# Breakthrough Automation Meets a High-throughput Challenge

Fürst Medisinsk Laboratorium Implements Europe's First *FlexLab for High Throughput* Solution

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**Case Study**

**Strategic Partner**

Laboratory Automation

inpeco Automation in Healthcare

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# Honoring Commitments: Delivering Excellence to Customers and Employees Alike

### Fürst Medisinsk Laboratorium at a Glance

- Private reference laboratory
- Hours of operation: Monday–Friday, 7 a.m. to 9 p.m.
- 10 FTEs support automation track
- 400 employees in total

Fürst Medisinsk Laboratorium was founded as a small, family operation in 1950. Back then, Dr. Valentin Fürst's wife biked around Oslo picking up tests from doctors' offices for her husband to process in his home laboratory. Today, 100 drivers deliver samples from across Norway to a private reference lab that employs 400 people, including specialists in biochemistry, microbiology, and clinical pathology as well as doctors, a large IT group, and support staff.

As requested by Norwegian health authorities, Fürst must report at least 95% of results before noon on the following day. As year-to-year testing volumes grew, the lab was challenged to consistently fulfill this turnaround time (TAT) requirement. As its operation has grown, Fürst has remained committed to delivering excellent service to its customers and preserving the feeling of family among its employees.

Due to capacity limitations, Fürst was unable to increase the workload on its existing track system. In addition, company management refused to add a night shift, as they felt doing so wasn't in alignment with their employee satisfaction-centric values. With these challenges, it was clear that Fürst needed a revolutionary solution to address its increasing workload.

"When I started to work here, we were just working one shift each day," said Marie Buchmann, medical director at Fürst. "After adding a second shift in 2009, I did not want to be the one to introduce three shifts for the lab techs. I hope I retire before we have to introduce a night shift!"

In 2014, Fürst began planning a solution with Siemens Healthineers, its long-time diagnostics partner, and Inpeco SA, a pioneer in laboratory automation. The three companies soon determined that a new, groundbreaking solution would be needed to deliver capacity, add flexibility, and lower costs at Fürst.

# Unique Challenges Demand a Groundbreaking Automation Solution

Keenly focused on creating a best-in-class lean laboratory to support its current and anticipated growth, Fürst made the bold decision to add a fourth floor to its three-story building. The triangular shape of the building and location of load-bearing walls would greatly influence the configuration of the new automation track. However, it was the unique nature of incoming work that posed the greatest challenge for the project.

Fürst has a very compact, 13–14-hour working day. "Importantly, they received the largest amount of tubes late in the afternoon," said Jeff Appleyard, head of Healthcare Consulting for Siemens Healthineers EMEA Region. "Those tubes had to be handled before the lab closed—either immediately tested or safely stored for analysis the following morning. The track and workflow had to be configured to ensure that everything could be finished by the hour at which they wished to close the lab."

After careful evaluation, the three companies concluded that solutions based on proven technologies and dual-track approaches had limitations. To best meet the challenge, the innovative and versatile Inpeco SA *FlexLab™ for High Throughput* track would serve as the ideal backbone for the solution. "We actually had to design some customized tools to fully analyze the data and understand if the system was going to be suitably designed," said Appleyard. Since this would be the very first high-throughput solution to be installed in Europe, outstanding technical support throughout the planning and implementation phases of the project would be required for success.

## Design Goals

- Support daily and peak-hour volumes for high-volume private reference lab.
- Maintain two shifts over a 13–14-hour workday.
- Report 95% of results before noon the following day.
- Increase capacity by 20%.

# Ushering in a New Breed of Tailor-made Automation

*"This new generation of FlexLab track provided an ideal solution to combine multiple specialties and support complex workflows while managing a very high volume of specimens."*

**Einar Svartsund**
Head of Laboratory Department
Fürst Medisinsk Laboratorium

The *FlexLab for High Throughput* track is engineered with a new, active gate design to quickly move pucks to/from diagnostic analyzers and pre- and post-analytical processing modules. Consequently, the track is able to carry more pucks, closer together, to significantly increase hourly throughput—up to 7200 tubes per hour—of the new solution.

