REPORT

16th IPPOG meeting

CERN, 4-6 October 2018

Prepared by Claudia Marcelloni

PARTICIPANTS

COORDINATION TEAM (CT):

Hans-Peter Beck (University of Bern), Steven Goldfarb (University of Melbourne), Barbora Bruant Gulejova (University of Bern), and Claudia Marcelloni (CERN)

MEMBER REPRESENTATIVES:

Pedro Abreu (Portugal), Nicolas Arnaud (France), Andrej Gorisek (Slovenia), Despina Hatzifotiadou (ALICE) Rolf Landua (CERN), Rasmus Mackeprang (Denmark), Sascha Mehlhase (ATLAS), Marcelo Gameiro Munhoz (Brazil), Ivan Melo (Slovakia), Spencer Pasero (USA), Bolek Pietrzyk (LHCb), Vojtech Pleskot (Czech Republic), Panja-Riina Luukka (Finland), Jonas Strandberg (Sweden), Charles Timmermans (Netherlands), Krzysztof Wieslaw Wozniak (Poland)

CANDIDATE MEMBER REPRESENTATIVES:

Atanas Ivanov Batinkov (Bulgaria), Dezso Horvath (Hungary) and Daniel Lellouch (Israel)

ASSOCIATES:

Claire Adams (LAL), Katarina Anthony (Universita degli Studi di Udine (Italy), Claudia Behnke (Technische Universitaet Dresden (Germany), Uta Bilow, TU Dresde n(Germany), Kenneth William Cecire, University of Notre Dame (US), Panagiotis Charitos (CERN), Giorgio Chiarelli, INFN Sezione di Pisa (Italy), Pasquale Di Nezza, INFN e Laboratori Nazionali di Frascati (Italy), Yiota Foka, GSI/FAIR (Germany), Fabio Gargano, Universita e INFN, Bari (Italy), Rosario Nania, Centro Fermi and INFN (Italy), Teodora Nikolova, University of Sofia (Bulgaria), Jiri Rames, Institute of Physics (Czech Republic), Emma Sanders (CERN), Kate Shaw, University of Sussex (UK), Alexander Sharmazanashvili, Georgian Technical University (Georgia)

INVITED SPEAKERS:

Ludivine Ceard, University of Wisconsin (USA), Manuela Cirilli (CERN), Ferdinando Giordano (CAEN), Xavier Gorra (X-TRONIX LTD), Sarah Leach, Imperial College (UK), Thomas McCauley, University of Notre Dame (Paris), Björn Pötter (ESG), Tibor Simko (CERN), Massimo Venaruzzo (CAEN)

WEBPAGE

https://indico.cern.ch/event/742487/

CONTENTS

1 GENERAL IPPOG ISSUES

1.1 IPPOG NEWS

Presented by Steven Goldfarb

IPPOG membership

- **IPPOG Members:** As of today IPPOG has 22 members, 19 Countries, 2 Experiments and 1 Lab.
- **IPPOG New Members:** Greece, Austria, Denmark, LHCb and ALICE have become members of IPPOG. CMS is in the process of becoming a member. Georgia has also shown an expression of interest.
- **IPPOG Candidate Members**: IPPOG members of the pre-collaboration phase that have not yet signed the MoU became automatically Candidate Members until **18 December 2018**. Those that have not yet become members are: Bulgaria, Ireland, Israel, Spain, South Africa and UK. After this date, Candidate Members that have not become members will lose the right to vote and must go through the accession procedure to MoU to become member again. Candidates making a serious effort to join, but facing certain, well-defined obstacles, are asked to present their case to the CB by December 12th, 2018. A potential extension to the deadline will then be considered on a case-by-case basis.

IPPOG Representatives

- New IPPOG representatives are: Christine Kourkoumelis for Greece, Natascha Hoermann for Austria, Rasmus Mackeprang for Denmark, Bolek Pietrzyk for LHCb and Despina Hatzifotiadou for ALICE.

