CERN Bulletin

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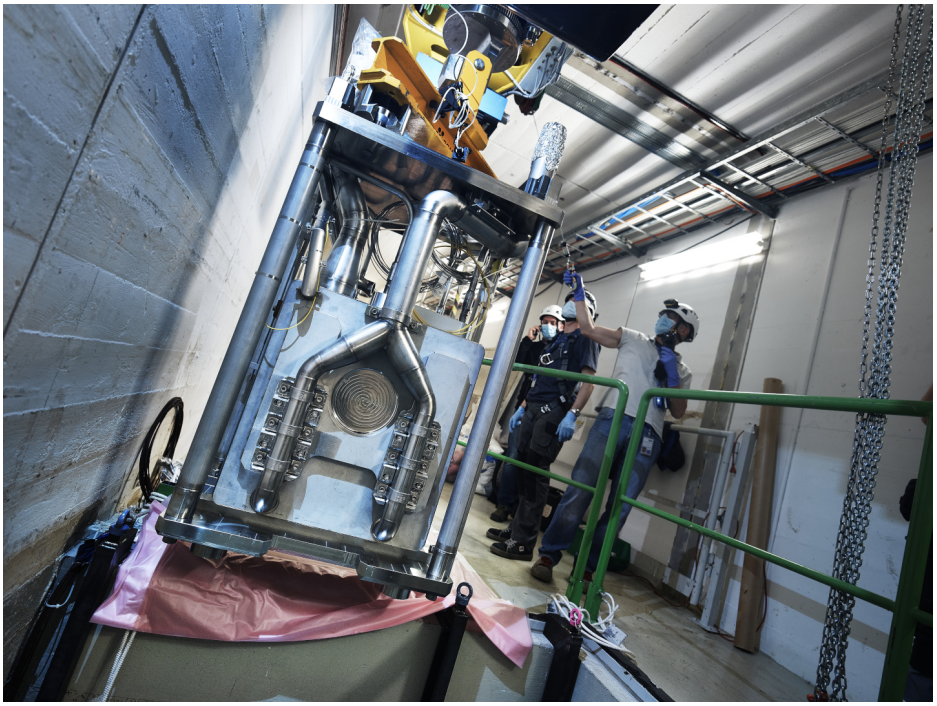
N_TOF POISED FOR 10 MORE YEARS OF RESEARCH WITH THIRD-GENERATION NEUTRON SPALLATION TARGET

The installation of a new-generation neutron spallation target at the n_TOF facility marks the beginning of a new era for the collaboration



Installation of the third generation n_TOF spallation target in the target pit in April 2021. (Image: CERN)

Target-based experiments are plentiful at CERN, be it at the Antiproton Decelerator, the ISOLDE facility or the North Area. They provide the Laboratory with a variety of secondary particles through the interaction of the target's components with high-energy proton beams from the accelerator complex. One example is the n_TOF (Neutron Time-Of-Flight) facility, where a spallation target is used to produce a neutron beam. After ten years of service, the old n_TOF neutron spallation target was removed and a third-generation target successfully installed in the facility this month. This achievement marks the culmination of four years of development led by the Sources, Targets and Interactions (STI) group in the Systems (SY) department, which is responsible for the operation of the n_TOF facility.

The n_TOF collaboration (numbering more than 120 physicists) hopes to find answers to the questions posed by the processes of nucleosynthesis (how are chemical elements produced outside of nuclear fusion during Big Bang nucleosynthesis and within stars, and what role do neutrons play in this phenomenon?), as well as to much more pragmatic issues, such as nuclear waste disposal.

(Continued on page 2)

A WORD FROM JOACHIM MNICH

MOUTH-WATERING PROSPECTS FOR RESEARCH AND COMPUTING AT CERN

It's great to be back at CERN after a gap of 21 years. Even if the middle of a pandemic is a strange time to arrive, it's also a time to experience first-hand the strengths of this great Organization as it adapts to the evolving situation. We all have much to take satisfaction from in the way our community is living with COVID-19.

(Continued on page 2)

In this issue

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A WORD FROM JOACHIM MNICH

MOUTH-WATERING PROSPECTS FOR RESEARCH AND COMPUTING AT CERN

In this, my first message in the *Bulletin*, I'd like to take a look at what the Research and Computing sector (RCS) has in store for the coming five years. In short, the task ahead of us is no less than to implement recommendations of the 2020 update of the European Strategy for Particle Physics. First and foremost, that means ensuring the success of Run 3 of the LHC and, with recent results from both CERN and Fermilab showing potential cracks in the Standard Model, that is a mouth-watering prospect.

The next task in hand is to prepare for a successful transition to the high-luminosity phase, the HL-LHC, starting in 2027. Whatever emerges from Run 3, the HL-LHC is a vital successor to the LHC, bringing significantly larger amounts of data and thereby extending the potential for precision studies. Greater precision will not only bring greater clarity to the discoveries made by the LHC, it will also come with new discovery potential.

Although it is our flagship facility, the LHC is far from being the only show in town. At CERN, the fixed-target programme has some vibrant years ahead of it, full of potential, and with intriguing results promised across the board. The experimental results that are emerging are giving our Theory department plenty of food for thought, and with the Neutrino Platform in full swing, we have important contributions to make to neutrino programmes in the US and Japan.

Perhaps the most significant recommendation of the updated Strategy is that CERN should conduct a feasibility study for a 100 km collider, with an electron–positron Higgs and electroweak factory as the Laboratory's next major facility, followed by a hadron collider at the highest possible energy. Although the timescales for such facilities are long – the earliest possible start date for the Higgs factory is around 2040, while the hadron collider would not be producing physics results until 2060 at the earliest – there's not a moment to lose. The Future Circular Collider (FCC) Feasibility Study is tasked with providing input for the next update of the Strategy in around five to six years' time.

