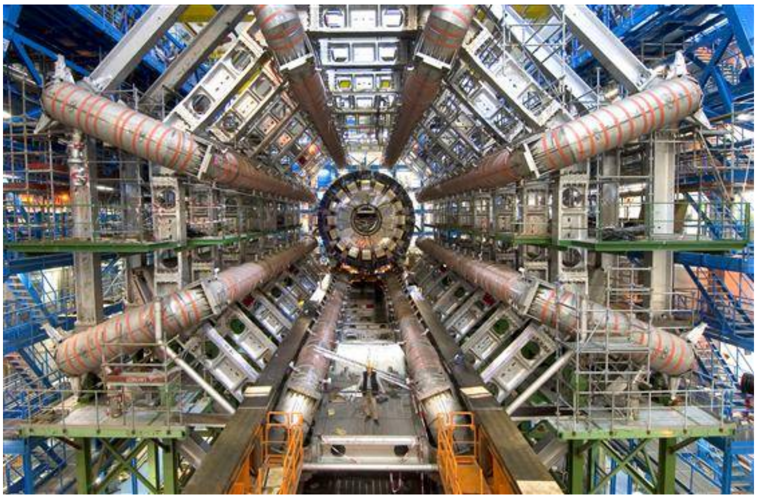
UPPSALA UNIVERSITET

Besök CERN

7 februari 2008



ATLAS

CTF3

GRID

Uppsala University at CERN

The research program at CERN aims at exploring the most basic structure of Matter and the fundamental forces of Nature. High Energy Physics works at the frontier of those domains in micro-cosmos where we so far have no empirical knowledge at all, i.e. the domains beyond the currently well established Standard Model of Particle Physics. The investigation of the smallest particles and the strive towards a unification of the physical forces furthermore has direct bearing on the understanding of how the Universe was created in the Big Bang and on the nature of the recently discovered Dark Matter, which is nowadays thought to constitute the dominant part of the matter in the Universe.

To carry out research in this domain requires very high energy accelerators and colliders, highly specialized and huge particle detector complexes, very advanced computational and data analysis techniques and cutting-edge particle physics theory development. Uppsala University has an extensive research program at CERN with well-focused activities in all of these four domains that are outlined in this leaflet. Through our research program we contribute to the exploration of the fundamental structure of the physical nature. But we also contribute to the development of the front-line technologies and methods that are crucial for this kind of basic research, like new particle acceleration and detection technologies (the Compact Linear Collider and high-speed, high resolution Silicon radiation detectors) and high-level computational techniques (simulation of complex particle processes and the GRID). These technologies play an increasingly important role in medical diagnosis and care (like at the PET center and at the future radiation treatment center in Uppsala), industry (in Uppsala Scanditronix, Scandinova and other companies) and in society at large (e.g. GRID, which is now becoming a sort of superweb).

With the start of the Large Hadron Collider this year CERN will become the leading world laboratory in High Energy Physics for at least a decade. CERN is furthermore the most long term and most extensive international laboratory in the world. Sweden was one of it found members in 1954 and has since contributed to the build-up and success of the laboratory. In this sense we, High Energy Physicists in Uppsala, consider CERN as a crucial extension or branch of our University laboratories without which we would have no way of performing high energy accelerator based research. We are very happy to receive at CERN our University and Faculty management, thus giving us the opportunity to demonstrate to you how we make use of this important branch of Uppsala University.

