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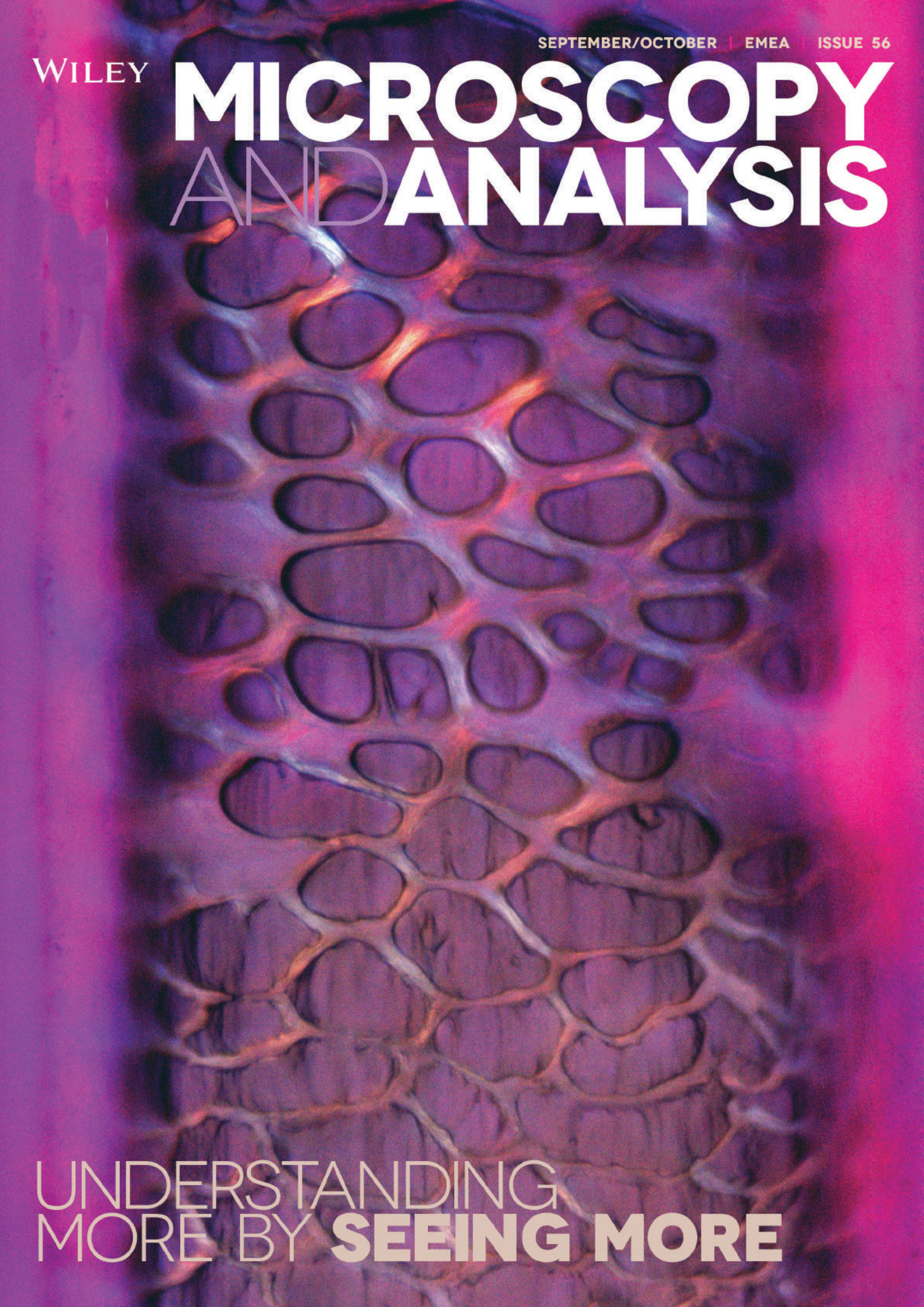
MICROSCOPY AND ANALYSIS



UNDERSTANDING MORE BY SEEING MORE

From small beginnings to mighty microscopes

This year, Tescan is celebrating its 30 year anniversary. Chief executive, Jaroslav Klíma, tells M&A about how he and his friends built one of the world's leading manufacturers of scanning electron microscopes.

