



Opening words

Dear EBEAM Friends,

The year 2025 marks an important milestone for the EBEAM project. As part of the prestigious ERA Chairs Horizon Europe programme, EBEAM continues to strengthen its role in building cutting-edge research capacity in electron beam-driven precision manufacturing at VSB – Technical University of Ostrava.

One of the key developments this year has been the transition of the EBEAM project to the Nanotechnology Centre (CNT). This move represents a natural step forward, aligning the project more closely with fundamental research in nanotechnology and providing access to a unique portfolio of advanced instrumentation. The new environment not only enhances our technical capabilities but also opens up fresh opportunities for interdisciplinary collaboration and scientific growth.

Throughout the year, the EBEAM team has expanded into a truly international and multidisciplinary group of researchers, combining expertise in electron microscopy, nanomaterials, spectroscopy, data science, and advanced manufacturing. Together, we are working toward a shared vision: pushing the boundaries of nanoscale fabrication with the long-term ambition of achieving atom-by-atom control.



Our activities in 2025 reflect this ambition. From participation in

international conferences and workshops to strong engagement in science communication events such as the European Researchers' Night, the EBEAM team has actively contributed to both scientific excellence and public outreach. At the same time, we continue to build and strengthen collaborations with leading academic institutions and industrial partners across Europe and beyond.

These partnerships are essential. They allow us to connect fundamental research with real-world applications, accelerate innovation, and position EBEAM as a globally relevant research hub in the field of advanced materials and electron beam technologies.

Looking ahead, our priorities remain clear: to further develop our experimental infrastructure, expand our research team, deepen international cooperation, and deliver high-impact scientific results. Equally important is our commitment to supporting young researchers and creating an open, dynamic environment where new ideas can thrive.

We believe that EBEAM is not just a project, but a platform for long-term transformation of research, collaboration, and innovation at VSB-TUO and beyond.

Thank you for being part of this journey.

The EBEAM Team

Hot News! EBEAM project is a part of CNT

Interview

The EBEAM project, part of the prestigious ERA Chairs Horizon Europe programme, brings a unique opportunity for cutting-edge research and international collaboration to VŠB – Technical University of Ostrava. Previously based at the IET, it is now moving to the Nanotechnology Centre (CNT), where it will gain new facilities and prospects. We spoke with **Professor Gražyna Simha Martynková**, head of the CNT, and **Professor Mark H. Rummel**, ERA Chair holder, about the reasons for this move, the significance of the project for the university, and the prospects for the research team.



Can you briefly explain the essence of the EBEAM project within the ERA Chairs Horizon Europe programme?

Prof. Rummeli. The EBEAM project is a strategic initiative under the ERA Chairs Horizon Europe programme aimed at building world-class research capacity in electron beam precision manufacturing. Its essence lies in establishing a leading centre at VSB-TUO focused on nanoscale fabrication using electron beams, initially this is taking place through scanning electron microscopy (SEM), with a long-term

goal of achieving atom-by-atom control through more Advanced electron microscopes in the future.

Beyond the scientific goals, EBEAM is about transforming the institutional environment: strengthening international collaboration, nurturing young researchers, and implementing structural changes in research management. It's a unique opportunity to bring frontier science to a widening country and position VSB-TUO as a competitive, innovative, and globally connected research hub.

What makes the EBEAM project unique in terms of science and research?

Prof. Rummeli. What makes EBEAM truly unique is its focus on developing electron beam-driven fabrication at the nanoscale, with the ambitious goal of eventually reaching atomic precision. We are beginning with advanced SEM-based techniques to control material growth and removal at the nanometre level, this is a challenging and still relatively unexplored area.

The project combines real-time in situ experimentation, cutting-edge microscopy, and theoretical modelling to push the boundaries of what is possible in precision manufacturing. This integrated approach opens up new possibilities for creating next-generation materials and devices with tailored functionalities, which can have wide-ranging applications from energy storage to quantum technologies.

