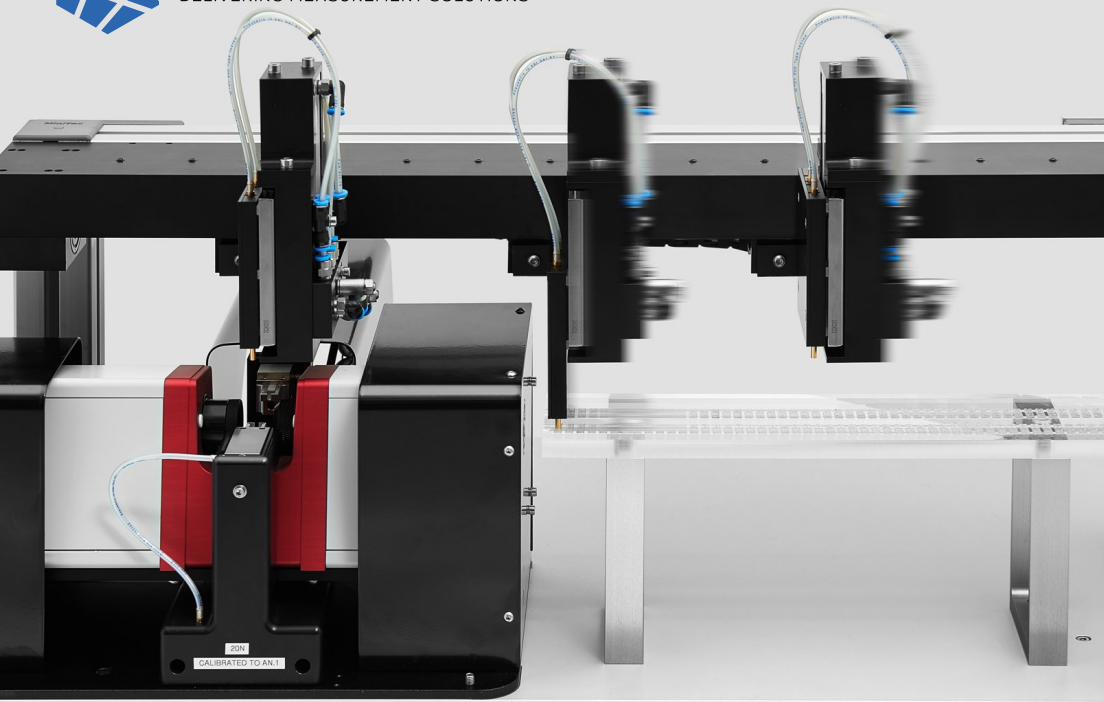
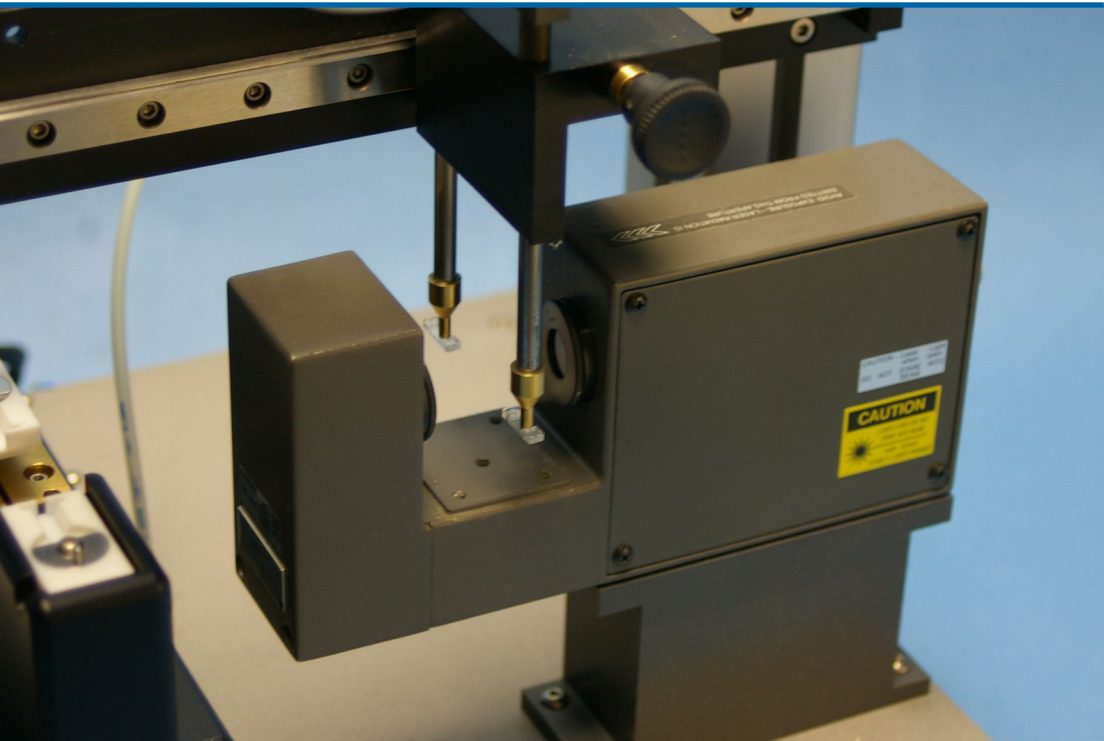
DIA-STRON
DELIVERING MEASUREMENT SOLUTIONS




