Interview with Rainer Erdmann,

Co-founder and CEO of PicoQuant

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Can you describe your scientific background?

It goes back more than 36 years. I grew up in East Germany and studied physics at Humboldt University in Berlin. While I was working on my diploma thesis, the reunification happened, which completely changed academic life as well as everything else.

At first, I intended to work after my studies in biomechanics supporting professional athletes. But due to the political changes, I eventually switched to the Academy of Sciences, where I began working on single-photon counting techniques and related fluorescence topics in DNA sequencing, which were still very new at the time. My professor was highly enthusiastic and managed to attract a few students to this topic despite the usual competition between universities and research institutes.

How did you create PicoQuant?

For almost five years, I had to survive under extremely difficult financial conditions out of passion for the subject. I worked without a contract, relying on short-term mini-grants from a non-profit association. Later, I joined a company that aimed to develop time-resolved fluorescence products, but it had barely any sales and eventually couldn't pay salaries for several months. Everything took place on the Adlershof campus, and we collaborated with strong groups in Heidelberg, Göttingen and key PIs in the US (e.g. Joe Lakowicz, Dick Keller, W. E. Moerner – later a Nobel laureate) and gained a lot of experience and knowledge about the needs of these labs but stability was very hard to achieve. However, we believed in our ideas the whole time, and finally I founded our own company together with three former colleagues in August 1996. We wanted to make complex instrumentation more accessible to researchers. That was the beginning of PicoQuant.

What were your objectives and motivations when creating the company?

Our first major R&D contract developing a UV microscopic detection system came in December of that year with the University of Jena. Our very first serial product was a picosecond pulsed compact laser at 670 nm. Within half a year, we were selling these units, which helped immediately many researchers substituting their large dye or TiSa lasers. We had our first profitable fiscal year in 1997. In mid of 1997, we received our first BMBF start-up grant supporting the professional development of a wider spectrum of pulsed diode, including wavelengths around 405nm.

Later, we also developed our own time-correlated single photon counting electronics, which simplified together with the diode laser experiments that previously required large, complex setups. By 1999, we had a complete set of components enabling turnkey experiments. This was the basis to expand our portfolio also to complete fluorescence systems. In 1999 we installed our first time-resolved fluorescence spectrometer at the Université Catholique de Louvain (Leuven, Belgium).

In late 2002, we installed our MicroTime 200 - a single molecule sensitive confocal microscope at the Chinese Academy of Science in Beijing. Around 2005, we began collaborating closely with Stefan Hell, providing customized depletion lasers that contributed to his STED microscopy. That collaboration eventually brought us close to the Nobel Prize story of 2014, where I was even invited to the Nobel ceremony.

How has the company grown over the years?

We started with four people in 1996. Today, we are about 120. On average, we have grown by four employees per year—steady, organic growth, not a sudden expansion. We never relied on external venture capital. Growth has always been financed by our own profits. That makes us very different from startups that expand too fast and then collapse.

How did PicoQuant expand from lasers to photon counting and systems?

We have always described our products as generic tools. Our picosecond lasers can be used in many areas: life sciences, material sciences, quantum, communications, lidar, biomedical imaging, and more. Likewise, our timing electronics became a reference worldwide. A majority of labs doing TCSPC now use our products and almost every synchrotron benefits from our precise timing electronics monitoring 24/7 important beam parameters. Our HydraHarp 400, for example, was the first scientific device that used USB 3.0 for high data throughput. Then we expanded into systems, mainly focused on life sciences and fluorescence applications. Today, the system-related products generate the largest part of PicoQuant´s turnover. But every system includes lasers and timing electronics which allows us a nice vertical integration and to customize our systems to the special needs of the research labs. We have about 30 PhDs, not only working in R& D with many dedicated to application support, sales, customer training, and joint experiments with users. In recent years, we also entered material science, applying our tools to solar cells, LEDs, micro-displays, and other advanced materials.

How did you manage to combine such different areas of expertises ranging from electronics to life science within your team?
From the very beginning, we recruited people with both technical expertise and scientific experience. Many of them had just finished their PhD and wanted to bring their knowledge from academia into industry. Over the years, we built a very multidisciplinary team: physicists, electrical & mechanical engineers, chemists, biologists, and software developers.
It's true that electronics and optics require very different skills, but our culture has always been based on collaboration and listening to customers. That helped us create a coherent company spirit and deliver complete solutions rather than isolated components.

