Performance of the OFDA 100 compared to other instruments

1. Measurements available

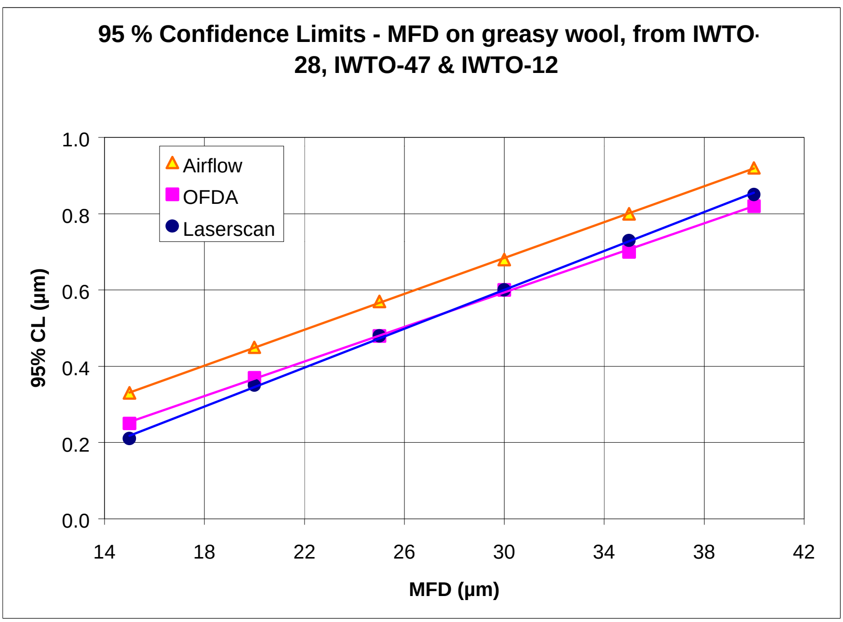
The OFDA instrument is used to certify mean fibre diameter (MFD) and diameter distribution (SD or CvD) under IWTO-47. It can also be used to measure medullation and the percentage of objectionable fibres under IWTO-57.

Additional measurements available from the instrument include mean fibre curvature, and parameters that relate to the amount of residual material on the surface of the fibres.

2. Precision when measuring greasy wool

Greasy wool may be certified for diameter under IWTO rules using Airflow, OFDA or Laserscan. Each method is documented in the respective IWTO test methods IWTO-28, IWTO-47 and IWTO-12. The relative precision values of the complete measurement process (including some elements of sampling and preparation), as documented in these methods are as follows:

95% confidence limits			
MFD	L'scan IWTO-12	OFDA IWTO-47	Airflow IWTO-28
15	0.21	0.25	0.33
20	0.35	0.37	0.45
25	0.48	0.48	0.57
30	0.60	0.60	0.68
35	0.73	0.70	0.80
40	0.85	0.82	0.92

