

TESA MICRO-HITE

SWISSNEUTRONICS – KLINGNAU – SWITZERLAND

SwissNeutronics

HIGH VALUE-ADDED KNOW-HOW FOR THE DEVELOPMENT OF COMPONENTS DEDICATED TO RESEARCH WORLDWIDE

In the 1990s, at the Paul Scherrer Institute (PSI) in Villigen (CH), a motivated team of specialised neutron researchers decided to develop some innovative high-precision components for their experimental systems that were too expensive to be manufactured by an external company.

At scientific conferences, the scientists quickly realized that the components they produced themselves could also be interesting and pioneering for other research laboratories around the world.

In particular, they received inquiries about the manufacture of neutron transport systems, which are called “neutron guides” in scientific circles.



TESA MICRO-HITE at the service of the latest technologies

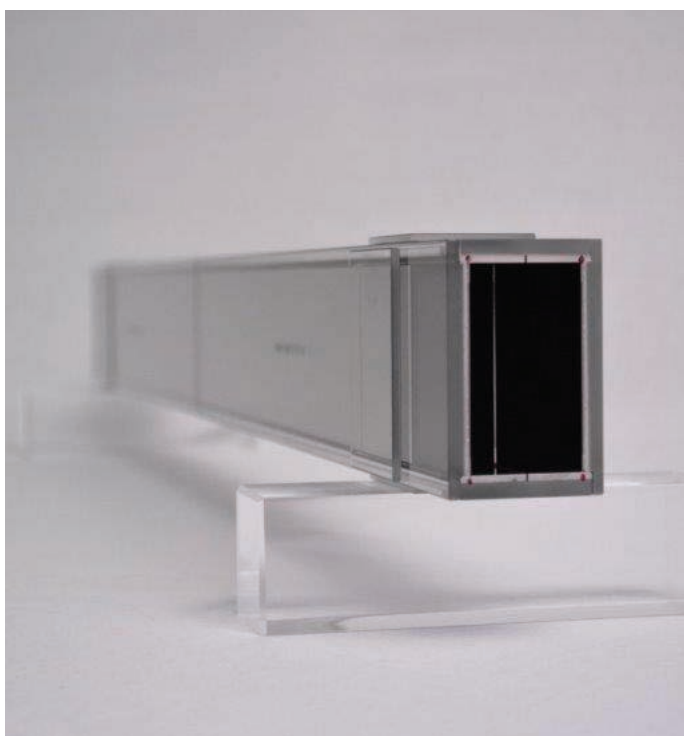




SwissNeutronics manufactures and uses glass plates of different sizes and thicknesses according to the needs of their customers

As the commercialisation of this know-how cannot be done by a research institute, the possibility of setting up a company responsible for the technology transfer outside the PSI was evaluated. In 1999, the creation of SwissNeutronics AG as a spin-off of the PSI made it possible to develop and commercially exploit innovative concepts and manufacturing processes previously defined within the PSI. This Swiss know-how, kept by about sixteen employees, is all the more important as the company has only two other competitors in the world, in Hungary and Germany.

“ THE CHALLENGE LIES IN MATCHING THE SUBASSEMBLIES AND GUIDES TO ONE ANOTHER SINCE THEY MUST BE ULTRA-PRECISE OVER DISTANCES OF UP TO 200 METRES.



THE NEUTRON GUIDES

The neutron guides that are the core business of SwissNeutronics AG are made of glass plates that are given a special treatment. The process developed by SwissNeutronics makes it possible to deposit ultra-thin metal coatings (nanometre thin) to the already super-polished glass using sophisticated sputtering systems.

This “supermirror“ coating allows and guarantees the neutron guiding properties of the final system. Once the plates have been prepared, they are carefully assembled to build ultra-precise square or rectangular channels of approximately 2,5 m in length.

Finally, these rectangular guide sections, placed together one by one, form a long channel that serves as a guide from a neutron source to the experimental devices. The length of these channels can vary according to customer needs and can reach more than 200 m!

“Each guide section is about 2 to 2,5 m long. Once all the guides have been produced, the SwissNeutronics team visits its client to carry out the final assembly of the guides in the complete system. The challenge lies in particular in matching the guides to each other since it is a question of being ultra-precise over distances of up to 200 m (or more).” says Alexander Hunt, a member of the assembly and installation team.

The person in charge of the system for coating the plates explains that, depending on the thickness of the layers applied to the glass, the transport efficiency can be adapted (losses, speed, etc.).