Tescan has its roots in communist Czechoslovakia – how did it all start?
Our story began 30 years ago, but the history of electron microscopy in the Czech Republic goes back even further. The first electron microscopes arrived in Czechoslovakia in 1947 from the US under the United Nations Relief and Rehabilitation Administration development assistance.

One was acquired by Professor Wolf to Prague at the UK Medical School, and the other went to Professor Herčík at the MU Medical School. They also attracted interest at Brno Tech, where Professor Aleš Bláha invited his students to learn more about them. That was when the plan to develop the first Czechoslovak electron microscope was born, which became a reality a few years. A key credit was given to one of the Bláhových students and later to the head of the Institute of Instrumentation Engineering of the AV CR in Brno, Armin Delong.

Communist Czechoslovakia acquired production of electron microscopes as part of the former Eastern Bloc's "division of labor," and the talent of the region's engineers and physicists made it a world leader in microscope production under the large, state-owned electrotechnical conglomerate, Tesla. However, trouble came in the 1970's and 80's. In the post-war period the quality of electron microscope was determined by the quality of physical design, the precision of engineering manufacturing and precision assembly, but in the following decades electronics came to dominate, and the Tesla microscopes fell behind other industry-leading instruments.

How was manufacturing in Communist Czechoslovakia at this time?
Socialist central planning did not favour innovation. Russian payments were delayed, manufacturing suffered from a shortage of components, and the once successful business was rapidly losing competitiveness. The centrally planned economy was further constrained by the reformist "perestroika" introduced in 1984 by the General Secretary of the Communist Party of the Soviet Union, Mikhail Gorbachev.

By November of 1989, all of Czechoslovakia was in the throes of social agony, seeking hope in demonstrations. The company's business virtually stopped for several weeks. After the Velvet Revolution, Tesla was in bad economic shape and the company had no established business chains or qualified management. Meanwhile, social change continued, culminating in free elections and the gradual democratization of society.

In the early 1990s, literally everything changed in Czechoslovakia, including the economy. The societal transformation continued with the split into the Czech and Slovak Republics. Five friends from Tesla, including myself, wanted to start businesses to support themselves. We understood electron microscopy, but the expensive manufacture of the entire microscope was an elusive dream. So, we decided to service and improve them instead.

What happened next?
In 1990 I went to a US trade fair and saw digitization for the first time and saw a great future in it. I applied for a PhD course at the CTU of Basic Computer Image Processing and traveled for two semesters to Prague. It was the experience of the first computers that led to developing our first product, an analogue-to-digital converter. We began programming and working on hardware that could digitize video signals from an electron microscope, while reversing the digital signal from a computer to an analog one so that raster could be controlled.

Tell us about your first Tescan Image Processors?
Thirty years ago, electron microscopes used analogue screens instead of digital monitors to display samples. Tescan's first product thus became an analogue-to-digital image converter. We supplemented the original microscope with electronics connected to a specific location in the microscope, which made it possible to manage the imaging, store the images and then view them in digital form.

Using analog shades was very hard on the eyes, and the microscope had to be placed in the dark. The Tescan Image Processor (TIP) allowed images to be displayed directly on the monitor, stored on a disk, and further processed.

It was our first official product, and was sold to the Institute of Instrumentation Engineering of the Czech Republic. This was the first money we made back then. When we bought our own computer, we were arguing about whether we had to have a 3.5-inch drive and if we could afford it. We lived on savings as a garage company and sold the TIPs for around a hundred dollars.

How did you develop your first electron microscope?
Tescan was steadily growing, getting into the black and hiring employees. We ventured into increasingly complex matters, mostly concerning the innovation of electron microscopes from the already cancelled Tesla production. We bought unsold tubes from Tesla warehouses and assembled our own production chambers under them. This resulted in the production

JAROSLAV KLÍMA, *above, Chief Executive of Tescan*

NEW YEAR'S EVE *1992 – all Tescan employees.*

ALL TESCAN *employees in 1998 – a year later the Vega SEM was to be launched.*

of our first electron microscope, which was sold under the name Proxima.

Was it easy to grow the company back then?

No, this wasn't an easy time for us – the banks didn't lend much money and interest rates were high. As a growing 'start-up', Tescan was spotted by foreign investors and we were approached by LEO Microscopy.

