Single fibre tensile testing

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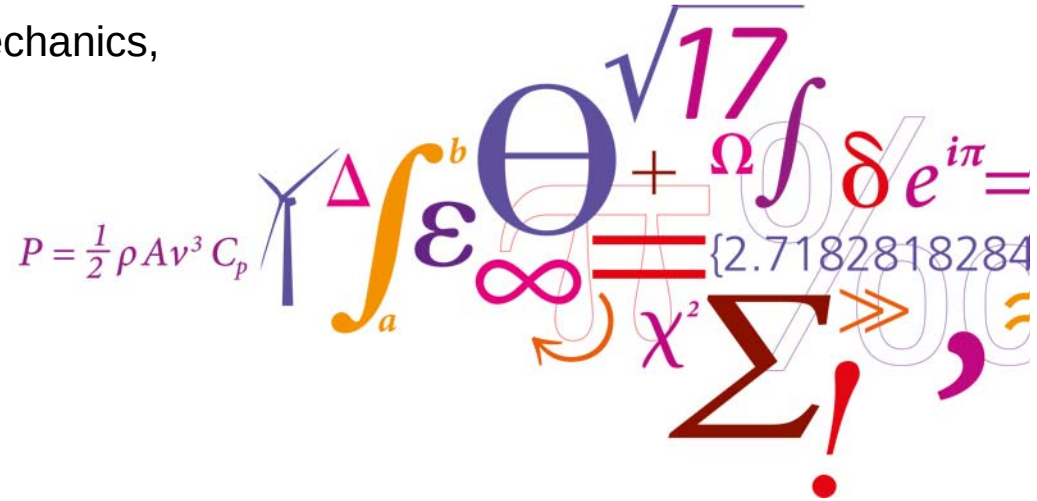

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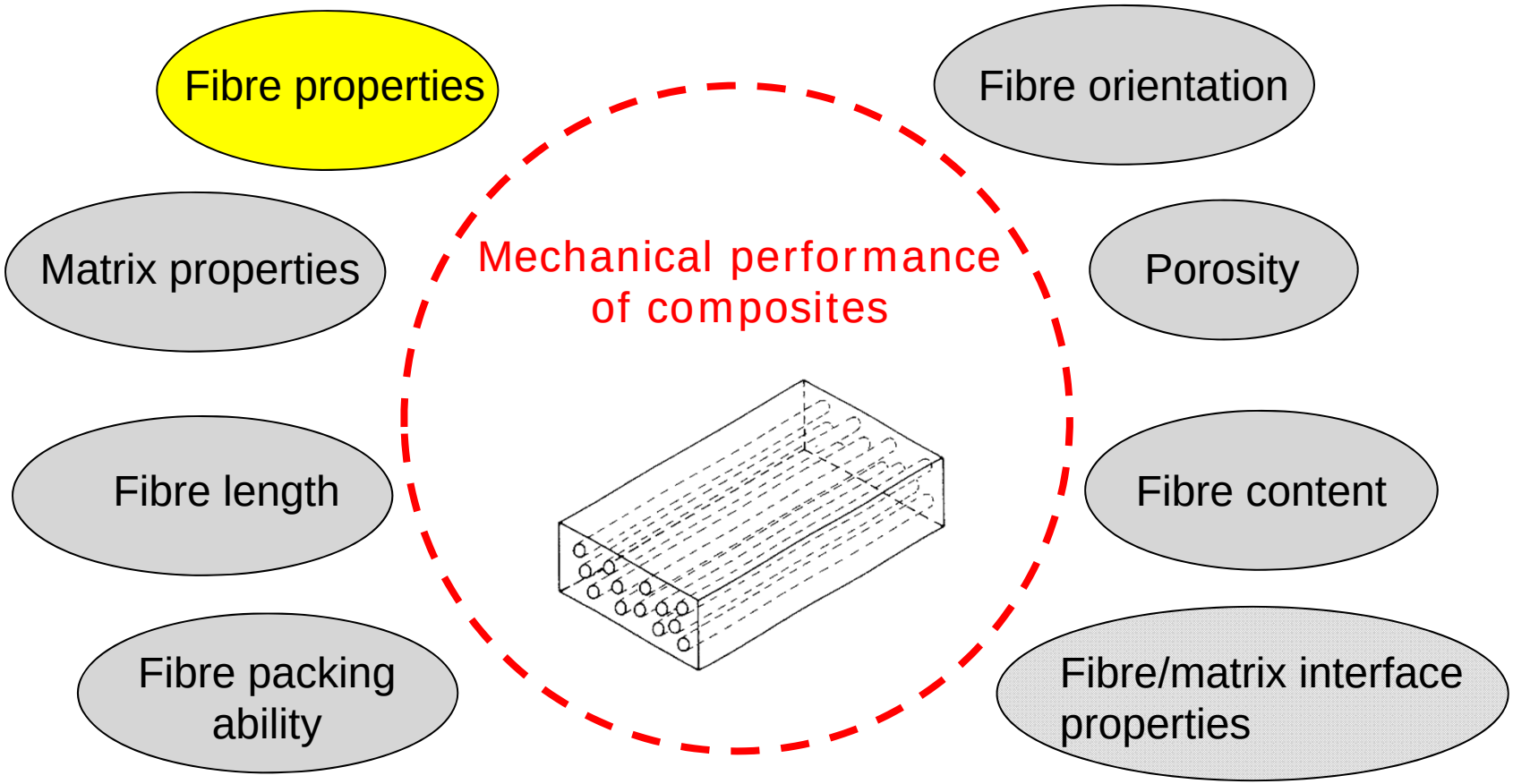
Introduction

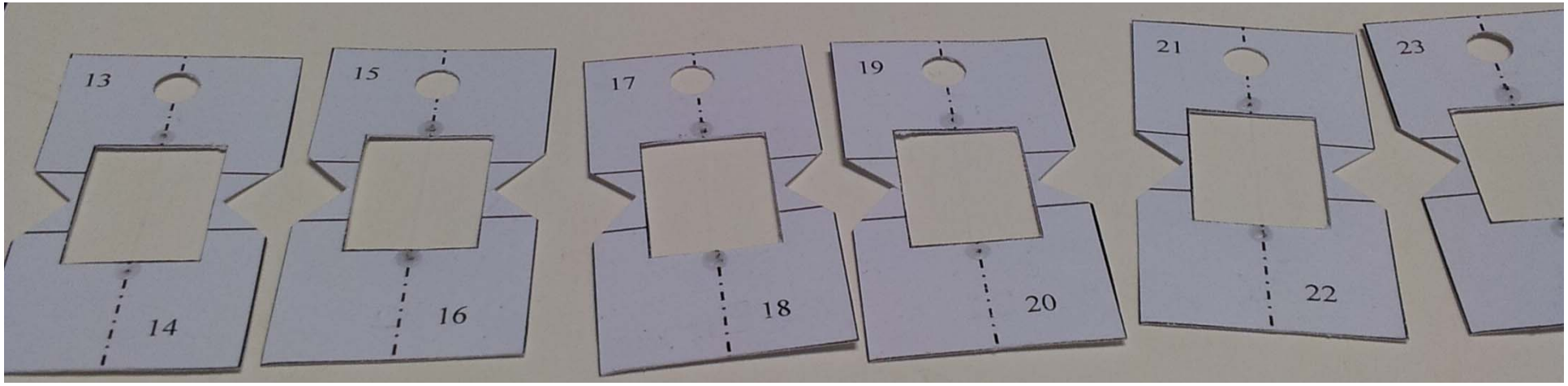


Introduction

Favimat+ and Airobot2 from TechTexhno

The alternative

- Manufacturer’s data sheet;
- “Card board method” ASTM C1557-03 procedure.



