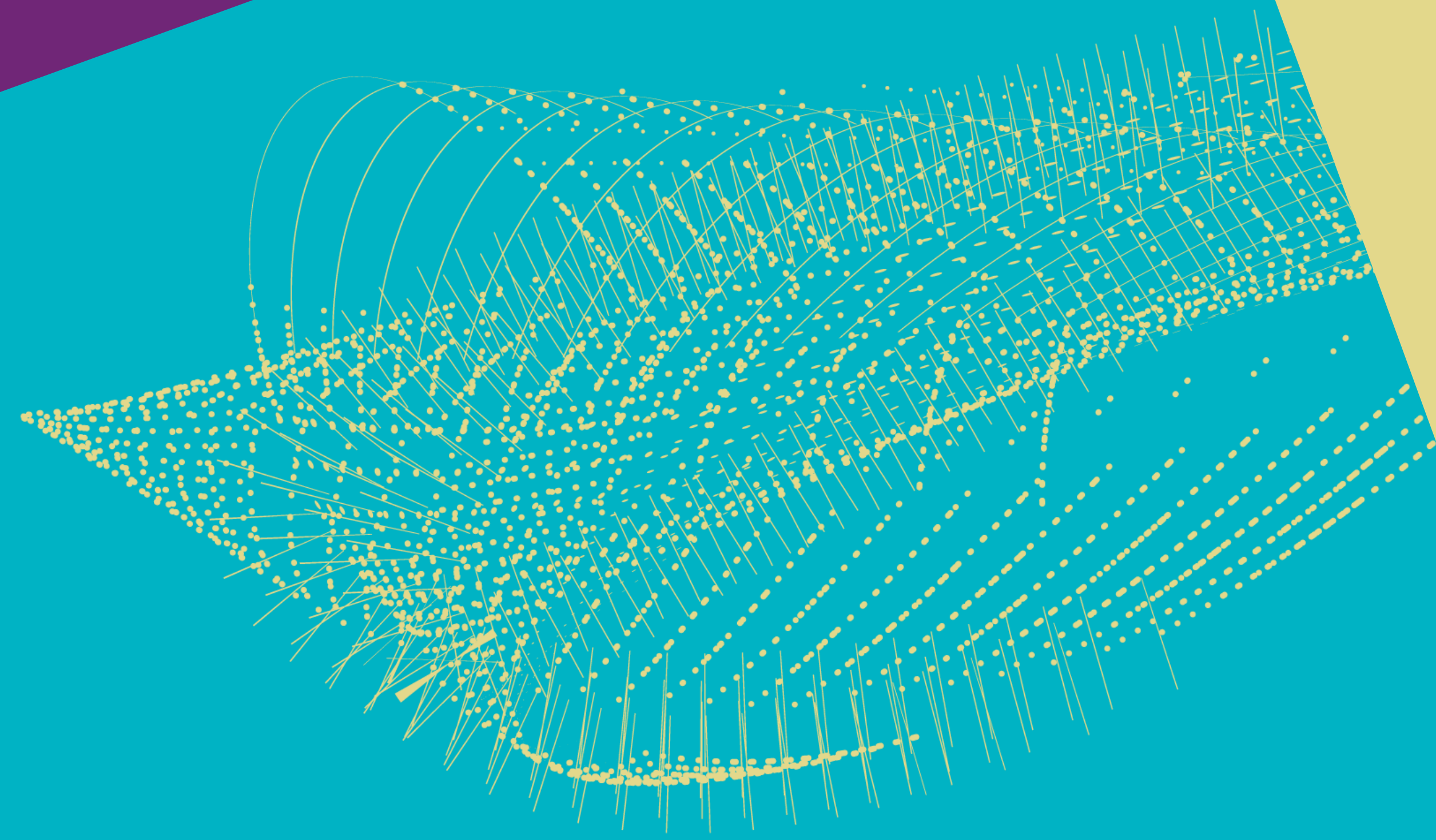


Nikhef



CONNECTION TO INDUSTRY

RECFA meeting
19 October 2018
Arjen van Rijn

NIKHEF MISSION

NIKHEF MISSION

The mission of the National Institute for Subatomic Physics Nikhef is to study the interactions and structure of all elementary particles and fields at the smallest distance scale and the highest attainable energy.

Two complementary approaches are followed:

1. Accelerator-based particle physics – studying interactions in particle collision processes at particle accelerators, in particular at CERN;
2. Astroparticle physics – studying interactions of particles and radiation emanating from the universe.

Nikhef coordinates and leads the Dutch experimental activities in these fields.

The research at Nikhef relies on the development of innovative technologies. The knowledge and technology transfer to third parties, i.e. industry, society and the general public, is an integral part of Nikhef's mission.

Goals in the past period (2012-2018):

- Improve context for spin-offs;
- Continue existing and explore new opportunities for working with industry;
- Cherish successful market activities (in particular with our data center);

Since mid 2016:

- Jan Visser: coordinator Industrial Contacts, covering spectrum of industry as supplier, user and collaborator; includes the role of Industrial Liaison Officer (ILO) for CERN;



TOPICS

- Collaboration with industry
 - with industry funding
 - co-design, co-development
- Spin-offs
 - CERN-BIC
- CERN return
 - ILO activities
- Nikhef datacenter
 - Combining market and science goals

ACTIVITIES WITH INDUSTRY (1)

Company	Topic / status
Shell	Collaboration centered around the development of ultralow-power seismic sensors. This has resulted in a series of projects under a research collaboration agreement (including the Nikhef spin-off Innoseis) and additionally in an STW project for developing a dedicated ASIC for the readout of these sensors. The total cash and in-kind contribution of Shell in the period 2013- 2016 has been around 1,5 M€.
PANalytical	Long standing research collaboration with PANalytical, around the Medipix technology, resulting in the inclusion of Medipix 2 and Medipix 3 chip technology in the X-ray analysis equipment sold by PANalytical. One of the biggest success stories of bringing CERN technology to the market. PANalytical regularly uses (and pays for) Nikhef facilities (clean room, bonding machine) and manpower for the assembly of their detectors. The company has also been partner in several publicly funded research projects with Nikhef (Relaxd, Hidralon). Currently a new proposal on increased energy resolution pixel chip development is in preparation.
ASML	Several contract research agreements with Nikhef, first around cooling technology, recently around alignment solutions. Details cannot be disclosed. Currently no new initiatives are in sight.
Tata Steel	A project evaluating the viability of muon radiography for the analysis of the homogeneity of large vessels with (liquid) steel. Currently discussions are ongoing for a follow-up project.

