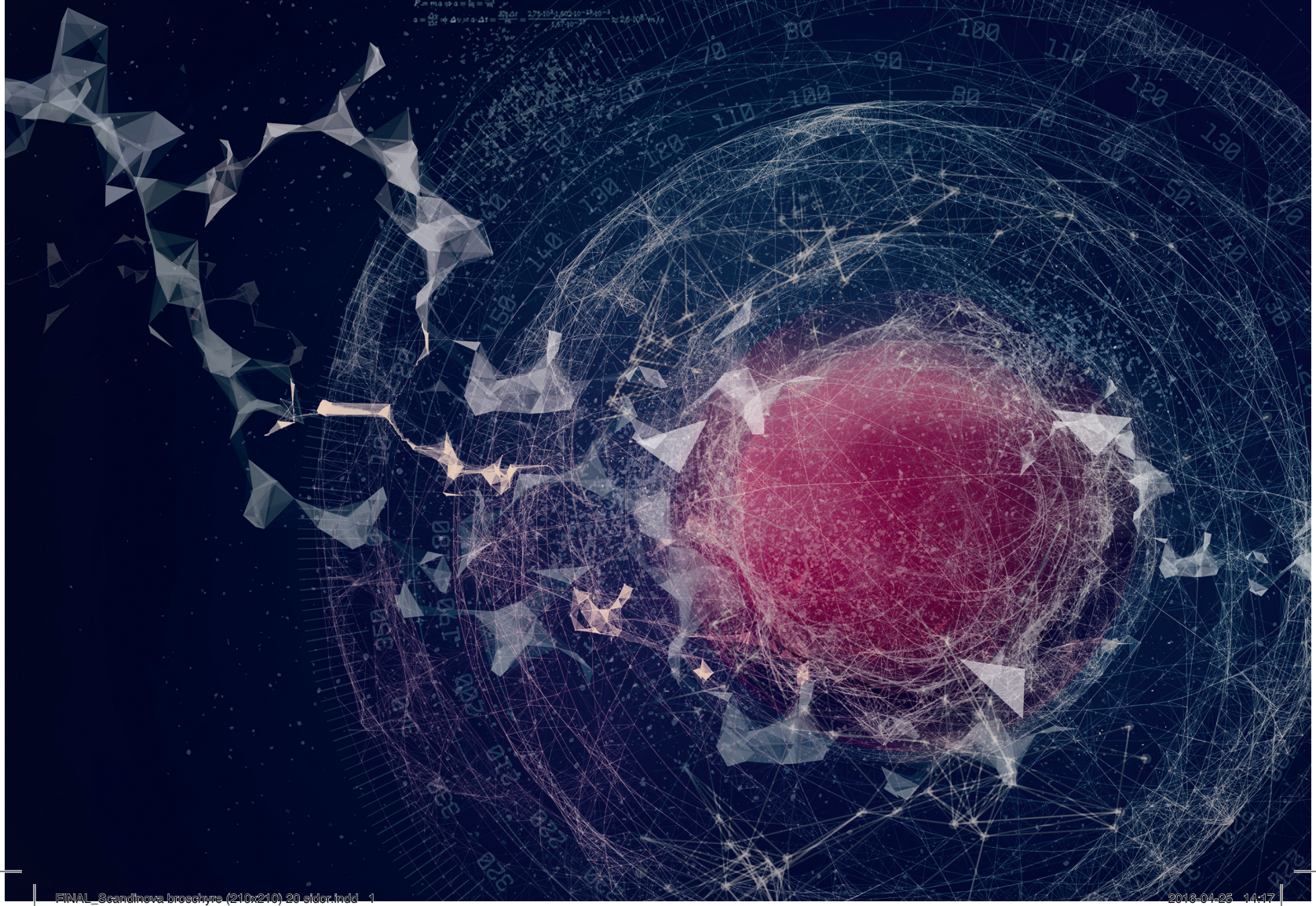
ScandiNova EXCELLENCE IN PULSED POWER

THE POWER AND PRECISION OF THE PERFECT PULSE



ScandiNova EXCELLENCE IN PULSED POWER

"The performance of the ScandiNova solid-state modulators comply with the high-power demands of the particle physics user community and provide excellent pulse to pulse stability, flatness and repeatability"

