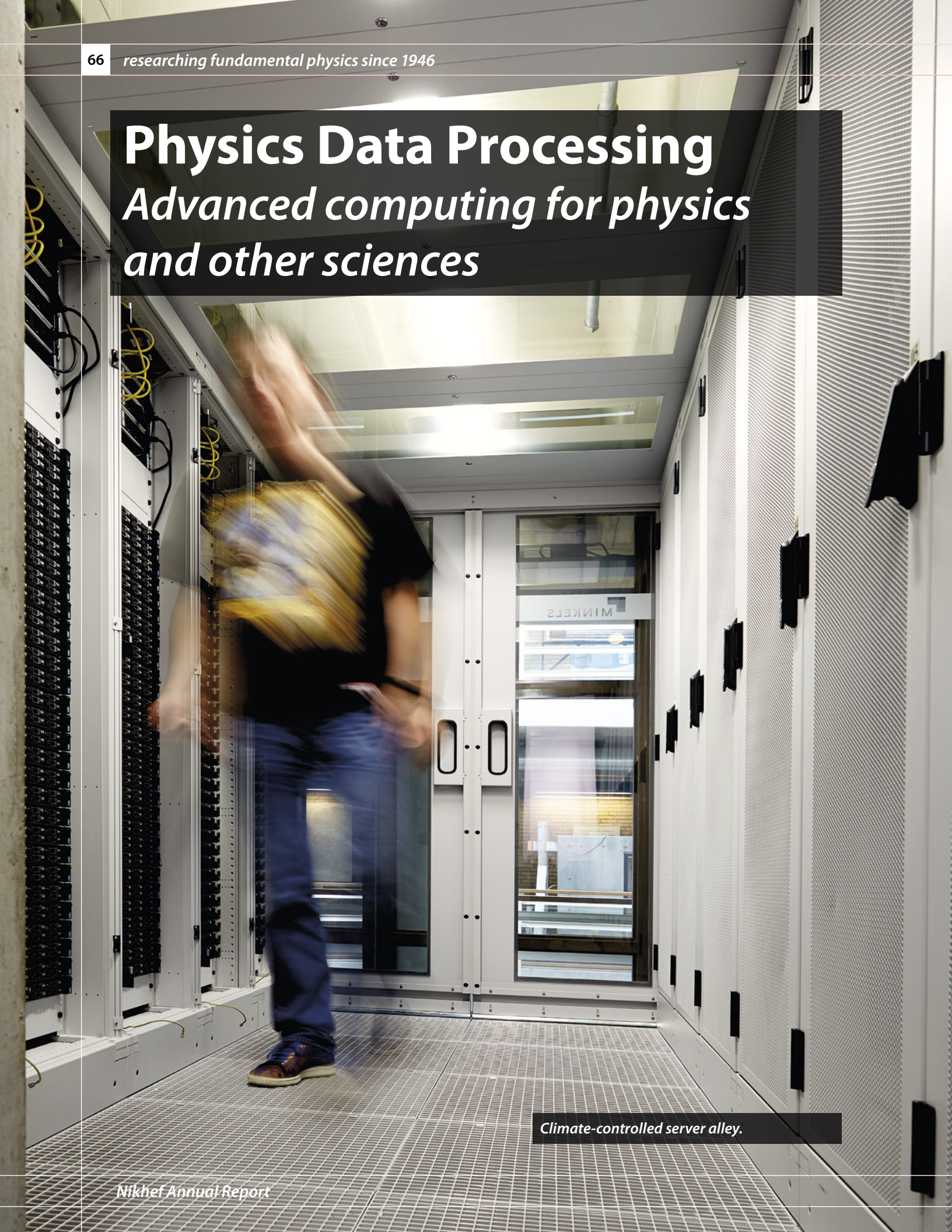
# Physics Data Processing

## *Advanced computing for physics and other sciences*




*Climate-controlled server alley.*


Daniela Remenska
8 February 2016

**Management**
dr. J. Templon

The Dutch Tier-1 for LHC Computing, roughly half of which is housed in the Nikhef Data Centre, ran well during 2016, providing about 50% more CPU cycles than promised to our LHC experiments. The extra cycles came from unused allocations to other groups on the National e-Infrastructure.

## New Developments

Our cloud infrastructure plans reached the advanced prototype stage in 2016. The developments are made in close collaboration with SURFsara and the University of Groningen, following also developments by our international colleagues. We expect the facility to be operational in the first half of 2017.

Part of our 'cloudification' project includes software-defined networking which will provide both the necessary isolation (security) as well as connectivity (bandwidth); in Q3 2016 we took delivery of an advanced switch '*kroonsteentje*' with an internal bandwidth of approximately 100 Tbit/s and capable of the required programmability. Not only does this switch enable our cloudification, it also lays a foundation necessary for the data rates expected in the HL-LHC era.

Cloudification of the facility provides several advantages in flexibility of resource provisioning. Perhaps the most important is that, outside of high-energy physics, very few scientists are interested in the grid computing paradigm. As long as LHC-scale data sets are not involved, there are alternatives to grid that are much more user-friendly. 'Cloud' is one of them, and others can easily be instantiated as a platform running on top of a virtualisation cluster. Whereas in 2013, 13% of our computing cycles were provided to researchers outside of high-energy physics, in 2016 this figure was just 4%, the other groups having moved on to cloud infrastructures available elsewhere. Serving our mission as a node in the Dutch National e-Infrastructure requires our move to a more flexible base system; the current LHC Computing Grid node will run transparently as a virtual grid site on top of the cloud platform.

Nikhef's security officer Sven Gabriel teaches a class on data security.

The group took delivery of one of the first Knight's Landing (Intel) Development systems, and performance studies are being made of several applications. The PDP group was also involved in the design and specification of a special machine for the theory group, designed for execution of large-scale FORM calculations. The machine includes 768 GB of RAM and about 20 TB of fast solid-state disk drives acting as extended memory for FORM.

## Gravitational Wave Searches

Starting in late September 2016, the VIRGO and LIGO collaborations began to make use of our grid cluster. For Europe, Nikhef is currently second only to CNAF in amount of computing cycles (about 400 cores, averaged the last two months) provided. Currently most of the cycles go to searches over data looking for sources of continuous emission of gravitational waves; developments are ongoing to extend this to other classes of gravitational-wave searches.

## Securing federated communities

The gravitational wave community is also at the forefront of federated authentication and collaboration technology, and one of the most active groups in Authentication and Authorisation for Research and Collaboration. In this global effort, Nikhef contributes both technology and services that bridge 'web based' single sign-on authentication systems to data-intensive computing infrastructures such as EGI. This year was especially successful: our 'RCauth.eu' service was successfully piloted by both EGI and ELIXIR (the ESFRI life sciences information infrastructure), and was subsequently selected as a core activity for the future of EGI. Our accreditation of this service to the Interoperable Global Trust Federation IGTF also represents the success of policy coordination, where we working closely with the global research and education community to improve trusted identity and the response to security incidents.

Operational security is also a key element in the 'cloudification' of both our infrastructure and those around us. Where experience has shown that systems hardening and configuration is not necessarily a forte of researchers, our own network and systems design will be based around the operational security experience we gained by coordinating the European EGI security response team.