

FACES AND PLACES

CERN

Merkel sees preparations for LHC...

As CERN prepares for the start of the LHC, Angela Merkel, the Chancellor of the Federal Republic of Germany, paid a visit to the laboratory on 29 April, making her the first German chancellor ever to come to CERN.

On arrival she was warmly welcomed by Robert Aymar, CERN's director-general, and introduced to the next director-general, Rolf-Dieter Heuer, along with members of CERN's upper management. The first stop on the subsequent tour was the ATLAS control room, where she was greeted by ATLAS spokesperson Peter Jenni, before travelling 100 m underground to the ATLAS experimental cavern and the LHC tunnel. The chancellor asked questions and showed a strong interest in what she saw throughout the visit, undoubtedly aided by her PhD in physics.

Merkel also met with 13 young German scientists working at CERN. The laboratory is an important centre for the training of future scientists and technical experts; every year between 50 and 100 doctoral theses prepared in the framework of CERN projects are completed at German universities.

German physicists have made important contributions to the construction of the LHC experiments. There are about 200 German scientists and engineers among CERN's personnel and of all the member states, Germany pays the largest contribution, 20% of the total budget. Of the 9000 or so scientific users at CERN, around 900 are German.



German Chancellor Angela Merkel and members of CERN's upper management. From left to right: Maximilian Metzger, secretary-general; Robert Aymar, director-general; Angela Merkel; Rolf-Dieter Heuer, future director-general; Jos Engelen, chief scientific officer; Sigurd Lettow, chief financial officer.



Angela Merkel (right) in the LHC tunnel with CERN's director-general, Robert Aymar (left).

...and German and Swiss ministers follow suit

Merkel was followed four weeks later by the German Federal Minister of Education and Research, Annette Schavan, and the Head of the Swiss Federal Department of Foreign Affairs, Micheline Calmy-Rey. The two ministers paid a joint visit to CERN on 23 May. After an introduction from director-general, Robert Aymar, the ministers signed the guest book. They then took the opportunity to tour the ATLAS experiment and the underground LHC tunnel, where they were guided by ATLAS spokesperson Peter Jenni.



German Federal Minister of Education and Research Annette Schavan (centre left) and the Head of the Swiss Federal Department of Foreign Affairs, Micheline Calmy-Rey (centre right), in front of the ATLAS experiment, accompanied by (left to right) Jos Engelen, Rolf-Dieter Heuer, Robert Aymar and Peter Jenni, ATLAS spokesperson.

WORKSHOP

Elba provides a view of the top



Participants at the 2008 International Workshop on Top Quark Physics in a good mood on a sunny day – finally. (Courtesy INFN-Pisa.)

After a successful start in 2006 on the Atlantic coast of Portugal, the International Workshop on Top Quark Physics moved to a location a little farther away from the “home of the top quark” (Fermilab, where it was discovered in 1995) and a little closer to CERN, where the LHC is expected to become a “top factory”. In May the island of Elba provided the setting for the second meeting in the series. The format of plenary talks only, with an almost equal time devoted to discussions as to presentations, was optimal for a rich exchange of ideas, as much as for dealing with a number of hot topics on both the experimental and the theoretical sides. The following few highlights give a taste of the meeting.

While the CDF and D0 experiments at Fermilab’s Tevatron provided the bulk of the results, speakers from the ATLAS and CMS collaborations at the LHC put forward many ideas for new measurements. With one top-pair per second in the low-luminosity phase ($10^{33} \text{ cm}^{-2} \text{ s}^{-1}$), the LHC experiments will have the chance to explore many new areas, although it was evident that some, which are already studied at the Tevatron (e.g. the top mass), will present a challenge.

The production cross-section for top-antitop with its current

accuracy is challenging not only the next-to-leading-order calculations available but also our understanding of the parton distribution functions. The large uncertainties in the predictions for the LHC call for a new programme of measurements aimed at improving our understanding of those quantities.

Doug Glenziski of Fermilab presented the new measurements of the top mass from the Tevatron. The accuracy of this measurement, which approaches the level of 0.8 % ($1.4 \text{ GeV}/c^2$), spurred a hot debate both on its interpretation on the theoretical side and on which observables are best suited to provide the top quark mass. Scott Willenbrock’s summary talk provided a short introduction to this subject.

