IPPOG

ANNUAL REPORT 2022

Preface

You have in your hands the 2022 annual report of the IPPOG Collaboration [1].
It is formatted in two blocks which, in the printed version, are placed in the left and right sides of a folder.

In this first block (the left part of the folder), we present our Collaboration and report on the activities of the coordination team and a section dedicated to the IPPOG 25th anniversary Symposium held at CERN on 29th October 2022.
In the second block (the right part in the folder), we report on IPPOG related activities carried out by our members and associated members. In some cases, outreach activities were not possible in 2022 for a member country, lab or experiment, or were not carried out for a variety of reasons. In these cases, in order to still provide an overview of the typical activities of that member, we report instead on that member's activities in a previous year. This is signalled in the title.
We hope that you enjoy the reading and that you get an impression of the depth and variety of the efforts and progress carried out by the IPPOG collaborators, each of whom are striving to improve scientific literacy in society, to motivate students to follow STEM careers, to bring particle physics to the common knowledge, and to disseminate the values of peaceful, international collaboration.

[1] www.ippog.org

Ready for another 25 years!

Pedro Abreu, *LIP and IST, Lisboa, IPPOG Co-Chair 2020–2025*

In 2022 IPPOG celebrated 25 years of existence (article in this report by Steven Goldfarb). Throughout its history, IPPOG has demonstrated the need and importance to do outreach, of science in general and of High Energy and Particle Physics in particular. What started in 1997 as a European group of 25 representatives from CERN and its Member States and from the LHC experiments, has turned into an international collaboration of 33 countries, 6 experiments, 1 international laboratory (CERN) and 2 national laboratories as associate members (DESY and GSI), spanning the 5 continents.

With the help of a dedicated core team, IPPOG organizes its global activities, such as the International Masterclasses in Particle Physics (IMC) and the Global Cosmics network, and manages the resources needed to help financially support local activities in its member countries and at other places.

Except for the dramatic years of the pandemic crisis, from which we are still recovering, IPPOG has had a steady growth in the number of participants in its activities and in the number of people engaged at events organized by our members. With the IMC programme alone, reaching more than 14 000 students participating at 220 institutes in 60 countries, IPPOG has truly attained a global level of recognition, bringing High Energy and Particle Physics (HEPP) to the hearts (and to the brains) of young people all over the world.

But there are still many regions in which the reach of HEPP is incipient, and there are not yet local outreach activities that could attract students to our scientific field or promote science in the communities. It is one of the many challenges ahead of us, for which we commit our efforts to address and overcome, in line with our mission and objectives.
Other very important challenges include

- the time span and costs of the projects for the present experiments and future plans in HEPP, requiring public support and global participation;
- the increase of the awareness of the importance of fundamental science in present day and all future technologies;
- the need to increase the reach of our activities to diverse audiences, different age groups, minorities, regions without internet access and/or electricity;
- the need to train the trainers – teachers, educators, tutors, motivators, facilitators, scientific ambassadors;
- the introduction of HEPP concepts in secondary school curricula.

Education, Communication and Outreach are essential pillars in the development of HEPP, as important as the development of new technologies, detectors, and methods. IPPOG is working hard and effectively in education and outreach to prepare/guarantee the next generation of scientists, to build up trust in Society for our field, to promote science and scientific reasoning worldwide, and to increase scientific literacy in Society.

We are ready for the next 25 years, let's all work together to build a better future!

O_treach does not exist without U !

Introduction

Since its establishment in 1997, IPPOG has been reporting its objectives and achievements through formal presentations to the European Committee for Future Accelerators (ECFA) and, starting from 2013, to the CERN Council. To complement and enhance these efforts, we present this written report. We believe that the collaborative's ongoing growth and its official recognition as an international collaboration justify this endeavour, while also serving as a historical record of our progress.

This document begins with a concise overview of the collaboration's expansion and activities in 2022. Immediately following this introduction, you will find an article dedicated to the 25th anniversary, authored by Steven Goldfarb (former IPPOG co-chair 2017-2022). This article was published on CERN courier in November 2022. Subsequently, we provide a general introduction to IPPOG, including information about our organisation, major programmes and activities, as well as our core support mechanisms.
Furthermore, the document includes a one-page report from each of our members. However, due to various circumstances such as the pandemic and the conflict in Ukraine, numerous informal education and outreach activities were cancelled, resulting in some members not having provided a report for 2022 (or, in some cases, also for 2021). In such cases, we have chosen to include last year's country page to provide an understanding of the typical activities conducted in those countries.

As you peruse these reports, you will observe a distinct independence in style that reflects the vibrant diversity of our collaboration. Each member employs methodologies that are best suited for their region's cultural, social, historical, and pedagogical contexts. Nonetheless, common threads unite us, namely, our commitment to continuous development and enhancement of global educational standards, the drive to expand the reach of our programmes to new audiences worldwide, and the unwavering dedication of all members to inspire a sense of awe in fundamental research and foster a deep appreciation for science and evidence-based decision-making among young minds and the general public. These principles permeate throughout our collaborative efforts.

IPPOG Celebrates 25 Years Of Engagement

Steven Goldfarb *University of Melbourne, Chair 2017–2022*

This year, the International Particle Physics Outreach Group (IPPOG) celebrates its 25th anniversary. Our group is an international collaboration of active particle physicists, communication experts and educators dedicated to disseminating the goals and accomplishments of fundamental scientific research to the public. Our audiences range from young schoolchildren to college graduates and teachers, from the visiting public to heads of state, and we engage them in classrooms, laboratories, experimental halls, music festivals, art exhibitions, office buildings and government offices across the planet. The activities we use to reach these diverse audiences include public lectures, visits, games, exhibits, books, online apps, and pretty much anything that can be used to demonstrate scientific methodology and instil appreciation for fundamental research.

What drives us to commit so much effort to outreach and public engagement when we are already deeply invested in a field that is both time and labour intensive? First of all, we love doing it. Particle physics is an active and exciting field that lies at the forefront of human understanding of the universe. The analysis methods and tools we employ are innovative, our machines and detectors are jaw-dropping in their size and complexity, and our international collaborations are the largest, most diverse ever assembled. It is a privilege to be part of this community and we love sharing that with those around us.

Secondly, we've learned that public engagement improves us as scientists. Learning how to distil complex scientific concepts into understandable descriptions, captivating stories and relatable analogies helps us to better comprehend the topics ourselves. It gives us a clearer picture in our own minds of where our work fits into the larger frame of society. It also significantly improves our communication skills, yielding capabilities that help us down the road as we apply for grants and propose new projects or analyses.

Global reach Undergraduate students at Kathmandu University show off their results while taking an ATLAS Masterclass run by the author and local researchers. Credit: IPPOG Collaboration

Thirdly, we also understand our moral obligation to share the results of our research with society. The endeavour to improve our understanding of the world around us is rooted in millennia of human evolution and culture. It is how we not only improve our own lives, but also how we provide the tools future generations need to survive. In more practical terms, we realise the importance of engaging those who support our research. That includes funding bodies, as well as the voters who select those bodies and prioritise the deployment of resources.

Finally, but equally as important, we realise the value to both our own field and society at large of encouraging our youth to pursue careers in science and technology. The next generation of experiments will include machines, detectors and collaborations that are even larger than the ones we have today. Given their projected lifetimes, the grandchildren of today's students will be among those analysing the data. And we need to train that workforce today.

IPPOG Celebrates 25 Years Of Engagement

Steven Goldfarb *University of Melbourne, Chair 2017–2022*

Birth and evolution

Dedicating time and resources to outreach efforts is not easy. As researchers, our days (and often nights) are taken up by analysis meetings, detector shifts, conference deadlines and institutional obligations. So, when we do make the effort it needs to be done in an effective manner, reaching as large and diverse an audience as possible, with messages that are clear and coherent.

Former CERN Director-General Chris Llewellyn Smith certainly had this in mind when he first proposed the establishment of the European particle physics outreach group (EPOG) in 1997. The group held its first meeting on 19 September that year, under the chairmanship of Frank Close. Its primary objectives were to exchange ideas and best practices in particle-physics education and outreach, to define common goals and activities, and to develop and share materials supporting the efforts.

Science interlude *Participants of the Colours of Ostrava music festival in the Czech Republic learn to build cloud chambers on the Big Bang stage organised by students and researchers from local universities and supported in part by IPPOG. Credit: IPPOG Collaboration*

The original members of EPOG were delegates from the CERN Member States, one each from the four major LHC experiments, one each from the CERN and DESY laboratories, and a chair and deputy chair assigned by the European Committee for Future Accelerators (ECFA) and the high-energy physics branch of the European Physical Society. Over the course of the following 25 years, EPOG has expanded beyond Europe (becoming IPPOG), developed major worldwide programmes, including International Masterclasses in Particle Physics and Global Cosmics, and established itself as an international collaboration, defined and supported by a memorandum of understanding (MoU).

Today (December 2022), the IPPOG Collaboration comprises 40 members (33 countries, six experiments and one international lab) and 2 associated members (national labs). Each member, by signing the MoU, commits to supporting particle-physics outreach worldwide. Members also provide modest funding, which is used to support IPPOG's core team, its administration and communication platforms, thus facilitating the development and expansion of its global programmes and activities.

The Masterclasses programme now reaches tens of thousands of students in countries spread around the globe, and is engaging new students and training new physics mentors every year. The Global Cosmics portal, hosted on the IPPOG website, provides access to a wide variety of projects distributing cosmic-ray detectors and/or data into remote classrooms that would not normally have access to particle-physics research. And a modest project budget has helped the IPPOG collaboration to establish a presence at science, music and art festivals around the globe by supporting the efforts of local researchers.

Most recently, IPPOG launched a new website, featuring information about the collaboration, its programmes and activities, and giving access to a growing database of educational resources. The resource database serves teachers and students, as well as our own community, and includes searchable, high-quality materials, project descriptions and references to related resources procured and contributed by our colleagues.

Our projects and activities are reviewed and refined periodically during twice-annual collaboration meetings hosted by member countries and laboratories. They feature hands-on activities and presentations by working groups, members, partners and panels of world-renowned topical experts. We present and publish the progress of our activities each year during major physics and science-education conferences. Presentations are made in parallel and poster sessions, and plenary talks, to share developments with the greater community and offer opportunities for their own contributions.

The challenging road ahead

While these accomplishments are noteworthy and lay a strong basis for the development of particle-physics outreach, they are not enough to face the challenges of tomorrow. Or even today. The world has changed dramatically since the days we first advocated for the construction of our current accelerators and detectors. And we are partly to blame. The invention of the web at CERN more than 30 years ago greatly facilitated access to and propagation of scientific facts and publications. Unfortunately, it also became a tool for the development and even faster dissemination of lies and conspiracy theories.

Effective science education is crucial to stem the tide of disinformation. A student in a Masterclass, for example, learns quickly that truth is found in data: only by selecting events and plotting measurements is she/he able to discover what nature has in store. And it might not agree with her/his original hypothesis. It is what it is. This simple lesson teaches students how to extract signal from background, truth from fiction. Other important lessons include the value of international collaboration, the symmetries and beauty of nature and the applications of our technology to society.

Steven Goldfarb *University of Melbourne, Chair 2017–2022*

How do we, as scientists, make such opportunities available to a broader audience? First and foremost, we need more of us doing outreach. Many physicists do not make the effort because they perceive it as costly to their career. Taking time away from analysis and publication can be detrimental to our advancement, especially for students and junior faculty, unless there is sufficient support and recognition. Our community needs to recognise that outreach has become a key component of scientific research. It is as essential as hardware, computing and analysis. Without it, we won't have the support we need to build future facilities. That means senior faculty must value experience in outreach on a par with other qualities when selecting new hires, and their institutions need to support outreach activities.

We also need to increase the diversity of our audience. While particle physics can boast of its international reach, our membership is still quite limited in social, economic and cultural scope. We are sorely missing women, people of diverse ethnicities and minorities. Communication strategies and educational methods can be adopted to address this, but they require resources and dedicated personnel.

That's what IPPOG is striving for. Our expertise and capabilities increase with membership, which is continually on the rise. This past year we have been in discussion with Nepal, Canada and the Baltic States, and more are planned for the near future.

Who we are

About IPPOG

IPPOG is a network of scientists, science educators and communication specialists, working across the globe in science education and public engagement for particle physics. Particle physics explores the fundamental aspects of matter, energy, space, and time, aiming to uncover the fundamental building blocks of our universe. IPPOG endeavours to introduce young people to the latest discoveries in this captivating field and communicate to the public the intrinsic beauty of nature manifested in the interactions of its most basic constituents—the elementary particles.

Operating under a Memorandum of Understanding (MoU), IPPOG is an international collaboration comprised of its members, including countries, international laboratories, and experiments, as well as associate members such as national laboratories and other organizations. As of the end of 2022, IPPOG consisted of 40 members: 33 countries, 6 experiments, and CERN as an international laboratory, with 2 national laboratories (DESY and GSI) serving as associate members. The Collaboration Board (CB), composed of member and associate member representatives, convenes biannually to discuss and vote on IPPOG-related matters (associate members do not have voting rights). Member representatives also act as liaisons to significant national-level science networks.

Regular forum meetings are organized by IPPOG to facilitate the exchange of ideas and best practices, with the primary objective of elevating the standards of science education and public engagement. Through globally coordinated outreach programmes, IPPOG contributes to fostering cultural awareness, comprehension, and support for particle physics and related sciences, as well as nurturing the next generation of researchers. The forum comprises member representatives and individuals invited by the members. Collectively, the forum forms a global network encompassing countries, laboratories, institutions, organizations, and individuals who share interest for particle physics and outreach activities.