How did VŠB-TUO get involved in this prestigious European project?

Prof. Rümmeli. My connection with VŠB-TUO actually began more than 15 years ago. The then-director of the Nanotechnology Centre introduced me to Professor Grażyna Simha Martynková during a European networking event in Zurich. That initial meeting led to a visit to Ostrava just a few weeks later, and since then, Grażyna and I have maintained a long-standing and productive research collaboration.

Over the years, we discovered a strong alignment in our research interests, particularly in the field of nanomaterials and their synthesis and characterization. When the opportunity to apply for the ERA Chairs programme arose, it was a natural progression of our joint vision to build something much larger: a world-class centre for electron beam precision manufacturing. The trust and collaboration we built over time formed a solid foundation for this ambitious initiative.

Prof. Simha Martynková. EBEAM project has only recently become part of CNT, joining us several weeks ago, but our collaboration with Professor Mark Rümmeli goes back many years. Mark has been a regular invited speaker at our NanoOstrava conference, and we have worked together on topics related to nanocarbons. My colleagues and I have always appreciated his generous support and valuable advice in the areas of carbon materials and microscopic analysis, where Mark is a true expert. Several students from our Nanotechnology study program have also had the opportunity to visit and work in his laboratories in Germany and China.

The EBEAM project is now moving from the IET to the CNT. What was the main reason for this transition?

Prof. Simha Martynková. As the EBEAM project is related to nanotechnology and primarily focuses on fundamental science, it was a logical decision to include EBEAM project within CEET to CNT, where there is a closer connection in science.

How will the facilities and conditions for the research team change?

Prof. Simha Martynková. The Nanotechnology Centre is equipped with a wide range of high-quality instruments, perfectly aligning with the EBEAM project philosophy of working with novel and creative technologies that bring a fresh perspective to conventional science. CNT possesses nearly a dozen different microscopes, offering a unique and complementary combination of analytical capabilities such as CPEM or FIB SEM.

How does the project contribute to strengthening the university's international cooperation?

Prof. Rümmeli. International cooperation is at the core of the EBEAM project. From the beginning, we have leveraged a global network of collaborators, drawing from my own longstanding research relationships across Europe, Asia, and North America. The project actively promotes joint publications, researcher exchanges, and collaborative grant proposals with leading institutions and research centres worldwide.

By positioning VSB-TUO as a hub for nanoscale electron beam manufacturing, EBEAM enhances the university's visibility on the global stage. We're not only attracting international researchers and students, but also fostering partnerships with top universities and industries.

This creates opportunities for long-term, high-impact collaboration that extends well beyond the life of the project.

How does the entire team work together to connect research, practice and international cooperation?

Prof. Rümmeli. Our team operates as a cohesive, interdisciplinary group that blends research excellence with a growing international outlook. We bring together scientists, students, technical experts, and administrators who collaborate closely to advance our scientific goals while building the foundations for long-term partnerships.

While our industrial ties are still in development, we are actively working to align our research with practical applications that can serve industry needs in the future. At the same time, we maintain strong engagement with international research institutions through joint publications, knowledge exchange, and collaborative project planning. This integrated approach ensures that our work remains globally relevant while laying the groundwork for both applied impact and sustainable collaboration.

What are the next plans for the project after the move to CNT?

Prof. Simha Martynková. The EBEAM team will fit naturally within the Nanotechnology group, sharing the same scientific vision while keeping full independence in research decisions and the freedom to build a strong, innovative team that continues to grow in expertise.

Prof. Rümmeli. The transition to CNT provides an excellent opportunity to deepen the scientific focus of EBEAM. Our research aligns very well with CNT's strengths, especially in nanomaterials and advanced microscopy, which creates natural synergies for collaboration and shared development.