Company	Topic / status
Photonis	Interested in co-developing a new type of photo multiplication device ('Topsy') in the context of the ERC Advanced Grant project 'MEMBbrane'. Also interested in another patented development started at Nikhef, microHV. Currently Photonis funds a test setup for such a microHV system.
Hardware vendors	Vendors such as Intel, Dell, Fujitsu, IBM, Mellanox and Juniper regularly use the Nikhef Physics Data Processing (PDP) group as beta-tester of their ICT equipment, based on Nikhef's expertise in developing and operating large-scale computing facilities (including part of the Dutch WLCG Tier-1).

Examples of third parties (co)funding - mostly technology driven- research.

(Industry almost never wants to collaborate with us on / pay for finding the Higgs boson or gravitational waves).

ACTIVITIES WITH INDUSTRY (2)

Co-design and co-development with industry for detector solutions.

Two examples (KM3NeT):

- MCAP: an SME specialized in cable assembly; after several years of development now supplier of Vertical Electro Optical Cables. This has learned them new techniques and delivered them new customers.



- Tallgrass:



"Tallgrass was invited to participate in technical sessions regarding the roll-out of the architecture of KM3NeT. As a SME [Small/Medium Enterprise], we were able to quickly adapt (and deliver) our products to the specific requirements of this project. By contributing our hands-on approach to this knowledgeable environment, we feel we created a mutual benefit, both for the project as well as for our company, not only financially, but also in terms of knowledge transfer."

According to Reindert Hommes, CEO of Tallgrass, a company focusing on optical transport solutions, operating from the Science Park in Amsterdam.

SPIN-OFFS

Amsterdam Scientific Instruments (inc. 2011):

- Based on Medipix technology: radiation imaging;
- Continued collaboration with Nikhef on read-out electronics;
- With new owners and investors (Oct. 2017) moving forward;



AMSTERDAM
SCIENTIFIC
INSTRUMENTS



Sensiflex (inc. 2011):

- Based on RASNIK alignment technology;
- Very few activities;



Innoseis (inc. 2013):

- Based on gravitational wave research: seismometers and vibration isolation systems;
- Continued collaboration with Nikhef on MEMS based seismic sensors and readout;



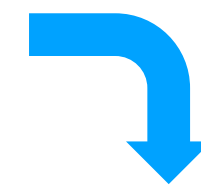
Oliscience (inc. 2018):

- FPGA development; empowering OpenCores community;



CERN-BIC @ NIKHEF

- June 2014: Agreement between Nikhef and CERN signed.
- 2014 – 2018: several Expression of Interests received (not that many ...).
- June 2018: renewal of CERN-BIC contract with new set-up; Nikhef coordinating three existing Dutch BICs:
 - Amsterdam Science Park; theme “ICT”;
 - Brightlands in Geleen: theme “new materials”;
 - HightechXL in Eindhoven; theme “hardware”;



Jul. 2018 – Hackathon

- Hackathon: 450 applications; 100 invitees; 80 attendants

Sept. 2018 – Start accelerator programme

Dec. 2018 – Teams pitching for investors

- 6 teams working on 3 CERN technologies

(<https://kt.cern/article/reverse-hackathon-cern>)



SOME LESSONS LEARNED

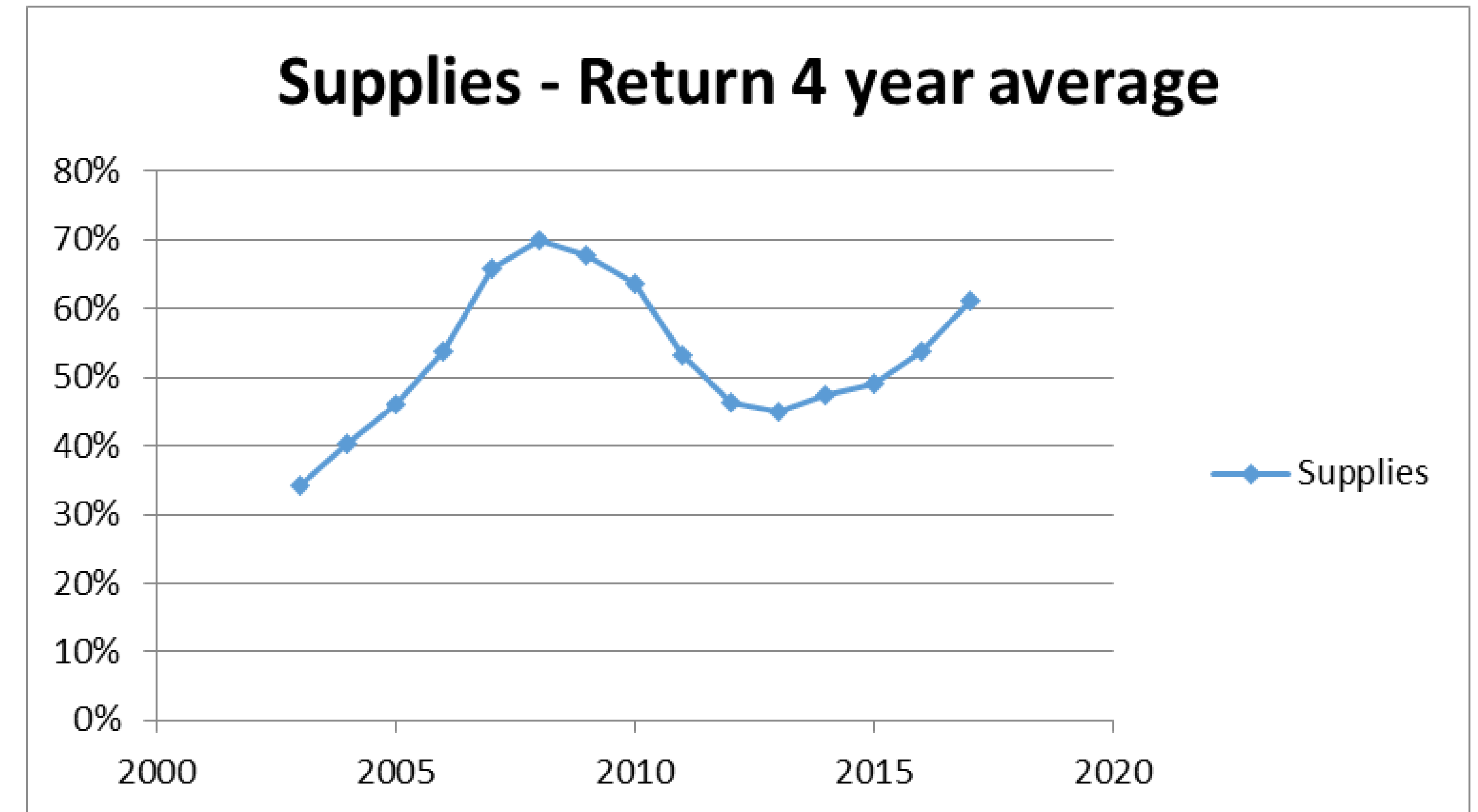
- Startups are 'sexy'; enabling startups (both as shareholder and through license agreements) has been a valuable (but sometimes cumbersome) addition to our valorization instruments;
- Seek partners for expertise complementing those of the research institute (investment opportunities, market analysis, business case, legal, etc.);
- The timelines for (techno)startups are always (much) longer than you think;
- There are *always* issues around conflicts of interest – try to be as transparent as possible in supporting the start-up, balancing between incentives for entrepreneurship and equality within your institute;
- There are *always* issues around IP;
- There is no one size that fits all: the entrepreneur/initiator/researcher determines largely how you can support the startup.