Who we are

List of members and associate members as of 31 December 2022

Country/Lab./ Exp.	Signatory Organization	Representative
ALICE	ALICE Collaboration	Despina Hatzifotiadou
ATLAS	ATLAS Collaboration	Rebeca Gonzalez Suarez
AUSTRALIA	CoEPP	Paul Jackson
AUSTRIA	HEPHY, ÖAW, ÖPG	Natascha Hoermann
BELGIUM	F.W.O. and F.R.S.-FNRS	Gwenhaël de Wasseige
BELLE II	BELLE II Collaboration	Rok Pestotnik
BRAZIL	RENAFAE	Marcelo Munhoz
BULGARIA	Sofia Techpark	Roumyana Hadjiiska
CERN	CERN	Ana Godinho
CMS	CMS Collaboration	Freya Blekman
CYPRUS	University of Cyprus	Fotios Ptochos
CZECH REPUBLIC	Institute of Physics of the Czech Academy of Sciences	Vojtech Pleskot
DENMARK	Danish CERN Instrumentation Centre, NICE	Ian Bearden
DESY (Associate)	DESY	Thomas Naumann
FINLAND	Helsinki Institute of Physics	Sami Lehti
FRANCE	CNRS / IN2P3	Nicolas Arnaud
GEORGIA	Ministry of Education, Science, Culture and Sport	Alexander Sharmazanashvili
GERMANY	DESY for KET	Christian Klein-Bösing
GREECE	Ministry of Development - General Secretariat of Research, Technology and Innovation	Christine Kourkoumelis
GSI (Associate)	GSI	Ralf Averbeck
HAWC	HAWC Collaboration	Jose Ruben Alfaro Molina
HUNGARY	Wigner Research Centre for Physics	Dezso Horvath
ISRAEL	Weizmann Institute of Science	Ehud Duchovni
INDIA	National Institute of Science Education and Research	Bedangadas Mohanty
IRELAND	Dublin Institute for Advanced Studies	Jon-Ivar Skullerud
ITALY	INFN	Catia Peduto

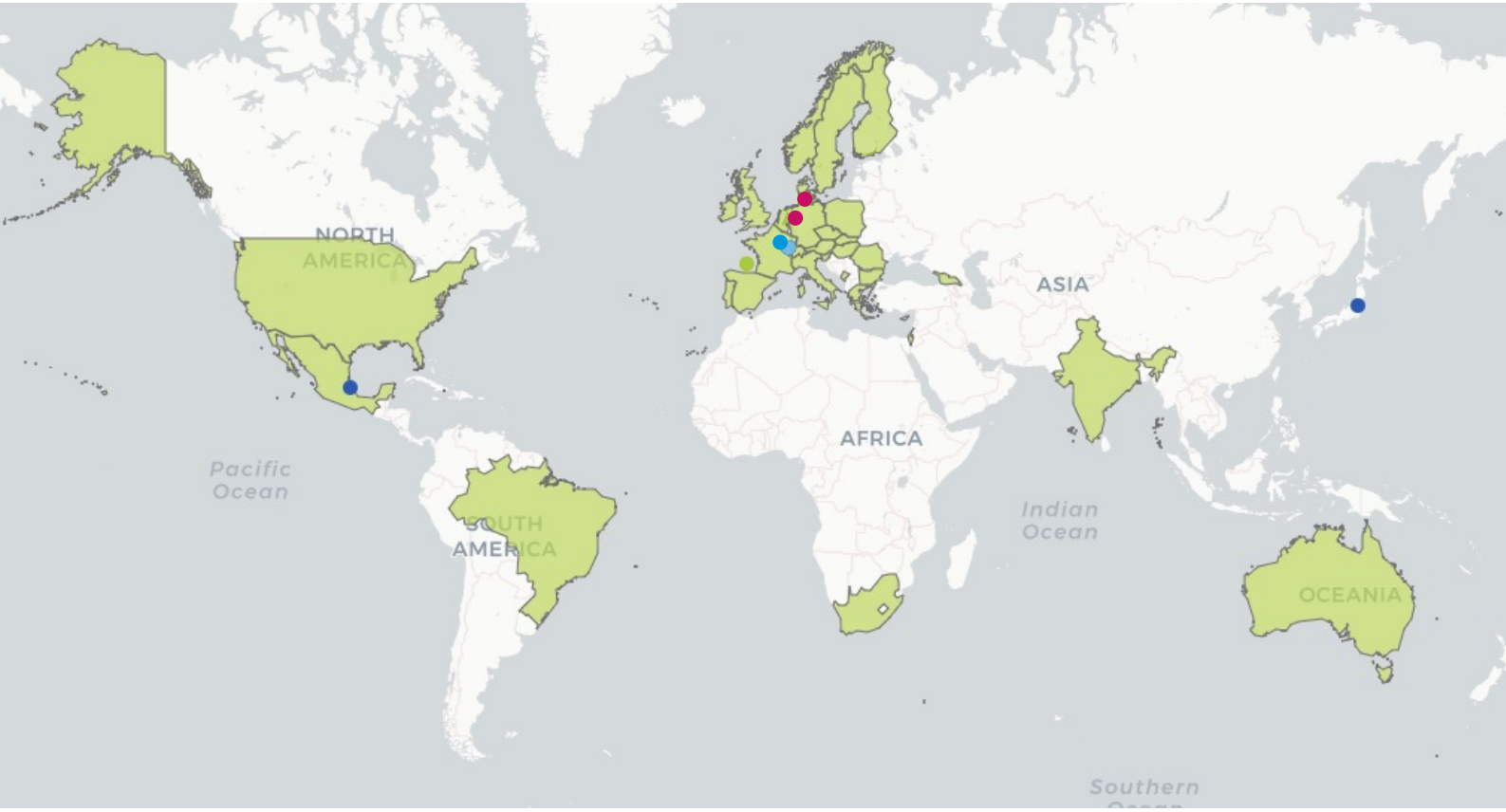
Who we are

List of members and associate members as of 31 December 2022

Country/Lab./ Exp.	Signatory Organization	Representative
LHCb	LHCb Collaboration	Bolek Pietrzyk
MONTENEGRO	Ministry of Science of Montenegro	Ivana Picuric
NORWAY	Physics Department of the University of Oslo	Farid Ould-Saada
MEXICO	BUAP	Arturo Fernandez Tellez
POLAND	The Henryk Niewodniczański Institute of Nuclear Physics, Polish Academy of Sciences	Krzysztof Wozniak
PORTUGAL	LIP	Ricardo Gonçalo
ROMANIA	Institute of Atomic Physics	Paul Gravila
SLOVAK REPUBLIC	Ministry of Education, Science, Research and Sport	Ivan Melo
SLOVENIA	Jôsef Stefan Institute, Ljubljana	Anja Kranjc Horvat
SOUTH AFRICA	iThemba Labs. for the National Research Foundation	Sahal Yacoob
SPAIN	Spanish National Particle Physics Programme	Jesús Puerta-Pelayo
SWEDEN	Swedish Physical Society	Jonas Strandberg
SWITZERLAND	CHIPP	Katharina Mueller
THE NETHERLANDS	NIKHEF	Charles Timmermans
UK	STFC	Darren Price
USA	Univ. Notre-Dame on behalf of Quarknet	Spencer Pasero

Where we are

Map of the member locations (Dec.31st, 2022)



Countries

CERN

Associated members (DESY, GSI)

International Experiments (ALICE Collaboration, ATLAS Collaboration, Belle II Collaboration, CMS Collaboration, HAWC Collaboration, LHCb Collaboration)

What we do

IPPOG Activities

IPPOG autumn meeting 2022 (CERN)

The collaboration forum, comprising member representatives and their invited collaboration members, meets twice a year, holding topical panel sessions, working group discussions and presentations of key activities. The meetings are organised by the core team and alternatively hosted by a member or aspiring member institutions. These meetings provide a key platform for the development and sharing of ideas and coordination of the programmes.

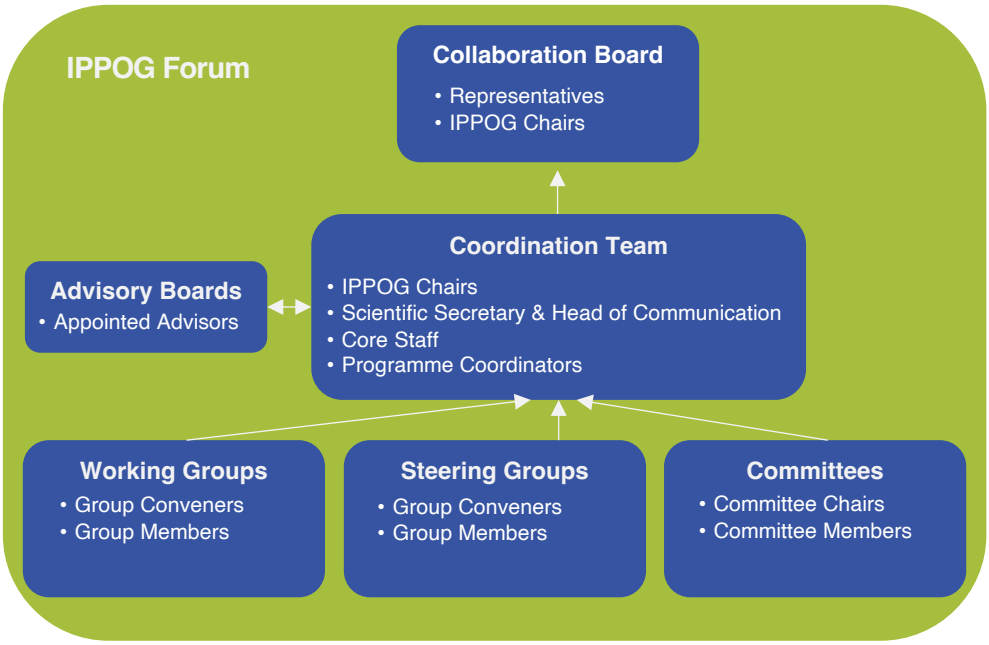
Well-established IPPOG activities, including International Particle Physics Masterclasses and Global Cosmics, reach thousands of students in dozens of countries around the world, every year. More recent programmes bringing particle physics to music, art, science and other cultural festivals, reach new audiences, including members of the public already interested in science, as well as those who have yet to realise they are.

IPPOG also maintains strong visibility in major particle physics conferences, participating in and convening dedicated sessions in education and outreach, and organising associated public events and exhibitions. These activities increase awareness with both the public and members of the physics community, encouraging and helping young scientists to participate in public engagement.

Through these activities, IPPOG not only communicates the excitement of our research, but it instils young minds with a better understanding of the scientific method and a deeper appreciation of evidence-based decision making. This is essential today, in a world, in which these human values are continually under attack by public figures and the media. Thus, the repercussions of IPPOG activities go far beyond that of simply supporting and popularising our field, helping to create a key strategic basis for the future.

How we do

IPPOG Organization



The MoU establishes the base structure of the IPPOG Collaboration. Activities are planned and coordinated by small groups: the Coordination Team, Working Groups, Steering Groups and Committees. Advisory Boards, constituted by Collaboration Board members, advise the Chairs on important matters and decisions.

At the end of 2022 we had the following Working Groups:

- Exhibitions and public events
- Explaining hot topics to a lay audience
- Bringing International Masterclasses to new countries
- Outreach of applications to society
- Resource database curation

the following Steering Groups:

- International Masterclasses (report below)
- Global Cosmics (report below)

the following Committees:

- Speakers and publications (report below)
- Position committee, to help prepare the process to hire a “Scientific Secretary” and that will be dissolved when the process is concluded

and the following Advisory Board:

- Financial Advisory and Auditing Board.

Coordination Team

Composition 2022

The IPPOG Coordination Team in 2022 comprised Pedro Abreu (LIP and IST, U. Lisbon, Portugal) and Steven Goldfarb (U. Melbourne, Australia) as elected chairs, Uta Bilow (TU Dresden, Germany) and Kenneth Cecire (U. Notre-Dame, USA) as International Masterclass Coordinators, Carolin Schwerdt (DESY) and Sabine Hemmer (INFN, Italy) as Global Cosmics Coordinators, Fabiola Cacciatore (IPPOG-CERN) as Communication Officer, Barbora Bruant Gulejova (Univ. Bern) as Strategic Development Lead and Lila Mabiala (CERN) as Assistant of the Coordination Team, Hanife Olgunsoy (CERN) who replaced Anita Bens (CERN) in the role of Financial Support and Zoe Nikolaidau (CERN) as Administrative Support.

The team is responsible for organising global IPPOG activities, developing infrastructure and activities in support of the collaboration, in line with the strategic vision set forth by the chairs, coordinating the International Masterclasses in particle physics programme and Global Cosmics, coordinating twice-yearly collaboration meetings in cooperation with IPPOG members and proposing and managing the core budget.

Detailed reports on these activities follow.

Pedro Abreu, (Chair)

Steven Goldfarb, (Chair)

Fabiola Cacciatore, (Communication Officer)

Anita Bens, (Administrative and financial support officer)

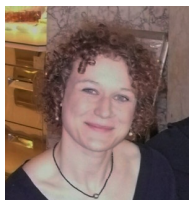
Barbora Bruant Gulejova, (Strategic Development Lead)

Lila Mabiala, (Assistant Coordination Team)

Uta Bilow, (Masterclass Coordinator)

Ken Cecire, (Masterclass Coordinator)

Carolin Schwerdt, (Global Cosmics Coordinator)



Sabine Hemmer, (Global Cosmics Coordinator)

Hanife Olgunsoy, (Financial support officer)

Zoe Nikolaidau, (Administrative support)

IPPOG Website and RDB

Barbora Bruant Gulejova, Strategic Development Lead, IPPOG

IPPOG new website and Resource Database

Barbora Bruant Gulejova, Strategic Development Lead, IPPOG

IPPOG new website development

The development of IPPOG website and resource database (RDB) has been a complex and dynamically evolving project, full of unprecedented and unpredictable challenges including management and coordination of many stakeholders (experts and groups of experts created specifically for the IPPOG website and RDB development) during several years. After 5 years of efforts, on 29th of June 2022, the new IPPOG website has been successfully published. One of the major technical milestones in 2022 was the transition of website to Drupal 9, which was successfully accomplished during several complex phases.

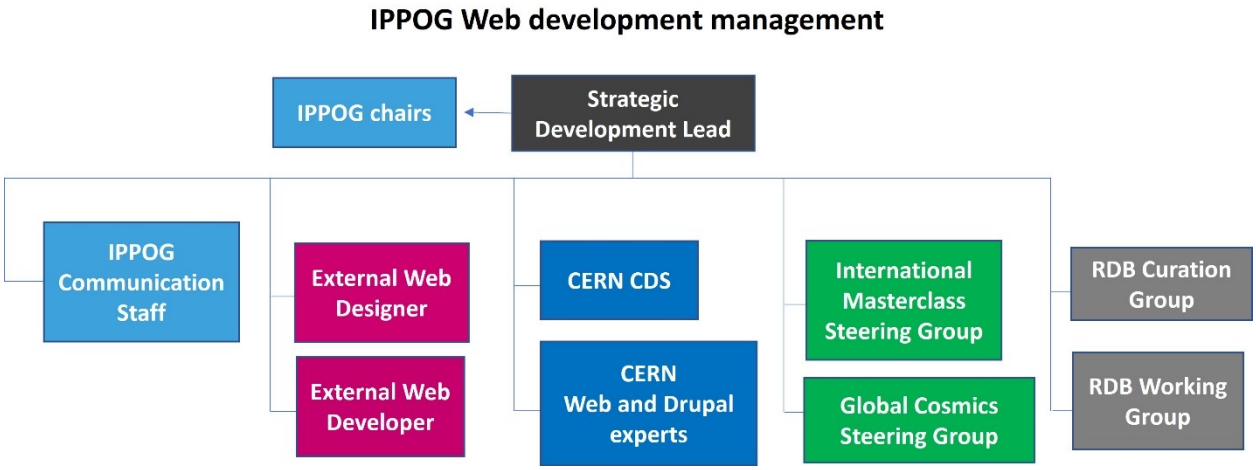


Figure 1: IPPOG web and RDB development project management organigram

New content: IPPOG members and people

IPPOG members and people webpages have been finalized with new content, including information on not only members (countries, experiments and labs) and member representatives, but also other new categories (not present at former IPPOG website), as IPPOG Forum members, IPPOG Coordination Team, and IPPOG Partners and Contributors. It has been decided that the contribution of active IPPOG Forum members will be recognized on the new IPPOG website, and their names will be featured, based on the nomination / endorsement by member representatives. Other parts of the website, like news, events and gallery have been also filled with new content.

IPPOG Website and RDB

Barbora Bruant Gulejova, Strategic Development Lead, IPPOG

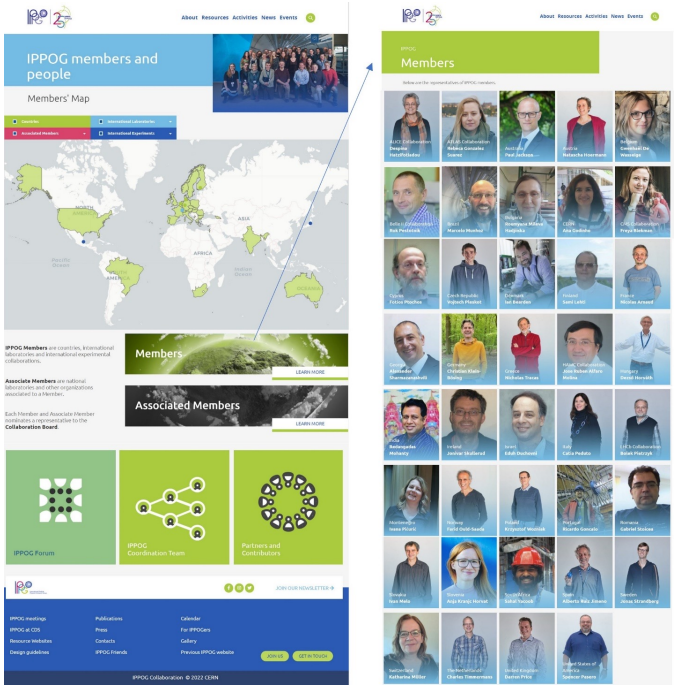


Fig 2: New IPPOG members and people webpages.