Gerard McMonagle
Engineer, CERN, Geneva, Switzerland

A founder with a vision

OUR STORY BEGINS

During the 1980s and 90s, Mikael Lindholm worked as project manager at a manufacturer of accelerator systems. The many drawbacks of that era's thyratron-based technology did not escape him. If Mikael could find a solid-state alternative, he would be well on the way to significantly enhancing the applications work of end-users around the world. But how could he overcome the challenge of handling voltage levels in excess of 100,000 V while still protecting the solid-state switches?

Via mutual friend David Woodburn, Mikael was introduced to the American inventor Walter Crewson. Walter had just come up with a new idea that enabled solid-state switches to handle high voltage levels by using a special transformer with a split core and letting the switches connect in parallel. Mikael realized that this was the answer to his dilemma.

GENERATING THE PERFECT PULSE

Soon this new breakthrough technology, not surprisingly called Split Core™, was replacing the old thyratron-based systems in the company's accelerators. In their place, high-voltage pulse generators (so-called modulators) were quickly delivering the major improvements that Mikael had envisaged; better performance and greater reliability – plus a perfectly generated pulse.

In 2001, Mikael, David and Walter formed a new company that was destined to take this breakthrough to even greater innovative heights – ScandiNova was born!

ScandiNova today

WORLD LEADER IN PULSED POWER SYSTEMS

From our headquarters in Uppsala, Sweden, we supply solid-state pulsed power modulators to almost every major particle research facility in the world. The order for our klystron modulator placed by Germany's DESY accelerator research institute for the European X-Ray Laser Project XFEL was the 400th received for our solid-state systems!

