

Faces & Places

APPOINTMENT

New director for particle physics at RAL

Dave Newbold from the University of Bristol has been appointed director of the particle physics department for the UK's Science and Technology Facilities Council (STFC), based at the Rutherford Appleton Laboratory (RAL) in Oxfordshire. Previously head of particle physics at the University of Bristol, Newbold is a member of the CMS collaboration and currently leads the UK's CMS upgrade programme. He is also trigger and data-acquisition coordinator for the international Deep Underground Neutrino Experiment based in the US. Succeeding Dave Wark of the University of Oxford, Newbold took up the new position at RAL in September.

Funded and managed by the STFC, RAL supports the UK particle physics programme by providing capabilities that complement and go beyond what can be done in individual universities. The laboratory



Dave Newbold took up his new role at Rutherford in September.

recently marked its 60th anniversary (*CERN Courier* March 2018 p46) and comprises more than 1000 researchers, engineers and

technicians working across a number of areas. It currently hosts two major research facilities – the ISIS neutron and muon source and the Central Laser Facility – and is a Tier-1 node of the CERN–UK distributed computing grid, GridPP.

Among his goals as director of the particle physics department, Newbold intends to focus on integrating RAL more closely with UK universities and to strengthen relations with CERN and other international laboratories. “RAL particle physics has a world-class team, backed with all the facilities of the national lab,” he says. “With LHC upgrade construction now starting, we have an intense few years of activity coming up across the UK institutes – we’ll be supporting that, and developing plans for a number of new projects in particle physics. I’m looking forward to the challenge.”

AWARDS

Friedrich Wilhelm Bessel award for Higgs phenomenology

Theorist Michael Spannowsky of the Institute for Particle Physics Phenomenology at Durham University in the UK has been awarded a Friedrich Wilhelm Bessel Research Award in recognition of his work on Higgs-boson phenomenology.

The award recognises a recipient's outstanding research record and covers a number of disciplines, not just physics. The Alexander von Humboldt Foundation grants about 20 awards per year and winners receive funding to enable them to spend up to a year collaborating on a long-term



Michael Spannowsky of Durham University.

research project with colleagues at a German institution.

Spannowsky's research has contributed to the design of novel reconstruction and analysis strategies to improve measurements of the top- and bottom-quark Yukawa couplings and the Higgs self-interaction. He will use his award to collaborate with colleagues at the University of Tübingen in southwest Germany on research into dark matter and Higgs phenomenology.

NSREC accolade for radiation paper

Federico Faccio from CERN has received the Outstanding Conference Paper Award for the 2017 IEEE Nuclear and Space Radiation Effects Conference (NSREC), as lead author of the paper titled “Influence of LDD spacers and H⁺ transport on the total ionising-dose response of 65 nm MOSFETs irradiated to ultra-high doses”. The prestigious award was presented at this



Faccio (far left) together with co-authors from the other collaborating institutes.

year's NSREC, which took place in Kona, Hawaii, on 16–20 July.

The paper (doi:10.1109/TNS.2017.2760629), which summarises the work of a collaborative effort between CERN and the universities of Padova, Salento, Udine and Vanderbilt, marks an important contribution to the understanding of how radiation influences the behaviour of modern CMOS processes. Faccio leads a small team of experts at CERN studying radiation effects in microelectronics, for instance identifying commercially available processes for use in the extreme radiation environment of the LHC detectors.

Faces & Places

Swiss Physical Society presents annual awards

At its 2018 annual meeting, held at École Polytechnique Fédérale de Lausanne (EPFL) on 28–31 August, the Swiss Physical Society (SPS) recognised the achievements of four researchers working in the area of high-energy physics.

Theorist Lavinia Heisenberg, a junior fellow at ETH Zurich, was presented with the ABB General Physics Prize “for her pioneering and essential contributions to alternative theories of gravity”. Heisenberg studies the fundamental properties of field theories, their cosmological consequences and possible signatures, with the aim of comparing general relativity with alternative theories of gravity.

The Charpak-Ritz Prize 2018, granted jointly by the SPS and the French Physical Society, was presented to Roland Horisberger of the Paul Scherrer Institute at the Journées de la Matière Condensée in Grenoble on 27 August for his extensive work development of precision silicon vertex detectors. Horisberger made important contributions to the silicon microstrip detector for the DELPHI experiment at CERN’s Large Electron Positron Collider, the H1-central vertex detector at DESY’s HERA collider, and the pixel detector for the CMS experiment at the Large Hadron Collider (LHC). He has also successfully transferred novel detector technologies, such as PILATUS pixel detectors, to the field of synchrotron science.