Computing is the third key ingredient of the RCS portfolio, and there are significant challenges ahead to keep pace with the increasing data volumes from the LHC. A new computing centre in Prévessin will go a long way towards addressing those challenges, and will be a flagship for CERN's environmental credentials, since it will have heat recovery built in from the start. Looking further ahead, CERN is joining the global effort to bring about a new quantum revolution. Through the Quantum Technology Initiative, we will be exploring potential new computing, communication, sensing and simulation devices. We will also be pursuing our efforts on commercial software products and their licensing policies in order to ensure the best value and quality we can achieve.

Last but not least, the Scientific Information Service is, in a way, the embodiment of all we do, since the product of science is knowledge. We'll be refurbishing the library, expanding the functionality of INSPIRE, and driving forward CERN's open science and data preservation frameworks.

All in all, it's an invigorating prospect, and as vaccines appear to be offering a way for us to emerge from the pandemic, I'm looking forward to rediscovering, with you, the vibrant CERN I knew so well 21 years ago.

Joachim Mnich
Director for Research and Computing

N_TOF POISED FOR 10 MORE YEARS OF RESEARCH WITH THIRD-GENERATION NEUTRON SPALLATION TARGET

To achieve this, n_TOF scientists work with a high-quality neutron beam produced by the collision of high-energy protons (20 GeV/c, 7 ns wide) from the Proton Synchrotron (PS) with the lead nuclei of the spallation target. The neutrons “knocked” from the target assembly by the proton beam fly towards and collide with experimental samples, after being moderated by water, doped with enriched boron. Their time of flight and the number of decay products allows the calculation of the probability of interaction (cross section). This makes it possible to take unprecedented measurements of isotopes of elements such as osmium, thulium and beryllium, to name just a few, which help to shed light on nucleosynthesis processes.

The old spallation target, a 1.2-tonne water-cooled monolithic lead cylinder, had to retire after ten years of receiving high-energy protons. Its replacement is made up of six separate U-shaped lead blocks – weighing a total of 1.5 tonnes – a new design that offers several logistical advantages. First of all, it allows the beam-heated lead to be cooled with gaseous nitrogen at ambient pressure instead of with water, which will significantly reduce the pollution of the circuit by removing the erosion and corrosion mechanisms induced

by the water in direct contact with lead. Secondly, the new target was designed to house an additional demineralised water moderator tank on its top, across one of the two neutron beam tracks. This new moderator tank will improve the resolution of the measurements of a neutron's time of flight in the vertical flight path, a crucial aspect of n_TOF's research. Thirdly, it further improves the physics performance of the facility.

Finally, new modified target shielding was installed in order to provide access to the target area for inspection and operational purposes, as well as to irradiate materials in a field representative of CERN's accelerator systems and evaluate their long-term behaviour within the framework of the Radiation to Materials component of the R2E (Radiation to Electronics) project at CERN. In addition, it would make it possible – if required – to develop an experimental test station much closer to the spallation target than the two existing ones, significantly increasing the measurable number of neutrons per proton pulse. While the construction of this additional experimental station is still under review, the new spallation target leaves n_TOF scientists poised for at least ten more years of world-class neutron research at CERN.

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For more pictures of the installation, go to: https://cds.cern.ch/record/2759329?ln=en.

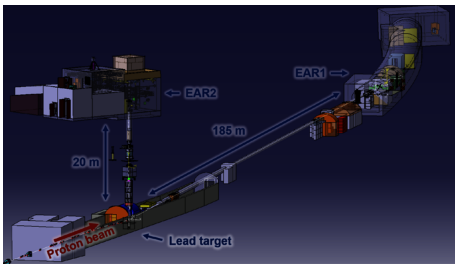
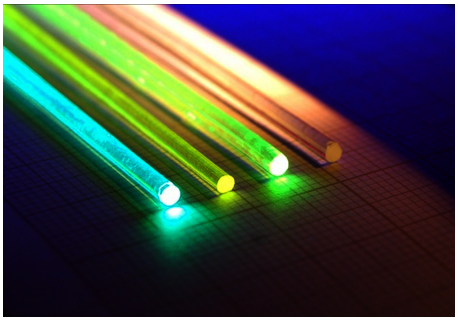


Diagram of the n_TOF facility. EAR1 and EAR2 are the two experimental areas situated at the end of the neutron beam lines. (Image: CERN)

Thomas Hortala

CRYSTAL CLEAR, 30 YEARS ON

The Crystal Clear collaboration is celebrating its 30th anniversary this April – an opportunity to retrace an unusual journey



Scintillating crystal fibres developed for future detectors at the Institut Lumière Matière (ILM) in Lyon (France), as part of the Crystal Clear collaboration. (Image: ILM, Université Claude Bernard Lyon 1)

The Crystal Clear collaboration (experiment RD-18) began in 1991 as part of the R&D programme run by the Detector Research and Development Committee (DRDC) to address the formidable challenges posed by the future LHC. The objective was clear: identify the most suitable scintillating crystals to pave the way for the discovery of the Higgs boson. Now, 30 years on, it is clear that the collaboration has exceeded all expectations. Not only did it contribute to one of the greatest physics discoveries of the twenty-first century, but it also went on to help drive innovation in the medical technology sector.

Amidst the large-scale R&D efforts to develop the detectors for the future LHC, the collaboration quickly set to work in studying scintillating crystals whose scintillation mechanisms were still a mystery. In 1994, that research led to the recommendation to use lead tungstate ($PbWO_4$or PWO), a material combining the advantages of high density, fast scintillation and good resistance to radiation with relatively low manufacturing costs, for the construction of the CMS electromagnetic calorimeter and the ALICE PHOS detector. That recommendation was followed, as both detectors are made from PWO crystals.

The purpose of an electromagnetic calorimeter is to measure the energy of photons, electrons and positrons. The particles' energy is transformed into light as they pass through the crystals and is then detected by a photodetector whose signal is analysed to identify the original particle. Notably, it was in the heart of the CMS electromagnetic calorimeter that the Higgs boson was identified by its decay into two photons.