The enhanced gate design also significantly reduces noise in the lab, thereby meeting another of the project's objectives—to ensure that Fürst remained an attractive place for employees to work.

Inpeco SA has also engineered state-of-the-art redundancy into the design of the *FlexLab for High Throughput* track. The Fürst track is powered by dual motors, increasing confidence that the solution will deliver uninterrupted operation.

The 120-meter track at Fürst anchors 38 pre- and post-analytical processing modules and 31 multidisciplinary analyzers. It also features open gates for future connections.

Importantly, the ADVIA Centaur® XPT and ADVIA® Chemistry XPT analyzers were well-suited to the increased throughput capabilities of the groundbreaking solution. However, Inpeco SA would need to refine and validate connectivity to support several other instruments planned for Fürst's multidisciplinary track. Fürst, Inpeco SA, and Siemens Healthineers worked closely together during project planning, installation, validation, and stress testing phases to ensure smooth implementation.

"Sound field project management is crucial to success. Seamless synchronization by Inpeco SA and Siemens Healthineers, as well as pragmatic change management led by Fürst senior managers, enabled us to deliver high-volume, complex workflows in a controlled and steady way in the assigned time," said Pietro Ferrario, Inpeco SA project manager.

"The team from Fürst and the people from Siemens Healthineers worked as one team," said Håvard Selby Ebbestad, CEO, Fürst Laboratory. Effective collaboration and a shared goal of workflow excellence enabled this team to work with third parties to successfully design and incorporate several more innovative features into the solution.

A system of mechanized rollers automatically transports bins of incoming samples to the receiving team, where paperwork is removed for processing and tubes can be loaded to the automation track without wasted motion.

A series of customized chutes connects the elevated track to three bulk input modules located at the beginning of the automation track. Tubes descend gently to avoid hemolysis of samples.

Video study: Learn about the workflow consulting, data-driven design, transition planning, and strong management behind this automation project at siemens-healthineers.com/furst.

An elevated conveyor raises the track overhead so lab technicians can easily cross the lab floor.

The disposal chute on each of the seven refrigerated storage modules (RSM) is connected to a pipe that passes through the floor of the lab. Each day, approximately (1000) week-old tubes pass directly to several large hazardous waste bins located in the basement of the building. Rather than burden lab staff with frequently servicing small individual waste bins for each RSM, the janitorial staff handles the large basement bins and resets the counter installed to prevent overflow.

# One-touch Workflow: The Brains behind the Brawn

### Total Analyzers: 32

- ADVIA Chemistry XPT System: 6
- ADVIA Centaur XPT System: 18
- DiaSorin LIAISON XL: 1
- IMMULITE 2000 XPi Immunoassay System: 2
- TOSOH G8 Analyzer: 5

### Total Modules: 38

- IOM: 2
- BIM: 3
- TIM: 5
- U-turn: 2
- T-module: 7
- L-module: 1
- Buffer: 2
- Centrifuge: 1
- Decapper: 4
- Sealer: 4
- Desealer: 2
- Rack Builder: 2
- Refrigerated Storage: 7
- Aliquotter: 3
- Aliquot Recapper: 3

While the throughput of the *FlexLab for High Throughput* track brings tremendous muscle to Fürst's workload, it still requires carefully planned pre- and post-analytical processing, multidisciplinary testing, and customized features to enable the organization to meet its operational goals.

The configuration also reflects Fürst's desire to create a healthy work environment for the staff. "Each operator is responsible for 2–5 instruments. So the way the systems are laid out, they have very little movement, and that was part of the design iteration... to ensure minimum amounts of staff movement during the maintenance and running times of the systems," notes Appleyard. "They have space to prepare reagents, QCs, and calibrations, and the relevant freezers and cold storage rooms are also nearby."

