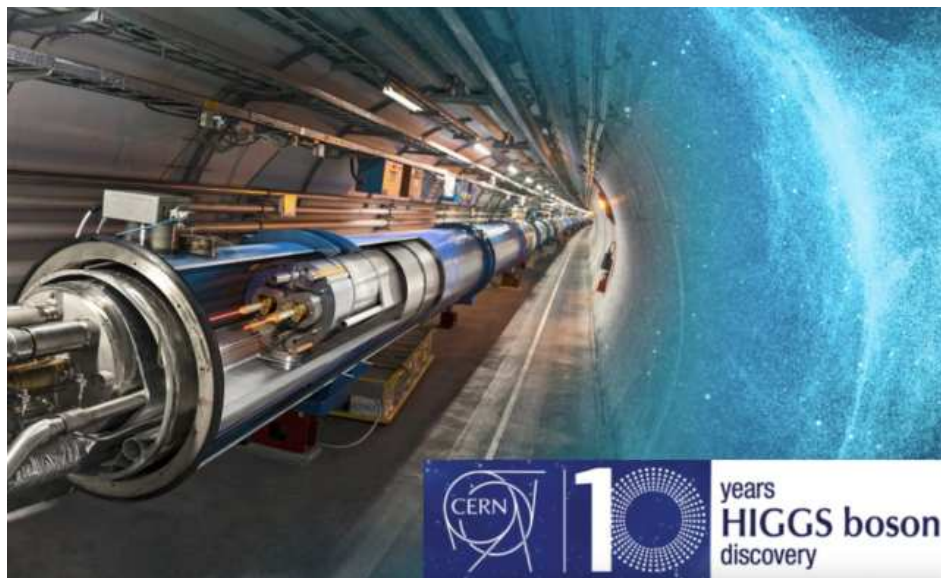


## Higgs10: inventing the future of Higgs research

History teaches that those who explore relentlessly and fearlessly are often the ones rewarded with the greatest prize of all: the truth.



(Image: CERN)

In 1975, three CERN theorists, John Ellis, Mary K. Gaillard and Dimitri Nanopoulos, undertook the first comprehensive study of the collider phenomenology of the Higgs boson. Almost 40 years later, it was discovered at the LHC. Now, ten years on, might we have such long-term foresight in anticipating the varied paths that future Higgs research may follow? On 4 July 2022, enjoying the many beautiful presentations at the Higgs@10 symposium, a phrase kept ringing in my ears: "Compatible with Standard Model (SM) predictions". Alarm bells were ringing. Really? Are we sure? Whether or not the Higgs is SM-like is a

question that will shape the experimental future of Higgs research. We may quantify an answer through the language of effective field theory, which is a mathematical manifestation of the notion that the most effective way to describe an object depends on the length scale you're viewing it from. To astronauts, Earth is very effectively described as a smooth sphere. For summer stude ...

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Matthew McCullough

## A WORD FROM JOEL BUTLER

### Mapping out the future of high-energy physics in the United States

On 17 July 2022, hundreds of US high-energy physicists, along with colleagues from all over the world, gathered for a ten-day meeting to take one of the final steps in the latest US high-energy physics (HEP) community planning exercise.

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# Mapping out the future of high-energy physics in the United States

On 17 July 2022, hundreds of US high-energy physicists, along with colleagues from all over the world, gathered at the University of Washington in Seattle for a ten-day meeting to take one of the final steps in the latest US high-energy physics (HEP) community planning exercise. These exercises, hosted by the Division of Particles and Fields of the American Physical Society (APS), take place every seven to ten years. Their goal is to identify the most important questions in HEP for the next two decades and the tools and infrastructure required to address them. The process and the final meeting go by the name “Snowmass”, harking back to the early editions, starting in 1982, which concluded with a community summer study in Snowmass, Colorado. The Seattle meeting, originally scheduled to take place in July 2021, was delayed by one year because of the COVID-19 pandemic.

Snowmass is a “science study” in which all scientifically credible ideas and proposals are welcome. It does not concern itself with costs or budget constraints. However, the projects and proposals that it develops provide input to a follow-up Particle Physics Project Prioritization Panel, known as P5, which makes recommendations to the US Department of Energy and National Science Foundation on which HEP projects to undertake, based on various funding scenarios.

The Snowmass study was organised into ten working groups, or “frontiers”: accelerator, cosmic, community engagement, computing, energy, instrumentation, neutrino, rare processes and precision measurements, theory, and underground facilities and infrastructure. An organisation of early-career physicists helped bring the issues of young people into the community study. More than 2000 physicists from all over the world

contributed to over 500 white papers that are now being distilled into frontier reports. The reports, together with an overall summary and all the white papers, will then be provided to P5.

The Seattle meeting, which ended on 26 July, was a hybrid event, with approximately 700 people attending all or part of the meeting in person and another 650 people participating remotely. It provided a final opportunity for the frontiers to discuss their visions internally, to ensure that they were aligned with those of the other frontiers and to resolve any issues before writing their final reports. The daily programme typically started at 8.00 a.m. and ran until 7.00 p.m. Days 2–8 were packed with parallel sessions in the mornings and three 90-minute plenary sessions in the afternoons. Days 1, 9 and 10 consisted entirely of plenary sessions that included special presentations of plans and planning processes by many leaders of US and international institutes and laboratories, including Fabiola Gianotti (CERN), Masanori Yamauchi (KEK, Japan), Yifang Wang (IHEP, China), and Lia Merminga (Fermilab, US).