Starting in 1995, in parallel with its R&D work on scintillators for high-energy physics, the Crystal Clear collaboration branched out into medical applications with the development of several positron emission tomography (PET) devices for imaging in nuclear medicine. PET uses scintillating crystals for the coincidence detection of pairs of photons resulting from electron–positron annihilation. The collaboration started by developing ClearPET prototypes, PET cameras for small animals[(1)], then moved on to ClearPEM prototypes for detecting breast cancer [(1)]and, more recently, the EndoTOFPET-US prototype for detecting pancreatic and prostate cancer.

Today, the collaboration's efforts to improve the coincidence time resolution (CTR) of these tomography machines continue, the target being a CTR of 10 picoseconds (as against more than 200 picoseconds for commercial PET cameras), which would improve image quality while reducing the time spent in the scanner and the dose administered to the patient[(2)]. To this end, the collaboration is exploring new detection concepts, including the development of scintillating nanomaterials.

The Crystal Clear collaboration is also currently pursuing its initial R&D work on future detectors. “Detectors for future accelerators will have to deal with unprecedented constraints on their components. Developing fast, radiation-resistant crystals and coming up with new ways to use them will be vital to designing detectors based on the scintillators of tomorrow,” says collaboration spokesperson Étiennette Auffray, laying out a vision for the future of Crystal Clear.

The technologies developed for high-CTR PET cameras, known as time-of-flight PET cameras, inspired the insertion of a layer of LYSO (lutetium-yttrium oxyorthosilicate) crystals, called the “barrel timing layer”, in the CMS central barrel between the tracker and the electromagnetic calorimeter, which will measure the time of flight of each particle. A “Spaghetti Calorimeter”, or “SpaCal”, made up of an absorber and scintillating crystal fibres, is also being studied as part of the EP department's R&D programme. It could replace the central part of the current LHCb electromagnetic calorimeter.

Unfortunately, the current health situation prevents the members of the Crystal Clear collaboration from celebrating its 30th anniversary, at least for now. But despite that, Crystal Clear, which has always moved with the times, is looking resolutely forward to a bright future for scintillating crystals.

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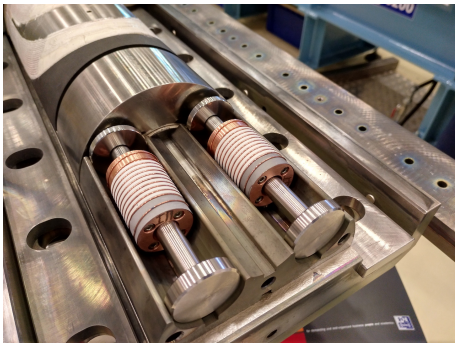
(1) See CERN Courier *July/August 2013 p.23*
(2) Paul Lecoq et al, 2020 Phys. Med. Biol. 65 21RM01

Thomas Hortala

THE SUPERCONDUCTING COILS FOR THE 11 T DIPOLES HAVE BEEN DELIVERED

35 niobium–tin superconducting coils have been manufactured as part of a fruitful collaboration with the company General Electric. They will be used in the 11 T dipoles for the HL-LHC



Control samples fitted to the ends of the niobium–tin coils' heat-treatment mould to check the conformity of the electrical performance. (Image: CERN)

Starting in 2018, a team of experts from the company General Electric (GE) worked with the Magnets, Superconductors and Cryogenics (TE-MSC) group at CERN to manufacture superconducting coils for the new 11 T dipoles being developed for the HL-LHC project. In January, following three years of fruitful collaboration, the 15-strong team left the Laboratory.

The 11 T dipoles are based on superconducting niobium–tin (Nb_3Sn). They are just six metres long but, thanks to their higher field, they might be able to replace some of the main 15-metre-long LHC dipoles in strategic parts of the accelerator, notably at Point 7, freeing up space for new collimators. The plan is to install a total of four 11 T dipoles for the HL-LHC.

“From the very beginning, we established a relationship of trust between the CERN and GE teams to ensure knowledge transfer and cross-fertilisation,” explains Arnaud Devred, leader of the Magnets, Superconductors and Cryogenics group. “We have learned from their industrial approach and their organisational structure, using production units, which has helped us to improve our quality assurance. As for GE, they have developed specific skills in the manufacture of superconducting magnets thanks to their work on the 11 T dipoles, a new technology that is still evolving.”

A total of 35 coils have been manufactured and assembled in the Large Magnet Facility on the Meyrin site, using tools provided by CERN. They will form part of the 11 T dipoles, which may be installed in the LHC during a future technical stop.

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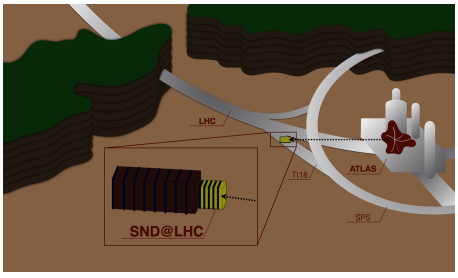
To find out more about the manufacturing process for the Nb_3Sn coils, read this article (https://cerncourier.com/a/taming-the-superconductors-of-tomorrow/) published in the CERN Courier.

Anaïs Schaeffer

CERN APPROVES NEW LHC EXPERIMENT

SND@LHC, or Scattering and Neutrino Detector at the LHC, will be the facility's ninth experiment



SND@LHC will be located 480 metres downstream of the ATLAS detector in an unused tunnel (TI18) that links the LHC to the Super Proton Synchrotron (SPS). (Image: Antonia Di Crescenzo/SND@LHC)

The world's largest and most powerful particle accelerator is getting a new experiment. In March 2021, the CERN Research Board approved the ninth experiment at the Large Hadron Collider : SND@LHC, or Scattering and Neutrino Detector at the LHC. Designed to detect and study neutrinos, particles similar to the electron but with no electric charge and very low mass, the experiment will complement and extend the physics reach of the other LHC experiments.

