



How *does* the *do* knowledge *notes* get *in* the *cheese?* AI?

These and many other questions were posed to Dr. Mattis Hartwig of singularIT in an interview. You can find the answers starting on page 15.

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AI Hype

FOOD-Lab Provides Deep Insights

Organized by foodRegio, a business association of the food industry in Schleswig-Holstein, the NutritionX conference focusing on "Artificial Intelligence" took place on October 11th. FOOD-Lab was present in Lübeck and spoke with entrepreneur Jochen Brügggen, head of Brügggen KG, who also chairs foodRegio. There are already many applications for AI, such as quality management and product development, as well as in production—anywhere where large amounts of data are generated repetitively and can be processed more quickly with the help of machine learning software. Increasing efficiency in the food industry is a frequent goal, explains Dr. Mattis Hartwig of SingularIT, a highly innovative software company, in a FOOD-Lab expert discussion. He also cites concrete examples, such as product development. Knowledge gained from numerous recipes, including which ingredients harmonize, combined with engineering expertise, can be used to train a model that then calculates the probabilities of which new combinations might work. This saves development time; however, ultimately, a human being must make the decisions.

Mario Ubiali, from THIMUS, IT, presented his talk on how to improve the high failure rate of 50-80% for new food products on store shelves. Neuroscience can help in creating tasty and commercially successful products. Ubiali, a pioneer in neuroscience, is known for his work with Netflix and RAI. He also gave a lecture in Lübeck. Despite all its advantages, AI requires caution when implementing new systems, as these systems are always based on calculating probabilities. These probabilities are inherently only as accurate as the training data and can therefore produce incorrect results.

Of course, many people also have anxieties due to insufficient knowledge or inadequate communication of the technical details. Therefore, a sensitive approach is essential when introducing AI into a company. It's crucial to meet people where they are.

Dagmar Behmer from Bruker explains the advantages of real-time process optimization with FT-NIR spectroscopy for sustainable oilseed processing.

In the FOOD-Lab expert discussion, Professor Geraint Morgan from the University of Southampton, UK, explained the differences between traditional one-dimensional gas chromatography methods and the two-dimensional GCxGC solutions from LECO. This highly complex method, available on the market for only 18 months, is capable of accurately and reproducibly detecting and quantifying hundreds of chemical compounds in smoke aromas. For producers of alcoholic beverages, such as whisky, or those producing complex flavorings, compound detection is improved by a factor of 5-10, and the analysis time is reduced from two weeks to just a few hours. Professor Morgan also offers his expertise commercially. Christine Loeb-Stubbins, LECO, explains in the supplementary article on ChromaTOF software the capabilities of the latest software, which works on all LC-GC-FID devices.



**Merry Christmas and
Happy New Year 2026!**

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Sustainable oilseed processing

Real-time process optimisation using FT-NIR spectroscopy



Author: **Dagmar Behmer**, dagmar.behmer@bruker.com, www.spectroscopy-in-process.com/food

The oil and fat industry is undergoing profound change. Increasing demands for sustainability, energy efficiency and product quality are coupled with a shortage of skilled workers and rising costs. At the same time, legislators and consumers are demanding transparent, resource-efficient processes. Modern analytics, especially FT-NIR spectroscopy, offer new ways to address these challenges. This article demonstrates how innovative measurement technology can improve process control and contribute measurably to environmental and climate goals.

Key challenges in oil and oilseed processing

The oil and fat industry is currently facing a number of complex economic and social challenges. A key issue is the increasing pressure to reduce CO₂ emissions and produce more sustainably. As part of the European Green Deal, the European food industry has set itself the ambitious goal of achieving climate neutrality by 2050, and customers and legislators already expect transparent, resource-efficient production today.

At the same time, energy prices are at a historically high level, significantly affecting the cost of processing oilseeds and fats. Companies must therefore find ways to minimise energy consumption and make their processes more efficient. Added to this is the shortage of skilled workers: qual-

ified personnel are hard to find, bringing the introduction of digital and automated solutions into focus.

Another key issue is quality assurance. The requirements for product safety, traceability and documentation are constantly increasing. Traditional laboratory analyses are reaching their limits because they are time-consuming and often only provide results retrospectively. In environments where quick decisions and flexible process adjustments are required, real-time data and continuous process monitoring are becoming increasingly important.

Last but not least, international standards and certifications, such as those

relating to life cycle assessments (LCAs) or carbon footprints, require the full recording and evaluation of all relevant process data. Companies that can meet these challenges will not only gain a competitive advantage, but also actively contribute to environmental and climate protection.

FT-NIR spectroscopy: Technology and functionality

Fourier transform near-infrared spectroscopy (FT-NIR) has established itself as a key technology for process analysis in the oil and fat industry. Its main feature is its ability to analyze organic materials quickly,

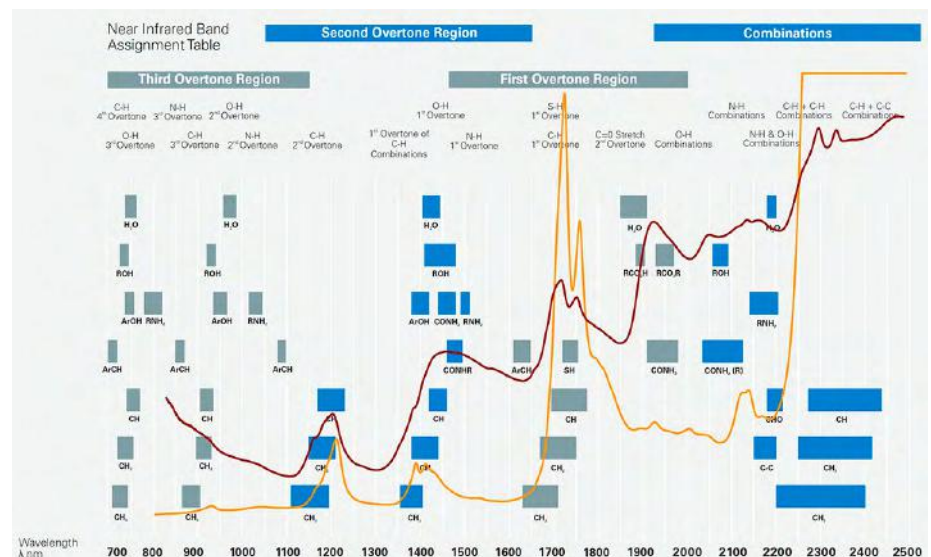


Figure 1: Typical FT-NIR spectra of rapeseed (brown) and rapeseed oil (yellow)

Process steps for quality control and process monitoring with FT-NIR

Goods receipt

Classification of rapeseed, soybeans, and other oilseeds according to moisture and oil content for optimal ensiling and processing of the raw material.

Processing and conditioning

Control of moisture to target values for the subsequent process steps (pressing and extraction) to avoid over- and under-drying and ensure a stable process with the lowest possible energy consumption.

Pressing and extraction

Monitoring of the residual oil content in the press cake to adjust process parameters such as temperature and dwell time for yield optimization.

Refining

Testing of fatty acid composition and relevant quality parameters for process monitoring during deacidification, bleaching, and steaming.

End product control

Rapid testing of edible oils for free fatty acids, moisture, and fatty acid composition to ensure compliance with product specifications and quality standards.

non-destructively, and without time-consuming sample preparation. The operating principle is based on the interaction of near-infrared light (approx. 800–2,500 nm) with the molecules in the sample. The resulting spectra (Fig. 1) are characteristic of the respective composition and allow the exact determination of the ingredients. NIR is particularly sensitive to molecules with the following functional groups:

- **C-H bonds** (e.g., in fats, oils, carbohydrates)
- **O-H bonds** (e.g., in water, alcohols)
- **N-H bonds** (e.g., in proteins)
- **S-H bonds** (e.g., in amino acids)
- **Other groups:** C=O (carbonyl), C-N, C-O, C=C (aromatics, alkenes)

FT-NIR systems deliver precise results for parameters such as moisture, fat content, protein, or specific fatty acids within seconds.

Practical examples from oil and fat processing

FT-NIR spectroscopy enables efficient and precise monitoring of quality-relevant parameters along the entire processing chain, from goods receipt and preparation to end product inspection. This ensures the quality of both the oilseeds and the oils extracted from them while optimizing processes in a resource-efficient manner.

Two typical applications are presented below to demonstrate the practical benefits of FT-NIR spectroscopy.

When analysing rapeseed, the focus is on several ingredients that are crucial for quality and subsequent processing. The erucic acid content is particularly important, as its level is strictly limited by law for health reasons. Reliable monitoring is therefore essential to ensure compliance with these limits and guarantee food safety. Glucosinolates also play a central role, influencing not only the taste, but also the suitability of the press cake for use as animal feed. Excessive glucosinolate content can significantly reduce acceptance and usability. Additionally, parameters such as chlorophyll content provide information about the seed's maturity and quality, while fat and protein content significantly impact the economic value and yield. Continuous monitoring of these parameters enables flexible response to fluctuations in the raw material and optimal adjustment of the process control.



Figure 2: Test installation of an FT-NIR sensor above a conveyor belt carrying soybean meal



Figure 3: Comparison of real-time measurements with FT-NIR (orange: fat, blue: moisture) and laboratory measurements (red)

When processing soybean meal, continuous monitoring of parameters such as fat, protein, moisture, fiber and ash is crucial for product quality and economic efficiency. A practical example from production illustrates the significant difference between classic laboratory analysis and modern online monitoring: While laboratory analyses were only carried out at longer time intervals, the online analysis with a measuring head above the conveyor belt continuously provided real-time values (Fig. 2). In one specific case, quality fluctuations occurred in the production process that were not detected in time by the laboratory due to the long intervals between measurements (see Fig. 3). Online measurement, on the other hand, immediately indicated the deviations, allowing for an immediate response. This example highlights the importance of continuous, real-time monitoring to ensure consistent product quality and prevent waste.