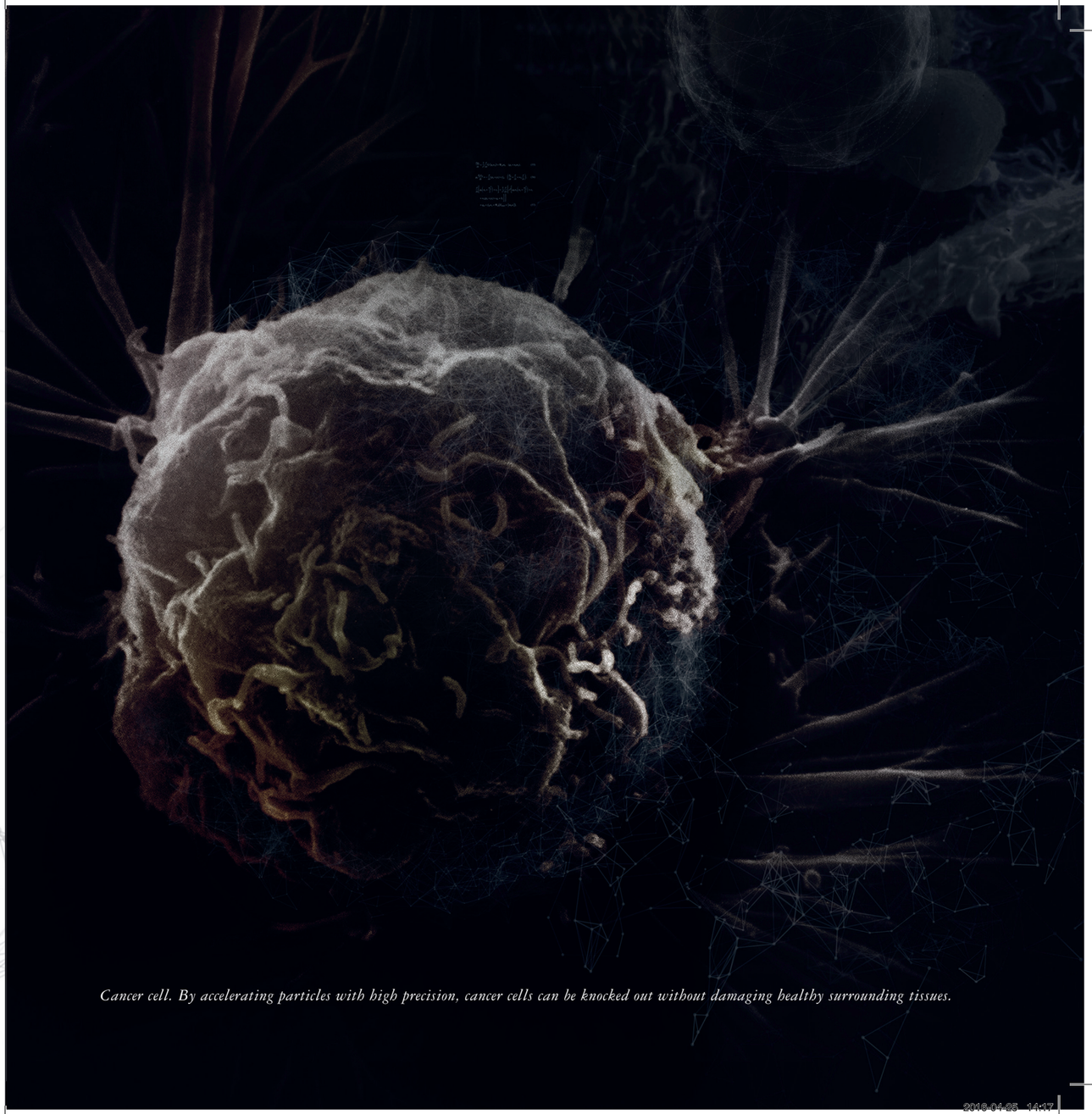
What's more, our pulse modulators are finding increasing success in other equally-challenging fields, including high-precision cancer therapy, cargo scanning and pulsed electric field food processing. We export our products to clients in more than 30 countries all over the world.

REACHING NEW HEIGHTS

Through close collaboration with many end-users – all experts in their particular fields – a better understanding of the critical requirements of solid-state modulators has been acquired.

Our vision is to create innovative yet reliable solid-state solutions and use the benefits of optimized, high-quality pulsed power to further improve product performance in particle research, medical technology and selected industrial sectors.

Our cutting-edge products and qualified support will enable end-users the world over to reach new heights – above and beyond their expectations.



Cancer cell. By accelerating particles with high precision, cancer cells can be knocked out without damaging healthy surrounding tissues.

A whole world of applications

THE PERFECT PULSE KNOWS NO BOUNDARIES

Pulsed power is a cornerstone of nuclear research, life-saving medical technologies and many essential industrial processes. Yet for many years, particle researchers, radiation therapists and industry scientists struggled to gain control of the pulse. Generating the exact shape, amplitude and length essential for precise results – and to achieve this time after time without variation – was no easy task. This lack of precision and reliability, plus high levels of maintenance, hampered their endeavors.

ScandiNova's Split Core™ technology led to a new era of pulse precision marked by exact shape, amplitude and length – the perfect pulse. Furthermore, levels of reliability scaled new heights. The very first pulse modulator ever built and delivered to Japan for advanced radiotherapy ran for almost 15 years without any service or maintenance. Not a single part was replaced!

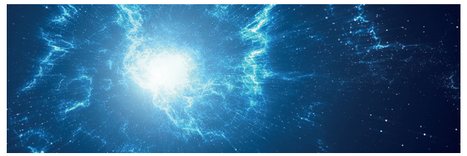
NEW OPPORTUNITIES EMERGE

ScandiNova had changed the rules of the industry. Armed with its innovative new technology, scientists were quickly at work, pushing back research frontiers and generating industrial gains. New opportunities were identified and pursued in earnest.