Many scientists from the CERN community contributed their ideas to the Snowmass process and several attended the Seattle meeting. Both Director-General Gianotti and Fermilab Director Merminga acknowledged the importance of US–CERN collaboration on the LHC and the HL-LHC, the LHC Accelerator Upgrade Project and DUNE at LBNF, and expressed an openness to discuss collaboration on future projects, including future colliders.

On the final day, Priscilla Cushman of the University of Minnesota put it all in perspective with her inspiring “Community Summer Study and Workshop Synthesis”. As the audience

held its breath, JoAnne Hewett of SLAC National Accelerator Laboratory and chair of the US High Energy Physics Advisory Panel (HEPAP) announced that the new P5 chair would be Berkeley professor Hitoshi Murayama.

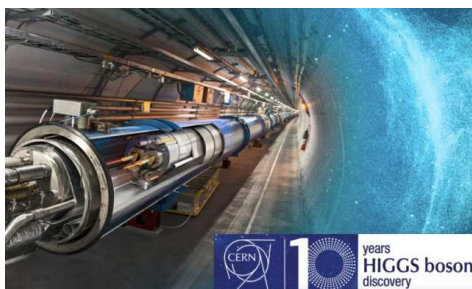
We wish to acknowledge the work of the University of Washington local organising committee, led by Professors Gordon Watts and Shih-Chieh Hsu, for running an outstanding workshop under difficult circumstances. We thank the four units of APS whose work is closely related to HEP, namely astrophysics, nuclear physics, physics of gravity, and especially the physics of particle beams, for their many contributions to this Snowmass process. Finally, we express our thanks and admiration to the Snowmass community, who produced great physics studies despite the many challenges facing them in this period.

*Joel Butler, US Division of Particles and Fields, Chairperson, 2022, Fermilab, Batavia, IL, US.  
Sekhar Chivukula, University of California, San Diego, San Diego, CA, US. (DPF Chairperson-elect)  
Andre de Gouvea, Northwestern University, Evanston, IL, US. (DPF Vice-Chairperson)  
Tao Han, University of Pittsburgh, Pittsburgh, PA, US. (DPF Chairperson, 2021)  
Young- Kee Kim, University of Chicago, Chicago, IL, US. (DPF chairperson, 2020)  
Priscilla Cushman, University of Minnesota, Minneapolis, MN, US. (DPF recent chairperson, 2019)*

Joel Butler

## Higgs10: inventing the future of Higgs research

**History teaches that those who explore relentlessly and fearlessly are often the ones rewarded with the greatest prize of all: the truth.**



(Image: CERN)

In 1975, three CERN theorists, John Ellis, Mary K. Gaillard and Dimitri Nanopoulos, undertook

the first comprehensive study of the collider phenomenology of the Higgs boson. Almost 40 years later, it was discovered at the LHC. Now, ten years on, might we have such long-term foresight in anticipating the varied paths that future Higgs research may follow?

On 4 July 2022, enjoying the many beautiful presentations at the Higgs@10 symposium, a phrase kept ringing in my ears: “Compatible with Standard Model (SM) predictions”. Alarm bells were ringing. Really? Are we sure? Whether or not the Higgs is SM-like is a question that will shape the experimental future of Higgs research.

We may quantify an answer through the language of effective field theory, which is a

mathematical manifestation of the notion that the most effective way to describe an object depends on the length scale you’re viewing it from. To astronauts, Earth is very effectively described as a smooth sphere. For summer students hiking to Le Reculet, it is not. So, too, of the quantum world. Far from a neutral atom, it effectively appears as a point-like particle with some leftover multipolar interactions with photons. At shorter distances, getting in amongst the electrons, this description fails entirely.

Ditto the Higgs. Whatever’s going on in there, at energies near enough to mh, it is effectively described as a point particle with a handful of additional “operators”, which are essentially

new particle interactions that aren't contained in the SM (don't feature on *that* mug or T-shirt) but do involve SM particles. By eye, the astronaut may be able to make out some features on Earth and surmise that there may be mountains, but they couldn't actually estimate the students' elevation gain. Similarly, the non-SM Higgs operators can capture the long-distance leftover effects of the microscopic innards of the Higgs, but not reveal their full glory in detail. If all of these extra operators vanish, the Higgs is SM-like. Let's consider two hand-picked examples and investigate just how SM-like the Higgs is...

How "fuzzy" is it? Is it point-like down to the smallest distance scales or is it, like the pion, made up of other as-yet-unidentified new particles? In the latter case, much as for the pions and their constituent quarks and gluons, directly observing the new stuff would require going to higher energies. Alternatively, it could be point-like but probing it closely may reveal the telltale clues of a cloud of new particles that it interacts with. For your interest, the operator that can capture these properties is written  $(\partial\mu H)^2$ . If it vanishes, the Higgs is entirely point-like. If not, it's fuzzier than expected. How fuzzy is it? Present LHC Higgs coupling measurements suggest it is effectively point-like down to a length scale merely a factor three below the electroweak scale. It could still be very fuzzy indeed! As fuzzy as a pion. If so, hardly an SM-like Higgs! We must do better and, through much more precise coupling measurements at the 0.2% level, a future Higgs factory like the FCC-ee could determine if the Higgs is point-like as far down as the 6% level.