The dimensions of the guides as well as the characteristics of their coating are parameters that depend on the experiments for which they are optimized. Depending on the final needs, it is not unusual that each plate has to undergo a significant number of cycles (up to 16'000) during the coating creation process, corresponding to one week of non-stop use of the installation creating the successive layers on the glass plate. Consequently, each plate can have its price rise to several tens of thousands of francs. And one guide requires a lot of them to be completed!



Glass plates

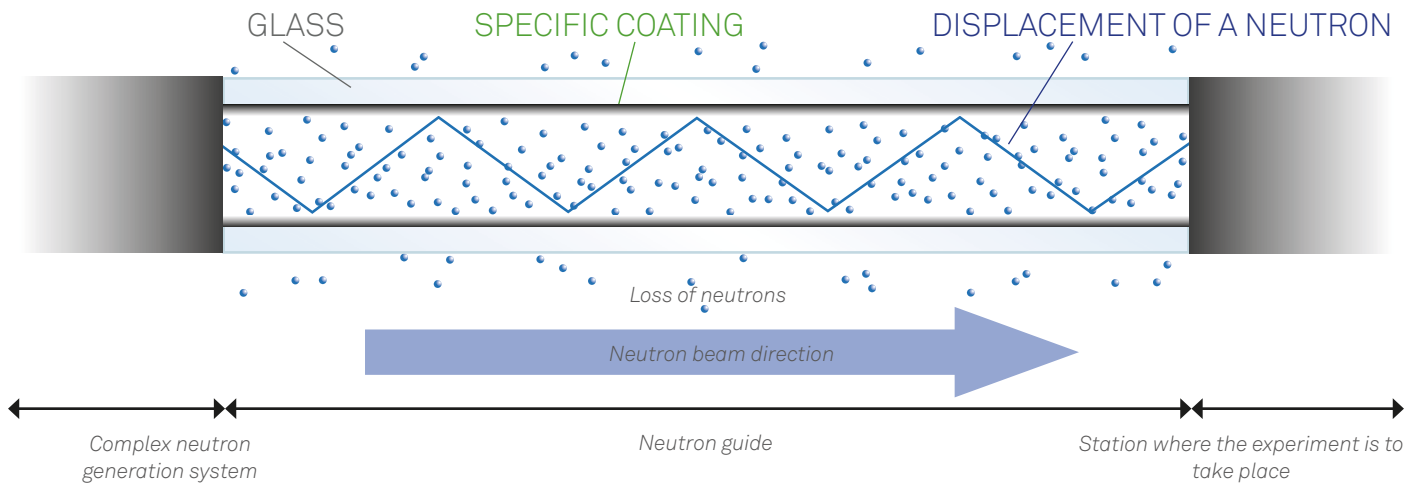


ONE PLATE CAN COST SEVERAL TENS OF THOUSANDS OF FRANCS. AND IT TAKES A LOT OF THEM TO BUILD A COMPLETE GUIDE!

• • • COATING

• • • GLASS PLATES





“But what is the purpose of the guide systems manufactured by SwissNeutronics?” we ask Mr. Beat Brisacher, another member of the assembly and installation team.

“In order to explain the interest of the neutron beam, we could simply draw a parallel with the X-rays that everyone knows when he goes to his doctor. Indeed, neutrons like X-rays can cross all kinds of objects and give direct access to a visualization of their interior.” he replies.

The field of application is very broad and it is almost impossible to give an exhaustive list of all potential assignments.

Some of which are listed below:

- Stress analysis in materials
- Structure and dynamics of new materials (superconductors, semiconductors, etc.)
- Analysis of magnetic properties
- Properties of coating systems for electronic applications
- Protein dynamics
- Fossil studies
- Study of historical documents
- Component tomography.



WE LIKED A LOT THE FLEXIBILITY OF THE MICRO-HITE



The TESA MICRO-HITEs are used on both sides of the guide and they measure different characteristics.



In the assembly cell for the guides two motorised TESA MICRO-HITE are used in order to ensure that the subgroups are well matched together.

In this context of high added value, a major challenge had to be met. Actually, the 2-2,5 m guide segments are not directly produced. They must be assembled from smaller rectangular sub-groups of about 50 cm in length, which corresponds overall to the length of one glass plate. The problem lies in the control of the dimensions of the subgroups since:

- The glass plates of each sub-group must be mounted together in a way that their surfaces are as parallel and perpendicular to each other as possible.
- The subgroups must be perfectly matched to ensure that the guide is as straight as possible, otherwise the transmission quality of the neutron beam will be deteriorated.