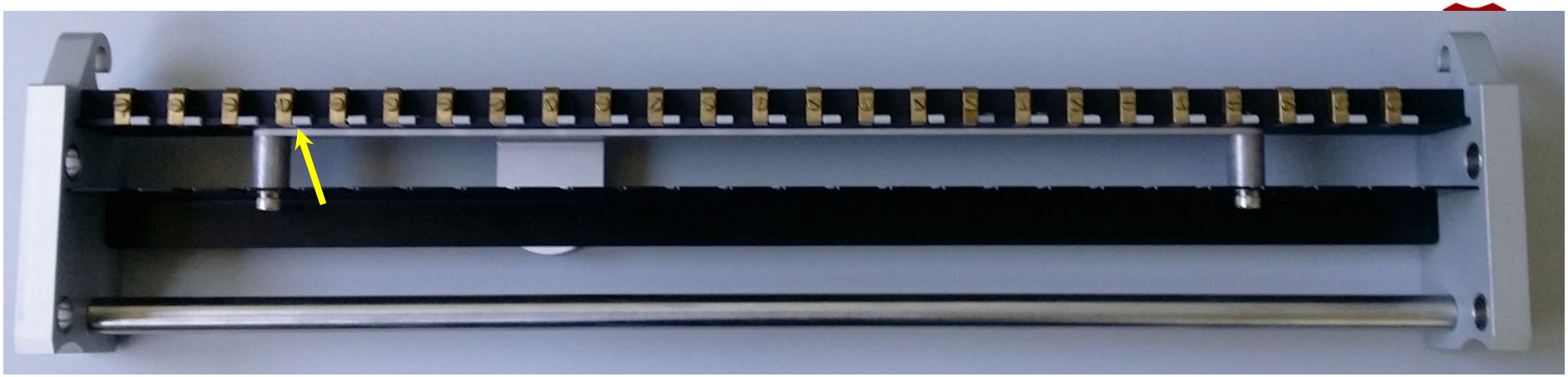
Presentation

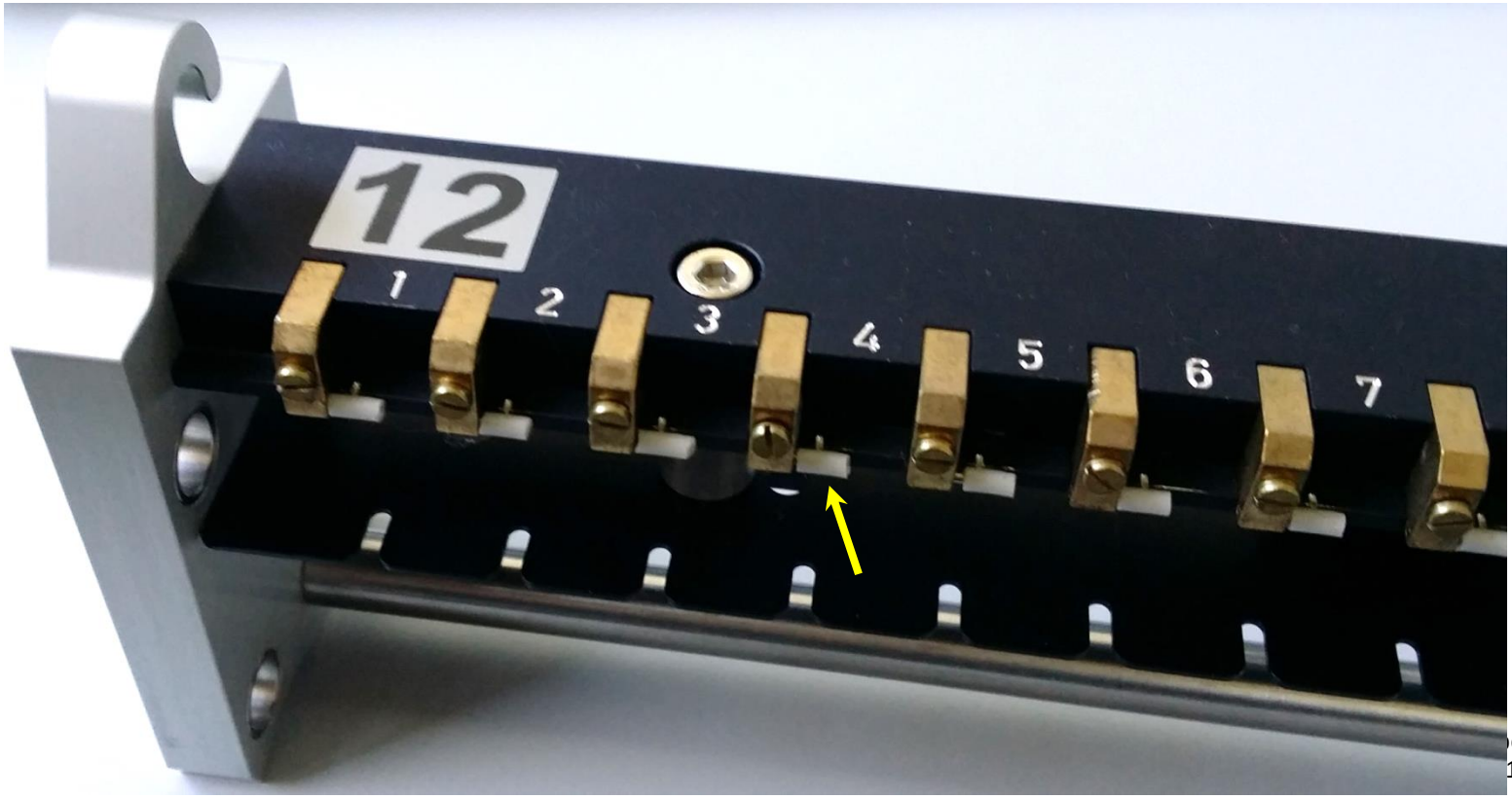
- The machine
- The test
- The results

The machine


Textechno ROBOT 2
Textechno FAVIMAT
Preparation area
Testing area
Robot
Storage area

