Title: Finnish engineers shape the future of digital hydraulics
Subtitle: With the financial support of the EU, the Tampere University of Technology, Fluiconnecto and Tamlink are testing the potential of this new technology.

Engineers from the Tampere University of Technology (TUT), Fluiconnecto Oy and Tamlink Oy are testing the use of digital hydraulics in ITER - the biggest fusion energy project financed by China, Europe, Japan, India, the Republic of Korea, the Russian Federation and the USA. The Parties of this ambitious collaboration represent half of the world's population and 80% of the global GDP. ITER promises to explore the potential of fusion energy as a safe and sustainable energy source for the future.

The EU is responsible for 45% of the project. Its contribution is managed by Fusion for Energy (F4E). The manufacturing of components and much of the R&D still need to be developed offering the possibility to European companies and research organisations to innovate with the help of EU funds. During ITER's operation, various pieces of equipment will need to be repaired and re-installed remotely because engineers will not be able to enter in the machine to fix them. F4E has signed a contract with Tampere University of Technology (TUT), Fluiconnecto and Tamlink co-financing a number of improvements to the design of digital valves to test their potential as part of the machine's remote maintenance system.

The group of Finnish engineers has proposed a digital valve system relying on a set of 16 fast, small and simple on/off valves working simultaneously as part of the equipment of ITER's remote handling system. After months of trials, they have concluded that the digital valves present several merits compared to traditional hydraulic servo valves. First, they are more resilient. Second, contrary to servo valves, where the system relies solely on one valve, digital valves offer a combination of many and in the event of failure there is a backup to fall back on guaranteeing continuity. Third, as trials pointed out, the digital valve system demonstrated a new state-of-the-art control performance.

The successful results, have motivated the group of engineers to explore the commercial potential of digital water-hydraulics in fields such as transport, aeronautics, construction, industry and machining. Where there is a need for extra muscle to lift and move loads with precision, there is a niche for this promising patent. Tamlink and TUT have been working the last 20 years in this field. For example, Bosch Rexroth has licensed this technology operating with oil. In fact, digital oil valves of such kind are used in some of Finland's high-speed trains. Thanks to the intense trials conducted for ITER, now more than ever, the group of engineers sees a clear business prospect.

The EU's involvement in ITER and the potential to stimulate spin-offs are important to Carlo Damiani, F4E Project Manager for Remote Handling. "This is a success story that could yield commercial benefits. The collaboration of R&D centres and companies, making the transition from fusion to other areas of work, shows the diversity of technologies we use and their far-reaching application. This is another example demonstrating how the EU can further increase Finland's high rank in innovation."

Lauri Siivonen, Tamlink Project coordinator, believes that digital hydraulics are a strong candidate for ITER. "The tests showed superior tracking accuracy. In spite of some faults detected during the long-

term tests, their performance overall was not seriously affected. The project was carried out in line with the scheduled time and resources."

Harri Sairiala, technical responsible of Fluiconnecto adds "…we have been working with ITER water hydraulic maintenance tools for almost 20 years. The digital valve technology paves the way for new interesting possibilities to achieve reliable, accurate and efficient motion control. ITER is probably the most demanding environment we can imagine for a hydraulic system. If we successfully address this challenge, then we will have many possibilities in more traditional industrial applications in future."

Matti Linjama, Adjunct Professor at TUT, and inventor of digital hydraulics, explained that "this joint venture with F4E, Tamlink and Fluiconnecto has been fruitful. The digital hydraulic solution offers a unique combination of performance and reliability. The project is a good example of transferring research to an application."

Next, the digital valves will be installed in the Divertor Test Platform (DTP2), an ITER test facility in Tampere. On the basis of their performance, experts will decide how to use them in the biggest fusion device.

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