STUDY INTO COMPARATIVE DIFFERENCES OF THE OFDA2000 TESTING MACHINE USING " TRIM HIGH OFF" AND " TRIM HIGH ON" for ALPACA FIBRE MEASUREMENT

A Report to the Australian Alpaca Association

By

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STUDY INTO COMPARATIVE DIFFERENCES OF THE OFDA2000 TESTING MACHINE USING " TRIM HIGH OFF" AND " TRIM HIGH ON" for ALPACA FIBRE MEASUREMENT

By Mr C M Holt

RATIONALE

Objective measurement of alpaca fibre is now an integral process in the breeding, marketing and classing of alpacas and alpaca fibre. Four systems are in common use, those being the OFDA100, OFDA2000 and Laser systems in their laboratory and shed configurations.

For "Wool" measurements, both the OFDA 100 & LASERSCAN have IWTO approved test methods and may be used to produce certified results in accordance with the relevant test method. When the OFDA 2000 is in the OFDA 100 mode (special slide attachment fitted to the OFDA 2000) it has IWTO approval. (It is known as snippet mode).
The OFDA2000 (apart from the OFDA100 mode) can measure in two modes. I.E. " Trim High OFF" and " Trim High ON".

Currently only "Testing house" certificates are issued for alpaca test results.
This is due to the fact that no "IWTO" approved test method has been developed for the alpaca industry certification. However, those laboratories that are IWTO accredited testing houses and others with a similar level of accreditation are issuing their own house certification based on wool industry IWTO testing method. For grower sampled tests, only guidance histograms are issued.

" Trim High " is a setting used by the OFDA2000 to control how the machine interprets the parameters used to assess the fineness etc of the fibre. When the " Trim High " is ON, the program removes some course end fibres from its assessment.

It is acknowledged that the OFDA2000 "staple mode" is not approved for certification and that the results can only be considered as "Guidance" tests at best.

OBJECTIVE

This study aims to test the comparability of the OFDA2000 technique in measuring alpaca fibre in " Trim High OFF" and "Trim High ON" mode and thereby validate the use of this machine in comparing fibre measured with the two programs mentioned above for guidance testing.

1. Identify a Testing House that can supply tested data (Around 2000 to 3000) from an OFDA2000 with " high trim off" and high trim on".

INTRODUCTION

OFDA2000 HISTORY

The OFDA 2000 was designed and developed originally for the wool industry to be used in the shearing shed for guidance testing of sheep (ranking for animal selection) and in classing of wool (to specific fleece groups).

The OFDA2000 has a "Grease Correction Factor" which is used when measuring fibre in the "Greasy state". This is most practical for use in the shearing shed. This "grease correction" is not switched on when samples are washed or solvent treated, (Clean).

When measuring greasy fibre for the wool (In-Shed) industry, fineness is measured from 0 - 80µ. There is another setting named "Trim High" which is set to ON. This is used to eliminate vegetable matter and fibres that may be stuck together particularly if the samples are in a greasy state. This "Trim High" can be switched "on or off". Wool is on the average, more uniform than alpaca fibre and therefore more predictable.

This optical measuring device was developed in Australia by Mark Brims of BSC Electronics Pty Ltd. This machine is widely used in guidance testing wool, Alpaca and other animal fibres

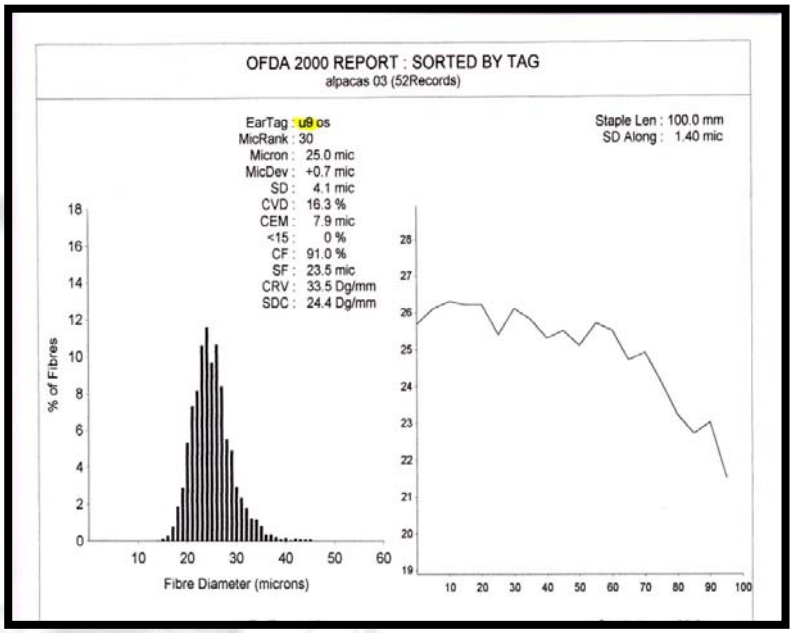
A grower site sample staple (usually from the animals' midside) is sub-sampled selecting around 3 staples which are divided and spread on a large slide and measured.

The full length of the staple is scanned and a diameter profile along the staple is produced. Measurement is from the butt to tip in that staple:

The OFDA 2000 produces a graph, which records the average fibre diameter of the staple, measured at different distances along the staple from the skin. Variations in the fibre diameter along the staple may be interpreted as representing variations in the health, pregnancy, nutrition or climate enjoyed by the animal over the period between shearings.

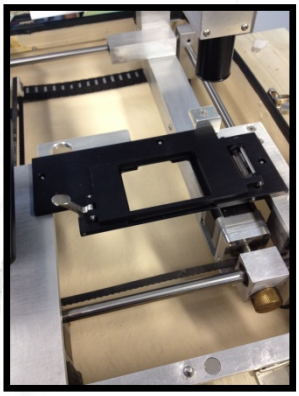
OFDA 2000

HISTOGRAM and GROWTH REPORT



OFDA2000 gives a report based on the entire staple, sampling it along its entire length. The OFDA2000 also prints the standard histogram.

For the OFDA 2000 to test normal “grid samples” (taken by the breeder), it needs to have an OFDA 100, attachment to the machine.



This “OFDA 100 snippet mode” would allow for measurements of the 2mm snippets which come from the mini-core that is used in laboratory sub-sampling

The Laser machine and both OFDA’s produce a histogram, indicating the number of fibre measurements recorded in a sample for every possible fibre diameter value in a given range. That range used is 0 to 80 (Wool) and 0 to 80 (Alpaca December 2016).

MATERIALS & METHODS

THE TESTING LABORATORY

OFDA 2000

The alpaca settings are engaged on the machine, polyester calibration slide is run through which is set at 18.6 microns.

IN THE GREASY STATE

The grease correction factor for alpaca was selected for 20 µ greasy - 0.6µ = 19.4µ.
From the sample, which had been received and identified, the operator will take one staple of finger width from the centre of the gross sample.

The staple selected is then spread out with the tip to the top of the slide ready for measurement by the OFDA 2000. The sample is measured in the grease (there is no scouring) for this test.

SAMPLING AND MEASUREMENT

1 An Australian registered fibre testing company was selected to supply 2000/3000 OFDA2000 data results with high trim off and on.

The above results in 1, were measured in the grease using the correction factor as mentioned earlier.

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2. The procedure for this comparison of the measurement of a given sample between two testing settings on the one machine (OFDA2000) is to test in "Trim High Off" mode and using the same test readings, re-calculate the data with the "Trim High On" setting engaged.
This then displays the results in "Trim High ON" Mode.

This is the only way to accurately compare these tests, as it uses the same measurement for comparison. This method does not have fibre sampling error and uses the same machine which should avoid machine error. Actual differences due to the formula for estimating the truncation point should be an accurate indication of the "Trim High off" and the "Trim High" on" calculations .

SUMMARY OF RESULTS

These average figures from Alpaca breeders show the effect on "Data" when the "trim high" is turned OFF and ON

These average figures are from some 2479 Alpacas, (A number of breeders chart 1),

2479 alpacas Mixed data OFDA 2000 data off & on

FD(µ)	FD(µ)	DIFF	%	SD (µ)	SD (µ)	DIFF	%
OFF	ON			OFF	ON		
24.00	23.64	0.36	1.52	6.05	4.96	1.09	17.69

CV%	CV%	DIFF	%	COUNT	COUNT	DIFF	%
OFF	ON			OFF	ON		
25.41	21.12	4.29	16.45	2839.10	2802.93	36.17	1.23

CEM (µ)	CEM µ	DIFF	%	CE%	CE%	DIFF	%
OFF	ON			OFF	ON		
10.73	8.91	1.82	16.83	4.61	3.71	0.90	23.00

NOTE; The TOTAL averages from the example above - chart 1apart from the micron, the SD, CV and CEM were around 15% - 20% + or - 3%.

All the results show the effect on "Data" when the " Trim High " is turned OFF and ON. The samples were from alpacas that had a large spread of fibre excellence.