From my side, the next steps involve fully establishing the research environment; completing the SEM lab setup and initiating our core nanoscale fabrication work. In parallel, we are working to expand the team, with an additional postdoc and also through the addition of senior researchers such as a part-time professor and associate professor (or their equivalents), who can bring complementary expertise and help drive the scientific agenda forward.

What message would you like to convey to students and colleagues who would like to get involved in the project?

Prof. Rümmeli. If you're curious, motivated, and passionate about pushing scientific boundaries, EBEAM is a great place to grow. We're building a dynamic, international team, and there's space here for fresh ideas, collaboration, and innovation. Join us!

Prof. Simha Martynková. I believe that having such a prestigious project at CNT marks the beginning of a "new ERA" for our centre. We should build upon the good practices established by EBEAM Centre, and I am ready to contribute to this promising future.

Thank you for the interview.

Adéla Macháčková – EBEAM project coordinator, VŠB-TUO.

THE EBEAM TEAM IS COMPLETE!

Meet the research EBEAM team working together and read a few words about them.

<p>Prof. Alicja Bachmatiuk, Poland</p>	<p>I joined the EBEAM project team in 2025, contributing alongside my academic and research leadership roles. I am a University Professor at Wrocław University of Science and Technology and collaborate closely with the EBEAM Centre at VSB–Technical University of Ostrava. My research focuses on electron-beam-enabled materials science, advanced electron microscopy, and two-dimensional materials for energy, electronics, and sensing applications.</p> <p>Within EBEAM, I work on electron beam–assisted fabrication and modification of low-dimensional materials, including graphene, MXenes, and layered heterostructures. My activities combine high-resolution TEM and SEM characterization with studies linking processing conditions to structural and functional properties. I also support the mentoring of researchers through guidance on experimental design and microscopy data interpretation.</p> <p>I joined EBEAM because of its interdisciplinary approach to electron beam technologies and its strong integration of fundamental research with application-oriented goals. The project creates an important platform for collaboration across physics, chemistry, and materials engineering while advancing nanoscale materials science.</p>
<p>Prof. Katarzyna Marzec, Poland</p>	<p>I have been a member of the EBEAM project team since November 2025. I am a Professor at AGH University of Science and Technology and a Professor at Jagiellonian University Medical College, with extensive experience in vibrational spectroscopy and biomedical applications. I joined EBEAM to introduce advanced spectroscopic methods as complementary tools for surface and thin-layer characterization in electron beam–based technologies.</p> <p>Within the project, my work focuses on integrating Raman and infrared spectroscopy, including nano-IR and SERS, with electron beam fabrication approaches. My research provides non-destructive, molecular-level analysis of surfaces, coatings, and layered nanomaterials. I also support EBEAM students through consultation on vibrational spectroscopy measurements, data interpretation, and methodological validation.</p> <p>I joined EBEAM because of its interdisciplinary nature and its strong connection between physics, chemistry, materials science, and biomedical applications. The project offers an excellent environment for developing advanced surface diagnostics and strengthening collaboration between academic and applied research communities.</p>
<p>Prof. Gabriela Kratošová, Czech Republic</p>	<p>I am a Research Fellow specializing in Electron Beam Surface Science and Nanomaterials Engineering. I joined the project in November 2025, motivated by my long-term interest in nanomaterials and electron-based analytical techniques.</p> <p>My education includes a BSc in Chemical Structure of New Materials from University of Ostrava and an MSc in Process Engineering, specializing in materials characterization, from VSB – Technical University of Ostrava. I obtained my PhD in Metallurgy, focusing on bioleaching and metallurgical waste recycling, which directed my research toward bionanotechnology and the biotechnological synthesis of metal nanoparticles. My work also involves advanced materials characterization, including SEM techniques, X-ray microanalysis, and correlated AFM-in-SEM methods for nanomaterials research. I am the author and co-author of 48 Web of Science–indexed publications, with over 1,100 citations and an H-index of 16 (January 2026). I see this project as an important opportunity to strengthen interdisciplinary collaboration and contribute to advanced nanomaterials research.</p>
<p>Dr. Szymon Piotr Abrahamczyk, Poland</p>	<p>I am a postdoctoral researcher at VSB–Technical University of Ostrava within the EBEAM Centre since September 2024. I joined the project to work on electron-beam-driven approaches to modern materials processing and to connect fundamental beam–matter interaction science with practical, direct-write manufacturing concepts.</p> <p>Within the project, I focus on electron-beam-induced chemistry, particularly chemical and structural transformations in polymer layers and a range of substrates. My work involves systematic SEM exposure studies, thin-film preparation, and post-processing characterization of chemical and microstructural changes using SEM, SEM-EDS, AFM, Raman spectroscopy, and FTIR.</p> <p>The main outcome of my work is to establish a robust mechanistic understanding of electron-induced transformations, enabling reproducible experimental strategies that support both publications and the development of demonstrator systems for advanced materials processing.</p>
<p>Dr. Maria Hasan, Pakistan</p>	<p>I have been associated with the EBEAM project as a Junior Researcher since June 2025. I joined the EBEAM team based on my background in nanomaterials research and my interest in advanced electron-based technologies for materials and energy applications. The project provides an excellent opportunity to expand my doctoral expertise in chemistry within an interdisciplinary research environment.</p> <p>Within the project, my work focuses on the synthesis and modification of advanced nanomaterials, particularly graphene-based and composite systems for energy and functional applications. I am involved in chemical vapor deposition growth processes and in microstructural and energy-related characterization using techniques such as SEM, Raman spectroscopy, and XPS.</p> <p>Participation in the EBEAM project provides valuable experience in advanced materials research and multidisciplinary collaboration. I see the project as an important step in developing my career in nanomaterials, materials characterization, and applied energy technologies.</p>