Another hot topic was the elusive electroweak production of the top quark. The evidence for single top, which is still an effect of about 3σ after seven years of running the Tevatron collider, will have to wait a little longer to become an observation. In the meantime its naïve interpretation as directly related to the V_{tb} element of the Cabibbo–Kobayashi–Maskawa (CKM) matrix has been challenged, because the exploitation of the third family as a probe for new physics

calls for relaxing many assumptions that are true within the Standard Model. Not surprisingly, the possibility of improving direct measurements of the CKM elements involving the top quark was one of the highlights of the workshop. Despite the large uncertainties, a few brave souls are already using the determination of the CKM elements involving top to set limits on new physics. Does this mean that there is room for a new Ufit collaboration? It should at least provide more food for thought for the existing one.

Many speakers stressed the need for better Monte Carlo (MC) simulations in order to go to new physics, and a whole session was devoted to top-specific MC tools. The lively discussions showed that we need more data from the Tevatron and, of course, the LHC.

Statistics was one topic under discussion so, a few statistics on the meeting are not out of place. There were 117 participants, most of them students or postdocs, including a number of theoreticians. All of this calls for a third workshop, to be held in 2010 in a place still to be discovered (unlike top quark) but for which we have some evidence (like for single top). Now, 13 years after its discovery, this quark as heavy as gold has found its “home”.

COLLABORATION

CERN and Turkey agree on cooperation...

On 14 April, Okay Cakiroglu, president of the Turkish Atomic Energy Authority (TAEK), visited CERN, accompanied by Ahmet Uzumcu, the permanent ambassador of Turkey to the United Nations in Geneva, and by Ali Tanrikut, the deputy director of TAEK. During the visit, Cakiroglu and CERN's director-general, Robert Aymar, signed an international cooperation agreement.

At the signature, Cakiroglu expressed his hopes that this agreement will enhance the cooperation between TAEK and CERN, and added that it will motivate Turkish scientists and engineers. He also noted that this is an important milestone towards Turkey's membership of CERN. Turkey has been an observer state of CERN since 1961, and has participated in the CHARM, SMC and CHORUS



Signature of the cooperation agreement between Turkey, represented by the president of the Turkish Atomic Energy Authority, Okay Cakiroglu, and CERN, represented by the director-general, Robert Aymar.

experiments. Turkish physicists are now actively involved in the CMS, ATLAS, ALICE

experiments at the LHC and in the CERN Axion Solar Telescope.

...while Saudi Arabia signs up to new protocol



Mohammed I Al-Suwaiyel, president of King Abdulaziz City for Science and Technology, shakes hands with CERN's Robert Aymar, on signing a protocol to the 2006 international cooperation agreement.

On 9 May, Mohammed I Al-Suwaiyel, president of the King Abdulaziz City for Science and Technology, representing the Government of Saudi Arabia and accompanied by members of the Saudi Arabian Government, visited CERN. Al-Suwaiyel and CERN's director-general, Robert Aymar, signed a protocol to the 2006 international cooperation agreement

between CERN and Saudi Arabia defining the operational framework needed to carry out various specific tasks provided for in the cooperation agreement. These tasks will help promote the development of a high-energy particle physics community in Saudi Arabia, as well as providing an illustration of the visible participation of Saudi Arabia as a member of the global CERN community.

APPOINTMENTS



Achim Richter (right) will take over at ECT from Jean-Paul Blaizot. (Courtesy ECT*.)*

ECT* selects Richter as its next director

Achim Richter, former chairman of CERN's ISOLDE experiments committee, will be the next director of ECT*, the Centre for Theoretical Studies in Nuclear Physics and Related Areas located in Trento. He is currently director of the Institut für Kernphysik at Technische Universität Darmstadt and will succeed Jean-Paul Blaizot as director of ECT* on 1 November. After four years in office Blaizot will return to the Theory Division of CEA Saclay.

Richter's scientific interests span a range of physics, including nuclear structure and reactions, atomic physics, accelerator physics, symmetries, invariance principles and nonlinear dynamics.

Merminga takes charge of accelerator division at TRIUMF

TRIUMF, Canada's national laboratory for particle and nuclear physics, has announced the appointment of Lia Merminga as the new head of its Accelerator Division. She moves to TRIUMF from Jefferson Lab, where she has been director of the Centre for Advanced

Studies of Accelerators since May 2002.