Industrial-grade FT-NIR solutions for process monitoring

Modern FT-NIR systems such as Bruker's BEAM Single-Point Analyzer and the MATRIX-F II with 6-port multiplexer are specially designed for use in harsh industrial environments. They feature high optical resolution, automatic background measurements, and maximum long-term stability, crucial advantages for continuous operation in the process industry. The robust design and low-maintenance components ensure reliable operation even under demanding conditions.

A particular advantage of these systems is their flexibility in terms of location: measurements can be taken directly in the process, for example via conveyor belts and chutes, or through viewing windows in closed systems such as reactors or pipelines (Fig. 4). This provides plant operators with real-time data on all relevant quality and process parameters, which can be used directly for process control.

Integration into existing production lines and automation systems is usually straightforward. NIR systems offer standardized interfaces for connection to Profibus, Industrial Ethernet, or directly to the distributed control system (DCS). Automatic transmission of measurement results to the process control technology enables seamless monitoring and control without

Figure 4:
Schematic
installation
of the BEAM
FT-NIR spectro-
meter on a
process line



time delays. This drives forward the digitalization of production, makes processes more efficient, and ensures consistently high product quality.

Economic and sustainability advantages

The targeted use of FT-NIR spectroscopy in oil and fat processing opens up a wide range of opportunities for companies to make their processes more sustainable and economical. Continuous monitoring and optimization of key process parameters can significantly reduce energy and resource consumption. For example, unnecessary heating or drying phases can be avoided, the use of steam and solvents can be reduced, and the yield of valuable products can be increased. This not only leads to a better environmental balance, but also to a quick return on investment, often within a few months.

Another advantage is improved process stability: fluctuations in raw materials or in the production process are detected at an early stage, enabling targeted countermeasures to be taken. This reduces the rejection rate and minimizes rework. Companies benefit from consistently high product quality and more efficient use of raw materials and energy.

The targeted use of FT-NIR spectroscopy as part of process analytical technology (PAT) enables companies such as Bayer to optimize energy-intensive processes in a targeted manner, thereby making a significant contribution to sustainability. Processes such as drying and distillation are often essential, but also particularly energy-intensive. Precise monitoring and control of these processes with FT-NIR can significantly improve both thermal and chemical efficiency.

At Bayer Dormagen, for example, FT-NIR process automation led to a 10% increase in capacity and a corresponding 10% reduction in the carbon footprint per ton of product. Annual savings amounted to 2,000 tonnes of steam and 400 tonnes of CO₂, equating to a net value of around €40,000.

The integration of FT-NIR spectroscopy into process analytics is a decisive lever for greater sustainability and economic efficiency in industry. Companies such as Bayer demonstrate that investments in modern analytics are not only ecologically but also economically worthwhile and make an important contribution to achieving ambitious climate targets.

Conclusion and outlook

FT-NIR spectroscopy is much more than an analytical tool; it enables sustainable, efficient and future-proof oil and oilseed processes. Companies that invest in modern process analytics at an early stage benefit from cost savings, higher product quality and an improved environmental balance. The technology enables processes to be controlled flexibly and in real time, compensating for fluctuations in raw materials and allowing resources to be used in a targeted manner. At the same time, it reliably meets the growing demands for transparency, traceability and sustainability, a clear competitive advantage in an increasingly challenging market.

The continuous development of FT-NIR systems and their seamless integration into digital production environments opens up new opportunities for process optimization and automation. Companies that embrace this technology will secure a strong market position, both now and in the future.

The Bruker team is available to answer any questions or provide personalized advice.



FT-NIR SPECTROSCOPY

FOOD ANALYSIS



FT-NIR solutions for safe processes, highest product quality, and sustainable production.

Quality begins with precise analysis. We support food manufacturers in ensuring safety and efficiency along the entire value chain: from raw materials to the final product.

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Process Control: Continuous monitoring directly in production for maximum safety and optimized resource utilization.

Sustainability: Less waste and stable processes contribute to cost efficiency and responsible use of resources.

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Innovation with Integrity

eFOOD-Lab International technical talk with **Prof. Geraint Morgan**, University of Southampton, UK on advanced flavour analysis



Background

Prof Geraint (Taff) Morgan is Professor in Analytical Chemistry in the School of Chemistry and Chemical Engineering at the University of Southampton and is the Director of the Chromatography and Mass Spectrometry Facility. He specialises in the development and optimisation of novel assays for the quantification of volatile organic compounds (VOCs) in complex samples.

His appointment has a Research and Knowledge Exchange & Enterprise (KEE) focus, as such, his aim is to expand the existing portfolio of consultancy and lab service contracts with commercial and academic customers. This includes being the preferred analytical partner of a large international automobile company and a strategic partnership with a leading US instrument company, LECO.

Funding from previous academia-industry programmes has allowed him to work with end-users to develop novel solutions (GC-MS, GCxGC-MS and SIFT-MS) for a diverse range of commercial partners, from SMEs to global multi-nationals. These included the SPRINT and the STFC Food Network + programmes, for which he was a Co-I. His research team have established a leading capability for the analyses of distilled spirits, especially Scotch Whisky – working with the growing number of English, Welsh, Irish, US and even Chinese distillers and Agencies/Institutes.



Good to talk to you again after our first debate in February 2021 on detection of whisky flavors. At that time you were working with The Open University. You've recently moved to the University of Southampton. What motivated that transition, and what research priorities did you bring with you?

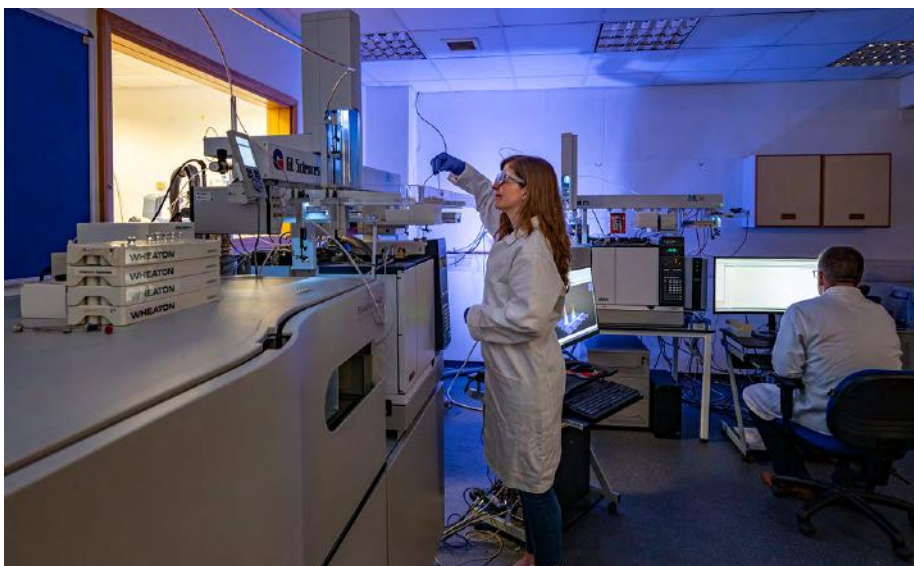
Thank you, basically the position at the University of Southampton was advertised at Professor level and it so was an opportunity for a promotion and a new challenge. The University of Southampton is also a Russell Group University with a higher ranking in terms of research and is one of the leading universities in the UK. I had a 31.5 year tenure at The Open University (OU), where I was a member of the teams that developed the Ptolemy and GAP instruments for the Rosetta and Beagle2 space missions. Since 2004, I had spent my time translating this multi-disciplinary knowhow to solving challenges back here on Earth with both academic and commercial partners, most notably Dr Simona Nicoara.

What attracted me most about Southampton was the so-called "Triple Helix"

strategy. At the university level, the "Triple Helix" model refers to the dynamic interaction between universities, government, and industry to foster innovation and economic growth. This concept shifts the university from a secondary institution to an equal partner, acting as a source of knowledge and a driver of commercialization through activities like research, technology transfer, and the creation of spin-off companies. Universities have an "entrepreneurial" role and a "third mission" to contribute to socio-economic development beyond their traditional functions of education and research.

Personally, I like to solve challenges and work with talented people from both academia and industry, so this strategy was perfectly aligned to my career ambitions and what I am good at. Indeed, as hoped, the first six months since moving here has already provided a large number of new collaborators that have identified that our analytical expertise will provide them with greater insights into their research questions.

Another key parameter in making the decision to leave the lab and the team that I had grown at the OU, was the fact that the Chromatography and Mass



Dr Lourenco loading the LECO Pegasus HRT+, with Prof Morgan working on the LECO Pegasus BT.

Spectrometry Facility at the University of Southampton already had two LECO 2D GC-MS instruments, a HRT+ and BT, both fitted with a liquid nitrogen thermal modulator. I would not even have applied for the job if it did not have the LECO 2D GC-MS capability. The Facility also has significant LC/MS and SFC capabilities and expertise, which I have not worked with before, but, I could see the potential benefits for my research, beyond VOCs.