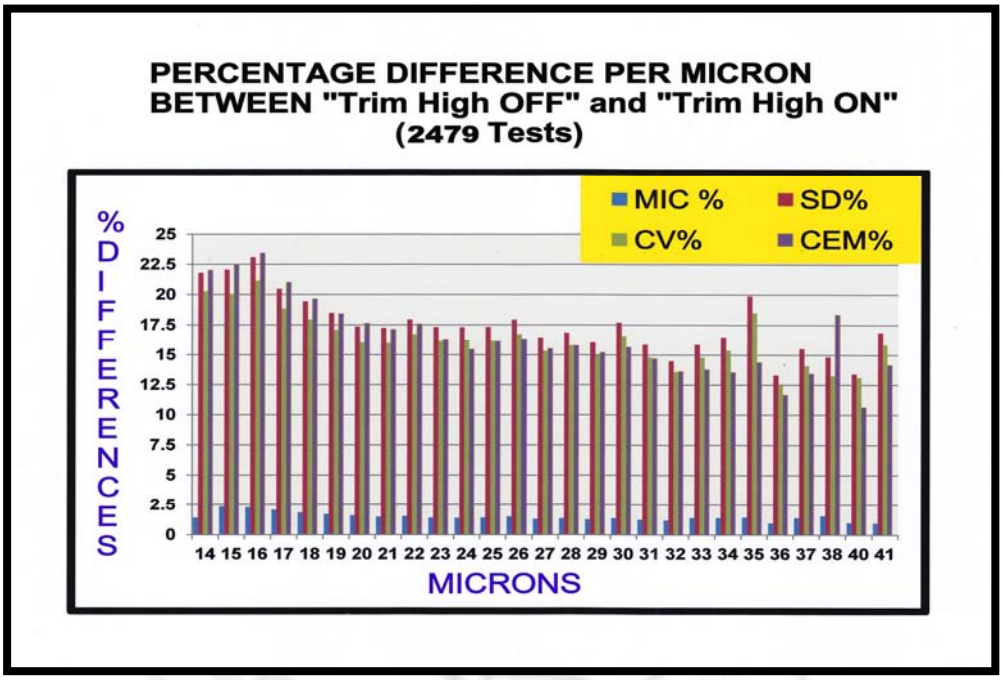
The chart "1" above clearly shows the differences between the two methods. The Micron is close with only 1.52% difference, but the SD (17.69%) and CV (16.45%) seem high considering the pressure breeders and testing advisers are putting on for this measure of evenness.

***TERM;* CEM (µ) - Coarse Edge Micron (µ)**

The CEM (16.83%) is where the coarse fibres and guard - hair are hiding. <u>The "High Trim ON" appears biased to give a finer / lower result compared to the " High Trim OFF".</u>

This method (Trim on) "used for wool" is widely used by OFDA 2000 operators in alpaca testing.

(chart 2)



(chart 3)

BREAKDOWN OF SPREADS FOR % DIFFERENCES

("N" 2479) *(BULK "N" FALL WITHIN)*

% DIFFERENCE	MICRON	SD	CV	CEM
1	*731*	2	4	4
5	6	23	26	13
10	12	226	279	37
15	0	*654*	*772*	*966*
20	0	*788*	*766*	*956*
25	0	*486*	*432*	*342*
30	0	206	146	103
35	0	65	44	44
`40>	0	29	10	14
TOTAL RANGE %	0 - 9.8	0 - 47.4	0 - 44.7	0 - 45.1

NOTE; In the group of 2479 (chart 3), the bulk of %differences (SD, CV and CEM) apart from the micron, fell in the 15% to 25% groups.

Action of the Trim High "ON or OFF"

When the "Trim High" setting is on, the results are lower.

The truncation is calculated by:
About halfway through the measurement process an "estimated SD" is derived;
Estimated SD = (0.246 X FD) - 1.069
this estimated "SD" is then used to make the truncation calculations as seen below.

The procedure, for simplicity, is being explained as described below;

TRIM HIGH ON;
The diameter measurement of the histogram is trimmed to 4 SD's above the mean,

E.G.
Normal measure is 0-80 and using this data say;

Average micron	= 23 microns
SD	= 4.5 microns

Then 4 SD's above the mean equals (4xsd [4.5]) =18.
Add 18 to average micron [23] = 41.

This means for this example that the cut off measurement on the fineness scale for this test is (0 - 41) not (0-80).

The real truncation for this example using above formula is;

SD = (0.246 x 23) -1.069 = 4.589
4 x 4.589= 18.36
18.36 + 23 = 41.36

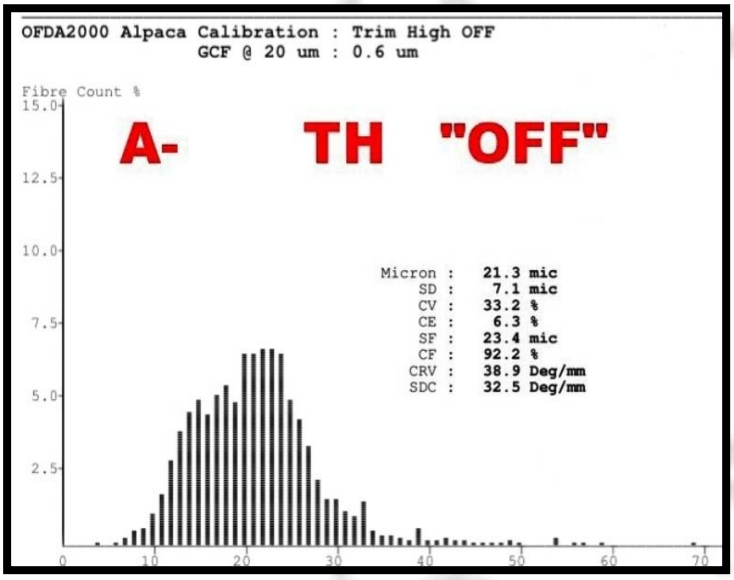
This method might improve the repeatability of the test, but for alpaca misses those fibres over 41 microns, which may contain very coarse fibres and "Guard Hair". It is important to identify these coarse fibres for breeders when they are using this data in their selection criteria.

TRIM HIGH OFF: The whole histogram is measured from 0 to 80um. This "high trim off" measurement may be less repeatable, but gives closer results to the snippet mode of the OFDA 100 and Laser Scan machines and therefore closer, (given breeder sampling methods may vary), to the standards used to certify Alpaca fibre as mentioned earlier.

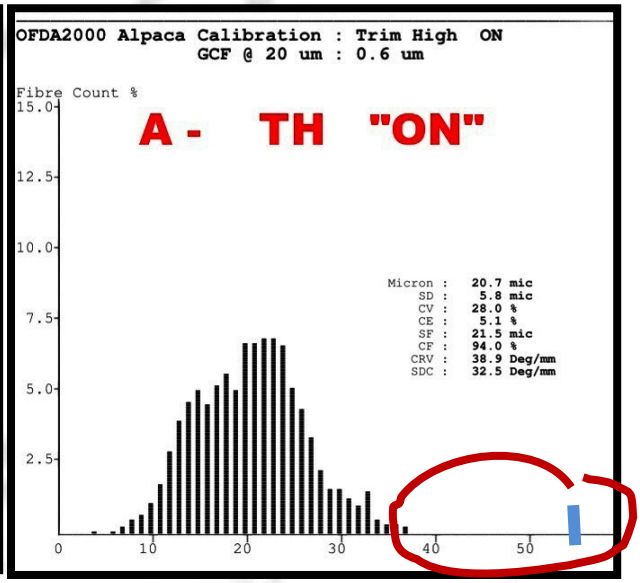
TESTS, A + B

A random selection; Histograms of two tests (similar microns) from the research data clearly show what the "Trim ON" effect is on two similar microned samples, one with a tail (1-2A) and the other (3-4B) relatively even.

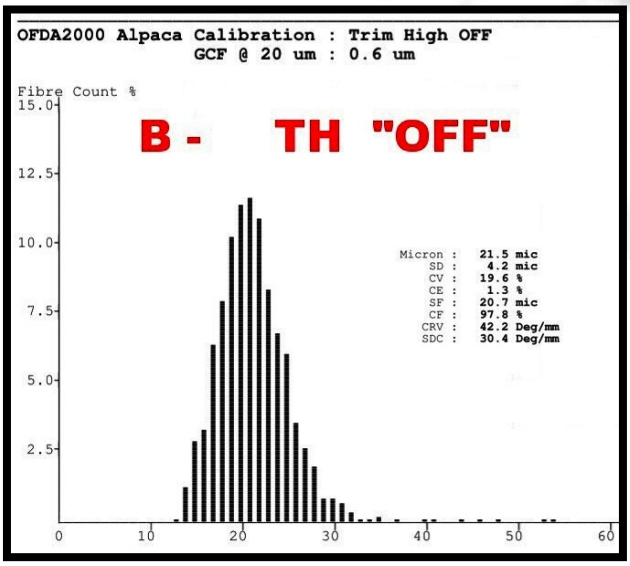
(Histogram 1a)