<p>Dr. Maria Zdończyk, Poland</p>	<p>I have been a member of the EBEAM team since October 2025. I am a postdoctoral researcher within the EBEAM project. I joined the team driven by my interest in electron matter interactions and the use of electron beams for structuring and functionalizing advanced materials. My background in responsive hybrid materials and luminescent systems allows me to connect molecular level phenomena with beam induced transformations.</p> <p>Within the project, I focus on organic and hybrid thin films, investigating how electron irradiation can be used to induce controlled structural and functional changes. My work combines material design, thin film processing, and advanced characterization to explore new routes for functional nanostructures and state-based material responses.</p> <p>Being part of the EBEAM project provides me with the opportunity to work in an interdisciplinary and international environment, to develop independent research ideas, and to bridge fundamental materials chemistry with emerging electron beam-based technologies. I see this project as an important step toward building an independent research profile in advanced functional materials.</p>
<p>Muhammad Aashir Awan, Pakistan</p>	<p>I have been a member of the EBEAM team since May 2025. As a doctoral researcher on the EBEAM project, I joined the team because of its pioneering focus on electron-beam technologies and the exploration of monolayer graphene and doped graphene via chemical vapor deposition (CVD). The project's blend of fundamental and applied science aligned perfectly with my interests, allowing me to leverage my theoretical training while contributing to cutting-edge advancements in materials and energy research.</p> <p>Within EBEAM, I focused on developing doped single-layer graphene for energy and technical applications. I aim to enhance the material's efficiency and durability, and I employ advanced analytical techniques to investigate its microstructure.</p> <p>Being part of this project offers valuable experience, the chance to work in a multidisciplinary team, and an opportunity to refine my scientific and technical skills. It serves as a strong foundation for my future career in advanced materials research and applied energy technologies, and I am grateful for the chance to contribute to such a forward-thinking initiative.</p>
<p>Pavel Kuzník, Czech Republic</p>	<p>I have been a member of the EBEAM team since September 2025. I am a doctoral student within the EBEAM project, which I joined due to its strong focus on advanced technologies employing Scanning Electron Microscopy for the fabrication of graphene and other 2D materials with near-atomic precision. These technologies have the potential to significantly impact the (semi)conductor industry. The project enables me to combine the theoretical knowledge acquired during my bachelor's and master's studies with advanced experimental research, while collaborating with experts from the academic research community.</p> <p>Within the project, I am involved in the development of thin polymer layers suitable as substrates for the precise transformation into graphene-based 2D materials using Scanning Electron Microscopy. My work primarily focuses on preparation and characterization of these thin polymer layers using Atomic Force Microscopy, Raman Microscopy, Scanning Electron Microscopy and Fourier Transform Infrared Spectroscopy.</p> <p>Participating in the project provides me with valuable experience, the opportunity to work in an international research team, and the chance to further develop my scientific and technical skills. I consider the EBEAM project to be a strong platform for my future career in modern materials research and applied energy technologies.</p>
<p>Ondřej Sakreida, Czech Republic</p>	<p>I have been member of the EBEAM team since October 2024.</p> <p>I am a doctoral student in the EBEAM project. I joined the team due to the focus on the emerging manufacturing of graphene via electron beams. This technique would have the potential to revolutionise semiconductor industry. Also, for me personally the graphene have been in my interest for a while, so working in research focused on this marvellous material was obvious choice.</p> <p>Within the project, I am involved in electron beam manufacturing of 2D carbon-based materials via the electron beam exposure and manufacturing of doped graphene in atmospheric pressure chemical vapour deposition from solid precursors. I am working with scanning electron microscopes (analysis, fabrication), chemical vapour deposition and purely for analysis I am using Raman spectroscopy with optical microscope and Infrared Spectroscopy.</p> <p>Participating in the project provides me with valuable experience in soft-skills, English language experience in international team, the opportunity to work in a multidisciplinary team, and the chance to develop my scientific and technical skills. These skills are valuable for the successful progress in the future scientific career. Last, but not least, is also the opportunity to work with brilliant colleagues, which motivated me and helped me along my scientific journey.</p>
<p>Daniel Slavík, Czech Republic</p>	<p>I have been a member of the EBEAM team since 2025.</p> <p>I am a Master's student of Informatics & Data Science within the EBEAM project. I joined the team because I saw a unique potential to combine Data Science and AI with the physical world of electron microscopy.</p> <p>Within the project, I focus on R&D to counteract non-linear system dynamics of Scanning Electron Microscopes (SEM), such as drift or mechanical hysteresis. To address this, I am engineering a real-time active stabilization system. My work involves research, exploration, and experimentation with various state-of-the-art AI approaches to model and compensate for these mechanical behaviors. Participating in this project enables me to further my knowledge and develop creative solutions, while utilizing my background in machine learning and computer vision to explore potential applications of AI-driven control and to experiment directly with real-world data and hardware.</p>