The Russell Group is an association of 24 research-intensive public universities in the United Kingdom, founded in 1994, known for high academic standards and a focus on research. Members include some of the UK's most prestigious universities. The group's main purpose is to represent its members' interests, primarily to government and Parliament.

You are in close touch with companies?

Yes, I have established a good network with a number of companies over the last 10 years. There are also some very good research groups at Southampton with strong strategic partnerships to industry, notably with some of the biggest companies and government agencies in the country. I am now actively collaborating with a number of these research groups to expand on their existing offerings; within the School, the Faculty of Engineering and Physical Sciences and across the University, particularly with the Faculty of Environmental and Life Sciences.

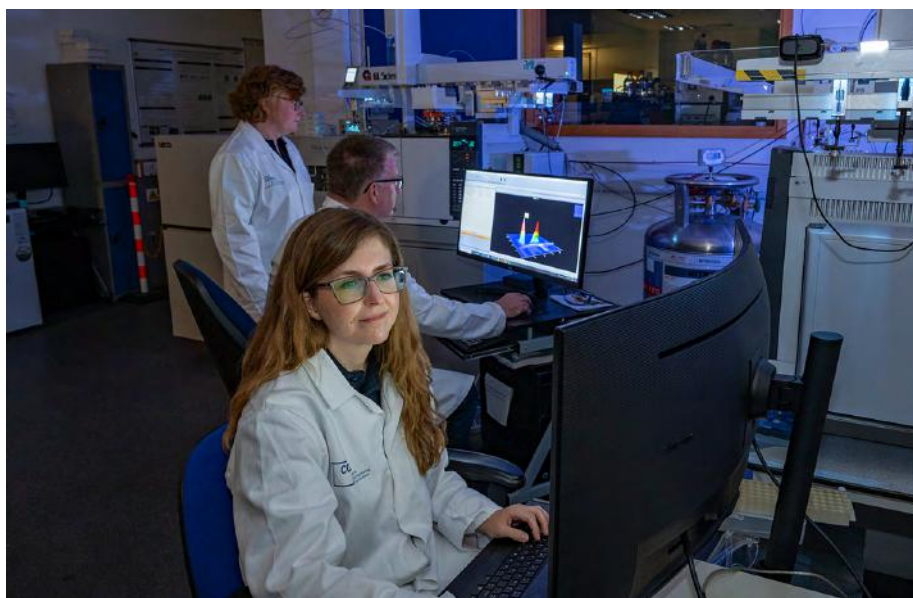
What they are looking at providing are enhanced analytical capabilities and that

is where I come in with my specific knowhow in the analysis of volatile organic compounds (VOCs). Previously the Facility had mainly provided the School of Chemistry with support for the synthetic chemists, more recently it has become the School of Chemistry and Chemical Engineering – with a wider portfolio of research activities and analytical needs. We have also recently launched Chemistry and Chemical Engineering Solutions (CChES), to commercialise the School's expertise. With my background in developing novel sampling interfaces, I hope to open up new types of measurement to CChES, the School and the Faculty.

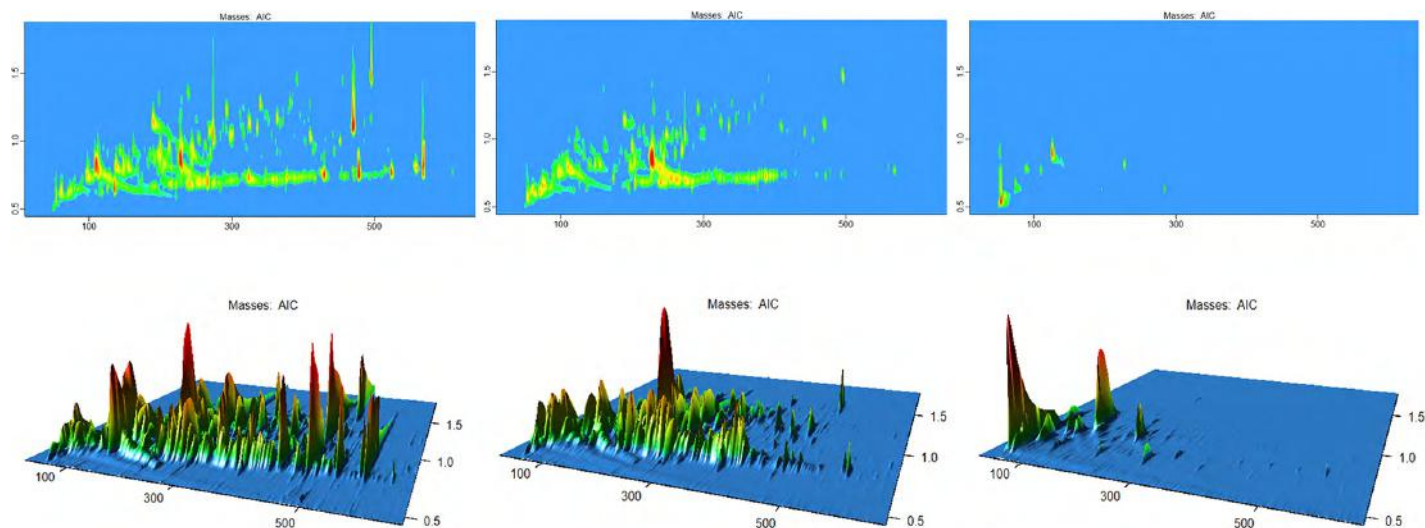
What have been the most exciting aspects of rebuilding and reshaping your research environment besides the existing analytical environment with the LECO Pegasus GCxGC-MS?

I have established a strategic relationship with LECO over the last five years or so. As a result, one of the things I was able to organise was the transfer of the LECO BTX to Southampton. The LECO BTX with Paradigm Shift is their latest technology, launched only some 18 months ago, that offers new benefits, most notably the ability for simultaneous compound identification by mass spectrometry and quantitation by FID. I often liken the LECO GCxGC-MS systems as being the Formula 1 or Rolls Royce equivalents in this analytical field, because they give you much better insights into complex samples over traditional 1D GC-MS systems. The fact that we have now these three LECO systems i.e. Pegasus 4D BTX/BT/HRT+ with both thermal and flow modulation, all in the same lab, gives us much greater flexibility for comprehensive non-targeted analysis of flavour compounds.

Over the last six months we have completely restructured the lab. Formerly there was a large LCxLC-IMS which we have moved. Now we have a dedicated 2D GC-MS Lab, a dedicated high-end SFC/ LC-MS Laboratory for power users and a separate Open-Access laboratory where students, post-docs and academics have full access to a range of instruments. The former is managed by my col-



Dr Lourenco (foreground) working on the LECO Pegasus BT, with Prof Morgan and Dr Herniman working on the LECO Pegasus HRT+.



A series of Contour (top) and Surface (bottom) plots, illustrating the differences in the profiles of VOCs in the headspace above similar quantities of three different algae.

league, Dr Celia Lourenco, the other two labs by Dr Julie Herniman. I like to think of our Chromatography & Mass Spectrometry Facility as a bit like “Marks and Spencers”, where you have everything available in one place, a “one-stop shop”.

What are you working on today compared to our first talk in 2021 when you were detecting whisky flavors?

Nowadays we are still working on distilled spirits but not so much as we were. We are about to offer our analytical service to the industry, as we have a couple of US companies who have asked for such a service, having sampled the benefits of our analytical work. We also have to bear in mind that UK Universities are operating under severe financial constraints. So, we want to build on what we have and then look at all the other opportunities to ensure we are sustainable.

For example, I have also worked with several flavour companies where LECO hardware and software (Pegasus BT 4D, ChromaTOF, NTS workflows, etc.) were used for comprehensive non-targeted analysis of their products. In general, the LECO systems help you to identify approximately 5-10 times more peaks compared to traditional 1D GC systems.

You start to see the smaller compounds. Allowing you to separate, identify, and quantify more species. In addition, one of the big advantages of the LECO Chroma TOF software is the very visual outputs that they produce – the human brain is great at looking at patterns, identifying if two images are the

same or finding the differences between images.

With regard to the food and drink industry, if you are helping customers optimise their process, their questions are always: what is the impact if we change one of the ingredients or other parameters in the manufacturing process? That is what we can help answer for them with the outputs from the LECO 2D GC-MS systems. In the first instance, by visually looking at the chromatograms. We can use either Surface or Contour plot to give different perspectives on the compounds present in their samples. With this visualization of the data sets, you can easily evidence to non-experts the impact of changing process parameters, and whether they are getting closer or further away from their optimal target species. In addition, the LECO software can be used to mathematically identify which compounds are discriminatory between the different classes of samples. These results, which can be output in the form of heat maps or bar charts, aren't always obvious initially, as it can be due to changes in smaller, less obvious peaks that are the most important. We find this a very valuable tool to enable discussions with the domain experts, the customers.

What were the analytical challenges that companies wanted to solve?

Several companies wanted to replicate their flavourings. With our technology we can help them see the impact of changes they make, this is quantitative and reproducible and we can then sup-

port them going through an iterative product development process before the huge costs associated with human sensory panels. It is up to the customer or the person providing the sample to know the relevance of the compounds we are identifying. We can tell them the changes but not necessarily the sensory influences. However, we can quite easily show them which compounds go up and which go down in each of their samples.

Other projects were to help them produce a better version of an existing flavouring. Usually, the big questions from their customers in the food and drink industry are: “Can you make it nicer or can you make it cheaper?”