The machine – Preparation area





The machine – Preparation area

The machine


Textechno ROBOT 2
Textechno FAVIMAT
Preparation area
Testing area
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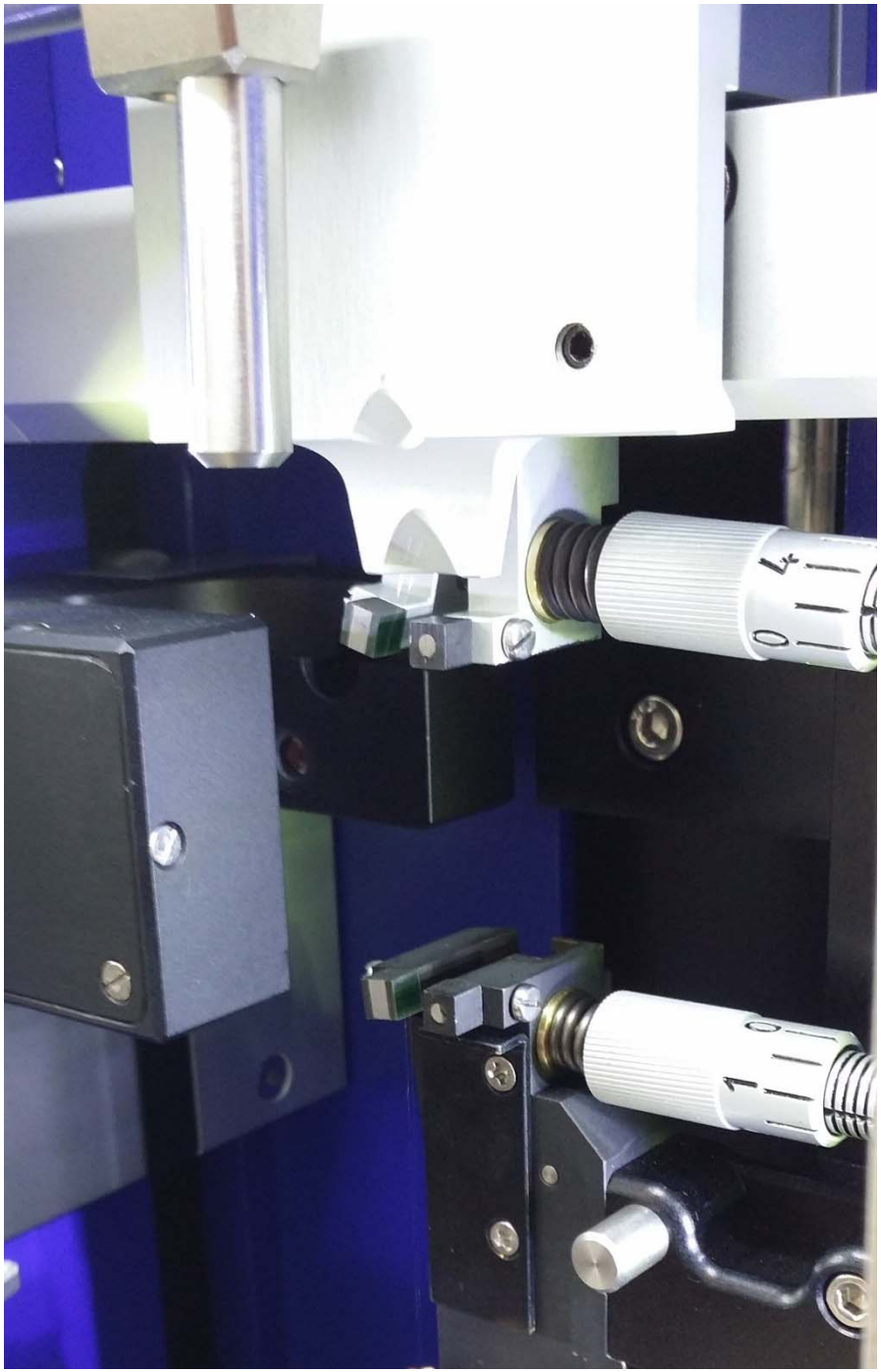
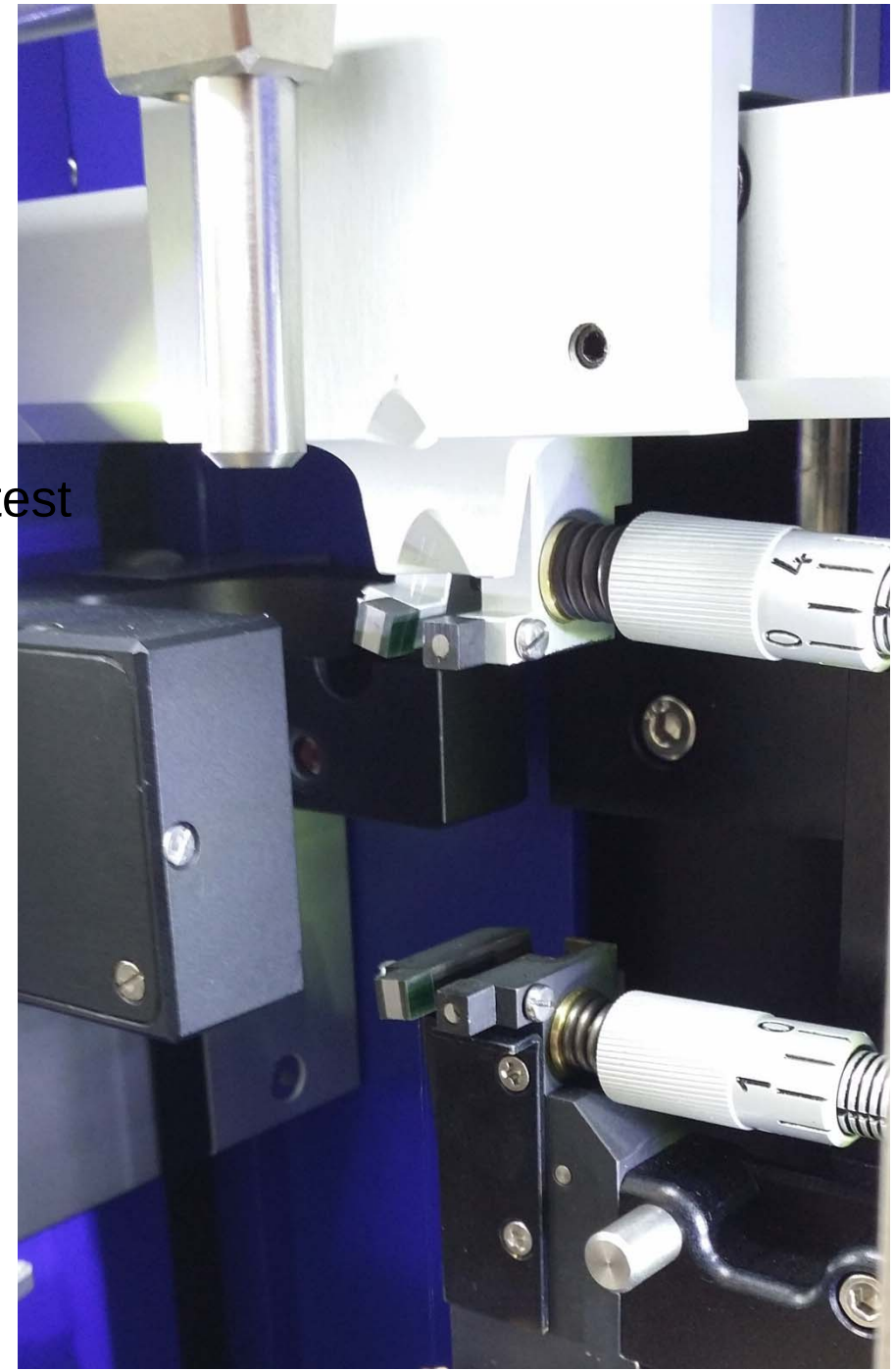
The machine – Testing area