OUTCOMES

Activities and results of EBEAM Research team

	<p>Prof. Gabriela Kratošová participated on Correlative Materials Characterization Workshop 2025, taking place from 21 to 22 October at CEITEC Masaryk University in Brno, Czech Republic and took discussion with Jan Neumann, the head of NenoVision company.</p>
	<p>NanoOstrava 2025, 19 - 22 May Dr. Szymon Piotr Abrahamczyk had talk and presented preliminary EBEAM Centre research at the NanoOstrava conference at VSB – Technical University of Ostrava, contributing to scientific dissemination and constructive discussion on emerging results.</p>
	<p>NanoOstrava 2025, 19 - 22 May Muhammad Aashir Awan, participated as an oral poster presenter on the topic “Polymer Thin Films as sources of Carbon for Graphene Manufacturing”.</p>



DSL Naples Italy 2025

Dr. Szymon Piotr Abrahamczyk, Prof. Alicja Bachmatiuk and Prof. Mark H. Rummeli attended DSL 2025 as a representative of the EBEAM Centre, contributing to Special Session 11: Innovative Characterization Techniques for 2D Materials and Beyond. The event enabled valuable technical dialogue on emerging microscopy and spectroscopy strategies for 2D materials, supporting knowledge exchange and strengthening collaborative visibility in the field.