Budget

- Total revenues for 2019 are projected to be 60 k€ from membership fees + 45 k€ earmarked for ½ FTE Masterclass Cordination + ½ FTE In-Kind Support for Scientific Secretary.
- Total expenditures for 2019 are projected to be 130 k€, of which 50 k€ will support hired expertise for Web and Communication Content Development. This foresees an exceptional surplus spending of 25 k€ from carry-over for major infrastructure development and expansion of IPPOG's global reach.
- IPPOG CT is preparing a template for requests for specific project support, similar to what has been prepared by the Masterclass SG.

1.2 PROPOSAL FOR MEMBER ASCENSION

1.2.1 Georgia

Presented by Alexander Sharmazanashvili

Georgia would like to become an official and active IPPOG member through the NEC (Nuclear Energy Centre). NEC has good experience and connectivity hosting IPPOG Masterclasses and CERN Outreach events in Georgia. The group would like to see Georgia become an active member of the IPPOG collaboration and will propose the development of software tools and methodology for Masterclasses, as well as new exercises, subjects and events in support of particle physics outreach. Some key points in support of membership are:

- NEC built the so-called Georgian IPPOG Network that includes schools, universities and the

physics community.

- NEC was the first group to start organizing IPPOG Masterclasses (MC) in Georgia
- Overall, NEC organized 3 sessions of MC in Georgia.
- A Masterclass at Georgian Technical University followed by combined IPPOG MCs with Workshop for school teachers.
- The third event was in the west part of Georgia at Tbilisi State University (TSU) and at Kutaisi Akaki Tsereteli University (KATU).
- Plans for the near future include 3 days of IPPOG MCs, a 2-day workshop and a 5-day Art@Science exhibition.

1.3 SIGNATURE CEREMONIES

- Two countries and two experiments signed the MoU during the IPPOG meeting at CERN on October 6th.
- Austria's MOU was signed by Jochen Schiek (HEPHY), Eberhard Wiedmann (Stefan Meier Institut), and Reinhold Koch (Austrian Physical Society), together representing Austria participation at IPPOG. Natascha Hoermann is the country representative.
- Denmark's MoU was previously signed by Jens Jørgen Gaardhøje (NICE) representing Denmark at IPPOG. IPPOG chairs confirmed the agreement by signing the MoU during the meeting at CERN in presence of the representative for Denmark, Rasmus Mackeprang. Photos of the ceremony can be found here: http://cds.cern.ch/record/2642399
- LHCb'S MoU was signed by its spokesperson Giovanni Passaleva. IPPOG chairs confirmed the agreement by signing the MoU during the meeting at CERN in presence of the representative for LHCb, Bolek Pietrzyk. Photos of the ceremony can be found here: http://cds.cern.ch/record/2642420?ln=en
- ALICE's spokesperson, Federico Antinori participated in the signature ceremony in person, making ALICE an official member of the collaboration. ALICE's representative is Despina Hatzifotiadou. Photos of the ceremony can be found here: http://cds.cern.ch/record/2642398?ln=en

1.4 IPPOG Participation to EPPSU

- The CERN Council has set itself the objective of updating the European Strategy for Particle Physics by May 2020. To achieve this, it has established a Strategy Secretariat to which it has assigned the task of organizing the update process. The Strategy update process will include two major events: an "Open Symposium" and a "Strategy Drafting Session". At the Open Symposium, to be held in the second half of May 2019 in Granada, the community will be invited to debate the scientific input into the Strategy update, which will take the form of a "Briefing Book".
- To prepare for the Open Symposium, the Strategy Secretariat hereby calls upon the particle physics community in universities, laboratories, national institutes and institutions to submit written input following the enclosed guidelines.
- The deadline for input is 18 December 2018. Input should be submitted via a portal that will be created on the Strategy update website, which will be available from the beginning of October 2018, once the Strategy update has been formally launched by the CERN Council. The link to this website will appear on the CERN Council's web pages - https://council.web.cern.ch/en and be widely communicated through the appropriate channels. The Strategy Secretariat Update of the European Strategy for Particle Physics EPPSU-Strategy-Secretariat@cern.ch.
- Volunteer members of the IPPOG working group who will make a proposal on behalf of IPPOG

are Darren Price, Farid Ould-Saada, Hans Peter Beck, Michael Kobel, Pedro Abreu, Steve Goldfarb, Thomas Naumann and Yiota Foka.