CERN RETURN

The Netherlands still poorly balanced

- Supplies: improving towards well balanced; (achieved for a single year, but is judged on a 4 year average);
- (Peak around 2007 caused by LHC construction; current trend for NL seems more fundamental than due to increased Hi-Lumi expenses);
- Services: very difficult, usually requires personnel at CERN;

Best value procurement might help Dutch industry, but recent developments in trying to pilot this are not very positive ...

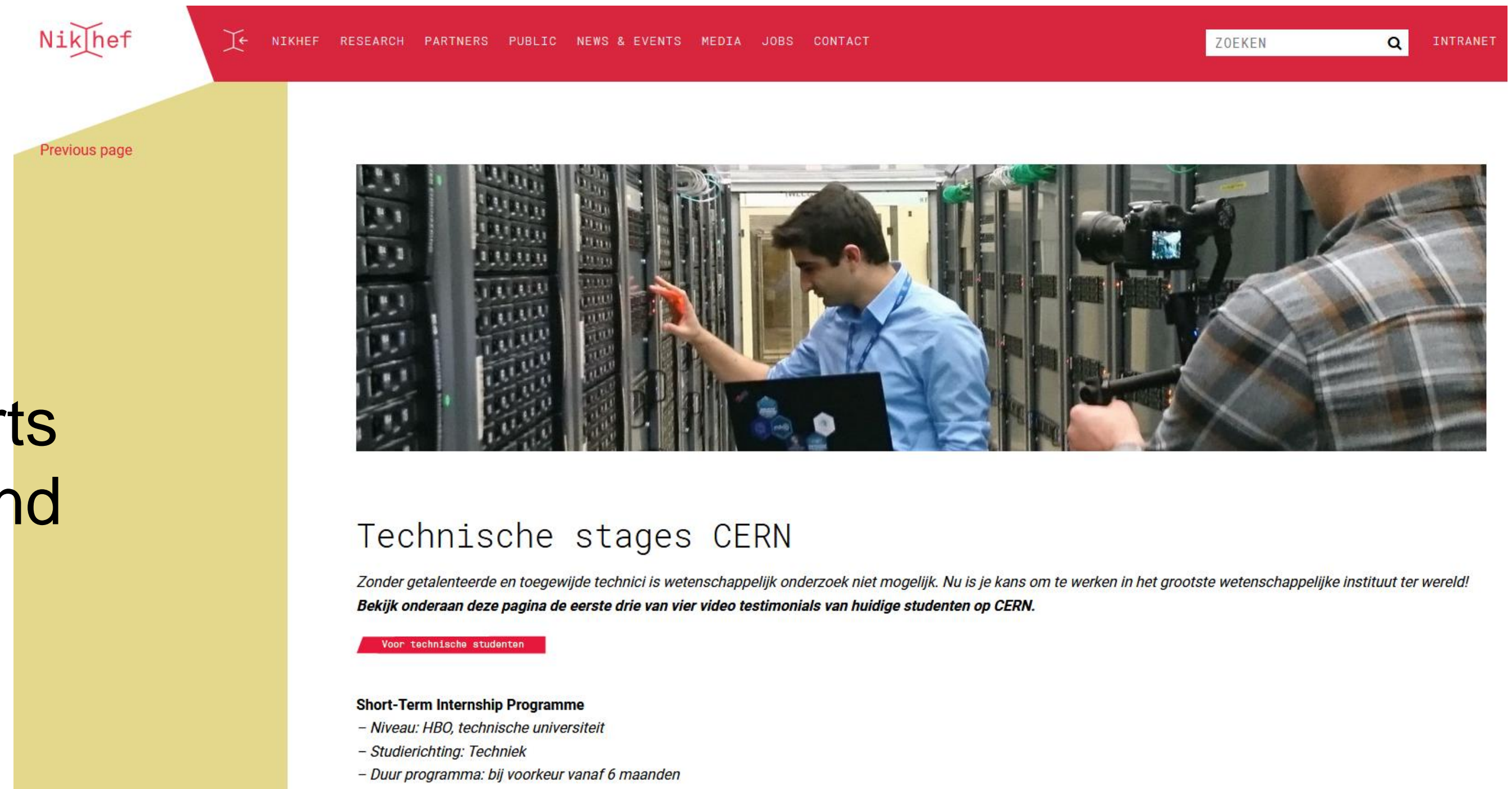


CERN RETURN - ACTIVITIES

ILO tasks:

- Building up network of capable and potentially interested companies;
- Organizing events such as Holland@CERN 2018:
 - 26 companies visited CERN;
 - Several new companies have landed their first orders;

Increase interest in working at CERN: efforts made with technical educational schools and universities as majority of jobs is in the engineering area;



The screenshot shows the Nikhef website header with navigation links: NIKHEF, RESEARCH, PARTNERS, PUBLIC, NEWS & EVENTS, MEDIA, JOBS, CONTACT. A search bar labeled 'ZOEKEN' and an 'INTRANET' link are also visible. The main content area features a large image of a man in a blue shirt working in a server room, with a camera operator filming him. Below the image, the text reads: 'Technische stages CERN', followed by a quote: 'Zonder getalenteerde en toegewijde technici is wetenschappelijk onderzoek niet mogelijk. Nu is je kans om te werken in het grootste wetenschappelijke instituut ter wereld! Bekijk onderaan deze pagina de eerste drie van vier video testimonials van huidige studenten op CERN.' A red button labeled 'Voor technische studenten' is present. Below this, the 'Short-Term Internship Programme' is detailed with the following points: '- Niveau: HBO, technische universiteit', '- Studierichting: Techniek', and '- Duur programma: bij voorkeur vanaf 6 maanden'.

NIKHEF DATACENTER

Some figures:

First floor ('Nikhef housing')

- 275 racks
- 491 kW installed power

Second floor (Nikhef only)

- 47 racks
- 207 kW installed power

Total facility designed for 900 kW

- Last major upgrade: 2009
- Thermal storage system (ground) : 2013.

Energy-efficiency: PUE of ~1.3

Extension (planned for 2020):

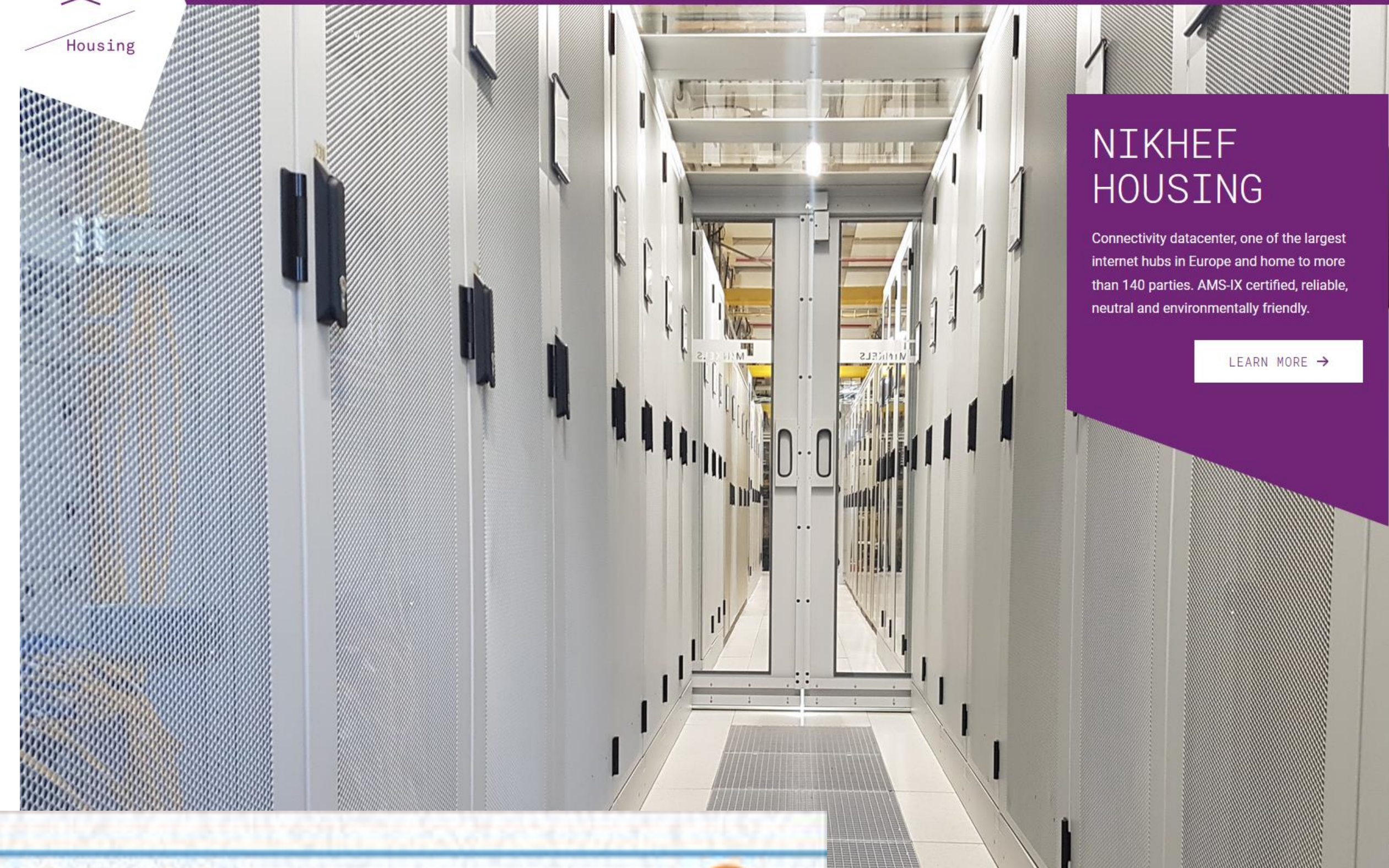
- + 250 kW (+ 80 racks)



FIRST FLOOR

Nikhef housing:

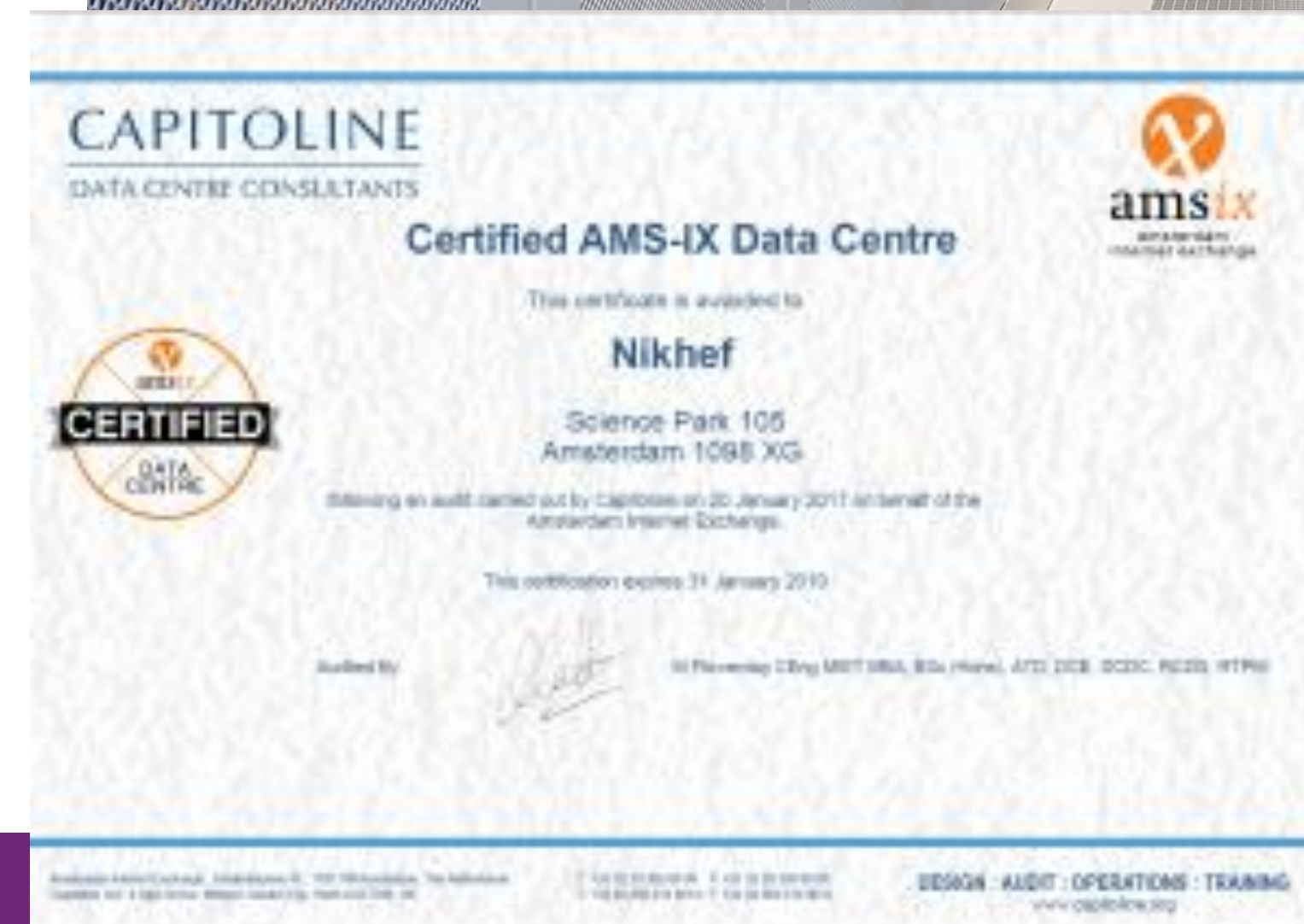
- historical position due to early involvement of Nikhef in internet developments ('80/'90);
- focusing on internet connectivity (not on hosting): more than 170 connected networks (#1 in NL, #7 in Europe, # 14 worldwide);
- *neutral* colocation (not owned by a commercial third party);
- certified AMS-IX data center;
- more than 150 customers generating a sizable turnover (3,5 M€/year);



NIKHEF HOUSING

Connectivity datacenter, one of the largest internet hubs in Europe and home to more than 140 parties. AMS-IX certified, reliable, neutral and environmentally friendly.

[LEARN MORE →](#)



SECOND FLOOR

Scientific activities:

- Computing infrastructure for science;
- Part of the national e-infrastructure (cyberinfrastructure), coordinated by SURF;
- Tier-1 facility (computing and data processing) for the LHC-experiments at CERN;