“Initially, we had old instruments for carrying out these measurements. Some time ago, we started looking for an alternative system that is flexible, reliable and that could guarantee us the necessary accuracy in relation to our tolerances. We therefore contacted our supplier who referred us directly to the TESA MICRO-HITE+M, a motorised height gauge. We had already had the opportunity to work with height gauges of different brands in the past, so we saw immediately the advantages that this system could offer us. We already have two of them!”

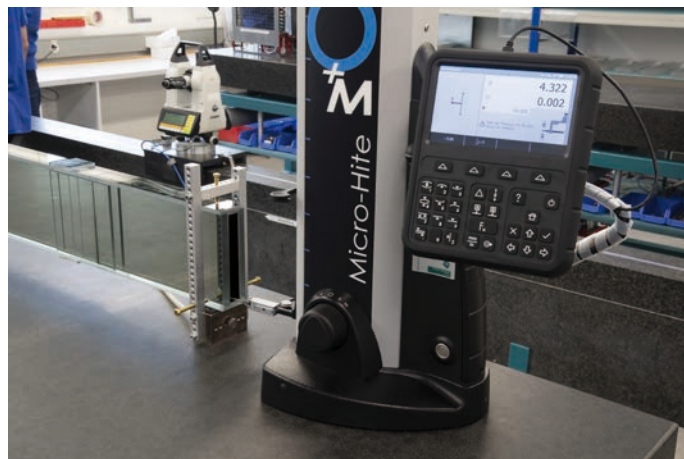
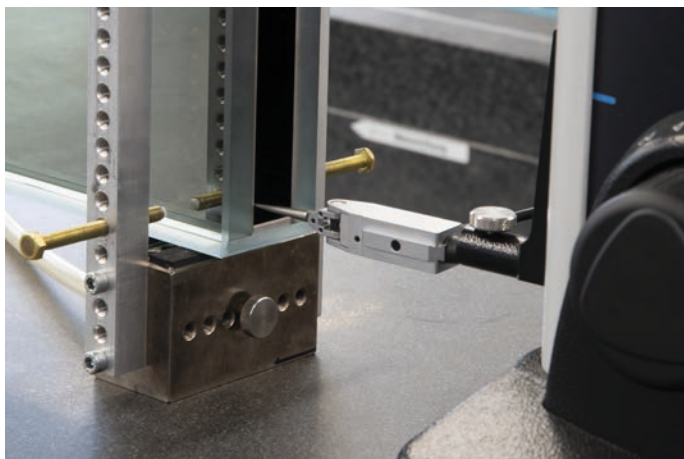


Mr. Brisacher realizing a perpendicularity measurement.



WE IMMEDIATELY SAW THE ADVANTAGES THAT THIS SYSTEM COULD OFFER US

“In addition to its userfriendliness and pleasant software, we also wanted an instrument that allows us to manage measurement data simply, quickly and without cables, because our computer is located at a certain distance to the granite plate. With the TESA TLC-BLE system we can send our results automatically or manually to a control report specifically designed for each type of measured part.” comments Alexander Hunt.