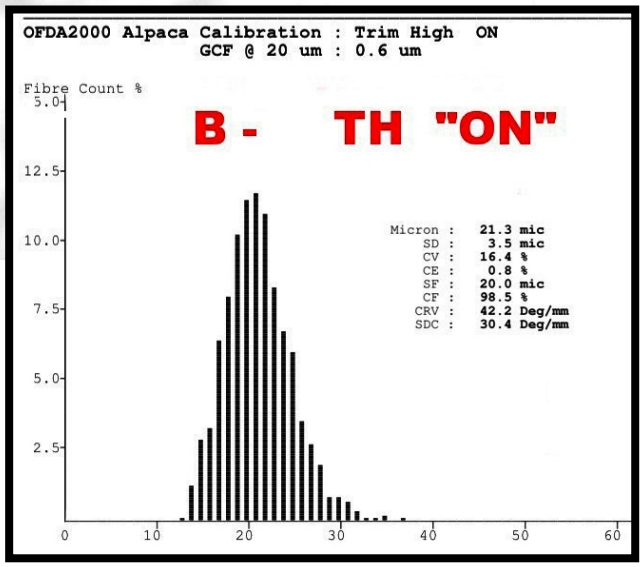
(Histogram 2a)



(Histogram 3b)



(Histogram 4b)



(chart 4)
DATA FROM HISTOGRAMS (1-2A) and (3-4B)

ID NUM	FD(µ) OFF	*FD(µ) ON*	DIFF	%	SD (µ) OFF	*SD (µ) ON*	DIFF	%
A	21.3	*20.7*	0.6	2.82	7.1	*5.8*	1.3	18.31
B	21.5	*21.3*	0.2	0.93	4.2	*3.5*	0.7	16.67

ID NUM	CV% OFF	*CV% ON*	DIFF	%	CEM (µ) OFF	*CEM µ ON*	DIFF	%
A	33.2	*28*	5.2	15.66	12.1	*10.1*	2	16.53
B	19.6	*16.4*	3.2	16.33	7	*5.9*	1.1	15.71

This test "Trim High ON" for the two samples of near identical microns, gave a lower micron, SD CV and CEM in both alpaca results as shown in the data above. The main difference was that in the "Trim High OFF" mode the alpaca "A" had a poor "CV" of 33.2%. The tail extended to 69µ. The CV after the truncation was 28% still indicating an average result, but did not reflect the inclusion of the very coarse fibre in the original sample.

The sample "B" lowest point was around 55µ. When in the "Trim High ON" mode, the scattered tail of "B" which was not as strong as "A" and therefore the TH "ON" did not affect this sample as severely.

With the "Trim High ON" the truncation was;
"A" The calculation should have been around 50µ, but truncated at 37µ (The calculated (4 X SD) result was hiding the worst of the tail, and should have showed an issue of coarse fibre. The histogram indicated a cut, giving a more even looking graph.

"B" around 37µ , showing a very even sample, CV of 16.4% down from19.6%

WHEN DISCUSSING THE TRIM "ON or OFF" --- CARE

The true calculation (Truncation) is based on a formula. That formula is used in the histogram preparation. For ease of discussion between breeders a simplistic calculation is often used. These can give very different results.

USING FORMULA FOR ESTIMATED "SD"

TEST "A"

The "simplistic" truncation gives a result of;

sd: 7.1 x 4= 28.4 +21.3 = 49.7µ truncation

"Formula" truncation;

sd: {(0.246 x 21.3) -1.069} = 4.17

sd: 4.17 x 4 = 16.68 + 21.3 = 37.94µ truncation

A difference of, 11.76 microns or 23.66 %

The actual high reading on the histogram was 69µ. This is some 32 microns above the cut off point.

TEST "B"

The "simplistic" truncation gives a result of;

sd: 4.2 x 4= 16.8 +21.5 = 38.3µ truncation

"Formula" truncation;

sd: {(0.246 x 21.5) -1.069} = 4.22

sd: 4.22 x 4 = 16.88 + 21.5 = 38.38µ truncation

A difference of, minus 0.08 microns or 0 %

This very even sample is not affected by the "Truncation formula"

Having "Trim High" ON would make it harder to compare results for certain individual alpaca animals because the range of fibres included may differ from animal to animal due to the varying reduction in the measurement scale as seen in the histograms above.

(chart 5)

% DIFFERENCES for OFDA2000

TRUNCATION METHODS

("N" 2479)

% DIFFER-ENCE	NUM	MIC OFF AVE	OFF SD AVE	SD X 4 TRUN AVE	FORM TRUN AVE	AVE FORM SD DIFF	AVE SD X 4-FORM TRUN DIFF	AVE % DIFF
- .01 > .10	147	28.6	5.57	50.54	51.79	5.88	-1.25	-2.43
1	46	26.90	5.62	49.37	49.09	5.55	0.28	0.57
5	373	26.21	5.76	49.25	47.72	5.38	1053	3.11
10	704	24.92	5.99	48.88	45.17	5.06	3.71	7.59
15	623	23.56	6.21	48.42	42.46	4.73	5.96	12.32
20	355	21.31	6.15	45.89	38.0	4.17	7.89	17.24
25	173	19.92	6.37	45.38	35.24	3.83	10.14	22.3
30	48	18.29	6.39	43.86	32.02	3.43	11.84	26.97
39	10	20.05	8.54	54.21	35.5	3.86	18.71	34.47
TOTAL AVE		23.99	6.05	48.18	43.33	4.83	4.85	10.27

In the Data (chart 5) the bulk of the differences between the "SDx4" (simplistic method) and the "SD formula", fall within the 10 - 15% differences groups. These are around the total average for micron (23.99) and percentage differences (10.27%).

So care is needed in comparing truncations using the simplistic method with the factual machine formula.

STATISTICAL ASSESSMENT

(figure 1)

1

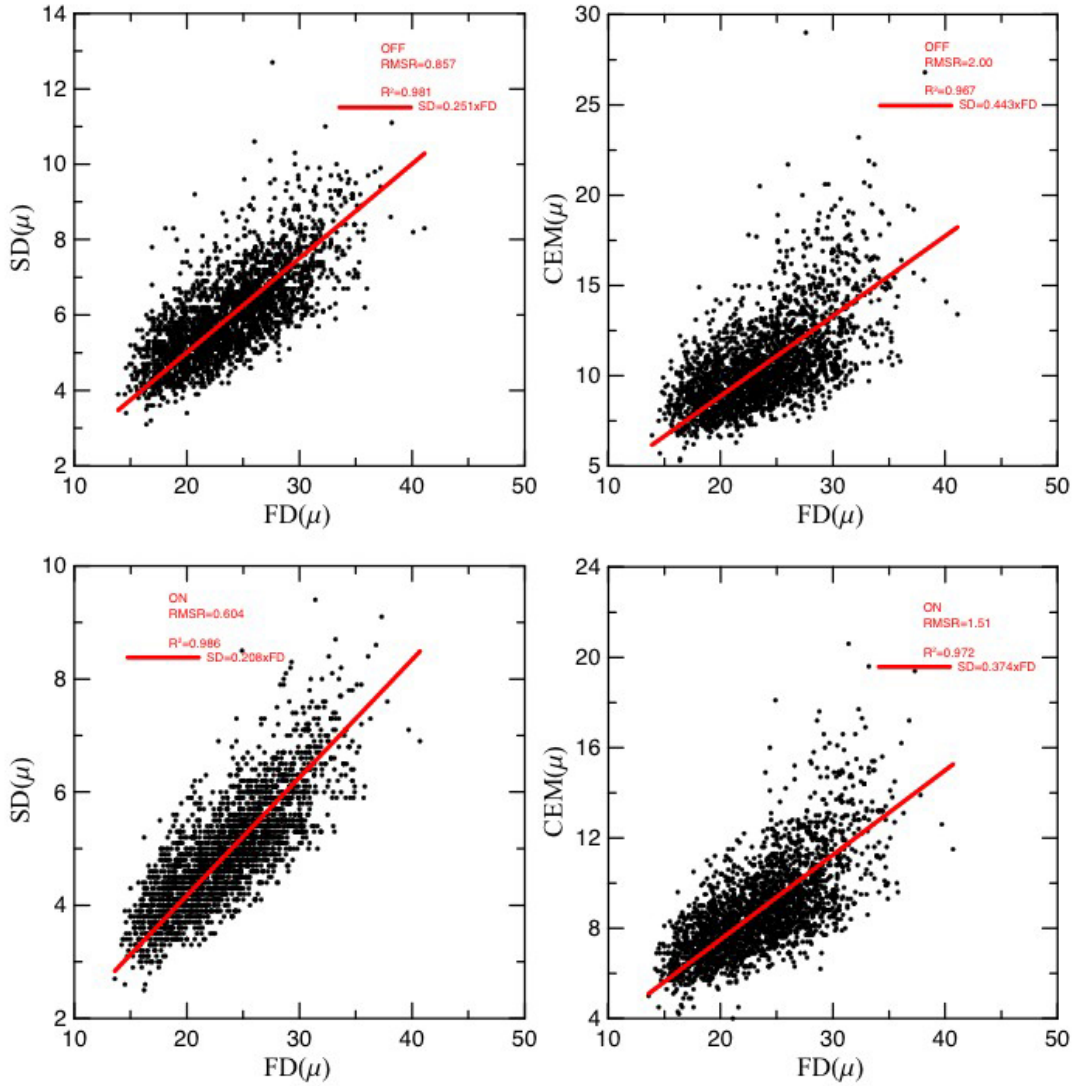


Fig. 1. Standard deviation and CEM as functions of mean fibre diameter for TRIM OFF (top two plots) and TRIM ON (bottom two plots). The red line is a least squares fit for a line of direct proportion, e.g. SD = *a* FD, which gives a better fit to the data than a linear fit with an offset, SD = *a* FD + *b*. The legend gives values for the proportionality constant *a*, the R2 value for the fit (the proportion of the variance explained by the fit), and the RSMR value, the root-mean-square residual. This is the square root of the mean square residual, which is the sum of the squares of the deviations from the fit divided by N-2, where N = 2479 is the number of samples. The RSMR is a measure of the vertical scatter of the points about the line of best fit.