Accelerator physicist Claudia Tambasco of EPFL received the 2018 Swiss Institute of Particle Physics (CHIPP) Prize for PhD research that improved the understanding of the stability of proton beams in the LHC. In her thesis work she measured the Landau



Clockwise from top left: Lavinia Heisenberg (on right, with SPS president Hans Peter Beck), Roland Horisberger (right), Maurice Bourquin, and Claudia Tambasco (on right, with Adrian Signer, chair of the CHIPP Prize committee).

damping of the LHC beams, a process that reduces beam losses caused by interactions between the proton beam and the vacuum pipe. The results led to a proposal that increased the integrated luminosity, and have also been applied to future colliders such as the FCC.

Finally, Maurice Bourquin of the University of Geneva, who in 2001 was elected as the first and so-far-only Swiss

president of the CERN Council, was made an honorary member of the SPS. Bourquin was recognised for his enormous scientific achievements in particle and astroparticle physics, his extraordinary commitment in science policy at CERN and at Swiss universities implementing the Bologna Reform, and also for his far-sighted commitment to the promotion of future thorium-based nuclear reactors.

MEETINGS

Particle interactions up to the highest energies

The 20th International Symposium on Very High Energy Cosmic Ray Interactions (ISVHECRI 2018) was held in Nagoya, Japan, on 21–25 May. More than 120 attendees from 19 countries discussed various aspects of hadronic interactions at the intersection between high-energy cosmic-ray physics and classical accelerator-based particle physics. The 65 contributions reflected the large diversity and interdisciplinary character of this biennial series, which is held under the auspices of the International Union of Pure and Applied Physics.

In his opening address, Sunil Gupta paid a tribute to Oscar Saavedra, one of the leading scientists and founders of the ISVHECRI series, who passed away in 2018. Following the long tradition of this symposium series, the main topic was the discussion of particle physics of relevance to extensive air showers, secondary cosmic-ray production, and hadronic multi-particle production at accelerators. This time, the symposium expanded its coverage of multi-messenger astrophysics, especially to neutrino and gamma-ray astrophysics. Many talks were invited from the Pierre Auger Observatory

and Telescope Array, as well as from IceCube, Super-Kamiokande, CTA and HAWC, and space-borne experiments such as AMS-02, Fermi and CALET.

Participants discussed how many open questions in high-energy astroparticle physics are related to our understanding of cosmic-ray interactions from the multi-messenger point of view; for example, the relevance of production and propagation of positrons or antimatter for indirect dark-matter searches, or of atmospheric-neutrino production for neutrino oscillations or neutrino astronomy. ▷



A. Minamizaki

The participants of the ISVHECRI 2018 symposium, which took place in Nagoya in Japan.

Showcasing several models of high-energy cosmic-ray interactions, and their verification by accelerator measurements, was also a highlight of the symposium. The event offered a unique opportunity for developers of major cosmic-ray interaction models to gather and engage in valuable discussions. Other highlights were the talks about accelerator data relevant to cosmic-ray observations, reported by the teams behind CERN's large LHC experiments as well as smaller fixed-target experiments such as NA61. Emphasis was put on forward measurements by ATLAS, CMS, LHCb and LHCf, including first results from the SMOG gas-jet target measurements of LHCb (see p15).

A public lecture, "Exploring the Invisible Universe" by Nobel Laureate Takaaki Kajita, attracted more than 250 participants, which was complemented by a tour of the nuclear emulsion lab of Nagoya University to see state-of-the-art emulsion technology. The progress in this technology was clearly visible when Edison Shibuya and others recalled the early days of studying cosmic rays with emulsion chambers and Saavedra's related pioneering contributions.

There were many discussions on future studies of relevance to cosmic-ray interactions and astroparticle physics. Hans Dembinski discussed prospects in the near and far future in collider experiments, including possible proton–oxygen runs

at the LHC and a study of multi-particle production at a future circular collider. The cosmic-ray community is very enthusiastic about a future proton–oxygen run since, even with a short run of 100 million events, charged particle and pion spectra could be measured to an accuracy of 10% – a five-fold improvement over current model uncertainties that would bring us a crucial step closer to unveiling the cosmic accelerators of the highest energy particles in the universe.

The next ISVHECRI will be held in June 2020 at Ooty, the location of the GRAPES air-shower experiment in India.