Does the Higgs find itself attractive? Yes, according to the SM. New particles means new forces and so it follows that if the Higgs boson interacts with new heavy particles they will generate a new force between the Higgs and itself. The operator effectively capturing this is  $|H|^6$  and it literally shapes the way in which the Higgs field gave mass to particles during the very nascence of our universe! So, how SM-like is the Higgs self-attraction? With present experimental constraints, we know the Higgs self-attraction could be 530% stronger than the SM value (not merely self-attraction, more like outright vanity) or even -140% less (self-repulsive, more like). Hardly SM-like in either case! To have any idea of whether the self-attraction is SM-like, we must do a lot better. A

future facility, such as the FCC-hh, CLIC or a muon collider, could probe the self-attraction at the much more precise 5% level.

Patience is a virtue; complacency is not. It is far too early to call time at the bar for the Higgs boson. Who knows, we may even be served with something completely unexpected, like a new window into the dark sector of the universe. Truly exploring all facets of the nature of the Higgs boson, understanding whether or not it is SM-like, will take time (measured in decades) and a lot of hard work. But it can and should be done. This is the experimental future of Higgs research that we look forward to.

All that said, it's no secret that many theorists expected the Higgs to be much less SM-like than it appears to be already. Heads duly scratched, a theoretical coup d'état is now silently under way. There were good reasons to expect something different: chiefly the hierarchy problem. This problem is not simply aesthetic. The SM breaks down at high energies, ultimately making pathological predictions, thus it can only be a long-distance effective field theory description of something else more fundamental. If, as was the case for pions, the Higgs mass is determined by the more fundamental parameters, then for the Higgs there is no mechanism to keep it lighter than the mass scale of the new particles in that theory. Yet colliders tell us there is a gap between the mass of the Higgs and that of those new particles. In the past, this motivated the discovery and development of new mechanisms to explain a light Higgs, such as the venerated low-scale supersymmetry, thus far a no-show at the LHC physics party, with its attendant non-SM-like Higgs.

Rudely awoken by the deluge of exclusion plots, coffee reluctantly smelled, theorists have, in recent years, put forward what could well transpire to be revolutionary theoretical developments. The hierarchy problem hasn't gone away and neither has the data, so the other foundational assumptions covertly injected into the old theories, often linked to symmetry or aesthetic principles such as simplicity or minimality, have been interrogated and found wanting. In response, intrepid new classes of theories have been developed that can address the hierarchy problem whilst being consistent with all those bothersome exclusion plots. They range from relatively modest conceptual tweaks of existing

structures, to the abandonment of aesthetic principles, and then all the way out the other side to attempts to link the Higgs mass to the origins of the universe, cosmology, the nature of the Big Bang and, at an extreme, speculations about possible links between the Higgs mass and the existence of life itself. You name it, we're boldly going.

It's no *fait accompli*. None of these ideas are as intoxicating as supersymmetry or as stupefying as extra dimensions, each leaving those who study them with more of a "watch this space" feeling than the "eureka" that Archimedes enjoyed. Various, they're not radical enough, too radical or simply not to taste. No Goldilocks moment just yet. However, in my view these issues are cause for hope. In similar moments in the past, we have been essentially on the right track, having to wait a little longer than expected for the confirming experimental data (top quark). At other times, the right ideas have been too radical for most to stomach in one sitting (quantum mechanics). Yet for others the correct approaches languished in relative obscurity far too long, simply for not being *à la mode* (quantum field theory). Look up the citation records of the original Brout-Englert, Higgs, Guralnik-Hagen-Kibble papers or Weinberg's "A Model of Leptons", all foundational to the physics of the Higgs boson, and you'll see they are important cases in point that we would do well to remember. Nature made no promises that understanding the origins of the Higgs should have been easy, nor should it be in the future, but history teaches that those who explore relentlessly and fearlessly are often the ones rewarded with the greatest prize of all: the truth.

Where will all this go in coming years? Will we be tenacious enough to build the accelerator, the detectors and the village it will take to measure the Higgs self-attraction or discover the fuzziness of the Higgs? Will some plucky theorists unlock the door to the fundamental theory beyond the SM? Will future phenomenologists lay the first foundational stones on the path to discovering it?

As Dennis Gabor, the inventor of holography, put it: "The future cannot be predicted, but futures can be invented." We're working on it.

Matthew McCullough

## Celebrating five years of the CERN Alumni Network, with gold!

On 8 June 2022, we celebrated the fifth anniversary of the CERN Alumni Network and its vibrant community

(Image: CERN)

On 8 June 2022, we celebrated the fifth anniversary of the CERN Alumni Network and its vibrant community, which has grown to more than 7800 members.

The network was established for multiple reasons, namely to enable former members of personnel to stay connected with the

Organization and its people, to demonstrate the positive impact of a CERN experience through its alumni, to establish a network of ambassadors in support of CERN's mission and to support those in their early career if and when they decide to leave the Organization. The diverse alumni community orbits around the alumni.cern platform, the heartbeat of the programme.



