



REPORT
from
10th IPPOG meeting
CERN, 5-7 November 2015

(by Barbora Gulejova)

PARTICIPANTS

COORDINATION TEAM (CT):

Hans-Peter Beck (University of Bern), Marjorie Bardeen (Fermilab), Barbora Gulejova (CERN)

MEMBERS DELEGATES:

Pedro Abreu (Portugal), Nicolas Arnaud (France), Marjorie Bardeen (US), David Barney (CMS), Hans Peter Beck (Switzerland), Beatrice Bressan (TOTEM), Despina Hatzifotiadou (Italy), Natascha Hoermann (Austria), Rolf Landua (CERN), Daniel Lellouch (Israel), Rasmus Mackeprang (Denmark), Ivan Melo (Slovakia), Thomas Naumann (DESY), Farid Ould-Saada (Norway), Jiri Rames (Czech Republic), Riitta Rinta-Filppula (Finland), Dirk Ryckbosch (Belgium), Jonas Strandberg (Sweden), Nick Tracas (Greece), Peter Watkins (UK), Krzysztof Wozniak (Poland)

ASSOCIATES:

Claire Adam-Bourdarios (ATLAS), Uta Bilow (University of Dresden), Kenneth Cecire (University of Notre Dame), Catarina Espirito Santo (LIP), Achintya Rao (CMS), Steven Goldfarb (University of Michigan), Eirik Gramstad (University of Oslo), Christine Kourkoumelis (Greece), Thomas McCauley (University of Notre Dame), Iva Raynova (University of Sofia), Zhi-zhong Xing (IHEP, Beijing)

GUESTS:

Katarina Anthony (ATLAS), Wojciech Bialas (CERN, CMS), Rossana Centioni (LNF), Adam Davis (LHCB), Panagiotis Charitos (CERN), Andrej Gorisek (Jozef Stefan Institute), Leila Haegel (University of Geneva), Markus Joos (CERN), Jean Young (Fermilab)

EPPCN GUESTS:

Pawel Bruckman de Renstrom (Poland), Maria Chamizo Llatas (Spain, CIEMAT), Eleonora Cossi (Italy), Isidoro Garcia (Spain, IFIC), James Gillies (CERN), Hilde Lynnebakken (Norway), Arnaud Marsollier (CERN), Terry O'Connor (UK), Ana Poletto (France), Danica Stojiljkovic (Slovenia), Sophie Tesauri (CERN), Marc Türler (Switzerland), Lubos Veverka (Czech Republic)

WEBPAGE

<http://indico.cern.ch/event/440711/>

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1. GENERAL IPPOG ISSUES

1.1. WORD FROM CERN MANAGEMENT

CERN new DG (as of 1/1/2016) Fabiola Gianotti, in her opening word of the joint IPPOG – EPPCN session stressed the relevance of both IPPOG and EPPCN groups and expressed the wish, that these would meet even more often. She explained, that the new ECO (Education, Communication and Outreach) group (see below) should reflect the different facets of the same strategy and fusing E&O and Communication (C) groups together is the best way to maximise synergies and collaboration.

Open session of IPPOG was opened by **Head of Education and Outreach Group of CERN directorate office (until 31/12/2015), Rolf Landua**, who highlighted the importance of IPPOG and willingness of CERN to continue support IPPOG in terms of its activities (e.g. Masterclasses), IPPOG becoming an official collaboration and in-kind contribution to coordination of IPPOG (50 % of Fellowship of Barbora).

Change of CERN's structure since 2016: Creation of new sector of CERN 'International Relations Sector' (on equal level as other 3 sectors: Accelerators and Technology, Research and Computing, Finance and HR), which includes the new 'Education, Communications and Outreach (ECO) group' – a fusion of the former E&O and Communications groups and 'Stakeholders relations group' (host states, member states, non-member states, international organisations, etc...). As of **1/1/2016 Charlotte Warakulle is the new directrice of the IR sector and interim Head of ECO group** (until the recruitment process is finished – possibly in April 2016).