New platform "Talking to society" has been created under the IPPOG Resources menu, aiming to provide a powerful tool for the scientific community to shape the attitude and perception of physics and fundamental research by decision makers, funding bodies and the public, and to motivate young people to undertake physics studies. Complementing the resources in the RDB category "Particle Physics and Society", this new platform offers useful materials developed by two IPPOG working groups, ready to be used by science community willing to talk to society.

In first part "Benefits of fundamental research for society", developed by working group "Outreach of Applications for Society", one can find structured and categorized online collection of short stories with clear messages and explanations of "science at work" in the applications and spin-offs, thus connecting science to everyday lives of citizens and solutions for global societal challenges. Second part "Particle Physics for lay audience", developed by working group "Explaining particle physics to lay audience", aims to offer articles written and recommended by IPPOG working group, explaining the complicated particle physics subjects to non-physicists, including physics case of future Higgs factories.

Fig 3: New IPPOG online platform "Talking to society"

IPPOG Website and RDB

Barbora Bruant Gulejova, Strategic Development Lead, IPPOG

IPPOG Resource Database

Barbora Bruant Gulejova and Lila Mabiala

After a major revamp of the RDB interface and functionalities and an important curation process in the past 2 years (boiling down 370 to 180 up-to-date high-quality resources and adding 80 new resources), the main challenges in 2022 were the preparation metadata and its implementation into a dedicated CDS (CERN document server) submission form; finalization of the CDS–Drupal interface; and new external submission flow development. Around 80 best-rated resources have been entered into the RDB, while several technical issues with CDS submissions were resolved and corrected during this process. The preparatory work for external submissions to the RDB by IPPOG-approved contributors has advanced. For obvious reasons (mainly technical), the submissions can be opened only once the RDB has been filled with the most important mass of the curated data (remaining efforts in 2023). The new contributors will be prompted to fill the request to become an official contributor and approved ones will be directly sent to the CDS submission form to submit their resource. The RDB submission flow on the CDS-Drupal interface (including the automatic notification of all concerned parties, like submitters and RDB curators after modification requests and changes implementation, approvals and publishing), has been proposed and approved by the RDB working group. For these purposes, a new standing RDB maintenance committee has been created, whose responsibility will be to ensure that RDB resources are of high-quality and up to date, reflecting the latest discoveries in particle physics and related sciences. This submission mechanism will be tested and finalized in 2023.

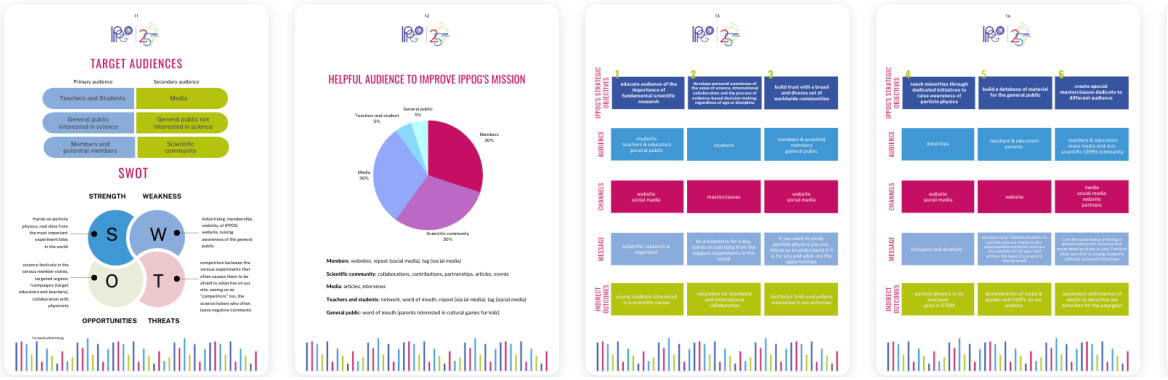
RDB audience and resource types

The first primary group of IPPOG RDB users (particle physics and scientific community active in outreach and education) are expected to seek the materials in support of their own particle physics outreach projects and as inspiration (e.g. for public talks). The second primary group, teachers and educators, are expected to find the extra-curricular activities, lesson plans or projects for the classroom, and even the materials to inspire young students and motivate them to study STEM subjects and become scientifically aware citizens. Curious students will find materials or activities in particle physics and related sciences complementary to what they are being taught at school.

Communication and Social Media

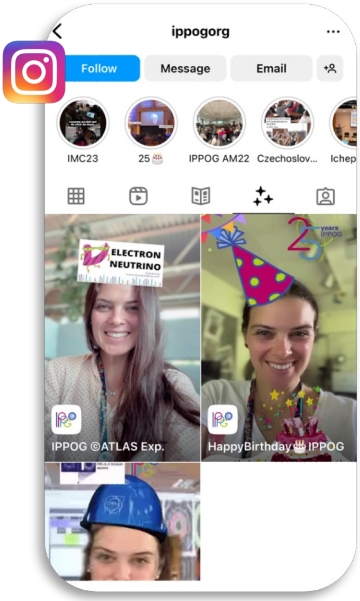
Fabiola Cacciatore (Communication officer)

In February 2022, IPPOG hired a student (Fabiola Cacciatore) to assume the role of communication officer. The communication tasks encompassed various activities such as managing social media platforms, generating content for the website, handling internal and external communications, and providing support for website management. Furthermore, the website was undergoing renovations, which limited the ability to share certain news. To enhance communication efforts in 2023 and 2024, a new editorial plan was developed, focusing on a "transmedia" communication style. This approach involves using diverse media formats to enhance the user experience and provide distinct and refined information. Each social media platform possesses unique characteristics that can be effectively utilized to convey messages to the public, facilitating outreach initiatives. The tone of communication has been adjusted to be more engaging, thanks to a revised content strategy aimed at capturing the interest of a youthful audience with a keen interest in scientific subjects, particularly particle physics.

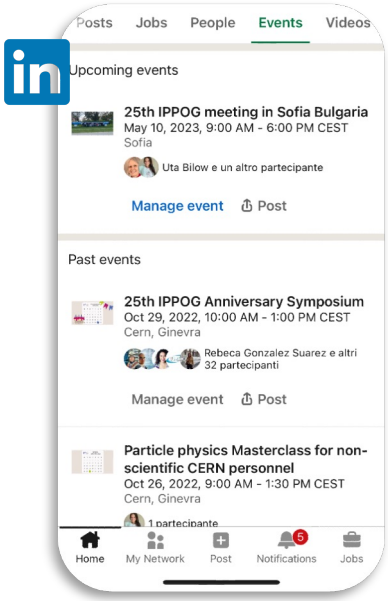


Part of the IPPOG communication plan proposed by Fabiola Cacciatore (https://cernbox.cern.ch/s/K3MT3jV3ax3871w)

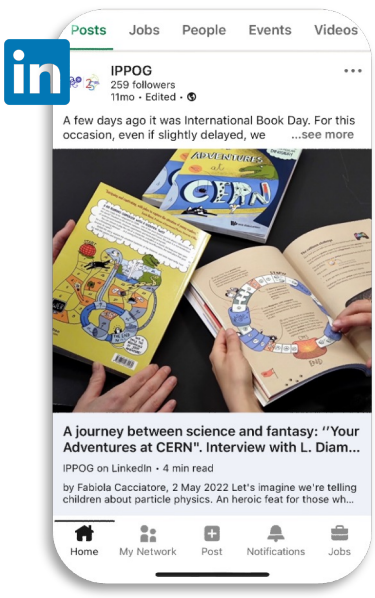
In the following section, there are examples of IPPOG's transmedia communication activities carried out in 2022.



Instagram filter for special events happened in 2022



LinkedIn calendar to share IPPOG's events to the business community



LinkedIn article for sharing news when the website was not ready

Communication and Social Media

Fabiola Cacciatore (Communication officer)

Social Media

IPPOG's presence on various social media channels in 2022 is as follows:

Instagram remains the top-performing social media platform for IPPOG, demonstrating the highest engagement and audience response. It is closely followed by Twitter, which primarily serves as a means of sharing news and information, but still receives a good level of interaction. Facebook, recognized for its extensive user base and the quality of content published, is considered a necessary platform for IPPOG. LinkedIn, a relatively new social media platform for the organization, was established in February 2022. The initial results on LinkedIn have been satisfactory, showcasing potential for further growth. TikTok, although not the most suitable social media channel for IPPOG, has attracted a small audience through the resharing of short videos. Throughout 2023, TikTok will continue to be tested to assess its long-term suitability. Discussions have also taken place regarding the potential establishment of a YouTube channel. However, due to resource limitations, along with the substantial time commitment required, the creation of an IPPOG YouTube page has been postponed.

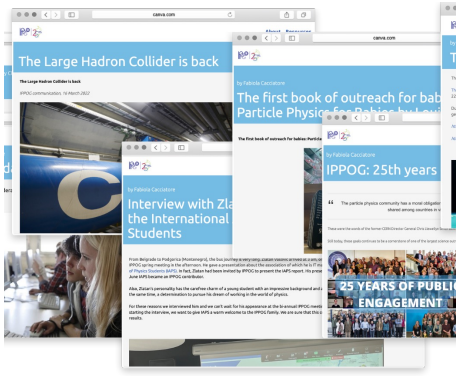
Summary of IPPOG's Social Media Presence in 2022:

- Instagram: Top-performing platform with strong engagement.
- Twitter: Used primarily for news updates, but still receives a good level of response.
- Facebook: Considered essential for IPPOG due to its audience and content quality.
- LinkedIn: Established in February 2022, showing satisfactory results and potential for growth.
- TikTok: Not the most suitable platform, but has generated interest among a small audience. Testing will continue in 2023.
- YouTube: Plans to open a channel are postponed due to resource and time constraints.

915 followers	**3742 followers**	**2226 followers**	**243 followers**	**62 followers**
+ 157 new followers in 2022	**+ 822 new followers in 2022**	**+ 1544 new followers in 2022**		

Website

Throughout 2022, a total of 24 pieces of content were published on the IPPOG website. These included interviews, articles focusing on both internal and external events related to IPPOG, as well as various announcements. Unfortunately, due to Drupal's update process involving new modules, connecting the IPPOG website to Google Analytics was temporarily unavailable. As a result, comprehensive insights and analytics regarding website performance could not be obtained. However, in the first half of 2023, a new tool called Matomo is expected to be implemented. Matomo will enable the analysis of visit frequency directly within the Drupal platform, providing valuable website insights for IPPOG.



Communication and Social Media

Fabiola Cacciatore (Communication officer)

Featured articles

IPPOG related articles have been published on the following media.

SCIENTIX

An article written by Fabiola Cacciatore and published on Scientix Blog:
https://blog.scientix.eu/2022/08/be-a-scientist-for-a-day-the-international-masterclasses-program-for-high-school-students/

CERN news

An article written by CERN editorial team with the relevant contribution by IPPOG co-chairs Pedro Abreu (LIP, IST) and Steven Goldfarb (U. Melbourne) and published on CERN currier:
https://home.cern/news/news/knowledge-sharing/happy-25th-birthday-ippog

The announcement of the symposium to be held at the Globe by IPPOG for non-scientific CERN personnel written by CERN editorial team:
https://home.cern/news/announcement/knowledge-sharing/ippog-event-special-particle-physics-masterclass-cern-personnel

An article about the symposium held at Globe of Science and Innovation for the 25th IPPOG anniversary written by CERN editorial team:
https://home.cern/news/announcement/knowledge-sharing/ippog-event-symposium-and-celebration-ippogs-25th-anniversary

SIF

An article dedicated to the 25 anniversary of IPPOG written by Despina Hatzifotiadou:
https://www.primapagina.sif.it/article/1584/happy-birthday-ippog#.Y1mGAOxByEu

NEW PARTNERS

During 2022, IPPOG welcomed two new partners: the International Association of Physics Students (IAPS) and the Women in Technology community at CERN (WIT).

Special Event

Fabiola Cacciatore (Communication officer)

25th IPPOG Anniversary Symposium

In October 2022, IPPOG commemorated its 25 years of dedicated service with a special event hosted at the CERN Globe of Science and Innovation on October 29. The celebration took the form of an illuminating symposium, during which all former chairs shared insights into the evolution of IPPOG throughout the years.

The symposium gathered an esteemed lineup of speakers, including former CERN Director-General Chris Llewellyn Smith, Frank Close, Erik Karl Johansson, Michael Kobel, David Barney, Marge Bardeen, and Hans Peter Beck. Additionally, Kenneth William Cecire and Uta Bilow, the International Masterclasses programme Coordinators, provided their valuable perspectives. The event's speakers shared their experiences and observations in chronological order based on their respective mandates.

The celebration counted 58 attendees, both online and in person. The event's opening remarks were delivered by Steven Goldfarb and Pedro Abreu, setting the stage for an engaging discourse. Charlotte Lindberg Warakaulle and Ana Godinho represented CERN, warmly welcoming and introducing the event to the audience.

These mementos not only marked the milestone but also spread the IPPOG spirit. The symposium's culmination was marked by the ceremonial cutting of the cake, symbolizing IPPOG's continued growth and impact. A heartwarming video added a touch of joy to the festivities.

The success of the event was a result of effective communication through various channels. Information about the symposium was disseminated through social media announcements, posters placed in the CERN Meyrin and Cessy areas, and an article penned by Steven Goldfarb in the CERN Bulletin.

The dedication of the IPPOG community and its commitment to celebrating a quarter-century of accomplishments was truly heartening.

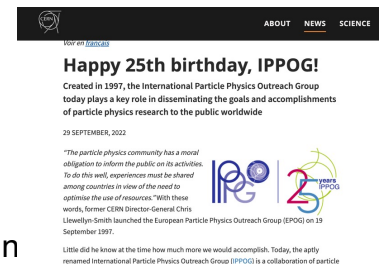
The festive occasion was further enhanced by the distribution of commemorative gadgets.

For those interested in revisiting the event or accessing related materials, please find the event link here: https://indico.cern.ch/e/ippog25

Printed Poster

Gadget

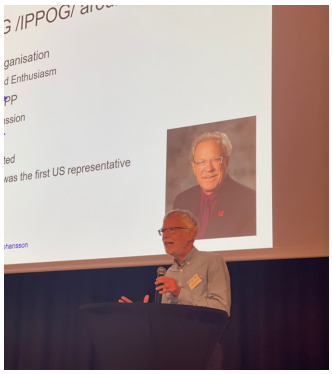
CERN bulletin



IPPOG Celebrates 25 Years of Engagement

The Birth of IPPOG
Chris Llewellyn Smith
(former CERN Director-General 1994–1998)

Our First Steps
Frank Close(former Chair 1997–2001)



Growing Up
Erik Karl Johansson
(former Chair 2002–2008)

Adolescence
Michael Kobel
(former Chair 2009–2012)

Teen Spirit
David Barney
(former Chair 2009–2012)

Coming of age
Marge Bardeen
(former Chair 2013–2016)

Adulthood
Hans Peter Beck
(former Chair 2013–2019)

Master(classe)s of the Universe
Kenneth William Cecire, Uta Bilow
(IMC coordinators)

Celebration
Erik Karl Johansson, David Barney, Marge Bardeen, Hans Peter Beck, Steven Goldfarb, Pedro Abreu, Claire Adam

Special Event

Fabiola Cacciatore (Communication officer)

Special Masterclass for non-scientific CERN personnel

In collaboration with Women in Technology (WIT), IPPOG organised a **special masterclass dedicated to CERN non-scientific personnel** in October 2022.
The event had a quota of participation of 40 people. We received 40 registrations, but only 32 people participated in this event.
The goal is to propose this experience as an annual event for all those who, working at CERN, would like to know better the work of the scientific research at CERN, putting hands on particle physics as their scientists colleagues do.