Food flavourings are incredibly complex so that they overwhelm traditional 1D GC-MS and GC-FID processes. You will get literally hundreds of compounds. There is a vast range of compounds present, all at different concentrations and with different functional groups. In fact, it is a whole range of chemical species. With GCxGC-MS you have the advantage of having a second column, with a different stationary phase, enabling co-eluting species to be resolved before entering the mass spectrometer. The starting point for any customer was: what do each of these flavouring compounds actually look like?

Do these companies have their own Labs?

Yes, however like most of the sector, they do their analyses with the more traditional one-dimensional GC-MS and GC-FID systems. They are dealing mostly with

targeted testing rather than non-targeted screening. However, they recognised that they needed a deeper insight into their samples and having successfully supported them for their first project they came back to us for more.

From my perspective the primary aims of the projects were to help companies better characterise and understand the samples of interest; with a view that beyond the project they would be in a better position to make the business case to either up-grade their own laboratory or, if that case could not be made, then they would return to us for our commercial analytical service. Both ways are positive. But decisive for this journey was that the company was not left alone, once a more complex and expensive technology had been purchased.

During the projects we also helped by developing a new assay approach that significantly removed a lot of their sample processing prior to analysis, whilst also being more reproducible and sensitive than their existing methods. However, the biggest advantage lay in the data analysis and interpretation made possible by the LECO software packages.

What was the duration of the whole data analysis process?

Well, using a one-dimensional GC-FID the data analysis process will usually take about two weeks and they were certainly not separating all the peaks. With our GCxGC-MS you can pretty quickly get a good idea of the differences between the samples within an afternoon!

Now, when you plot the different samples in Chroma TOF, using both Surface and Contour plots, it quickly becomes clear how similar or different each of them are. Chroma TOF can also be used to identify the elution times of any target substances they were interested in. In addition, through the use external n-alkane standards, we can derive the Retention Indices and Delta RI for each compound and a mass spectral similarity match, based on the thousands of compounds in the NIST library. This allows us to express a confidence level to the assignment of each compound, as we did with the earlier whisky publication. The Chroma TOF software also gives you all the synonyms which is a big advantage, because not everybody uses the same name for the same compound. Each of

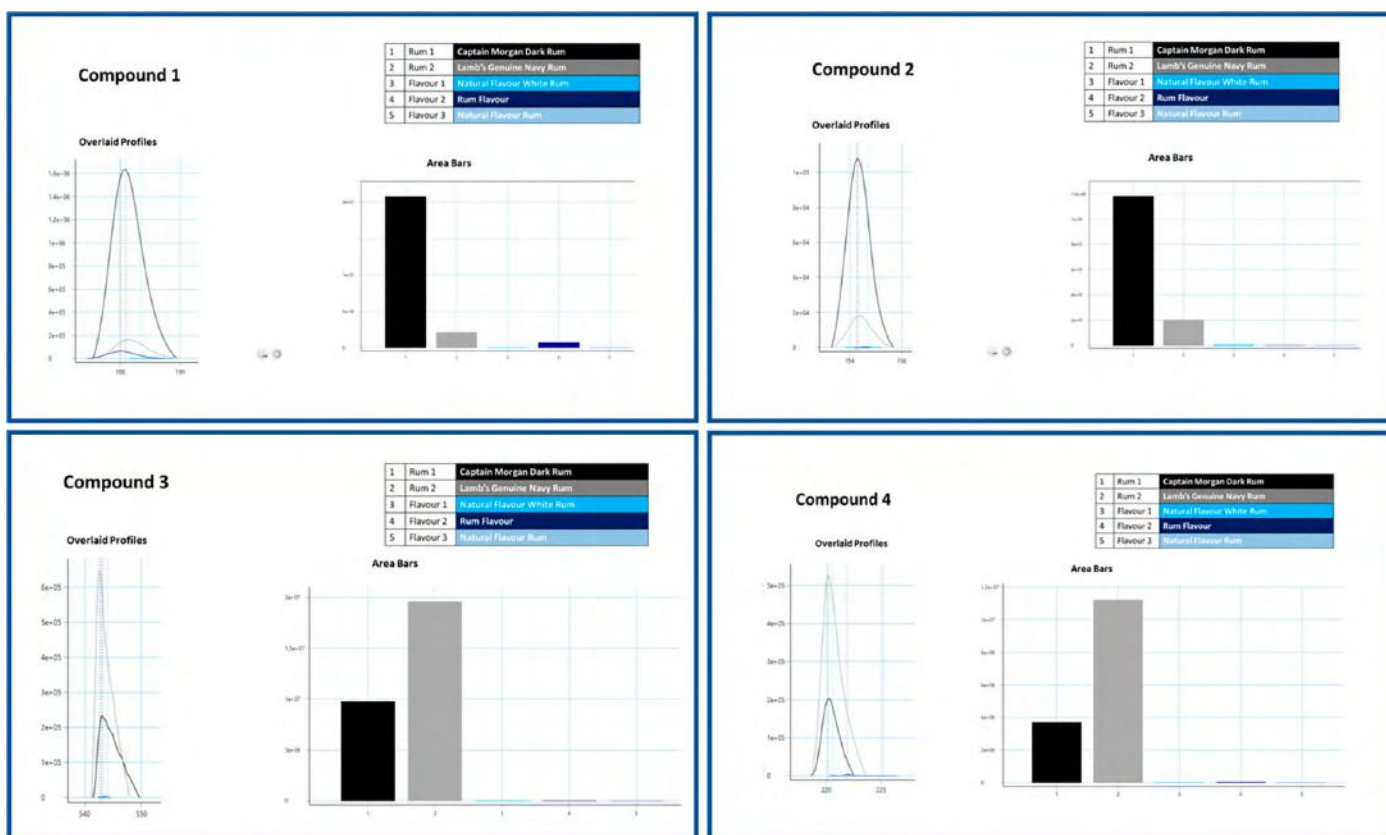
these are therefore an important benefit of the library used.

Another important question again: what were your findings regarding reproducibility in terms of sample to sample?

Indeed, that was one of the questions from each company, we were able to demonstrate that by using the LECO GCxGC TOF MS and our modified assay the reproducibility was higher when compared to what they got with their one-dimensional GC assay.

Were there some surprising findings?

I believe that all our customers were surprised by the sheer number of different, previously unknown, species present in their samples. For me, it's like comparing an early black and white TV technology of the sixties to the high resolution pictures we see today on our flat screens. You could not imagine at those early times what the development would be to-date. Companies can now get a better picture of what impact changing their recipes will have, because they can now characterise



Bar Charts illustrating compounds that are more abundant in commercial rums, compared to the company's rum flavourings

the differences in the multitude of substances present in any sample. Hopefully, other companies will also recognise the benefits such insights can bring.

Where do you see non-targeted screening and multivariate data analysis heading in the next 5–10 years for food and flavour companies?

I think the hardware is already advanced and suitable. The challenges ahead of us lie in the data analysis and how to turn the data sets into useful information on which people can make informed decisions, with confidence, in a timely manner. The reality is that no human can look at 600+ peaks in a sample, across many,

many samples and draw accurate conclusions. The future will be about machine learning and how do we then check if our hypothesis is correct or not. So, in principle it is the data analysis and data interpretation that needs to be made even more accessible in the future, so that it can become more of a routine tool. LECO are leading in this area and I'm excited to see how their future products will develop and benefit my research and commercial customers.

People also need to understand, among other things, that it is often the smaller peaks that can be making the biggest sensory difference. As soon as you can resolve and accurately identify and quantify these smaller peaks, by 2D GC-MS,

then the more likely it is you can change your production processes to optimise the outcomes and produce a better selling product.

In my view, 2D GC-MS will give you greater insights into the compounds that make up your complex mixtures and how changes in your inputs will impact the characteristics of the product. Through a combination of our expertise utilising LECO hardware, data analysis and classification software we can accelerate your journey to market. To borrow a phrase from Dan Golding (former NASA Administrator) we can help you launch new products "faster, better, cheaper".

Thank you

“The collaboration vastly sped up our ability to analyse the volatile components of our complex flavourings. The Leco instrumentation combined with its powerful software tools, as well as the expertise to utilise these together were invaluable. It was possible to gain an insight into the chemical composition of the flavourings and the differences between them which has helped improve our understanding of them greatly.

Phil Metcalfe, Founding Director, Efficiency Technologies Ltd.

MOSH/MOAH COMPLIANCE WITHOUT COMPROMISE

The Regulations Are Clear. Your Results Should Be Too.

STAY AHEAD WITH LECO

Mineral Oil Hydrocarbons are under increasing scrutiny from EFSA and JRC guidance, with strict requirements for accurate monitoring in food and packaging. Conventional LC-GC/FID often falls short in specificity and confirmation.

LECO's **Pegasus® BTX GCxGC-TOFMS/FID** is the first validated workflow to deliver both:

- **Qualitative insight**
To separate MOSH from MOAH, and identify contamination sources
- **Quantitative accuracy**
That meets EFSA recommendations
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A New Standard for Routine Mineral Oil Analysis



Author: **Christine Loeb-Stubbins**, European Field Product Manager, Separation Science, LECO Europe

Mineral oil testing remains one of the most technically challenging workflows in food safety laboratories. The complexity of real-world samples and increasing regulatory focus require analytical tools that provide consistent, traceable, and reproducible results. LECO's new stand-alone ChromaTOF[®] for MOSH/MOAH software has been developed to support these needs by offering a harmonised workflow for MOSH/MOAH determination.

A key development in this release is full compatibility with non-LECO LC–GC–FID systems. Through the Import Wizard, laboratories can import CSV and CDF data formats directly into ChromaTOF[®], enabling unified processing and evaluation across different instrument platforms. This supports method consistency and simplifies integration into existing laboratory environments.