Our product range today spans large klystron radio frequency (RF) systems for big science installations to smaller magnetron-based systems for cancer treatment as well as electron guns and pulse generators for treating foodstuff.

Leading light in particle physics

SCIENCE DOESN'T GET ANY BIGGER



Our solid-state pulse generators power the world's most powerful particle accelerators. We are there when the big discoveries are made. In the Compact Linear Collider (CLIC) study at CERN for example.

As well as CERN and the DESY institute, organizations who have put their trust in ScandiNova include the European Light Infrastructure Nuclear Physics (ELI-NP) Gamma Source, Swiss-FEL at PSI and the MAX IV electron accelerator laboratory (home of the brightest X-ray source in the world). In North America, MIT, Lawrence Livermore, Brookhaven NL and CLS are committed users, while in Asia, PAL, Jiao Tong and Tsinghua University have all adopted the new technology. The Australian Synchrotron Project was also an early adopter.

EXPANDING HUMAN KNOWLEDGE AND HORIZONS

The sharp, controllable pulses we generate are destined to play pivotal roles in some of the biggest and most spectacular experiments ever planned – dramatically improving our understanding of the universe, for example – as well as making real progress in materials science and pharmaceutical development. Our big science heritage continues to open up new horizons every day.

"Without the ScandiNova modulators' quality it would be difficult to reach this admirable stability and reliability of our Linac electron beam."

Dionis Kumbaro
Research Engineer, MAX IV

ScandiNova's pulse modulators comprise a vital part of radiotherapy systems for treating cancer. We are closely involved in the development of next-generation treatment systems.

At the sharp end of medtech

CUTTING-EDGE PARTICLE THERAPY

Particle therapy has become a true work-horse within cancer treatment and the pulses we generate are now being adopted in high-precision systems, especially new-generation electron and proton-beam instruments. Compact pulse modulator design plus advanced control and high uptime continue to provide new possibilities for providers of particle therapy systems.

We will not defeat cancer overnight, but the quality improvements our controllable pulses can bring ensure that we make distinct therapeutic progress every day. For example, Elekta, a pioneer of clinical solutions for treating cancer and brain disorders, has selected ScandiNova to supply pulse modulators for its ATLANTIC project that combines magnetic resonance imaging and radiotherapy.

"The unique solid-state pulse technology provided by ScandiNova is an important part of our game-changing LIGHT systems, which will take cancer treatment to a new level"

Sanjeev Pandya, Executive Vice President, Advanced Oncotherapy, London, UK

Industry's recipe for success

PRODUCTIVITY ALWAYS MATTERS

Whatever branch of industry we talk about, process productivity always matters. That suits ScandiNova. High reliability, safety and power efficiency, combined with low maintenance, have made us a preferred supplier of robust pulsed-power solutions. Our stable, easy-to-use modulators bring new levels of reliability to applications such as electron beam sterilization, non-destructive testing and cargo scanning. In the latter case, the high precision of our pulses has achieved significant improvements by creating sharper images that display far greater detail.

PULSED ELECTRIC FIELD PROCESSING

In the food industry, our solid-state modulators optimized for pulsed electric field (PEF) processing appeal to all tastes. Outstandingly reliable, PEF processing is now regarded as a viable future alternative to traditional thermal processing. Producers benefit from low running and maintenance costs plus welcome energy savings. What is more, our compact pulse modulators require very little space. For consumers, the benefits are even more tangible – high-quality food that looks good and tastes great.

Above and beyond expectations

FROM THE MICROCOSM OF THE HUMAN BRAIN TO THE VAST EXPANSE OF SPACE

Pulsed power is a universal element in many of mankind's greatest endeavors – from solving the fundamental mysteries of our existence to saving an individual life. Precise pulsed power will help achieve significant gains in many of these vital fields.

This is ScandiNova's key strength. Our unique technology breakthroughs have changed the rules of the industry, creating extremely precise and stable pulses. And we will continue to set the highest standards and exceed the highest expectations.