Shenzen, China – Invited talk at SUN YAT-SEN UNIVERSITY: 16th November 2025

Prof. Mark H. Rummeli was invited to deliver a lecture at Sun Yat-sen University to present the EBEAM project.



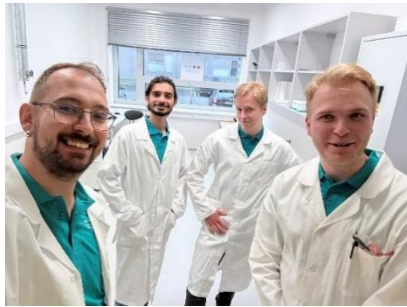
Shenzen, China – Invited talk at the 10th Chemistry and Materials BRICS Forum jointly with Lehn Institute of Functional Materials International Forum and the 4th Interdisciplinary Forum on 'Functional Molecular Engineering – Frontiers and Applications' in Guangdong: 25th November 2025

Prof. Mark H. Rummeli was invited to deliver an invited lecture to present the EBEAM project and discuss recent advances in advanced characterization techniques and 2D materials research.



Workshop on Correlative Characterization of Materials, CEITEC - Central European Institute of Technology

Prof. Mark H. Rummeli attended the Workshop on Correlative Characterization of Materials at CEITEC - Central European Institute of Technology as a representative of the EBEAM Centre. The workshop brought together leading experts in advanced characterization techniques that are currently pushing the boundaries of materials science. The event enabled valuable discussions on correlative microscopy approaches and emerging analytical methodologies for advanced materials research, supporting knowledge exchange and strengthening collaborative visibility in the field. Special thanks to NenoVision and Jan Neuman for the stimulating discussions and exchange of experiences.

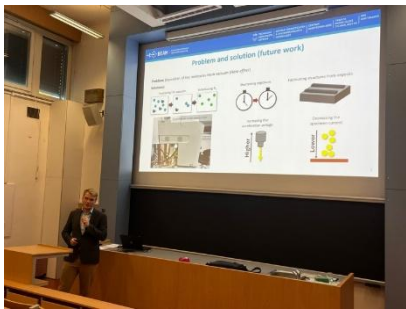


Researcher Night 2025

Dr. Szymon, Aashir Awan, Pavel Kuzník and Ondřej contributed to the European Researchers' Night took place at VSB - TUO, where we demonstrated multiple microscopic techniques and supported public understanding of nanoscale phenomena through interactive explanations and hands-on engagement.



Ondřej Sakreida was part of the panel discussion concerning the topic How to build a sustainable collaboration ecosystem between science, industry, and the community at 12. **National transfer conference, 19.-20.3.2025 held in Ostrava, Czech Republic.**



Ondřej Sakreida as a doctoral student at faculty of Materials Science and Technology presented his thesis at PhD day, 31. 10. 2025, Took place in **VSB-TUO in Ostrava**. He was presenting research topic *Synthesis of carbonaceous material/graphene via electron beam from polymers*. And he was awarded for 1st place for the best presentation in the section covering Materials Science and Engineering, Nanotechnology, Chemical Metallurgy, and Chemical and Environmental Engineering.

COOPERATION

EBEAM Centre: Advancing International and Industry Collaborations

The EBEAM Centre at VSB – Technical University of Ostrava is expanding its international and industrial research network through a number of dynamic and high-level collaborations. These relationships support the Centre’s mission to pioneer atomically precise manufacturing using electron beams and to innovate in advanced nanomaterials.