SND@LHC is especially complementary to FASERν, a neutrino subdetector of the FASER experiment, which has just recently been installed in the LHC tunnel. Neutrinos have been detected from many sources, but they remain the most enigmatic fundamental particles in the universe. FASERνand SND@LHC will make measurements of neutrinos produced at a particle collider for the first time, and could thus open a new frontier in neutrino physics.

SND@LHC is a compact apparatus consisting of a neutrino target followed downstream by a device to detect muons, the heavier cousins of electrons, produced when the neutrinos interact with the target. The target is made from tungsten plates interleaved with emulsion films and electronic tracking devices. The emulsion films reveal the tracks of the particles produced in the neutrino interactions, while the electronic tracking devices provide time stamps for these tracks. Together with the muon detector, the tracking devices also measure the energy of the neutrinos.

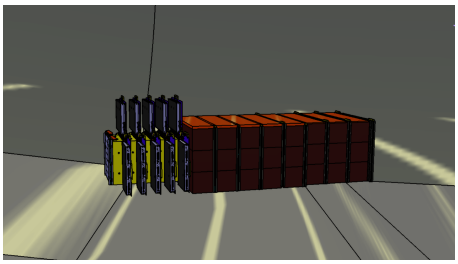
Like FASERν, SND@LHC will be able to detect neutrinos of all types – electron neutrinos, muon neutrinos and tau neutrinos. Unlike FASERν, which is located on one side of the ATLAS detector and along the LHC's beamline (the line travelled by particle beams in the collider), SND@LHC will be positioned slightly off the beamline, on the opposite side of ATLAS. This location will allow SND@LHC to detect neutrinos produced at small angles with respect to the beamline, but larger than those covered by FASERν.

“The angular range that SND@LHC will cover is currently unexplored,” says SND@LHC spokesperson Giovanni De Lellis. “And because a large fraction of the neutrinos produced in this range come from the decays of particles made of heavy quarks, these neutrinos can be used to study heavy-quark particle production in an angular range that the other LHC experiments can't access.”

What's more, SND@LHC will also be able to search for new particles – very weakly interacting particles that are not predicted by the Standard Model of particle physics and could make up dark matter.

SND@LHC will be installed in an unused tunnel that links the LHC to the Super Proton Synchrotron over the course of 2021, and it is expected to begin taking data when the LHC starts up again in 2022.

Find out more about SND@LHC in this Experimental Physics newsletter article (https://ep-news.web.cern.ch/content/designing-sndlhc-experiment).



The SND@LHC experiment consists of an emulsion/tungsten target for neutrinos (yellow) interleaved with electronic tracking devices (grey), followed downstream by a detector (brown) to identify muons and measure the energy of the neutrinos. (Image: Antonio Crupano/SND@LHC)

Ana Lopes

FANCY CYCLING AROUND A PARTICLE ACCELERATOR?

One of the platforms of the Passport to the Big Bang cycle route. (Image: CERN)

Make the most of the sunny days and set out to discover a giant of science, the Large Hadron Collider, or LHC. The LHC is the world's largest particle accelerator. Its 27 km ring is situated a hundred metres below the Franco-Genevan countryside.

The Passport to the Big Bang is a 54 km cycle route that circles the LHC ring at ground level. At each stage, you'll learn about an aspect of the LHC thanks to an interactive platform. The rides between two stops are 4 km long on average, but there's no need to cover the entire route in one day: take your time to solve its riddles and find the codes to restart the accelerator.

Before setting off on your adventure, get your Passport to the Big Bang, a booklet containing information, a map and the riddles you need to solve at each stage. The passport is available in tourist offices and town halls in the Pays de Gex and the Canton of Geneva, as well as Genève Roule (Montbrillant, Terrassière) and Meyrin Roule shops, Pro Vélo Genève, and CERN Reception. It can also be downloaded from the official Passport to the Big Bang website: http://cern.ch/passeport-big-bang.

The Passport to the Big Bang is a free activity for the whole family. No booking is needed and the platforms are freely accessible to the public all year round. So get out your bike and begin your adventure!

Share your photos and videos on social media with #PasseportBigBang and mention @CERN.

APPLY NOW FOR THE KNOWLEDGE TRANSFER FUND AND MEDICAL APPLICATIONS BUDGET

The upcoming deadline for knowledge transfer funding opportunities for CERN personnel is 17 May 2021

(Image: CERN)

The CERN Knowledge Transfer (KT) fund and the Medical Applications (MA) budget are funding opportunities for projects proposed by CERN personnel and based on CERN technologies with high potential for a positive impact on society. Over the years, the projects funded have spanned many technological fields and applications, from the medical and biomedical fields to industry 4.0, environmental protection and sustainability and cultural heritage.

Since 2011, 100 projects have been funded, with the amounts received ranging from 12 to 550 kCHF. In order to be considered, a project should be based on CERN technologies, it should have the approval of the department head, and the department should agree to cover the salaries of the staff members involved. If your technology has the potential for applications in medical or biomedical technologies, you should apply for funding from the MA budget, while if you are targeting other societal applications you should apply for the KT fund.

Submissions for the MA budget should be first presented – even if they are incomplete – at one of the Medical Applications Project Forum meetings. The next forum is on **5 May.**

Full applications for both the KT fund and the MA budget should be submitted by **17 May 2021**.
All applicants will then present their proposals to the KT fund and MA budget selection committee on **24 June 2021**.

Do not hesitate to contact us directly: kt@cern.ch

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Read more about how to apply for funding:

- *CERN Knowledge Transfer fund: https://kt.cern/funding/kt-fund*
- *CERN Medical Applications budget: https://kt.cern/funding/ma-budget*

WHAT A PROGRAMME FOR THE DJANGO GIRLS!

On Saturday 24 April, 45 super-motivated "Django Girls" learned the basics of website development with CERN mentors by their side

CERN Director-General Fabiola Gianotti addressed the Django Girls on Saturday 24 April. (Image: CERN)

Django is a free, open-access website development platform, written in the programming language Python, which helps users develop websites quickly and easily. Members of the female user community decided to encourage women without any computing experience to use the platform via free programming workshops – and that's how Django Girls were born.