We see that there is a good relation between SD and FD and CEM and FD, and that the scatter in the ON results is about 70 -75% of that of the OFF results.

(figure 2)

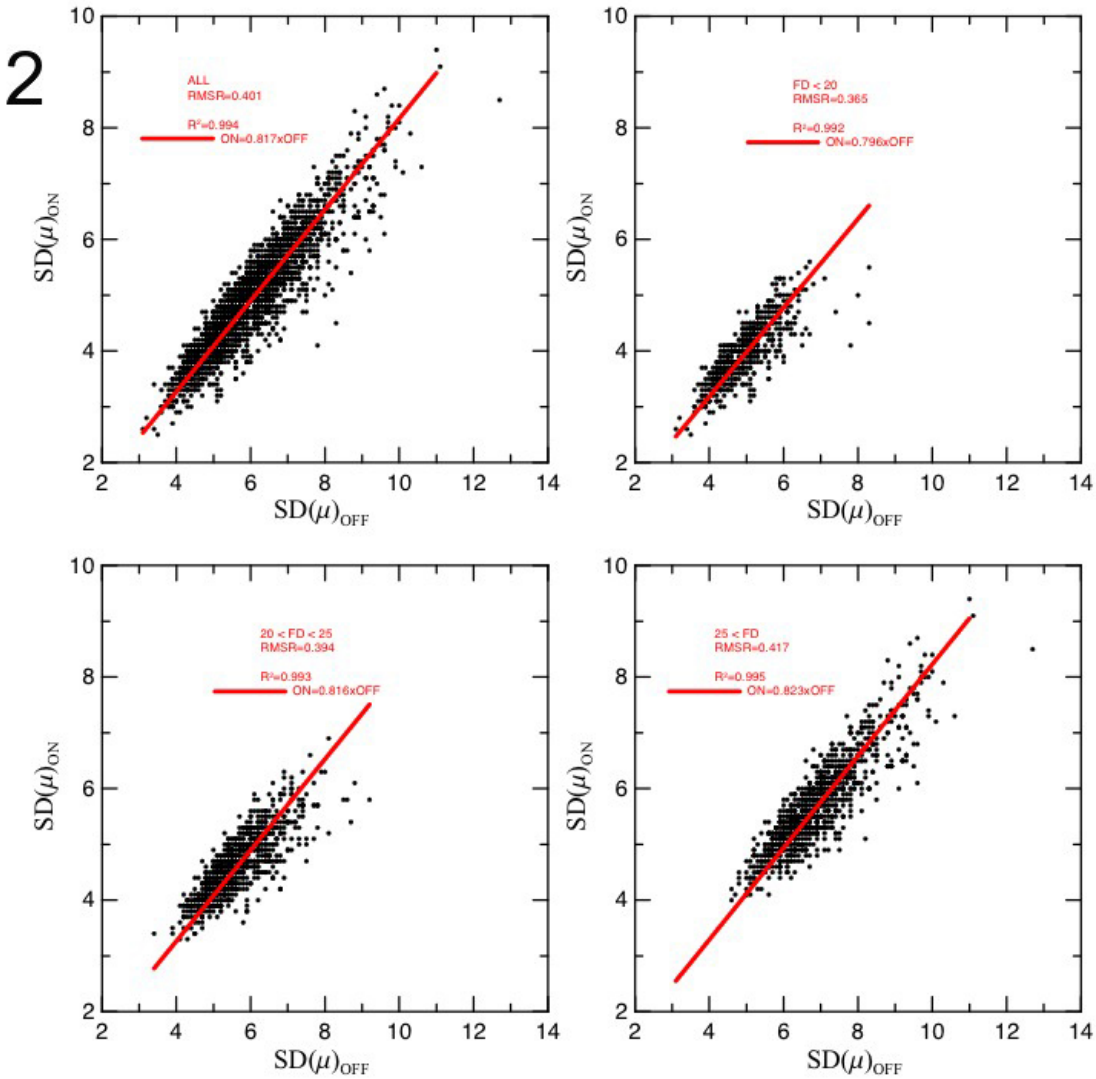


Fig. 2. Standard deviation for TRIM ON versus standard deviation for TRIM OFF. The top left hand plot includes all the data, and the next three plots show plots for mean fibre diameters in the ranges 0 < FD < 20 (top right), 20 ≤FD < 25 (bottom left) and FD ≥25 (bottom right). The fits are all excellent with values for R2 > 0.99, and low scatter, RSMR < 0.5m.

These plots show that TRIM ON and TRIM OFF measurements of the standard deviation are closely related, and in particular reliable estimates for TRIM OFF can be obtained from TRIM ON measurements by increasing the latter by about 22% (=100/0.817).

The trend for the proportionality constant to increase with increasing fibre diameter, probably reflects that fact that as the fibre diameter increases, the standard deviation also increases, and the cut-off point for the TRIM ON data gets closer to 80m, the cut-off for the TRIM OFF data. Thus the difference between TRIM OFF and TRIM ON decreases.

(Figure 3)

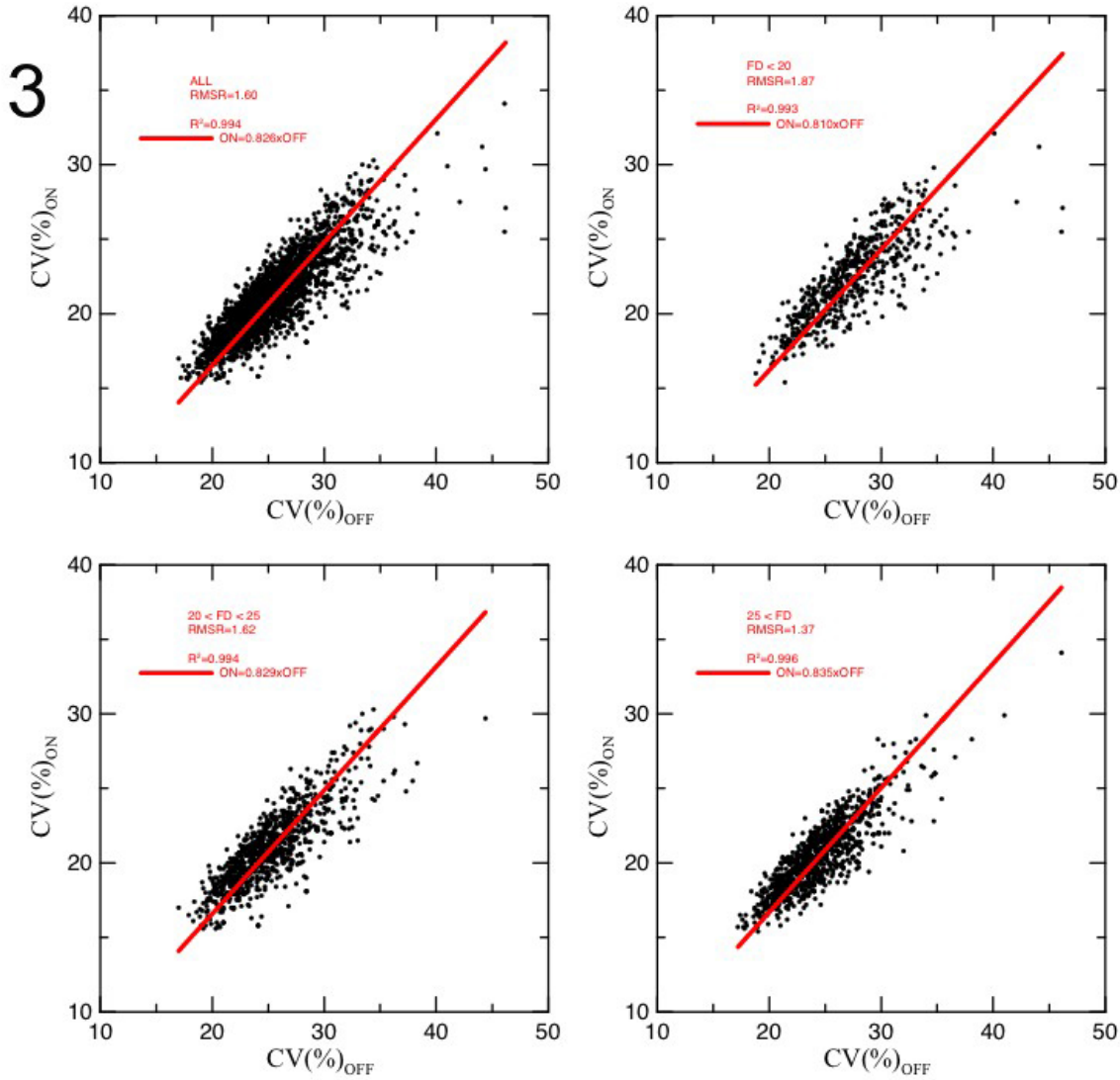


Fig. 3. The coefficient of variation for TRIM ON versus standard deviation for TRIM OFF. The top left hand plot includes all the data, and the next three plots show plots for mean fibre diameters in the ranges 0 < FD < 20 (top right), 20 ≤FD < 25 (bottom left) and FD ≥25 (bottom right). The fits are all excellent with values for R2 > 0.99, and low scatter, RSMR < 2%.