MO Quant Tool – Key Functions

- Automated data processing
- Biogenic interference separation
- MOAH hump smoothing
- Transparent and traceable calculations
- Suitable for regulatory-focused reporting

Universal Software Compatibility

- Works with any LC–GC–FID system
- Direct CSV and CDF import
- No manual data conversion steps
- Enables harmonised workflows across instruments

The software incorporates the MO Quant Tool, which automates several processing steps within the MOSH/MOAH workflow, including baseline handling and fraction assignment. Automated calculations and fraction definition help reduce operator variability and support consistent reporting in routine environments.

To support method control and quantification, the software works alongside the MO Mix Certified Reference Standard, designed to provide clear structural separation of relevant compound classes such as mono-, di-, and poly-ring fractions. This facilitates reliable identification and quantification across different sample types.

For laboratories conducting migration studies, contamination assessments, or supplier quality evaluations, a centralised processing environment supports efficient data handling and reproducible results. Standardised evaluation criteria across instruments and users can help streamline internal quality control and external reporting.

Dr. Mattis Hartwig co-founded singularIT GmbH, a software company based in Leipzig and Lübeck, with Felix Hammann while studying business informatics. To gain international and strategic experience, he worked for 4.5 years at a major strategy consultancy. After completing his doctorate in artificial intelligence at the University of Lübeck, he rejoined singularIT. Today, in addition to his role as Managing Director, he is also a Senior Researcher at the German Research Center for Artificial Intelligence (DFKI).

With a young team of over 60 employees, the successful company singularIT has completed more than 400 projects since 2016 in the areas of data science and AI, web, cloud, and app development, as well as UX/UI design. singularIT leverages partnerships with universities to stay at the forefront of the dynamic field of data science and AI. By merging academia and industry, the rapidly growing company is achieving groundbreaking progress. Dr. Mattis Hartwig was one of the speakers at the NEWTRITION X conference, which was organized by foodRegio in Lübeck on November 11th.

How did you come up with the idea to found singularIT, what was the background?

We want to make processes more efficient using digital technologies. That's the main focus. Letters used to be transported by horse, which meant only a few could be delivered. Today, email is orders of magnitude faster. These kinds of efficiency gains are everywhere. As a service provider specializing in areas such as data science and AI, we actively seek out these efficiency opportunities and realize them together with our clients.

You are positioned horizontally, meaning across industries. What applications can you envision for the food industry?

The food sector has many cross-cutting themes; purchasing, for example, doesn't function fundamentally differently than in other industries. We therefore address similar use cases across different sectors. Two concrete examples are the analysis of market data, such as product ingredients, for sales management and the application of image processing in production for quality management. Product development is also

very exciting. The central questions there are: how do I combine ingredients to create new products? How do I replace certain ingredients? How do I address trends like "vegan" or "healthy eating," "alternative proteins," etc.?

Ideally, one wants to formulate recipes so that specific characteristics emerge in the final product. These processes contain implicit knowledge that can be automated and made accessible.

AI can only help if it possesses knowledge. How does that knowledge get into the AI, i.e., into your software?

Often, this is achieved through a vast amount of training data. Let's take an example from the chemical industry, where we set up a formulation project: the goal is to elicit specific properties using certain types of solvents. We trained a model based on 1.5 million chemical reactions and then performed further fine-tuning on specific solvents. This significantly reduces the number of reactions. So, we have a model that understands the fundamental properties of chemical reactions

and is then specifically trained on solvent properties. This system is then used to identify new solvent candidates based on the ingredients. The same principle applies to the food industry. If a company already has many formulations, these formulations contain immense knowledge from numerous products, as well as engineering expertise. Among other things, it's known which ingredients work well and what properties result from each ingredient. Based on this knowledge, I can train models, also known as predictive models.

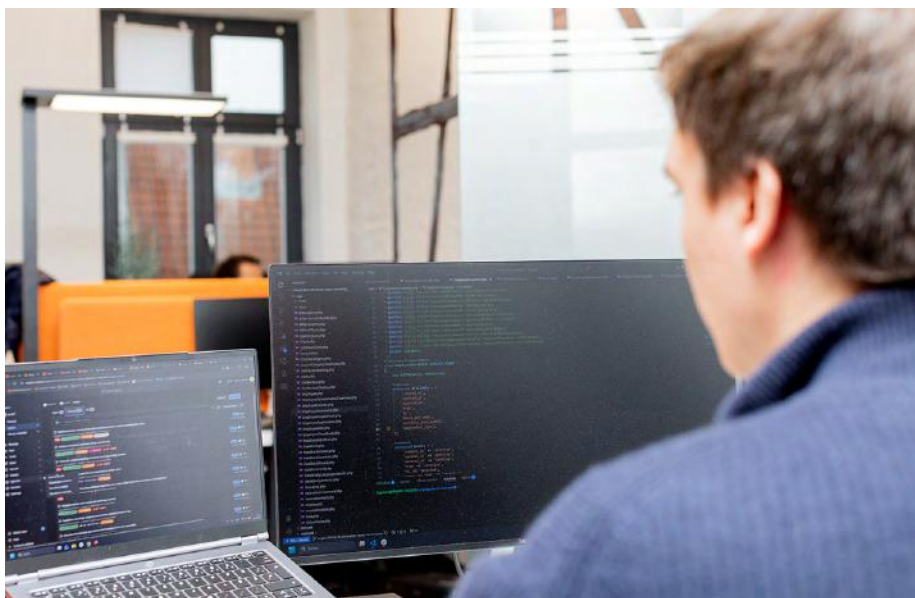
If I work in R&D at a food company, do I need to worry about my job?

No, I believe quite the opposite. Intelligent systems offer far more possibilities for product development. At the NEWTRITION X conference, for example, a distinction was still made between product development and quality management. With suitable predictive models, product development becomes much faster, and the number of product cycles increases rapidly. Without these models, physical testing of new products in the lab takes much longer, and the uncer-

eFOOD-Lab International expert discussion with **Dr. Mattis Hartwig**, singularIT, Lübeck on AI for increasing efficiency in the food industry

Convened by Th. F.-W. Kützemeier





tainty is relatively high. With the help of models, the predictive accuracy regarding desired characteristics increases, and the time required for each individual development phase decreases. This could reduce the number of failed product launches, or at least allow me to identify potential failures much more quickly. As an R&D manager, I would consider this development very positive.

You mentioned the separation between product development and quality earlier during the conference. Ideally, these should be combined. The ultimate goal, of course, is a fully integrated system that manages everything. But that's probably unaffordable.

We are dealing with an archetypal problem. If you have a long-term quality issue with a product, the current approach is to initiate a new product development cycle, which consumes a significant amount of time. In computer science, there are reinforcement learning strategies that use feedback directly to adjust the strategy. Ultimately, the goal is a high-quality product that satisfies consumers. To illustrate this, consider this: why are chess computers so good? Because they play a large number of games and, so to speak, generate new observations and thus new training data "in silico." "In silico" describes a scientific method in which biological or medical processes are studied through computer simulations, rather than on living organisms (in vivo) or outside of them (in vitro). The term derives

from "in silicio" (in silicon), since computer chips are made of silicon. This method is used in fields such as drug development, personalized medicine, and the study of complex systems.

A yogurt tester can't test an infinite number of yogurts. The more feedback I manage to feed back into the process, the faster the cycle becomes.

How do potential customers become aware of you?

It varies greatly. We meet at events, during networking sessions, and sometimes companies simply approach us. The



chemistry project is directly transferable to the food industry, and the same applies to sales processes in the pharmaceutical and/or food sectors. We always strive for interdisciplinary collaboration. After all, we're not food experts; we're computer scientists with in-depth methodological expertise.

Cybersecurity is a key issue. How do you ensure that data storage does not lead to misuse, data theft, or other undesirable consequences?

We always discuss the entire architecture with our clients in accordance with their guidelines and requirements. There are many use cases where clients say, "No problem at all – it's completely non-sensitive data that can safely end up with Microsoft or OpenAI." But of course, there are also use cases involving highly sensitive data. In these cases, we can differentiate by, for example, using American products but data centers in Europe when it comes to data storage location. Many of our clients also have local infrastructure. This provides a good foundation for development. There are now also language models that can be deployed on local machines. It doesn't always have to be ChatGPT. There's a suitable solution for every use case.

Is there a minimum size requirement for companies to use AI applications?

The key question is: what does AI deliver? Every company should consider efficiency issues and not ignore costs. If the corner kiosk wants to use AI-powered forecasting for liquorice sales, the investment is probably not worthwhile, as the development costs will likely never be recouped. The smaller the company and the less critical its processes, the more difficult it is to achieve a return on investment. However, even for small businesses, there can be worthwhile use cases.

Are there actually any guarantees for the functionality of intelligent systems?

For clearly defined tasks with unambiguous input and corresponding output, meaningful, guarantee-like assessments can be made through careful testing and documentation. The more unspecific the task, the more difficult a clear formalization becomes. If a chatbot is asked whether the yogurt now tastes better,

this is quite unspecific, and a single correct answer cannot be formalized.

Is there an in silico system capable of digitally recognizing and processing, for example, tastes and smells?

The question of which originally biological capabilities can be replicated by a computer system and corresponding sensors is constantly evolving. I wouldn't rule it out. I would be very cautious about claiming that a computer will never be capable of this in the future. Certainly, there are biological sensors that are more sensitive than machine sensors. Even in robotics, we are far from achieving the sensitivity of biological systems, for example, in the sense of touch.