After the event, the following **survey** was sent to all participants, but only 14 replied:

- **How did you hear about the event?**

7.14 % Social Media
7.14 % IPPOG Communication
28.57 % WIT Communication
35.71 % Friends/Colleagues
28.57 % CERN Communication
7.14% others

- **How complicated to think were the topics covered?**

14/14 answers: complicated

- **Do you think this experience can be useful for the purpose of your work?**

12 yes, 2 no

Would you recommend the masterclass to your colleagues who don't have a background in particle physics?
14 yes



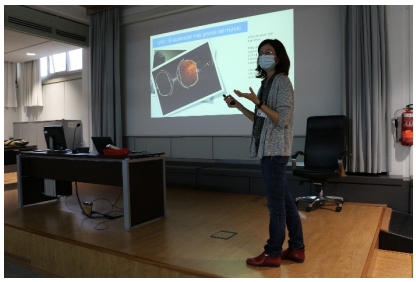
International Masterclasses 2022

Uta Bilow and Kenneth Cecire




In 2022, much of the programme was still carried out under pandemic conditions, resulting in a mixture of online and in-presence Masterclasses. By the numbers:

- 191 LHC Masterclasses with CERN VC
- 32 LHC + 9 MINERvA Masterclasses with Fermilab VC
- 11 Belle II Masterclasses with KEK VC
- 28 Particle Therapy Masterclasses with GSI VC



Girls Masterclasses were held on February 11, the UN International Day of Women and Girls in Science. 11 institutes from Europe, Brazil, and India followed the call and held a Masterclass for girls with in total 500 high school students. The institutes participated in videoconferences with CERN where the girls talked to CERN women scientists and learned about the careers of these role models.

World Wide Data Day was held on November 10 with 46 high school classrooms participating from 12 countries around the globe.

New participants in International Masterclasses came from:

- Yerevan (Armenia)
- Karachi, Islamabad, Lahore (Pakistan)
- Riga (Latvia)
- Tirana (Albania)
- Pristina (Kosovo)
- Skopje, Tetovo (North Macedonia)
- Guatemala (Guatemala)

} Via Particle Therapy Masterclass

Speaker and Publications Committee (SPC)

Members: Despina Hatzifotiadou, Dezsö Horvath, Farid Ould-Saada, Jonas Strandberg

The SPC makes a regular survey of conferences of interest for IPPOG participation, such as major conferences in particle physics and specialised conferences in physics education. Abstracts are prepared and sent to these conferences. For the abstracts accepted, speakers are identified and selected to attend the conference and present on behalf of IPPOG (in plenary, parallel, or poster sessions). The committee also checks the presentation, regarding the content and style, and finalises the proceedings and/or other publications.

In 2022 IPPOG was present at the following conferences:

LP2021 9-14 January 2022, Manchester, UK
(LEPTON PHOTON 2021 postponed from 2021) https://indico.cern.ch/event/949705/
“Public Engagement in HEP”
plenary talk by Pedro Abreu
"The International Particle Physics Outreach Group - Engaging the world with science”
poster by Steve Goldfarb

LHCP2022 16-21 May 2022 Taipei, Taiwan – online
(Large Hadron Collider Physics Conference) http://lhcp2022.phys.ntu.edu.tw
“Particle Physics for babies : Outreach for the youngest audience”
Poster by Louie Dartmoore Corpe

ICHEP 2022 6-13 July 2022, Bologna, Italy
(International Conference on High Energy Physics) https://www.ichep2022.it
"The International Particle Physics Outreach Group – Reaching across the globe with science”
presented by Steve Goldfarb
“Particle Physics for babies : Outreach for the youngest audience”
presented by Louie Dartmoore Corpe
“International Masterclasses: Forward from Pandemic”
presented by Uta Bilow and Ken Cecire
“Implementation of a Portal Dedicated to Higgs Bosons for Experts and the General Public” (http://cern.ch/higgs)
poster by André Sopczak
“Outreach Modules for a New Particle Search Using the ATLAS Forward Proton Detector and Higgs Boson Physics” (http://cern.ch/cppp)
poster by André Sopczak

Relevant presentations by IPPOG members (not on behalf of IPPOG):

LHCP2022 16-21 May 2021, Taipei, Taiwan (online)
(Large Hadron Collide Physics Conference) http://lhcp2022.phys.ntu.edu.tw
“Quarknet in LHC Education and Outreach”
presented by Ken Cecire

ICHEP 2022 6-13 July 2022, Bologna, Italy
(International Conference on High Energy Physics) https://www.ichep2022.it
“CMS International Masterclasses in Mexico”
presented by Ken Cecire

ICHEP 2022 6-13 July 2022, Bologna, Italy
(International Conference on High Energy Physics) https://www.ichep2022.it
“Education, Outreach and Public Engagement”
Presented by Claire Adam-Bourdarios

Conferences on Education in 2022:

EDULEARN22 International Education Conference
Palma de Mallorca, Spain, 4-6 July 2022
https://iated.org/conferences
https://iated.org/edulearn/
“The IPPOG Resource Database: Supporting global particle physics outreach & education”
presented by Ivan Melo

Collaboration meeting – Spring

Scientific Secretary and Head of Communications: Fabiola Cacciatore

23rd IPPOG meeting - Podgorića, Montenegro 11 – 12 - 13 May 2022

IPPOG arranges two collaboration meetings each year, one in spring and the other in autumn. In 2022, the 23rd IPPOG Collaboration Meeting was held in Podgorica, Montenegro, spanning from Wednesday, May 11th to Friday, May 13th.

These annual meetings serve as platforms for various activities, including the presentation of reports from Working Groups, Steering Groups, the Speakers and Publications Committee, as well as the sharing of Inspiring Success Stories and reports from select members/associated members. One of the notable highlights of these meetings is also the panel discussion.

After three years of virtual meetings due to the COVID-19 pandemic, 26 collaboration members (out of 39) had the opportunity to convene in person for the first time. However, it was still a hybrid meeting, with some representatives connecting via Zoom.

The meeting concluded on Friday, May 13th, with an organized excursion to explore some of the most beautiful locations in Montenegro.

International Masterclass Steering Group

The Global Cosmics Steering Group presented by Carolin Schwerdt and Sabine Hemmer and the International Masterclass Steering Group presented by Kenneth William Cecire and Uta Bilow took place in the morning of 11th May.

Wednesday, May 11

Opening Session
The collaboration meeting commenced in the afternoon of May 11th.
Pedro Abreu and Steven Goldfarb, the IPPOG co-Chairs, initiated the session by extending a warm welcome to the newest members of IPPOG: Bedangadas Mohanty as the representative from India and Fotios Ptochos as the representative from Cyprus. They also introduced Fabiola Cacciatore, the new student who would join the Coordination Team as Communication Officer.

During the opening session, the co-Chairs also announced the new representatives for various entities:
- Rebeca Gonzalez Suarez replaced Sascha Mehlhase as the representative for the ATLAS Experiment.
- Rok Pestotnik took over from Zdenek Dolezal as the representative for the BELLE II Collaboration.
- Ivana Lagator was succeeded by Ivana Pićurić as the representative for Montenegro.
- Anja Kranjc Horvat replaced Andrej Gorisek as the representative for Slovenia.

Core Team reports:
- News on the Website and Resource Database by Barbora Bruant Gulejova (Universitaet Bern (CH)) and Lila Mabiala (CERN)
- Communication news by Fabiola Cacciatore (IPPOG)
- Masterclass Steering Group by Kenneth William Cecire (University of Notre Dame (US)) and Uta Bilow (Technische Universitaet Dresden (DE))
- Global Cosmics Steering Group by Carolin Schwerdt

Inspiring success stories:
- Kamiokanne: Cosmic Ray detectors in Nijmegen by Charles Timmermans
- I'm a scientist - Get me out of here by Uta Bilow
- Portuguese language advanced teacher's programme online by Pedro Abreu
- IPPOG in Nepal by Steven Goldfarb

Member and Partner Reports
- Ana Godinho (CERN): CERN ECO
- Ms Alexandra Lau (APS : APS
- Zlatan Vasović (International Association of Physics Students) : IAPS
- Louie Dartmoor Corpe (CERN): Particle Physics Baby Book

Thursday, May 12th

On Thursday morning, a public event was organized, inviting students from local schools to participate. Steven Goldfarb delivered a captivating presentation titled "Universal Questions: How we measure what we can't see." The students actively engaged in the session by asking thought-provoking questions. Following the presentation, the HEPscape activity took place for the first time in an international setting. Livia Soffi from INFN provided a descriptive and interactive demonstration of the game. This occasion served as an opportunity to introduce the activity to the IPPOG members, encouraging them to collaborate with the HEPscape team (Livia Soffi, Francesca Cavallari, Pia Astone, and Chiara Rovelli) for translating the materials into different languages and utilizing them during science-focused events. For more information, visit https://web.infn.it/hepscape/.

In the afternoon, the working groups presented their reports in the following sequence:
1. Diversity, Inclusion, and Accessibility
2. Masterclasses to New Countries
3. Applications for Society Working Group
4. Explaining Particle Physics to Lay Audiences

During the afternoon session, a special panel discussion/workshop on Masterclasses for different target audiences took place. Participants were divided into groups, each focusing on a distinct target audience. Proposed targets included masterclasses for the classroom, general public, media, and middle school masterclasses (PhysicsQuest).

Before concluding the second day, Despina Hatzifotiadou from the University and INFN, Bologna (IT), presented the report from the Speaker and Publication Committee.

Friday, May 13th

The final session was dedicated to Collaboration Matters. At the beginning of the meeting, 28 members (representatives and proxies) were present, establishing a quorum.

Steve and Pedro provided an update on Potential Members, including Mexico, the Baltic States, Canada, Pakistan, and Nepal.

Then the CB went to the following topics:

- **Human resources in 2021**
- **Scientific Secretary position**
- **Chair search committee.** A vote for Chair (re)election will will be held during the Fall meeting. The volunteers for the committee are: Despina Hatzifotiadou, Charles Timmermans, Ian Bearden, Freya Blekman and Ivan Melo.
- **IPPOG@25 Anniversary Celebration**
- **Venue and dates for fall meeting.** As per tradition and also due to the fact that the symposium will be organized for the 25th anniversary, the autumn meeting will be held at CERN. The dates have not been defined. Bulgaria offered to host the spring 2023 meeting in Sofia Tech Park.

Short meetings reports – Spring

- Select the commission for the selection of the Scientific Secretary and Head of Communication

- Select the commission for the selection of the new IPPOG co-Chair

- **Fall meeting 2022** will be hosted at **CERN**

- A **symposium** will be organised to celebrate the **25th anniversary** of the Organisation

Below the link to the meeting' s Indico page:
https://indico.cern.ch/e/ippog-2022-spring

Collaboration meeting – Autumn

Scientific Secretary and Head of Communications: Fabiola Cacciatore

The 24th Collaboration meeting took place both at CERN in person and on-line.
It was held from 26 to 28 October 2022 at CERN, with 76 registered participants, including high school teachers from abroad.
It was a meeting full of guests, many of whom finally attended in person.

Pedro Abreu and Steve Goldfarb welcomed the collaboration to the meeting, remarking on the technical specificities of a hybrid meeting.

They welcomed the new CT members: Hanife Olgunsoy (finances support) who replaced Anita Bens and Zoe Nikolaidau (administrative support).

The chairs also announced that Paul Jackson, the representative for Australia is officially replaced by Jackie Bondell, Nicholas Tracas, the representative for Greece, is officially replaced by Christine Kourkoumelis, Gabriel Stoicea, the representative for Romania, is officially replaced by Paul Gravila and Alberto Ruiz Jimeno, the representative for Spain, is officially replaced by Jesús Puerta-Pelayo.

Wednesday, October 26:

The morning of October 26 marked the inaugural edition of the special masterclass designed specifically for CERN's non-scientific personnel. This initiative, proposed by Fabiola Cacciatore (IPPOG communication), aimed to provide colleagues outside the scientific community with a better understanding of the data research work conducted by physicists and researchers at CERN. Further details can be found in the Communication Report provided above.

In the afternoon, the Masterclasses Steering Groupmeeting took place, covering the following topics:
- Review of Neutrino Masterclasses presented by Kenneth William Cecire and Spencer Pasero
- Update on the CMS Masterclass presented by Kenneth William Cecire
- Open Online Masterclasses presented by Steven Goldfarb
- Introduction of a new Masterclass activity featuring public data from the Pierre Auger Observatory presented by Raul Sarmento

Thursday, October 27:

The official opening of the 24th meeting occurred on October 27 at 10 am. Following a warm welcome by the Chairs Pedro Abreu and Steven Goldfarb.
The core team provided the following reports:
- News on the Website and Resource Database presented by Barbora Bruant Gulejova
- Communication report presented by Fabiola Cacciatore
- Report from the Masterclass Steering Group presented by Kenneth William Cecire and Uta Bilow
- Report from the Global Cosmics Steering Group presented by Carolin Schwerdt and Sabine Hemmer

This was followed by 19 success stories, featuring a range of inspiring initiatives and projects:

- *CERN TIF EXPO* presented by Yiota Foka
- *Beamline for Schools Competition announcement* presented by Margherita Boselli and Sascha Schmeling
- *CERN-Solvay Education Program* presented by Guillaume Durey and Julia Woithe
- *TU Dresden Masterclass on Nuclear Astrophysics* presented by Hannes Nitsche
- "*Your Adventure at CERN*" Material for teachers presented by Letizia Diamante. Letizia was interviewed by IPPOG in spring 2022, and the interview can be found on www.ippog.org. Her material will be added to the IPPOG resource database (available in English and French).
- "*Become a Particle Physicist in Eight Simple Moves*" written and presented by Simone Ragoni
- *The sketchbook and Collider project* in collaboration with Prof. Nikolopoulos presented by Ian Andrews
- *Higgsy App* created and presented by Kirill Skovpen
- *PM REINFORCE project* presented by Christine Kourkoumelis
- *The 4S+ Project* presented by Barbora Bruant Gulejova
- *MISK Special Masterclasses* presented by Steven Goldfarb
- *The Big Bang Stage 2022* presented by Vojtech Pleskot
- *Sparks! presented* by Lila Mabiala and Sofia Caterina Hurst
- *QuarkNet - Activities and Coding* presented by Kenneth William Cecire and Spencer Pasero
- *A Digital Learning Module about Positron Emission Tomography* presented by Sarah Zoechling
- *Women in Technology (WIT)* presented by Simona Kriva
- Report from *IAPS* by Yash Gurbani
- *The "Fun-Q" muography* presented by Miki Ohtsuka
- *Particle Physics in High School Curricula* presented by Anja Kranjc Horvat

To conclude the day, Dr. Anja Kranjc Horvat delivered a captivating performance that both entertained and educated participants about science. She showcased games and experiments that will be offered to the public following the opening of the Science Gateway at CERN in 2023.