How balanced are your activities between lasers, electronics, and systems?
Since the early 2000s, we have maintained a good balance between the three. I often compare it to a table with three legs: it may not be perfectly flat, but it is stable. Some years lasers perform better, some years systems, some years electronics. This diversification has been the key to our stability.
Geographically, our sales are also balanced: roughly one-third in Europe, one-third in the US, and one-third in Asia. That gives us resilience against changes in funding or politics in any one region.

One specific feature of your company is its annual scientific workshop. Why is this so important?
The workshops are part of PicoQuant's DNA. Already in 1995, before the company existed, we organized the first meeting on single molecules with about 50 participants. Here I want to give big kudos to my long-term friend Prof. Joerg Enderlein, now a professor in Göttingen who had very early the strong vision about the importance of single molecule research in the future. He continuously motivated us and we continued with the workshops because the feedback was so positive.
Today, our annual Single Molecule Workshop is the leading international event in this field and we just celebrated our 30th anniversary with 250 participants last month. It is not a commercial conference but a genuine scientific meeting. For us, it's a way to stay connected to the community, to get inspiration, and to give something back to our users. It is also a place where many of our collaborations and product ideas were born.

Who are your main customers: academia or industry?
About 85% of our applications are academic. We sell to many universities and research institutes worldwide. Some large companies, like Nikon or Zeiss, buy our modules to upgrade their microscopes, but in the end the users • • •

are academic researchers. Industry accounts for less than 15% of our business, often in internal R&D labs. Many of them are major technology companies, but due to confidentiality we cannot disclose names.

Which scientific domains are the most important for PicoQuant today?

Life sciences were central from the beginning, even before the term biophotonics existed. Our first instruments were designed to study fluorescent molecules and biological tissue. Materials science has grown strongly in the last decade with the soar of solar cells, displays and semiconductors. Quantum technologies are also important: our lasers and timing electronics are used for single-photon source characterization, quantum communication, and quantum optics experiments. I would roughly say: 40% life sciences, 40% material science, 15% quantum, and 5% metrology.

How have you dealt with the rise of quantum technologies?

As mentioned PicoQuant is mainly engaged in the field of enabling technologies for the quantum market. Since our lasers and time tagging electronics are not tied to a certain application, it very often only needs small modifications to make these products even more attractive to other user groups. To achieve this, we are in close contact with the community to include their needs into the next generation of our products or in the addition of specialized features for this user group. One very successful example is the development of a dedicated software interface "snAPI" as well as a specialized GUI for our time taggers because the needs as well as the language in this field is different compared with life science applications.

How do you organize the R&D activities?

Before we start an R&D project, we naturally need very good ideas. We draw these ideas from many sources and try to use a good mix of technology push and market pull. The wealth of experience of our employees is particularly helpful in this regard, but the feedback from our users, discussions at conferences and our workshops, and a regular review of specialist literature are also very important. A third source is cooperation projects with leading international and national research institutions. Of course, we cannot implement everything, so we use a software tool in which all ideas are discussed, moderated and evaluated. Our experts then examine particularly risky aspects in preliminary projects to assess their feasibility before the actual development projects begin. We achieve the best results in these projects when the teams are highly interdisciplinary, and we also obtain feedback from key opinion leaders during the prototype phase.

Is Berlin a great city to establish a company in optics and photonics?

Definitely. Berlin is one of the top campuses worldwide, with strong universities and research institutes. It's also a very attractive city for young people, which helps us recruit talented scientists and engineers.

What challenges do you face today?

Tariffs and trade barriers are currently a burden, especially with the US market, which represents one-third of our business. We try to absorb some of the costs ourselves and share the rest with our partners and customers. More generally, forecasting for the future has become difficult in recent years. But we continue to invest in new microscopes, new lasers, and new timing electronics. Life sciences and materials will remain strong; quantum is more uncertain, especially quantum computing, where we have decided not to engage in system-level projects but rather in the enabling technology sector with our laser and time-tagging solution.

Looking back over the last 30 years, what do you consider your greatest achievements?