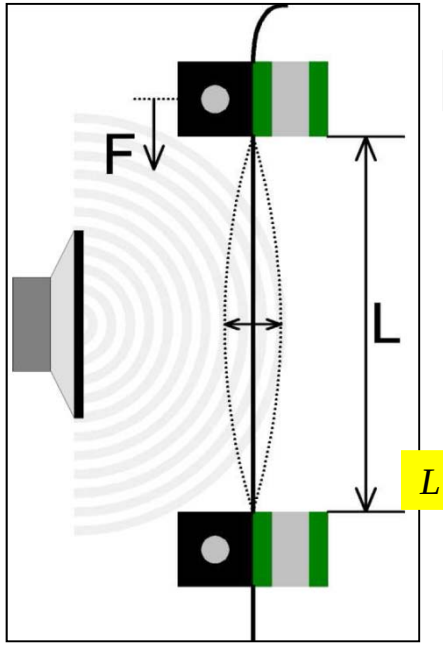


The Test

1. Linear density test
2. Tensile test



The test – 1. Linear density test



f: Resonance frequency

E: Fibre modulus

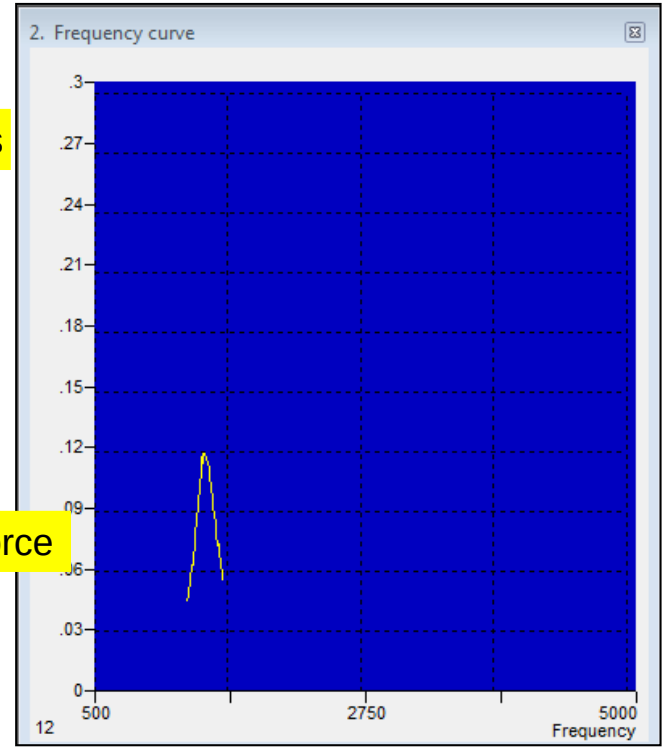
r: Fibre radius

$$f = \frac{1}{2L} \cdot \sqrt{\frac{F}{T}} \cdot \left(1 + \frac{r^2 . E}{[L . F]}\right)$$