The workshops are designed and organised on a purely voluntary basis.

In the evening of Thursday 22 April 2021 and for the whole day on Saturday 24 April 2021, CERN organised its own 100%-virtual Django Girls workshop, open to girls and women aged 15 and above.

In her welcoming word addressed to the participants, Director-General Fabiola Gianotti noted that "The scarcity of women in IT is a waste of human capital".

This year, 45 enthusiastic novices were formed into small groups and guided by 17 CERN mentors – all working in the field of IT – through the creation of a blog and its publication on the Web.

The volunteers all went the extra mile to help the Django Girls, who themselves displayed all determination and concentration needed to get the most from distance learning. "This has really helped open up channels for my future, I am so pleased to have had the opportunity to take part in this activity", noted one of the participants.

The Django Girls workshop was organised this year to mark the International Girls in ICT Day (ICT = information and communication technologies) and was led by three CERN teams, the Women in Technology community, the Visitor and Events Operations section, and the CERN MicroClub.

Let's hope the event spurred these girls and women into taking a closer look at the world of computing.

ON EARTH DAY, CERN UNDERLINES ITS COMMITMENT TO A BETTER PLANET

CERN's state-of-the-art technologies are being translated into solutions for a greener future

(Image: CERN)

Today marks Earth Day, an annual internationally coordinated event to promote environmental awareness and action. High-energy physics technologies and knowledge transfer from CERN have had a considerable impact on society, and the environment is one of the many areas concerned. Indeed, CERN is tapping into its technologies and creativity to help tackle the colossal challenge of making the planet healthier and more sustainable.

Through its Knowledge Transfer group, the Laboratory works with industry, in particular with start-ups, to drive innovation using technologies developed at CERN. Several of these technologies are being put to good use in areas from clean energy solutions to pollution prevention and agricultural optimisation.

One such technology is PlanetWatch, a CERN spin-off that aims to provide a tool to generate, validate, analyse and record air-quality data. Its environmental sensor uses the CERN technology C2MON, a modular Java framework for large-scale industrial monitoring and control. Currently, PlanetWatch has over 500 sensors installed across Europe and the US. Proprietary algorithms and mobile phone and web apps leverage a wide range of leading-edge technologies. These include Algorand, one of the most advanced blockchains in the world, as well as a data acquisition framework developed at CERN and a wide range of IoT-enabled sensors. PlanetWatch will help detect local air pollution peaks and identify local triggers.

Another example is BAQ (Better Air Quality), a start-up that tackles radon gas using RaDoM (Radon Dose Monitor), an innovative radon-monitoring instrument developed at CERN. Radon is a naturally occurring radioactive gas that easily escapes from the soil and accumulates in homes and other buildings. The progeny from radon decay is radioactive and, over time, can lead to health issues such as lung cancer. The RaDoM technology includes a cloud-based service to collect and analyse data, check the measurements and drive mitigation measures based on real-time data. It was field-tested in several successful pilot projects along the lines of Smart Cities and Smart Homes. In 2019, the project resulted in the spin-off BAQ, with CERN and BAQ signing a licence agreement on the technology in December. The future plans for the spin-off are to focus on the European B2B market and to establish BAQ as an innovative player in the field of radon monitoring and mitigation, bringing a positive impact on society by helping to prevent public health problems.

In terms of sustainable agriculture, a collaboration known as Fibre Optic Sensor System for Irrigation (FOSS4I) uses environmental measurement technology from the CMS experiment at CERN to develop a smart water-saving solution for agriculture. FOSS4I aims at optimising irrigation systems at low cost through the online measurement of key soil parameters such as temperature, humidity, and the concentration of pesticides, fertilisers and enzymes. The goal of the resulting system is to save water, increase crop yields and reduce the use of undesirable chemical products.

CERN is also coordinating a project, ARIES, aimed at finding ways to improve the performance, availability and sustainability of particle accelerators. The ARIES team has identified promising R&D projects that could significantly help to reduce air pollution from maritime traffic using particle accelerators, thus making maritime transport greener. One of them is testing a system to break down pollutants with an electron-beam accelerator before safely extracting them.

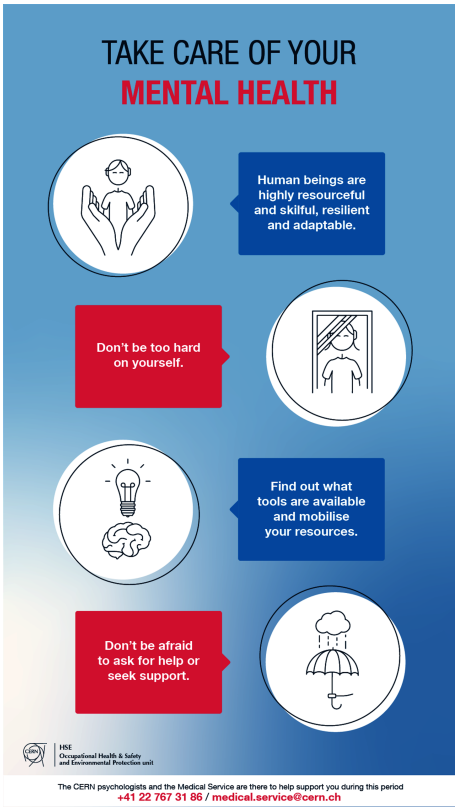
The CERN Laboratory, nested among islands of greenery, is home to a typical dry grassland flora with a rich biodiversity, notably featuring the largest variety of orchid species in the Geneva region. CERN is committed to continued development as a green lab by designing environmentally sustainable infrastructures for the future. These include the energy-efficient Prévessin Computing Centre and the Science Gateway, CERN's future education and outreach facility currently under construction. The latter will be surrounded by green spaces with rich and diverse vegetation and its infrastructure will be carbon-neutral thanks to the use of geothermal energy and solar panels.

