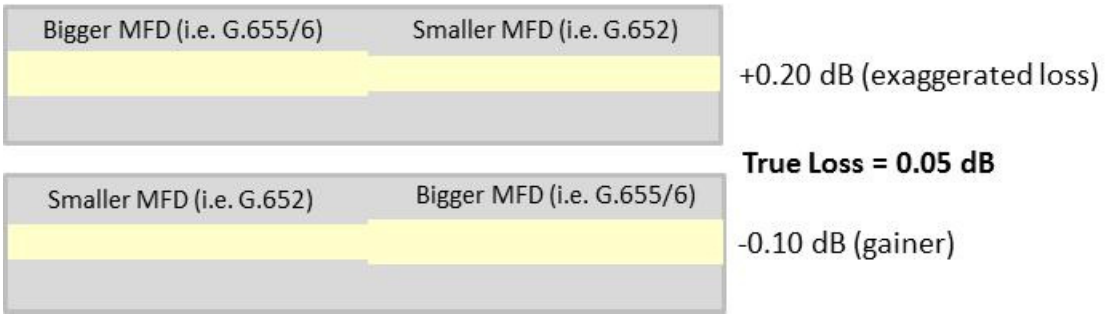
Fusion splicing single-mode G.655, G.656 or G.657 onto G.652D

It appears as if an OTDR knows not its A from its E, when testing G.652D Non-Dispersion-Shifted Fibre (NDSF), connected to the following fibre types: (a) G.655D or G.656, variants of non-zero dispersion-shifted fibre (NZ-DSF) and (b) G.657A bend insensitive fibre.

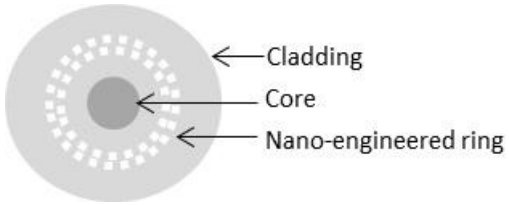
It is a difference in backscatter just before and just after the splice that confuses an OTDR:



a) The issue here is mode field diameters (MFDs). When splicing G.652D (smaller MFD) onto G.655/6 (larger MFD) a negative contribution (gainer) is incorrectly reported and G.655/6 onto G.652D reports an exaggerated loss… e.g. a real splice of 0.05 dB could bi-directionally measure -0.10 dB and +0.20 dB. These phenomena are well known, and operating procedures calling for bi-directional OTDR measurements and averaging the results has been a time-honoured tradition. More importantly though, using either Fujikura SM or NZ splicing modes, averaged dB splice losses as low as 0.04 to 0.02 are accomplishable without any obvious effort.



b) In the above context, one might suggest that G.657A also has a larger MFD than G.652D. But oddly enough, it has a marginally smaller MFD. I can immediately confirm that it is a relative index change, thanks in no small part to the nano-engineered ring in the cladding - that in this case, bewilders an OTDR.



I recently subjected my students (who all happened to be novices) to splicing G.652D onto G.657A, using Auto, SM and NZ splice modes and below, the outcome:

Fujikura 60S Splice Mode	AVG OTDR Splice Loss G.652 D → G.657 A	AVG OTDR Splice Loss G.657 A → G.652 D	Bi-Directional AVG
AUTO	-0.136	+0.242	**0.053**
SM	-0.157	+0.191	**0.017**
NZ	-0.167	+0.195	**0.014**

Auto, SM and NZ modes all deliver decent-looking splices, with the true loss being the average of bi-directional measurements. NZ proved to be superior by a whisker. Experienced splice techs are predisposed not to like Auto-mode because for them, it is intolerably slow. Note that while BI G.657.A-compliant fibres are required to be backward compatible with G.652.D - G.657.B-compliant fibres (called bend-tolerant), are not.

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