L: gauge length

T: Linear density

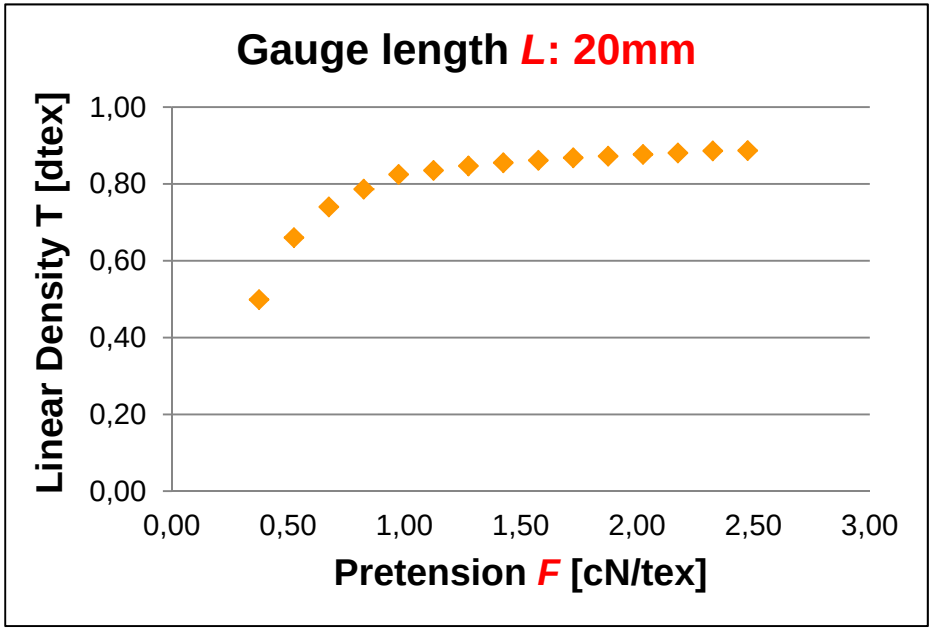
F: Pre-tensioning Force

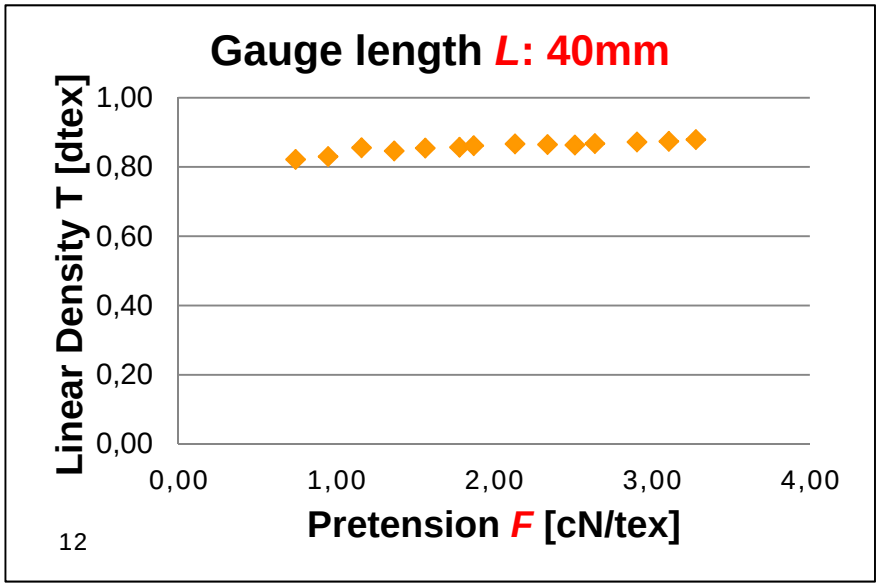


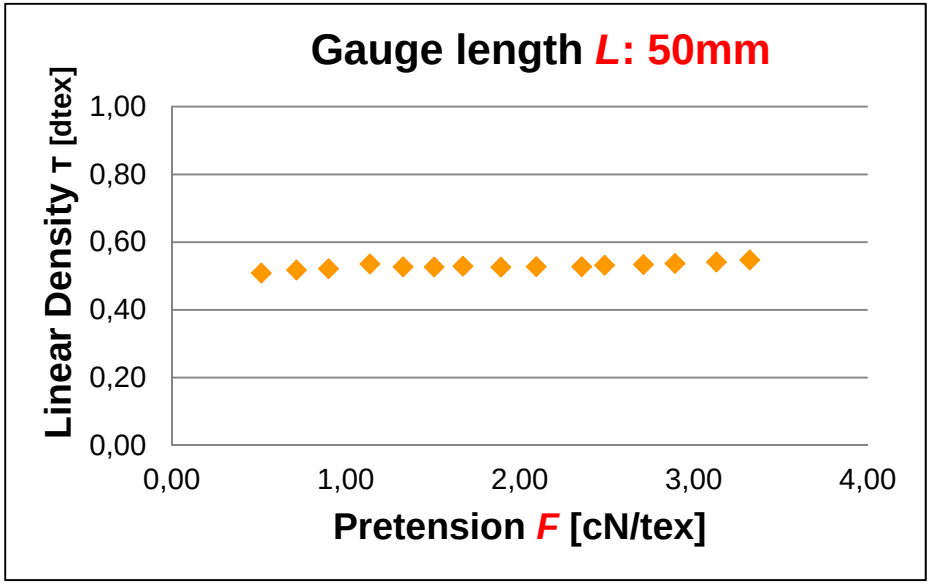
The test – 1. Linear density

Carbon fiber

$$f = \frac{1}{2L} \cdot \sqrt{\frac{F}{T}} \cdot \left(1 + \frac{r^2 . E}{[L . F]}\right)$$



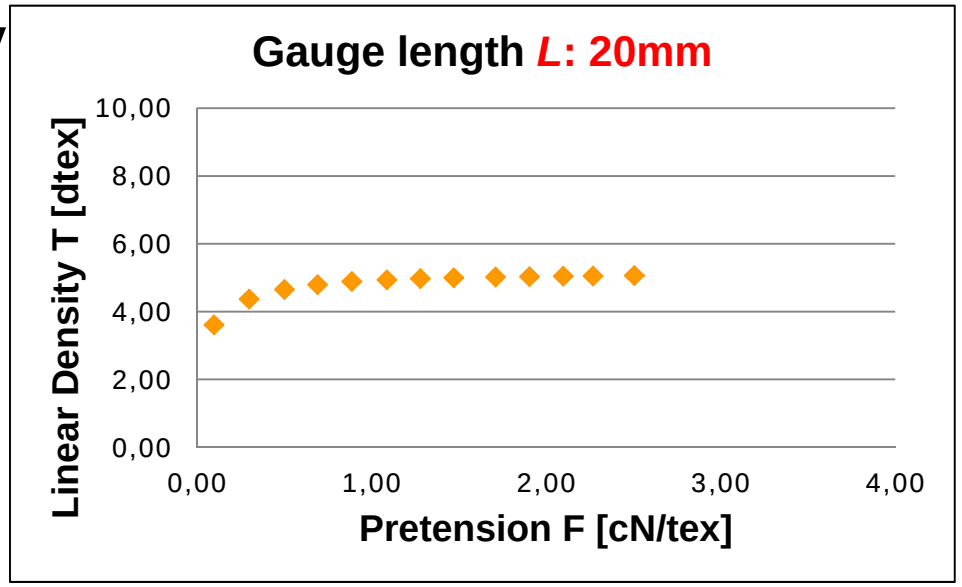


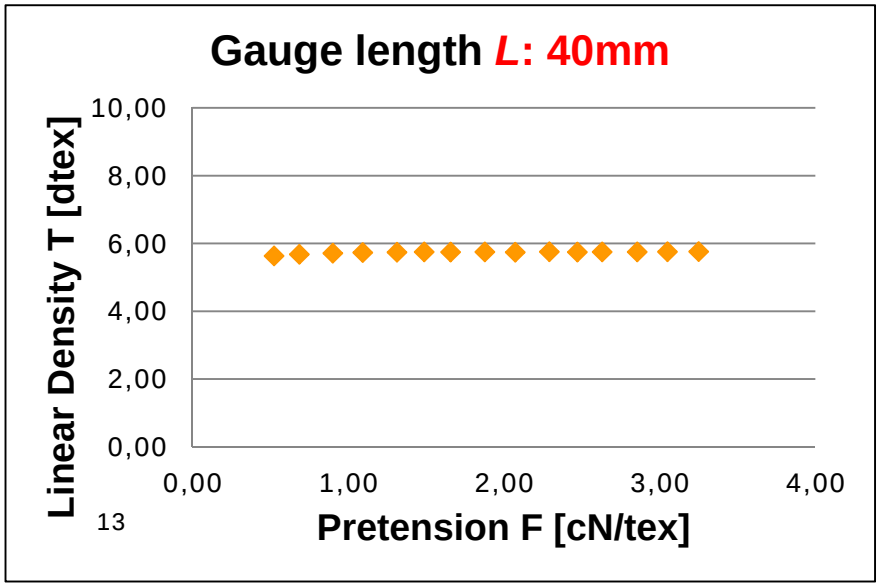


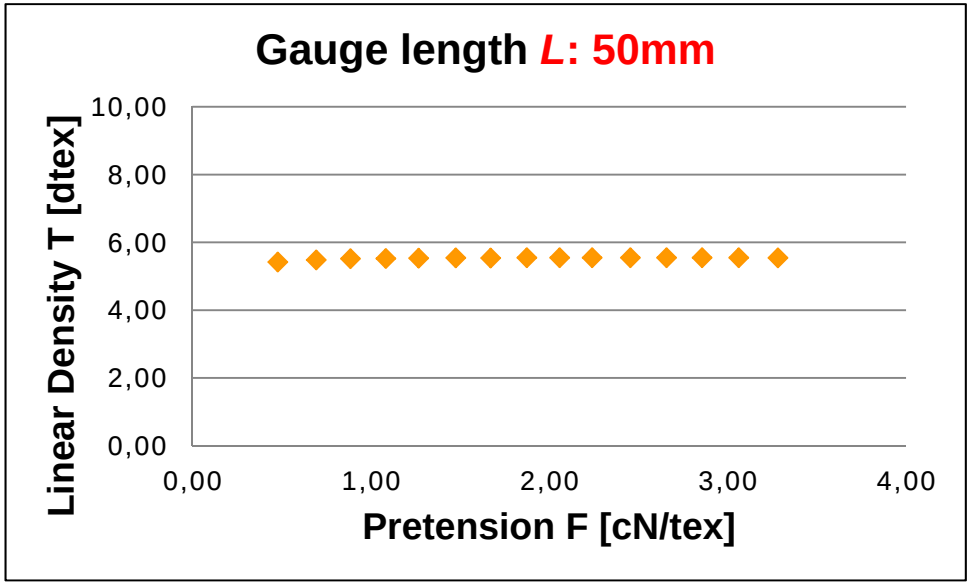
The test – 1. Linear density

Glass fiber

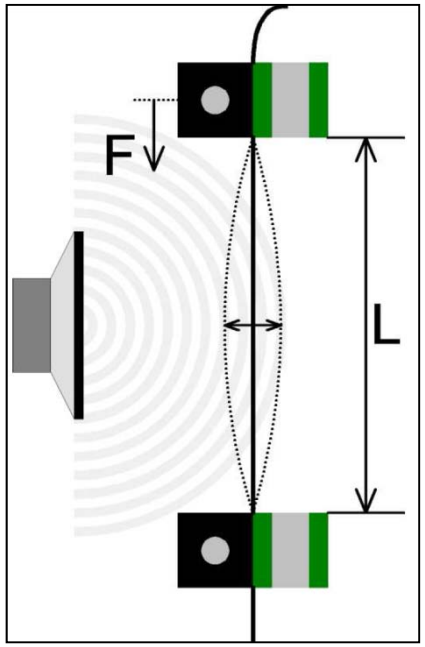
$$f = \frac{1}{2L} \cdot \sqrt{\frac{F}{T}} \cdot \left(1 + \frac{r^2 . E}{[L . F]}\right)$$