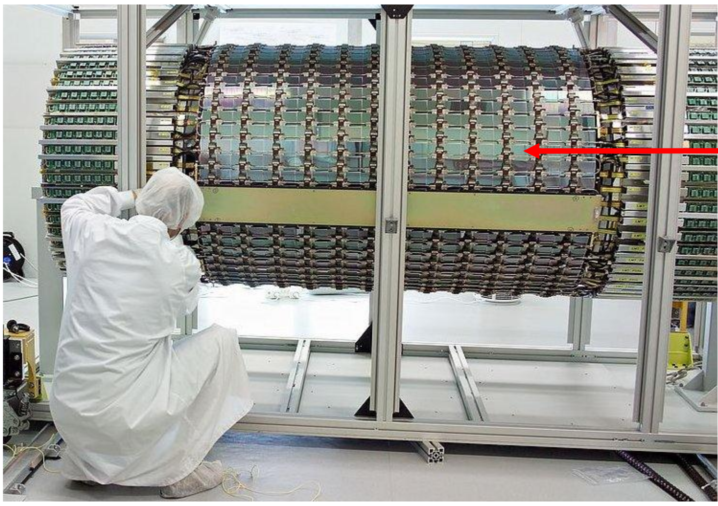
Tord Ekelöf

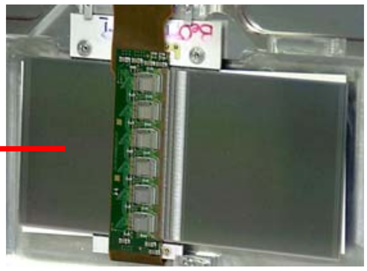
Head of the High Energy Physics sub-department, leader of the Uppsala Group at CERN and of the national Swedish Large Hadron Collider Consortium, Principal Investigator of the Uppsala CLIC Project and of the national SweGrid Project. I am in particular leading the physics analysis program of the Uppsala group and participating in the charged Higgs search analysis in the ATLAS experiment at LHC and, currently, also at the D0 experiment at Fermilab in Chicago.

Inger Ericsson

I am mainly working as personnel administrator and with the organization of conferences, workshops and summer schools for the High Energy Physics sub-department.

ATLAS



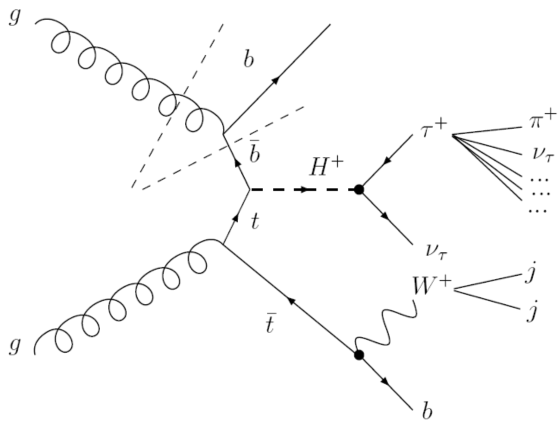


Semiconductor Tracker (SCT)

The ATLAS group in Uppsala has worked since 1992 with R&D and production of several parts of the SCT. Because the detector is near the proton-proton collision point of the LHC, it will be exposed to high levels of radiation. Use and development of radiation hard solutions have been of utmost importance. We did contribute to the development of the radiation hard silicon micro-strip detector for the SCT and we produced 300 modules (15%) for the barrel SCT in our lab in Uppsala. We were in charge of the design and implementation of the Detector Control System for the SCT. We tested the radiation hardness of the components and produced the read out system in our lab in Uppsala and in Swedish industry. Uppsala continues to carry the responsibility for DCS of SCT.

Physics Simulation Studies

We started the search for charged Higgs bosons already in DELPHI, one of the LEP detectors, and this work has continued in ATLAS. If found, the charged Higgs will be an unambiguous signature for physics beyond the Standard Model. In the preparation for ATLAS we have done extensive Monte Carlo simulation studies of Higgs bosons which will have impact on especially how the trigger system in ATLAS will be configured. The Uppsala group has been the dominating group in the charged Higgs study and we have lead this study group in ATLAS for the last two years.



Start of Run and Studies of First LHC Data

The group is now preparing for the start up of LHC this year. We will continue with our involvement in the instrumentation and in particular the DCS system and on-line monitoring of data from SCT. We will also continue to pursue the charged Higgs search on data. We have also expanded our activities towards the development of tools that will be important for the physics performance of ATLAS, and particularly relevant for our charged Higgs searches: we have started work on the optimization of the τ-trigger and we are planning to develop on a tool for the identification of top quarks.

