

Startup Contest Application

International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication

1. Venture Name. XRnanotech

2. Team Leader and Primary Contact Information.

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3. Additional Team Members.

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4. Describe the business opportunity.

X-ray microscopy bridges the current gap between light microscopy and electron microscopy and has a unique potential due to the penetration power and chemical sensitivity of X-rays. Hence, it is crucial for studying small biological samples, nanostructured microchips or modern energy materials. However, focusing X-rays is a real challenge and access to cutting-edge X-ray optics is currently a true bottleneck. In order to make smallest structures like cells, viruses, transistors or nanostructured battery materials visible, high-quality optics with highest resolution are needed. Apart from that, images need a good brightness, which means that optics require the best possible photon efficiency. Moreover, advanced applications at high-power lasers rely on highly radiation-stable optics. Thus, challenges in the fields of resolution, efficiency and stability of optical elements have to be addressed. After years of research and development, we managed to overcome these challenges and we now bring unprecedented technology to the market: Diffractive optics based on cutting-edge nanotechnology.

5. Describe your technological solution.

1) We revolutionize the technical performance of X-ray optics. Our disruptive solution relies on three main selling points, fully addressing the whole latitude of existing customer needs and pain points of the industry (Figure 1), in particular:

- **Unprecedented ultra-high resolution** (5nm) is achieved by a unique line-doubling technique. Using this technique, we broke the world-record in resolution enabling customers to obtain sharpest images from smallest structures.
- **Best image quality** (brightness) is provided by the outstanding performance of our optics, which achieve twice the photon efficiency than state-of-the-art products by nanofabricated blazed structures. This yields high-quality images in short times, enabling measurements at much faster speed than before.

- **Highest radiation stability** enables applications at high intensity laser sources without melting away like conventional products. In contrast to other materials, our diamond-based devices have improved heat dissipation effectively suppressing thermally activated damage processes.

2) Fabrication method: Based on our patented fabrication method, we overcome existing limitations of optical elements. We apply groundbreaking innovations in the field of nanotechnology to establish a novel strategy for production of next-generation X-ray optics with unprecedented performance. By applying a patented patterning process based on electron-beam lithography, we take advantage of the greatly enhanced flexibility regarding the optical design, allowing for enhanced optical performance and novel optical functionalities.

6. Who is your competition and what are your product differentiators?

Direct competitors of XRnanotech are companies offering X-ray optics equipment. This includes several international players, shown in Figure 2. Apart from those, there is some competition from specialized research institutes, able to provide advanced optics solutions. Our competitive landscape analysis has identified a wide range of differentiators across technical features, fabrication methods and business-related aspects, including customer and quality management as well as delivery speed to customers.

7. Describe the Market Opportunity.

XRnanotech's novel solution has tremendous growth opportunities in several markets. With the rapidly increasing global dependence and demand for inspection of micro- and nanostructures, we provide X-ray optics tailored to the needs of highly demanding industries. This includes academic and industrial X-ray applications such as non-destructive inspection for manufacturing and semiconductors industry, medical X-ray, laser and space technology (Figure 3). Here, our beachhead market lies in X-ray microscopy, which had been valued at 1.23 bn \$ in 2016 and is expected to reach 3.31 bn \$ by the end of the forecast period 2027 growing at 9.42% CAGR [medgadget.com, 2019]. In the future, we see applications of our products in wider markets ranging from semiconductor inspection tools via high-intensity laser applications to protein crystallography and X-ray lab sources. This opens up a market potential of around 20 bn \$.

8. Describe the Team.

Our team consists of nine dedicated people coming from six different countries. We combine scientific expertise with business know-how enabling XRnanotech to fulfil its vision of becoming the world-market leader in X-ray optical elements.

9. Describe any traction.

XRnanotech is an award-winning deep-tech company with early market traction. We have broken a world-record, sold products to prestigious customers in eleven different countries and won several start-up prizes and grants. Our traction ranges from the academic sector to the space industry and we managed to grow our company, our revenue and our team continuously.

Figures and Additional Information

Website: <https://www.xrnanotech.com/>

LinkedIn: <https://www.linkedin.com/company/xrnanotech/>

Twitter: <https://twitter.com/xrnanotech>

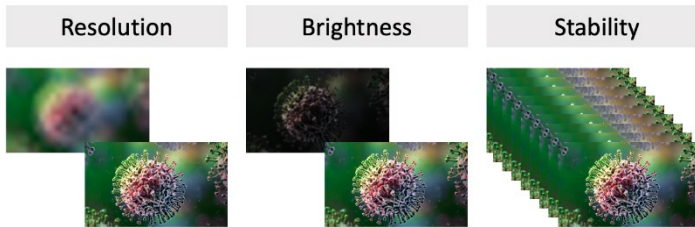


Figure 1: Unique selling points of XRnanotech's optics



Figure 2: Competitive landscape: We offer products with highest resolution and brightness.

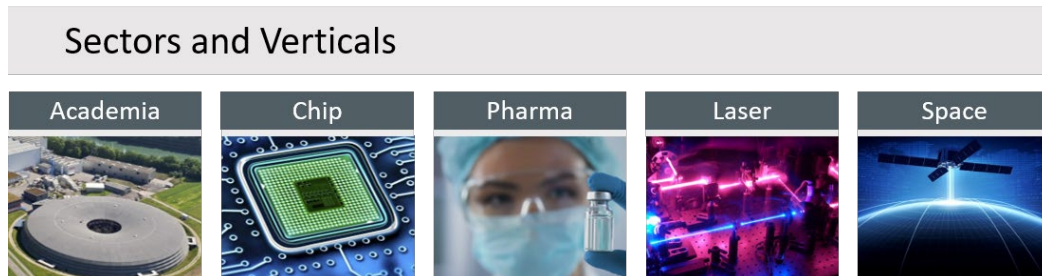


Figure 3: Our different sectors and verticals range from academic applications via diverse industry and medical sectors to space applications.



Figure 4: Awards, recognitions and accomplishments: XRnanotech is an award-winning deep-tech company supported by prestigious organizations.