Friday, October 28:

The last day began with an engaging Panel Discussion on Future Facilities. The panellists included Daniel Schulte (CERN), Linda Cremonesi (Queen Mary University of London), Matthew Philip McCullough (CERN), and Naomi Zahira Dinmore (CERN), with Steven Goldfarb serving as the moderator.

This was followed by a session dedicated to reports from the IPPOG Working Groups:
- Ken Cecire and Uta Bilow provided updates on the progress of the Masterclasses-to-New-Countries.
- Gwen De Wasseige reported on the activities of the Diversity, Inclusion & Accessibility group.
- Michael Hoch and Hans Peter Beck shared insights into the Exhibits and Public Events Working Group.
- Barbora Bruant Gulejova and Yiota Foka presented the developments of the Application for Society Working Group.
- Barbora Bruant Gulejova also reported on the progress of the Explaining Physics to Lay Audience Working Group. Detailed information can be found in their respective presentations.

In the afternoon, the Collaboration Matters session took place. Steven Goldfarb presented the progress made and highlighted any potential challenges related to the possible membership of the CERN Baltic Group in IPPOG. Additionally, Vassil Karaivanov (Bulgaria) presented the proposal for hosting the next spring meeting in Sofia in 2023, which was subsequently accepted.

The Collaboration Board session included the following agenda items:
- Update on Potential Members
- Report of the selection process for the Scientific Secretary and Head of Communications half-time position. After the vote, Fabiola Cacciatore was appointed as the new Scientific Secretary and Head of Communication. Fabiola had previously worked as an Administrative Student in 2022
- CERN Administrative Student position and Strategic Development commitment
- Budget Proposal for 2023
- Election of the new IPPOG co-Chair for 2023-2025. Steven Goldfarb will step down from the position in December 2022, and Claire Adam will assume the role of co-Chair alongside Pedro Abreu starting from January 2023
- Bulgaria's proposal to host the spring meeting at Sofia Tech Park was accepted

Collaboration meeting – Autumn

Scientific Secretary and Head of Communications: Fabiola Cacciatore

Short meetings reports – Autumn

- The new **IPPOG co-Chair** is Claire Adam (2023-2025)
- The new **Scientific Secretary** and **Head of Communications** will be Fabiola Cacciatore
- The Collaboration Board approved the **budget for 2023**
- **Spring meeting 2023** will be hosted in **Bulgaria**
- Below the link to the meeting's Indico page:
https://indico.cern.ch/e/ippog-2022-autumn

IPPOG

MEMBERS REPORT

Member Reports

In this section, we present a comprehensive overview of the IPPOG-related activities conducted by our Members and Associate Members. The information has been provided by their respective representatives. Due to various reasons, some member countries, laboratories, or experiments were unable to carry out outreach activities in 2022. In such cases, we have included activities from the 2021 or 2020 reports to provide a glimpse into their typical initiatives. This distinction is clearly indicated in the title.

While reading these reports, one will notice a distinctiveness in style that reflects the diverse collaboration. Each member employs methodologies that are tailored to the cultural, social, historical, and pedagogical aspects of their respective regions. However, there are common threads that unite us, such as the ongoing commitment to enhance global educational standards, the drive to expand our programmes to new audiences worldwide, and the unwavering dedication of all members to inspire a sense of wonder in fundamental research and foster a profound appreciation for science and evidence-based decision-making among the younger generation.

We hope you find these reports enjoyable to read and gain a comprehensive understanding of the work and efforts undertaken by IPPOG collaborators. Their efforts aim to improve scientific literacy in society, motivate students to pursue STEM careers, promote the widespread knowledge of particle physics, and disseminate the values of peaceful and international collaboration.

Member Reports

Below is the list of available reports divided by years. Please note that some members do not have reports to display for 2022, which is why they have chosen to include reports from the previous two years. You will find reports from 2021 and 2020 as well as an illustration of the type of activities carried out in the countries.

2022

ALICE Collaboration
ATLAS Collaboration
AUSTRALIA
AUSTRIA
BELLE II
BRAZIL
BULGARIA
CERN
CMS Collaboration
CZECH REPUBLIC
DESY
FINLAND
FRANCE
GERMANY
GREECE
GSI
HAWC
HUNGARY
ITALY
MONTENEGRO
POLAND
PORTUGAL
ROMANIA
SLOVAK REPUBLIC
SLOVENIA
SPAIN
SWITZERLAND
UNITED STATES OF AMERICA

2021

IRELAND

2020

GEORGIA
NORWAY
SWEDEN

ALICE- 2022

ALICE Collaboration Representative in IPPOG – Despina Hatzifotiadou

28 sessions of ALICE masterclasses took place during 2022, including special masterclasses for girls on the International Day of Women and Girls in Science (11th February); most of them were at the institutes but there were also some online sessions. ALICE masterclasses were also held for participants of the MISK Leaders 2030 Programme from Saudi Arabia. Last but not least, ALICE contributed to the High-School Teachers programmes at CERN with masterclasses and presentations on heavy ion physics.

More than 30 virtual visits to the ALICE cavern and control room were done for high-school and University students, as well as general public, often in combination with masterclasses or other local events.

Visits to the ALICE underground installations were done when there were no beams; visits to the ALICE exhibition have been taking place all year round.

Female ALICE members visited schools in the neighbourhood of CERN, in France and Switzerland, and talked to young pupils about their work, on the occasion of the International Day of Women and Girls in Science.

An online “Work Experience Week” was organised in February for high-school students from European School Brussels III, Belgium.

Outreach activities of ALICE were prersented at the International Conference on High Energy Physics (ICHEP2022), in Bologna, July 2022.

A week-long internship at CERN was organised in July, for high-school students from Liceo Gandini, Lodi, Italy. In addition to following lectures and visiting sites, they constructed a LEGO model of ALICE. The design of the model, which consists of 18 000 pieces, had been done during a six-month online workshop in Germany during 2021. Two of the model’s “architects” instructed the students.

The ATLAS Collaboration - 2022

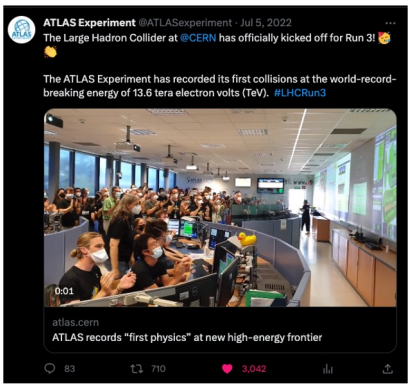
ATLAS Collaboration Representative in IPPOG – Rebecca Gonzalez

2022 was a year of milestones for the ATLAS Experiment. **April** brought the lowering of the 2nd of two new "small" wheels, a major upgrade of the muon spectrometer. On **July 4th**, ATLAS celebrated the **10th anniversary of the Higgs boson discovery** together with its CMS colleagues. And, on the following day, **July 5th**, the startup of **LHC Run 3** lit up the detector with the promise of an exciting new era of exploration with higher energy beams and greater luminosity than ever seen before.

These major events spiked interest on **social media**. In particular, one tweet during the LHC Run 3 startup drew more than **half a million** impressions.

2022 also saw the re-opening of the popular **ATLAS Visitor Centre** (AVC) at Point 1, rejuvenated with an immersive video, real detector components, interactive screens and a new surprise view of the Control Room.

New ATLAS results presented at the **major physics conferences,** were summarised with News, Briefings and Press Statements. Its members also shared their expertise in education and outreach in plenary talks and parallel sessions at LHCP and ICHEP.



877k

Twitter Impressions in July
(Higgs10 and Run 3 startup)

AVC Reopens!

Australia - 2022

Jackie Bondell – ARC Centre of Excellence for Dark Matter Particle Physics

In 2022, Australia's internal and international borders once again opened and provided opportunities for particle physics groups to engage with audiences across the country and with colleagues from overseas. 2022 also marked major progress on SUPL, the southern hemisphere's dark matter detection lab.
In 2022, Jackie Bondell took over the role of Australian representative to IPPOG from Paul Jackson. Jackie leads the Education and Outreach programs for the Centre of Excellence for Dark Matter Particle Physics (CDMPP) and is based at the University of Melbourne. Thanks to Paul from the University of Adelaide for his years of service to IPPOG.
Jackie looks forward to continuing the connections between IPPOG and Australia.

In 2022, the CDM focused on three portfolios that promote the goals of IPPOG.

1. Student Engagement: The CDM delivers a school partnership program to create long-term relationships with schools in regional and rural locations across Australia. Many activities are inspired by CERN's S'cool Lab lessons.
2. Educator Professional Development: Jackie delivered a talk about IPPOG as part of the virtual International Conference on Physics Education. Additionally, she gave workshops and talks about incorporating topics such as dark matter and particle physics at state, national, and international education conferences.
3. Public Outreach: In conjunction with EQUS, a research centre focused on quantum science, the CDM organized and delivered a three-week long National Quantum and Dark Matter Road Trip, visiting over 40 schools and community centres along a route from Brisbane to Perth. Over 20 physicists joined along the way to engage audiences with talks and hands-on activities.

Left: Renee Key of CDM assists students doing an activity with the CERN Mystery Boxes

Right: The Quantum and Dark Matter Road Trip team

Photos: J. Bondell

Austria - 2022

Austria Representative in IPPOG – Natascha Hoermann

Wiener Forschungsfest 2022

© Wirtschaftsagentur Wien / Tirza Podzeit

Kinderuni 175 ÖAW

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- Belle II International Masterclasses for students
(HEPHY Vienna: 23 March 2022 online)

- Pint of Science, different pubs in Vienna, outreach event within the Identification of Dark Matter conference 2022 in Vienna

- KinderUni Wien for school classes at the Campus of the Austrian Academy of Sciences (17 – 19 May 2022)

- Lange Nacht der Forschung 2022 at the Austrian Academy of Sciences (20 May 2022)

- Wiener Forschungsfest 2022 at the Vienna City Hall
(9 – 11 September 2022)

- ÖAW Studienstiftung at CERN (15 – 16 September 2022)

- Open Day at the Federal Ministry of Education, Science and Research (26 October 2022)

- Dark Matter Day 2022 at the Statt-Beisl WUK (31 October 2022)

- Public talks for the general public and at schools
(as a part of the initiative “Akademie im Klassenzimmer)

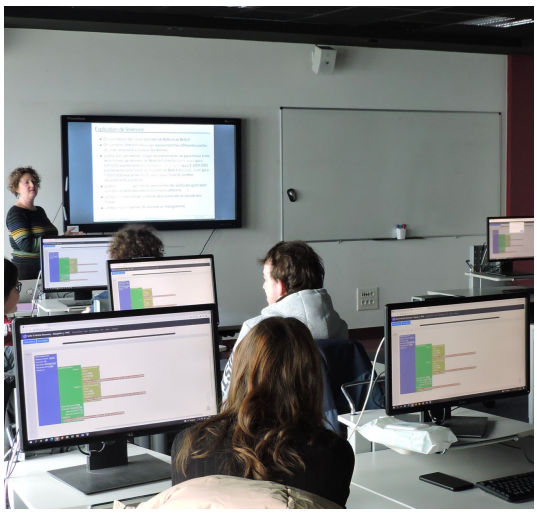
Belgium

Belgium Representative in IPPOG – Gwenhaël De Wasseige

Due to various reasons, the report from Belgium is not available.

Belle II experiment - 2022

Belle II Representative in IPPOG: Rok Pestotnik



In 2022, the outreach activities of the Belle II Collaboration were gradually recovering from the impact of COVID-related measures. Nearly half of the institutions involved were able to successfully organize live events. The online infrastructure played a crucial role in facilitating these activities, as participants could utilize their own equipment and connect to the dedicated online app. This technological advancement has significantly expanded the possibilities for hands-on activities to be organized.

We hosted three Belle II International Masterclasses events, where participants had the opportunity to reconstruct B meson decays using a sizable data sample of 5 million events. Additionally, a new exercise was specifically designed to focus on measuring quark colors and was deployed by several institutions. Both of these exercises have been made available online, enabling citizen engagement in the research process.
In addition to the aforementioned events, the Belle II Collaboration also organized outreach activities at notable gatherings such as the Flavor Physics and CP Violation 2022 Conference, the University of Mississippi, and the Physics Summer School at the University of Ljubljana. Furthermore, we actively participated in the European Researchers Night at multiple locations, further promoting our outreach efforts and fostering public interest in our research endeavors.

Belle II International masterclasses:

- 3 full day events
- 11 institutions
- 216 participants

- Additional 5 satellite half day events

We have maintained a consistent flow of communication by sharing our latest news and updates with our social media audience across multiple platforms, including Facebook, Twitter, and Instagram..

Brazil - 2022

Brazil Representative in IPPOG – Marcelo G. Munhoz

Masterclasses Hands On Particle Physics

During 2022, the event was organized in both formats: in person and remotely. It was organized in São Paulo, Rio de Janeiro and the states of Minas Gerais and Ceará, in the north of the country. Around 700 students had the opportunity to participate in these events around Brazil, making the events very inclusive.

Cosmic Ray Detectors Network in Schools

Two workshops were organized in 2022 involving students from public schools. They visited the research laboratory where the cosmic ray detector was produced and discussed the principles of cosmic rays detection. The students analyzed the data collected by the detector to interpret a cosmic muon flux measurement. The event was finalized with a historical and epistemological discussion conducted by science education experts. This is the first step to introduce the detectors in the schools.

IPPOG-Brasil Web Portal

The first version of the IPPOG-Brasil web portal was finalized in 2022. Its main purpose is to serve as a meeting point to Portuguese-speaking lay people interested in Particle Physics. A data base with materials and activities in Portuguese was created to reach anyone interested in Particle Physics, mainly students and teachers. Events, opportunities, forums for questions and discussions will also be provided in the portal.

1200 students
participated in the ATLAS Virtual visits around the country

700 students
participated in the Masterclasses during 2022 in Brazil

Bulgaria - 2022

Brazil Representative in IPPOG – Marcelo G. Munhoz

International Masterclasses in Bulgaria

Bulgaria participated in 5 IMC in 2022
•Particle therapy class in Sofia
And four CMS IMC in diffrent towns:
•Dimitirovgrad, Pleven, Varna and Sofia.
More than 150 students attendted the classes online.
•After the end of the pandemic restrictions,
in June, the students were invited to celebrate at
a dedicated Masterclass party in TechoMadgicLand,
at Sofia Tech Park, having fun with different physics
experimental setups and visiting the Supercomputer.

Growing interest to participation in W2D2
10 Bulgarian schools analyzed CMS and ATLAS muon data

Local events
• Virtual tour of CERN, with the help of Bulgarians working in CERN at Sofia Tech Park in September,
• IMC and CERN open data presented to the educational forum
“The quality of education in the conditions of digital transformation
and the specifics of generations”
in Varna, Bulgaria

CERN - 2022

CERN Representative in IPPOG – Ana Godinho

Empowering teachers and students

More than 550 teachers from 50 countries took part in the 24 on-site Teacher programmes, run in the second half of 2022. In parallel, online teacher programmes reached a further 1 100 teachers, thus sustaining the crucial relationship with teacher communities across the globe.

S'Cool LAB activities again gave 4 500 students and teachers the opportunity to experience first-hand the cutting-edge research being carried out at CERN.

High-School Students Internship Programmes for Italy and Serbia took place, completing this programme. After two years at DESY (Hamburg), two teams from Spain and Egypt conducted their winning proposals at CERN, with a third team from France at DESY.