Richard Brenner

I have lead the development and production the SCT detector modules in Scandinavia. I have also led the development of the Detector Control System for the SCT. The system is in its final commissioning phase and I will continue leading that project at the start-up of LHC. I started last year to work with the τ-trigger system which is a challenging system essential for detection of the Higgs and new physics signatures.

Camille Bélanger-Champagne

The trigger is the part of the data acquisition system of ATLAS that selects, out of 40 million particle collisions every second, 100 collisions to be registered for detailed analysis. I work on measuring the performance of the trigger in selecting events that contain a specific particle, the τ lepton. I focus on preparing the trigger performance measurements with the very first LHC data. At the D0 detector at Fermilab, USA, I work to determine if a new analysis method, the Matrix Element method, can be used to discover the existence the charged Higgs boson.

Claus Buczello

I have recently been awarded a forskarassistenttjänst within the Uppsala High Energy Physics sub-department to work with ATLAS physics analysis. I made my thesis project on ATLAS Higgs physics analysis. After my disertation in 2004 I have been working with the D0 experiment at Fermilab and more recently with the LHCb experiment at LHC. My plan is now to focus on the ATLAS physics analysis of the Uppsala group and work with the doctoral students of the group as a coordinator of this activity at CERN.

Elias Coniavitis

I am looking at some of the possibilities for new physics discoveries with ATLAS. Specifically I am performing simulation studies of charged Higgs bosons - particles which if observed would have important consequences for many High Energy Physics theories. In parallel, I have recently started to work on software for on-line monitoring of a part of the ATLAS detector, the Semi-Conductor Tracker, which will allow experts to quickly access information about the status of individual components.

Arnaud Ferrari

In 1999, I received my PhD degree in high-energy physics on the search for heavy neutrinos and detector development at the ATLAS experiment. I then worked with the CLIC and CTF3 projects (2 years at CERN and 6 years in Uppsala) where, in addition to instrumentation design and beam dynamics studies, I performed several high-energy physics studies, in particular on heavy neutrinos and more recently on charged Higgs bosons. Physics beyond the Standard Model has always been my major motivation for research and, in view of the outstanding opportunities offered by the close start-up of the LHC, my main focus is now the search for new physics in ATLAS, in particular charged Higgs bosons.

Martin Flechl

I am working in the Higgs group of the ATLAS Collaboration and mainly involved in searches for the charged Higgs boson, an observation of which would be a definite signal of new physics beyond the current models in particle physics. I am convener of the ATLAS charged Higgs group, currently comprising about 25 people from 13 institutes. At the moment we are using simulated particle collision events in order to prepare for the data-taking phase of the LHC.

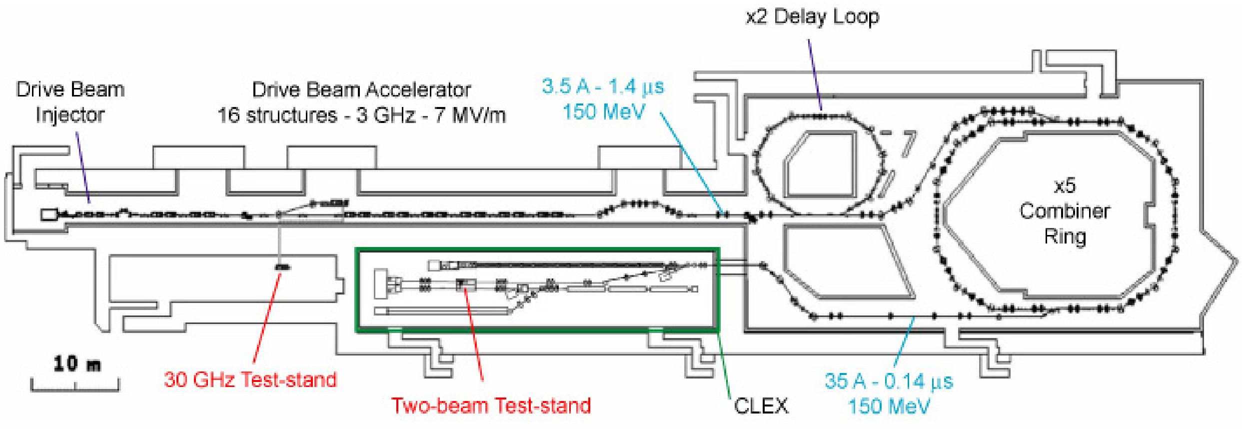
Nils Bingefors

The architect behind the design of the read-out electronics for the Detector Control System. Produced and tested a large part of the system in Uppsala.