For example, in close collaboration with the Paul Scherrer Institute (PSI) in Switzerland, which operates nine ScandiNova modulators, we have achieved a pulse-to-pulse current stability of 13 ppm (0.0013%) RMS.

As a result, PSI ordered an additional thirteen of our solid-state modulators adapted to 50 MW C-band klystrons for its new X-ray free-electron laser facility SwissFEL. By generating intense, rapid pulses of X-ray light far more brilliant than even the most advanced synchrotron light sources, SwissFEL promises to provide unprecedented insights into phenomena as fast as the vibrations of molecular bonds and structures as small as an atom.

Worldwide partnerships and deliveries

CLIENTS AND COLLEAGUES ALIKE

Our reference list is extensive, encompassing the many end-users of our solid-state pulsed power modulators as well as collaborative partners who share their skills and expertise with us.

The following list shows some clients and partners, all of which are recognized as leaders in their respective fields.

- AVO (UK, Radiotherapy)
- Elekta (UK, Radiotherapy)
- Lawrence Livermore National Laboratory (US, Science)
- MIT (US, Science)
- Brookhaven National Laboratory (US, Science)
- KAERI (Korea, Science)
- Tsinghua University (China, Science)
- Jiao Tong University (China, Science)
- ELI (Czech Republic, Science)
- CERN (Switzerland, Science)
- PSI (Switzerland, Science)
- MAX IV (Sweden, Science)
- Varian SIP (US, Security and Industrial Imaging)
- Nuctech (China, Security and Inspection)
- Toshiba (Japan, Partner)
- CPI (USA, Partner)
- L3 (US, Partner)

Solid-state technology

IT ALL STARTED WITH THE SPLIT CORE

Generating high-voltage pulses has always been a challenge, especially from a safety point of view. Restrictions on modulator design meant disadvantages, compromises and high levels of maintenance – until ScandiNova changed the rules with an innovative breakthrough built on three technology concepts: Split Core™, Parallel Switching™ and Pulse to Pulse Control™.

SPLIT CORE™ – THE SECRET OF SCANDINOVA

With an idea as simple as it is beautiful, ScandiNova split the core of the pulse transformer, thereby separating the control and high-voltage pulse environments from one another. Primary voltage fell to levels suitable for commercially available switches and, equally importantly, the use of solid-state technology was now possible. This was a huge step forward.

Moreover, as well as increased safety and improved pulse reliability, Split Core™ technology opened up even greater opportunities. ScandiNova's R&D team realized that the perfect pulse was within their grasp – and with it greater control and performance, much reduced electrical power consumption and far lower maintenance costs.

PARALLEL SWITCHING™ – SECURES RELIABILITY

A reliable pulse ensures better results. ScandiNova's Split Core™ technology led to the development of Parallel Switching™, the concept that achieves just that. Reduced voltage levels permit the use of IGBT switches, thereby enabling precise control of pulse on/off. What's more, IGBT switches generate a very clean (no ripple) pulse shape.

Solid-state technology in action

PULSED POWER SOLUTIONS FOR YOUR APPLICATION

Our range of pulsed power solutions comprises RF (radio frequency/microwave) systems and PG (pulse generator) systems. RF systems are further divided into the klystron (K) and magnetron (M) series according to application. The operating foundation of all remains the solid-state pulse modulator technology developed by ScandiNova.

K-SERIES

Klystron-based RF systems. Primarily key components of high-power particle accelerators, their world-leading performance makes K-Series the first choice of leading research institutes everywhere. Several models also find use in particle therapy and industrial applications. We offer everything from a pure high-voltage pulse modulator to a turn-key RF station including klystron, control system and related components.