Second Collisions: Research Matters – Alumni impact on Society

Year: 2022  
Event: Alumni Gold Award  
Award Message: CERN  
Award: Circle of Excellence  
Category: Social Externs (Online Alumni Outreach)





For the fifth anniversary of the programme, CERN alumni who are actively “giving back” to both the network and CERN gathered for a LinkedIn live (<https://www.linkedin.com/video/live/urn:li:ugcPost:6940324151840673792/>), which was broadcast from the CCC (CERN Control Centre) and attended by both Rende Steerenberg, head of the Operations group (Beams department) and Charlotte Warakaulle, the Director for International Relations. The broadcast was also an opportunity to connect with alumni based in London, Stockholm and Madrid who are actively involved in supporting CERN and its Alumni Network, either as members of the CERN alumni advisory board, as regional or interest group managers, or by assisting our HR team in sourcing talent in their respective countries.

In Madrid, we met CERN alumna and Ion Biotech co-founder Ana Megía Macías. Along with representatives from the Medical Applications team in CERN’s Knowledge Transfer group, Ana announced the imminent creation of a CERN Alumni MedTech group. “During our time at CERN and in our

subsequent careers, we work in diverse fields and acquire special capabilities. Sharing our experience and knowledge with others can have a huge, positive impact. Therefore, I am keen to give back and co-found a CERN Alumni MedTech group to share my experience with other members.”

The celebrations continued well into June, when the alumni relations team was awarded the **CASE** (Council for the Advancement and Support of Education) **Circle of Excellence gold award** for the CERN Alumni Second Collisions online event, held from 1 to 3 October 2021. “What better accolade and greater honour than to be recognised by leaders from one’s industry?” commented Rachel Bray, head of CERN Alumni Relations. “We dedicate this award to the multiple teams and colleagues across CERN who contributed to Second Collisions and made it such an innovative and memorable success.”

The CASE judges commented: “We felt this was a highly innovative event, with the virtual re-creation of the CERN site giving alumni the

opportunity to revisit and explore iconic buildings and take part in a variety of activities, from keynote speeches to networking. We liked the use of in-house resources to deliver the virtual environment and increase internal buy-in, with events moderated by CERN colleagues and alumni award recipients nominated by CERN directors. Judges also commented on the creative use of the virtual booths, which featured CERN spin-off and start-up companies, as well as internal exhibits, and included job opportunities.”

You do not need to have left the Organization to take part in this vibrant community. Members of personnel are welcome to activate their account on the alumni website (<https://alumni.cern/>). Furthermore, the Office for Alumni Relations is seeking CERN colleagues who wish to speak in our online series “News from the Lab” and showcase their fascinating work to CERN alumni. Contact [alumni.relations@cern.ch](mailto:alumni.relations@cern.ch) (<mailto:alumni.relations@cern.ch>) if you are interested.

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## Strong CERN showing at the Atomiade Summer Games in Grenoble

The sports competition, which brings together members of public research institutes across Europe, was back on track after a three-year hiatus



The CERN athletics team at the 2022 Atomiade Games  
(Image: CERN)

From 10 to 13 June, more than 1300 athletes came together in the beautiful city of Grenoble for the 17th Atomiade Summer Games, hosted by AS CEA-ST (the sports club of the French Alternative Energies and Atomic Energy Commission (CEA), supported by CEA-Grenoble). Just under 80 competitors represented CERN in multiple disciplines including athletics, basketball, golf, tennis, table tennis, football, volleyball, cycling, mountain biking, swimming and trail running. Out of a total of 27 teams, CERN finished in 12th place, with 8 gold medals (tennis, swimming) 13 silver medals (athletics, basketball, swimming) and 26 bronze

(athletics, football, table tennis and swimming), the team’s best result on record.

The governing body overseeing such Atomiade events, ASCERI (Association of the Sports Communities of the European Research Institutes), aims to contribute to a united Europe through regular sports meetings, bringing together members of public research institutes across Europe. The Association’s members come from over 42 research institutes (<https://www.asceri.eu/en/as-sociated-institutes>) spanning 16 countries. (Due to the Russian invasion of Ukraine, ASCERI took the decision to suspend the membership of Russian sport associations with immediate effect, in line with the peaceful principles of ASCERI.)



The CERN team for the 2022 Atomiade Games  
(Image: CERN)

Sustainability was at the heart of this year’s summer Atomiade, with all sports venues easily accessible via public transport. It was a zero-plastic event, and locally sourced and seasonal produce was served in the picnic lunches and at the evening dinners. Conviviality and friendly competition are other key ingredients of the summer Atomiade: one CERN athlete commented that “despite the fact that we’re competing, my fellow athletes are only too happy to share tips and techniques to help me improve my performance, which resulted in a bronze medal!” After the effort and competition on Saturday and Sunday, participants came together at the Alpexpo venue to continue networking with fellow athletes from scientific institutes across Europe in a relaxed and celebratory environment. “After a hiatus of three years, it’s wonderful to reunite with old friends and connect with new ones,” commented one member of the CERN team.

Both the Staff Association and the CERN Management were strong supporters of the CERN team, having contributed to registration costs and provided the team with a distinctive CERN T-shirt, which participants wore proudly.

The next ASCERI event on the calendar is the mini Atomiade, to be hosted in Berlin in summer 2023. More information to follow soon on the ASCERI website (<https://www.asceri.eu/en/>).