These plots show that TRIM ON and TRIM OFF measurements of the coefficient of variation are closely related, and in particular reliable estimates for TRIM OFF can be obtained from TRIM ON measurements by increasing the latter by about 21% (=100/0.826).

The trend for the proportionality constant to increase with increasing fibre diameter, probably reflects that fact that as the fibre diameter increases, the standard deviation also increases, and the cut-off point for the TRIM ON data gets closer to 80m, the cut-off for the TRIM OFF data. Thus the difference between TRIM OFF and TRIM ON decreases.

(Figure 4)

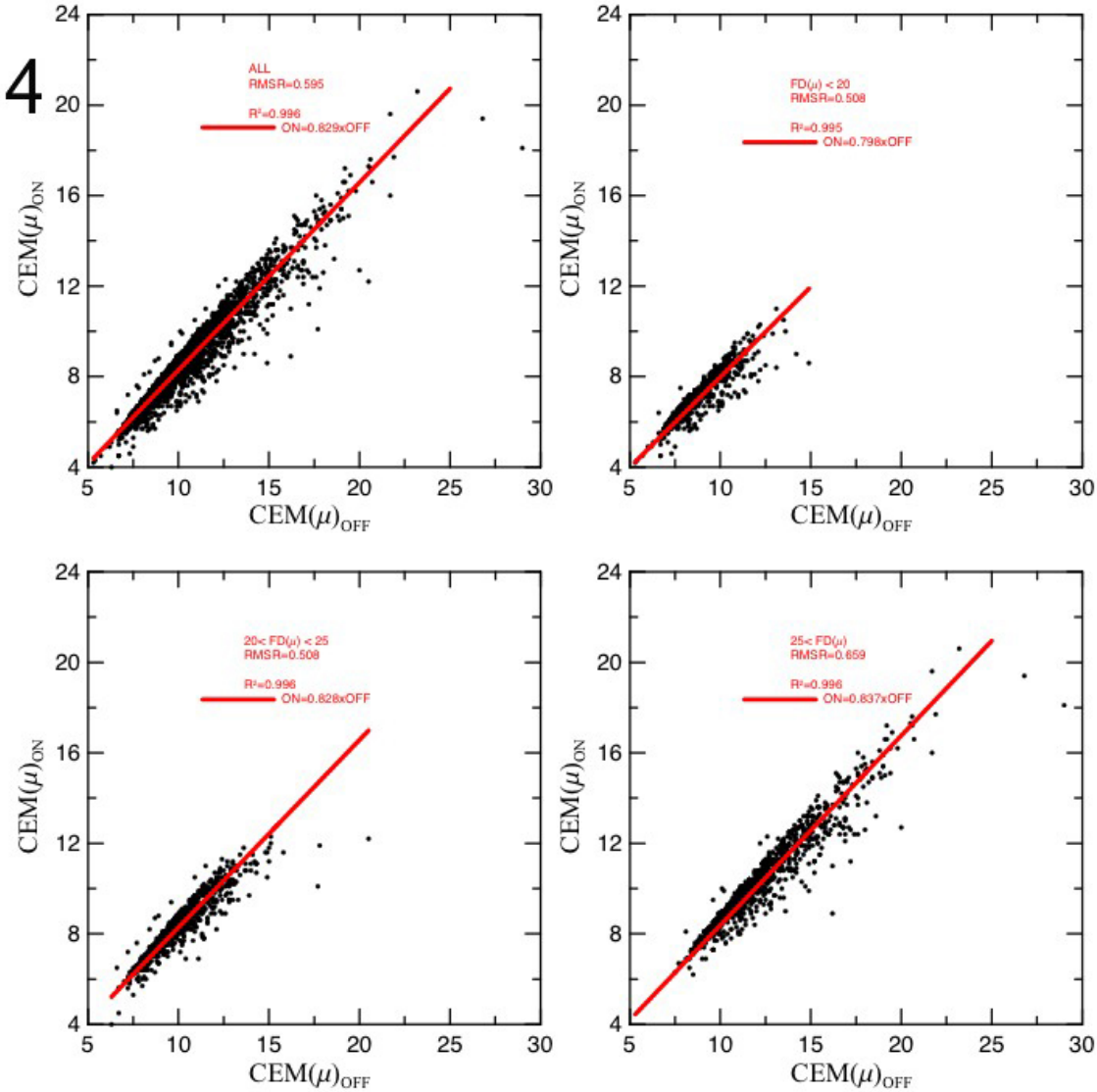


Fig. 4. CEM for TRIM ON versus standard deviation for TRIM OFF. The top left hand plot includes all the data, and the next three plots show plots for mean fibre diameters in the ranges 0 < FD < 20 (top right), 20 ≤FD < 25 (bottom left) and FD ≥25 (bottom right). The fits are all excellent with values for R2 > 0.99, and low scatter, RSMR ≈ 0.5m.

These plots show that TRIM ON and TRIM OFF measurements of the CEM are closely related, and in particular reliable estimates for TRIM OFF can be obtained from TRIM ON measurements by increasing the latter by about 21% (=100/0.829).

The trend for the proportionality constant to increase with increasing fibre diameter, probably reflects that fact that as the fibre diameter increases, the standard deviation also increases, and the cut-off point for the TRIM ON data gets closer to 80m, the cut-off for the TRIM OFF data. Thus the difference between TRIM OFF and TRIM ON decreases.

(Figure 5)