CERN and the Belgian science company Solvay launched a three-year programme combining online and on-site learning, as part of the education portfolio of Science Gateway. The online course videos have reached 6 500 unique viewers on CERN's YouTube channel.

The 10th anniversary of the Higgs boson discovery and the LHC Run3

A coordinated, multi-channel campaign celebrated three key 2022 milestones: the re-start of the LHC (on 22 April); the 10th anniversary of the discovery of the Higgs boson (4 July), and the start of the third run of data taking for physics at the LHC (5 July).

Three themes underpinned the campaign: Celebration; 10 years on; Preparing the future. Developed by CERN in collaboration with partners in CERN Member States and laboratories worldwide, the campaign encompassed media relations, digital communications, special issues of the Bulletin and the CERN Courier, an exhibition and in-person events, including a scientific symposium for the Higgs boson discovery anniversary.

The campaign won a European Excellence Award, in the category Science and Education.

The live broadcast of the start of Run 3)on 5 July 2022) registered 75K concurrent viewers and more than 27K comments and questions. By September 2022, the video of the start of Run3 had gathered almost 5 million views.

Cyprus

Cyprs Representative in IPPOG – Fotios Ptochos

Due to various reasons, the report from Cyprus is not available.

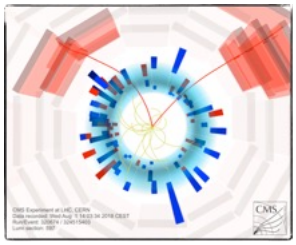
CMS Experiment - 2022

CMS Experiment representative - Freya Blekman

Live & International Events have been a lot of fun over 2022!

•CMS was part of the **CERN live** events marking the start of **Run 3** and **Dark Matter Day**, and the **Higgs' 10 year** anniversary celebrations.
•**Virtual visits** and **guided tours** to the detector continued throughout the year, with **over 2700** online visitors and **over 7400** in person visitors underground.
•CMS set up an expo area at the **GeekTouch** convention in Lyon, including games and a VR station. There was a huge amount of enthusiasm from colourfully dressed people!
•CMS continues to contribute to the IPPOG particle physics **Masterclasses** throughout the year

Physics Briefings continue to be a priority, and in 2022 we published 28 including **5 key results** as highlights.



Open Data sets CMS apart - it is unique for sharing all its proton-proton data from Run 1 with the public.

A **dedicated Open Data workshop** was set up and run at CMS, including **high school students and teachers**!

Online Presence
Continued presence on social media platforms
NEW accounts on **LinkedIn** & **Mastodon**
11 blog posts on the Cylindrical Onion
18 detector and collaboration **news stories**

CMS Social Media & Website Links!

Videos
CMS produced **14 new** YouTube videos, including **explanations** of the CMS upgrades and the **expectations** for Run 3, as well as **fun videos** such as showing the strength of the magnet through paperclips, chains, keys, and a variety of other objects

Czech Republic - 2022

Czech Republic Representative: Vojtech Pleskot

Events for high-school students:

- Four Czech institutions organized seven International Masterclasses events.
- Particle Prague 2022 hosted 32 highly motivated high-school students at a one-week-long internship programme organized by 4 Prague institutions. Their stay was full of hands-on projects, lab visits, talks and social events.

The Big Bang Stage at the Colours of Ostrava music festival offered
28 hours of programme about particle and nuclear physics. In 4 days, 3500 people visited talks, science shows, discussions and workshops.

A meeting on the 30th anniversary of the accession of the Czech and Slovak Federal Republic was held in 2022. Ministers and ambassadors of both countries and the CERN Director for Research and Computing Joachim Mnich joined the celebration.

30

years ago, the Czech and Slovak Federal Republic became a CERN member state.

Denmark

Denmark Representative in IPPOG – Ian Bearden

Due to various reasons, the report from Denmark is not available.

DESY- 2022

Thomas Naumann

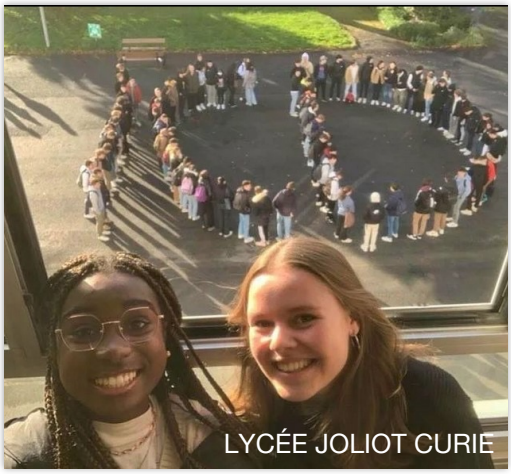
Since 2012, **DESY** initiates and coordinates the International Cosmic Day (**ICD**) in cooperation with **IPPOG** and many national networks and partners. The ICD2022 took place on November 22. The day is dedicated to the unnoticed cosmic particles that flood our universe and constantly surround us on Earth.

On this day the students get the chance to become a part of the science community. Participants from various institutions all over the globe such as schools, universities, and research institutes perform experiments and attend lectures. Students listen to scientists and to other students who present their results and discuss their research. A special guest and supporter of this year's **ICD** was Rebecca Smethurst, astrophysicist at Oxford University, known on YouTube as Dr Becky.

DESY provides material and organizes the communication between the groups. The team consisting of scientists, students and event experts came up with some new highlights: activities for anyone who wants to spontaneously join in on the day, including a quiz on astroparticle physics and a drawing and selfie competition on social media. Those who do not live near a venue could also participate without conducting their own experiments. The Cosmic@Web website provides data from long-term experiments and tools for evaluation.

Another special feature was the online masterclass for Ukrainian students in Ukrainian. This was held in cooperation with the organisation Astrosandboxers and young scientists at **DESY** in Zeuthen.

https://icd.desy.de | http://globalcosmics.org | http://cosmicatweb.desy.de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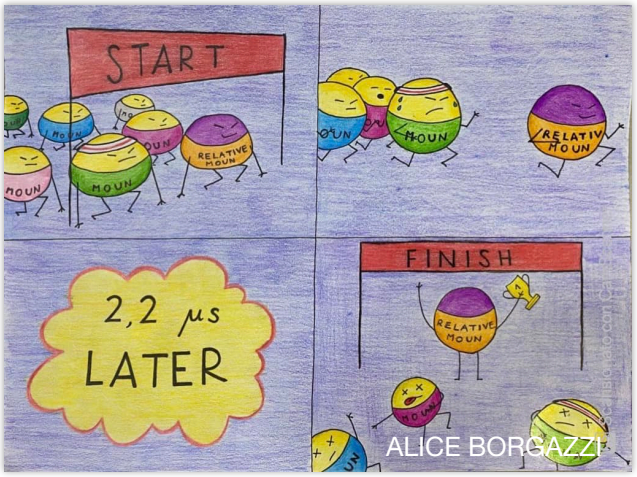


Winners of the Cosmic Selfie and Drawing Contests.

Finland - 2022

Finnish Representative in IPPOG – Sami Lehti

In 2022 the covid situation made organizing outreach events still challenging. In February-March a science course for high school students was organized in Otaniemi. The students were given open CMS data. There were around 80 participants.
The Finnish participation to International Masterclasses was cancelled. School visits to CERN stopped. In June, after the epidemic, the Finnish school teachers were the first group to visit CERN in the CERN National Teacher Programme, and a CERN Bootcamp was organized for students from universities of applied sciences (participants from Laurea, Metropolia and Haaga-Helia) together with Helsinki Institute of Physics and CERN Ideasquare.

Finnish high school teachers vising CERN, and building cloud chambers using dry ice. Photos J.Aaltonen

Students from Finnish universities of applied sciences participating a CERN Bootcamp kickoff. Photo J.Aaltonen.

France - 2022

France Representative in IPPOG - Nicolas Arnaud

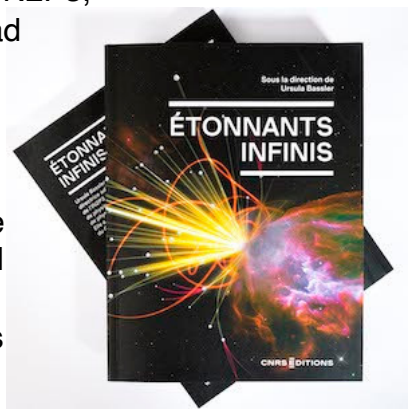
Introducing **young people** and **the general public** to **basic science** (nuclear physics, particle physics, cosmology and astrophysics), the **technological advances** required (accelerators, detectors, computer science) and the related **applications** (energy, health, etc.), is a key mission for the **29 CNRS/IN2P3 laboratories, infrastructures and national platforms**, and the **CEA/IRFU**.

Educational and outreach activities are carried out in close collaboration to teachers and take many forms: in-person, online, virtual, websites, exhibitions, educational detectors, printed and media resources, training courses, etc.

Our goal: to give people a taste for science and physics

2022 has been a revival year after the pandemic, with many in-person activities restarting, among which the yearly National Science Festival in October.

"Étonnants Infinis" ("Amazing Infinities", CNRS Éditions) is a contributed book written by 41 researchers and engineers from CNRS/IN2P3, CEA/IRFU and Universities. Its goal is to make a broad audience discover the variety of the physics of the "infinitely small" and of the "infinitely large", such as the diversity of the people who have dedicated their carreer to this endeavor. 30 short chapters, copiously illustrated, provide a state-of-the-art overview of these scientific fields, highlight the main open questions and describe the experiments and projects which aim at expanding our knowledge of the Universe in the years to come. Watch this playlist to know more about it.



Parallel to the EDSU2022 scientific conference in Réunion (Indian Ocean), a large program of outreach and education activities has been run for two weeks on the whole island: 50+ conference in schools, 8 public lectures, 2 university seminars, 3 school contests, 1 primary school teacher training and 1 round table about "women in science". A total of 4,500 students and 2,000 spectators were involved.

In addition to its museum "Information technology from now and then", the CNRS/IN2P3 Computing Center, CC-IN2P3, is now offering a virtual tour. All year long, it takes part in many events, including the particules.com festival.

Georgia - 2020

Georgia Representative in IPPOG – Alexander Sharmazanashvili

Tbilisi, October 5, 2020

Dr. Mikheil Chkhenkeli, Minister of Education, Science, Culture and Sports of Georgia, and Steve Goldfarb, IPPOG Co-Chair, sign the Addendum of the Georgia accession to IPPOG Collaboration

Georgia become a member of IPPOG in 2020, through the Ministry of Education, Science, Culture and Sports. Foreseen as a relevant contribution are the software applications for masterclasses, in particular a new web-based 3D event display for the ATLAS exercises and cognitive visualization applications.

In 2020, International Masterclasses were held at the following places:

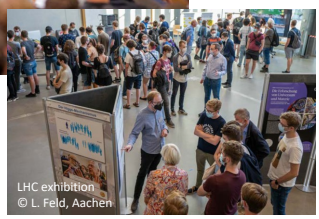
- Backswood private school - Tskneti
- 63rd public school - Tbilisi
- Martvili high school - west of Georgia
- British school - Tbilisi
- American school – Tbilisi

A Masterclass was also held in Georgian Technical University with the participation of 23 students. Another two sessions programmed for Tbilisi and Batumi State University were cancelled due to pandemic restrictions.

Development of Augmented Reality Applications to enhance the Experience of participants in Masterclasses (e.g. ATLAS), by students of Georgian Technical University, Tbilisi

Germany – 2022

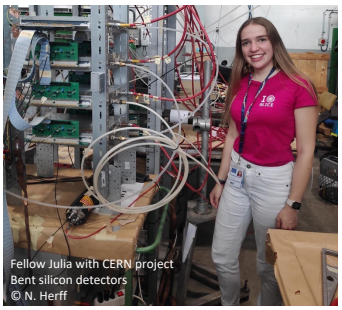
Germany Representative in IPPOG : Christian Klein-Bösing



10th Anniversary of Higgs Discovery – Celebrating the past and looking into the LHC future. Coordinated nation-wide, common web page and design templates, events at 15 places (public talks, exhibitions, masterclasses, guided tours and visits, etc.)

New age groups – From primary school to seniors with the building blocks of matter (LHC LEGO models), more than 700 young people in junior university/Kinder-Uni at various places plus virtual reality and cloud chambers in science camps, stores and fairs.

Multi-Step Program of Netzwerk Teilchenwelt – From masterclasses in high schools to own research at CERN and into a Germany-wide fellow program.



2022

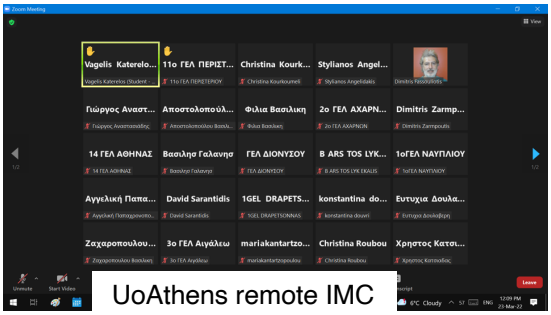
133 active fellows (50% female)
11 students @ CERN, 2 week project
44 (+20) students @CERN, 3 day workshop
71 (+11 online) Masterclasses

Greece - 2022

Greek Representative in IPPOG – Christine Kourkoumelis

In 2022 the pandemic still forced most of the IMC Masterclasses to be on-line. Seven Masterclasses took place in Athens, Crete and Thessaloniki with a total of about 320 high-school students.
Also two masterclass, for the International Day for Women and Girls in Science took place in Thessaloniki.

Crete IMC

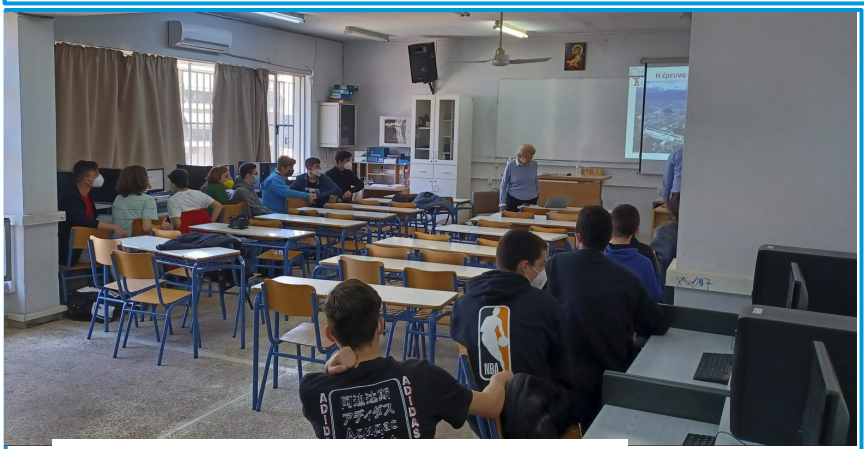


UoAthens remote IMC

Greek Teacher Programme

John S. Latsis Public Benefit Foundation

The Greek teacher programme coordinated by Prof. E.Tsesmelis took place at the end of August-beginning September 2022. The four-day seminars take place at CERN for 75 selected Greek science teachers from every prefecture of Greece. The annual event includes lectures, on-site visits, exhibitions, and hands-on workshops in order to introduce its participants to the cutting-edge particle physics. They in turn, upon their return, are hoped to serve as HEP ambassadors in their schools and pass on the subject to the next generation of physicists and engineers.