# Technical Fibre Testing Instrumentation

Dia-Stron's history may be rooted in hair fibre metrology, but our mission has always been to drive innovation in line with our customers' ever changing requirements. A customer enquiry in early 2000 led Dia-Stron to begin trialling tensile and dimensional measurements of carbon fibres on our existing hair testing instrumentation, resulting in the development of the range of technical fibre testing instruments that we offer today.

These instruments have evolved specifically for measuring challenging technical fibre samples; starting with the inception of the LEX Linear Extensometer — a tensile measurement system with the high level of precision and sensitivity required for measuring carbon or glass filaments.



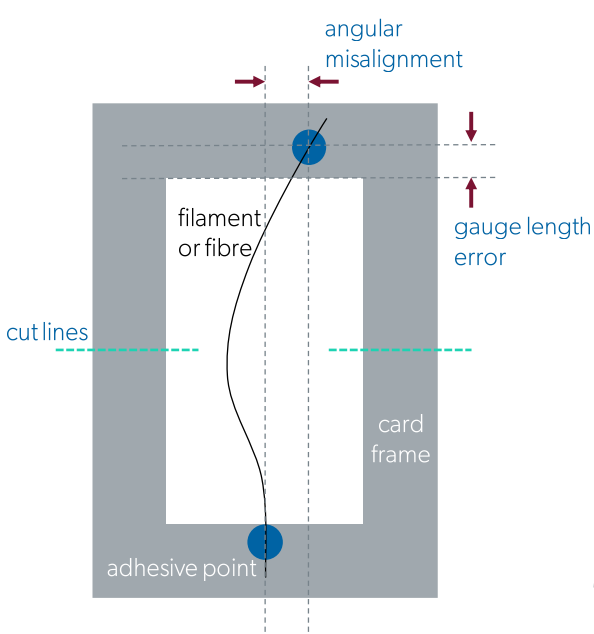
We then released an innovative dimensional analysis module, the LDS — Laser Diffraction System, capable of accurate diameter measurements of fibres as small as 5μm. Our latest innovation, the IFSS module, takes us beyond single fibre/filament testing into exploring the relationships between fibres and matrices in composite materials.