"I think we've actually exceeded their expectations in terms of meeting their turnaround time requirements," said Appleyard. "So we have a solution that really works for them and their customers. But also, we've given them the ability to expand the workload when they win new business. So they have capability to grow and really become even more successful."

1. The majority of the 12,000 tubes received each day enter the track via three bulk input modules (BIM) located immediately beyond the drivers' entrance to the lab and receiving station.

2. Two input/output modules (IOM) are used to introduce uncapped tubes and/or sort and remove tubes for aliquoting and off-track testing at the facility.

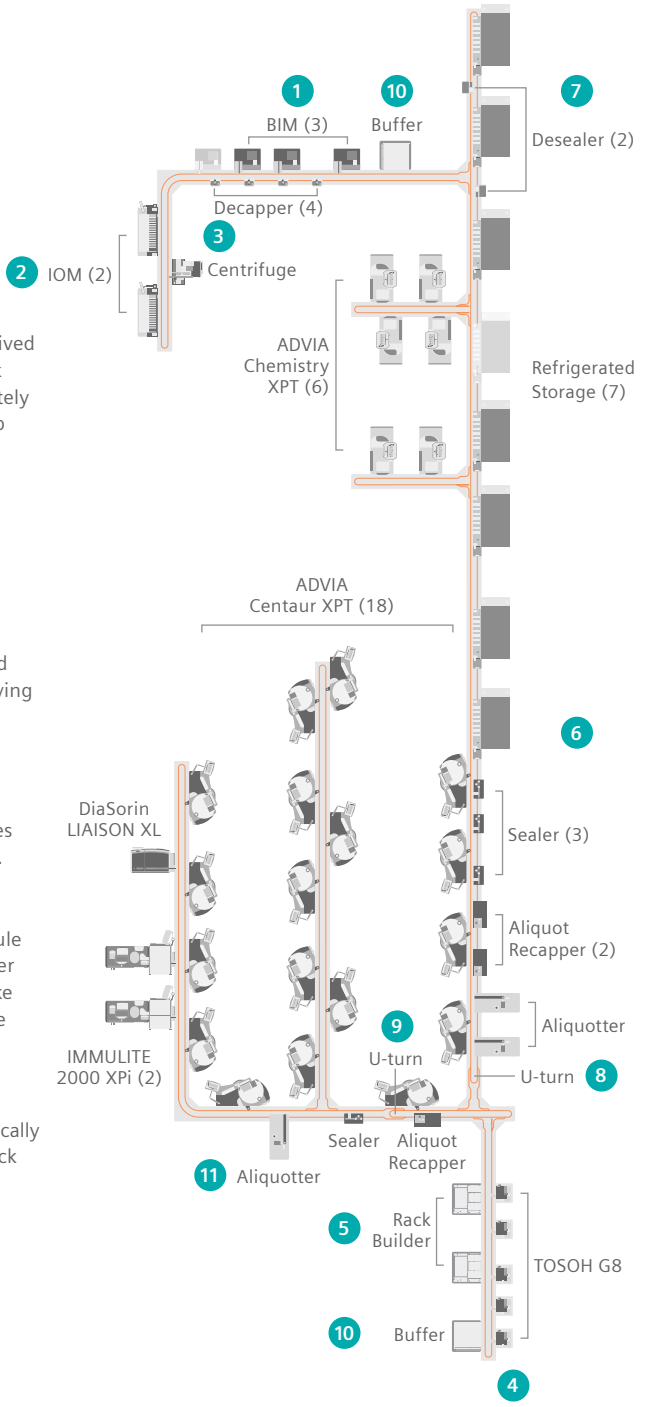
3. Tubes then travel to the centrifuge and one of four decapper units before moving further into the lab for chemistry and immunoassay testing.

Intelligent routing ensures that certain tubes can bypass the pre-analytical modules and travel directly to the far end of the lab.