PROPOSAL: Based on the input from the collaboration through the meeting, the proposal for the scope of a document IPPOG should produce:

> The key message of the paper should be: As we entered the so-called "post-factual world" emerging from political ideologies in a growing number of modern democracies, it is more important than ever for science and society to maintain an open and transparent dialogue. It has also become evident that the tools and methods currently used to support such a dialogue have not been as successful as we would have hoped. While only a fraction of young students will become scientists, and fewer still will become particle physicists, all will become ambassadors for the scientific method and evidence-based decision-making.

The proposed structure of the paper is:

- Introduction (1/2 page): Define Outreach, Dissemination, Education, and why these are crucial strategic elements "Communication" is not Outreach and EPPCN is an example network of expert communicators of PP Impact in society, enthusiasm, building up the next generation, engage society Address the challenges we are going to face in view of future, world-wide, large-scale projects in particle physics
- The situation today in PP (1/2 page): length and duration of projects large scale international collaborations
- Outreach today in PP (1 ½ page): How it is organized, show cases, examples Outreach and Communication and how these interrelate. How is Outreach perceived in particle physics and how is it valued Funding of Outreach and its Return of Investment
- IPPOG a strategic pillar for particle physics (2 pages): describe IPPOG and its mission (an international network, sharing and joining forces) describe what IPPOG has achieved and its potential (including reaching out geographically) underline the limitations of today's scheme based on voluntary effort
- Future challenges (2 pages): the near and long term future will make challenges even harder IPPOG is crucial to meet these challenges
- Conclusions (1/2 page): Outreach is crucial and of strategic importance for the success of particle physics challenges now and even more in the near and long term future that cannot be underestimated.

2 IPPOG STORIES and IMPACT

2.1 INSIDE VIEW

2.1.1 Sponsored activity report: Universal Science – CHEP 2018

Presented by Steven Goldfarb

IPPOG co-sponsored and organised a public outreach event in coordination with the organising committee of the International Conference on Computing for High-Energy Physics (CHEP) and a local science communication group called RATIO in Sofia Bulgaria. The event was attended by a several hundred people from the general public, as well as physicists from the conference. It featured short presentations on particle physics, computing, and diversity, followed by a panel discussion.

Exhibits were set up by physicists attending the conference, showing off software programs and devices used for public outreach, such as virtual reality, grid maps, etc. Significant time was reserved before,

during, and after the workshop for direct public interaction between scientists and attendees.

IPPOG played a prominent role in the event, with Steve acting as the event host, Claire Adams of ATLAS organising exhibits, and the local Bulgarian IPPOG group helping with early advertisement to encourage participation from local students. The event was a first for CHEP and a first IPPOG.

Support for Universal Science

- CHEP Motivation for the event included engagement with the local audience and conference participants and the production of an exhibition of particle physics.
- The CHEP Organising Committee requested support for venue costs, audio and video equipment, publicity and speakers travel. IPPOG provided 1,000 €
- It is natural for IPPOG to Sponsor/Organise Public Events at Conferences in order to encourage and expand their occurrence, broaden our reach to the general public, and to communicate the IPPOG name and goals to both the public and our colleagues in particle physics.

PROPOSAL:

- Include a line item for IPPOG support for conferences in the 2019 budget on the order of 2 k€

2.1.2 Request for support for Masterclasses

Presented by Uta Bilow and Ken Cecire

Projects, such as International Masterclasses are invited to request funding for specific items or activities in support of new initiatives. Following discussion with the CT on how to handle requests from people involved in the project in a fair manner, Ken and Uta took the initiative to write up a proposal for guidelines.

