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LASCAM FOCUS | Interview

Czech Laser Technology
for Nuclear Energy

Laser cleaning opens a new chapter in the maintenance of nuclear facilities

For more than a decade, LASCAM systems has been among the leading innovators in the field of industrial laser technologies. The company demonstrates that Czech know-how has much to offer-not only in the development and production of automated systems for laser processing of metals and plastics, but also in one of the most demanding industries: nuclear energy. Its solution for laser cleaning of VVER-type reactor vessels proves that modern optical technologies can remove layers of corrosion and impurities safely, efficiently, and without contact in places where conventional methods have long reached their limits.

In an interview with Karol Flimel, Managing Director and Sales Director of LASCAM systems, you will learn how this unique project was born, what technical challenges the team had to overcome, and why laser technologies are opening a completely new chapter in the nuclear industry.

Source: wirestock

LASCAM systems has recently established itself as a specialist in the application of laser technologies. You have recently completed a project involving the laser cleaning of a VVER-440/213 reactor. Could you describe what this project was about?

It involved the development and deployment of a laser system for cleaning the pressure vessel of a VVER-440/213 reactor. The main purpose was to enable regular ultrasonic inspections, which are essential for monitoring the condition of the reactor welds. Over time, corrosive layers combined with boric acid residues form on the vessel surface, preventing the ultrasonic waves from properly penetrating the material. These layers therefore had to be removed very carefully, without damaging the surface or its structure. Interestingly, the use of a non-abrasive cleaning method was a direct requirement from the client, which made laser technology the ideal choice for this task.

„Laser technologies are changing the way we think about the maintenance of nuclear facilities.“

What were the main technological challenges you had to address when designing the system?

The key challenge was the limited space there is only about thirty centimeters of clearance between the reactor pressure vessel and the concrete containment. Designing an entire system that could fit into such a confined area was extremely demanding. This meant, among other things, that we had to develop a special laser processing head with a unique geometry that could operate within this narrow gap. At the same time, the system had to be robust, fully automated, and capable of functioning without direct operator presence. Assembling the entire setup under these spatial constraints was a significant engineering challenge.

How did the actual cleaning process take place in practice?

The entire process was completely contactless. The laser head was equipped with a number of sensors and a vision system that enabled remote monitoring and diagnostics of the process. In addition, the head featured two focusing optics, which made it possible to clean not only along the circumference of the reactor vessel, but also in its upper inclined sections. An integrated autofocus system compensated for any operator inaccuracies. Thanks to the precise control of the laser beam, impurities were removed layer by layer — without any damage to or loss of the base material.

How does laser cleaning differ from the traditional methods previously used in the nuclear industry?

The main difference, as I've already mentioned, is that the laser process is non-abrasive and completely contactless. We don't use any brushes or chemicals. As a result, virtually no secondary waste is generated, which is a huge advantage in the nuclear environment.In addition, the cleaning process is much faster, more precise, and fully repeatable. When you add the ability for remote operation and the zero need for maintenance during reactor shutdown, it represents a major step forward compared to conventional methods.

How long did the entire operation take?

The reactor unit outage lasted approximately ten days. During this time, we installed the system, carried out the cleaning, and then dismantled the equipment. Everything was conducted in accordance with the strict safety protocols that apply to nuclear power plants. It was crucial for the system to operate flawlessly and without any human intervention and we successfully achieved that. Of course, all of this was preceded by thorough preparation, starting as early as the development phase of the laser cleaning system.

What specific results did you achieve?

The laser system successfully cleaned the entire reactor vessel without requiring any maintenance and without causing any surface damage. After the cleaning was completed, subsequent work and inspections could proceed as planned. At the same time, we confirmed that the technology can also be applied to other types of equipment within the nuclear power plant.

„A laser can remove layers of contamination where conventional methods fail.“

That sounds like a breakthrough application. What other possibilities do you see for using laser cleaning in the nuclear industry?

The laser has great potential in this field. In addition to cleaning reactor pressure vessels, the technology can be used for underwater cleaning inside the reactor, decontamination of spent fuel boxes, cleaning of steam generator collector flanges, or even for weld preparation. Everywhere precision, safety, and zero waste are required, the laser proves to be an ideal solution.

Would you say that laser technologies are opening a completely new chapter in the nuclear industry?

Yes, absolutely. Laser technologies today are far more than just tools for industrial marking or cutting. They are becoming a key element in maintenance, inspection, and safety operations across some of the most demanding industries including nuclear energy. And we are proud to work on these projects with partners who have the courage to implement innovation even in such a sensitive environment

And one last question – where do you see the future of laser cleaning in this field?

The direction is clear. Toward greater automation, precision, and integration with diagnostic systems. In the future, we also see the possibility of combining laser cleaning with other optical inspection methods so that the process not only cleans, but also continuously evaluates the condition of the material. The ultimate goal is to maximize the safety and efficiency of nuclear facility operations.

Thank you for taking the time to discuss this topic with us.

Thank you for the interview.

Karol Flimel

Co Founder & Sales Director LASCAM systems

LASCAM systems has been developing and manufacturing laser systems across various industrial sectors for more than 10 years.

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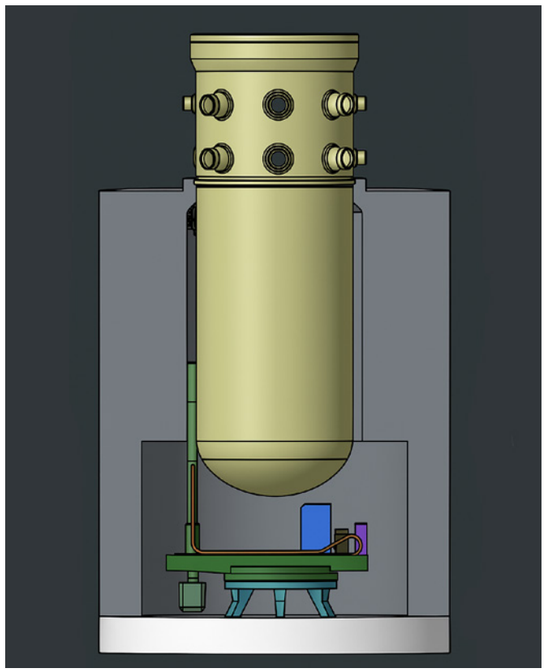

Diagram of the equipment inside the pressure vessel.