Speaking of interfaces, you will surely be setting up your systems in such a way that they can be seamlessly integrated into an SAP environment?

In computer science, we try to approach problems modularly. We don't build from scratch, but almost always on top of existing structures. I don't know of a system that comprehensively solves everything. Take the idea of sales optimization: I have, for example, an ERP system, and I also have other interesting data sources, or I want to run analyses. Which of my business customers are behaving abnormally, which ones are at risk of leaving? Perhaps my existing systems don't have a perfect solution for this... then you focus on finding a good interface. For a specific problem, we gather data, process it, develop a corresponding predictive model, and then feed this data back into the system. That's the typical approach to optimization within an existing system landscape.

We strive for open development so that clients can continue using the data and systems. I'm not a fan of artificially creating dependencies for companies. We always aim for thorough documentation and open interface development, so our clients can decide at any time to end their collaboration with us in favor of another provider. We don't want to bind anyone with closed architectures but rather convince them through excellent performance. Historically, we've seen that previous providers were significantly more restrictive. This modularity is crucial, and I recommend it to all our clients to ena-

ble continuous improvement. I'm seeing a significant shift in thinking in the software sector. Many modern products now allow interfaces for data import and export. This wasn't the case in the days of proprietary systems, when software was installed directly on the desktop.

What is your unique selling proposition? What sets you apart from the competition?

In complex service setups, this can sometimes be difficult to highlight. One of our unique selling points is clearly the combination of classic software development and extremely strong expertise in AI and data science. There are other companies that specialize in AI, but ultimately, the learning model must be integrated into existing business processes. They may struggle to implement this properly so that it functions reliably on a daily basis and interacts seamlessly with other components. Others may not be as methodologically proficient because AI development is a dynamic process. An extremely important factor is: can I attract good employees? The application and hiring process is a central process for us, and we invest heavily in it. Good software development is challenging, so it's crucial to attract the right people. We actively collaborate with universities and receive several thousand applications for our positions every year.

Why should the food industry hire you?

We are a good partner to support projects end-to-end. We are always interested in exciting challenges and interesting use cases. A strategic perspective is needed to identify which applications to focus on. It's not about just doing anything with AI; it requires a clear objective and a smart, strategically sound approach. We don't stop at consulting, however; we also want to get involved in implementation. Good, customized solutions offer the opportunity to stand out from the competition. That's what we can offer.

Where do you see your company in 10 years? It's about sustainability. I want to work with a company that I can be sure will still be around in a few years and that I can rely on for continued support.

We are very down-to-earth. For us, problem-solving is paramount. Our history shows that for almost 10 years we have been able to attract many competent employees and solve complex problems. We will continue to pursue this in the future. We focus on quality and will grow in the medium term based on our performance. We have now left the start-up phase behind and are very confident.

Thank you.



DON'T BE AFRAID!

What AI and neuroscience are teaching us about the future of product development



Author: **Mario Ubiali**,
Founder and CEO, Thimus

What is happening in the food and beverage space? What are the trends for 2026? What tools can you not survive without?

Fortunately for you, this is not why I am writing this piece.

There's already a long list of prophets and forecasters out there, some of them a lot smarter and more informed than me. However, I feel a lot of these conversations are missing out on a very important point: human behaviour.

The food and beverage industry is built on a very simple principle: repeated consumption. Selling large numbers of products has been the dominating rule of the game: more revenue, more profit.

However, in the process of predicting product success in the market, human behavior has been treated as a black box for over 50 years. What I mean by this assumption is that the vast majority of players in the food and beverage space has observed declarative, purchasing and consumption acts and have implied some sort of generic foresight based on faulty logic.

The fact that this logic is not functioning is clearly proven by the astounding number of failed food products in the market: depending on the source, between 50 and 80% of the total of launched products do fail.

So why did we accept this incredible failure rate?

- ▶ Because there was enough profit to justify and cover the trial-and-error losses.
- ▶ Because successful products were such for years, decades even.
- ▶ Because the intelligence we could get from declarative data was adjusted by massive marketing capabilities in an age of ingenuity.

Look back at those three reasons and ask yourself if any of them is CURRENTLY valid. I believe they are not.

In a singular way, it seems to me that the food and beverage industry has failed to realize that it had to deal with its very own Schrödinger's cat. Much like the famous cat in Schrödinger's hypothesis, human behav-

ior in consumption seems to be one thing when seen from the perspective of ACTS of purchase and one completely different thing when seen from the point of view of MOTIVATION (drivers). Since almost no one is looking at the cat from the perspective of deep motivation, the cat is not where you think it is. Result: you fail. We need to build a unified model to look at that cat from the combined perspective of declarative and implicit.

In the food space, we have long assumed that inside the black box of WHY humans would behave like they do, there would be a set of rational and rather direct explanations. We even assumed that declarative likeability scales and purchase intention expressions could be taken at face value and in good faith (and paid a lot for them). Like with everything else in the domain of economics, shortcomings of this decision-making model did not emerge until the system underwent some serious stress. And that's what we have right now.

The age of inertia is almost over: the golden age of the green revolution, mass produced convenient products, global supply chains and diamond level marketing are showing some serious cracks.

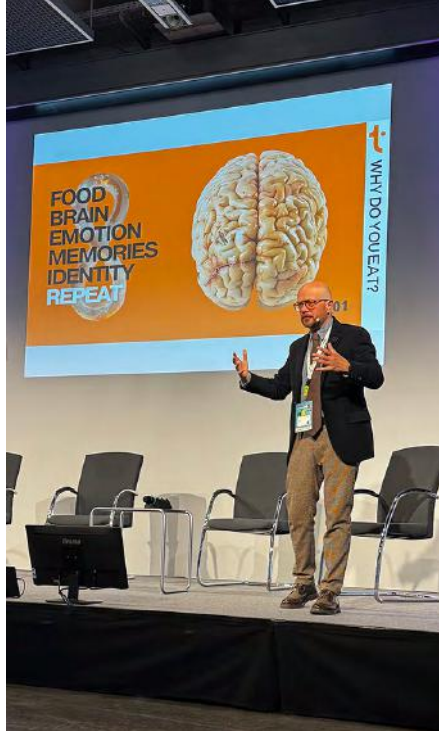
New generations came on the stage of society and showed unpredictable behaviour, changing patterns in consumption, a very different brand of consumerism. The digital revolution accelerated and complicated the picture. International conflicts and pandemics altered supply chains, whilst the climate crisis posed an overarching, catastrophic layer to the entire perspective.

The result is that food and beverage companies are waking up, some while being slapped in the face, to a completely new challenge: understanding and forecasting human behaviour with food, fast.

Essentially, you need to understand the "why" if you want to shape the "what" and the "how". Or, in very cynical terms, you could say that there's no way you can be successful with your products unless you have full control of what is making humans buy them. Also, you have to be able to do it quickly, with great amounts of intelligence being built on digital data.

Can you obtain digital data on meaningful emotional and cognitive processes presiding over decisions and habits?

We are facing a big challenge in understanding and predicting human behaviour with food, but we are also very lucky because we have now two instruments we did not have before: AI and neuroscience. Let's see how they enter the picture.



The beauty of the bio-digital age

The present age in history is characterized by the ubiquitous domain of digital technology and the prominence of the digital dimension. This is in fact such a deep element in today's world, that we are effectively facing a very deep mutation not just in the landscape of what reality is becoming, but also of how the human brain is rewiring to adapt to this new scenario.

The imminent domination of AI, altogether a fact to be reckoned with, suggests a level of computational power with no precedence.

At the same time, a singular thing is also happening: one that is less popular in the public debate and certainly much more limited in how it seems to impact humans. This is the rise of disseminated neuroscience. What I mean with this expression is the technological capability of miniaturizing and reducing the cost of high quality electroencephalographic devices. As these devices turn into comfortable, easy

to wear headbands which wirelessly operate with mobile phones, the huge amount of data they can collect about brain activity is finally manageable due to that acquired computational abilities of new chips, which in turn are the product of the exponential growth of AI.

This largely ignored loop is on the verge of becoming one of the most relevant elements in the food and beverage industry globally: as behavior and product development are equally being disrupted, we are acquiring an astounding, unprecedented ability to mobilize technology that allows to collect massive amounts of data on our food interactions, preferences, habits and memories.

This is what I have decided to call the rise of "the bio-digital age", because it merges very advanced technologies, computational power, massive amounts of neurophysiological and biometric data, new discoveries on human interaction with food.

Whilst a threat is born and disruption is triumphing, the very solution to govern this apparent chaos is given.

The solution consists of an ability to mobilize and rapidly dig into the deeper layers of human decision making on food, understanding elements driving preference and ultimately unlocking the emotional element of food experiences that can (finally) be converted into clear instructions for new product development.

Much like Rosetta's stone, being able to read brain implicit data on human food interactions is laying in front of us an almost magical decoding tool: the black box is finally opened and thanks to AI it can be really put into full light.

This means that adoption of the combined powers of AI and brain data will most likely follow some logical steps:

► **Phase 1:** early adopters develop and train simple models. New product development





and reformulation processes are put under scrutiny and slowly changed.

► **Phase 2:** large amounts of implicit (brain) data on human preference and food emotion are made available. AI is trained to see layers of correlation to product development variables and a completely new efficiency is reached.

► **Phase 3:** democratisation and dissemination of self-testing becomes a standard human practice to connect emotion and habit with health, so that solutions and products become steadily more and more personalised and targeted.