In 1998 we produced the first prototype under LEO Microscopy, and we didn't know what a surprise we were in for. The planned investments never materialized. Soon after the transfer of shares, internal tensions peaked. The German part was dissatisfied with the work of the CEO of LEO Microscopy, forced him to resign and called in an emergency manager to stabilize the business. The acquisition was cancelled. It was quite a shock for us, but we were able to buy back our shares at the original price.

Suddenly we were back to square one, but our desire to develop our own product, which seemed already within reach, was too strong. We finished developing the tube, the rest was basically finished, and the next year we presented our first microscope at the Brno Exhibition Centre.

Tescan Vega came next – tell us a little about this SEM.

Eight years after starting Tescan, with a team of just 25 people, we developed from scratch and commercialised the Vega. It could not have been more emblematic; it was indeed our star. This was a thermionic emission scanning electron microscope, originally with one tube. After a number of modifications, it is still produced today and accounts for about a third of our product portfolio. The first tool went to a university in Chemnitz, Germany, and after that, the contracts began to pile up.

Which microscopes followed?

Vega was a huge success – it was a high performance workhorse used by a wide variety of customers. In 2001, Vega won the gold medal at the International Engineering Fair. It was a time when scientific institutes and research sites of private companies were switching to digital electron microscopes and wanting to innovate.

Come the early 2000s, we had penetrated the US market and acquired a patent for our LVSTD technology, a low-vacuum secondary electron detector. By 2003, sales were at an all-time high and we began exporting to Asia.

Tescan Mira was soon developed. With Mira we took our technology to the next level with the emission cathode. We presented it in 2005 at the Microscopic Conference in Davos. We were able to freely decide where we wanted to export to, after so many years of centrally controlled production in communist Czechoslovakia, we felt real freedom and enthusiasm. We would load the microscope into our own cars and go to install it at the customer's facility in Germany.

Then, around 2007, a new trend began to take hold in electron microscopy: editing a sample using an ion beam. So we launched of a third series of electron microscopes called Tescan Lyra.

TESCAN IMAGE PROCESSOR *(TIP): the first version of which was written while still in the MS DOS operating system.*

JAROSLAV KLÍMA *connecting a Tescan Image Processor to an electron microscope.*

Why merge with Orsay in 2014?

Tescan had worked with the French firm, Orsay, for a long time and the benefits of this merger have since been extremely positive for both organizations. In 1984, Orsay's Pierre Sudraud and Paul Ballongue were the first in the world to combine a focused bunch of gallium ions with a raster electron microscope from Phillips. They pioneered the device that would later become known as the 'dual-beam' or FIB-SEM. In April 1989, Sudraud officially founded Orsay Physics. In 2013, Tescan, then a customer, proposed merging all activities into one group and officially established Tescan Orsay Holding in April 2014. In 2017, NanoSpace, the first FIB-SEM operating under ultra-high vacuum was launched.

What does the future hold for Tescan?

In 30 years, Tescan has moved to the very limits of the laws of physics. As the quality of the component parts improved, so have the devices as a whole. The level of electron microscopy today is already on the very edge of human knowledge, and it can't be done in isolation. It requires the cooperation of physicists, engineers, software developers, researchers, and other disciplines that must support each other