A strong collaboration exists with Soochow University in China, specifically with the College of Energy, where Professor Mark H. Rummeli holds an affiliation as a Chair Professor. This partnership focuses on the chemical vapor deposition (CVD) fabrication of novel nanomaterials and their exploitation in ion battery systems. It also includes advanced characterization techniques, particularly the use of aberration-corrected transmission electron microscopy (Cs-corrected TEM).



In Poland, the EBEAM Centre collaborates closely with Wrocław University of Science and Technology (WUST). Professor Alicja Bachmatiuk and Dr. Krzysztof Lis, from the Department of Soft Matter Physics, are working with the Centre on nanosensor development. These include precision-positioned sensors fabricated using electron beam techniques. Conventional in-situ TEM characterisation is being developed by Professor Andrzej Żak from the Faculty of Chemistry at WUST.

Another Polish partnership is with AGH University of Science and Technology in Krakow, where Professor Katarzyna Marzec of the Department of Medical Physics and Biophysics is engaged in joint research on advanced vibrational spectroscopy techniques. This collaboration supports the structural analysis of nanomaterials and electron beam-modified systems.

In Germany, the EBEAM Centre collaborates with Dr. Thomas Gemming at the Leibniz Institute for Solid State and Materials Research (IFW Dresden), Institute for Metallic Materials, focusing on advanced electron microscopy studies. A parallel collaboration is active with Professor Gianarelio Cuniberti at the Chair of Materials Science and Nanotechnology, Technical University of Dresden, where joint work is underway on the development of electronic nose (e-nose) gas sensors based on nanostructured materials.

On the industrial side, discussions are ongoing with NenoVision, a Czech company, about joint development of advanced AFM-EM systems incorporating artificial intelligence (AI) and machine learning (ML) solutions. Similarly, Specion, also based in the Czech Republic,

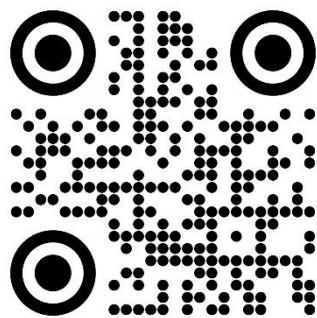
is engaged in early-stage talks regarding instrumentation for in-situ SEM applications tailored to the needs of atom-precise electron beam fabrication.

The Centre is also engaged in scientific dialogue with Chemnitz University of Technology, particularly with Prof. Sybille Gemming and Prof. Anette Gunnæs from the Chair of Microscopy of Nanoscale Materials, Oslo University. This exchange focuses on the fundamental science of momentum transfer and atom manipulation using electron beams.

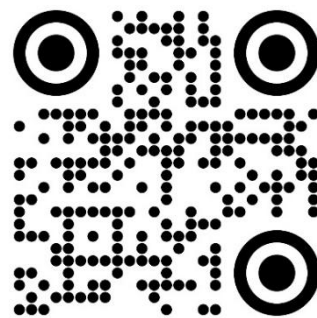
Although no Memoranda of Understanding (MoUs) have yet been formalised, these collaborations are active and impactful. Notably, a joint proposal involving WUST, IFW Dresden, TU Chemnitz, and the University of Oslo was submitted but not funded, demonstrating EBEAM's continued effort to build a cohesive and ambitious European research network.

These partnerships are vital to advancing the EBEAM Centre's scientific goals and reinforcing its position as a leader in nanoscale precision manufacturing and nanotechnology research.

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The banner features the EBEAM logo (a circular cluster of dots) and the text "EBEAM Electron Beam Precision Manufacturing". Below this is the tagline "Shaping the future, atom by atom." and four icons representing: Advancing Research (microscope), Building Collaborations (handshake), Empowering People (group of people), and Delivering Impact (target). The background shows a molecular structure and a globe. At the bottom, there are contact details: a globe icon, the website "WWW.EBEAM.VSB.CZ", the LinkedIn logo, "EBEAM PROJECT", an email icon, "ebeam@vsb.cz", and the European Union logo with the text "Funded by the European Union Horizon Europe".