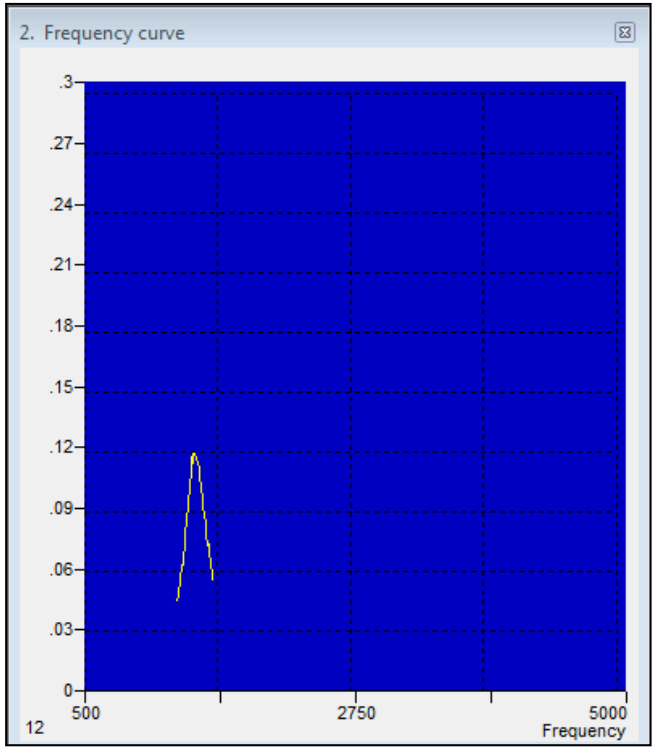


The test – 1. Linear density



$$f = \frac{1}{2L} \cdot \sqrt{\frac{F}{T}} \cdot \left(1 + \frac{r^2 . E}{[L . F]}\right)$$

$$T = \frac{F}{4\,L^2 f^2}$$



$$A = \frac{T}{\rho}$$

Density measured with pycnometer

The test – 2. Tensile test

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Single fiber testing results

Type of material

Density Glass: Density Carbon:

Serie number	Test parameter		Test description		Performance [GPa]	
no ref	Gauge length [mm]		Number of test		E-modulus	
	Clamp pressure [N]		Number of valid test		Tensile strength	
	Test speed [mm/min]		Sliding			
	Drop of Force [%]		Number break in middle			
	Threshold [%]					
	Pretension [cN/tex]					