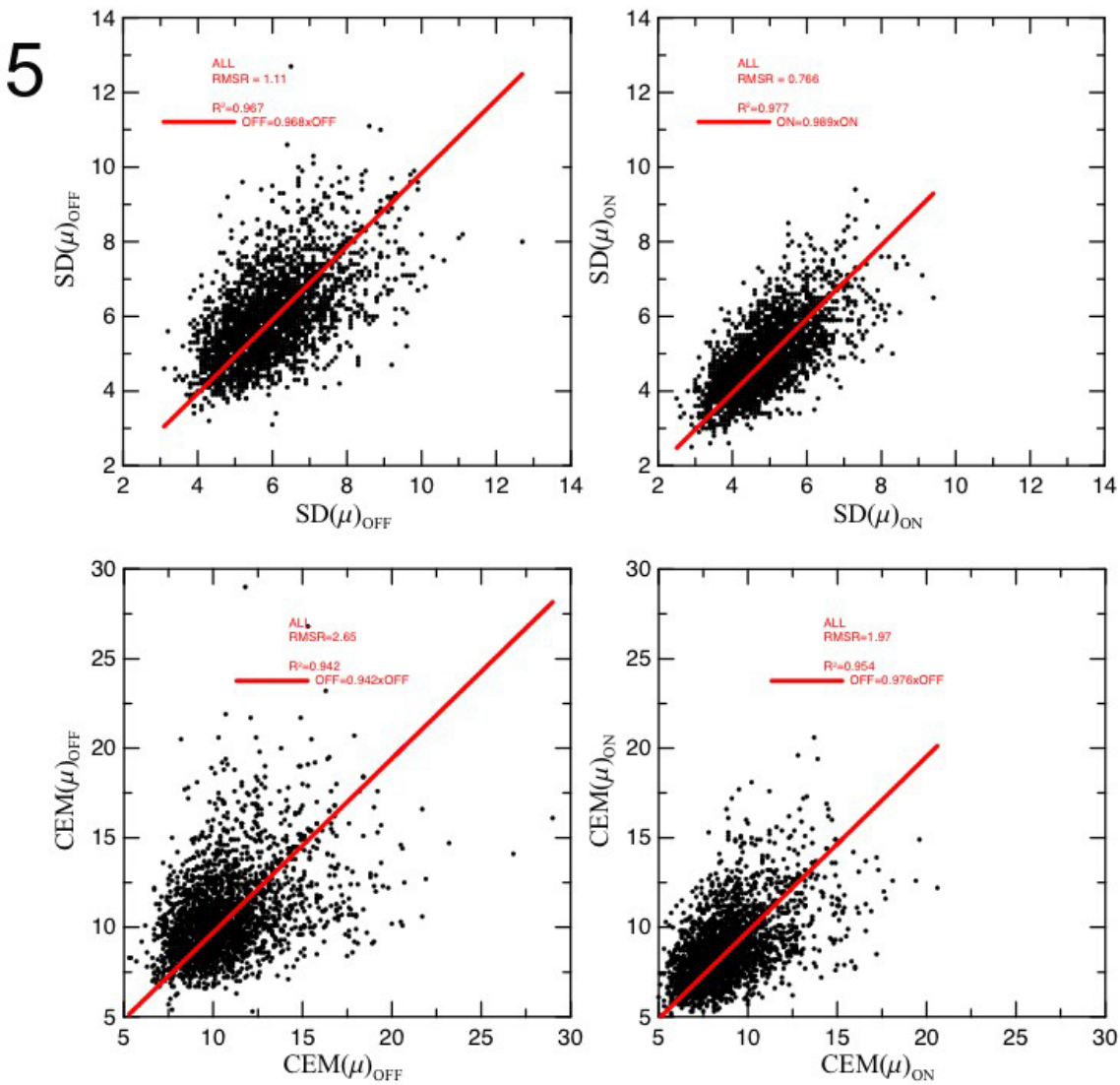


Fig. 5. Plots of standard deviation (top) and CEM (bottom) for 2478 pairs of samples with effectively the same mean fibre diameter. The pairs were chosen by sorting the data in order of FDOFF and then taking pairs consecutively down the list; i.e. samples 1 and 2, 2 and 3, 3 and 4 etc. The plots show the second member of each pair plotted against the first. This was carried out for both TRIM OFF and TRIM ON samples. It gives an estimate of the inherent variability among samples with the same mean diameter.

We see that the correlation is good, R2 ≈ 0.94 – 0.99, but that the scatter is 3-4 times larger than that in the plots of TRIM ON vs TRIM OFF in Figs. 2 and 4. The RMSR values are 70 – 75% lower for the TRIM ON plots, but since the TRIM ON data values are systematically about 80% of the TRIM OFF values, the relative scatter is only about 10% lower for the TRIM ON results.

(Figure 6)

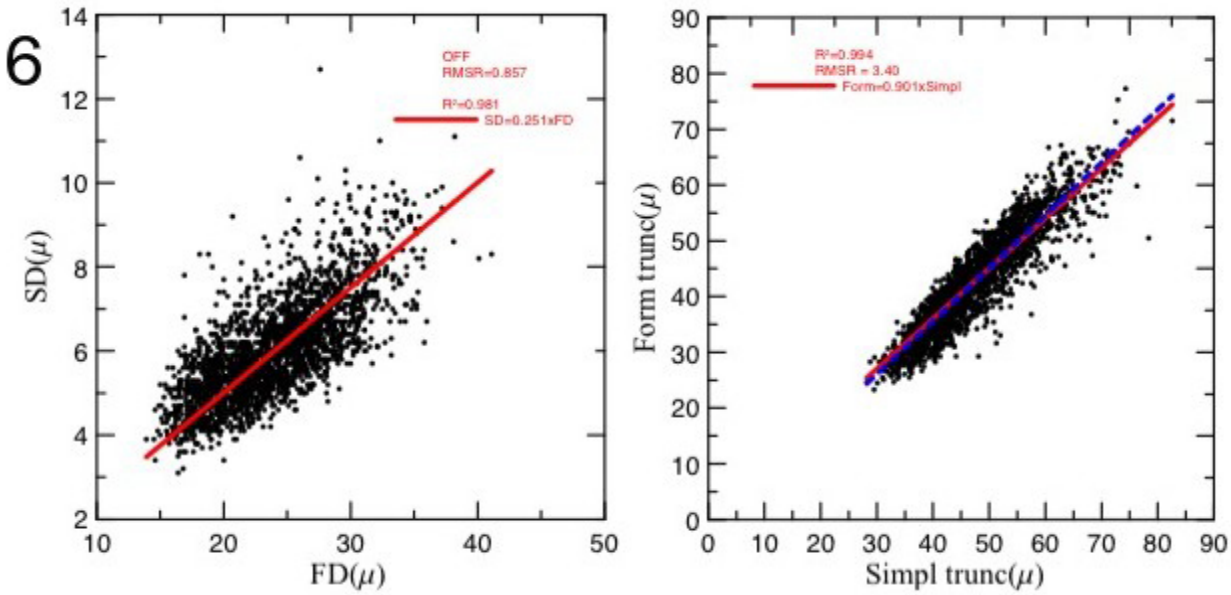


Fig 6. Standard deviation as a function of mean fibre diameter for TRIM OFF (left) and truncation according to formula as a function of simplistic (true) truncation (right). In both cases the red line is a least squares fit for a line of direct proportion, e.g. SD = *a* FD, and in both cases gives a better fit than a standard linear fit e.g.SD = *a* FD + *b*, shown by the blue dashed line in the right hand figure. The RMSR (root-mean-square residual) number is a measure of the scatter about the line of best fit.

The values for the two figures are consistent. Since the right hand figure is for FD + 4 SD, we should rescale the left hand figure by a factor of 4 to compare the RMSR numbers. We see that 4x0.857 = 3.428, very close to the value 3.40 in the right hand figure. So the scatter in the truncation, simply reflects the scatter in the formula for the SD in terms of FD

COMMENTS

Firstly we need to refer to opening statements and appendix numbers 1 & 2

OS "The OFDA 2000 was developed originally for the wool industry to be used in the shearing shed for guidance testing of sheep (ranking for animal selection) and in classing of wool (to specific fleece groups)".

AP 1 "The original OFDA2000 settings were developed based on greasy merino wool staple measurement, which was the majority of measurement around 2001-2005. The maximum diameter for individual wool fibres was set at 80um and a "trim high" setting which trimmed the coarse edge of the histogram was applied based on the fibres following a normal distribution (bell shaped). This "trim high" setting cut off all fibres above 4 standard deviations above the mean.

There is no doubt that the measurement of an individual Merino sheep's fleece is relatively evenly shaped when viewed in a histogram form. Thousands upon thousands of measurements confirm this. The odd "outriders" seen would make little or no statistical difference to the final result. This is why, for the sheep, the "Trim High ON" operation in the shearing shed (In Grease form or washed) with the OFDA200 makes it a handy machine for ranking animals and classing fleece. This of courses recognizes that this not to "International IWTO " standards and is only a guidance test.

However the alpaca results here reflect its genetic background and most alpacas do not follow the more bell shaped histograms of the merino sheep. The majority have "outriders " (tail) showing on the histograms. These are coarse alpaca fibres and guard - fibres (gare) which have to be bred out or the fleece.

AP 1 "Having spoken to several OFDA testers, each with extensive experience in testing alpaca over several years, it has been agreed that the maximum individual fibre diameter be set to 80um, and the "trim high" function be turned off. This will allow best agreement with the OFDA100 and Laserscan settings, and also allow the coarse edge of the histogram to be seen. It may result in some higher SDs being seen on animals that were previously tested with "trim high" turned on, but the advantage for breeders is that all the instruments will agree better, and the coarse edge which contributes to higher SD, higher prickle and less even yarns will be seen more clearly to assist in breeding out".

Trim High "off /on" relationship
Refer to "Statistical Assessment"

Results showed consistency for both trim off and trim on. This would indicate that for comparisons of "off" and "on" in their individual groups would be valid. Cross comparisons would not be reliable. However correction values can be applied (fig 1-4) to give an estimated comparison.

Summary

Little difference was seen in the XL data for micron. The 2479 results showed an average "off" 24.00µ, "on" 23.64µ, an overall difference of 0.36µ (1.52%) with a spread of 0 - 2.7µ.

In the analysis SD-FD and FD-CEM there was a good relationship between each of the comparative measurements. The scatter in the results was about 70 - 75%.

Comparing the SD On with SD Off showed all scatters of the TRIM ON and TRIM OFF of the SD were closely related and reliable estimates. The data suggests that the TRIM OFF can be calculated by increasing the measurement for the TRIM OFF by about 22%.

It was also noticeable that as the micron increased the SD also increased. This follows the trends in Huacaya averages chart 6 in Appendix 3. It was noticeable also, that as the SD increased the cut off point for the "TRIM ON" data became closer to the 80 micron cut off used in the "TRIM OFF" method.

Comparing CV off with CV on, again through the measurements they were found to be closely related and estimates for "TRIM OFF" can be calculated by increasing the "Off" result by about 21%.

The statistical data for CEM v CEM, graphs again showed highly correlated results. By increasing the TRIM ON measurements by 21% an approximate "TRIM OFF" can be obtained.

The "TRIM ON " data values are systematically about ' 80% " of the "TRIM OFF" values with the relative scatter being only about 10% more consistent (lower) for the "TRIM ON" results.

The 'Trim off" measurements on the OFDA2000 are compatible with results from the Laserscan, OFDA100 and OFDA2000 run in snippet mode (100 mode). Those machines do not truncate the measurement, that is, all fibres 1-80 microns are measured unlike the OFDA2000 "Trim on" which are truncated.