On a personal level, being part of the Nobel Prize story in 2014, even with a tiny contribution, was very emotional. On a company level, I would say our greatest achievement is having created a stable, independent company that has lasted almost 30 years, supporting science worldwide. I am no longer the main technical expert, but my role is to support our 120 people, give them resources, and make sure PicoQuant will still be here in 20 years. Above all, I am proud that we have stayed true to our long-term vision: remaining independent, fostering our scientific spirit, and supporting the community by making complex instrumentation more accessible for a broader field of researchers.

How do you see the future of photonics?

Photonics will remain a fantastic field to investigate. There are so many opportunities: from quantum technologies to new materials, from advanced displays to medical diagnostics. For young researchers, I can only say: it's a great opportunity to build a career in optics and photonics because light will remain central to solving key challenges in society.

HAMAMATSU
PHOTON IS OUR BUSINESS

PHOTONICS – A KEY ENABLING TECHNOLOGY IN THE QUANTUM WORLD

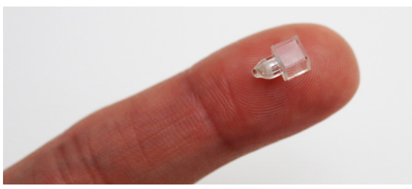
In recent years, quantum technologies have rapidly moved from research labs into industrial applications, supported by increased public funding, venture capital, and patent activity [1].

These technologies harness quantum phenomena like entanglement, tunneling, and superposition to achieve results that surpass classical limitations. Some compelling examples include:

- Quantum computers capable of solving complex problems beyond current supercomputers.
- High-precision time measurement for synchronizing communications.
- Compact sensors that detect minute magnetic fields—replacing room-sized systems.
- Secure communications that resist eavesdropping.

At the core of these innovations is a medium that behaves in a quantized manner. In neutral atom computing, this medium consists of a collection of trapped atoms; in ion computing, it comprises trapped ions; and in certain types of atomic clocks, it is a collection of alkali atoms in vapor phase. Photonics technology plays a crucial role in interacting with and manipulating these delicate quantum media while also exhibiting quantized behavior and acting as a reliable carrier of information for networks of quantum devices. In other instances, such as in photonic quantum computing or quantum communications, individual photons themselves act as the quantized medium. In addition, photons can transfer information over long distances with minimal losses compared to electrons and they are unaffected by electromagnetic fields. Simply put, photonics is foundational to the realization of many quantum technologies.

▼ A small form vapor cell from Hamamatsu



HAMAMATSU PHOTONICS: A TRUSTED PARTNER IN QUANTUM TECHNOLOGIES

Hamamatsu Photonics has long been a trusted partner to the scientific research community, developing some of the most advanced photonic technologies available. Alongside this, the company has deep experience in high-volume production for industrial, medical, and semiconductor applications. This unique combination of precision, scale, and reliability positions Hamamatsu as an ideal photonics partner for quantum technology development.

VAPOR CELL TECHNOLOGY: A FLAGSHIP INNOVATION

One standout contribution is Hamamatsu's vapor cell technology. Known for its expertise in photomultiplier tubes (PMTs), the company has adapted its vacuum technology capabilities to manufacture vapor cells in various shapes and sizes, featuring different coatings and filled with a variety of alkali vapors and buffer gases.

These vapor cells, when integrated with light sources, detectors, optics, and electronics, become the core of quantum sensors. A notable example is Hamamatsu's optically pumped magnetometer (OPM), unveiled at Photonics West 2025 [2]. This compact sensor

▲ OPM detection heads for MEG application

(under 8.5 cm^3) achieves a magnetic field sensitivity of 20 $fT/\sqrt{Hz}$, making it well-suited for biomedical functional imaging [3].

A BROADER QUANTUM PORTFOLIO

Beyond vapor cells, Hamamatsu offers a wide range of products that support quantum research and applications, including:

- Liquid Crystal on Silicon Spatial Light Modulators (LCOS SLMs)[4]
- High-speed, low-noise cameras for qubit readout[5]
- Single-frequency lasers for precise quantum state control[6]

LET'S COLLABORATE

Our engineers welcome one-on-one discussions about quantum innovations and custom solutions. To explore collaboration or learn more, reach out at info@hamamatsu.eu.

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