The latest draft of their proposal can be found at

- https://indico.cern.ch/event/742487/contributions/3138375/attachments/1725822/2787857/go

Discussion and TO DO:

- IPPOG CB chairs will create a general template for project grants inspired by this excellent initiative

2.1.3 Creating Ambassadors for Science and Society

Presented by Barbora Gulejova

- Classroom to Boardroom: A business / innovation / entrepreneurial challenge was given to students by large international enterprises (e.g. international organisations, multinational companies, banks etc). The format of the 4-day programme included 2 days working on the challenge under the guidance of a professional coach from Entrepreneurs in Action. The students then presented the findings and proposed solutions in front of a senior panel from the challenge-setting enterprise. Main activities consisted of Masterclasses, participation in the CERN High School Internship Program and an important music festival called “Colours of Ostrava”. The main challenge was to set-up an internal communication channel and strategy for the group.
- Actions to prepare a Marketing and Fundraising plan for IPPOG include: an education engagement strategy to increase the number of young people taking up STEM subjects and careers, and an engagement campaign for schools to excite and educate young people about the important roles of science and particle physics. The marketing plan is to improve engagement of teachers and the use of extra-curricular activities in particle physics designed by

CERN and IPPOG. The fundraising strategy is to engage big businesses, funding agencies, and foundations to consider supporting our work (impact investing).

- An IPPOG Website survey among teachers found 73% didn't know of the site. It also found that the teachers woiuld like to have real life examples for their particle physics classes. The goal would be to create links from a general physics curriculum to a particle physics curriculum through teaching lessons, videos, posters and demonstrations.

2.1.4 Development Strategy for IPPOG

Presented by Barbora Gulejova

Barbora presented a proposal for the role of Development Strategist for IPPOG. Activities include:

- Strategy and Vision Developer: Help IPPOG Chairs in development of IPPOG vision and strategy, mission, communication, fundraising and propose and create strategic partnerships and synergies
- IPPOG Website main Developer: Write technical specifications for the design development company, follow the procurement process, build the new IPPOG website in Drupal 8 based on the new design and develop the content of the website
- Fundraising Coordinator: development of a fundraising strategy; Identifying the best fundraising partners and negotiating with potential fundraising partners.
- Communication Coordinator: Development of communication strategy, planning and development of content, maintenance and development of platforms, implementation of a communication plan based on strategy.
- Social Media Coordinator: develop strategy, establish goals, audiences, messages, policy and create network of contributors and coordinate activities.

2.2 INSPIRING SUCCESS STORIES

2.2.1 The PolarQuEEEst Experiment

Presented by Rosario Nania

- The goal of the project was to teach kids how to build detectors at CERN
- Students went through three days training, before building and testing the detectors at CERN. They installed them in three boats in different locations (Nanuq, Oslo and Turin) and collected and analyzed the data.

2.2.2 Outreach Particle Physics to Developing Countries

Presented by Kate Shaw and Thomas Mc Cauley

- It is Important to reach out to universities, schools, and science organisations worldwide that lack access to resources. It is Important to listen to what they are interested in, what topics they want to learn and what resources they need. Every country and culture is different and our community can be Euro Western-centric sometimes. Activities must be culturally appropriate.
- By resources we mean, books, booklets, online material, support and help such as YouTube tutorial. Content needs to be adapted and go beyond the LHC and include other topics such as cosmic rays, astronomy, etc

Discussion and TO DO:

- Tom and Kate are looking for people to collaborate with (J. Gillies is involved and is head of SESAME communications) to put together a proposal for a SESAME / Lightsource Masterclass and where to look for funding.
- Kate is interested to work with IPPOG to see how we can 'kit' up resources and distribute them.

2.2.3 ALICE Masterclasses

Presented by Yiota Foka

- The main goal for updates on the ALICE Masterclass is to strengthen and facilitate HI communities. Possibility to implement Masterclass measurements for different experiments and re-use existing or develop new masterclasses in a flexible and economic way.
- ALICE Masterclasses are based on ROOT. It has a simplified event display, close to the real one used at the experiment, including visual analysis of a small event sample (50 events). It has also a large statistics analysis including background and the capacity to "write code".
- The main advantages of the updated version are the 3D display and the easier access to histograms by simple clicking on the tracks.
- The proposal is to implement a Masterclass on hadron therapy. There is a lot of support material and the aim is to have common software, which is not too complex to use but still accurate and powerful.

