European Strategy Update

Particle Physics in the Netherlands

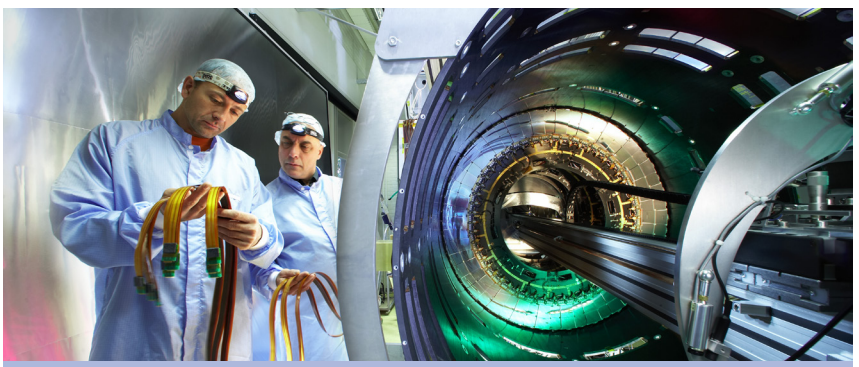
The Netherlands was one of the 12 founding members of CERN in 1954. Dutch researchers have maintained a high profile at CERN and in the field of particle physics ever since.

The National Institute for Subatomic Physics (Nikhef) coordinates and leads the experimental subatomic physics research in the Netherlands. Nikhef is a partnership between the Foundation for Fundamental Research on Matter (FOM) and four universities: Radboud University Nijmegen, University of Amsterdam, Utrecht University, and VU University Amsterdam.

Nikhef's main research ambition is to exploit the discovery potential of CERN's Large Hadron Collider (LHC) program. With the recent discovery of the Higgs particle the LHC program made a superb start. The Dutch ATLAS group aims to study this Higgs particle in detail; the LHCb group strives towards a better understanding of the minute matter-antimatter asymmetry; whereas the ALICE group plans to study the details of a state of matter common in the very early hot Universe: the quark-gluon plasma.

Since a decade, Nikhef is also involved in the relatively new and exciting interdisciplinary research field of astroparticle physics. The main themes of the Dutch researchers in this field are studies of: neutrino point sources using huge detectors deployed at 2-4 km depth in the Mediterranean Sea; cosmic-ray point sources using a 3000 km^2 detector on the Pampa Amarilla in Argentina; gravitational waves using the ultra-precise VIRGO laser interferometer near Pisa in Italy; and dark matter using the deep underground XENON1T detector in Italy.

All these fields require groundbreaking innovative technology, such as detector technology, computational techniques and data handling and analysis. Therefore knowledge and technology transfer to third parties is an integral part of Nikhef's mission.



End-cap of the ATLAS Semiconductor Tracker (SCT) built at Nikhef in the Netherlands.

Society and Skills

Inspiring the next generation
The Netherlands puts great effort in outreach. Nikhef runs Particle Physics Masterclasses every year in which until now hundreds of high school students have participated to work with real data from CERN experiments. The HiSPARC-project gives high-school students a chance to participate in real research by building and running their own cosmic ray detector. High school teachers can find out about the latest developments in particle physics at the Dutch CERN teacher programme.

Top talent for top sectors
More than 1000 students start studying physics in the Netherlands every year. Nikhef delivers on average 15 highly trained PhD graduates to the labour market every year. They have acquired skills that are highly desirable for Dutch industry, in particular in the area of high tech and ICT. An example: the 'Big data' group at KPMG consultants is almost exclusively recruited from Nikhef graduates.

New technologies

A networked world
Since its inception in 1990 at CERN the web has evolved to an essential tool for business, communication, education and leisure. Nikhef has played a pioneering role in bringing the Internet further. Nikhef staff was involved in initiating the internet registry organization RIPE and Nikhef contributed to the establishment of the Amsterdam Internet Exchange (AMS-IX), currently one of the largest Internet Exchanges in the world. A sizable number of AMS-IX customers is still housed at the Nikhef datacenter.

Building on its expertise in networking and distributed computing, Nikhef has through the 'BiG Grid' project contributed heavily to the establishment of an advanced, sustainable national e-infrastructure, including a Tier-1 for CERN.

New technologies, new industries
In a long and close collaboration with Nikhef, Dutch high tech company PANalytical has achieved to successfully market the PIXcel detector, the first commercially available X-ray detector based on Medipix technology. Emanating from the same technology, the Nikhef spin-off company Amsterdam Scientific Instruments (ASI) was established in 2011, which commercialises silicon pixel detector equipment for applications such as medical and analytical X-ray imaging. ASI has already sold several systems to a number of high-profile customers around the world. Another Nikhef spin-off company, Sensiflex, distributes RASNIK alignment systems to industry to monitor slow mechanical deformations of constructions such as bridges and tunnels. RASNIK was originally developed at Nikhef for use in the ATLAS detector at CERN.

Sharing and exploiting knowledge
Nikhef's scientific and advanced instrumentation capabilities offer unique opportunities for adding economic value. Therefore Nikhef has established, together with an investment partner, the company Particle Physics Inside Products (P2IP), with founding shares in Sensiflex and ASI. Through P2IP and in the entrepreneurial environment of Science Park Amsterdam, Nikhef aims to host one of CERN's Business Innovation Centres.