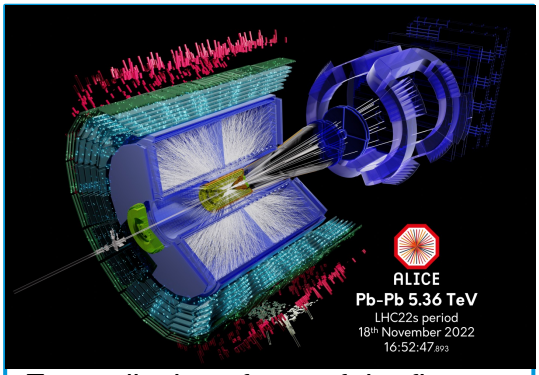

A local MC in a Chalkida high school

In spring and autumn 2022 (when the pandemic restrictions permitted it) a small number of mini-masterclasses in local schools took place.

GSI Helmholtzentrum für Schwerionenforschung - 2022

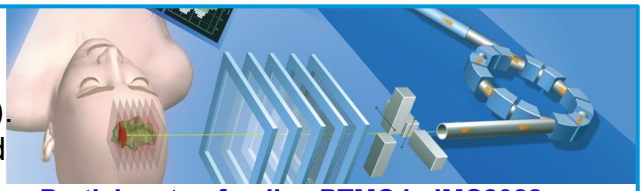
GSI Representative in IPPOG - Ralf Averbeck

GSI is an Associate Member of IPPOG since 2020, but GSI had a significant impact on the Masterclass program already since 2010. A Masterclass on measurements of the suppression of jets in the quark-gluon plasma produced in heavy-ion collisions with the ALICE experiment at the LHC has been developed at GSI and it has been regularly offered for more than 10 years now, in 2022 still in an online version due to the still ongoing Corona pandemic.



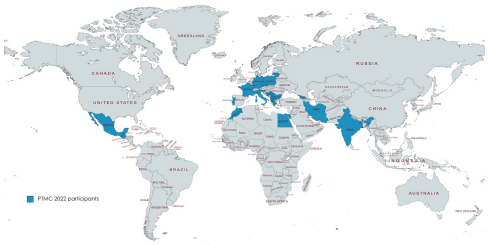
Event display of one of the first Collisions of lead nuclei recorded with ALICE in LHC Run-3.

Another cornerstone of Masterclass activities at GSI is the more recent Particle Therapy Masterclass (PTMC). This program, which was initiated and is coordinated by GSI scientists since 2020, has become a very successful world-wide activity in which pupils get an in-depth insight into cancer therapy with particle beams. In 2022, Particle Therapy Masterclass sessions took place online but also in person at 37 institutions in 22 countries.



Participants of online PTMC in IMC2022

PTMC: https://indico.cern.ch/event/840212/



Since 2022, cloud chamber workshops have been added to the outreach portfolio of GSI. This was possible thanks to the sponsoring of the German Netzwerk Teilchenwelt, which allowed for the acquisition of ten do-it-yourself cloud chamber kits for outreach events at GSI. These kits were used for the first time at the Girls' Day 2022 at GSI, when pupils from local schools built five cloud chambers.

HAWC - 2022

HAWC Representative in IPPOG – Jose Ruben Alfaro Molina

HAWC was presented during the Child's day at UNAM campus. The visitors enjoyed more than 40 activities including the HAWC virtual visits, or the cloud chambers

IFUNAM Open Door Days is a well-known event among High School Teachers and students. HAWC was one of the favourites sections of this virtual event.

In 2022, it became possible to start hosting science festivals, and Children's Day provided the first opportunity. On April 30th, at the UNAM esplanade, parents and children had the chance to delve into various scientific subjects, in particular, they could learn about the HAWC and witness the passage of cosmic rays through the installed cloud chambers. On December 3rd, "La noche de las Estrellas" took place in Mexico City's Zocalo Square. This is Mexico's most significant science outreach event, which offers to people of all ages, the opportunity to spend an afternoon exploring and marveling at the Universe. HAWC made its presence felt with virtual tours, an electronic event simulator, and the cloud chambers, which allowed children and adults to gain insights into and observe cosmic rays reaching Earth. The "Bingo HAWC" game was designed and executed with resounding success among the attendees. In addition to these events, in November, the IFUNAM open doors have consistently provided an excellent opportunity for high school students to delve into various physics topics. Particularly with HAWC, they could learn about the most energetic events in our Universe.

Noche de las Estrellas

More than 200,000 visitors enjoyed "La noche de las Estrella" in Mexico City Downtown. HAWC presented a photograph exposition besides activities as; virtual tours, cloud chambers and Bingo HAWC.

Hungary - 2022

Hungary Representative in IPPOG – Deszo Horvat

1. Eötvös Loránd University, Budapest •
- From the Atoms to the Stars: popular lecture series (http://atomcsill.elte.hu/NEW/)
- Researchers' Night: https://www.facebook.com/events/1240338936723879/?active_tab=discussion

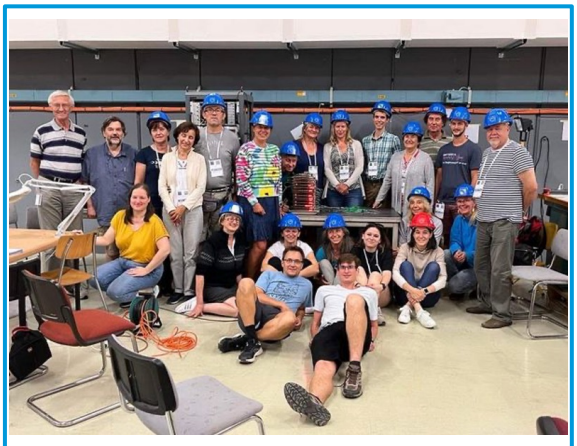
2. Wigner Research Centre of Physics, Budapest:
- Science camp for high-school students: https://wigner.hu/hu/veget-ert-az-idei-kutatodiak-tabor
- Girls' Day at Wigner RCP with 14 high-school girls: https://wigner.hu/hu/sikeresen-lezajlott-lanyok-napja
- Researchers' Night with particle physics lectures, exhibitions, escape room and virtual visit to the CMS Experiment at the LHC (https://wigner.mta.hu/wignerdc/)
- Dedicated students' laboratory: building detectors for cosmic muons

3. University of Debrecen and ATOMKI, Debrecen: Building detectors by high-school students for cosmic muons

4. Hands-on Particle Physics Masterclasses at four institutes in Budapest, Debrecen and Székesfehérvár

5. Hungarian Teachers' Programme 2022: After 2 years' Covid stop we have brought 17 Hungarian physics teachers (including 2 from Slovakia, 1 from Romania) to CERN for a week to listen to lectures, visit experiments, and build muon detectors (cloud chambers and multiwire proportional ones). This was the 15th such occasion, it was organized by the Wigner RCP

6. 10 years of the Higgs boson organized by G. Pásztor (Eötvös University):
- Special outreach workshop at the Hungarian Academy of Science
- Outreach afternoon for children at Eötvös University with lectures, escape room and other games Dedicated issue of Fizikai Szemle, the outreach journal of the Roland Eötvös Physical Society



Participants of the 2022 Hungarian Teachers' Programme at CERN after the chamber construction exercise

Particle Physics Masterclass in Debrecen

India

India Representative in IPPOG Bedangadas Mohanty

Due to various reasons, the report from India is not available.

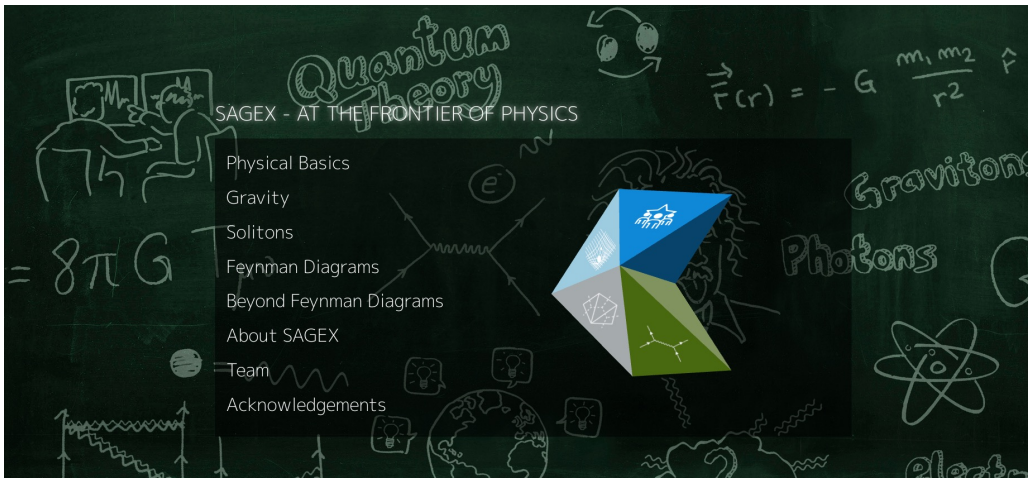
Ireland - 2021

Irland Representative in IPPOG – Jonivar Skullerud

Interactive online exhibition

PhD students at Trinity College Dublin, together with others in the EU-funded SAGEX network, have created an interactive online exhibition on scattering amplitudes and related topics.

The exhibition features animations and videos explaining issues including Feynman diagrams, solitons, gravity, and novel geometric methods.
See https://exhibition.sagex.org/#/exhibition-hub



Online Masterclasses

After the 2020 Particle Physics Masterclasses were cancelled, Maynooth University organised online Masterclasses featuring the ALICE experiment.

The online format allowed us to include a virtual visit to the ALICE detector, and also to spread the event over two days, making for a more relaxed pace.

About 30 took part, including a class joining from their school, and 10 local tutors guided them through the exercises in Zoom breakout rooms. Long and engaged discussions ensued with several of the students after the event.

Italy - 2022

Italy Representative in IPPOG – Catia Peduto (INFN)

4000 spectators attended the show «One step away from the Big Bang» in Bologna (Piazza Maggiore) during the ICHEP conference.

The video-mapping »Shapes and colours of a discovery» was one of the highlights of the Science Festival of Genoa, projected on Palazzo Ducale every day during the Festival.

Due to the pandemic, in 2022 the IPPOG Masterclasses took place online and in presence (depending on the university), and saw the participation of 2000 students. INFN participated in several science festivals, co-organizing numerous conferences, live shows, and laboratories. A special focus was given to the 10th celebration of the Higgs discovery. To celebrate the anniversary, a show took place in the central piazza Maggiore of Bologna, in July, during the ICHEP conference. The interactive multimedia exhibit “Make collisions” was set up nearby during the whole conference period. A serie of a podcast called “Traces – Lexicon of a discovery” was broadcasted. At the national Science Festival in Genoa, in October, a video-mapping showing LHC and its experiments was projected on Palazzo Ducale. A “goose game” about the universe was designed and realized for the Festival, experiencing great success. Live streaming events on YouTube were performed during the whole year, with different targets: from primary to high-school students and the general public.

«The goose cosmos”», a goose game based on the history of the universe, was very successful in Genoa: 3000 students played with it during the 10 days of the Festival.

a total of about
21,000
students
students from primary and secondary schools participated in the YouTube live streaming events

Israel

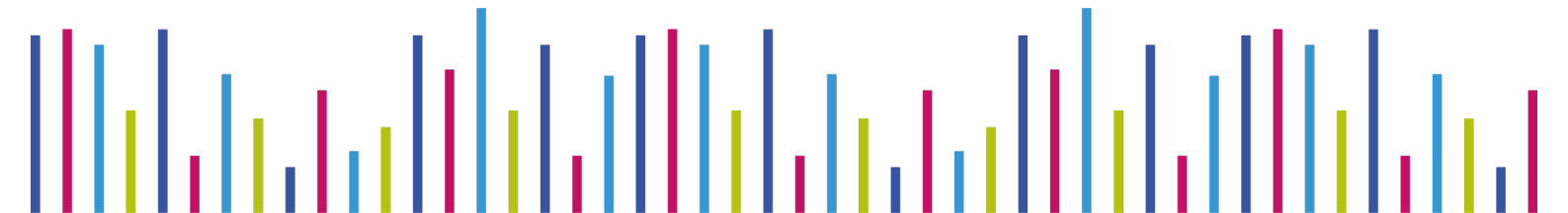
Israel Representative in IPPOG – Ehud Duchovni

Due to various reasons, the report from Israel is not available.

LHCb Collaboration

LHCb Collaboration Representative in IPPOG – Bolek Piertrzyk

Due to various reasons, the report from LHCb Collaboration is not available.



Montenegro - 2022

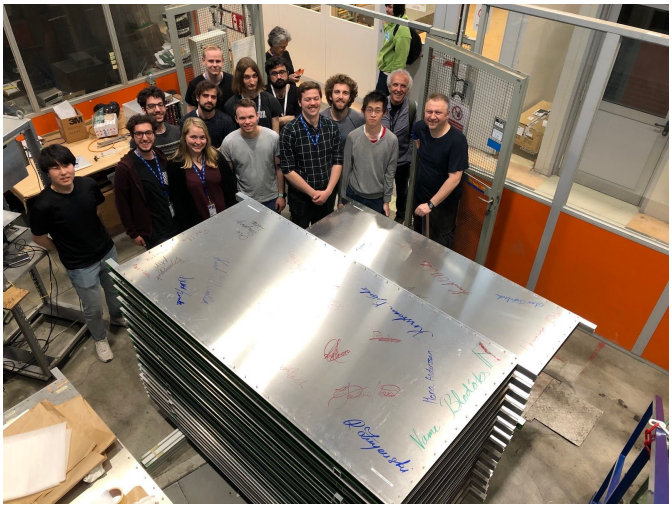
Montenegro Representative in IPPOG – Ivana Picuric

In May 2022, Montenegro hosted the 24th IPPOG meeting in Podgorica. Local school students were invited to participate in the public session, where Steven Goldfarb presented on the topic of "Universal Questions: How we measure what we can't see." After the presentation, Livia Soffi (Infn) engaged the students with an adapted version of the HEPscape activity. The meeting had a total of 39 members, both in person and remotely.

In September2022, Montenegro hosted the Science Festival where Steven Goldfarb held a presentation on behalf of IPPOG and performed with his band during the concert.

Norway – 2020

Norway Representative in IPPOG – Farid Ould-Saada



In 2020/21 the CERN student visit to build cosmic-ray detectors from scratch was cancelled. Looking forward to 2022.

Highschool students have also participated in similar activities. These will be revived in the future.

The activities in 2020 and 2021 were concentrated in the maintenance and further improvements of the ATLAS Zpath educational material.

Within the student-active research project, funded by the Olav Thon foundation, efforts went into setting up and developing a research and education platform with seamless access to a dedicated and powerful computing station. A computing engineer and the IT University Center, are helping setting up seamless access for students at various level to: analysis and statistics codes, Jupyter notebooks, machine learning algorithms, datasets, and computing resources. Two powerful compute nodes are up and running, a third one joining soon. This system will also serve IMC events and related in the future.

A scalable mini-cluster has been set up in Oslo to serve as educational portal in addition to a scientific research station for the high energy particle physics group.

10 000

Approximate number of students and institutes making use of the ATLAS Zpath educational material in 2020 and in 2021.