Lars-Erik Lindquist

Did the advanced work in the production of the SCT modules in Uppsala. Continued at CERN with the installation of SCT and contributed to the testing and commissioning of the Detector Control System.

Two-beam Test-stand for CTF3



Design, construction, commissioning and utilization of two 17 m long fully equipped beam lines with support structures, magnets, vacuum components, and beam diagnostics.

The Two-beam Test-stand (TBTS) is a central part of the CTF3 installation to test the key-components of the two-beam acceleration scheme that will make the next generation of linear colliders possible. The TBTS is the place where essential questions regarding the realization of the Compact Linear Collider (CLIC), identified by an international committee, will be answered:

- Test of devices for microwave power-generation and beam acceleration.
- System integration of power generation and acceleration with probe-beam.

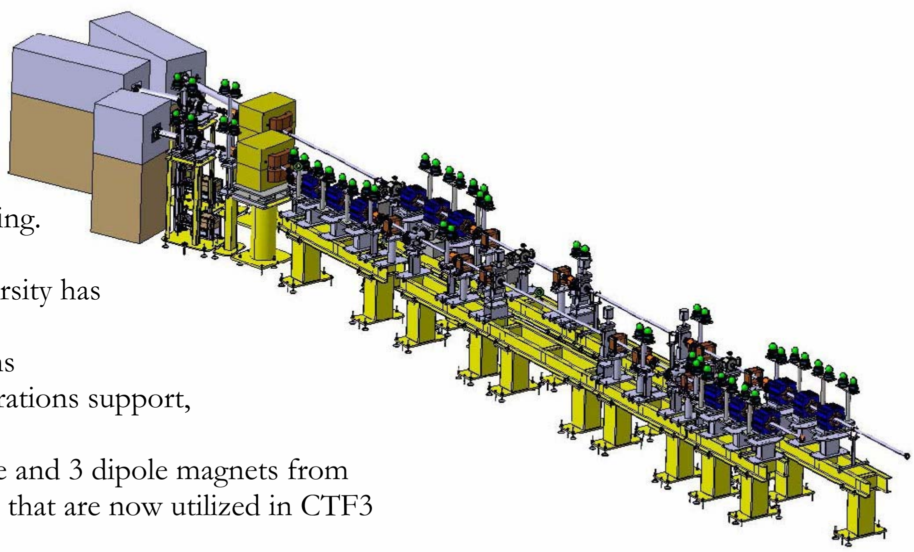
High visible and well-recognized contribution from Uppsala within the CTF3 collaboration

Supported by UU through personnel and by VR and KAW with about 16 MSeK until early 2010.

Utilization of the investment beyond 2010 is unclear. FP7 application pending.

Apart from the TBTS, Uppsala University has contributed to CTF3 by

- beam dynamics simulations
- beam diagnostics and operations support, partially funded by FP6
- donation of 16 quadrupole and 3 dipole magnets from The Svedberg Laboratory, that are now utilized in CTF3



Peder Eliasson

As a doctoral student, I have for four years been working on the study and optimization of beam quality preservation in the main linac of future high-energy linear colliders. Preservation of the beam quality is absolutely essential in order to obtain favourable conditions for the physics experiments in these next-generation colliders. Due to the complexity of the colliders and the extreme requirements on beam quality, the preservation is a challenging task. Ground motion, power supply noise, magnet displacements, monitoring errors, and many more imperfections have to be considered during the design of efficient feedback systems and other preservation means (e.g. so-called beam-based alignment).