2.2.4 Fermi-LAT Masterclasses

Presented by Fabio Gargano

- The Fermi Masterclass is designed to give secondary school students the unique opportunity to personally discover the world of astroparticle physics.
- There have been two editions organized by INFN (mainly Italian sites): the first in 2017 on AGN on variable gamma-ray sky and the second in 2018 on Gamma-ray Burst and connection with Gravitational Waves. More than 200 students participated in each edition with very good feedback
- INFN will support the 2019 edition. Fermi is a recognized CERN experiment and scientists outside the collaboration, including physicists, can join the work. In other words, IPPOG participation is very welcome.

2.2.5 Physics Olympiad

Presented by Pedro Abreu

- The Portuguese Physics Society is a society of physicists, researchers and teachers engaged with the promotion of physics in Portugal and Europe, along with its EPS partners. It is responsible for the Physics Olympiads in Portugal, under mandate by the Ministry of Education of the Portuguese Republic.
- The Olympiad is a competition in 2 Levels: A-level for kids up to 14 yrs. old, teams of 3, and B-level for high-school students, individuals. It has started in 1985 and 1993 became international. The 2018 in Portugal had 87 countries and 400 students and 270 professors involved. The event lasted 8 days and included an opening and closing ceremonies with the attribution of prizes, 1 experimental exam, 1 theoretical exam, preparation, discussion, approval, correction of the exams and touristic and social events for all participants
- The three take home messages are:
    - The IPhO's are the top of a pyramid. Many more students are engaged in schools at earlier times.
    - The IPhO's put Physics on the media and [should] involve strongly the physics community(ies).

- The IPhO's set a standard for an excellency in studying/teaching/practicing in physics and education.

2.2.6 QuarkNet data portfolio and activities

Presented by Spencer Pasero

- The goal of the Data Portfolio is to make current physics accessible to high school teachers and students, to establish a resource on the Web of tested lessons vetted against best practices in instructional design and to develop pedagogical pathways to guide teachers in selecting modern physics lessons for the classroom.
- We want to expand our neutrino content. Neutrino in the Classroom provides links to background material, events of the Minerva detector with an interactive histogram divided by slices. They plot the muon decay curve.

Discussion:

- What are the enduring understandings that you think students should take away from this activity?
- What do you think students should be able to do as a result of completing this activity?

2.3 COUNTRIES, EXPERIMENTS AND LABS HIGHLIGHTS

2.3.1 Outreach Initiatives in Denmark

Presented by Rasmus Mackeprang

- The particle physics community in Denmark is engaged at many levels in public discourse, Examples of activities are: Culture Night a city-wide event in Copenhagen with national interest most aimed to adults) and Open University.
- There are many opportunities for (high) school students and teachers through easy access to scientists and plenty of support for visits and activities
- Among the new initiatives are: the Big Bang til naturfag (to science), DIY PET scanners and Roskilde Festival

2.3.2 Follow –up on HSSIP for Czech students

Presented by Vojtech Pleskot

- The CERN High-school students internship programme in the Czech Republic had 240 applications and selected 24 students to participate
- The Outreach group offered something similar in Prague for those who didn't get selected. The program included excursions, lectures, cloud chamber workshop and mini-projects. Fifty students participated with their travel and accommodations paid by the outreach group. The feedback was very positive.

2.3.3 Wire chamber construction in the Hungarian National Teacher Program

Presented by Dezso Horvath

- Third year of the project which consists of a one week workshop with the goal to build cloud chambers at S'Cool Lab at CERN
- It is a good exercise for both teachers and students to work together. It is also an opportunity for students to develop manual skills, group work and team building.

- Additionally, it also promotes cooperation among schools and with universities

2.3.4 Project KONTAKT in Germany

Presented by Uta Bilow

- Outreach and knowledge transfer activities in Germany have been organized since 2010 via a structured program called the Netzwerk Teilchenwelt. The program audience are high school students and teachers.
- Since 2017 there has been much cross-sectional activity around German by the LHC-groups (FSP).
- KONTAKT is a new project that builds on and extends the existing framework of Netzwerk Teilchenwelt. It is an intensified cooperation with other professional players in the areas of communication and recruitment of new talents. It gives focus on topics and contents from other fields of physics of the smallest particles. It also aims to reach other target groups.