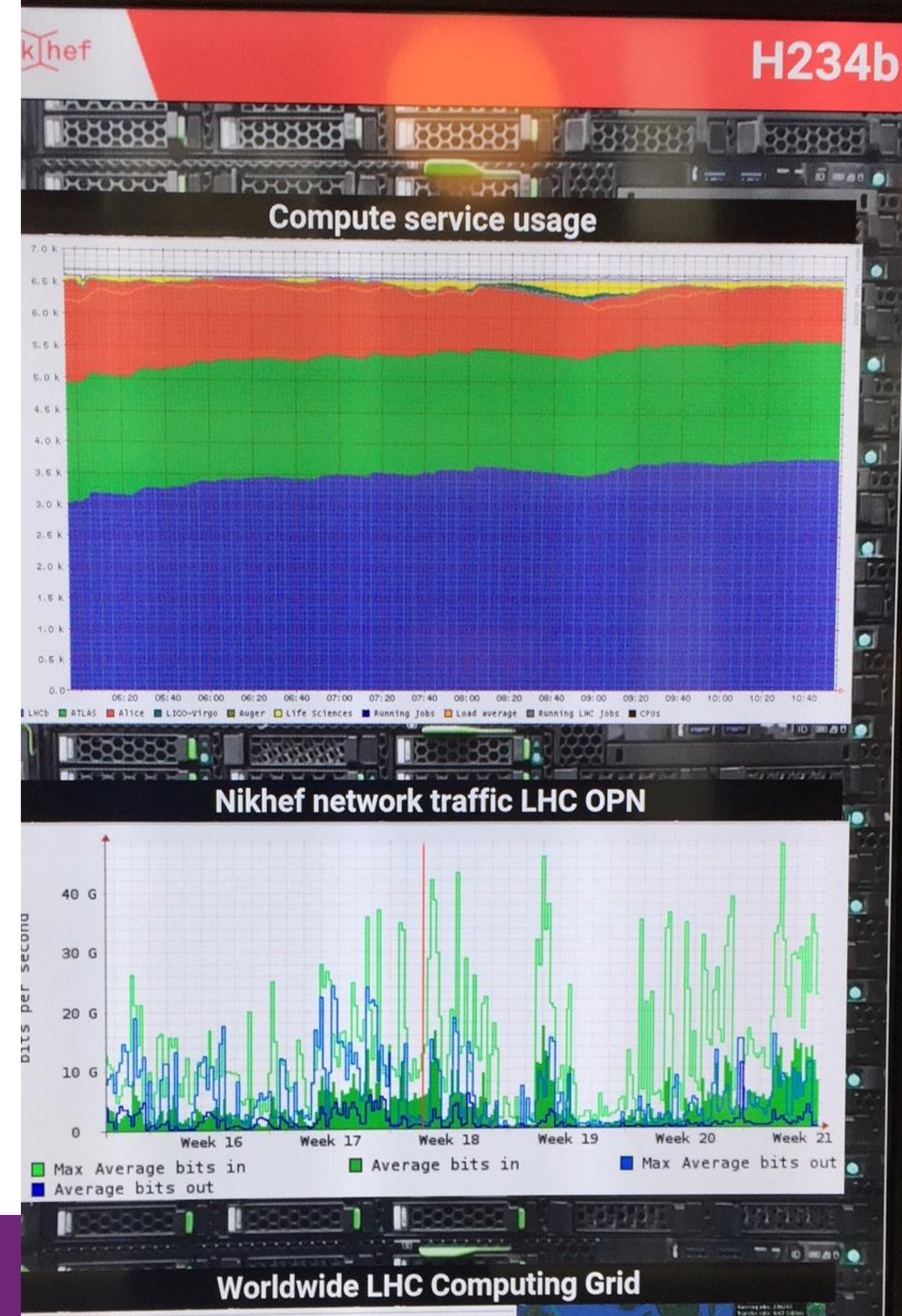
NIKHEF Data Processing Facility Systems

The NDPF is the collection of services that enabled high-throughput data processing at Nikhef and that supports the Dutch National e-Infrastructure. An integral part of the high-speed backbone of Nikhef and closely linked to the other institutes at the Amsterdam Science Park and SURFnet, it comprises many different functions. The NDPF is supported by Nikhef mission and programme resources and by the Dutch National e-Infrastructure.

The most visible element of the NDPF is probably the 5500+ node compute facility, linked with 1.2Tbit to a 5 PByte high-speed distributed storage cluster running a combination of DPM and dCache. But there are also specialised systems for software development, integration testing, authentication and trust services, and network test systems.

Information on the current status is available on the [NDPF Info page](#) and on the [EGI GOCDB status page](#) (authentication required).

The Nikhef NDPF is part of the [Dutch National e-Infrastructure](#), coordinated by [SURF](#). It offers high-throughput platform services (grid) and infrastructure access characterised by bottle-neck free interconnects and high retrieval performance. Nikhef NDPF operates an open private peering policy for data-intensive academic institutions.