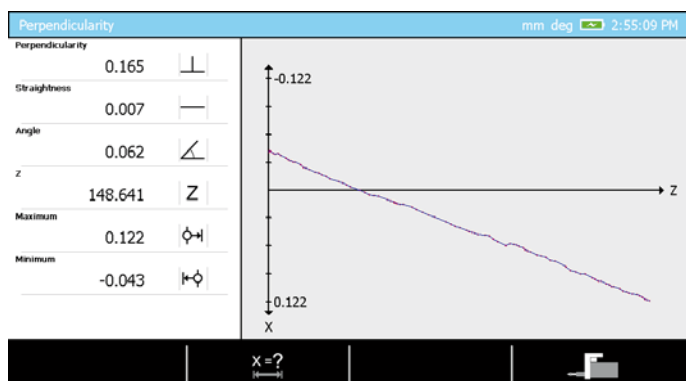


The complete system for perpendicularity measurement

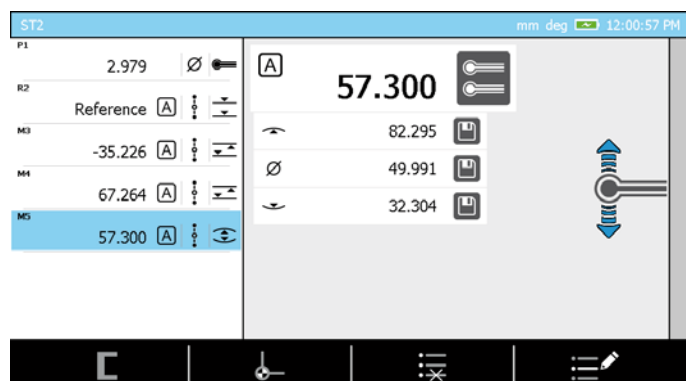
Once all measurements have been carried out, the values are sent to the computer linked to two large screens on each side of the assembly room. It is easy for the installers to see in real time the status of the system on which they are currently working. The MICRO-HITE+M height gauge is used with two different probe configurations. The first configuration, a 5 mm diameter ball probe, measures the width of the guide at the ends and in the middle.

The second configuration includes a GT31 probe that allows the determination of perpendicularity errors.

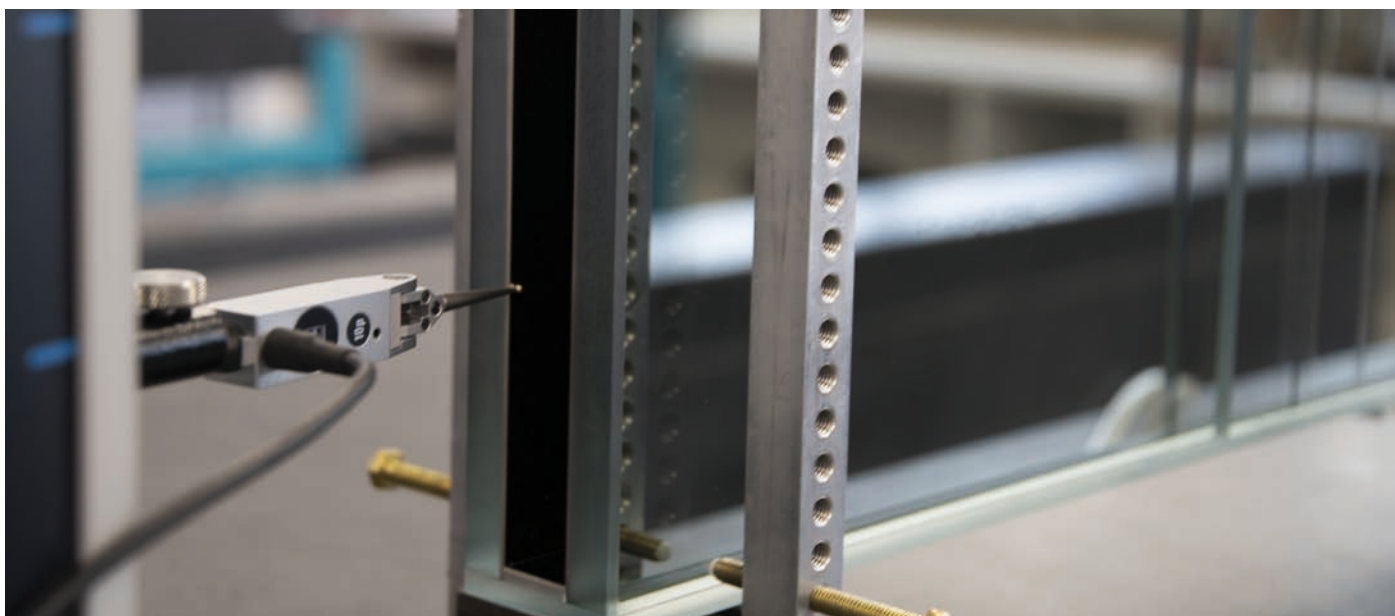
The MICRO-HITE+M has been specially adjusted mechanically to allow such a measurement with all 1D probes of the TESA range. All you need to do is connect the probe at the back of the control panel and carry out the measurement. The results and a graph corresponding to the measurement will be displayed.