2.3.5 Outreach Initiatives in CMS

Presented by Marzena Lapka

- A few recent successful social media activities:
  - CMS new instagram page
  - ttH result explained in 5 minutes video has been the most popular post on CMS
- A new paper on "Playing with Protons" has been accepted for publication in Physics Education
- CMS Panorama viewer is now part of a cross-experiment project https://github.com/HEPPanoramic
- CMS Augmented Reality (AR) materials:
  - On your mobile go to: https://tpmccauley.github.io/ar-cms
  - Point your camera to the printed marker: https://jeromeetienne.github.io/AR.js/data/images/HIRO.jpg
- CMS Virtual Visits has reached more than 1000 people during Researchers Night: http://cms.cern/news/news/bringing-cms-lithuania-hungary-mexico-italy-and-portugal

2.3.6 ALICE new exhibition and virtual visit itinerary

Presented by Despina Hatzifotiadou

The elements of the ALICE visitor's centre are:

- Real-size poster of ALICE cross section
- ALICE Run control centre explains the LHC operation and data taking
- Interactive window at ALICE Control Room
- View of shaft, PAD and MAD
- New ALICE exhibition, which is a projection mapping on the real size mock-up. There are a series of objects in show cases accompanied by touch screens
- New system for virtual visits that allows the host to show the cavern underground and also easily bring in visual support material during the visit.

2.3.7 Open Data Portal

Presented by Tibor Simko

The Open Data Portal (www.opendata.cern.ch) was launched in November 2014. It follows the LHC collaboration data policies and has over 1.5 Petabytes of open particle physics data. The users are general public, high-school and masterclasses students, data scientists and physicists.

Usage for outreach include:

- digital repository use cases:
  - upload/download data, Virtual Machines (VM), and documentation
  - version control, mint and cite persistent identifiers (DOI)
  - organise and search through data
- reaching wider scope:
  - traditionally hosting LHC experiment data
  - first non-LHC data included by OPERA
  - forthcoming Machine Learning reference datasets
- reaching wider audience:
  - O(200K) "visitors" in six weeks; O(40K) deeper, O(3K) heavy use
- run realistic examples:
  - in-browser visualisations and histogramming
  - analysis examples via Virtual Machines (ROOT, non-ROOT)
  - analysis examples via containers (ROOT, non-ROOT)
  - runs locally or on cloud.

3 WORKING GROUPS

3.1 BRINGING MC to NEW COUNTRIES

Presented by Ken Cecire and Uta Bilow

- New Ideas Good ideas from Claudia (Mini-MC) and Kate (Tutor Toolkit)
  - Mini-masterclass format can be used in New Countries where all you have available is pen/paper
  - Physical deliverable "masterclass-in-a-box" it is not so easy but valuable
  - Foster "masterclass champions" who make masterclasses happen
  - Masterclass tutorials videos and other training tools
  - Follow-up in the next 3 months

DISCUSSION/TO DO

- Look into the e-learning tool developed by CERN IT
- Look into what ALICE has been doing

3.2 EXPLAINING Particle Physics HOT TOPICS to a LAY AUDIENCE

Presented by Dezso

The key topics for best practices discussed are:

- For general audiences, provide a list of subjects for presentation.
- Not necessary to stick to your own HEP research topic. Emphasize mathematics as the real language of physics.
- It is possible to present even the most abstract subject, like string theory
- The smaller the auditorium the friendlier the atmosphere
- Animations make it more interesting
- Good example: LHC in the beginning of Angels & Demons. Bad if attracts attention away from physics. TV series The Big Bang Theory is good to raise interest in Physics
- "Escape room" and "Petting a physicist" are new ideas visited

TO DO

- The WG will collect written recommendations for hot topics and questions about particle properties

3.3 EXHIBITS

Presented by Emma Sanders

Workshop was divided into two teams:

- Team 'DETECTOR' brainstormed ideas for an exhibit on detectors for a secondary school audience. Installation where you have lasers of different colours representing different particles. The visitor will enter a room and will see only dots. Then smoke will come out and the visitor will suddenly see the lines coming out of the lasers and see the representation of tracks. Together they will understand the different characteristics of particles and how reconstructions is done.
- Team 'DARK MATTER' brainstormed ideas for an exhibit on dark matter for a general public audience. Inspired on the Nasa's jelly bean universe, the group tried to discuss ideas for a room that conveys the fullness of dark matter of the universe versus matter

DISCUSSION

- Ideas for a future meetings are to focus on NEUTRINOS and ANTIMATTER
- The working group could be better integrated into the agenda of the meeting and also be given a proper amount of time; one hour was not enough.