4. Five TOSOH G8 analyzers perform on-track HbA1c testing. A buffer module is used to create a queue for this slower testing rather than waste time and take up space by allowing tubes to circulate on the track.

5. A track-to-rack workstation, designed and engineered by Inpeco SA, automatically builds racks of sorted tubes for off-track hematology/hemostasis testing.

Capped samples received too late in the day for analysis are immediately centrifuged (but not uncapped) and stored for next-day processing.



# Designed with Growth in Mind

6 When diagnostic testing is complete, tubes are sealed, stored in one of seven refrigerated storage modules (RSM), and automatically disposed after 7 days.

7 If add-on or reflex testing is required, tubes are retrieved from the RSM and decapped or desealed before traveling to the diagnostics area of the track. Importantly, the automation solution is integrated with a robust IT system that enables Fürst customers to directly order reflex and rerun tests.

The track configuration incorporates additional features to speed TAT and support other lab work.

8 A U-turn can route samples directly to post-analytical modules after chemistry and/or immunoassay testing to avoid congestion on the track if no further analysis is required.

9 A U-turn can bypass chemistry and/or immunoassay instruments to shorten travel time for HbA1c and/or offline hematology/hemostasis testing.

10 A buffer module acts as a holding pen for empty pucks to avoid congestion on the track. Pucks are released when needed to support increased testing/processing during peak hours.

11 An aliquotter and capper (scheduled to come online in 2018) support preparations required for chromatography testing performed in another part of the facility.

The automation solution implemented at Fürst was designed to accommodate a 20% increase in testing capacity on any given day as well as support longer-term growth for the lab as it wins new business. In addition to open gates, which will enable the lab to add more instruments within the current footprint, the project was designed to accommodate longer track spurs in several areas if needed.

The initial cutover to the high-throughput lab took place on April 4, 2016, and the lab processed a record-setting 12,400 tubes. Since then, the track has been proven to be highly reliable.

After introducing on-track HbA1c testing shortly after go-live, Fürst expanded its ADVIA Centaur XPT system menu to support on-track serology testing previously performed in another area of the facility. As planned, the DiaSorin LIAISON XL instrument and a second IMMULITE® 2000 XPi Immunoassay System were also added to the track. Plans are underway to bring hematology testing onto the track as part of a 2019 expansion.

Drugs-of-abuse testing is performed in another area of the facility on an Atellica® Solution chemistry analyzer. However, these and other urinalysis tubes are checked in on the track, undergo pre-analytical processing, and then are sorted/offloaded for further testing. Plans are also in process to bring the Atellica Solution onto the track.

*"The system does give us a continuous flow, and it automates all manual processes. So you have more predictability through the process. And that's important to keep the turnaround time. But in addition, we have tried to do things smarter, and consolidate more to the system…and use people more efficiently."*

**Einar Svartsund**
Head of Laboratory Department
Fürst Medinisk Laboratorium

At Siemens Healthineers, our purpose is to enable healthcare providers to increase value by empowering them on their journey toward expanding precision medicine, transforming care delivery, and improving patient experience, all made possible by digitalizing healthcare.

An estimated 5 million patients globally benefit every day from our innovative technologies and services in the areas of diagnostic and therapeutic imaging, laboratory diagnostics, and molecular medicine, as well as digital health and enterprise services.

We are a leading medical technology company with over 120 years of experience and 18,000 patents globally. Through the dedication of more than 50,000 colleagues in 75 countries, we will continue to innovate and shape the future of healthcare.



Product availability may vary from country to country and is subject to varying regulatory requirements. Please contact your local representative for availability.

The outcomes achieved by the Siemens Healthineers customers described here were achieved in each customer's unique setting. Since there is no typical hospital or laboratory, and many variables exist (e.g., hospital or laboratory size, case mix, level of IT adoption), there can be no guarantee that others will achieve the same results.

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