Magnus Johnson

The acceleration structures for future linear colliders are limited by discharge due to the extremely high surface electric field which will limit the performance and reliability of the entire accelerator. I analyze the effect of the discharge on the primary beam trajectories and ejected secondary particles. To make the measurement possible I participate in the construction of the two-beam test-stand especially the diagnostic system such as the beam position monitors.

Roger Ruber

At my dissertation I was offered a position at the CELSIUS accelerator in Uppsala. I spend a sabbatical at the KEK laboratory in Japan on the development of LHC magnets, and was asked by ATLAS to take charge of the installation and commissioning of their superconducting central solenoid. Last year I was appointed researcher at the High Energy Physics sub-department and project manager of the CTF3 Two-beam Test-stand.

Volker Ziemann

After post-doctoral positions at SLAC and CERN and a position at the CELSIUS accelerator in Uppsala I joined the high-energy physics group and am presently heading accelerator related projects, mainly focussed on CLIC at CERN and the XFEL at DESY. Recently I was appointed director of the 'Center for Accelerator and Instrumentation Development'.

GRID Computing Projects

The grid is a technology with cross-disciplinary usage. NDGF and SweGrid resources are used by researchers from other academic fields, such as bioinformatics and quantum chemistry. There are also users from industrial research projects.

NorduGrid

The High Energy Physics group at Uppsala University is one of the founders of the NorduGrid Collaboration. NorduGrid has developed the grid middleware Advanced Resource Connector (ARC). ARC is used for connecting geographically distributed computing resources to larger grid systems. ARC has e.g. been used to connect Sweden's national grid infrastructure SweGrid. The NorduGrid (ARC) resources used by ATLAS have shown a remarkable efficiency w.r.t. the number of successfully completed jobs. Data to the left represents one week in January 2008.

grid	*success*	*failure*	*efficiency*
LCG	6313	7224	46.6%
OSG	1515	433	77.8%
None	1998	664	75.1%
Nordugrid	6357	447	93.4%
total	*16183*	*8768*	*64.9%*

KnowARC

KnowARC is a project supported by the European Union's 5th framework programme. Its goals are to further develop ARC by adapting it to new grid standardisation initiatives, implement extended functionalities and improve its interoperability with other grid middlewares.

Nordic Data Grid Facility (NDGF)

NDGF coordinates computing resources in the Nordic countries for users with large computing needs. NDGF is supported by the Nordic countries through the Science Councils' cooperation body NOS-N. NDGF is one of 10 Tier-1s for ATLAS that provide computing and storage resources for the experiment. NDGF's resources are distributed among various computing centres in the Nordic Countries and are connected with ARC. NDGF's Tier-1 has delivered computing time to the worldwide LHC computing grid. The accounting data shows that NDGF's Tier-1 was the biggest European Tier-1 for ATLAS during 2007. NDGF's Tier-1 delivered 10% of the computing time for ATLAS and 12% for Alice in 2007.

Normalised CPU time [units 1K.SI2K.Hours] by TIER1 and VO							
TIER1	**alice**	**atlas**	**cms**	**lhcb**	**Other VOs**	**Total**	**%**
CA-TRIUMF	0	4,463,305	0	0	24,809	**4,488,114**	**6.73%**
CH-CERN	2,425,120	1,962,054	2,623,014	904,796	395,677	**8,310,661**	**12.46%**
DE-KIT	2,529,727	1,510,853	2,154,989	1,004,171	71,809	**7,271,549**	**10.90%**
ES-PIC	0	904,885	850,552	510,898	15,223	**2,281,558**	**3.42%**
FR-CCIN2P3	2,408,281	2,052,169	1,928,082	696,294	4,218,657	**11,303,483**	**16.95%**
IT-INFN-CNAF	1,162,184	1,698,409	1,560,147	833,114	2,245,540	**7,499,394**	**11.25%**
NDGF	1,230,314	2,618,708	0	0	7	**3,849,029**	**5.77%**
NL-T1	483,529	932,599	225	908,622	1,172,615	**3,497,590**	**5.25%**
TW-ASGC	0	498,288	412,239	0	514,375	**1,424,902**	**2.14%**
UK-T1-RAL	304,466	1,292,661	601,991	571,041	444,599	**3,214,758**	**4.82%**
US-FNAL-CMS	0	2,752	6,488,710	0	0	**6,491,462**	**9.74%**
US-T1-BNL	0	7,049,143	11	0	0	**7,049,154**	**10.57%**
Total	**10,543,621**	**24,985,826**	**16,619,960**	**5,428,936**	**9,103,311**	**66,681,654**	
Percentage	**15.81%**	**37.47%**	**24.92%**	**8.14%**	**13.65%**		
Click here for a csv dump of this table							