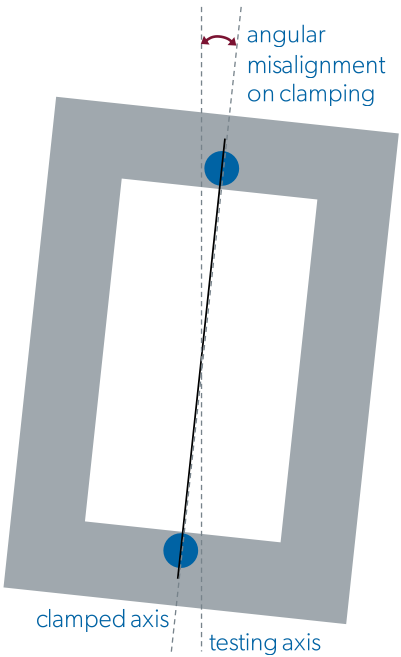
Dia-Stron is an industrial partner in the FiBreMoD consortium — an EU-funded project training interdisciplinary researchers to develop and apply state-of-the-art tools for designing the materials and fibre-reinforced composites of the future.

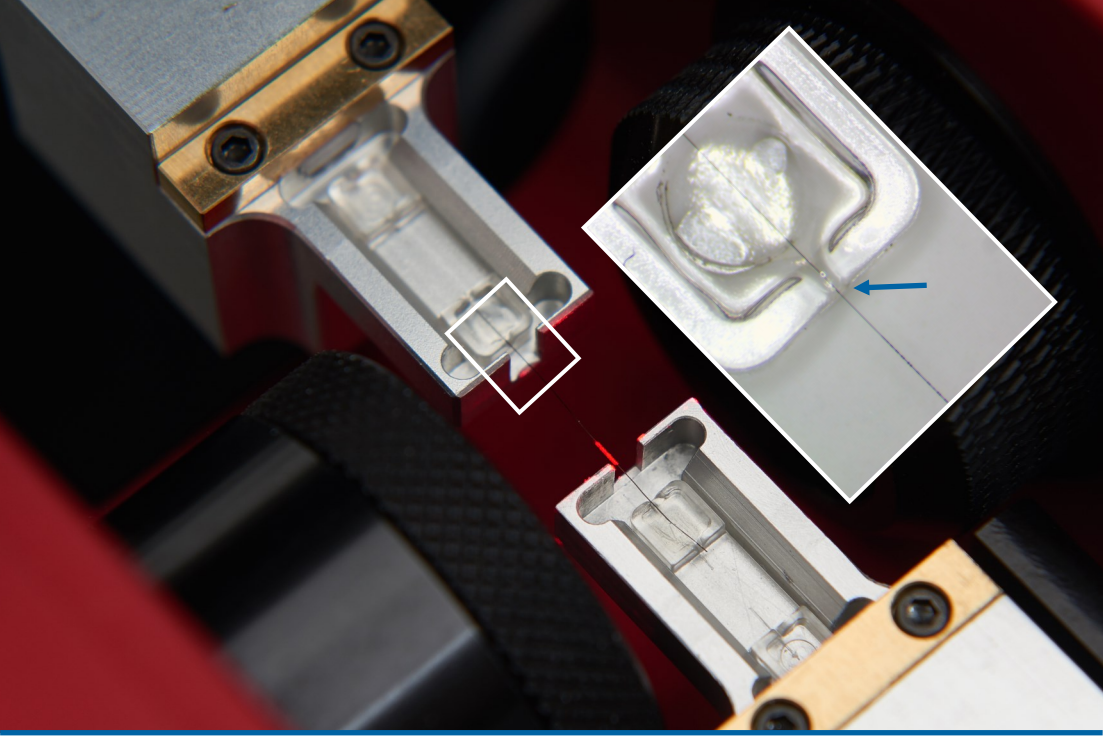
## From an error-prone card frame method ...

Fibre specimen preparation and testing based on a card frame approach is cumbersome and time consuming. Possible sources of error such as angular misalignment, inaccurate gauge length or imprecise positioning on clamping coupled with low measurement success rate makes single fibre testing laborious for researchers.