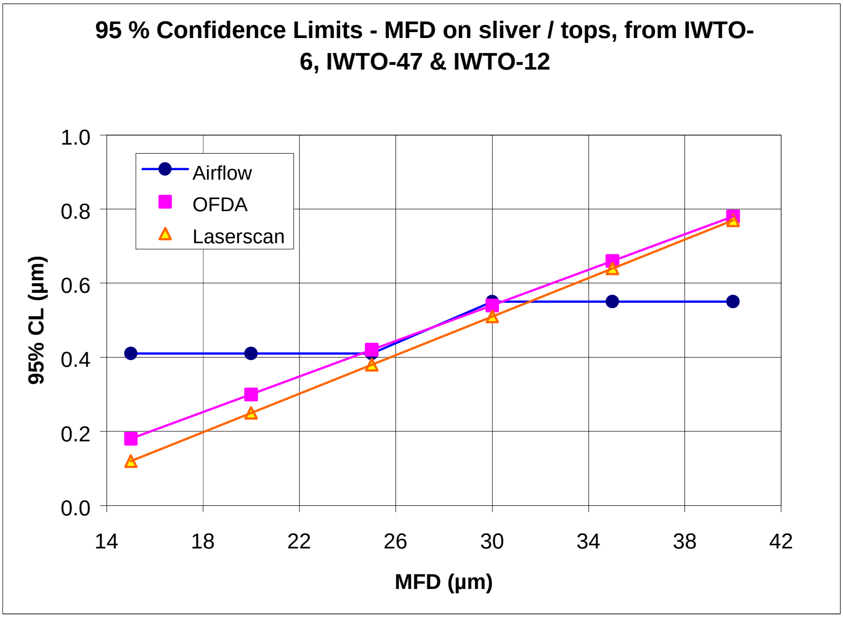


3. Precision when measuring tops

When used for certifying sliver or tops, the documented precision values in the IWTO test methods are as follows for IWTO-6, IWTO-47 and IWTO-12:

95% confidence limits			
MFD	L'scan IWTO-12	OFDA IWTO-47	*Airflow** IWTO-6*
15	0.12	0.18	*0.41*
20	0.25	0.30	*0.41*
25	0.38	0.42	*0.41*
30	0.51	0.54	*0.55*
35	0.64	0.66	*0.55*
40	0.77	0.78	*0.55*

*** It should be noted that the precision data in IWTO-6 has not been updated since 1980*



With the exception of the data from IWTO-6, all the above data was obtained in carefully-controlled round trials under the auspices of IWTO[1,2].

Another source of data for top testing is the 6 monthly Interwoollabs trials. Approximately 100 airflow laboratories, 30 OFDA laboratories and 20 Laserscan laboratories participate in these trials. In comparison with the IWTO round trials, these groups of laboratories encompass a much wider range of skill levels and throughputs, and therefore these trials would not be expected to produce exactly the same levels of precision as the IWTO trials. The summary data produced in

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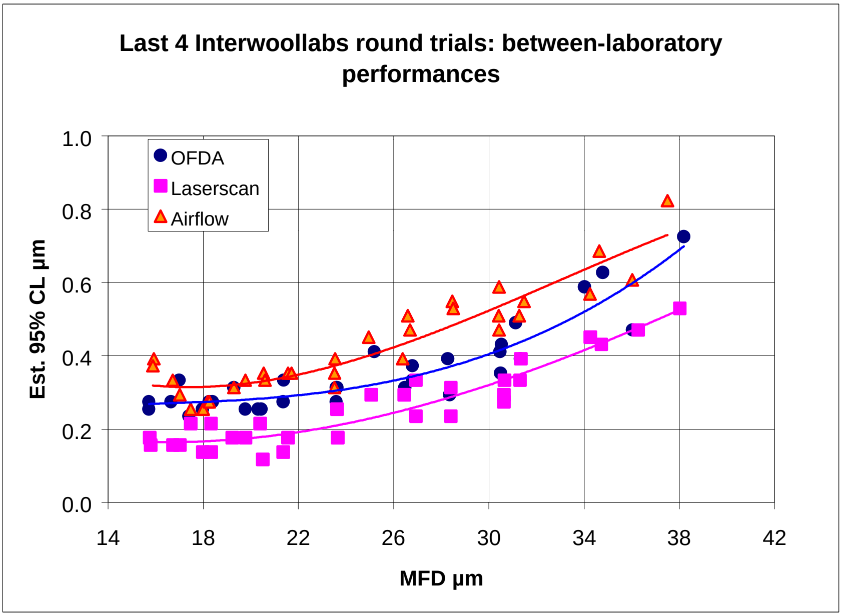
[1] Harig, H., report of the 1995 IWTO Round Trial, Part I (Raw wool) and Part II (Wool Tops), IWTO report 15, Harrogate, June 1995

[2] Marler, J.W. and Baxter, B.P., Addendum to Report 15: Confidence limits for Measurements made on raw wool and wool tops, IWTO Harrogate, June 1995.