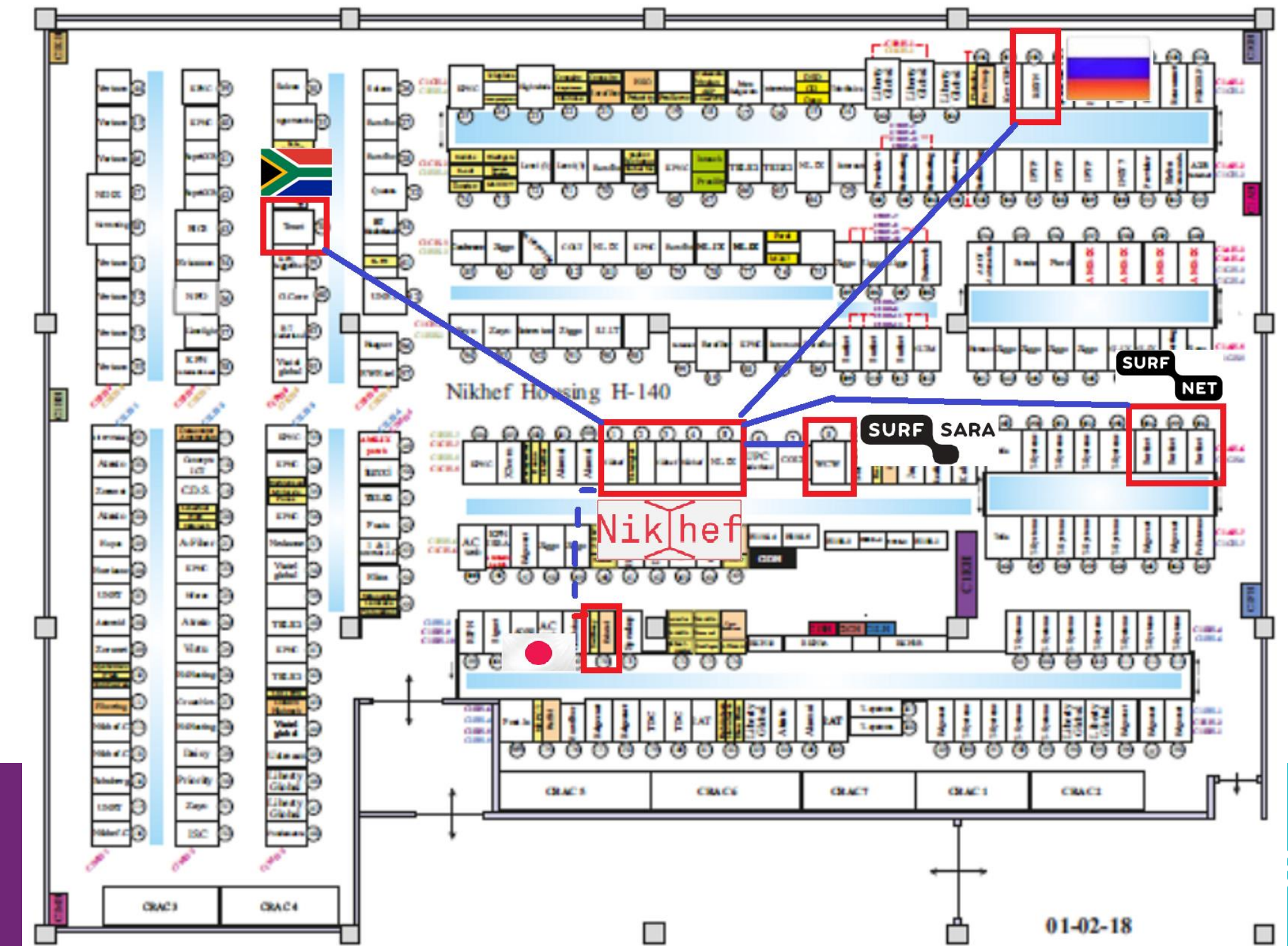
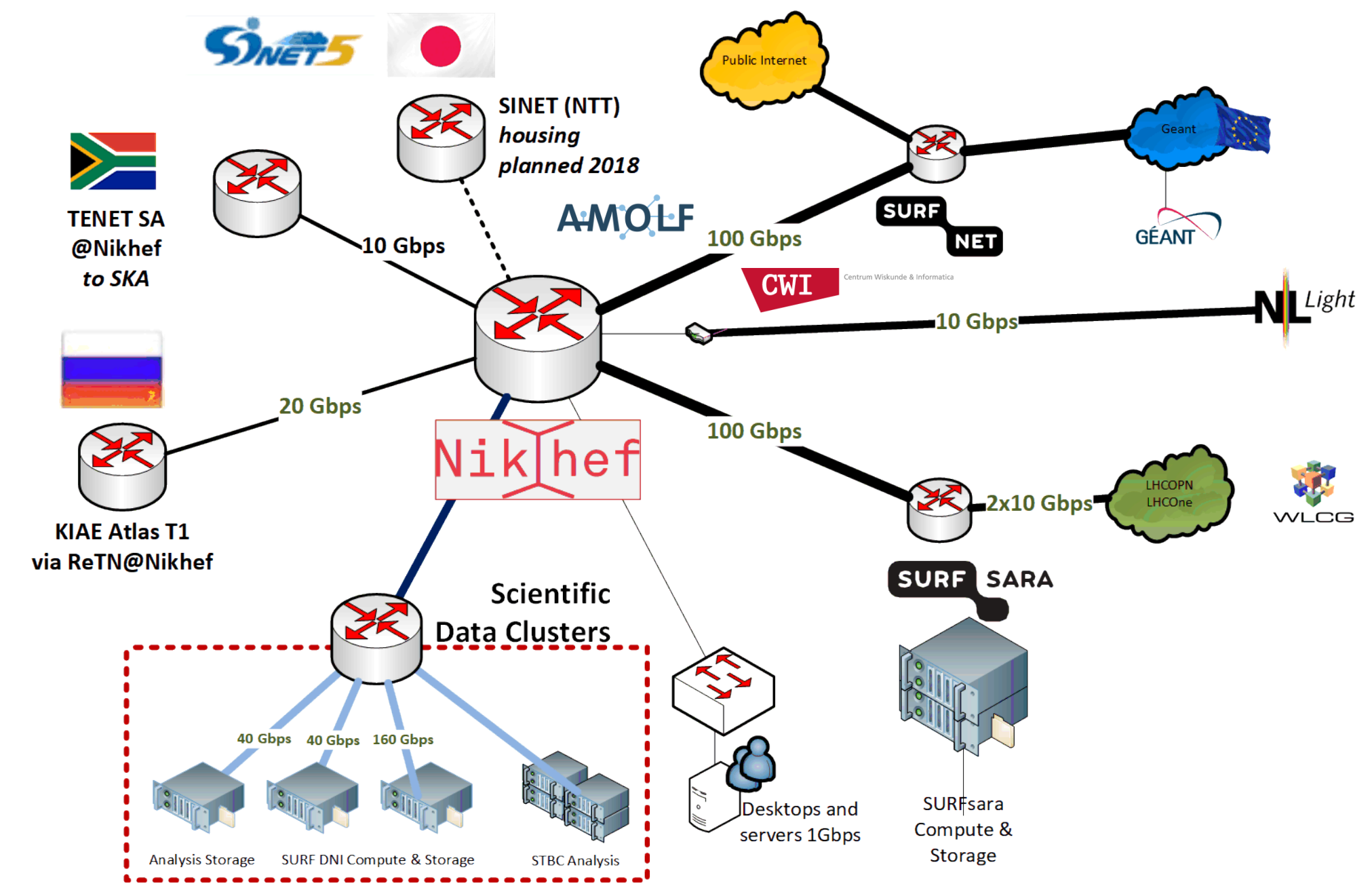
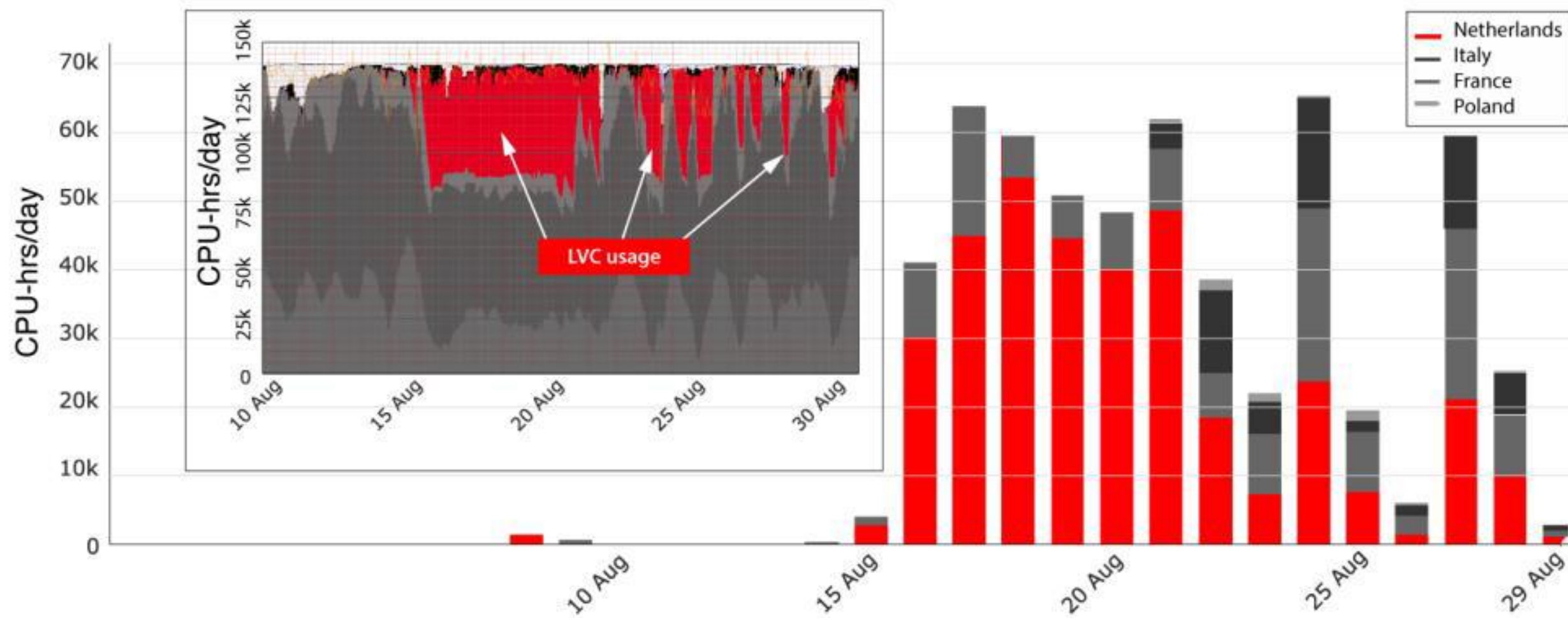