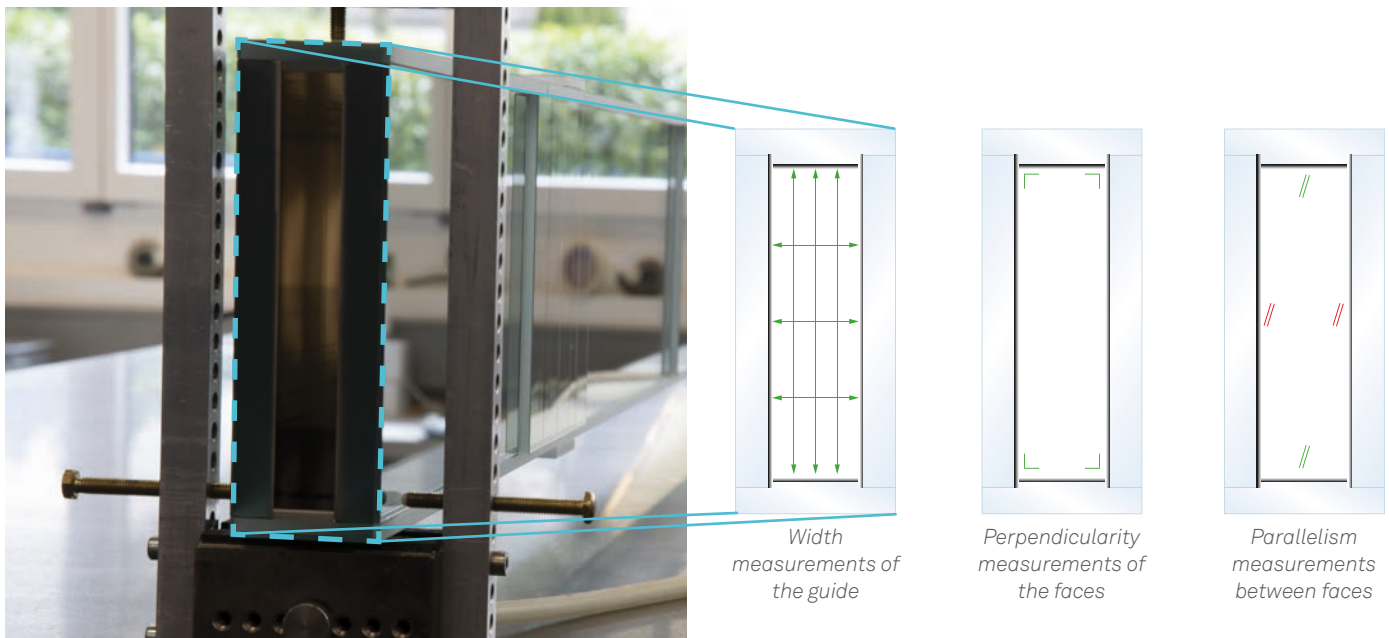
Example of a result page for perpendicularity measurement



Mode for viewing the results of the width/height measurement of the guide segment