● Yoshitaka Itow, Nagoya University, and Ralph Engel (KIT, Karlsruhe).

Higgs hunters meet up in Orsay and Paris

The 9th Higgs Hunting workshop took place in Orsay and Paris on 23–25 July, attracting 120 physicists for lively discussions about recent results in the Higgs sector. The ATLAS and CMS collaborations presented results based on up to 80 fb^{-1} of data recorded at an energy of 13 TeV, which corresponds to almost all the data that has been taken so far at the LHC. The statistical uncertainty on some measured properties of the Higgs boson, such as the production cross-section, is now almost three times smaller with the 13 TeV data than it was after LHC Run 1 at energies of 7 and 8 TeV, and in several cases the overall uncertainty is reaching a point at which the systematic uncertainty becomes dominant.

Several searches for phenomena beyond the Standard Model, in particular for additional Higgs bosons, were presented. No significant excess above background expectations was reported. The historical talk was given by Lyn Evans, who served as the project leader of the LHC. The last day of the event was devoted to the physics



L. Fayard

The Higgs Hunting 2018 workshop participants.

potential of the High Luminosity LHC and possible future colliders, in view of the upcoming update of the European strategy for particle physics. The last session was chaired by Halina Abramowicz, the strategy

secretary for the update.

The next Higgs Hunting workshop will be in Orsay and/or Paris from 29 to 31 July 2019.

● Louis Fayard, Laboratoire de l'Accélérateur Linéaire.

Faces & Places

Göttingen hosts HASCO summer school

This year's Hadron Collider Physics Summer School (HASCO 2018) took place on 22–27 July in Göttingen, Germany, marking the seventh consecutive year that this dynamic and international school, primarily aimed at master's students, has been offered.

This year, 40 undergraduate students from 18 different institutes in 12 countries came together for a week to learn about hadron-collider physics. The nine lecturers also came from a variety of institutes throughout the world. The students learnt about the foundations of quantum field theory and hadron-collider physics, particularly in the context the Large Hadron Collider (LHC).

At the HASCO school, numerous research topics are discussed, among them quantum chromodynamics, jet physics, statistical methods in data analysis, accelerator physics, detector physics, top-quark physics and searches for supersymmetry or exotic models and particles. The focus was on the physics



The HASCO 2018 students.

of the Higgs boson and the new opportunities that come with the high-statistics data sample being recorded during the LHC's 13 TeV run.

Almost all participating students passed the

written examination at the end of the school and received three European Credit Transfer System points, for which they can obtain course credits at their home universities.

● Stan Lai and Amulf Quadri, University of Göttingen.

Research infrastructures event brings particle physics into focus

The 4th International Conference on Research Infrastructures (ICRI 2018), held in Vienna on 12–14 September, offered a forum for discussions about international cooperation for research infrastructures (RIs), with participants from more than 50 countries taking part. During an intense programme, participants drafted a roadmap to inform Europe's policy and investment in RIs, with CERN's director for international relations, Charlotte Warakaulle, offering a glimpse of the organisation's plans and ongoing R&D for future colliders and detectors. The new ESFRI 2018 roadmap was presented, including a "landmark" portfolio of 37 long-term engagements in all fields of science and 18 projects.

During the event, a new exhibition "CODE of the Universe" also made its first international stop. The exhibition (pictured) addresses open questions in physics and the role of particle accelerators both in fundamental research and as concrete applications. It is organised by CERN, the Institute of High Energy Physics (HEPHY), the Natural History Museum of Vienna and publisher Edition Lammerhuber. A public event was hosted on the evening of



The ICRI 2018 conference featured a new photography exhibition.

the same day, bringing together scientists, entrepreneurs and politicians to discuss: "Research: Why does it matter to me?" Participants included former CERN Director-General Rolf Heuer and George Bednorz, who shared the 1987 Nobel Prize in Physics for the discovery of high-temperature superconductivity.

● Panos Charitos, CERN.

OUTREACH

CERN is guest of honour at Swiss National Day

On 1 August, CERN was the City of Geneva's guest of honour at the Swiss National Day celebrations. Many thousands of visitors had the opportunity to learn about the laboratory's activities via workshops, virtual-reality tours, physics demonstrations, educational games and a new "Particle Identities" quiz. Participants also visited the CERN Data Centre via virtual-reality headsets.