A modern, improved and effective technique is required to reliably and productively mount and characterise the mechanically properties of single fibres or filaments.





**… to an efficient and contemporary fibre testing approach**

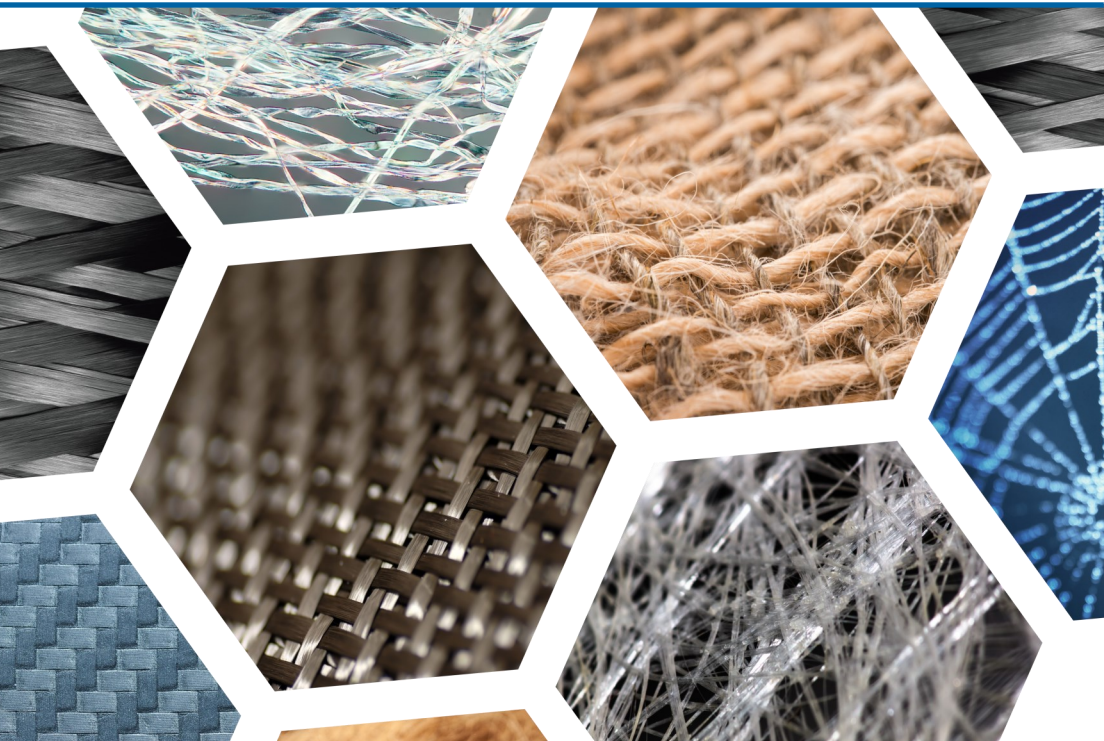
Dia-Stron developed a complete and automated testing solution including specimen preparation, loading, measurement and data analysis, complying with the majority of testing standards dealing with dimensional and tensile properties of single filaments.

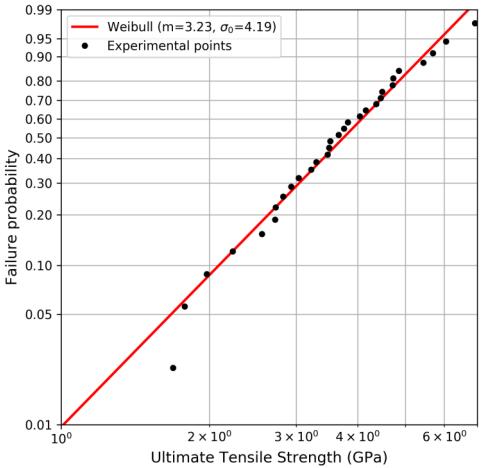
Fibres are mounted between pairs of plastic tabs with alignment features, pre-loaded in a storage cassette, and secured using a UV-curing adhesive. Specimen cassettes are then loaded onto our automated platform for testing, keeping specimens at a consistent gauge length, aligned and square without the need for user intervention.