# “Collider Diaries” web series receives prestigious SCINEMA Festival award

CERN research made waves at the 22th edition of SCINEMA, the largest science film festival in the southern hemisphere



(Image: CERN)

CERN research made waves at the 22th edition of SCINEMA (<https://scinema.org.au/>), the largest science film festival in the southern hemisphere, which takes place in Adelaide, Australia. Established in 2000, SCINEMA attracts hundreds of entries from across the world, including from some of the world's most respected popular science creators and documentary directors. An episode of “Collider Diaries”, a series created by the Future Circular Collider (FCC) collaboration and Terra Mater Studios with the support of the H2020 MSCA EASITrain (<https://easitrain.web.cern.ch/>) project, won the **Best Online Format award** at last week's edition of the festival.

The Collider Diaries follow five young scientists involved in the FCC study, portraying their motivations, inspiration and personal journey

as they strive to make the ambitious scientific project a reality. The short films take a behind-the-scenes look at Dorothea, Vanessa, Maxime, Alice and Aisha, who share their personal insights about science and their work for the FCC, and reflect on the lessons learned from participating in a global collaboration and the processes that lead to the birth of new ideas. Premiered in summer 2021, the first episode, “Unvarnished diaries of a CERN scientist – working on the biggest science experiment ever ([https://www.youtube.com/watch?v=K0NqsgHNQnc&ab\\_channel=FutureCircularColliderStudy](https://www.youtube.com/watch?v=K0NqsgHNQnc&ab_channel=FutureCircularColliderStudy))”, features Dorothea Fomesu, an engineer currently working at CERN's Central Cryogenic Laboratory.

As with any major scientific endeavour, the success of the FCC project will depend on honest and transparent communication with peers and the general public. Besides generating countless particles, the FCC will also generate a trove of human stories, and the Collider Diaries aim to capture and share these stories from the project's outset. In the words of Markus Mooslechner, executive producer of the project at Terra Mater Studios: “Their stories, who they are and how they came to do what they do, are very personal. By focusing on the individuals, we try to get to the heart of their backgrounds and motivations for doing science – because it's usually personal dedication and

commitment that drives science to excellence.” The Collider Diaries capture the five scientists' technical expertise alongside their human experience, to engage a wider audience around the globe.

Courses in communication delivered by Terra Mater Studios and CERN's Education, Communications and Outreach group have proved key to the success of the shooting and production of the Collider Diaries. This emphasis on communication training, driven by the EASITrain project, helped the film-makers develop innovative solutions to overcome the travel restrictions in the midst of the COVID-19 pandemic and to keep production sustainable (the series is certified under the UZ76 Green Producing criteria of the Austrian Ecolabel (<http://s://cutt.ly/JmWoYgY>)).

The SCINEMA award crowns months of creative work and is testament to the success of the Collider Diaries in sparking the interest of non-scientific audiences in the FCC project's technological challenges and the internal life of the collaboration. Following this success, Terra Mater Studios have become involved with the H2020 FCCIS design study to find novel ways of sharing stories from the daily activities of the collaboration.

Tune in for more Collider Diaries episodes here (<https://cutt.ly/oQnlpqD>).

## ALICE congratulates its PhD thesis award winners



ALICE Thesis Award winners pose with their awards. From left to right: Philippe Crochet (co-chair of the selection committee), Marielle Chartier (chair of the collaboration board), Shreyasi Acharya, Dimitar Mihaylov, Jasper Parkkila, Mike Sas and Barbara Erasmus (ALICE Deputy Spokesperson). Mattia Faggin (right) connected remotely. (Image: CERN)

On 28 July, the ALICE collaboration awarded the annual prizes for the best PhD theses at a ceremony held in the CERN Main Auditorium as part of the ALICE Physics Week. Since 2008, the collaboration has recognised the most outstanding PhD theses in the field of physics and instrumentation based on the excellence of the results obtained, the quality

of the thesis manuscript and the importance of the contribution to the collaboration.

After reviewing all the theses submitted for the award, the ALICE Thesis Awards Committee selected five winners: **Shreyasi Acharya** (Variable Energy Cyclotron Centre, HBNI, Kolkata, India), **Mattia Faggin** (University of and INFN, Padova, Italy), **Dimitar Mihaylov** (Technische Universität München, Germany), **Jasper Parkkila** (University of Jyväskylä, Finland) and **Mike Sas** (Utrecht University, Netherlands).

The winners gave flash talks on their thesis work and received prizes and mementos from the ALICE Deputy Spokesperson, Barbara Erasmus, with congratulations from the Chair of the Collaboration Board, Marielle Chartier, and the Chairs of the selection committee, Giuseppe Bruno and Philippe Crochet.

The winning theses are:

Multiparticle production in proton–proton collisions at the LHC energies (<http://cds.cern.ch/record/2790621?ln=en>) by Shreyasi Acharya

Measurement of heavy-flavour decay electrons and heavy-flavour baryon production with ALICE experiment at LHC (<http://cds.cern.ch/record/2798337?ln=en>) by Mattia Faggin

Analysis techniques for femtoscopy and correlation studies in small collision systems and their applications to the investigation of  $p$ – $\Lambda$  and  $\Lambda$ – $\Lambda$  interactions with ALICE (<http://cds.cern.ch/record/2766680?ln=en>) by Dimitar Mihaylov

Quantifying the transport properties of quark–gluon plasma through measurement of higher harmonic flow and their non-linear response (<http://cds.cern.ch/record/2791172?ln=en>) by Jasper Parkkila

Illuminating Light (<http://cds.cern.ch/record/2774578?ln=en>) by Mike Sas.

More on the ALICE collaboration's website (<https://alice-collaboration.web.cern.ch/node/35036>).