TODO

- IPPOG CT will look into a re-organisation of future meetings to allow more time for WG work, with the goal of giving time to create prototypes or to develop ideas by the end of the meeting.

4 PANEL DISCUSSIONS

4.1 IS BEAUTY LEADING PHYSICS ASTRAY?

Presented by Ivan Melo

The discussion revolved around the differing points of view between Platonists and Skeptics, inspired by the book "Lost in Math, how beauty leads physics astray by Sabine Hosenfelder". The book claims that physicists believed beauty must be involved and that this influence can be observed on how the communication of the LHC discovery was made. The author adds that naturalness arguments are widely believed to be mathematical but in fact they are aesthetic.

DISCUSSION/TO DO

What shall we do? Is an opportunity to create a new message to the public?

- Should we communicate to people this state of the field? Our beauty ideals? Our confusion?
- Well, even if we did not see anything beyond the Higgs, it makes everything even more interesting
- Is it that nature is truly beautiful in its foundation but right now it is hiding that from us?
- Or is simplicity an artefact of our times and there is a place for ugly (complex) solutions?

- Thomas Naumann suggested inviting Sabine Hosenfelder to our next IPPOG meeting.

4.2 OUTREACH OF PARTICLE PHYSICS APPLICATIONS

Presented by Babora Bruant Gulejova

Due to increasing pressure on research funding, the community needs examples of science impact. Some of the ideas that emerged from the WG:

- Public is very interested, but industry doesn't seem to have interest in telling that they developed things in connection with science and the very few stories that emerge in the media don't stay alive for too long
- Suggestion is for the IPPOG database to have a category "particle physics and society" and a WG on particle physics applications. CERN would provide material and have a participant of the KT group at the WG. However, the first challenge is to first collect facts and the second challenge is to take these facts and construct the stories around them.

DISCUSSION/TO DO

- Craft a message that incorporate both messages, the philosophical and practical reasons we search
- Continue the discussion through a WG on Outreach of PP applications

5 ACTIVITIES REPORTS

5.1 REPORT MASTERCLASSES

Presented by Uta Bilow and Ken Cecire

In terms of IMC scope:

- Traditional LHC masterclasses are being updated and brought to new institutes
- The International Day of Women and Girls in Science is growing
- World Wide Data Day is growing and we need more people involved to support it
- There is a beginning of development for the Neutrino masterclasses and more to come in the near future
- The communication for the projects are done through circulars, QuarkNet Friday Flyer, Social Media, (#LHCIMC19) and Press releases

Discussion and TO DO:

- IPPOG Members, Associates, and Friends can help with International Day of Women and Girls in Science by putting the MC team in touch with their Institutes or local teachers and by being a moderator
- Input from members of IPPOG on the communication items are welcome

6 KT AND OUTREACH AT CERN

6.1.1 Particle Physics applications for societal benefits

Presented by Manuela Cirilli

- CERN knowledge transfer through people is a very important aspect but we don't have yet a

coordination entry; the alumni is a good initiative to start tracking that

- There are six major applications that we transfer to society: medical, aerospace, safety, industry 4.0, cultural heritage and emerging technologies. Some topics are easier to explain, others need in-depth knowledge.
- The main examples are:
    - Hadron Therapy: Robert Wilson was the first to promote hadron therapy into medicine. PIMMS machines available in Padua, Italy and Vienna, Austria.
    - Massive gantries are marvellous engineering feats, but big (15m). The goal is to explore radically new ideas on how to make a gantry smaller. If successful it will take about one decade to be implemented.
    - CERN MEDICIS is the first medical isotopes produced for both treatment and diagnosis
    - Crystals for PET – a field in which particle physics had major impact but it is hard to commercialize due to monopolization of the field.
    - Medipix is a family of read-out chips for particle imaging and detection developed by the Medipix Collaboration.
    - Spectral CT is a colour X-ray developed by MARS Bio-Scanner start-up in Australia. The spectroscopy information permits material separation. It creates realistic images and great media coverage
    - FLUKA is a fully integrated particle physics Monte Carlo simulation package.
    - GeneROOT uses ROOT to analyse a large genomics datasets.
    - Timepix is being use in space.