OUTREACH

Packed house for CHEP public event

A large and enthusiastic crowd attended “Universal Science,” a public event preceding the International Conference on Computing for High Energy and Nuclear Physics (CHEP), in Sofia, Bulgaria, on 8 July. With the three-part theme of research, computing and diversity, tickets for the event sold out well before deadline, and overflow had to be accommodated through online participation.

Such an outreach event is not typical for CHEP, a conference that focuses on specialised topics such as distributed computing, event reconstruction, data handling and virtualisation. This year’s organising committee, however, saw it as an opportunity to reach out to the local public and to foster open discussion on the impact of particle-physics research on society. Similar



Audience Q&A with the scientific panel (from left): Steven Goldfarb, Andreas Salzburger, Lee Bitsoi, and Hannah Short.

events have grown in popularity at other major conferences, such as ICHEP, EPS and LHCP, and the particle-physics-computing

community has become increasingly engaged in public outreach.

Hands-on exhibits, including interactive virtual-reality displays, entertained and informed the audience. Andreas Salzburger, a physicist on the ATLAS experiment, kicked off the evening with a short talk on the motivation for and history of particle physics. This was followed by talks on diversity by Lee Bitsoi of Stony Brook University and on the growth of distributed computing by CERN computer engineer Hannah Short. Talks were followed by a panel discussion generating a barrage of questions from both the local audience and those connecting via Facebook Live. The event was organised by CHEP, Ratio, IPPOG, Brookhaven National Lab, ATLAS and Belle II.

● Steven Goldfarb, University of Melbourne.

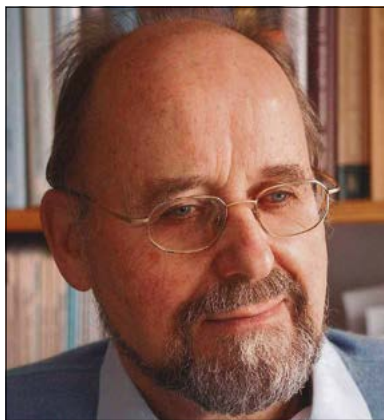
OBITUARIES

Joachim Kupsch 1939–2018

Eminent mathematical physicist Joachim Kupsch passed away in Heidelberg, Germany, on 19 June aged 78. He made wide-ranging contributions to scattering theory and elementary particle physics, quantum field theory and infinite-dimensional analysis, Fermionic integration and supersymmetry, not to mention open systems and decoherence. He also had many collaborators, most of them from Germany. His work, always characterised by mathematical rigour and scholarly exposition, includes three books. The last – *Quantum Fields and Processes: A combinatorial approach* (Cambridge University Press) came out in March 2018.

Joachim received his diploma in physics from the University of Köln in 1966 and embarked on a postdoc at the University of Bonn. He worked on analytic scattering theory during his tenure as a CERN fellow from 1968 to 1970, where he was influenced deeply by André Martin. After postdoctoral work and habilitation at the University of Heidelberg (1970–1973), Joachim secured a permanent position at the University of Kaiserslautern from 1973 to 2005 and then became an emeritus professor. During 1985–1986 he visited CERN many times, and until 2008 had guest-professor positions in China (Beijing and Shanghai), Portugal (Lisbon) and India (Mumbai, Chennai, Pune and Delhi).

One of the outstanding results of the analytic S-matrix theory is the Froissart–Martin bound, which sets an upper limit



Joachim Kupsch made wide-ranging contributions to scattering theory.

(equal to a constant times the square of the logarithm of energy) on the total cross section of a two-particle scattering process. It was first derived by Marcel Froissart in 1961 assuming Mandelstam representation with a finite number of subtractions; and was rigorously proved by Martin in 1966 using only unitarity and analyticity properties following from axiomatic field theory, in particular the analyticity of the absorptive part in the Lehmann–Martin ellipse. The question was whether it was possible to construct scattering amplitudes that saturate this bound and obey

fundamental analyticity constraints?

In 1968, David Atkinson pioneered the theoretical construction of pion–pion scattering amplitudes obeying Mandelstam representation, crossing symmetry and elastic unitarity in the elastic region, and the inelastic unitarity inequalities in the inelastic region. Atkinson obtained an amplitude with a total cross section decreasing at high energies. Joachim joined this research with full vigour. After persevering for nearly 12 years, and after many intermediate results, he constructed a pion–pion amplitude saturating the Froissart–Martin bound, and obeying Mandelstam analyticity, crossing symmetry and inelastic unitarity in the inelastic region. The result is significant because the bound appears to be saturated at the LHC. An essential ingredient in his proof is the Auberson–Kinoshita–Martin theorem. Perhaps Joachim’s efforts in 1970 did not succeed because this theorem was not yet published. The main constraint not yet incorporated in Joachim’s 1982 construction is elastic unitarity in the elastic region.