## Fibres & Filaments —

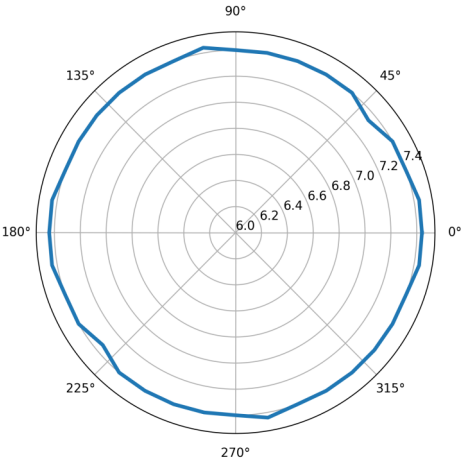
Our instrumentation range has been developed for measurements on two distinct fibre types — man-made and natural. Man-made fibres include carbon, ceramic, glass, basalt, aramid, quartz or polymeric such as polyethylene and textiles (polyester). Natural fibres comprise of plant-based fibres such as flax, bamboo, sisal, coco, hemp, jute and cotton, as well as animal-based fibres such as wool, hair and silk.

Single fibre testing is preferred over fibre tow or bundle testing as the most reliable and unambiguous means of characterising fibres and filaments.






Single carbon filament tensile strength



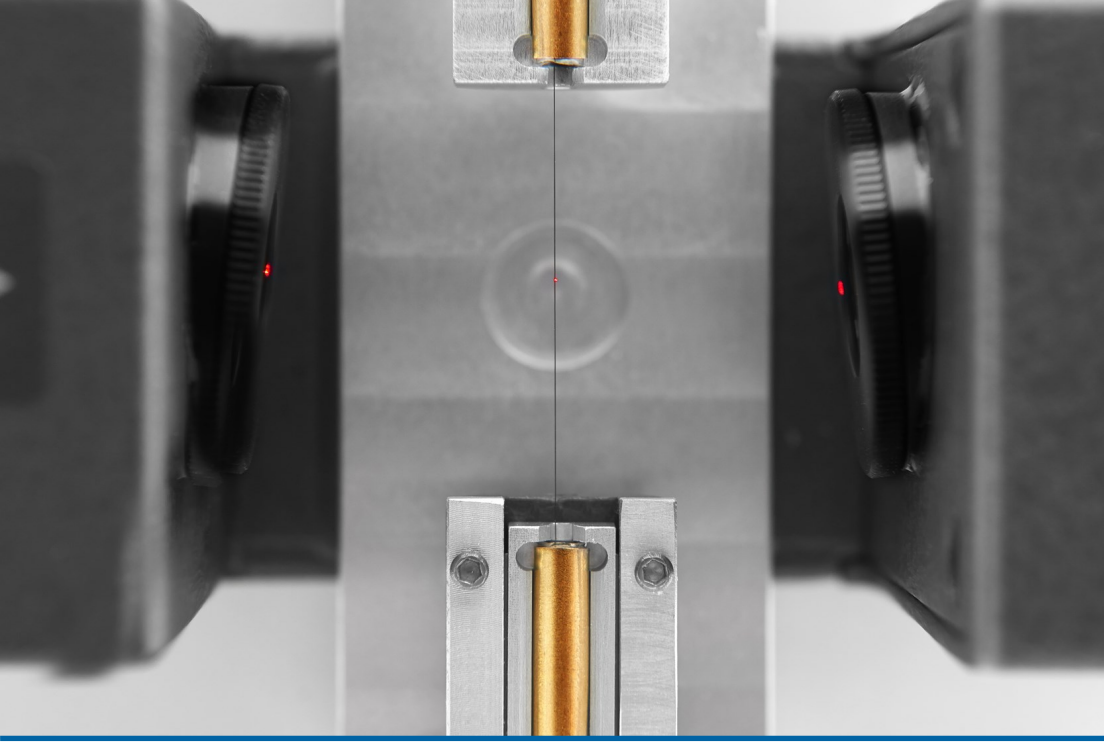

Angular variation in fibre apparent diameter

## Typical Applications —

- Tensile properties of single fibres such as elastic modulus, break stress/strain
- Interfacial shear strength properties between glass filaments and epoxy resin
- Evaluation of cross-sectional swelling of natural fibres immersed in water
- Fatigue survivability of textile fibres: S/N curves, Weibull & Kaplan Meier analyses
- Assessment of anisotropy of polymeric fibres: tensile, bending, torsion deformations

## LDS0200 — Laser Diffraction System

The LDS0200 is designed for direct, non-contact diameter measurements of small, opaque fibres. When a fibre is placed in a laser beam, new sources of coherent light appear on each side of the filament, producing an interference fringe pattern. The spacing in the fringes in the diffraction pattern is directly related to the filament diameter. The LDS is integrated with our LEX820 to guarantee alignment and orthogonality between the fibre and the laser beam for accurate measurements.