# ATTRACT unveils the projects that will benefit from its €28 million fund for innovation

ATTRACT, a research and innovation project funded by the European Union and backed by a consortium of nine partners, including CERN, will commit €28 million to finance 36 projects from more than 20 countries



*ATTRACT is a European funded project whose goal is to develop next-gen scientific tools, co-create new business and market products, increase European companies' competitiveness, and trigger more and better jobs for Europeans. (Image: ATTRACT)*

It takes years for a spinoff idea to leave the lab, mature and eventually hit the market, if ever. ATTRACT aims to develop a funding model to help diminish the time needed and increase the chances of great ideas leaving labs and directly benefiting society.

In its first phase, which focused on turning ideas into functional prototypes, ATTRACT supported 170 breakthrough ideas with €100 000 each in seed funding in order to create a proof-of-concept pool of ideas in detection and imaging. The pool includes drones capable of detecting pollution in the air, through to AR/VR aid for surgeons and new cryptographic methods.

During a kick-off meeting on 31 May 2022, ATTRACT presented the 18 R&D&I projects that it had selected from the 68 proposals in the proof-of-concept pool. The 18 projects have received between €500 000 and €2 000 000 each, depending on their start-end technology readiness level (TRL), to help them to move from a prototype to a pre-market product (risk mitigation phase).

One of the R&D&I projects selected for the second phase of ATTRACT is AHEAD, a project by CERN and five other partners, which proposes to develop a new way to manufacture components for the next generation of cooling systems. By combining 3D-printing technologies, AHEAD aims to produce cooling systems with a reduced number of components that are lighter, smaller and therefore able to be placed closer to areas that need to be cooled. Better performance for the complex cooling systems at CERN is an evident potential benefit. Furthermore, such technologies could also reduce fuel consumption in the aerospace industry. CERN will also study the extension of the potential application of the product to the market of natural refrigeration plants.

In addition to 18 R&D&I projects, a further 18 Academy projects and socioeconomic studies will also benefit from €28 million in EU funding.

"Incremental innovation will not be sufficient for addressing the upcoming societal challenges in the next decades. The ATTRACT project and methodology aim to accelerate the market uptake of breakthrough innovation", says Pablo Garcia Tello, ATTRACT project coordinator and leader of the Development of EU Projects and Initiatives section at CERN.

The Academy call will run programmes for university students to generate ideas for social innovation inspired by the technologies developed within the R&D&I projects. Each student programme has received between €80 000 and €240 000.

Under the Socioeconomic Studies call, eight projects have received funding of €125 000 to conduct novel studies designed to gain new perspectives and enrich traditional impact metrics in order to evaluate the current working

methods of ATTRACT and other European research infrastructures and innovation ecosystems and assess their impact on society.

For more information and to follow the development of the projects, please visit:

[www.attract-eu.com](http://www.attract-eu.com) (<http://www.attract-eu.com>)

\*ATTRACT has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101004462.

\*\*AHEAD is a consortium in which CERN collaborates with CSEM SA, Thales Alenia Space France, LISI Aerospace, the Norwegian University of Science and Technology and InanoEnergy.

Sources and extra material:

[https://indico.cern.ch/event/887477/contributions/3741865/attachments/2002012/3342873/11\\_SWaP\\_CERN-ATTRACT-P1.pdf](https://indico.cern.ch/event/887477/contributions/3741865/attachments/2002012/3342873/11_SWaP_CERN-ATTRACT-P1.pdf) ([https://indico.cern.ch/event/887477/contributions/3741865/attachments/2002012/3342873/11\\_SWaP\\_CERN-ATTRACT-P1.pdf](https://indico.cern.ch/event/887477/contributions/3741865/attachments/2002012/3342873/11_SWaP_CERN-ATTRACT-P1.pdf))

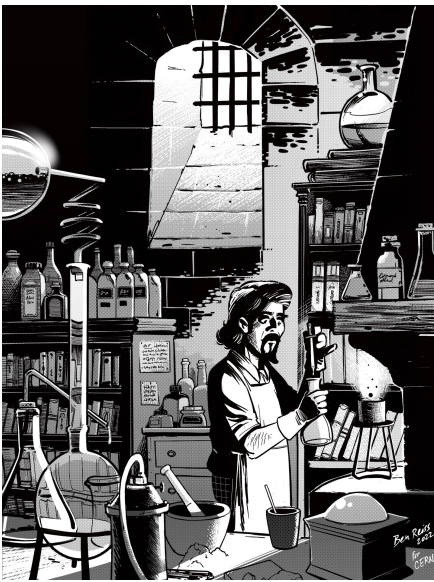
<https://attract-eu.com/e28-million-fund-will-finance-36-projects-that-hold-the-most-promise-for-science-and-society/> (<https://attract-eu.com/e28-million-fund-will-finance-36-projects-that-hold-the-most-promise-for-science-and-society/>)

Claudia Marcelloni de Oliveira

## Wandering artist explores CERN

French graphic novelist Benjamin Reiss took advantage of a stay in the Pays de Gex to visit the ISOLDE facility and soak up the world of science





*When Benjamin Reiss visited CERN's ISOLDE, he was inspired by the facility's ability to fulfil the medieval alchemists' dream of changing one element into another. He left this drawing as a souvenir of his visit. (Image: CERN)*

In Einstein's words: "The most beautiful thing we can experience is the mysterious. It is the source of all true art and science." And faced with the mysteries of the universe that CERN strives to explain, the dichotomy between science and art sometimes becomes blurred. The spontaneous visit to CERN by French artist Benjamin Reiss once again highlighted this phenomenon.