RELEVANCE FOR NIKHEF

Scientific mission

“Excellent computing infrastructure, well connected to experimental collaborations” [SWOT-analysis, Nikhef evaluation 2011-2016]

- ICT is an integral part of each of our experiments.
- Computing infrastructure is our strategic resource in scientific collaborations (LHC Tier-1, Virgo, KM3NeT, Auger, etc.).
- Having your own analysis facility is a competitive advantage.



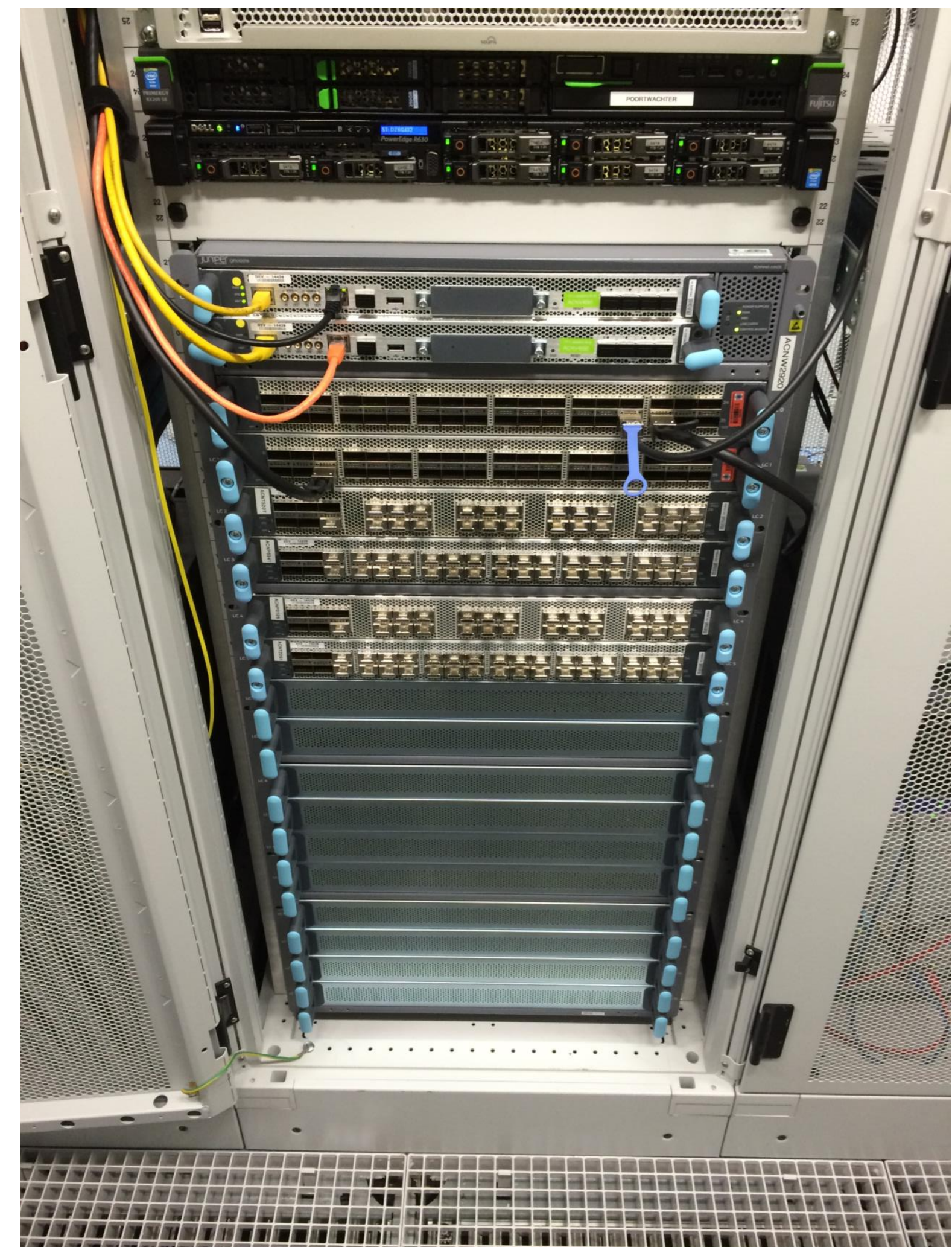
RELEVANCE FOR NIKHEF

Technology transfer:

ICT development:

- Our experiments put heavy requirements on ICT: lots of data, high throughput, distributed;
- Magnet for talent;
- Access to the newest technologies;
- beta-test location for vendors (a.o. Dell, IBM, Fujitsu, Mellanox, Juniper, AMD, Intel);

Datacenter provides a perfect match between scientific and market activities.



Used for 900 Gbit/s test between Nikhef and CERN; first machine worldwide was installed at Nikhef.

QUESTIONS?