Waste of time, natural resources, energy and money is reduced as a result of this general evolution and this is ultimately one of the most impactful revolutions that might take place in the food industry.

Keeping human emotion and deeper meaning of food in the equation will result in an industry that is a lot more sensitive to cultural and emotional relevance of products, counterbalancing nefarious side effects of a monolithic drive towards convenience.

Products will also be designed to enhance the emotional and social impact of cooking them or socialising their consumption.

This is what we wish to see happening. But will it? Maybe, in another article I might have an opportunity to argue that we need to be extremely vigilant as in any other AI application. Maybe, I will have one day the opportunity to also invite you to reflect on how political and socially relevant the issue of food independence and culture are becoming, to the point that I argue they are going to be the main form of political expression in humans very soon.

But not today, as this is a piece that needs to focus on what AI and neuroscience can do for the food industry.

Good news for small and medium size companies

The conclusion to this short journey is that the rise of AI and disseminated neuroscience can have an extremely positive and transformative impact on small and medium size companies in the F&B space.

Open access to refined tools at a very competitive cost can completely reshape the business landscape for SMEs in Europe and elsewhere. In my line of business, I am detecting a massive shift. Whilst the challenges posed to the food industry are quite similar regardless of business size, this is an historic phase in which the solutions that might sound high level and expensive are in fact available to everyone.

Think of the age in which computers became cheap: this was a tremendous benefit for small and medium sized businesses, even more than for large companies.

It is in my opinion clear that democratic access to AI and neuroscience is equipping SMEs in food with a very sharp tool: will they be able to use it to carve out quick and effective solutions for the changing market?

I am prepared to say that this might actually be the golden age of those SMEs: they have shorter decision-making chains, they are nimble and capable of adaptation.

They might lack internal structures, articulated R&D and product dev capabilities, or simply tend to be a little conservative on a few issues. However, when faced with strong challenges, they are wired to react and decide in an agile manner: AI and neuroscience can be their vehicle for success, the open road to being more effective in the market.

With sensory neuroscience, NPD is already becoming 3 times shorter than average. Neuroscience allows to objectify human preferences, overcoming the shortcomings of tradi-



tional surveys. This objective data is collected in one second intervals: product development is surgical and effective, as it can isolate formulation variables that need optimizing.

Add the AI layer and you have as a result a slow but steady development of foresight capabilities. Input your own data on machinery, stock, supply chain, costing, compliance, nutrition... and you have a very customized, learning system that will make the old way of making products quite ridiculously inaccurate.

Finally, I do not believe such changes are just desirable: they are necessary and urgent. For the planet, for the financial viability of food companies, for the sake of a new way of looking at the needs and cultural, emotional identities of humans.

Like with everything else, the direction we will take shall depend on our choices, as individuals and professionals, in making food for humans and for the planet. We need to be brave enough to listen to the sound of change and act accordingly.



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FOOD-Lab International
expert discussion with
Jochen Brügggen,
Managing Partner of H&J
Brügggen KG, Lübeck,
on the importance of AI

Discussion conducted by Th. F. W. Kützemeier

Mr. Brügggen, would you like to briefly discuss the history of the Brügggen company?

Yes, with pleasure. Our company was founded just over 150 years ago by my great-grandfather, and we now run it in the fourth generation, together with a brother and a cousin. We are a leading manufacturer of breakfast cereals and other breakfast products such as muesli, oatmeal, and muesli bars. As a private label supplier, we also serve the European food retail sector and customers worldwide. In addition, we operate a B2B

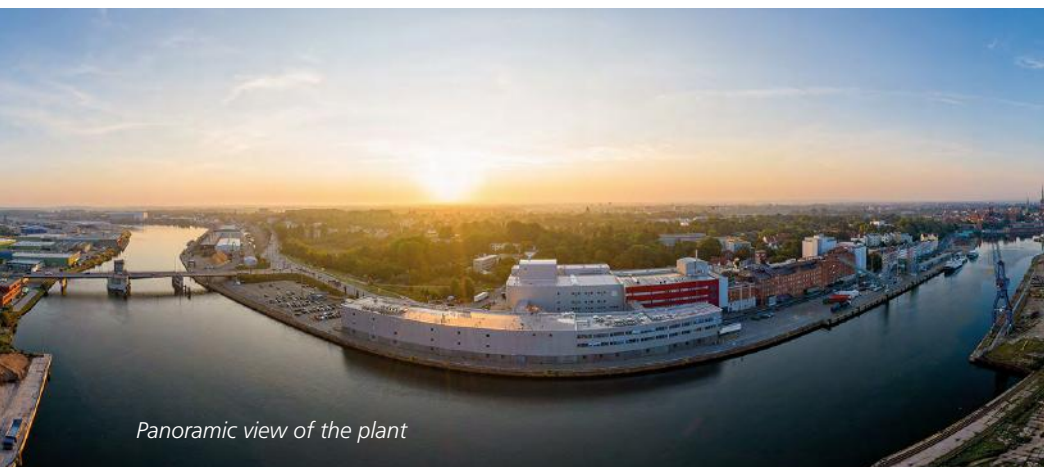
business, supplying processors. We have a joint venture with the Frischli dairy to produce and market an oat drink. This is a plant-based alternative that many consumers prefer for reasons of animal welfare and taste.

Let's talk about the central topic of the AI conference NewtritionX, organized by foodR-regio in Lübeck on October 11th and 12th, 2025. You are the chairman of this regional network and a driving force behind this topic. How do you use artificial

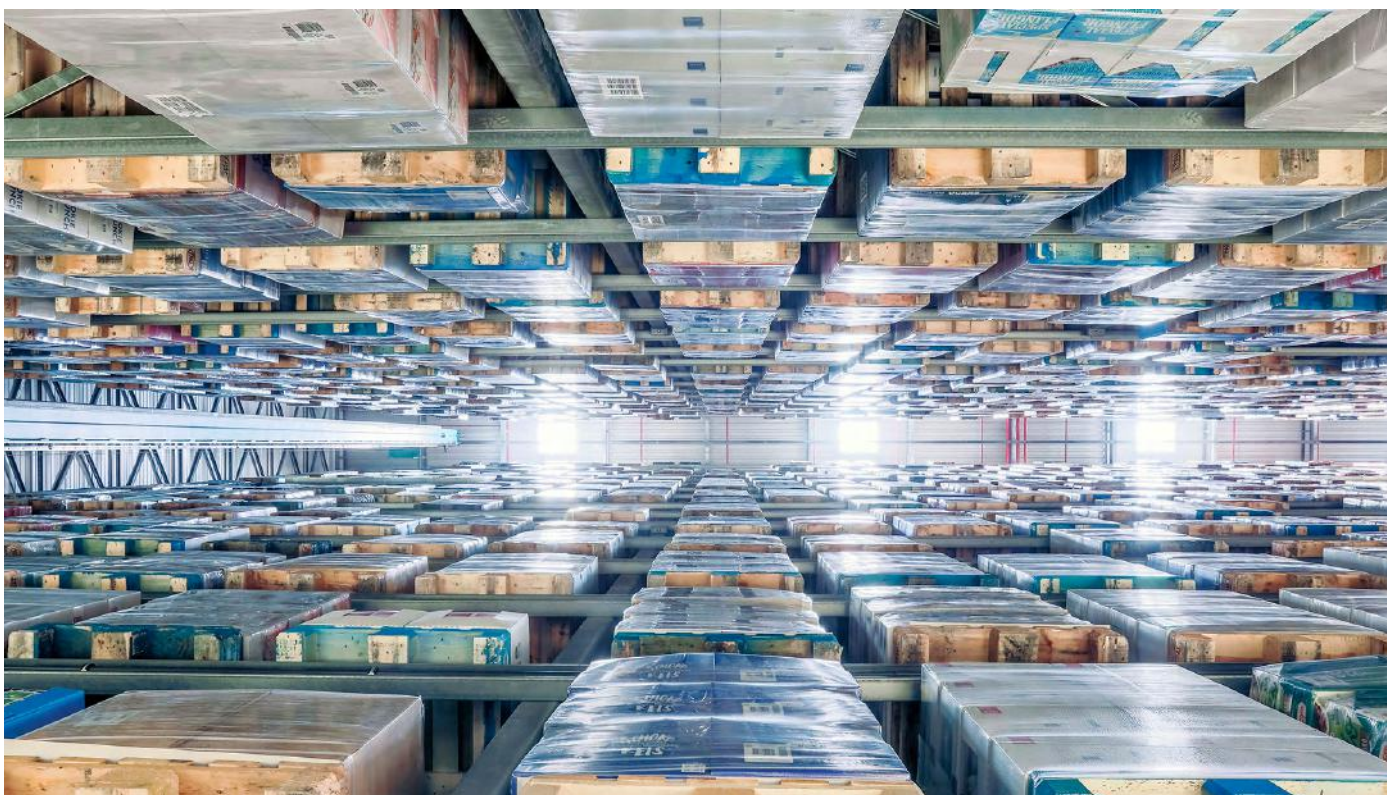
intelligence in your company, and what is your assessment of it?

Like most other companies, we're on a journey here. AI is a tool, not the "one and only solution." However, AI can help us make better decisions, and I try to make it clear to my employees that it's not meant to make their jobs obsolete, but rather to help ease tedious routine tasks. In that sense, we do see AI as a strategic building block for our company's transformation. There are many different applications. For example, in production and engineering, we've digitized numerous instructions for retooling, format adjustments, and cleaning, so our employees can find the specific instructions directly on their screens or tablets using an AI-supported assistance system.