Merminga, who has degrees from the University of Athens and the University of Michigan in Ann Arbor, is widely recognized for expertise in identifying problems and solutions associated with the push for higher-energy, higher-quality accelerator beams, and developing concepts for new accelerators. She has worked in advanced accelerator physics for 20 years, specializing in the physics and technology of energy-recovery linacs, high average power free-electron lasers, linac-ring colliders, multibunch instabilities in recirculating linacs, RF control and modelling, and nonlinear



Lia Merminga (Courtesy Jefferson Lab.)

dynamics. She is internationally known for her contributions to the design of potential applications of energy-recovery linacs.

INAUGURATION

NTU launches a new centre for cosmology

The National Taiwan University (NTU) in Taipei has inaugurated the Leung Center for Cosmology and Particle Astrophysics (LeCosPA). The centre has been made possible through a donation of NT\$205 million (around US\$7 million) from Chee-Chun Leung, co-founder and vice president of the Taiwan-based company, Quanta Computers Inc.

Leung studied physics at NTU, together with Pisin Chen, the cosmologist who is the first director of LeCosPA and NTU C C Leung Prof. of Cosmology. Chen, formerly of the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC) at Stanford University, has recently joined the faculty of NTU.

Leung became fascinated by high-energy physics and astrophysics when he was an undergraduate at NTU, but eventually entered the electronics industry. When his fellow student and friend Chen decided to join NTU to help promote cosmology and particle astrophysics, he resolved to provide the additional resources for Chen to realize his dream.

NTU has recently enjoyed an increasing number of major donations. At the inauguration, the president of NTU, Si-Chen Lee, stressed the uniqueness of Leung's donation, being the first for pure science. Moreover, the donation will be used mainly for the operation of LeCosPA rather



Chee-Chun Leung and NTU president Si-Chen Lee sign the LeCosPA donation contract, with (from left to right) Yee Bob Hsiung (NTU physics department chair), Ming-Je Tang (NTU vice-president of finance), Mrs Leung, Tai-Jen George Chen (NTU academic vice-president), Pisin Chen (LeCosPA director) and Pauchy W-Y Hwang (chairman of ceremony) observing. (Courtesy Yu-Chung Chen.)

than for its buildings.

International experts in cosmology and particle astrophysics attended the inauguration ceremony. In addition to Leung and Lee, distinguished speakers at the ceremony included the president of the National Central University, Luo-Chuan Lee, the Pehong and Adele Chen Director of KIPAC, Roger Blandford, and Joseph Silk the Savilian Prof. of Astronomy at Oxford University.

At the inauguration, Chen recalled the time when he and Leung founded an astronomy society at NTU. They bought a piece of window glass from the nearby Kee-Lung harbour, which had become a centre for the disintegration of retired ocean liners, and ground it night and day to build Taiwan's first eight-inch telescope.

Now Chen has the opportunity to turn LeCosPA into an important active centre

of cosmology and particle astrophysics. Blandford has already proposed that KIPAC and LeCosPA should develop special ties for collaboration.

● For more about LeCosPA see the web: <http://lecospa.ntu.edu.tw>.

MEETINGS

NNN08, the **2008 International Workshop on Next Generation Nucleon Decay and Neutrino Detectors**, will be held at Paris 7 University Denis Diderot campus on 11–13 September. Hosted by the AstroParticle and Cosmology Laboratory, it will be the eighth in a series of workshops to discuss future large underground detectors, as well as the theoretical work that motivates and describes such advances. New detectors will explore proton decay lifetimes and advance understanding of the neutrino sector, including

AWARDS

Art Poskanzer receives the Bonner prize from the APS

The Tom W Bonner prize is the only American award in experimental nuclear physics, and for the first time it has been given for work in relativistic nuclear collisions. Art Poskanzer received the prize at the April Meeting of the American Physical Society (APS) "in recognition of his pioneering role in the experimental studies of flow in relativistic heavy-ion collisions". In his acceptance talk, he stressed the important contributions of his colleagues, especially Sergei Voloshin of Wayne State University and Hans Georg Ritter of Lawrence Berkeley National Laboratory (LBNL).

Poskanzer, who is now a distinguished senior scientist emeritus at LBNL, was the first scientific director of the Berkeley Bevalac, the first relativistic nuclear accelerator. At the Bevalac he was co-discoverer of the collective flow of nuclear matter, the phenomenon in which nuclear matter, compressed to a state of high temperature and density, exhibits a fluidic motion.