1.2. IPPOG INTERNAL AFFAIRS / NEWS

Presented by Hans Peter Beck

- IPPOG has a **new member**: Australia has been recently voted in as 26th country in IPPOG
 - Australia aims to introduce the IPPOG Masterclasses programme as part of their formal science education in high schools in New South Wales
 - Paul Jackson has been mandated as an Australian delegate to IPPOG
- **Formal interest for membership**: 2 countries
 - China: Zhi-zhong Xing, IHEP Beijing participating as a guest/observer
 - Slovenia: Andrej Gorisek, J. Stefan Institute Ljubljana participating as guest/observer
- **New people/associates in IPPOG in 2015**
 - Eirik Gramstad succeeding Maiken Pedersen (developing ATLAS Z Path from Oslo, Norway);
 - Iva Maksimova Raynova (ALICE science writer);
 - Katarina Anthony Kittelsen (ATLAS science writer);
 - Panagiotis Charitos (FCC communication)
- **Professionalizing IPPOG** (Barbora)
 - Newsletter twice a year in between IPPOG meeting – see the first newsletter [here](#).
 - Memorandum of Understanding between IPPOG members in advanced state (see 1.3)
 - Well defined IPPOG structure and tasks
 - IPPOG Working groups with action items
 - Portraits of IPPOG delegated and associates for new IPPOG webpage taken at CERN studio
- **IPPOG is recognized internationally** – outreach & education sessions at international conferences (see details in Newsletter N1)
- **CERN Council congratulates IPPOG** in its 177th meeting 'European Strategy matters'
- **Next IPPOG Spring meeting 2016** - 19-21 May 2016 in Cracow (Krzysztof Wozniak)
- **Prolongation of term of office of chairs**:
 - Given 1) the transition of CERN management starting from 2016 and 2) the planned transformation of IPPOG into a formal international collaboration with its own funding structure, which is

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- a crucial and critical step in IPPOG history, it is important that the current chairs Hans Peter Beck and Marge Bardeen are given time and possibility to ensure the smooth implementation phase of the IPPOG MoU after its entry in force, and to hand over the IPPOG Collaboration in a good stable position, so that the new chairs can take up the work with clear vision for going forward.
- Therefore as the term of office of current chairs ended on 31st of December 2015, instead of starting new procedure of election of new chairs during this IPPOG Autumn meeting, the call for votes about the prolongation of their term of office has been executed by Pedro
 - As a result of the vote, Marge and Hans Peter were re-nominated on 18th of December 2015 for the period of one extra year, effective from 1st of January 2016 (until the end of 2016, when the MoU process is expected to be complete and a minimal defined set of signatures collected by this time).
 - Preparations for the 2017 term will start at the next Spring meeting in Cracow
 - Year 2016 will be crucial as the MoU is being signed and real money and other in-kind contributions will start flowing, This process will depend critically on the network and the trust built up by the current chairs with stated messages of support from CERN Council, RECFA, current and designate CERN DG

1.3. EVOLVING IPPOG – MOU PERSPECTIVES

Presented by Barbora Gulejova

- Memorandum of Understanding of IPPOG Collaboration has been drafted in order to enable IPPOG to become an official body on its own right
- **Advantages of this transformation and MoU:**
 - IPPOG collaboration account (at CERN) - securing funding; ability to dedicate resources to IPPOG activities, infrastructure and personnel
 - Formalization, developing and strengthening the existing network
 - Professionalization, better visibility and recognition – develop, design and maintain new website and database, promoting materials and publications and other activities
 - Relation with other bodies (on more formal basis)
- **Structure of the document:**
 - Main body of MoU: includes *Purpose & Nature of document* (not legally binding); *Membership rules* (eligibility, representatives – delegates&associates, admission); *Organisation&Governance* (IPPOG Collaboration Board, votes and meetings, IPPOG coordination team, IPPOG working groups and activities), *Funding* (team account, contributions from members); *Entry into force*, etc...
 - Terms of Reference: Annex 1 to the main document which may be amended by IPPOG Collaboration Board; includes detailed rules of meetings, voting procedures, responsibilities and duties of Members and their representatives, Chairs and IPPOG personnel, etc...
 - Annexes (valid for the whole IPPOG collaboration): e.g. List of Members, Accession agreements, IPPOG budgets, Details on Working Groups, Details on Activities
 - Addenda (between specific members only): e.g. Special agreements, Contracts...
- **Important points:**
 - Members eligible: national bodies representing the country (1 per country), major labs and experiments (in addition to the country members)
 - IPPOG Members shall nominate Delegate in IPPOG Collaboration Board, who will have a voting right on the IPPOG CB meetings; Delegates need to be assured to attend IPPOG meetings
 - Member will also appoint the Associates, involved in contributing to outreach activities, developing tools and methods
 - The Fall meeting shall rotate among participating labs (i.e. not CERN every year, but ideally also DESY, FNAL,...); Spring meeting will rotate among countries