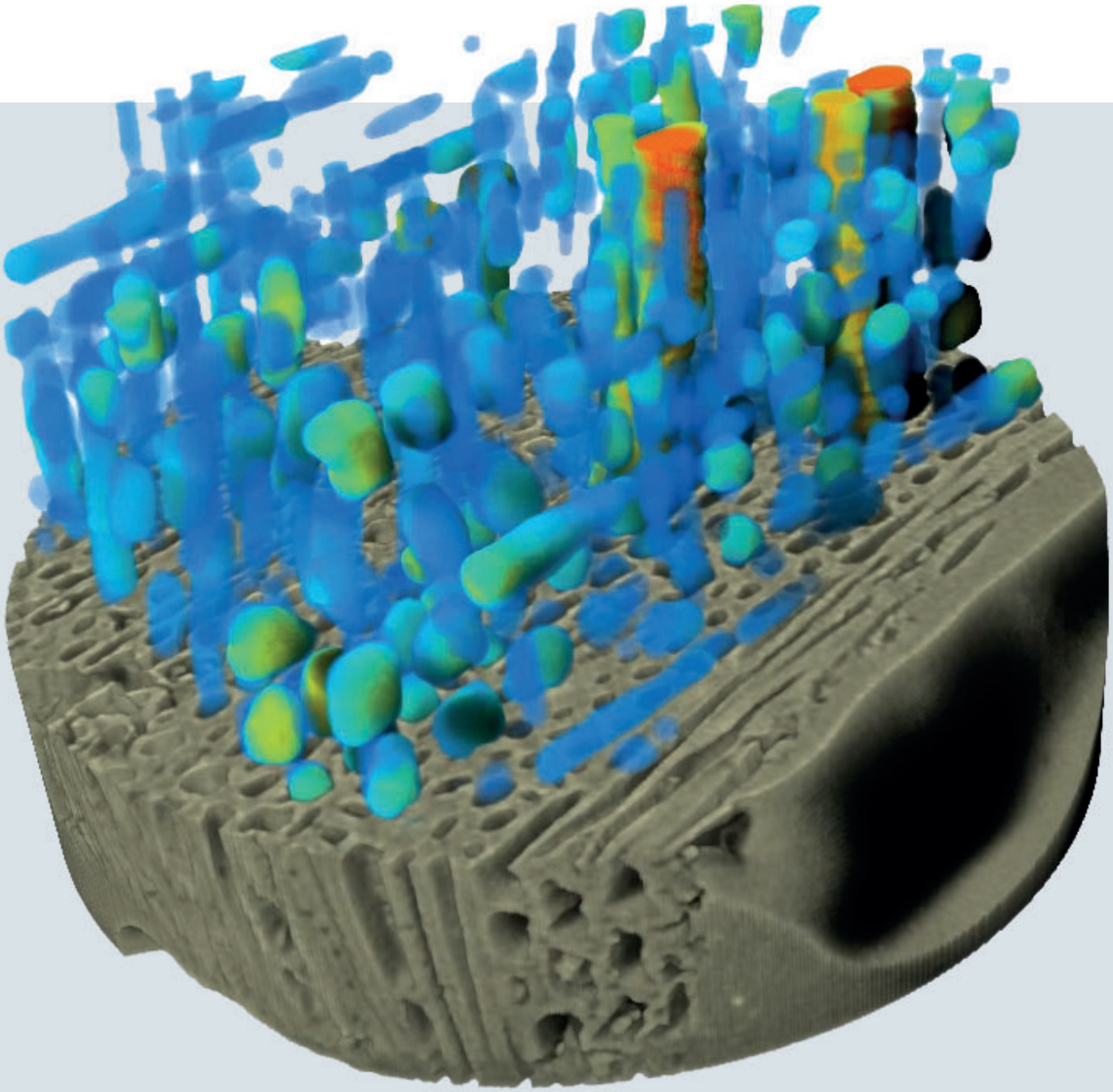
So, Tescan has now changed completely. We all knew each other once, but as our microscopes became increasingly sophisticated, we started new departments and specialities. Today's microscopes are the work of a number of top experts, often no longer known outside their specific department. But the values that our company grew up on still persist today, because the zest, joy and enthusiasm is still there. And the future is clear – we must continue to innovate, invest in development and adapt to new trends.

For example, we just launched the new UniTOM HR – the first dynamic micro-CT system to offer sub-micron resolution 3D non-destructive imaging for static studies and high temporal resolution for uninterrupted 4D dynamic CT experiments.

We believe, it is the dynamic capability that really sets the UniTOM HR apart from other micro-CT instruments on the market – the ability to collect data through real-time, not time-lapse, visualizations, providing a wealth of information previously unavailable to researchers.

From the beginning, the enthusiasm of our people has been behind our success and innovation. But the true joy for us is working with customers in both academia and industry to supply new, high-performance microscopes that enable them to advance their research and improve the world we live in.

TESCAN



Wood sample scanned at 280 nm voxel size - vessels are color-coded to thickness.

TESCAN UniTOM HR

The first micro-CT system to provide sub-micron spatial resolution and high temporal resolution dynamic CT in a single, highly versatile system.

What can you do with TESCAN UniTOM HR?
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