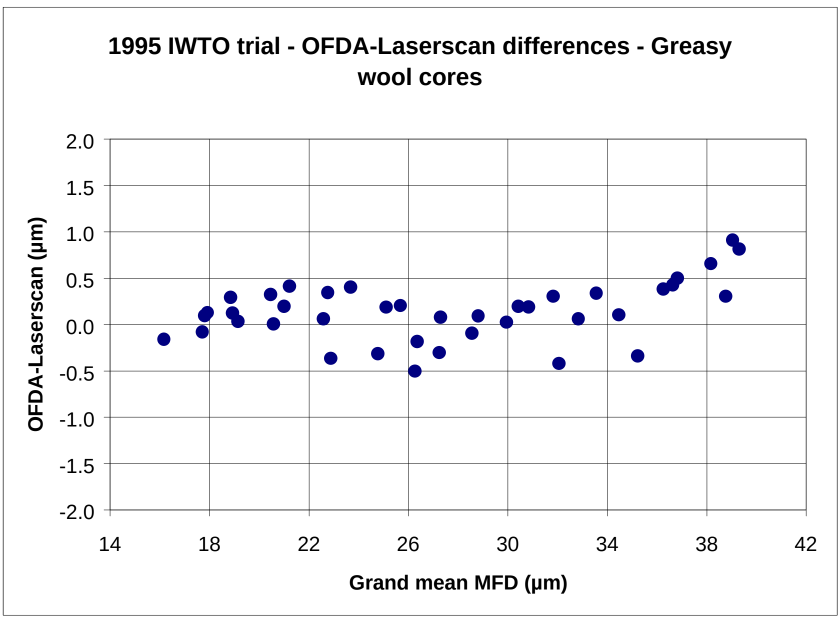
these trials minimises within-laboratory variance and focuses on between-laboratory variance. They cannot, therefore, be thought of as simply reflecting instrument performance.

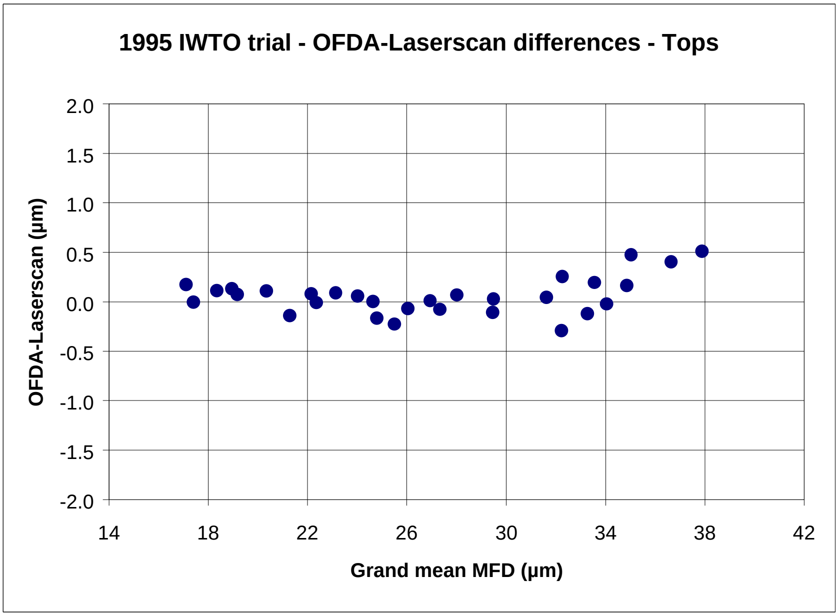


In all cases it can be seen that laboratories using OFDA and Laserscan perform more reproducibly than those using Airflow.

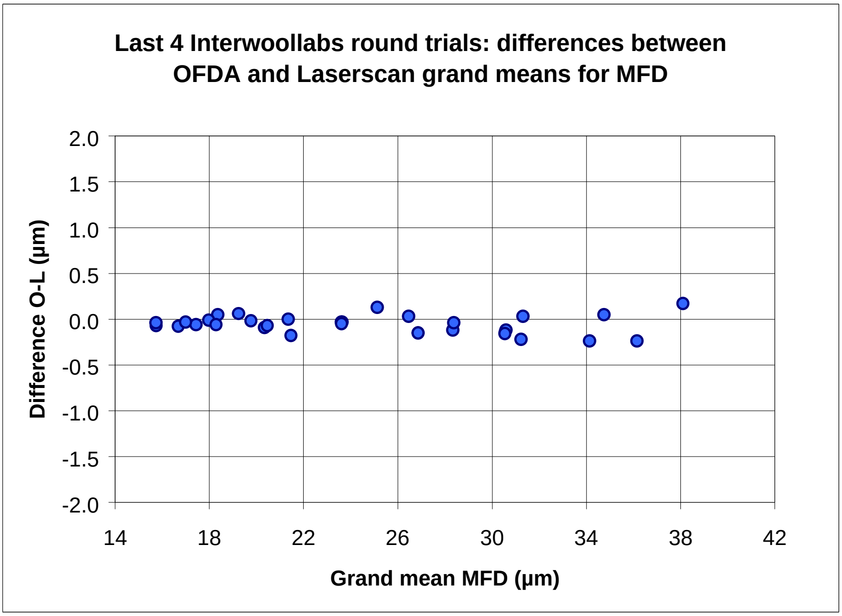
4. Comparison between the two new technologies