Joachim died in the arms of Sigrid Kupsch-Losereit, his beloved wife of 45 years. His friends knew him to be a warm, soft spoken, affable and kind person; he will be sorely missed for both his academic and human qualities.

● Shasanka Roy, Tata Institute of Fundamental Research, with input from André Martin and Sigrid Kupsch-Losereit.

Faces & Places

Bert Diddens 1928–2018

On 28 August, following a short period of sickness, our friend and colleague Bert Diddens passed away at the respectable age of 90. He was one of the veterans in CERN's proud history of particle physics and the first scientific director of the Dutch high-energy physics institute Nikhef.

Bert was born in the province of Groningen, in the north of the Netherlands. It is a region where people tend to be straightforward and down-to-earth, and Bert fitted that description very well, even up to his last days when telling his family that he didn't want flowers at his funeral, as the money could be better spent on science. But behind this demeanour he was a gentle and sensitive person, loyal to his friends and colleagues. He remained interested in the sciences throughout his life, regularly visiting the Nikhef library to stay informed. This was illustrated by his always to-the-point comments when the jury consisting of him and all other former Nikhef directors deliberated on what was the best PhD thesis of the past year.

Bert studied physics at the University of Groningen, where he also received his PhD. The experimental work that led to it, however, was done in Leiden, where he studied gamma radiation from oriented cobalt and manganese nuclei using low-temperature techniques. After his PhD he joined the small group of physicists at the University of Liverpool in the UK, which served as a warm-up for CERN's first experimental programme. He worked on proton–proton scattering at the university's synchrotron, a topic that remained a thread throughout his early career.



Bert Diddens was the first scientific director of Nikhef.

In 1963 with Giuseppe Cocconi and Alan Wetherell, later joined by Jim Allaby, he formed a group to study proton–proton scattering at the Proton Synchrotron. The experiment revealed that the slope of the diffraction peak shrinks with increasing energy. A few years later, with Alan and Jim, he initiated an experiment at Serpukhov to study particle production and the total hadron–hadron cross section at the then-highest proton energy of 70 GeV. In 1970, with CERN's Intersecting Storage Rings being constructed, Bert with his CERN colleagues joined Ugo Amaldi and Giorgio Matthiae of the Rome-ISS group to

design an experiment to study small-angle proton–proton scattering, introducing a novel technique that later became known as “Roman Pots”. Just before he was asked in 1975 to become the first scientific director of the high-energy physics section of Nikhef, Bert turned to neutrino physics when his CERN team joined Klaus Winter in the CHARM (CERN–Heidelberg–Amsterdam–Rome–Moscow) experiment.

As a director at Nikhef he was responsible for shaping its first experimental programme, of which CHARM became a valuable part. As Nikhef did not yet have its own building, Bert had the responsibility to make sure that the design and construction of a new laboratory fitted the ambitions of the Dutch high-energy physics community. The success of today's Nikhef is to a large extent determined by these first developments. When Nikhef had to decide which experiments to join at the Large Electron Positron collider (LEP), it was obvious that DELPHI would be one of them, extending into the LEP era the amicable bonds with his former CERN colleagues. He actively participated in the experiment after his directorship came to an end in 1983 and was the thesis supervisor for many PhD students of both DELPHI and CHARM.

We will all remember Bert Diddens with the greatest respect as a wonderful person, an excellent physicist and a key figure in establishing Nikhef as an important player in the international community of high-energy physics institutes.

● *His friends and colleagues.*

Francis Farley 1920–2018

Francis Farley, who played a pivotal role in experiments to measure the anomalous magnetic moment of the muon, passed away on 16 July at his home in the south of France at the age of 97.

The son of a British Army engineering officer, Francis was born in India and educated in England. Before he could complete his education, he transferred to military research and worked on radar, developing his knowledge of electronics and demonstrating his abilities in

innovation. Following a secondment to Chalk River Laboratories in Ontario, Canada, he resumed his formal education with a PhD in 1950 from the University of Cambridge, before starting his academic career at Auckland University in New Zealand. During his time at Auckland, he studied cosmic rays; represented New Zealand at a United Nations conference on atomic energy for peaceful purposes; measured neutron yields from plutonium fission (whilst on secondment to Harwell,

UK); and wrote his first book *Elements of Pulse Circuits*.