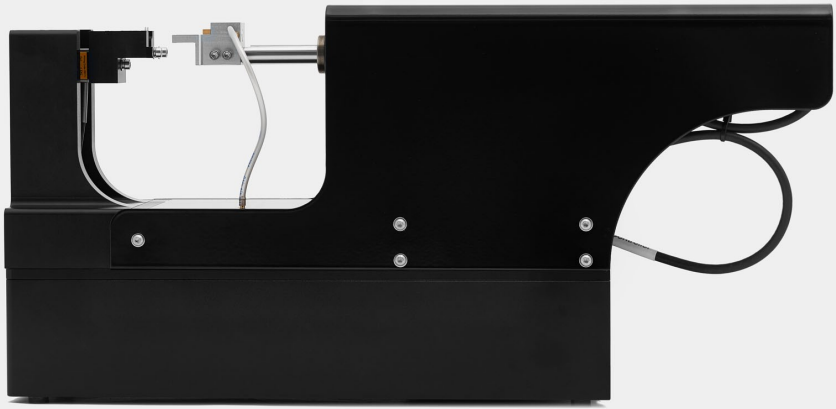


**FDAS770—Fibre Dimensional Analysis System**

The FDAS770 utilises a high-frequency Laser Scanning Micrometer for accurate, non-contact dimensional measurement of fibres with fully automated fibre rotation and translation. Fibre cross-sectional area can be calculated for the conversion of force to stress data. The FDAS770 lends itself to irregular, opaque or semi-transparent fibres, and our sample mounting techniques can support a wide variety of specimens, such as cotton, glass, flax, bamboo and silk. A Dynamic Swelling Module (DSM770) can be incorporated for swelling and wet diameter measurements.

## LEX820—Linear Extensometer

The LEX820 is a high resolution extensometer, especially developed for brittle fibres that fail at low strain values. At its core, a DC micrometer-drive delivers exceptionally smooth travel, combined with a high positional repeatability required to capture accurate strain data. The LEX820 features a 20N or 2.5N load cell to measure force data with an excellent linearity and low compliance. A compliance correction can be applied to tensile data through our software. The LEX820 open frame design means that it can be used in conjunction with techniques such as X-Ray diffraction or neutron scattering.