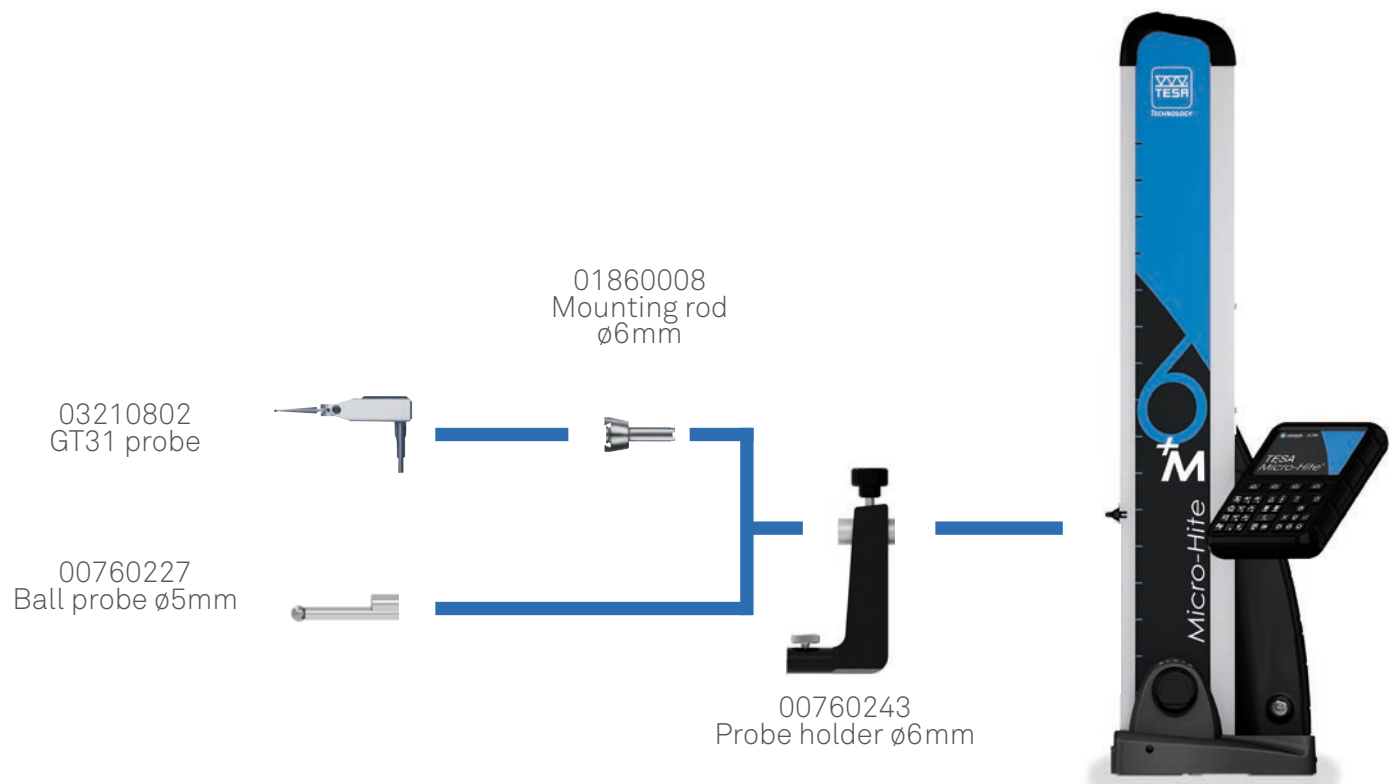
GT31 probe measuring the inside of the guide segment



THE MEASUREMENT CONFIGURATION USED BY THE SWISSNEUTRONICS TEAM

Among other things, the MICRO-HITE+M column is:

- A **hybrid panel** (keyboard or touch screen) for optimal user comfort
- A **simplified keyboard** for a simple handling without confusion
- A **contextual help** in real-time to avoid hazardous situations and poor results
- Quick and easy **culmination point** measurement with the patented QUICKCENTER technology
- A **control handle** with the patented FEEL&MOVE technology for fast and accurate probe positioning
- Automatic ***.pdf report** creation
- A **robust cast iron construction** to ensure stability of the results in the long-term.





Hexagon Manufacturing Intelligence helps industrial manufacturers develop the disruptive technologies of today and the life-changing products of tomorrow. As a leading metrology and manufacturing solution specialist, our expertise in sensing, thinking and acting – the collection, analysis and active use of measurement data – gives our customers the confidence to increase production speed and accelerate productivity while enhancing product quality.

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-  AUTOMATED APPLICATIONS
-  MICROMETERS, CALIPERS, HEIGHT GAGES, ETC...
-  DESIGN AND COSTING SOFTWARE



Established in 1941 and headquartered in Renens, Switzerland, TESA SA manufactures and markets precision measuring instruments that stand for quality, reliability and longevity.

For more than 75 years, TESA has distinguished itself in the market through its excellent products, its unique expertise in micromechanics and precision machining as well as its proven experience in dimensional metrology.

The TESA brand is the global market leader in the field of height gauges and a pioneer thanks to its wide range of instruments, including callipers, micrometers, dial gauges, lever-type dial test indicators and inductive probes. TESA is a true benchmark for the inspection of incoming goods, as well as for production workshops and quality assurance laboratories.

Through its worldwide distribution network the company focuses on the mechanical engineering, micromechanical, automotive, aerospace, watchmaking and medical industries.

In 2001, TESA became part of Hexagon, a leading global provider of information technologies.

[TESAtechnology.com](https://www.TESAtechnology.com)



SwissNeutronics is a spin-off company of the Paul Scherrer Institute founded in 1999 and based in Klingnau in the canton of Aargau (CH). The company develops and manufactures neutron guides and advanced optical components for laboratories around the world. The components that the company manufactures are integrated into much larger systems and are often used for material analysis.

TESA would like to thank the team of SwissNeutronics for their friendly support and for the authorization to publish this case study.

Sources used in the design of this document:
www.swissneutronics.ch
www.psi.ch