Poskanzer also has connections with CERN, dating back to 1971 when he collaborated in a PS experiment with the Orsay group. He participated in work at ISOLDE, WA80, NA35 and NA49. He helped to initiate the heavy-ion programme at the SPS and was deputy spokesperson of NA49. He then became co-founder of the STAR collaboration at Brookhaven's Relativistic Heavy Ion Collider.



Art Poskanzer (left) receives the 2008 Tom W Bonner prize from Arthur Bienenstock, president of the American Physical Society. (Courtesy APS.)

Poskanzer's work on collective flow in NA49 led to similar work in the STAR experiment, where large elliptic flow has been found (*CERN Courier* March 2007 p35). Here the experimental observations have provided important evidence for the existence of strongly coupled quark–gluon plasma with the characteristics of a perfect liquid.

IUPAP recognizes young researchers in particle physics

The International Union of Pure and Applied Physics (IUPAP) has announced the award of its first Young Scientist Prizes in Particle Physics to Yasaman Farzan of the Institute for Research in Fundamental Sciences (IPM), Tehran, and Kai-Feng Chen of the National Taiwan University, Taipei. The prize was recently established by IUPAP to recognize the scientific achievements of outstanding young experimental and theoretical particle physicists.

Yasaman Farzan receives the prize for her highly regarded theoretical contributions to neutrino and lepton physics. She has made several innovative conjectures, including the measurement of CP violation in the lepton sector, the extraction of neutrino mixing parameters from high-energy neutrinos, and supernova cooling processes involving new, weakly interacting particles. Many of her predictions will be addressed by future experiments in neutrino and lepton physics.

Kai-Feng Chen has made creative and innovative contributions to the analysis of B-meson decays with the Belle experiment at KEK. Among them is the very important measurement of time-dependent CP violation in $b \rightarrow s$ transitions and polarization measurements in B-decays. His contributions resulted in highly cited publications of the Belle experiment. He has recently started work with CMS.

mass hierarchy, more oscillation parameters, CP violation, supernova dynamics and high-energy cosmic neutrino sources. For more information, see <http://nnn08.in2p3.fr/>.

The **Pixel 2008 Workshop** will take place at FermiLab in Batavia, Illinois, on 23–26 September. The event will cover pixel electronics and sensors, high-density detector processing and interconnect technologies, hybridization techniques, particle tracking and imaging applications. All sessions will be plenary and will consist

of invited overview talks followed by shorter presentations. The workshop is open to anyone interested in pixel technology, but participation will be limited to 160 delegates.

For further information, see <http://conferences.fnal.gov/pixel2008> or contact Cynthia Szama; fax +1 630 840 8589; e-mail sazama@fnal.gov.

LCWS08, the **2008 Linear Collider Workshop**, and **ILC08**, the **International Linear Collider Meeting**, will be held in Chicago on 16–20 November. Hosted by

Argonne National Laboratory, Fermilab, Illinois Institute of Technology, Northern Illinois University, Northwestern University, University of Chicago, University of Illinois at Urbana Champaign and University of Illinois at Chicago (UIC), the meetings will be on the campus of UIC. The workshop will consist of plenary and parallel sessions for developing the physics case and reviewing detector and accelerator designs for an electron–positron linear collider. For more information, see <http://linearcollider.org/lcws> or e-mail: lcws08@uic.edu.

Arkani-Hamed receives the Sackler Prize

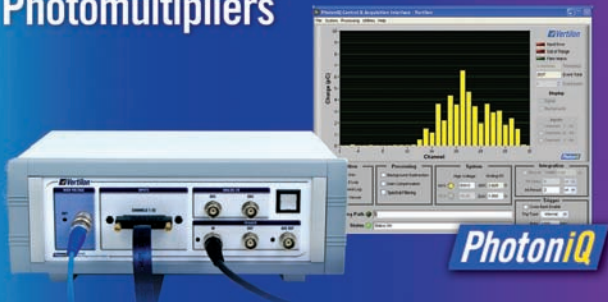
Tel Aviv University has announced that the 2008 Raymond and Beverly Sackler Prize in the Physical Sciences, this year awarded in the field of "Physics beyond the Standard Model in the LHC era", has been presented to Nima Arkani-Hamed of the Institute for Advanced Study, Princeton, New Jersey. He received it on 19 May during the annual session of Tel Aviv University's Board of Governors.