The results

Glass fibres

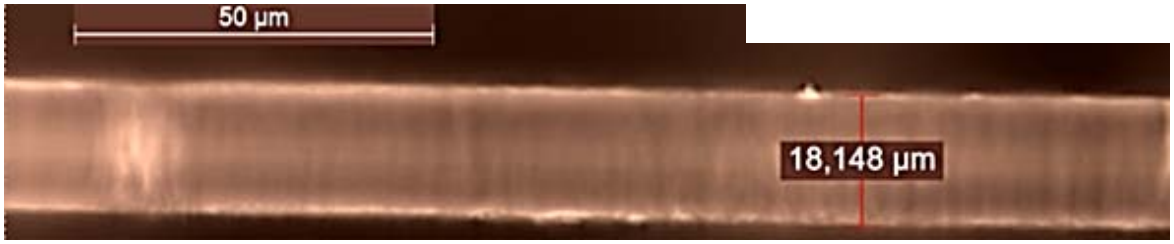
1. Linear density

2. Tensile test

The results – 1. Linear density

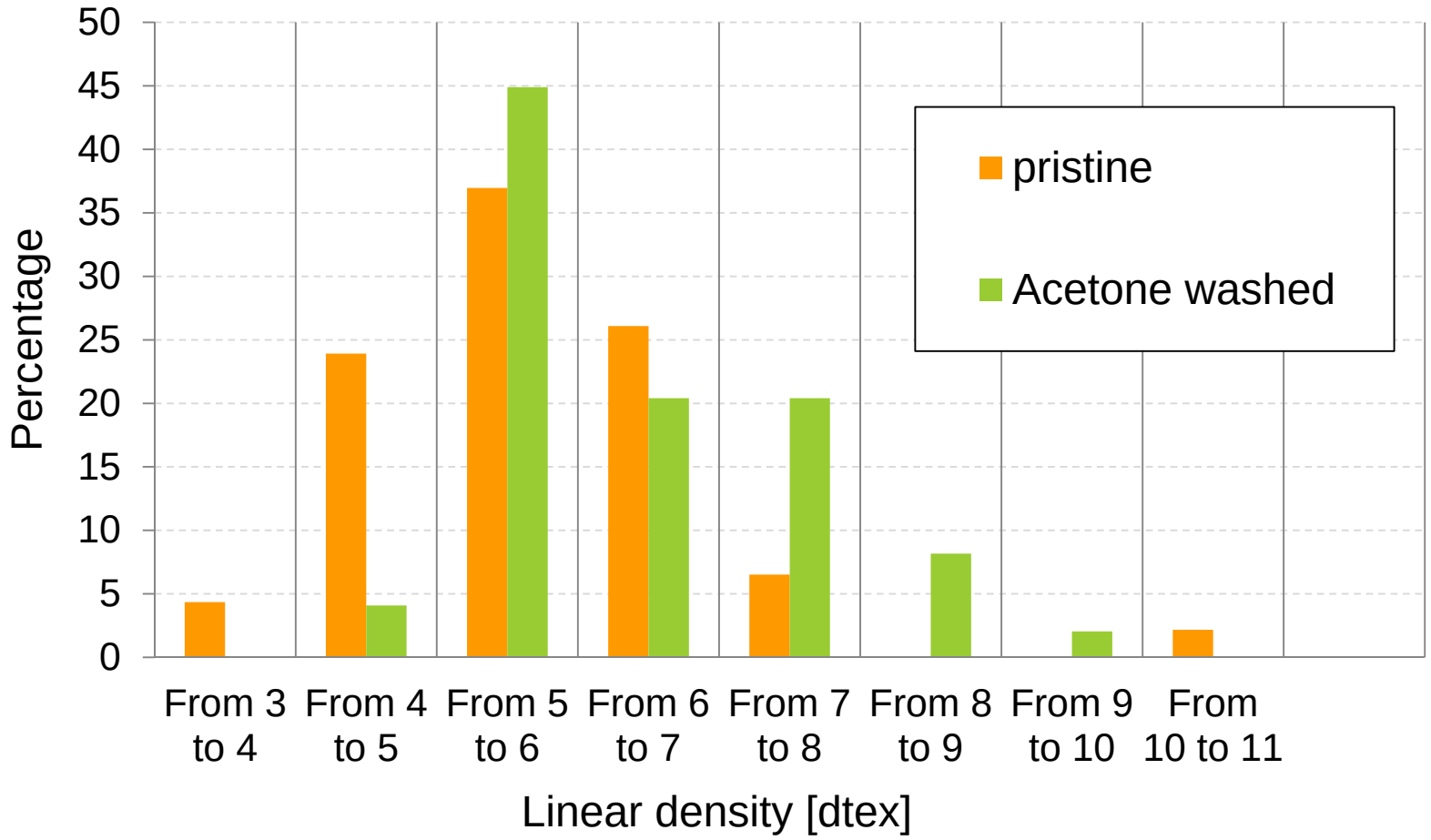
Comparison vibroscopy / microscopy

	Vibroscopy
	Linear density, T [dtex]
Fibre 1	5,74
Fibre 2	5,79
Fibre 3	6,39
Fibre 4	4,90
Fibre 5	4,02
Fibre 6	8,23
Fibre 7	5,62
Fibre 8	5,47
Fibre 9	5,82
Fibre 10	5,99



The results – 1. Linear density

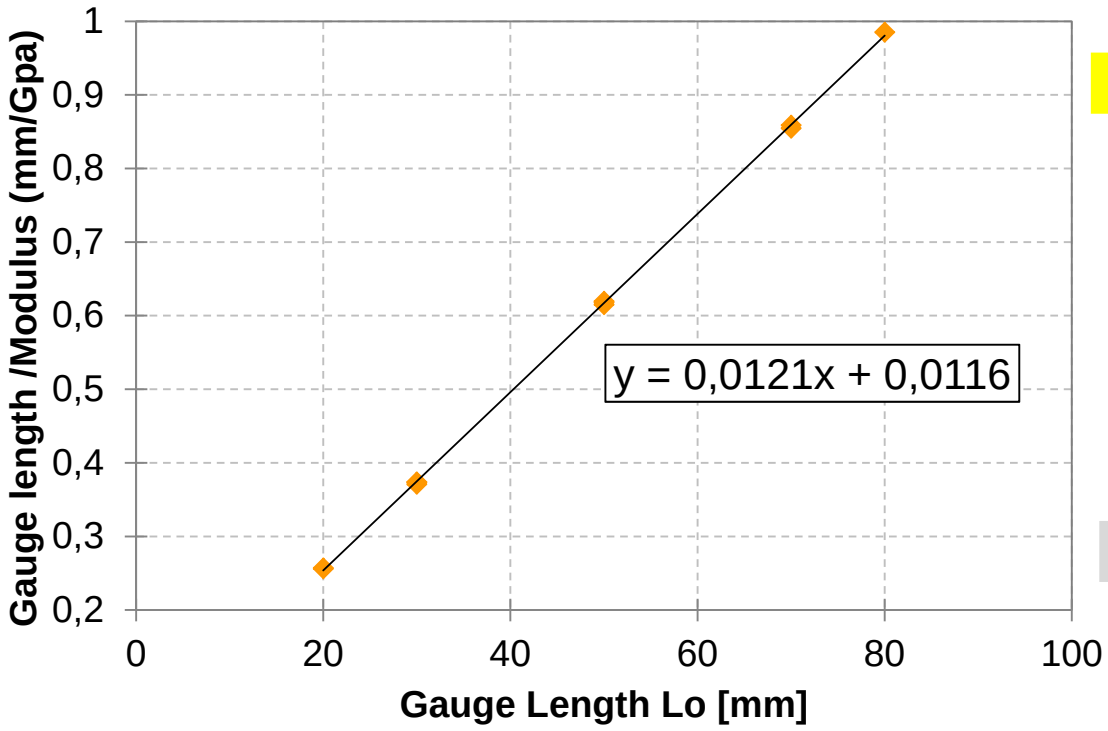
Effect of sizing



The results – 2. Tensile test

Machine compliance – Glass fibres

The contribution by the load train system and specimen-gripping system to the indicated crosshead displacement, by unit of force exerted in the load train.