Poland - 2022

Poland Representative in IPPOG - Krzysztof Woźniak

International Masterclasses in Poland

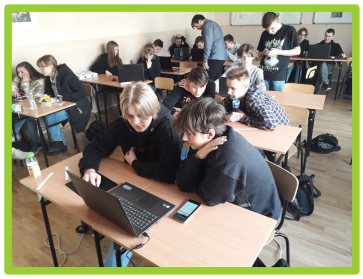
At universities and schools

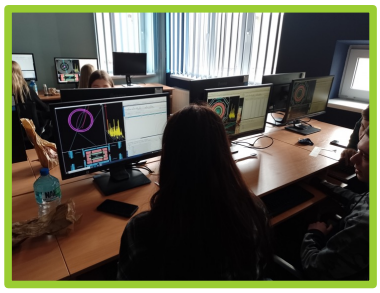
- Bielsko-Biała
- Lublin
- Rzeszów
- Warszawa

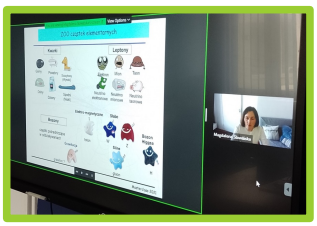
and online for students from 26 schools

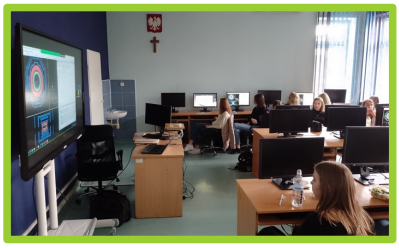
Over 600 participants

International Masterclasses in Poland









Series of videos describing current advances and problems in physics:

- Higgs boson discovery - 10 years anniversary!
- A bite in the Standard Model - B meson decay
- Quark Gluon Plasma in black
- holes
- Can we travel in time?

https://www.ifj.edu.pl/popularyzacja/filmy-podcasty/kanapa-fizykow/

Portugal – 2022

Portugal Representative in IPPOG – Ricardo Goncalo

Cloud Chambers developped for Ciência Viva Science Clubs in Schools, following nearly 20 partnerships established with LIP.

For the 2nd time since its start, teachers from all portuguese speaking countries participated in the programme, thanks to the partial support of CERN and Instituto Camões (M.N.E./PT).

Apart from these highlights we held more than 50 outreach talks at secondary schools and several other events. Some of the most noteworthy of these were:

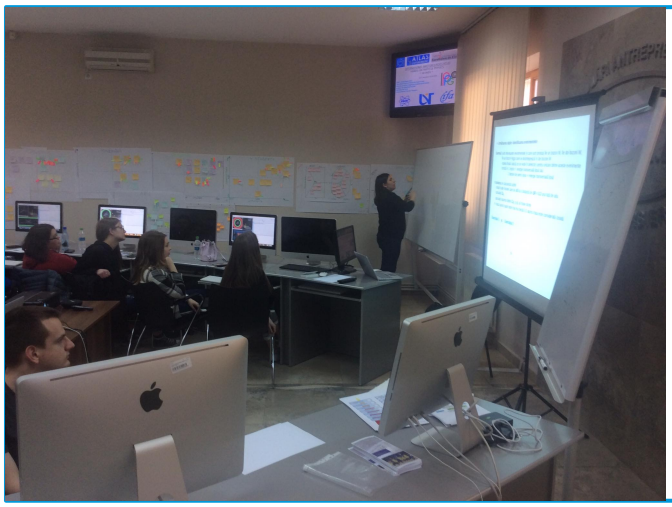
- Celebration of the International Day of Women and Girls in Science.
- International Masterclasses in Particle Physics, organized back in presence for a total of 1000 students in 13 sessions,
- Celebration of the Higgs boson 10th anniversary with the screening of the movie “Particle Fever” at several places, followed by live debates.
- European Researchers Night 2022: in-person public demonstrations and dialogues with researchers in Braga, Coimbra and Lisboa.
- ATLAS Week at Lisboa (October), culminating in a Universal Science event.
- Attribution to Pedro Abreu (IPPOG co-Chair and LIP Outreach Coordinator) of the 2022 Ciência Viva Education Prize, for the efforts with the Masterclasses and Teachers Programmes, and to bring modern physics to young students.

1 000 students

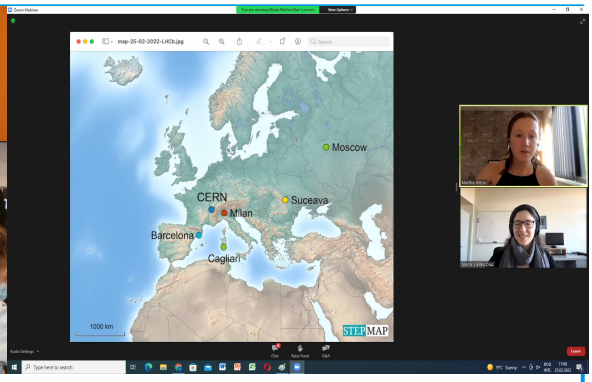
(aged 16-18 years old) Participated in one of the 13 masterclasses sessions organized all over Portugal (Madeira and Azores islands included).

Romania - 2022

Romania Representative in IPPOG – Paul Gravila



IMC - ATLAS are taking place every year at major Romanian Universities in Bucharest, Iasi, Timisoara. Also, European Researchers Night and Open Gates events at the same universities include presentations of CERN.



IMC 2022 at the Universities of Iasi (ATLAS-Z) and Suceava (LHCb) in Northern Romania. The University of Suceava has already a long standing tradition in organizing LHCb Masterclasses.

Numerous outreach activities were organized in 2022 to mark 10 years since the discovery of the Higgs boson: CERN press release sent to media, several Radio and TV shows, Colloquia on current status and perspectives (IFIN-HH, University of Bucharest), outreach seminar “Connected to the Future” at the University of Timisoara, CERN day and Q&A session at the University Politehnica Bucharest, invited lecture about the Higgs discovery at the Intl. TIM 2022 conference. (Timisoara 2022), lecture on “Introduction to particle physics at high energies” given at UB Summer University 2022 for upper secondary school pupils, and many more.
Coordination by U. Iasi of a team of 7 high school students at the international competition "A Beamline for Schools“. (https://beamlineforschools.cern)

Slovak Republic - 2022

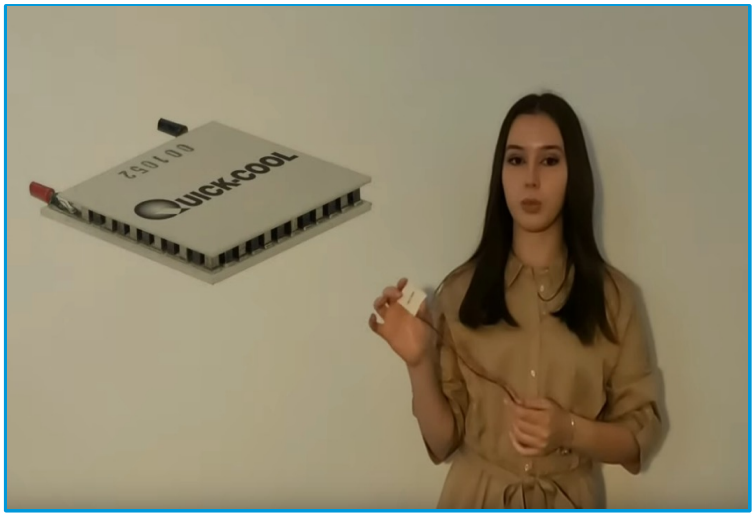
Slovak Republic Representative in IPPOG - Ivan Melo

International Particle Physics Masterclasses (21.2. - 9.4. 2022): five masterclasses were organized at four universities: Bratislava, Košice, Banská Bystrica, Žilina + a regional masterclass in Kežmarok on 24.11.

Cascade projects competition for high schools (May-Jun 2022): students competed with 5 min video presentations on physics topics. Videos were uploaded on a Youtube channel and judged by the joint Czech-Slovak jury.

Higgs@10 celebrations: Discusions & talks in cultural centres in Bratislava (Jun 28), Košice (Sep 14, 28, Oct 5, 19) and Banská Bystrica (Oct 19). 350 people participated (general public 290, high school students 60).

30 years of the Czech and Slovak Federative Republic at CERN – joint celebration in Prague Oct 12.



Emma Karolyi,

the winner of the Cascade competition from Košice high school, explains Seebeck and Peltier effects in her short video project

Slovenia - 2022

Slovenia Representative in IPPOG – Anja Kranjc Horvat

International Masterclasses

- Organized by the Jozef Stefan Institute
- 52 participants
- Three different masterclasses: ATLAS, Belle II, and Particle Therapy
- Various talks and a virtual walk through Belle II for all participants
- Lunch with physicists

Higgs@10 in Ljubljana, Slovenia

- Virtual walks around ATLAS at the Institute Josef Stefan
- Round table with particle physicists discussing the past, present, and future of particle physics and the Higgs boson
- Particle physics stand at the city center with virtual walks through ATLAS
- Outdoor exhibition

Virtual walk through ATLAS detector during the Higgs@10 celebration

Science shows at a science festival in Ljubljana Sciencetival 2022

- Science shows on particle detection
- Science show on data analysis

South Africa

South Africa Representative in IPPOG – Yacoob Sahal

Due to various reasons, the report from South Africa is not available.

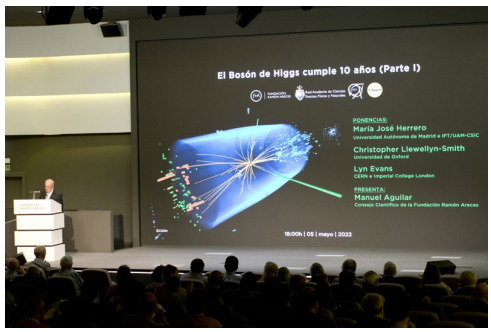
Spain - 2022

Jesús Puerta Pelayo - CIEMAT Particle Physics Unit

2022 will be remembered as the year of the **10th anniversary of the Higgs discovery**. The Spanish HEP community threw itself into organizing numerous activities around this historic event, being the outreach highlight of 2022. (https://cern.ch/higgs10spain)

Higgs anniversary event in Valencia

Our groups participate in other **international events** such as the **Science Week**, the **European Night of Researchers** and the **Dark Matter Day**, during which a dozen institutions organized several talks, experimental demonstrations, contests, round tables etc. We continue our involvement in the **IPPOG Masterclasses** with 9 institutions. During 2022 we extended to other versions such as astrophysics, neutrinos and nuclear physics.



Higgs anniversary conference in Madrid

Regarding media, at least **1000 appearances** in press have been reported within our community. Our reach has been boosted with remarkable examples such as IFT's **YouTube channel** with over 680k followers and new initiatives such as the ***Viaje a los límites del Conocimiento*** series.

Nuclear Physics Masterclass - Barcelona

Researcher's night – Santiago de Compostela

Regarding interinstitutional activities, in 2022 we resumed the **CPAN in High School series**, offering talks in high schools all over the country. The annual **CPAN outreach contest** had an added category for Higgs-related contributions. Other coordinated activities include **Avenue of Physics**, a series of virtual visits to scientific installations, and 6 editions of the **Astroparticles Marathon**, in different regions of Spain.

Gender equality and STEM promotion among female students is a strong pillar of our outreach policy. Several initiatives are directed towards tackling this issue. Many of them are locally organized around **February 11th** but not exclusively. Other initiatives outside the 11F frame are **YoFisica** (videos presenting activities of female scientists), "**Christiane" -a bio-scientific musical**, the theatrical **Meitner Project**, the "**Express-Arte ConCiencia**" contest and many specific individual talks.

Lastly, many new interesting activities keep sprouting in Spain. To mention a few, **Café Science** by IFCA and two other initiatives aimed to exploring synergies between science and art, such as **Quantum Harmony** and the ***Transfronteirizas* encounters**

Sweden - 2020

Sweden Representative in IPPOG – Jonas Strandberg

A lecture about CERN was recorded for participants in the annual physics competition for high school students.

Lund university researchers engage with industry through the Big Science Sweden initiative, for example presenting contributions about real-time analysis and the LHC computing grid at the yearly meeting.

Sweden has been a member of the IPPOG collaboration since its early days as EP(P)OG. The current IPPOG representative for Sweden is Jonas Strandberg, associate professor at KTH, who has served since 2014.
Each year researchers and educators in Sweden commit their time and efforts to hosting and convening particle physics masterclasses around the country, reaching out to students in highs schools. They also make the effort to reach out to policy makers, media and the public at large with public talks and hosted events and exhibitions. These activities not only foster public support of the Swedish research program, but help to prepare the next generation of scientists and experts to collaborate and compete in an international environment, whether in particle physics, other STEM-related fields, or simply as well-informed citizens contributing to the national well-being. The specific activities and projects in 2020 including masterclasses for high school students at Lund and Uppsala universities were cancelled due to the Covid-19 pandemic.

At the SciFest in Uppsala a 2D description of the universe was presented, where the visitors could test how stellar objects of different masses affect the space-time curvature; and could "see" the gravitational waves produced by two black holes merging.

Rebeca Gonzalez Suarez (Uppsala university) has been elected as co-convener of the ATLAS outreach group.

Switzerland - 2022

Swiss representative in IPPOG – Katharina Müller (UZH)

Dance Your Science

Illustration of the journey of a proton in the LHC in a dance performance
At the Science & Nature festival in Zurich

- Many workshops for high-school students in particle physics and cosmology
- International Day of Women and Girls in Science: special activities for young women such as workshops or lab tours
- Women in Physics Career Symposium
- Higgs@10: interactive and physical card games, educative walk with lots of information on particles and how to measure them.
- Many outreach events targetting the general public
  Nuit de la Science (Geneva)
  Open Day at PSI with 15'000 visitors
  Science & Nature Festival | Long night of museums | Night of Physics (Zurich)
- Exhibition on Search for New Physics at the Science Pavilion UZH
- UNSOLVeD: platform with 10 videos addressing open questions in physics

Higgs@10: Educative walk through the park

UNSOLVeD - video platform

The Netherlands

The Netherlands Representative in IPPOG – Charles Timmermans

Due to various reasons, the report from The Netherlands is not available.

United Kingdom

United Kingdom Representative in IPPOG – Darren Price

Due to various reasons, the report from UK is not available.

United States of America - 2022

United States of America Representative in IPPOG – Spencer Pasero

Student trips returning to Fermilab's Lederman Science Center in 2022

QuarkNet and Fermilab are the leading institutions for United States particle physics outreach. Both institutions did a lot in 2022 to expand particle physics education and outreach to new audiences in the "re-opening" era.

QuarkNet has continued to be a major partner in IPPOG's International Masterclasses, continuing work with the LHC and MINERvA masterclasses, and developing a new masterclass based on data from the NOvA experiment. The NOvA masterclass will be piloted in 2023 and officially launched in the 2024 IMC season.

QuarkNet also resumed hosting national workshops for high school teachers in-person. Data Camp, in which QuarkNet teachers come to Fermilab from across the country to work with LHC data and develop ideas for conducting particle physics analysis in their classrooms, was held in person for the first time in three years. Fermilab also hosted QuarkNet's first "Coding Camp 2." Coding Camp 2 is an extension of the original Coding Camp, which was developed as a virtual experience during the pandemic.

Fermilab's new MakerSpace made its public debut in March 2022. Team members collaborated on and wrote the code for a new interactive game entitled "What Particle Are You?"
In celebration of CERN's 68th birthday and the LSC's 30th birthday, the MakerSpace hosted a cupcake decorating event.
The chocolate and vanilla treats featured such designs as the Fermilab logo and a neutrino trio.
In 2023, Fermilab plans to launch a program titled Engineering Ad- ventures, which will allow learners to work with Fermilab engineers to solve real-life engineering challenges.

On March 28, 2022, Fermilab's Lederman Science\ Center reopened to the public after two years of closure and welcomed 275 visitors during its first week of operation. Guests interacted with educational exhibits, and were able to see the new MakerSpace.

Fermilab Virtual Ask a Scientist


25
years
IPPOG