M-SERIES

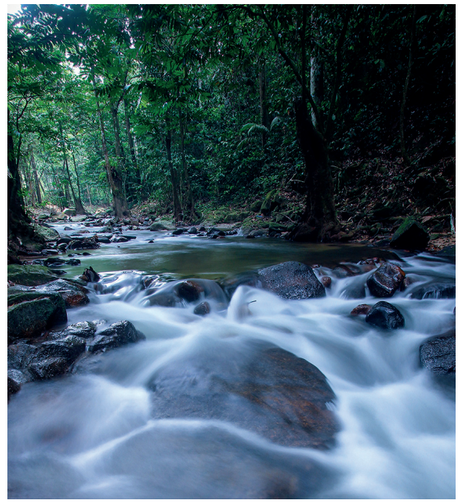
Magnetron-based RF systems. Mainly used in particle therapy and a range of industrial applications. Compactness is a major M-Series attribute. Our systems require about one third of the space of alternative solutions yet still offer around 30% higher efficiency, two operating advantages that especially appeal to cancer treatment providers. Their high reliability and performance also attract many end-users. Once again, we provide everything from a pure high-voltage pulse modulator to a turn-key RF station including magnetron, control system and related components.

PG-SERIES

Pulse generator systems. Applications include Pulsed Electric Field (PEF) generation in food processing. We offer modulator, control and cooling systems.

Hallmarks of our business

GLOBAL SUSTAINABILITY AND RESPONSIBILITY



ScandiNova's business operations benefit clients, employees and the world around us. Stable working conditions formed a key part of our initial concept and remain so today. Split Core™ technology continues to minimize the risks for personal and collateral damage and reduces the risk of fire. The modulator itself has built-in protection against arcs in the load, a unique feature that puts safety first.

Our solid-state products also reduce the environmental impact of pulse generation. Much improved efficiency minimizes the power required; end-users often experience at least a 30% reduction in direct energy consumption over modulator lifetime. The need for cooling water and air conditioning is also reduced. Hazardous materials are eliminated and day-to-day operations require no consumables. In addition, the space-saving design of our modulators simplifies integration and construction.

CERTIFIED AND COMPLIANT

ScandiNova is certified to ISO 14001, the framework for a holistic and strategic approach to an organization's environmental policy. We believe that currently, we are the only environmentally-certified pulse-generator supplier in the industry. In addition, we are certified according to the quality and management standard ISO 9001.

Furthermore, we comply with the Swedish Inspectorate of Strategic Products regarding the control of defense materials and dual-use products.

The vision comes true

RELIABLE, HIGH-PRECISION PULSED POWER AVAILABLE AND COST-EFFECTIVE EVERYWHERE

Founded in 2001 as a spin-off from accelerator manufacturer Scanditronix, ScandiNova was staffed from the very outset by individuals with extensive commercial and technical experience in pulsed power applications – plus a vision to greatly improve product performance.

The company quickly established a dominant position in high-precision pulsed power systems. Its product range grew to encompass radio frequency systems, pulse generators and electron guns – all based on solid-state technology. Collaboration with industry-leading partners bore fruit. A global network of sales and support offices began operations. Industrifonden, Sweden's most experienced venture capital investor, became a part owner in 2003. In 2005, SE-Banken Venture Capital became the second principal owner. Both remain today, ensuring long-term financial stability.

INNOVATION DRIVES US FORWARD

To date, ScandiNova has delivered more than 300 solid-state systems to approximately 70 clients in over 30 countries, mainly in Europe, Asia and North America. This success is only made possible through an innovative business climate.