CERTIFIED FIBRE TESTING LABORATORIES / FIBRE TESTING OPERATORS

Currently in Australasia there are a number of different machines and methods used (see appendix 4, chart 7), however most methods operate using the international standard of measurement. Some testing houses that are using the OFDA2000 in staple mode are suppling both "trim ON" and "trim OFF" results due to the differences between the 2 methods. As mentioned the histograms from the staple measurement ***must show*** *the method of test.*
Unfortunately not all operators are doing this, which creates more confusion to a 2 tier system of measurement.

AUTHOR'S RECOMMENDATIONS

1 MEASURMENT IN TRIM HIGH MODE (ON or OFF)

"Trim High" definition
The "trim high" setting which is usually set to "ON" is used to eliminate vegetable matter and fibres that may be stuck together particularly if the samples are in a very greasy state (mainly merino wool). The diameter histogram is trimmed to 4 SD above the mean (simplistic trim) , which slightly improves the repeatability of the test. Alpaca with its limited content of grease does not need this to be "ON" for a grease problem.

This method however will, in most cases, give a lower; micron, SD and CV in alpaca results.

2 METHOD OF CALCULATION

The documentation **MUST** identify the method of testing on any OFDA2000 used for measuring Alpaca fibre; eg, TRIM HIGH "ON" or TRIM HIGH "OFF".

3 INTERNATIONAL BREED ASSOCIATIONS

Alpaca breed associations should be aware that a 2-tier system is currently operating. Consideration for an accepted international standard for Alpaca fibre testing is needed if the alpaca fibre industry is to further develop. Textile industries are increasingly demanding suppliers deliver fibre to given specifications for their products.

4 ALPACA BREEDERS

The alpaca industry has benefited from the wool testing experience and must continue to use measurement to improve their fleece.

Alpaca breeders today need measurement in three areas:

a Animal fleece measurement to help in **breeding selection.**

b The use of measurement for the **sale of animals.**

c Measurement as an aid in **classing of fleece and the selling** thereof.

The Merino sheep industry took over 100 years to be where it is today. This applied not only in the conformation but also in the structure and evenness of the fleece. Alpaca however is probably only half way to matching that of the Merino wool industry. It still has a large coarse edge made up of not only coarse fibres but also the undesirable guard hair.

In the measurement of Merino fleece for "shearing in - shed measurement" as an aid to the classing of the fibre, it is quite appropriate to use the "Trim High ON" setting as the Merino fibre does not necessarily have enough fibres in the coarse end to be of concern.

For alpaca however this is not the case and the full 0 to 80 micron range should be measured and to do this with an OFDA2000 the "Trim High" setting must be OFF.

Animal selection

Data suggests that there is a high correlation between trim OFF and trim ON . This would enable Breeders to rank their alpacas, of a similar age, using either method. However coarse micron and Guard- hair would not be clearly identified in the trim "ON" setting. (Visual inspection needed).

The trim "OFF" mode may also need a visual inspection for Guard-hair identification.

Alpaca fleece classing

With the high correlation between trim OFF and trim ON this would enable Classers to grade the fleeces using either sets of measurement. As classing is a visual action, coarse fibre and guard is seen. The use of data becomes an important aid in confirming micron (both methods were within approximately 1 - 2% of each other for micron) and a secondary aid in particular for CVμ to help in assessing fleece evenness.

Commercial sale of alpaca fibre

Any trading of classed Alpaca fibre, either by commercial Auction or private sales direct to mills and tested results are supplied, they MUST have been tested to International standards. That means for the OFDA200 in the trim OFF setting and in snippet mode, as well as other approved machines.

5 PROCESSING

With the wool industry now selling its wool certainly in Australia by measurement and the purchasers buying the wool to strict specifications, particularly in the garment production where evenness of micron is important, the processors require low CV percentage to avoid the prickle affect.

Although currently only a small amount of alpaca fibre has been sold under specification it does not alter the fact that the same requirements are applicable to the alpaca yarn and fabric producers. Other areas of alpaca production in doona making and carpets do not require the level of evenness as for the former mentioned areas.

NOTE;

Only Huacaya tests were available for this review.

Based on thousands of test results gathered on Huacaya and Suri fibre it would be fair to say findings here for Huacaya could be applied to Suri. The results in Appendix 5 (charts 8 & 9), show the closeness of Huacaya and Suri Averages for similar characteristics which suggest a similar result found in this study on Huacaya.

Special thanks to Professor Sawford (formally with CSIRO, Monash University) for his analytical help in this study, the breeders who supplied herd information and "Micron man" WA for the testing of the samples used in this study.

APPENDIX

APPENDIX 1 NOV 2O16

Recommended OFDA 2000 Settings for Measuring Alpaca Diameter

Recommended OFDA Settings for Measuring Alpaca Diameter
Mark Brims 9 Nov16

I am the inventor of the OFDA instrument family (OFDA100, OFDA2000, OFDA4000) for measuring the diameter of fibre types including wool, alpaca, cashmere, mohair and many others. I have over 35 years experience in design and construction of instruments for the measurement of animal fibre diameter.

The original OFDA2000 settings were developed based on greasy merino wool staple measurement, which was the majority of measurement around 2001-2005. The maximum diameter for individual wool fibres was set at 80um and a “trim high” setting which trimmed the coarse edge of the histogram was applied based on the fibres following a normal distribution (bell shaped). This “trim high” setting cut off all fibres above 4 standard deviations above the mean. It was not applied to fibres measured on the OFDA100 clean snippet (70mm glass slide) mode, or to OFDA2000 operated in clean snippet (70mm glass slide) mode.

In recent years, alpaca measurement has increased and wider knowledge of alpaca fleece measurement has resulted. The merino wool industry measurement systems developed over 100 years from projection microscope to airflow to OFD100 to OFDA2000, and with extensive government backed research by organisations including WRONZ (New Zealand), CSIRO Australia and Department of Agriculture's (Victoria, Western Australia), often reported in papers to the International Wool Textile Organisation (www.iwto.org). These organisations do little or no wool diameter research now, and the alpaca industry does not have equivalent research organisations.

Having spoken to several OFDA testers, each with extensive experience in testing alpaca over several years, it has been agreed that the maximum individual fibre diameter be set to 80um, and the “trim high” function be turned off. This will allow best agreement with the OFDA100 and Laserscan settings, and also allow the coarse edge of the histogram to be seen. It may result in some higher SDs being seen on animals that were previously tested with “trim high” turned on, but the advantage for breeders is that all the instruments will agree better, and the coarse

edge which contributes to higher SD, higher prickle and less even yarns will be seen more clearly to assist in breeding out.

APPENDIX 2 DEC 2O16

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Technical Note On Alpaca Diameter Measurement
Mark Brims (inventor of the OFDA)

There are many variations of sampling and diameter measurement. Each has its own advantages, there is no right or wrong way, it is a matter of choosing the best way for your objectives, and comparing results using the same measurement technique.

Note;
The Ofda100 was originally developed for use in laboratories for the wool and other fibres. It has the ability with added software to measure medullation in light coloured fibres. It has no "trim high" setting as samples are normally scoured (washed).

The OFDA 2000 was developed originally for the wool industry to be used in the shearing shed for guidance testing in classing and animal selection. The settings were set at 0 - 80, with a "trim high" setting on to eliminate vegetable matter and fibres that may be stuck together, as the samples were in a greasy state. It has been agreed that the measuring range of 0 - 80 is industry acceptable for alpaca testing in lieu of any formal standard being put in place.

The 4 most common techniques used are:

1. **Snippets cut by minicore:** A minicore cuts 2mm snippets from a handful of fleece from the sampling site or random sites on the animal. The snippets are washed, dried and conditioned and measured on

OFDA100, OFDA2000 (glass slide mode/snippet mode) or Laserscan. Typical fibre diameter range is 0-80um. This gives an average measurement over the entire sample submitted but does not show the change in diameter over the growth period.

2. **Snippet butt test :** A guillotine cuts 2mm snippets close to the skin end of a staple (approx 1 cm) from the staples taken from the sampling site on the animal. The snippets are washed, dried and conditioned and measured on OFDA100, OFDA2000 (glass slide mode/snippet mode) or Laserscan. Typical fibre diameter range is 0-80um. This gives a measurement for all animals at the same point in time but does not show the change in diameter over the total growing period or the yearly average.
   SD, CV are normally lower as the variation over growth period for that year has been removed with the single butt cut.

3. **Staple mode:** A staple (usually from the animals' midside) is parted and laid on a large fibreglass slide. The full length of the staple is scanned and a diameter profile along the staple is produced that shows the history of diameter change since the beginning of the fibre growth to the end (butt to tip) in that staple:

   3.1. **Trimmed histogram:** The diameter histogram is trimmed to 4 SD above the mean, which improves the repeatability of the test by removing the few fibres stuck together, some very coarse fibres and fibrous vegetable matter. This method used for greasy wool is widely used by OFDA 2000 operators in alpaca testing. This method however can give a lower; micron, SD and CV in alpaca results.

   3.2. **Un-trimmed histogram:** The whole histogram is used from 0 to 80um. This un- trimmed histogram is less repeatable, but gives closer results to the snippet mode of the OFDA 100 and Laserscan instruments.

