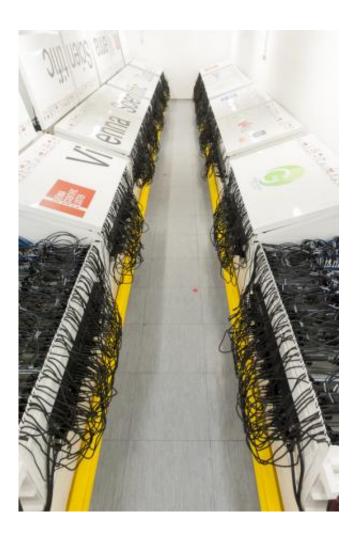# Austria's new green super computer

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Several universities have come together to construct Austria's most powerful mainframe computer. Phase VSC-3 (Vienna Scientific Cluster 3) offers not only impressive computing power, but also serious energy

efficiency.

Austria's scientific community has a new super computer. Comprising more than 32,000 individual processor cores, the VSC-3 cluster is now being put into operation in the Science Center at Vienna University of Technology (TU Wien). A total of eight Austrian universities are participating in the project. The new VSC-3 will enable scientific calculations to be performed in a variety of research areas, ranging from meteorology to particle physics. The plans for the super computer focused first and foremost on [energy efficiency](#) and reducing environmental impact, leading to the use of a completely new method of oil cooling. On 4 July 2014, VSC-3 was officially opened in the presence of Reinhold Mitterlehner, Federal Minister for Science, Research and Economy.

Successful partnership between Austrian universities

TU Wien, the University of Vienna and the Vienna University of Natural Resources and Applied Life Sciences had already jointly operated the previous VSC-1 and VSC-2 models with great success. This third incarnation also involves the University of Innsbruck and Graz University of Technology (TU Graz) and is coordinated by partners the University of Graz, University of Leoben and the University of Klagenfurt.

"This collaborative project between eight universities, which covers many disciplines and fields of study, is a prime example of cooperation in practice and shows the added value that can result for all involved. Austria now has the very latest infrastructure in a high-tech area that will serve as the basis for new findings in both the natural sciences and technical fields," said Reinhold Mitterlehner, Federal Minister for Science, Research and Economy.

In VSC-3, the participating universities now have at their disposal a computer cluster that can hold its own against the world's top scientific computers. "The current phase was realised by bundling the resources of the various partner universities. This is the only way in which we can develop the critical infrastructure mass required to draw the attention of the scientific community on the basis of our scientific expertise," says Johannes Fröhlich, Vice Rector for Research at TU Wien. "This not only ensures that current cutting-edge research will be performed properly, but also enables the future-orientated development of the location into a comprehensive centre for high-performance computing. In any event, VSC is a flagship project for cooperation between universities, securing a locational advantage for Austria's scientific community."

A view of the Server Room of VSC

"The super computer is a prime example of collaboration between universities," confirms Karl Schwaha, Chair of the VSC steering committee and Vice Rector at the University of Vienna, at the presentation of VSC-3. "For the universities, the VSC is a showcase for energy efficiency and sustainability; crucial topics for the University of Vienna in terms of its social and ecological responsibilities."

VSC-3 was built by the company Clustervision. Like its predecessors, VSC-3 is located in the Science Center of the Vienna University of Technology in the Vienna Arsenal. It is made up of 2,020 nodes, each with 16 processor cores. It has computing power of more than 600 teraflops, meaning that it can perform more than 600 trillion additions or multiplications in just one second. For example, in one nanosecond VSC-3 could take the speeds and ranges of every pass and shot in the entire World Cup tournament and calculate the corresponding launch angles. "Modern science would be inconceivable without adequate simulation and calculation methods. As a technical university, it is crucial that we have access to the requisite computer capacities. Take, for example, the simulations performed in modern-day mechanical engineering. With VSC-3, we can provide our researchers with a modern infrastructure that can compete on an international scale," explains Horst Bischof, Vice Rector for Research at Graz University of Technology. Many different research groups will have access to the computing power of VSC-3, in scientific fields ranging from developing new materials with the aid of quantum physics calculations through to meteorological simulations and biology.

"The computing power required in this day and age can only be achieved by pooling resources, and this is where the real added value comes from participating in the VSC (Vienna Scientific Cluster). This alliance gives us and the participating Austrian universities the computing power necessary for our researchers and opens doors into the relevant European networks", explains Sabine Schindler, Vice Rector for Research at the

University of Innsbruck.

Mastering energy savings with oil cooling

"It was crucial for us that energy efficiency be taken into account in the planning stage," says Professor Herbert Störi (TU Wien, scientific project manager for VSC-3 and member of the steering committee). VSC-3 will require about 540 kilowatts of power – around 0.8 kilowatts per teraflop. This makes it significantly more efficient than its predecessor, the VSC-2 cluster (2.3 kilowatts per teraflop, with approx. 150 Tflop/s), even though this was also a trailblazer in terms of ecology.

One important step for optimising the energy consumption of VSC-3 was a totally new cooling technology: instead of air cooling using power-guzzling ventilators, they turned to paraffin oil, similar to that used in cosmetic products. The tanks in which the processors are immersed contain 35 tonnes of oil. The oil is particularly good at conducting heat, meaning that the heat generated by the processors can be transported away very efficiently. The lack of air cooling means that the computer room does not have to be specially cooled either.

"Through the VSC collaboration, we are very pleased to be able to give our scientists access to one of most powerful computers around," states Vice Rector Georg Haberhauer of the Vienna University of Natural Resources and Applied Life Sciences (BOKU). "We are setting new standards here, not only in a scientific context, where we can examine complex questions to an even better level, but also in terms of sustainability: the novel, energy-efficient liquid cooling fits in perfectly with our university's philosophy of conserving resources while remaining open to innovation."

"High-performance computing forms the basis for all fields of research that need to process large quantities of data to make new discoveries. At

the University of Innsbruck, this area has been greatly expanded over the past few years and scientific computing is now one of our five key research areas. In Innsbruck, 11 scientists are currently using the VSC as part of their research projects – and this number is rising," comments Vice Rector Schindler of the University of Innsbruck.

However, it is not always easy to make direct comparisons with other computer clusters – VSC-3 is not primarily designed to take the number one spot in computer rankings. "Many of the computers currently topping the world rankings are now made up of graphic cards. However, we need to offer processors on which the existing scientific programme codes will run as well as possible," explains Herbert Störi. "You have to make a choice: do you want a racing car or do you want a bus, which can transport many more people with a similar amount of power? In any case, VSC-3 is ideally suited to the current needs of Austria's scientific community."

Provided by University of Vienna

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