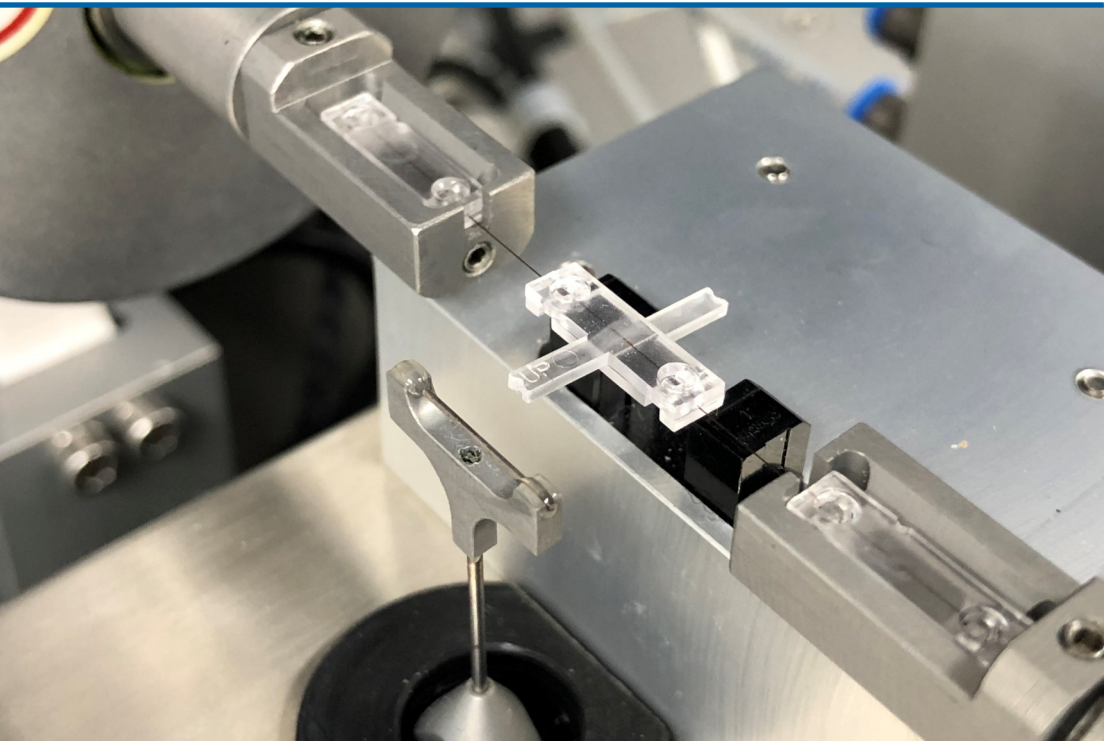
## IFSS—Interfacial Shear Strength Module

The Interfacial Shear Strength module (IFSS) is an interchangeable module for the Dia-Stron LEX820, used to measure the debonding force of micro-droplets on single fibres and filaments. The camera and light source enable users to visualise the fibre/droplet during the test and capture the mode of failure in video and still images. The IFSS method can be applied to various fibre and filament types: glass, carbon, ceramic, aramid, basalt or natural fibres.

## FTT950 — Fibre Torsion Tester

Our FTT950 system measures torsion/shear modulus (with dimensional data) and torsional stress relaxation. The instrument is fully automated for a high throughput and efficient workflow. Fibres are pre-tensioned to a set force and twisted by up to 360° against a micro-balance, directly measuring torsional properties.

Fibre torsion or shear is often neglected despite the importance of this mode of deformation in fibre/filament processing during production of composite materials.