In spring 2022, the graphic novelist – a graduate of the Émile Cohl art school in Lyon – visited the ISOLDE facility during his stint as artist-in-residence at the *Les Arts Frontières* bookshop in Ferney-Voltaire. Visiting CERN for the first time, Reiss took the opportunity to immerse himself in the world of science, which

has already inspired so many artists. "I had the impression that I was entering the workshop of a contemporary installation artist, with the clutter of cables and metal structures on one hand, and, on the other, passionate, dedicated people who are motivated by their research," explains Reiss.

For him, science and art are particularly intertwined in works of science fiction, where the world of science, which is his passion, is depicted and magnified. That passion for science led Reiss to leave his mark at CERN, in the form of a sketch on the isotopes table in the ISOLDE building.

Reema Altamimi

## Computer security

### Computer Security: Banks and work

**Over the past few months, the Computer Security team and the Identity and Account Management team have started to roll out two-factor authentication (2FA)**

Over the past few months, the Computer Security team and the Identity and Account Management team have started to roll out two-factor authentication (2FA). 2FA is considered to be the silver bullet for protecting computing accounts. You find it everywhere: for accessing Facebook, Twitter, Gmail and many other services. Your bank uses it to protect your money. Still, we are facing resistance. And I'm starting to wonder why it is that people at CERN are perfectly willing to protect their bank accounts with 2FA while trying to avoid using it to protect their work, which is what puts the money in said accounts in the first place...

CERN is under attack (<https://home.cern/news/news/computing/computer-security-about-risks-and-threats>), like any other organisation, institute or company, many of which have been hacked or compromised and their data stolen (see here (<https://home.cern/news/news/computing/computer-security-what-do-accelerators-and-pipelines-have-common>) and there (<https://home.cern/news/news/computing/blackmailing-enterprises-you-are-patient-zero>)). A successful ransomware attack against CERN could have devastating consequences (<https://home.cern/news/news/computing/disaster-your-crown-jewels>) for our operations and reputation. Ransomware attacks, like many other forms of attack, usually take the route of you clicking on a malicious link, opening a malicious attachment or browsing a dodgy webpage, and subsequently infecting your computer (<https://home.cern/news/news/computing/computer-security-truth-lies-url>). While the consequences for your laptop are local (and can be very nasty (<https://home.cern/news/news/computing/computer-security-risk-losing-it-all>))), the next hop from that compromised device

most likely requires your password. A password that can now be easily intercepted by an attacker who has a foothold in your device. Other successful ransomware attacks are more direct. By asking. By you providing your password directly to an attacker, via a fake login page. Every year, between 10% and 20% of us fall for the Computer Security team's clicking campaign (<https://home.cern/news/news/computing/computer-security-log-click-be-secure>). Between 10% and 20% of all CERN passwords are exposed. Lost.

Lots of juice for an attacker if those campaigns were real. Just think what they could access with your password. What power they could inherit from you. What the attacker could do if they could observe you working on different IT services, controls systems and financial applications. And what could happen if the attacker started acting on their own. Stopping accelerators? Manipulating experiments? Disabling safety systems? Stealing money? Deleting files? Exposing personal data? Impacting CERN's reputation?

In order to protect CERN against those types of attack, we are adding another – immense – hurdle for a potential attacker by deploying 2FA on your account. Not only would the attacker need your password, they would also need your second-factor hardware token – i.e. either your YubiKey or your smartphone. And you always know where your smartphone is, don't you? This is why we consider 2FA to be a silver bullet for account protection. Yes, we do acknowledge that it adds another layer of inconvenience. So we've tried, and continue to try, to make 2FA as easy as possible for you:

We deployed it at one single point, the new CERN Single Sign-On (plus a few dedicated services at the gates, such as AIADM and the Remote Operations Gateways).

We made adjustments so that the authentication lasts around 12 hours per browser, meaning that you will need to use your token about twice a day, which is likely much less often than some people go for a coffee or a smoke.

You can choose which token – YubiKey or smartphone – will be the default (just go to <https://users-portal.web.cern.ch> (<https://users-portal.web.cern.ch>)), click on "configure multifactor" and pick your "default login method").

You can choose between the two tokens every time you log in. If you forget one, the other is at hand. If you lose one, the other can be used to reset it. And we will add more options once they are compatible with our set-up.

Procedures are in place to help if your token gets lost and you are locked out: the Service Desk and the Computer Security team have put all the necessary means in place for quick recovery.

Finally, a more comprehensive list of answers can be found in our FAQ (<https://auth.docs.cern.ch/trouble-shooting/2fa-tips/>).

So, doesn't your CERN computing account deserve the same level of protection as your bank account? If you agree, give it a try ([https://cern.service-now.com/service-portal?id=kb\\_article&n=KB0006587](https://cern.service-now.com/service-portal?id=kb_article&n=KB0006587)) and let us know if you're happy with it, so that we can set it up for you permanently.

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## Announcements

### Traffic disruption on Route Weisskopf and Route Bloch from 15 to 19 August

The phased removal of the light poles will cause traffic disruption on Route Weisskopf

and Route Bloch from 15 to 19 August 2022 - please follow the planned diversions.