These are all tools we want to further develop in the areas of technology and repairs, including addressing questions like which ball bearing belongs in which packaging machine. These AI applications make life easier for our employees. All quality management documents, as well as all recipes, can also be digitally processed using AI. This also simplifies the work of the sales team, who, if needed, can access a specific recipe directly from the cloud during a customer meet-



Panoramic view of the plant



high-bay warehouse

ing and develop and simulate suggestions for customer-specific adjustments. We also expect this to reduce complexity. Duplicate applications will be avoided, and greater clarity will emerge.

Our daily newspapers point out that AI cannot and will not replace humans, especially in skilled trades. I understand your point to be the same: a stamp or format change is indeed carried out with the help of specific digital instructions, but still by a human operator; the instructions are stored on the machine's display?

This can be done at the machine or on a tablet. It must be provided in a way that allows employees to use it optimally.

You employ nearly 2,000 people across three plants. In your experience, is there a minimum company size at which AI can be used effectively, or is AI also suitable for smaller companies?

I believe it also makes sense for small businesses. There are already many ready-made solutions on the market that incorporate AI and are helpful and useful for small companies.

Do you have any experience regarding the cost of AI per share of revenue that needs to be invested?

No, I don't think there's a fixed figure. Some companies are pushing ahead with this decisively, while others are more hesitant and cautious, resulting in somewhat lower costs. Ideally, of course, AI should pay for itself as quickly as possible, for example, by allowing employees to save time on routine tasks and thus take on other responsibilities.

Have you gained experience in your plants regarding the extent to which such AI applications enable savings or increased data or operational reliability in quality assurance?

Much can be achieved in quality assurance, and also in planning processes, for example in sales planning and production planning. This often leads to results that are better compared to manually planned processes. However, despite all the advantages, I don't believe that AI will fundamentally change human work.

There seem to be different levels from which one starts. In the military sphere, risks appear to exist,

such as data security or the autonomization of processes.

Of course, it's always crucial for businesses to ensure the security of their own data. For example, we certainly don't want competitors reading our cleaning instructions or even our formulas. There's a wide range of confidential data—think "cybersecurity"—that must remain confidential. Furthermore, we also need human input to perform plausibility checks.

Many companies are concerned about cybersecurity. If the cloud is located in the USA, for example, American authorities or companies could theoretically access it. This could have unpleasant consequences for FDA approval and thus market access, or even lead to competitors spying on your formulas. How do you ensure the security of your company?

It's quite clear that we work with clouds located in Europe. We also have internal IT security measures in place to guarantee that we don't use our own data to train the AI. We have our own solutions for this. Of course, this requires extensive training for our employees to raise awareness of the risks involved.

Did you gain any insight into how other companies handle the issue of security during the foodR-regio NewtritionX?

My impression was mixed. Some companies are already very advanced and doing exciting things. Others, however, are only just starting out and perhaps come to such events to find inspiration. Even at our company, AI wasn't implemented consistently across all departments from the beginning. It's an evolving process.

Your conference was attended by many young business representatives, but also many young academics. How do you explain that?

Companies no longer "send" their employees as they often did in the past; instead, the initiative usually comes from the young people themselves. Furthermore, we've focused on product development and quality management, where the proportion of women is certainly higher. In Lübeck, we also have a good exchange between universities and businesses. This knowledge transfer is very important. foodRegio is a food cluster, and we use it, among other things, for networking.

Webinars are indeed becoming increasingly popular. I've noticed

that providers of other in-person events are having to cancel more frequently due to a lack of participants. Therefore, it must be said that your in-person event on October 12th, with over 120 participants, was exceptionally successful and of a high technical standard, also considering the participation of decision-makers from other German states and even other countries.

Thank you very much! We would like to continue this proven concept. To be perfectly honest, video conferences are certainly helpful and save on travel costs. However, they don't replace personal contact and don't offer the same level of networking opportunities. There's a real need to exchange ideas "off the record," to get to know new people, and to address specific topics. Therefore, I feel we offer genuine added value here. It's also important to remember that our cluster was founded exclusively by companies. This distinguishes us from many other clusters. We share many common interests. In northern Germany, specifically in Schleswig-Holstein, there's a strong food industry. Many processes are comparable: we grind, dry, bake, roast, cool, chop, or bind together... they're always similar processes; we go to the same customers, so we also have similar

goals in logistics, and we need the same employees with similar qualifications. Not every company needs individual solutions here; things can be bundled and simplified. Furthermore, we are generally not in a competitive environment within the network.

What are your thoughts on the future prospects for AI?

Next year, in 2026, our cluster will celebrate its 20th anniversary. To mark this occasion, we will certainly offer events again next year, including an AI Day. This year, we focused on product development and quality assurance. However, there are many other areas of interest to companies, such as predictive maintenance, which offers foodRegio member companies a wide range of AI applications.

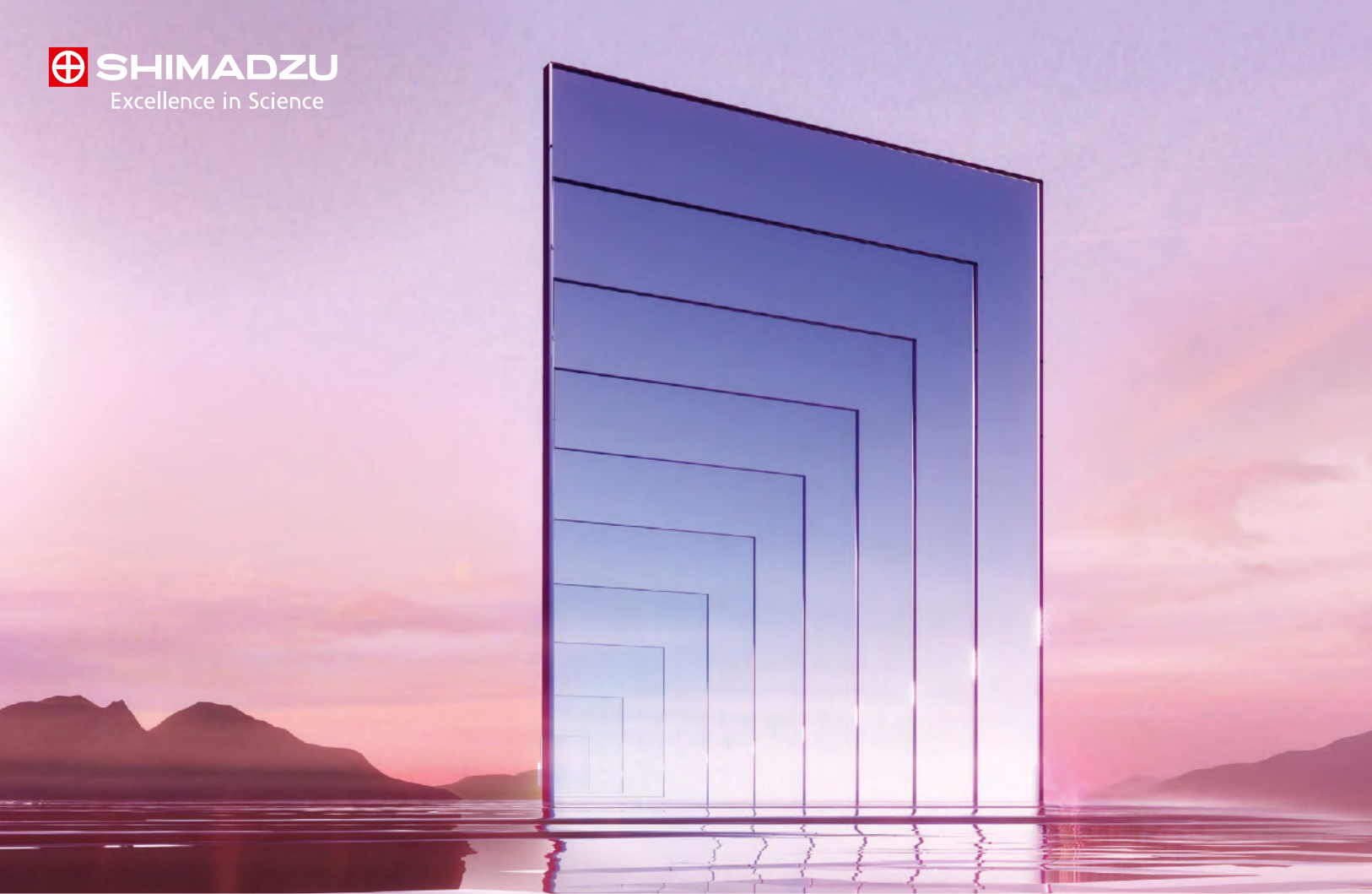
Indeed, there are already many remote work solutions available today. Do you have any experience with these?

This is primarily managed through the plant control systems. Predicting malfunctions before they even occur is crucial. This is essential for further increasing efficiency and planning reliability in our plants.

Thank you!



Muesli line



Where limits end, forever begins

The LCMS-8065XE pushes the boundaries of mass spectrometry. Thanks to its evolved StreamFocus ion source and advanced IonFocus technology, it delivers higher sensitivity while significantly reducing gas consumption – for improved performance and greater sustainability. Designed for laboratories that think beyond limits.

Evolved

Embrace the power of StreamFocus ionization

Efficient

Exceptional throughput, outstanding ROI

Exact

Exceptional accuracy and enhanced sensitivity