Mattias Ellert

I was one of the original middleware developers in the NorduGrid collaboration and have been working with ARC development since the start of the project, especially with developing client libraries and tools. I am now working as a developer for NDGF where I continue to develop ARC for the needs of the NDGF users, e.g. the LHC experiments.

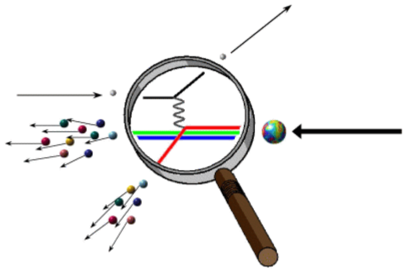
Bjarte Mohn

I am just starting in the Uppsala group as a middleware developer in the KnowARC project. My project is to adapt ARC to new standards for increased interoperability with other middlewares.

Theoretical High-Energy Physics

The activities in high-energy physics theory are directly connected to the experiments Uppsala are a part of at CERN. With the approach of phenomenology (= experiment-oriented theory), we study how new physics would show up in the experiments, and what consequences new discoveries have for understanding the world at the smallest scales.

During the last years, it has become evident that understanding the particle world is important also for explaining astronomical observations of the large-scale Universe. The most promising attempts to explain the Dark Matter, which is found to be four times as abundant as ordinary matter in the Universe, are in terms of additional elementary particles.



In particular, the group in Uppsala focuses on the theory of the strong interaction (QCD) and its manifestations in ee, ep and pp collisions. The group also has a broad program in Higgs physics beyond the Standard Model and issues related to electroweak symmetry breaking.

Naturally, to study fundamental questions like these requires advanced tools; in our case mostly in the form of Monte Carlo computer programs to simulate full scattering events in the particle detectors. Such codes are therefore developed and used extensively both in Uppsala and by fellow researchers world-wide. The demand for computing power increases with the complexity of the physics under study. This requires that the software developed is both efficient and portable. LEPTO, MAJOR, MATCHIG, and SuperIso are examples of codes developed and maintained by the Uppsala THEP group.