In 1957 Francis joined CERN, where he started his long and remarkable journey on experiments to measure the anomalous magnetic moment of the muon (μ on $g-2$). This endeavour would span nearly five decades and four major experiments, three at CERN and one at Brookhaven National Laboratory (BNL) in the US. The initial result from the first experiment had an accuracy of just 2%, whereas

Faces & Places

the final result from the last experiment reached 0.5 parts per million. Each experiment was at the time seen as a tour de force, and the measurement added an important restraint on the imaginations of theorists. It was also striking that each new measurement was within the error limits of the previous ones.

Many other people, including various highly renowned physicists, contributed to this long effort, but Francis is the sole common author, making seminal contributions to all of the experiments. The first experiment was performed on the initiative of Leon Lederman, a CERN visitor at the time, at CERN's first accelerator, the 600 MeV Synchrocyclotron. The other members of the noteworthy team on this experiment were Georges Charpak, Richard Garwin, Theo Muller, Hans Sens and Antonino Zichichi. By the time of the second experiment, CERN's Proton Synchrotron was operating and the second and third experiments were performed there – taking advantage of the higher-energy muons that the accelerator provided. Francis alone continued onto these experiments, but among others joining the experiments was Emilio Picasso. Later Francis, again alone, continued as a member of the most recently completed g-2 experiment at BNL. In the spirit of always looking for major improvements, it is noteworthy that in his review paper "The 47 years of muon g-2", written with Yannis Semertzidis, a totally new structure for a muon storage ring is suggested, should greater accuracy be justified for a future experiment.

The first experiment showed that the muon was a "heavy electron", the second validated electron loops in the photon propagator, and the third showed the contribution from virtual hadron loops. Each measurement has spurred theoretical physicists to include more and more effects in their calculations of the muon magnetic moment: higher-order corrections in quantum electrodynamics, first-order and then higher-order hadronic and electroweak contributions. These advances in the theoretical prediction in turn justified the next generation of experiment, to give an even more stringent test of theory. The muon storage rings also allowed tests of relativistic time dilation, with the third experiment achieving an accuracy of 0.1% for a "muon clock" moving at a speed of 0.9994c and the most accurate test of the "twin paradox".

During the 1970s, when he was again based in the UK and Dean of The Royal Military College of Science, Francis also

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Farley made seminal contributions to the measurement of the muon magnetic moment.

started to do research in wave energy. This work continued through his retirement, in parallel to the work on g-2. In this area too, he established a formidable reputation, with many papers written and patents produced over a period of 40 years. Indeed, his most recent paper on wave energy was published just a few days after his death.

Early in his retirement, he designed the beam transport system for a proton-therapy system at a cancer hospital, which was still being used more than 20 years later. He also published a special-relativistic single-parameter analysis of data on redshifts of type 1A supernovae that showed no evidence for acceleration or deceleration effects. Even more recently, he worked on other tests of relativity based on analysis of data from the muon g-2 experiments.

He received many honours, including election to a fellow of the Royal Society and the Hughes Medal for his work at CERN on g-2.

Outside of work, Francis had a passion for flying gliders, was a keen skier and windsurfer, a regular swimmer, and liked large American cars. All of these befitted a hardworking but somewhat playboy image, that years later formed much of the basis of his novel *Catalysed Fusion*.

Francis was a wonderful source of new ideas and insights, with a prodigious output. He was always enthusiastic, and he could be charming but forceful, and a stickler for precision.

He will be much missed.

● *His friends and colleagues.*

Ultra High Performance Silicon Drift Detector

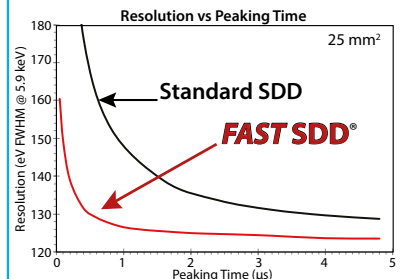
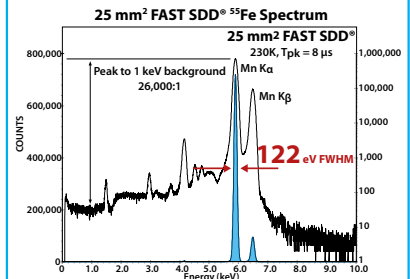
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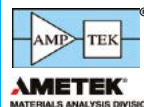


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