6.1.2 Researchers Night

Presented by Francois Briard

The goal of the visits sector is to develop a portfolio of hands on activities, since they tend to be more popular than talks, to be used in several events. The current activities in the portfolio are:

- Wall size map of LHC
- IT workshops such as “program a robot” and “introduction to programming”
- Cloud chamber workshops
- Particle identities – www.cern.ch/identities
- Connect the dots – www.cern.ch/connectdots
- Colouring book for kids
- Funny Hands On
- VR tour of the LHC
- Fun with physics show

6.1.3 arts@CMS/ORIGIN – cross disciplinary science education and engagement

Presented by Michael Hoch

- ORIGIN is a inter-experimental science collaboration on particle physics, astrophysics, cosmology, gravitational waves and neutrino physics which uses the cross disciplinary art@CMS methodology to inspire and engage students. The program is supported by ATLAS, ALICE, CMS, LIGO, ICEcube, Muography, Perimeter Institute, Canadian Light Source, and other global partners. Its main activities are exhibitions and workshops.
- We use our network to get into special and exclusive spaces. The National History Museum Vienna is one of these places. It has hosted a collaboration with local artists, art presentations, creative workshops, talks and masterclasses.
- Science & Art@School is a workshop format that supports teachers in organizing workshops that mix science content and art output.

- Cultural Collisions is similar to Art@School, adding to the format an exhibition at a local museum/location
- sciARTmasterclass is a masterclass hosted in these art events and includeingphysical exercises such as flash mobs to represent what they learn
- Cultural Collisions organized by ORIGIN in Canada to discuss the impact of such initiatives

Links:

- ORIGIN: https://originnetwork.web.cern.chhttps://twitter.com/OriginPhysics
- art@CMS: http://artcms.web.cern.ch/artcmshttps://www.facebook.com/artatcms
- General Information & History on art@CMSprogram since 2012: http://mhoch.web.cern.ch/mhoch/Art@CMS/Art@CMSprojects.pdf
- ORIGIN project example : Cultural Collisions Canada: walk through the exhibition: http://mhoch.web.cern.ch/mhoch/Art@CMS/CulturalCollisionsCanadaORIGIN_OUTLOOK.pdf
- Various art@CMSevents on youtube: educational science&art@schoolworkshop, Student interviews: https://www.youtube.com/watch?v=yTqDm0Yp04E

6.1.4 LHCreate

Presented by Ludivine Ceard

LHCreate is a two-day Hackathon with this year's goal to bring CERN inside the classrooms of 12-16 y/o students, through building an interactive exhibit dedicated to them and reproducible by them! The format is the following:

- 4 teams of 6, bringing together 4 CERN affiliates (physicist, IT, admin…) and 2 design students from IPAC Design Genève
- 2 days at IdeaSquare with professional advisers in physics, design, electronics and teaching, full workshop at disposal for fast prototyping
- Public event at the Globe with panel of judges and winning team
- Website at www.cern.ch/lhcreate

7 INVITED PARTNERS

7.1.1 CAEN Education

Presented by Massimo Venaruzzo

- CAEN is a spin-off from INFN. It is a network of 5 companies working on accelerator machines and detectors. CAEN enters the world of learning and training by providing modern physics experiments for the university
- The CAEN education initiative has as its goal to inspire students to better understand current physics development, and to create a community of young students interested in learning more through its platform: www.caen.it/education
- CAEN also produces educational kits which are divided into 4 main sections: Particle detector characterization, Nuclear physics and radioactivity, particle physics, including cosmic rays and photons and advanced statistics based on silicon photomultiplier detectors.
- They have six types of kits: Photon kit, Beta Kit, Gamma kit, and a premium version that offers the three first ones, Emulation kit and Easy PET kit.