As well as answering questions about the origins of our universe, fundamental science can play a key role in providing breakthrough solutions for a greener future. Read here (*https://www.eiroforum.org/news/eiroforum-statement-on-earth-day-2021/*) the Earth Day 2021 statement from the European Intergovernmental Research Organisation forum (EIROForum) Council, of which CERN is a member.

Cristina Agrigoroae

CERN'S MENTAL HEALTH RESOURCES

The many constraints and uncertainties associated with the current pandemic create stress and emotions that can put our inner balance and our mental health to the test



(Image: CERN)

Human beings are resourceful and skilful. We are resilient and capable of adapting. However, the many constraints and uncertainties associated with the current pandemic create stress and emotions that can put our inner balance and our mental health to the test.

Tips for coping:

- Don't be too hard on yourself: it's important to understand that we may not be feeling great at times and that this is perfectly **legitimate**. We can't always be physically and mentally at our best, nor can we give our all on every front. **It's also legitimate to want to feel better**, and resources are at hand to help.

- Find out what tools are available, mobilise your resources: advice on how to look after your health can be found at: https://hse.cern/content/find-support-covid-19

The Medical Service will be regularly sharing other tips for getting through the pandemic, from articles in the *CERN Bulletin* to workshops on Zoom, which the target audiences will be informed about in good time through the appropriate channels.

- Need help or support? If you feel that you would benefit from talking professional or personal matters through with a professional, don't hesitate to contact us. The Medical Service offers all members of the personnel (MPE and MPA) first-line psychological counselling. Appointments with our psychologists, Katia Schenkel and Sébastien Tubau, are free of charge and strictly confidential: https://hse.cern/content/psychologist

Remember, your general health also relies on your mental health.

CERN Medical Service

COMPUTER SECURITY: FANCY DINNER OR BURNED PIE?

Relying on external software packages comes with a risk. Successful attack scenarios have been executed in the past

Gosh, do I look forward to cooking for my friends and family again! Inviting them for a fancy dinner. A friends and family special. With a Caesar salad for the vegetarians; a selection of cold cuts for the carnivores; cheese fondue for the Swiss and lactose-tolerant; and, of course, meringue and *double crème de la Gruyère* for the grand finale! All prepared with care, love and skill, using only the very best, handpicked ingredients from a trip to the local market on a sunny Sunday morning. Preparing a many-star menu for the people I care about – a feast worthy of a chef, foodie and connoisseur.

But I'm not. I don't know how to cook. I just know Thermomixing. And how to programme my Thermomix. I am a programmer and software developer. And if I were to cook like I programme, my friends wouldn't come round again, not even for a simple apple pie. Because, as I programmer, I cook by picking the ingredients from random places without checking that the quality of the ingredients, their texture and taste, delicate and subtle flavours, are as they were in the past, as I expect them to be, as they should be, such that they add flavour and pleasure to my dinner. It's more like I just memorise the location of the market stall, the butcher, the cheese counter, the fruit and vegetable seller, and buy from them over and over again. Trusting those locations blindly. And ignoring that the stall, butcher, counter or seller might have changed their quality, flavour or checks, or just simply changed place or ownership.

No cook would trust a good dinner blindly to market locations. But as a programmer I do. I automatically import software packages and libraries from any source I deem worthy. Worthy at that time, because I found the right code snippets on that webpage. I opt for automatic re-import and update using tools like NPM or PyPi. Easy as apple pie. And risky as burning an apple pie...

Enter supply-chain attacks. Relying on external software packages comes with a risk. Successful attack scenarios have been executed in the past. Packages on

NPM, PyPi, GitHub or any other remote-software-provisioning platform have been compromised in the past by accepting backdoored source code into the newest release, by unverified packages and libraries, by compromising the account of the source-code owner or by handing over the maintenance of that source code to a new (evil) maintainer. Just recently, a security researcher executed a successful supply-chain attack against Microsoft, Apple, PayPal, Shopify, Netflix, Tesla, Yelp and Uber simply by publishing public packages using the same name as the company's internal ones. He took advantage of the fact that PyPi and NPM look out for the newest version and give them priority even over a download from internal sources. Software using NPM or PyPi with internal dependencies on third-party libraries hence fetches newly released dependencies from the internet, first. All the researcher had to do was to figure out the names of those libraries, publish a more "recent" version and wait for PyPi and NPM to do their job.

While CERN was not hit, our development methods do not differ, and the risk remains the same. PyPi. NPM. Automatic internet downloads. While there are mitigations, like using central software dependency curators like Snyk or Nexus, they need to be deployed, centrally managed and curated. Any other means of direct download must be avoided. Hence, I'd like to encourage the developer community at CERN, for the sake of the integrity and security – but also for better version and revision control, dependency management, and license compliance – of the software you develop, including the packages and libraries you import, to think about this and to appeal to your managers to make such a centrally managed service possible! In the end, it's your call: fancy dinner or burned pie? *Bon appétit*.

Do you want to learn more about computer security incidents and issues at CERN? Follow our Monthly Report. For further information, questions or help, check our website or contact us at Computer.Security@cern.ch.

The Computer Security Team

Announcements

CERN COLLOQUIUM ON THE LASER INTERFEROMETER SPACE ANTENNA (LISA), FOLLOWED BY A LIBRARY TALK EVENT | 29 APRIL

On Thursday, 29 April 2021 at 4.30 p.m., Professor Monica Colpi (Università degli Studi di Milano-Bicocca) will give a presentation on "The Laser Interferometer Space Antenna to Explore the Invisible Universe"

On Thursday, 29 April 2021 at 4.30 p.m., Professor Monica Colpi (*Università degli Studi di Milano-Bicocca*) will give a presentation on "The Laser Interferometer Space Antenna to Explore the Invisible Universe" (more on LISA below). To attend, follow the instructions available in the Indico event (*https://indico.cern.ch/event/1026571/*).

The colloquium will be followed by a Library Talk event presenting two science popularisation books on the beauty of astrophysics and gravitational waves: Monica Colpi's *Notte Siriaca* (Science Express) and Paola Catapano's *Il Lungo Viaggio delle Onde Gravitazionali* (Textus). The talks will be moderated by Antonella Del Rosso, after a short introduction by Tullio Basaglia. The books being published in Italian, the Library Talk event will be **in Italian only**.