The result and printout should show whether the "trim high" was on or off for an OFDA2000 test.

Testers and Consultants to breeders of Alpaca should understand and choose the best method for their purpose, and be aware which method was used when comparing results for alpaca selection and marketing.

The Alpaca industry has yet to form a global consensus to mandate a trading standard method for measuring diameter (eg as IWTO has done with Test Methods for wool over the last 60 years). This can be an advantage for innovation in that different methods can be used with their respective advantages.

Mark Brims

BSC Electronics Pty Ltd
December 2016

APPENDIX 3

CHART 6

AVERAGE RESULTS PER MICRON (2479) OF OFDA2000 IN TRIM HIGH "OFF & ON" MODES

MICRON	FD(µ) OFF	FD(µ) ON	DIFF	%	SD (µ) OFF	SD (µ) ON	DIFF	%	CV% OFF	CV% ON	DIFF	%	CEM (µ) OFF	CEM µ ON	DIFF	%
14	14.20	14.00	0.20	1.42	3.90	3.05	0.85	21.79	27.35	21.75	5.60	20.27	7.10	5.55	1.55	22.02
15	15.12	14.77	0.36	2.35	4.48	3.48	1.00	22.05	29.52	23.54	5.97	20.01	8.32	6.44	1.88	22.48
16	16.15	15.78	0.37	2.29	4.59	3.52	1.08	23.10	28.40	22.32	6.08	21.14	8.36	6.37	1.99	23.46
17	17.08	16.73	0.36	2.09	4.86	3.83	1.03	20.47	28.46	22.94	5.52	18.83	8.84	6.96	1.88	21.01
18	18.08	17.75	0.33	1.85	4.93	3.95	0.98	19.43	27.25	22.24	5.01	17.94	8.90	7.12	1.79	19.65
19	19.06	18.73	0.33	1.72	5.14	4.17	0.97	18.48	26.96	22.26	4.70	17.10	9.18	7.47	1.71	18.42
20	20.00	19.69	0.32	1.59	5.31	4.36	0.95	17.35	26.53	22.16	4.37	16.03	9.52	7.82	1.70	17.63
21	21.07	20.75	0.31	1.49	5.44	4.48	0.96	17.25	25.78	21.58	4.21	15.98	9.66	7.99	1.67	17.13
22	21.98	21.64	0.34	1.55	5.58	4.55	1.03	17.94	25.38	21.03	4.34	16.71	9.91	8.14	1.77	17.60
23	23.05	22.72	0.33	1.43	5.76	4.73	1.03	17.31	24.97	20.82	4.15	16.14	10.18	8.48	1.70	16.32
24	24.05	23.72	0.33	1.39	5.93	4.88	1.05	17.29	24.66	20.57	4.09	16.21	10.32	8.71	1.61	15.48
25	25.05	24.69	0.36	1.43	6.21	5.12	1.10	17.33	24.79	20.72	4.07	16.14	10.95	9.15	1.80	16.13
26	26.04	25.64	0.40	1.52	6.49	5.29	1.19	17.94	24.92	20.65	4.27	16.74	11.36	9.45	1.91	16.35
27	27.06	26.71	0.36	1.31	6.60	5.49	1.11	16.45	24.38	20.58	3.80	15.34	11.67	9.82	1.85	15.52
28	28.05	27.67	0.38	1.36	6.76	5.59	1.18	16.86	24.13	20.21	3.92	15.80	11.81	9.87	1.94	15.79
29	29.01	28.64	0.37	1.28	7.00	5.86	1.14	16.04	24.13	20.46	3.67	14.95	12.35	10.43	1.92	15.21
30	30.08	29.67	0.41	1.37	7.30	5.98	1.32	17.71	24.27	20.17	4.10	16.59	12.85	10.78	2.07	15.65
31	31.01	30.62	0.39	1.26	7.58	6.35	1.22	15.86	24.41	20.74	3.67	14.80	13.68	11.64	2.04	14.71
32	31.94	31.55	0.39	1.21	7.71	6.58	1.13	14.50	24.16	20.84	3.32	13.60	14.11	12.18	1.94	13.65
33	33.12	32.65	0.47	1.41	8.12	6.80	1.32	15.86	24.54	20.83	3.70	14.79	15.11	12.97	2.14	13.80
34	34.02	33.54	0.48	1.41	8.43	7.01	1.42	16.49	24.79	20.90	3.90	15.39	15.34	13.23	2.11	13.57
35	34.99	34.48	0.51	1.46	8.40	6.70	1.70	19.88	23.97	19.45	4.52	18.51	14.01	11.97	2.04	14.39
36	35.83	35.48	0.35	0.98	7.87	6.77	1.10	13.32	21.97	19.08	2.88	12.57	13.72	12.10	1.62	11.69
37	36.98	36.45	0.53	1.42	9.20	7.75	1.45	15.51	24.83	21.28	3.55	14.11	16.95	14.65	2.30	13.46
38	38.15	37.55	0.60	1.57	9.85	8.35	1.50	14.82	25.75	22.25	3.50	13.26	21.05	16.65	4.40	18.38
40	40.10	39.70	0.40	1.00	8.20	7.10	1.10	13.41	20.60	17.90	2.70	13.11	14.10	12.60	1.50	10.64
41	41.10	40.70	0.40	0.97	8.30	6.90	1.40	16.87	20.20	17.00	3.20	15.84	13.40	11.50	1.90	14.18
AVERAGE of ave's	27.12	26.74	0.38	1.49	6.66	5.50	1.16	17.46	25.08	20.90	4.18	16.22	11.95	10.00	1.95	16.46
MICRON	FD(µ) OFF	FD(µ) ON	DIFF	%	SD (µ) OFF	SD (µ) ON	DIFF	%	CV% OFF	CV% ON	DIFF	%	CEM (µ) OFF	CEM µ ON	DIFF	%
TRUE AVE OF ALL 2479 RESULTS	29.52	29.12	0.40	1.37	7.12	5.93	1.20	16.61	24.40	20.54	3.86	15.48	12.75	10.76	1.98	15.31

APPENDIX 4

CHART 9

CERTIFIED FIBRE TESTING LABORATORIES / FIBRE TESTING OPERATORS

An overview is seen as:

MACHINE	MODE	INTERNATIONAL STANDARD	RANGE MEASURED	TRIM ON	TRIM OFF	SCOURED - GREASY
Laserscan	snippet	√	0 - 80µ	n/a	n/a	SCR
ODFA100	snippet	√	0 - 80µ	n/a	n/a	SCR
OFDA2000	Snippet / 100 mode	√	0 - 80 µ	n/a	n/a	SCR
OFDA2000	staple	similar	0 - 80µ		√	EITHER
OFDA2000	Staple	no	0 - ? µ Truncation	√		EITHER

APPENDEX 5

Only Huacaya tests were available for this review and as previous research results below suggest, the closeness of Huacaya and Suri Averages would suggest a similar result for SD & CV

chart 8

HUACAYA			
MIC	MIC AVE	S D	C V
15	14.56	3.66	25.00
16	16.06	3.83	23.85
17	17.06	4.17	24.48
18	18.05	4.38	24.29
19	19.06	4.56	23.90
20	20.05	4.64	23.13
21	21.02	4.88	23.21
22	22.02	5.00	22.72
23	23.01	5.18	22.50
24	23.99	5.29	22.07
25	25.02	5.44	21.74
26	25.99	5.54	21.33
27	26.99	5.73	21.23
28	28.00	5.87	20.97
29	28.98	6.00	20.73
30	29.87	6.18	20.71
31	30.99	6.45	20.81
32	32.00	6.66	20.80
33	32.97	6.80	20.62
34	34.03	7.02	20.64
35	34.97	7.20	20.59
36	36.00	7.79	21.65
37	37.02	7.63	20.62
38	37.94	7.97	21.00
39	38.99	8.16	20.94
40	40.40	9.66	23.91
42/43	42.77	10.57	24.70
44/46	45.38	9.93	21.87
AVE	25.63	5.57	21.91

chart 9

SURI			
MIC	MIC AVE	S D	C V
15	15.01	3.91	26.10
16	16.09	3.68	22.87
17	17.05	4.07	23.89
18	18.10	4.32	23.90
19	19.06	4.45	23.32
20	20.06	4.52	22.56
21	21.03	4.79	22.77
22	22.02	4.89	22.21
23	23.01	5.13	22.29
24	24.00	5.22	21.74
25	25.01	5.39	21.54
26	26.00	5.50	21.17
27	27.00	5.72	21.21
28	28.01	5.84	20.84
29	28.97	5.99	20.66
30	29.96	6.25	20.86
31	30.99	6.43	20.75
32	32.00	6.69	20.90
33	32.97	6.76	20.51
34	34.03	7.02	20.63
35	34.98	7.27	20.78
36	35.98	7.91	21.97
38	37.83	7.94	20.97
42	42.08	9.97	23.70
AVE	26.3	5.6	21.6

APPENDIX 6

XL GRAPHS

These are the basic XL graphs.