Arkani-Hamed has been rewarded "for his novel, deep and highly influential contributions to new paradigms for physics beyond the Standard Model at the TeV energy scale, especially the ideas of large extra dimensions and of the large hierarchy of strengths of fundamental forces in nature, including gravity; supersymmetry model-building; theories of flavour and neutrino masses; and models of the cosmological constant".



Nima Arkani-Hamed explores large extra dimensions and natural forces. (Courtesy Tel Aviv University.)

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CENTENARY

Artem Alikhanian: the father of Armenian physics



Friedrich-Wilhelm Büber, chair of the Association of the Friends and Sponsors of DESY, congratulates Niklaus Berger (right) on the PhD thesis award. (Courtesy DESY.)

DESY prize for track trigger work

The 2008 PhD thesis prize of the Association of the Friends and Sponsors of DESY has been awarded to Niklaus Berger from the Swiss Federal Institute of Technology Zurich.

He received the prize for his thesis, entitled “Measurement of Diffractive Φ Meson Production at HERA with the H1 Fast Track Trigger”. In his work, Berger measured the cross section for the diffractive photoproduction of Φ mesons at HERA with the H1 detector. He contributed substantially to the set-up, programming and commissioning of the new fast track-trigger, which carried out a quick and precise track reconstruction online. This annual PhD thesis prize acknowledges the best doctoral thesis on DESY physics every year.

CORRECTION

An extra letter unfortunately found its way in to the name Shirkov in the headline of the article to celebrate the 80th birthday of Dmitri Shirkov on p27 of the May issue. Many apologies to all concerned.

Artem Alikhanian was born 100 years ago on 24 June 1908. With Piotr Kapitsa, Lev Landau, Igor Kurchatov, Abraham Alikhanov (Artem’s elder brother) and others, he laid the foundations of nuclear physics in the USSR. His role as a founder of a large-scale physics research centre in Armenia – the Yerevan Physics Institute – is especially notable.

Alikhanian’s research focused mainly on nuclear physics, cosmic rays and elementary particle physics, accelerator physics and technology. In 1934, with Alikhanov and Michael Kozodaev, he discovered the production of electron–positron pairs by internal energy conversion. Then in 1936, with Alikhanov and Lev Artsimovich, he experimentally confirmed energy conservation in positron annihilation. Together with Alikhanov, he conducted precision measurements on the beta spectra of a large number of radioactive elements and discovered the dependence of spectral shape on the atomic number. He also proposed the experimental method to prove the existence of neutrinos through nuclear recoil in electron capture in ^7Be .

In 1942 Alikhanian and his co-workers began their well known research on cosmic rays on mount Aragats near Yerevan. They discovered streams of fast protons in the cosmic rays; the intense production of protons by fast neutrons; a new type of shower (the so-called narrow shower); and the first hints of particles with masses ranging between those of the muon and the proton. Alikhanian also made significant contributions to the development of methods for the detection of high-energy particles, in particular the Alikhanian–Alikhanov mass spectrometer, wide-gap spark chambers, and X-ray transition radiation detectors.

As one of the founders and the first director of the Yerevan Physics Institute, Alikhanian led the development and construction of the 6 GeV Yerevan electron synchrotron. He also promoted the training of young physicists and from 1961 to 1975 organized the International Schools of High Energy Physics



Artem Alikhanian, 1908–1978. (Courtesy Yerevan Physics Institute.)

at Nor-Amberd, of which he was director. A staunch supporter of the international co-operation of scientists, his fidelity to science, his personality, and his great erudition captivated everyone.

LEARNED SOCIETIES

Sissakian elected academician, Foster FRS

At its meeting in Moscow on 26 May – 2 June, the General Assembly of the Russian Academy of Sciences (RAS) elected Alexei Sissakian, director of JINR, as RAS full member (academician) and member of the RAS Presidium. This followed soon after Brian Foster, European regional director for the International Linear Collider (ILC) and head of particle physics at Oxford University, was elected Fellow of the Royal Society (FRS) in the UK.