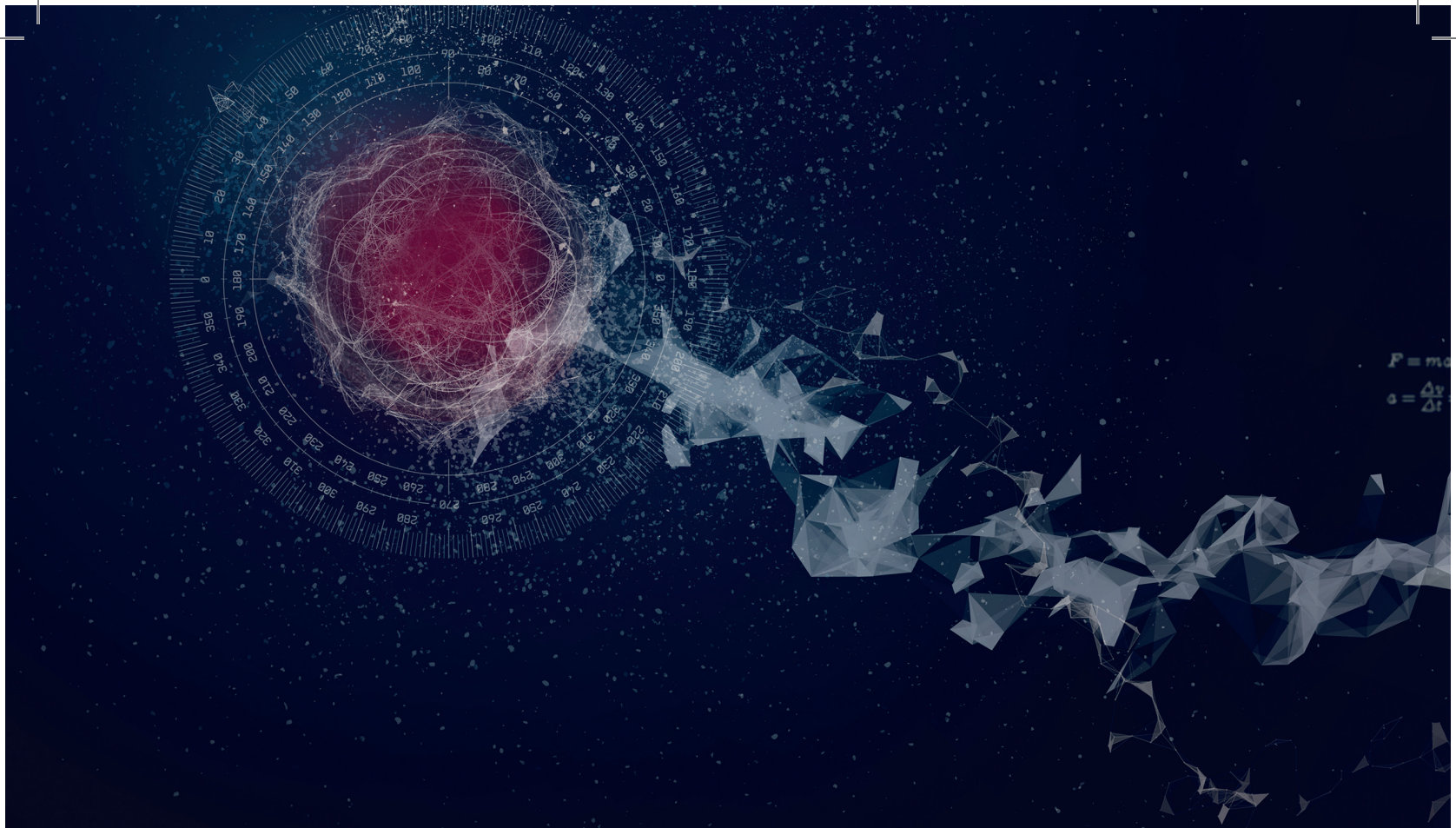
Innovation remains the main reason why we continue to provide world-class products and solutions – taking pulsed power technology to new levels and creating a perfect pulse. But it's not only about ground-breaking product innovations. We constantly challenge ourselves to improve production, testing and support as well.

COLLABORATION RAISES OUR STANDARDS

Collaboration is a key ScandiNova value. Our clients and partners are a primary source of inspiration and a prerequisite for our innovative culture. In-depth knowledge of their needs and market conditions both sets and raises the standards for our business development.

We always involve end-users in our product development, listening to their needs and acting accordingly. Our collaborative partners, a true source of inspiration, include industry-leaders such as CERN in Europe plus the Lawrence Livermore and Brookhaven National Laboratories in the US.

Our mission statement is clear:
To optimize the use of pulsed power
and enable our clients to reach new heights.



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