All colloquium attendees are invited to stay for this presentation, which will be accessible via the same Zoom link.

The Laser Interferometer Space Antenna (LISA)

LISA, a gigameter-scale space-based gravitational wave observatory, will explore the gravitational wave universe in the band from below 0.1 mHz to above 0.1 Hz. LISA will grant us access to a huge cosmological volume with unprecedented reach deep into space, detecting signals up to redshifts 20-30 and even beyond, if sources exist. LISA will detect massive black hole coalescences to unveil the as-yet-unknown origins of the first quasars and to shed light into the teeming population of middleweight black holes forming in galactic dark matter halos. LISA will discover the link between the most energetic phenomena in the universe – accreting and merging black holes – and the grand design of galaxy assembly. In synergy with third-generation ground-based interferometers, we will discover how gravitational collapse to a black hole is triggered, on all astrophysically relevant mass scales from a few tens to a few billions of solar masses. I will address how the X-ray mission Athena, which is joining LISA in concurrent multi-messenger observations of massive black hole coalescences, will greatly enhance our knowledge on the propagation properties of gravitational waves and on the rate of expansion of our universe.

Monica Colpi

SOFTWARE AND COMPUTING FOR HIGH-ENERGY PHYSICS WILL TAKE THE STAGE AT VCHEP2021

The CERN-organised 25th International Conference on Computing in High-Energy and Nuclear Physics (vCHEP2021) will take place online from 17 to 21 May 2021

Registration for the (virtual) 25th CHEP conference, which will take place from 17 to 21 May 2021, is now open (*https://indico.cern.ch/event/948465/registrations/*). In the light of the ongoing pandemic, it was decided to organise an online version of the free-to-join conference this year as a showcase for software and computing in high-energy physics (HEP) and to support the community, encourage discussion and foster further innovation in the field. Instructions for joining conference sessions will be sent to registered participants only.

The scientific programme for vCHEP2021 addresses the computing, networking, storage and software needs of the world's leading high-energy and nuclear physics experiments, which analyse hundreds of petabytes of data using worldwide computing resources. vCHEP2021 will place a strong emphasis on innovation, and the topics covered will span the Large Hadron Collider experiments upgrades, machine learning, quantum computing, distributed computing systems, and algorithm optimisation and parallelisation.

For the first time at CHEP, contributors have been asked to prepare an abstract and an extended submission of six to ten pages, describing their work in detail. More than 200 papers from all over the world have been submitted, which will certainly make for a rich and vibrant conference.

The programme has been designed with a strong high-energy and nuclear physics focus. The most innovative contributions have been placed centre stage: they will be the subject of a series of longer talks in plenary sessions. The many other relevant papers will be presented in a series of parallel sessions throughout the week. The programme has been arranged to allow for global participation from the Asia-Pacific region, Europe and the Americas.

All contributions accepted at the conference will be published in the form of proceedings. The best contributions will be submitted to *Computing and Software for Big Science (https://www.springer.com/journal/41781)* (CSBS, Springer), one of the premier peer-reviewed journals for the field.

And while you prepare for this year's conference, you might already want to save the date for next year's: CHEP2022, organised by Jefferson Lab, which will take place in Norfolk, Virginia, USA, from 16 to 20 May 2022.

For any questions related to vCHEP2021, contact: chep2021-secretariat@cern.ch.

JOIN DK@CERN 2021: CONNECTING TECHNOLOGY EXPERTS WITH DANISH COMPANIES

CERN will welcome Danish industry on 2 and 3 June 2021 in a digital format

The DK@CERN industrial exhibition, organised by CERN in collaboration with the Danish Technological Institute, will be attended by a wide spectrum of Danish companies active in fields of interest to researchers, engineers and technicians at CERN.

“The objective is to develop contacts and match Danish companies with the relevant CERN technical counterparts and procurement officers in order to address the upcoming challenging requirements at CERN. ” – *CERN Procurement Service*

Anyone at CERN is welcome to attend the event. The complete programme is available here (*https://denmarkcern.cern.b2match.io/*).

If you are not already considered a “CERN contact person” for Industrial Events@CERN and wish to make appointments with the Danish companies, please send an email to dk-at-cern-contacts@cern.ch to receive an invitation.

While the global situation is not exactly the same as it was during the previous iteration, the purpose of the event remains the same: to develop the commercial relationship between CERN and leading companies in its Member States. Procurement remains a fundamental aspect of CERN's economic impact in its Member States and, reciprocally, advancements in accelerators, detectors and computing take shape through successful business collaborations with a variety of industries.

DISCOVER THE NEW CERN LIBRARY CATALOGUE

The Library Catalogue, which used to be on the CERN Document Server (CDS), now has its own application: http://catalogue.library.cern

The CDS and Library teams have been jointly developing the CERN Library Catalogue with the aim of improving your experience when using the Library's services: searching the various collections, borrowing books, accessing electronic resources, requesting new documents, etc.

The CERN Library Catalogue only includes documents that are made physically or electronically available to the CERN community by the Library: e-books, books, proceedings, standards and journals.

CERN scientific publications such as preprints, published articles or theses written by CERN authors or collaborations will stay in CDS in its role as CERN's institutional repository. However, links between the two systems have been enabled to allow for smooth navigation between documents.

Please send any feedback to library-catalogue-feedback@cern.ch.

CERN Library

CERN ALUMNI EVENT: "MOVING OUT OF ACADEMIA TO THE ENVIRONMENTAL INDUSTRY" | 30 APRIL

(Image: CERN)

Learn more about how fellow alumni successfully managed a transition from Academia to the Environment Industry in this new Alumni event.

If you are considering moving into this sector of activity, this is your opportunity to come along with your questions and obtain first-hand information from panellists.