Sissakian started his scientific career in 1968 at the Bogoliubov Laboratory of Theoretical Physics of JINR, and he became JINR vice-director in 1989. He has been director since 2006. Under his direct leadership for the past decade, JINR has implemented the research programme for the Nuclotron Accelerator Complex, including activities in the design and development of the Nuclotron-based Ion Collider Facility to collide heavy-ions at high energies. In addition to his



Academician Alexei Sissakian (left) and Brian Foster FRS. (Courtesy JINR and J Liebeck.)

many scientific accomplishments, Sissakian has contributed much to the development of JINR as an open international scientific centre, co-operating with other national and world scientific centres, in particular CERN.

Meanwhile, Brian Foster has been elected FRS on the basis of his leadership in the development of particle accelerators and detectors. Before becoming part of the core management for the ILC Global Design Effort, he was spokesman of the ZEUS experiment at DESY and chairman of the European



Committee for Future Accelerators. The Royal Society recognizes Foster's role as an "international leader in the development of accelerators, instrumentation and physics analysis of electron-positron and electron-proton colliders", and it stresses that his "vision of a strong UK contribution to this effort and to accelerator science is reflected in his founding the Adams Institute for Accelerator Science in Oxford and Royal Holloway University of London, of which he was the first director."

NEW PRODUCTS

ACT/Technico has announced the VME RAIDStor, a single-slot 6U network-attached storage blade that provides the features of traditional box-level RAID storage modules in a more compact footprint. The device comes in conduction or convection-cooled versions and offers a network access for up to 18 slots. ACT/Technico has also introduced the SATA-based mass-storage PMC, which simplifies data storage technology for increased data transfer rates. For more information, contact Valerie Andrew tel +1 800 445 6194, e-mail valeriea@acttechnico.com or see www.acttechnico.com.

Keithley Instruments, Inc has enhanced its Automated Characterization Suite (ACS) software to include optional wafer level reliability test tools for semiconductor reliability testing and lifetime prediction. Version 4.0 builds on the ACS software, adding database capability, as well as software tools and optional licences for the new Reliability Test Module and ACS Data-Analysis capabilities. For further details,

contact Josef Flossmann e-mail flossmann_josef@keithley.com or see www.keithley.com.

Oerlikon Leybold Vacuum has announced the first high-vacuum cryogenic pumps with a suction volume of 60 000 l/s of nitrogen and 180 000 l/s of water vapour, producing a hydrocarbon-free ultra-high vacuum and reaching pressures of less than 10^{-7} mbar. The company has also introduced the TRIVAC NT series of vacuum pumps to replace the TRIVAC B series. For more information, tel +49 221 3470 (fax +49 221 347 1250), e-mail info.vacuum@oerlikon.com or see www.oerlikon.com.

UltraVolt, Inc has announced an enhanced series of floating-hot-deck power supplies. The EFL series modules are isolated power supplies featuring isolation up to 15 kV, along with analogue and digital I/O and improved IOF shielding to reduce power-stage coupling noise. The main output is now available at 12 V 1A or 24 V 1A/1.5 A. For more information, tel +1 800 948 76937 or see www.ultravolt.com.

Vector Fields has released a new version of its Concerto software tool for high-frequency electromagnetic design. Concerto v7 introduces many improvements, including 64-bit PC processing support, better distributed processing of simulations, greatly improved support for exploiting periodicity in designs, and an innovative optimization tool for complex problems. For more information, tel +44 1865 370 151 (fax +44 1865 370 277), e-mail info@vectorfields.co.uk or see www.vectorfields.com.

Yokogawa Measurement Technologies has developed the NX4000, a transport analyser for testing 40 Gbit/s SONET/SDH and 43/44 Gbit/s OTN optical communication systems, which meets OC0768/STM-256 and OTN OTU3 requirements. It can test 44 Gbit/s Ethernet over OTN using four 10 Gbit/s Ethernet channels with over-clocking of the OTU3 interface. For more information, contact Terry Marrinan, tel +31 33 464 1856 (fax +31 33 464 1859), e-mail terry.marrinan@nl.yokogawa.com or see www.yokogawa.com.

OBITUARIES

Frank Krienen 1917–2008

Frank Krienen, one of the pioneers of CERN, was killed in a tragic road traffic accident in Amsterdam on 20 March.

Frank was one of the first recruits for CERN's 600 MeV Synchrocyclotron, in 1952. He became a respected and inspiring leader throughout the construction period of the accelerator and, at the same time, an older brother and an exacting mentor. He later devoted himself to developing particle detectors, in particular spark wire chambers using different types of readout.