The 1995 IWTO round trials allowed comparison to be made between the grand mean results of OFDA and Laserscan over a range of laboratories (4 core test labs in the case of the greasy wool samples, and 16 core test and mill laboratories in the case of top samples). In terms of mean fibre diameter, these trials showed substantial equivalence between OFDA and Laserscan technologies:





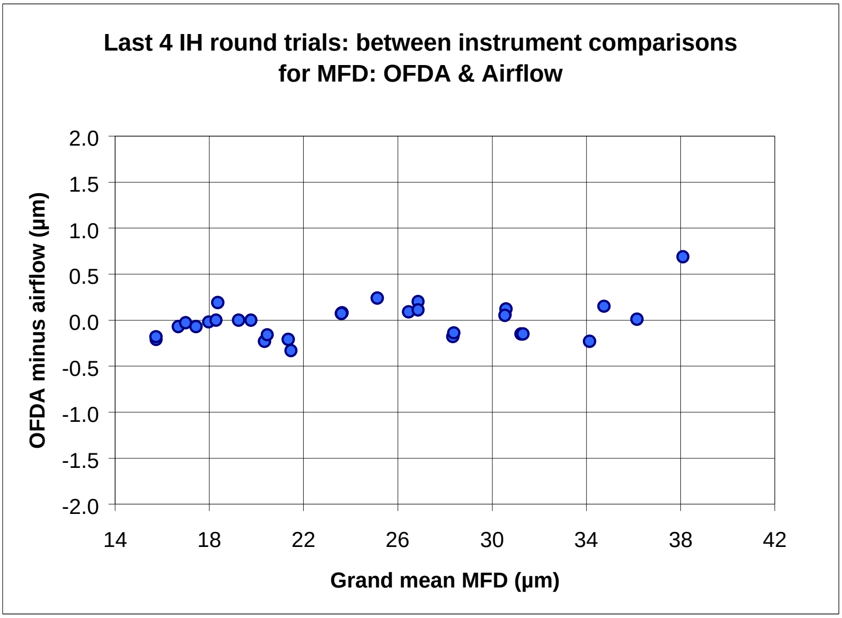
Data plotted in a similar manner for the last 4 sets of Interwoollabs trials (97/2, 98/1, 98/2 and 99/1) indicates a similar level of agreement:

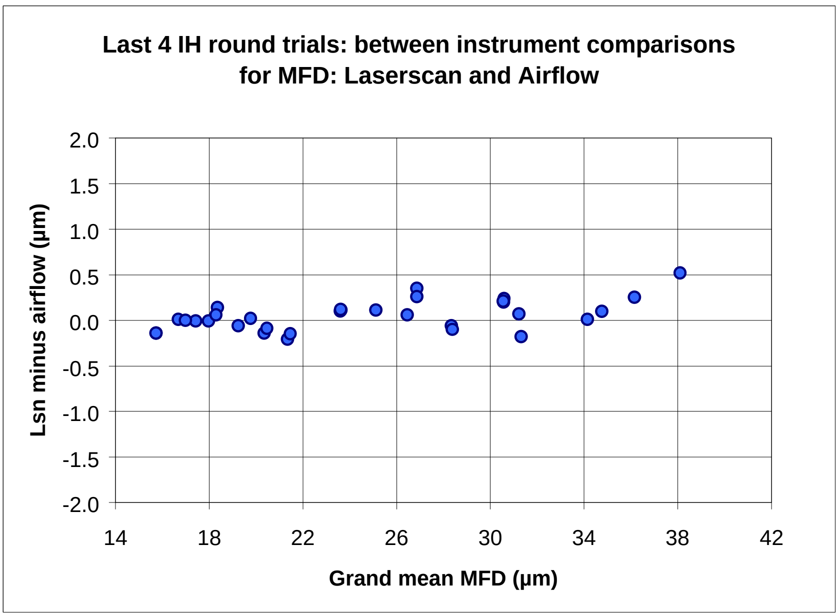


In each of the above plots, the grand means over all laboratories have been used. The improvement in precision of comparison can easily be seen – the first plot is for grand means from 4 laboratories, the second is for 16 laboratories and the third is for an average of 30 OFDA laboratories and 20 Laserscan laboratories. It would seem clear that whilst some individual wools may give slightly different results on each of the systems, the overall trend is towards equivalence.

5. Comparison against airflow

In view of the fact that there are 100 airflow laboratories participating in the Interwoollabs trials, perhaps the most precise comparison between the two newer technologies and airflow can be obtained from this data set. The plots below compare for each sample grand means from 100 airflow laboratories with grand means from either 30 OFDA laboratories or 20 Laserscan laboratories:





It is obvious that the level of agreement with airflow is similar for both instruments, but the comparisons with airflow are somewhat less precise than the level of agreement between OFDA and Laserscan. In numerical terms, the average differences of the grand means were as follows for these 32 samples tested over a period of 2 years:

Parameter	OFDA-Laserscan	OFDA-Airflow	Laserscan-Airflow
Mean difference (µm)	-0.06	-0.01	+0.05
SD of differences (µm)	0.10	0.19	0.17
Statistically significant?	yes	no	no

This clearly suggests that the overall differences are of little practical significance. There is no evidence for major fundamental difference between the average results from these instruments on tops.

6. Other data

Results have been published elsewhere that suggest that there may be significant differences between the instruments on greasy wool. Such suggestions are incorrect – differences that have been published refer to possible differences in results from different test methods, and it must also be noted that different laboratories have obtained different trends.

It must be observed that with the exception of the IWTO round trial quoted above, all the recent results published to date comparing OFDA and Laserscan on greasy wool were obtained in individual laboratories, and may therefore be influenced by the sample preparation systems and instrument calibration uncertainties in these respective laboratories. It is unrealistic to rely on such data to predict what may happen outside those laboratories, and therefore the above comparisons so far provide the most reliable data available.

There have also been a number of papers published on the apparent differences between the instruments (test methods) at the ultrafine end of the spectrum. Despite a significant change to the Laserscan calibration algorithm in 1997 (equivalent to a change of approximately 0.5 µm at 14 µm), specifically to address this issue, there does still remain the possibility of some relatively minor differences[3]. Additionally, another detailed study[4] has highlighted the errors inherent in the airflow method at this end the spectrum, and it is therefore invalid to draw comparisons between either of the new instruments and airflow on ultrafine wools.

In conclusion, it might be appropriate to quote Sommerville, the author of the last 2 studies:

> IWTO now has a number of Test Specifications for specifying fibre fineness, **all of which are fit for purpose**, provided the basis for their use in commercial trading of wool is adequately specified.
>
> Each of these instruments uses different geometric definitions of fibre fineness. This is a fundamental difference, which must contribute to the differences being observed, particularly where the characteristics of the wool being measured differ in some way from the calibration wools and/or the fibre fineness is outside the range of the calibration wools. **This does not limit the usefulness of any one of the instruments, provided the same instrument is used in all instances where comparisons must be made**.

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[3] Sommerville, P.J., Measurement of the Fineness of Superfine Wool: Effect of the revised Laserscan calibration function on comparisons between airflow, Laserscan and OFDA, IWTO report CTF 04, Nice, Dec 1998

[4] Sommerville, P.J., Fundamental principles of Fibre Fineness Measurement: the Airflow instrument, IWTO report CTF 03, Nice, Dec 1998