



# New cleanroom for nanofabrication

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Campus Service | Technical University of Denmark

# DTU develops new cleanroom for nanofabrication

State-of-the-art. DTU has chosen the international consulting firm Jacobs to design and project cleanrooms for nano- and microfabrication in a new building, Nanolab Phase 4. This will secure DTU's leading position in high-tech research, which is essential for the future of Denmark.

Nanotechnology is key to developing products such as bio/chemical microchips, quantum computers, and new advanced sensors. These are some of the technologies that companies and politicians are counting on to contribute to growth and to secure the future of Denmark. Therefore, DTU is constructing a new cleanroom for DTU Nanolab, which will strengthen and develop the interdisciplinary research environment surrounding nanotechnology on DTU Lyngby Campus.

"Academic environments within and outside DTU, industrial companies, and researchers at DTU Nanolab are requesting more space than we can offer today. At the same time, we expect demand to increase as nanotechnology is crucial in the development of quantum computers and sensors, and the facilities are part of DTU's contribution to the cooperation with NATO," says Jörg Hübner, director of DTU Nanolab.

Building a cleanroom of the magnitude that DTU Nanolab dreams of has sent DTU's client organization on the hunt for the best advisors in the field. The

chosen advisors for the task have been found in Glasgow, Scotland.

"Nanolab Phase 4 is a highly complex construction case, so it is crucial that we start right. Therefore, we have been looking for highly specialized advisors with experience in designing and projecting semiconductor cleanrooms. The choice has fallen on Jacobs, who has a specialized department in that field," says Francois Svend Court-Payen, project director at Campus Service at DTU.

**"We experience a great demand for more space. At the same time, we expect the demand to increase, as nanotechnology is a crucial technology in the development of quantum computers and sensors"**

– Jörg Hübner, director, DTU Nanolab

Campus Service will now develop a laboratory building, also named B346A, in close dialogue with the advisors and experts in nanofabrication from DTU Nanolab. The ambition is that in 2026, a building will stand as a focal point for DTU's collaboration partners and leading researchers across scientific disciplines, who will research and develop new nanotechnological methods and systems.

## More space for new technology

Today, DTU Nanolab has cleanrooms that are used by most of DTU's research centers and other academic environments as well as businesses. The facilities are important resources in several of DTU's initiatives and international research collaborations, including NATO's DIANA initiative. But more space is needed.



**Close cooperation.** Campus Service and DTU Nanolab are in close dialogue in the development of the new clean room for nano- and micro-fabrication. In the newsletter you meet Jörg Hübner, director of DTU Nanolab, and Francois Svend Court-Payen, project director in Campus Service. Photos: DTU

**“The cleanroom must be flexible. We must be able to install and uninstall equipment without disturbing the research and other activities that take place in the cleanroom”**

– Jörg Hübner, director, DTU Nanolab

“Almost all nanofabrication technology is additive. Even when a new technology emerges, the existing one does not become obsolete, and we also use the established machines and technologies. If we want to add new things and have the options that must be available in a state-of-the-art facility, we need more space,” says Jörg Hübner.

Additionally, DTU Nanolab wants the cleanroom to be flexible. This is one of the design criteria.

“We need to be able to change the interior of the cleanroom, and the layout must be flexible. If a collaboration partner needs to expand the equipment fleet for a period, we want to be able to respond to it quickly - and that without disturbing the research and other activities taking place in the cleanroom,” says Jörg Hübner.

DTU Nanolab’s requirements for flexibility mean that Campus Service is focused on tolerances and precision. The building must function even if a light rail runs through the campus 300 meters away and creates vibrations in the ground.

“We can only use the building if it meets the specifications. If there is no clean air and stable temperature and humidity, we can’t do any work. Then the building is worthless,” says the director of DTU Nanolab.

It requires expertise to make a cleanroom of this standard. As of today, there are no other semiconductor cleanrooms that meet DTU Nanolab’s wishes and needs in Denmark. This has sent DTU Campus Service on research trips to universities in Europe and the United States and on the hunt for the best advisors. They have now been found in Scotland.