His next major involvement at CERN was his contribution to the last g-2 experiment at CERN in 1969–1977, which was based on many innovative solutions. In particular he was in charge of the construction and operation of the electric quadrupoles necessary to provide the vertical focusing of the muon beam in the storage ring. His colleagues working on g-2 appreciated not only his technical competence but also his



originality in proposing new solutions, and his strong personality. He was a great friend.

The cooling of antiprotons using an intense electron beam à la Budker was his next project. Although not used in the first version of the antiproton source at CERN, this was later incorporated in the low energy antiproton ring.

The later stages in his long and fruitful career, after leaving CERN, took him to Stanford and Brookhaven, where

he continued his involvement in the latest g-2 programme. Frank made an important contribution to the design of the inflector that proved to be a real breakthrough in the experiment.

After being based first in California and then in New England, Frank lived for years in Florida, from where he travelled regularly to follow his many scientific and personal interests. He was a regular visitor to Europe and to CERN, and was always welcomed by his colleagues.

Gifted with a curious, inquisitive mind, Frank had an excellent training both in physics and in engineering. He remained active to the last, well beyond his 90th birthday. His many friends remember him, thankful for having been close to such an exceptional person and our thoughts are with Anneke, his wife, and Fenna and Frankie, his two children.

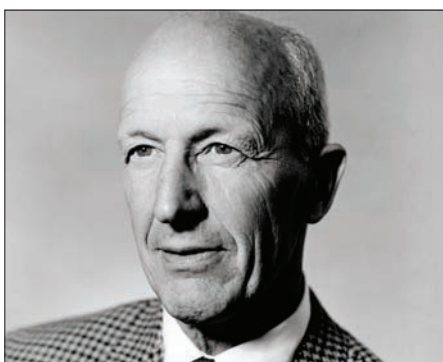
His friends at CERN. For more about Frank's contributions to particle physics, see p25.

Hugh Bradner 1915–2008

Particle physicist turned oceanographer Hugh Bradner passed away on 5 May aged 92.

After receiving his PhD from Caltech in 1941, Bradner was recruited by Robert Oppenheimer to join the Manhattan Project, where he worked on a variety of activities, including developing instrumentation to study high explosives and planning the nascent laboratory and town of Los Alamos.

After the war, Bradner moved to the Lawrence Berkeley Laboratory and UC Berkeley, where he developed instrumentation used in atomic tests. He also took up high-energy physics, using photographic emulsion to study particle production at the 184-inch cyclotron. Among other things, he measured the cross-section for pion interactions in emulsion, establishing that they interacted strongly. He also worked on a device to analyse bubble chamber photographs and performed some of the first experiments with polarized proton beams, studying the scattering of 285 MeV polarized protons in different targets.



Hugh Bradner, (Courtesy Scripps Institute of Oceanography.)

In the early 1950s, Bradner developed instrumentation for Operation Greenhouse atomic tests in the Marshall Islands. Installation required some underwater diving, and this stimulated an interest in diving equipment. Although the aqualung had simplified underwater work, ocean diving was still a very cold activity. Bradner experimented with neoprene, a synthetic rubber, and

discovered that it would hold water well; this water would gradually warm up to body temperature. By 1954, he and his colleagues were marketing the EDCO Sub-Mariner suit, which was designed to keep divers warm. Although there is still considerable dispute about who invented the wetsuit first, it seems indisputable that Bradner was the first to develop it for underwater diving.

On the basis of this experience, in 1960 Bradner was recruited to the Scripps Institute of Oceanography in San Diego. There, he put his high-energy physics experience to work, developing a variety of instrumentation. Among other things, he worked on using seismographs to detect earthquakes caused by nuclear tests, but did not abandon particle physics. One article that he wrote in 1964 was on the generation of heat by neutrino interactions in the Earth. He later became a member of the DUMAND and NESTOR collaborations.

Although Bradner formally retired in 1980, he remained active in a variety of pursuits.

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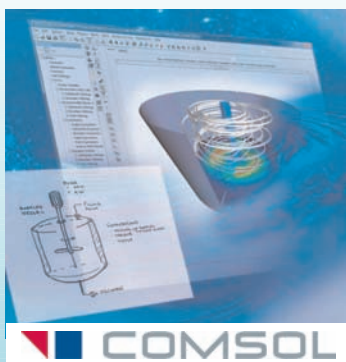
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