All buildings in the area will remain accessible.

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### I have seen a wasps' nest on the site: what do I do?

Following the recent communication (<https://home.cern/news/announcement/cern/wasps-cern-s-dedicated-picnic-and-barbecue-areas-stay-alert>) urging caution on dedicated picnic and barbecue areas of the CERN site due to the

presence of wasps, they have kept proliferating: if you come across a nest, please contact the Fire and Rescue Service immediately (74444) who will proceed with its elimination with due care.

Thank you for your collaboration!

HSE unit

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### CERN Year of Environmental Awareness campaign: don't miss your chance to give your feedback and opinion

CERN's Year of Environmental Awareness campaign came to a close with the last infographic on Biodiversity (<https://home.cern/news/news/cern/environmental-awareness-biodiversity-cern>) published on 20 July. The campaign has been rich and varied, covering 13 articles and 13 infographics across diverse subjects of environmental concern for the Organization.

Now is your chance to share your thoughts and feedback on this campaign by completing this short survey (<https://hse.cern/environment-survey>)\* (deadline 15 August).

The results of this survey will be presented on the occasion of the closing event to be held on 15 September for which further details will

follow in due course.

Thank you for taking the time to share!

*\*If you encounter any problems in accessing the page, please log in (SSO) and paste the following link into a browser: <https://hse.cern/environment-survey>. Thank you!*

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## Obituaries

### Alain Brissonnaud (1939 – 2021)





It is with great sadness that we inform you of the death of Alain Brissonnaud, a retired member of the CERN personnel who dedicated his career to budgetary and financial management of CERN's major projects, spanning the SPS, LEP, CLIC and the LHC.

Alain began his career at CERN in 1966 as an administrative employee in the Maintenance and Operation section of the Site and Building division, tasked with surveying the roofs of CERN's buildings. That's how he first got to know CERN, by walking its rooftops. He became a methods officer in 1968, before taking over the budgetary management of the Installation group during the construction of the SPS. In 1980, he was appointed leader of the Budget Management section of the Coordination – Budget group in the Site and Building division (SB-CB-BG). Six years later, he joined the LEP division, where he was in charge of budgetary and financial management for LEP 200, LHC R&D and CLIC

in his capacity as Departmental Planning Officer and Project Planning Officer of the Accelerators sector. Attuned as he was to the needs of all involved, he always managed to find the right solution to overcome problems. He was respected by all the engineers and technicians involved in the LHC project.

Alain retired in 2004, but continued to follow closely what was going on at CERN. For instance, he wanted to keep receiving the LHC Progress Report. He would happily speak about his career, which was a source of great pride to him. He was a gentleman who made a great contribution to CERN. Unfailingly positive and constructive, he contributed enormously to driving forward the projects in which he was involved.

We offer our heartfelt condolences to his loved ones.

*Alain's colleagues and friends*

## Ombud's corner

### Coping with pervasive anxiety

Thursday, 28 July was Earth Overshoot Day (<https://www.overshootday.org/>) – the date when humanity has consumed all the resources that the earth can sustainably produce for the entire year.

This information, heard first thing in the morning on the radio, just added to all the other bad news being broadcast daily by the media: armed conflicts around the world, political instability, the dire state of the planet, climate change and melting glaciers, staggering biodiversity loss, rocketing energy prices and, of course, wave after wave of the pandemic that regularly threaten us with self-isolation.

We're all living through a **very anxiety-inducing time**.

These issues and the resulting uncertainty affect us all individually and have an impact on our Laboratory, leaving us feeling powerless and stressed. These are some of the problems that people voice in the Ombud's Office.

When we are faced with this anxiety-inducing reality day after day, it's easy to let ourselves be influenced and shaped by it. For instance,

we might:  
become aggressive, cynical or indifferent, when we used to face challenges with calm;  
lose the spirit of solidarity and collaboration with our colleagues because we are so focused on our family's well-being and future;  
be on the point of speaking up to share our ideas or suggest solutions, but our anxiety keeps us silent.

Of all the tools we have available to help us tackle our stressful reality and its consequences, I'd like to highlight three that are easy to put into action in the workplace:

- Firstly, bring your attention back to the content of your work. Adopt a mindful approach ([https://lms.cern.ch/ekp/servlet/FORMAT1?CID=EKP000043874&LANGUAGE\\_TAG=en](https://lms.cern.ch/ekp/servlet/FORMAT1?CID=EKP000043874&LANGUAGE_TAG=en)) and focus on the quality and purpose of what you're producing, whether it's a one-off mechanical part, an equipment test, interface programming, a presentation, a contract, etc.
- Then, because the ties we forge with others are what define us, engage with and listen to your

colleagues more, in a spirit of empathy, collaboration and trust.

Last but not least, take care of yourself and your physical and mental well-being (<https://hr.web.cern.ch/wwfw>).

***Putting this advice into action, especially if you haven't been following it lately, will help you cope with the anxiety induced by everything that's going on in the world right now – both for your own sake and for the good of our Laboratory's unique mission.***

Laure Esteveny

*I want to hear from you – feel free to email [ombud@cern.ch](mailto:ombud@cern.ch) with any feedback or suggestions for topics you'd like me to address.*

***NB:*** *If you would like to be notified about posts, news and other communications from the CERN Ombud, please register to receive the CERN Ombud news (<https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=cern-ombud-news>).*