### DTU Nanolab

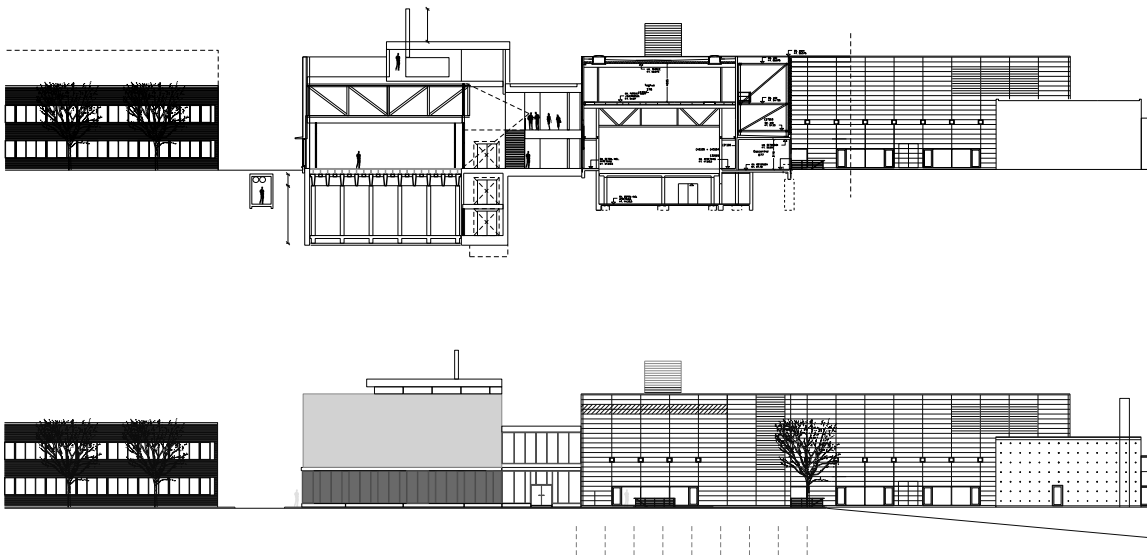
DTU Nanolab, National Center for Nano Fabrication and Characterization, researches micro- and nanotechnology and provides access to advanced equipment and expertise within the field. With its location on DTU Lyngby Campus, DTU Nanolab plays a central role in the development of micro- and nanotechnology in Denmark.

DTU Nanolab operates and maintains state-of-the-art equipment and cleanroom facilities. We do this to ensure open access to ideal working conditions for researchers and collaboration partners.



**Ørsted Square.** The new building Nanolab Phase 4, also called B346A, will be built on Ørstedes Plads, where there is currently parking. Visualization: DTU/ERIK Arkitekter/Kontekst





**New clean room.** Nanolab Phase 4 (B346A) will be next door neighbor to the existing clean rooms in B346, and the two buildings will be built together so that there is passage between the clean rooms. The new cleanroom is planned as a large, open and flexible cleanroom with an underlying deep subfab (a clean basement) and an open plenum. The clean room will be built as an ISO 4 ballroom with full subfab for 200 mm equipment. This structure provides maximum flexibility for use of the cleanroom and a plug-and-play environment where users can connect equipment as needed. Drawing and visualization: DTU/ERIK Arkitekter/Kontekst



### Nanolab Phase 4 in numbers

The new building will be approximately 5,600 m<sup>2</sup> spread out across 2 floors plus a basement. The area of cleanroom under filter will be approximately 700 m<sup>2</sup>.

The total finances for the construction are budgeted at 345 million DKK (2021). Additionally, there is research equipment for the cleanroom. DTU will finance the construction of B346A.

The goal is for the building to be handed over to DTU Nanolab mid 2026. A specific date has not yet been set. After the handover, DTU Nanolab will be responsible for the installation of tools and equipment before the building can be put into use.



## World-class facilities

In recent years, Campus Service has built several complex laboratory buildings for research. To achieve this assembling the right team is the best starting point.

"In this case, we start out to find the advisors who will design the technical solutions. In our preliminary studies, we quickly saw that we had to look internationally," says project director Francois Court-Payen.

In March, DTU signed a contract with the global engineering firm Jacobs. It is more specifically Jacobs' Glasgow-based department for "advanced facilities" that will be advisors. The company has several collaborations with researchers and universities. It is also Jacobs that developed the two facilities that DTU has today 20 years ago.

In this task Jacobs has provided the right team and demonstrated a thorough understanding of the task.

DTU awarded the task in a competitive tender with dialogue throughout the process. This has made DTU an attractive partner, according to Francois Court-Payen.

"DTU has used this tendering form in recent years, and it has many strengths. You can lay all the cards on the table, become smarter along the way and then adjust the building project accordingly. And with such skilled advisers on board, we expect that we will also attract top-notch contractors when the project goes to the market. We aim to get only the best on the team."

**"We look forward to working with Jacobs. We expect that we can also attract suppliers and contractors from the top shelf when the project goes to market"**

– Francois Svend Court-Payen, project director

## The team behind Nanolab Phase 4

DTU is the client. Nanolab Phase 4 (B346A) will be developed by Campus Service in close cooperation with DTU Nanolab, which is the primary user. DTU is working with international client advisors who have experience in building semiconductor cleanroom facilities for research and production environments.

The two Dutch consulting firms, Labadvies and Deerns, are technical client consultants. Jacobs has won the consultancy tender for the construction. DTU's framework consultant, ERIK Arkitekter with Spangenberg & Madsen Rådgivende Ingeniørfirma, has created the design program in collaboration with the architectural office Kontekst. The construction tender has not yet been planned.