## CYC802 — Cyclic Fatigue

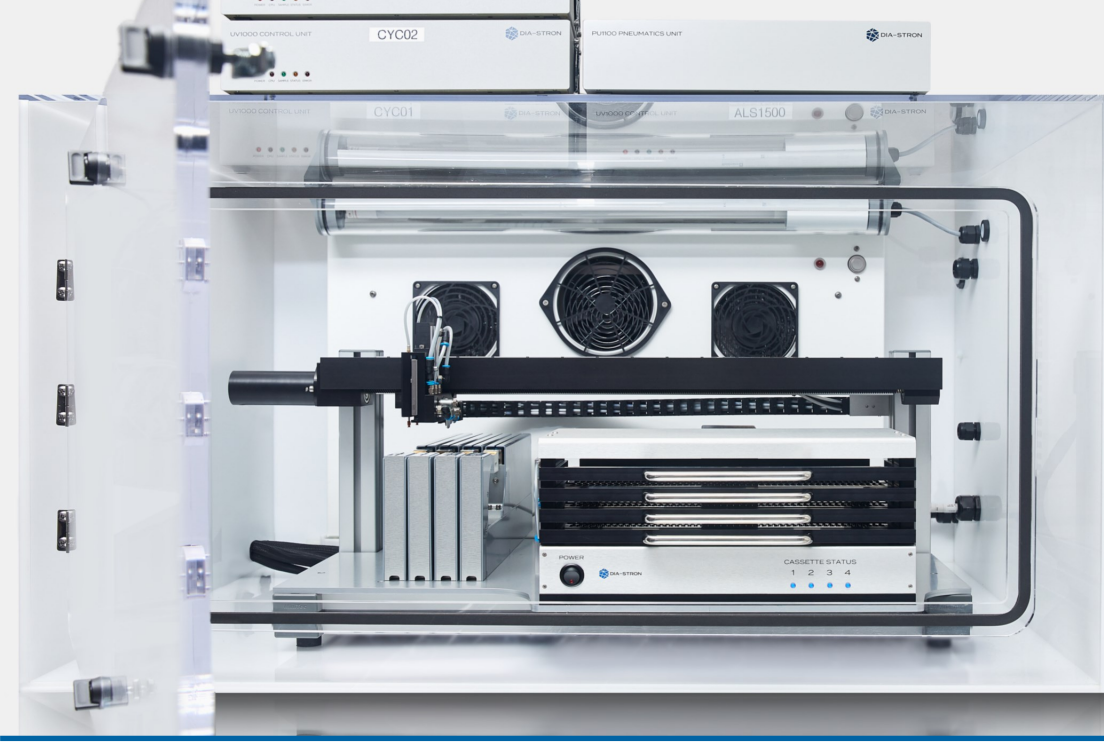
The CYC802 measures the fatigue strength of fibres by subjecting them to repeated cyclic tensile deformations or loading until failure. The CYC802 module is designed around a high velocity voice-coil drive to apply set strain, force or stress levels on fibre specimens. S/N curve methods are available on our dedicated application software.

Up to four cyclic modules can be integrated on our automated platform, offering high-throughput testing using up to four 50-fibre linear cassettes in a Cassette Hotel.

## FBS900 — Fibre Bending System

The FBS900 fibre bending system is based on the single cantilever method, where the fibre specimen is flexing against a pin with the bending force measured using a micro-balance as a function of deflection. Combined with dimensional data, the bending modulus can be calculated and bending stress relaxation monitored.

This method is ideal for evaluating short fibres or to study specimens in a different mode of deformation in order to assess fibre mechanical anisotropy.




## ALS1500 — Automated Loading System

All our measurement modules can be integrated with our ALS1500 automation platform, delivering high throughput testing of fibres for maximum productivity. The “Pick & Place” mechanism transports fibre specimens from storage cassette to measurement modules and back continuously, without the need for user intervention, 24/7. An additional multi-tasking option further increases testing efficiency.

For optimum sample capacity and throughput, the Cassette Hotel can be loaded with 4 cassettes equating to 200 fibre specimens.

## Contract Testing

Our dedicated fibre testing laboratory was established to provide customers with a wide range of technical fibre testing services. Our skilled laboratory staff and purpose-built instrumentation range enable us to conduct entire studies, big or small, in-house, using testing methodologies developed by experts with a wealth of practical experience in fibre metrology.

Our contract testing service is an efficient, cost-effective way to ensure you receive valid, reliable and reproducible results — contact us today for a tailored quotation!

# Contact Us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