The first part of the event will be focused on the nature of the work carried out by panellists and on other skills they acquired at CERN which have helped them (or not) in the transition. They will also explain which additional skills they had to develop after CERN for a successful career move.

The second part of the event will provide you with very practical advice on how to prepare for such a transition, how to get started, what errors to avoid, where to look for help and how to promote your assets.

Friday 30 April 2021
2 p.m. - 5 p.m.
Register now on the Indico page (*https://indico.cern.ch/event/998463/*)

Obituaries

PIERLUIGI RIBONI (1935 – 2020)

(Image: CERN)

Pierluigi Riboni passed away in Geneva on 9 November, aged 85, as a consequence of COVID-19. Born in Pavia, Italy, he graduated from Milan Polytechnic in 1961 as a mechanical engineer. After working a few years for Montecatini in Porto Marghera near Venice, he joined CERN as the head of the Mechanics group in the Engineering division. Initially his work focused on supporting the PS groups and, in particular, concerned the vacuum systems. In the 1970s he also contributed to the design of ESO's 3.6 m telescope.

During the early 1990s Riboni became the head of CERN's central machines shop, which is responsible for supporting the accelerators and detectors by supplying machines and material, from conceptual design to quality-controlled end products. Personnel shortages during these times meant that he often had to face the "making or buying" dilemma, leading him to become increasingly involved with technology transfer to industry. For nearly 20 years he co-organised the industry sessions of the biannual Conference on Astroparticle and Particle Physics, Detectors and Medical Applications, held in Como, Italy. The con-

ference became an important venue for knowledge exchange for several hundred scientists, engineers, managers and administrators of research institutions.

Pierluigi remained active long into his retirement, in particular contributing to CERN's activities. He was one of the first engineers involved in the CMS detector, and continued to contribute through an association with ETH-Zurich, focusing on the production of the superconducting cable of the solenoid and on the manufacturing of four grease pads. In 2002 he joined the TERA Foundation, which collaborates with CERN in the development of hadron therapy techniques, and contributed to the mechanical design of both high-frequency proton accelerators and gantries that support magnetic beam lines and rotate around the patient's bed. In particular, he designed a gantry that weighed 25 tonnes, which was 10 times less than the existing ones. The report on SIGRUM – the Superconducting Ion Gantry with Riboni's Unconventional Mechanics – was presented a few days after he left us to the international advisory committee set up by CERN, CNAO, INFN and MedAustron.

Pierluigi's cultural background covered philosophy, politics, economics and architecture. His vast knowledge originated from both an unbound curiosity and a great interest in learning. He also had a passion for athletics, tennis and skiing, balancing his intellectual interests with his physical wellbeing. His life choices were characterised by an unbeatable optimism, which allowed him to maintain a positive attitude towards all professional and life challenges. He had a gentleman's attitude in his relations with people, and he always encouraged and supported younger collaborators.

Pierluigi is among the best Italian engineers who have contributed to the successes of CERN. He will be missed by his family, friends and collaborators, but will always live in our memories.

His friends and colleagues

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This obituary will be published in the May-June issue of the CERN Courier .

Ombud's corner

MY OWN VISIT TO THE CERN OMBUD

I have been wondering what my first Word from the Ombud could be when I have only recently taken on the role. I thought that sharing with you my own visit to the Ombud would be a good start.

I contacted the Ombud many years ago, as I found myself in a semi-permanent, slightly conflictual situation. It wasn't particularly a big deal in the grand scheme of things but it was a real problem for me. Years of experience at the Laboratory, facing various situations, did not really help, as new interpersonal challenges tend to emerge throughout a career.

Although I had reflected carefully on the root of the conflict, and what I could possibly do to resolve it, it only became more and more present every day and was a constant challenge. I was angry, nervous and fed up with it.

One day, following a particularly tense exchange, I decided that I could do with some advice and contacted the Ombud. I got an appointment very quickly.

The Ombud's first words were to remind me of the four principles that apply in this office.

Confidentiality : Very often referred to but hard to get in the Laboratory. Still, I fully trusted that this would be the case with the Ombud.

Independence : This is the freedom from any kind of influence or conflict of interest. I trusted the independence of my interlocutor, guaranteed by a direct hierarchical link to the Director-General.

Impartiality : This is the absence of judgement and not taking a side. This was less my cup of tea, as everyone has a natural tendency to want to gain the sympathy of their interlocutor. However, I realised that the Ombud offers empathy but not sympathy. *Empathy* is when you understand the feelings of another but do not necessarily share them. *Sympathy* and sharing one's feelings is a dimension that a colleague, but not the Ombud, can offer.

Informality : This was new to me. It meant that I would stay in full control of the situation and no action would be taken that I did not agree to. I could use my own words, I could disclose any information that I was aware of, or reveal anything I feared I had done, and this would stay strictly between the Ombud and me and would not set in motion any process.

The Ombud then asked, giving me undivided attention: “So, tell me, what brought you to this office?”

To my great surprise, the Ombud was not interested in a full detailed analysis of the situation I was in. Rather, the questions were “So how do you feel about this? What impact has this conflict had on your work or your personal life? How would you feel if the problem were solved? How do you think the other person feels about this situation?”

That triggered a few thoughts.

The Ombud went on to ask: “What have you tried so far to solve the problem? What options do you have? What are their pros and cons? How do you think the other person will react? What do you need today to move forward?”

That led me to consider the issue from a different angle.

The Ombud concluded the discussion by asking what would be my next steps when I left the office and suggested that I come again to follow up on the discussion and see what progress I had been able to make in resolving the conflict. The Ombud also offered mediation with the other person, should we both be willing, in good faith, to address the conflict.

When I left the office, I had no ready-made solution, but a much more balanced and objective view of the situation and much clearer ideas of how I could move forward.

Whatever the issue you are facing, a discussion with the Ombud is worth your time, and remember: The Ombud's office is a safe place and the Ombud is here to help you!

Laure Esteveny

If you'd like to comment on any of my articles or suggest a topic that I could write about, please don't hesitate to e-mail me at ombud@cern.ch.