**Agreement.** DTU and Jacobs enter into an agreement on the design and planning of the new clean room. The signing was celebrated with representatives from DTU and Jacobs (bottom picture). In the top picture, Claus Nielsen, University Director of DTU, signs the agreement. Photo: DTU



## The vision is a place for technology and people

The new building should not only offer DTU Nanolab's researchers and partners flexible tools and top grade facilities. It should also be a place where different users can meet around the subject of nanotechnology.

**"Nanolab Phase 4 must become a place that is also for people, not just technology. There must be places where you can exchange knowledge, places where you can sit down with your computer for a break and also places for communication."**

– Jörg Hübner, director, DTU Nanolab

"We want to create an environment that enriches everyone, because we have all the different technology development stages under one roof. The goal is for the building to be used by researchers in micro- and nanofabrication from basic research - and then all the way up through the supply chain to small-scale production together with many different companies, both in size and technological orientation," says Jörg Hübner.

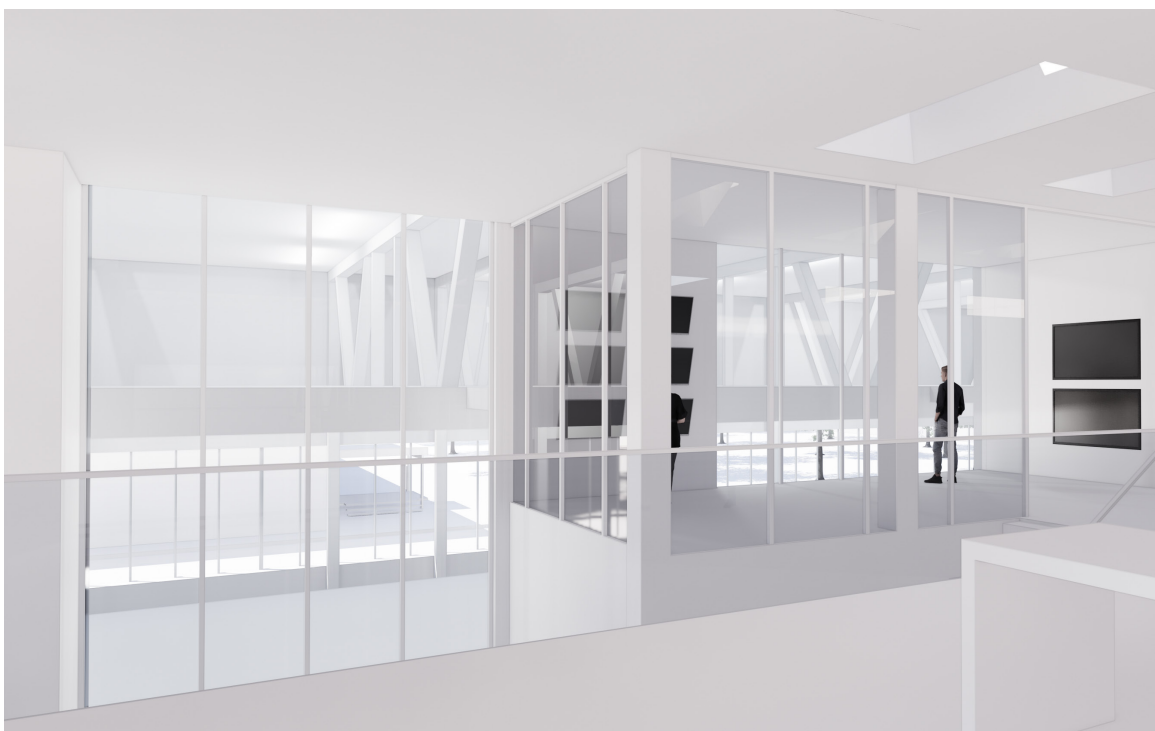
The building shall become a meeting point for professional communities from different disciplines. Therefore, efforts are being made to create a transparent building with space for meetings, work, and learning about nanotechnology.

"We focus on those who will use Nanolab. So there are places where knowledge can be exchanged, where you can hang your coat, sit down with your computer during a break, and also places for communication. It is a place that is also designed for people, not just technology," says Jörg Hübner.

In the building between B346A and B346 DTU Nanolab will invite guests and communicate the endlessly fascinating world of nano- and micro-fabrication.



**Transparency.** DTU Nanolab will create a professional environment around nanotechnology and also invite visitors to discover nanotechnology. The building between B346A and B346 is designed to be open and inviting with glass sections that allow users to look into and follow the work in the laboratory. The visualizations are from the illustrated building program. Photo: DTU/ERIK Arkitekter/ Kontekst



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