E^*: Experimental modulus

L_0: gauge length

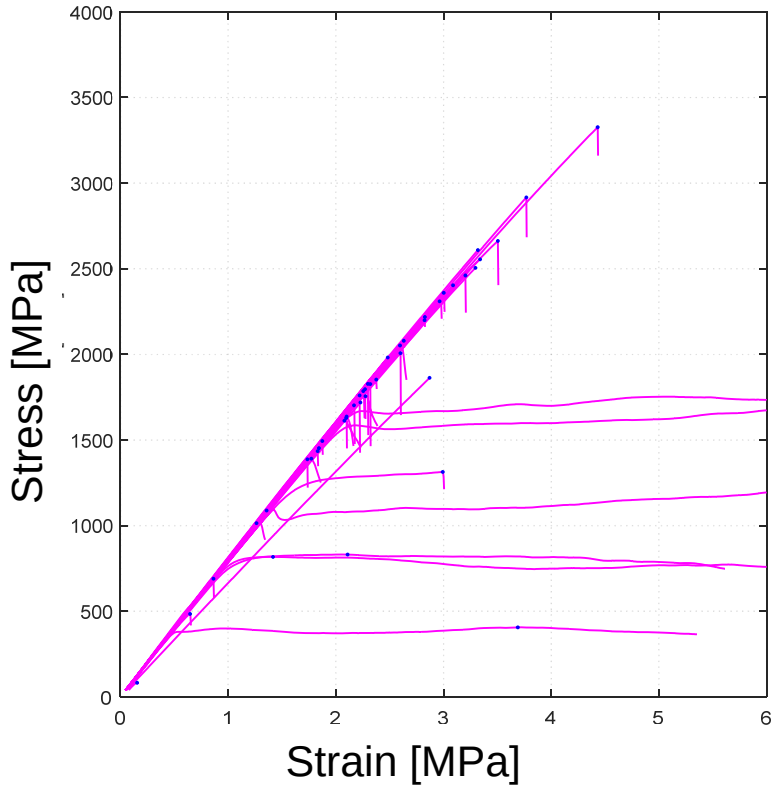
$$E = \frac{L_0 E^*}{L_0 - aE^*}$$

a: slope of the curve

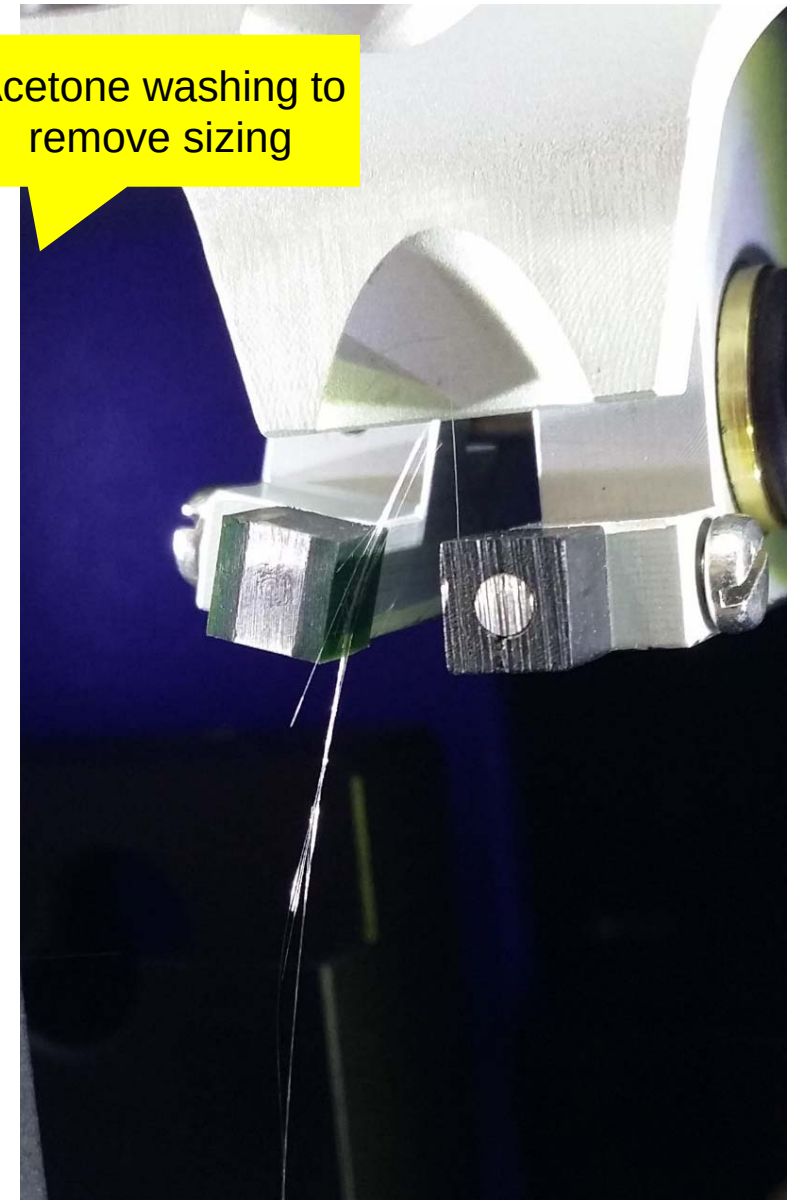
E: Actual modulus

The results – 2. Tensile test

Sizing removal



Acetone washing to remove sizing



The results – 2. Tensile test

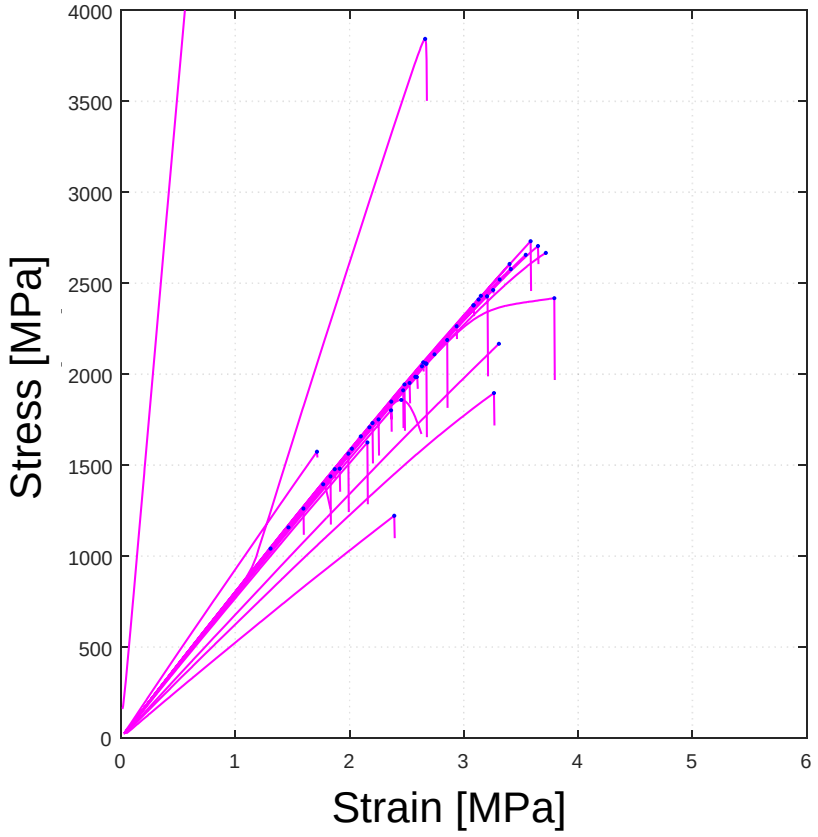
Data post-processing

Double fibre tested (strange stiffness, doubled linear density)

Gliding in the clamps

The raw data

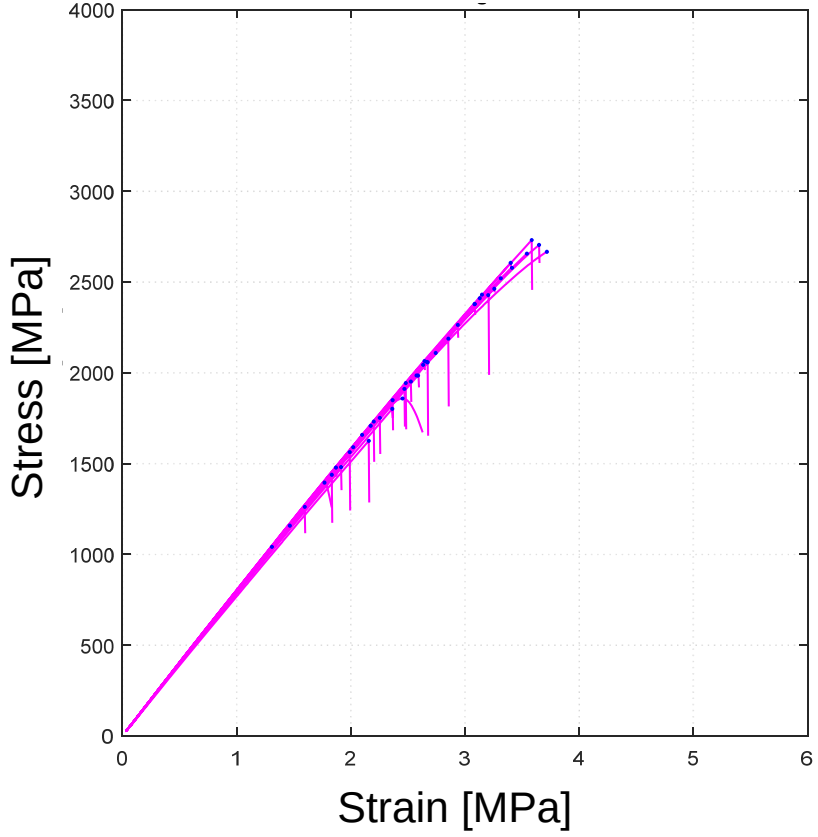
49 data



	Stiffness [GPa]	Strength [MPa]
Average	92,7	2445
Std dev.	90,8	3009

Deficient test removed

42 data



	Stiffness [GPa]	Strength [MPa]
Average	80,7	1998
Std dev.	0,6	452

Thanks you for your attention!

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