Johan Rathsman

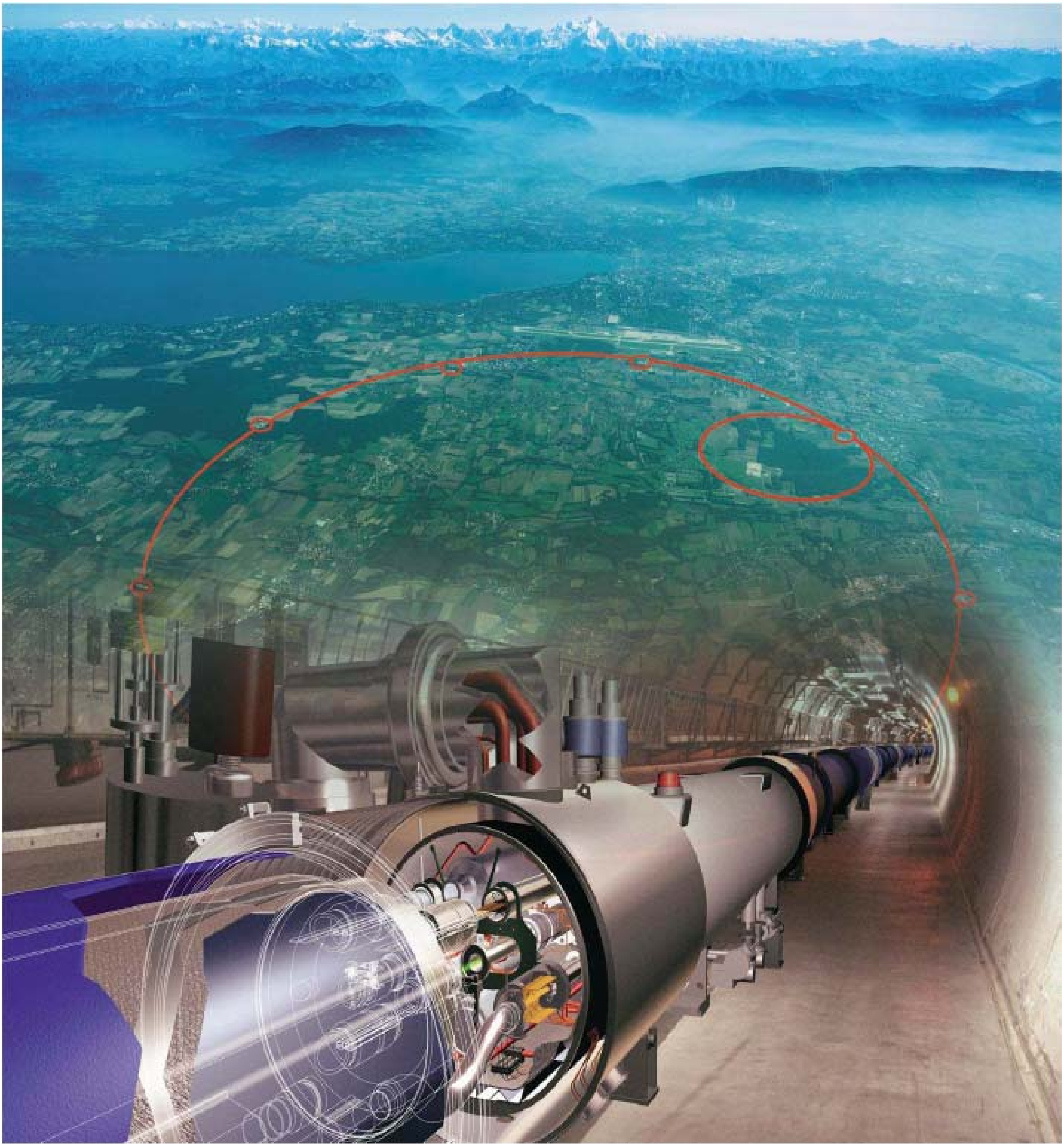
In the last few years I have mainly worked on exploring to what extent the experiments at the LHC will be able to find out the mechanism behind electroweak symmetry breaking. By combining our knowledge on the known electroweak and strong forces with assumptions on possible new physics I make precise theoretical predictions for the LHC experiments and study what type of new physics signals that can be detected. I find it very stimulating to work in close collaboration with the experimental group in achieving this.

Nazila Mahmoudi

Finishing my first postdoc, in Canada, I was very happy to arrive in Uppsala last year. The autumn I spent working on a program which calculates indirect constraints on Supersymmetric physics scenarios using data from earlier measurements. I'm looking forward to the LHC experiments delivering some new results to check the theories directly.

Oscar Stål

Right now I am trying to identify clever search strategies for charged Higgs particles at the LHC. I find it very exciting to participate at the forefront of research, especially since it combines two of my main interests: physics and computer software. It is not difficult to recognize how your new skills are applicable also outside the university, which to me is another advantage.



Leaflet for the visit of Uppsala University Rector to CERN, 7th February 2008.
Editor: Roger Ruber

Further information:
http://www.isv.uu.se
http://cern.ch/ctf3-tbts
http://cern.ch/atlas-magnet