- Membership fee of few kCHF per year is envisaged – to be decided and voted on IPPOG CB meeting
- Extra contributions, in-kind or cash, are possible and can allow pushing certain programs/activities on a more global scale
- IPPOG team account will be opened at CERN and administered by Chair(s) and IPPOG personnel
- The money will be used for the running of IPPOG, securing IPPOG personnel, IT support, travel of delegates and associates on behalf of IPPOG (where justified need is required), and overhead
- IPPOG is international and shall cover all areas in particle physics, which means that IPPOG is not CERN, but CERN is a member of IPPOG and money to IPPOG is not to be confused with money for CERN.
- **Questionnaire regarding the MoU** has been circulated to IPPOG delegates (hep-pr) in Summer 2015, the analysis of the replies gave very encouraging and positive result confirming, that the majority of the current IPPOG members are ready to take the next step and sign the MoU
 - IPPOG: 26 countries –big diversity of answers; 2 labs and 5 experiments
 - From 26 countries: 19 have identified the national organisational structure for PP, which would be the possible signatory of MoU and 7 have identified more candidates (2-6)
 - 65% from 26 countries are favourable to pay a membership fee (10 countries between 4-5 kCHF and 2 countries 2-3 kCHF); 45% of the countries require more investigation/discussion/negotiation with possible signatories
- **Current status and next steps:**
 - Draft of IPPOG MoU agreed by Coordination Team has been given to the Legal Service of CERN early 2016 followed by the meeting of H-P and Barbora with them
 - According to the CERN's legal service the draft is a solid document and the new version approved by them will be prepared in the next months to assure advanced decisions to be taken during the next meeting in Cracow

TO DO: If you didn't do so yet, please, check the slide 12 in the presentation 'Evolving IPPOG' from 7/11/2016 with possible signatories of IPPOG MoU, and send corrections to Barbora and H-P.

2. IPPOG STORIES / IMPACT

2.1. AN INSIDE VIEW FROM IPPOG

2.1.1. SLOVAKIA

Presented by Ivan Melo

IPPOG as seen from country (Benefits of membership)

- 10 years ago, when Ivan joined IPPOG, outreach was considered as inferior by scientists in Slovakia
- in IPPOG he met professionals on outreach in PP doing it on the top of research
- IPPOG has always been a source of ideas and inspiration for him

THANKS TO IPPOG:

- Today 7 out of 8 universities in Slovakia run Masterclasses every year, essays from Slovak students about MC appeared in CERN courier, photos from MC appeared in Symmetry magazine, filmed even by Slovak TV, regional MC in Kosice have been organised (university colleagues travel to the schools in eastern Slovakia), MC helped to raise profile of University of Zilina (management likes to be mentioned in news)

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- Inspired by IPPOG (UK colleague) project Cascade has been organised in Slovakia, today more than 15 successful teams
 - Recognition of outreach in HEP community (not considered inferior anymore), easier to get outreach grants, IPPOG meeting organised in Kosice got very good recognition in Slovakia, project Cascade

SUGGESTION: More publishing together as an IPPOG collaboration would be good

2.1.2. ATLAS

Presented by Claire Adam-Bourdarios

IPPOG as seen from a “large” experiment (Benefits of membership)

“ATLAS outreach without IPPOG would be less efficient! Go ahead, we (large and not so large experiments) need you!!!”

NETWORKING: IPPOG is a unique forum to exchange ideas beyond the “usual LHC circles”

- Learn from what people do in their countries... and get feedback on what we do
- Give echo and visibility to often fragmented efforts

Regional programs:

- Bringing “education” to countries who do not have access
- Programs get us into places where HEP is not present yet

MASTERCLASSES are a major enterprise and success from many point of view (Z- & W- path, virtual visits), brings ATLAS closer to outreach – impossible without IPPOG

OPEN DATA: entering new regime, challenges: remote teaching, “e-learning” adaptation, massive online open course “MOOC” style? – ATLAS is happy to be in IPPOG

COLLECTIVE MEMORY: The IPPOG database is unique in many ways - it is the backbone of the resources we need / use (especially newcomers as an introduction and source of inspiration)

-the fact that we heavily rely on this tool implies long term support; the work happening behind the scenes is highly appreciated

HEP CONFERENCES: The growing introduction of talks on outreach and communication is the result of years of efforts from a very small group of pioneers – summer 2015 was memorable for conference contributions

ISSUES: Borderline between Experiments and IPPOG contributions is not always clear (people wearing multiple hats); articulation with Speakers and Publication committees needs work

2.2. INSPIRING SUCCESS STORIES

2.2.1. TEDxYouth in Zurich

Presented by Dave Barney - [link](#)

IMPACT on public by making spectacular and illustrative tricks:

- Smashing lego protons with lot of noise and lego particles everywhere... to show that bigger particles are made of smaller until we get the most basic building blocks of everything in universe
- What happens if we collide these smallest particles? Surprise: magician would smash 2 little objects and create one bigger one ($E=mc^2$). Energy produced in the collision is converted into particles of different masses, charge,...than original ones (antimatter, particles from big bang).
- Hans Peter in [Rosanna TV show](#) (09:05'-11:05') – magic trick to show how to get more out of collision (including initial particles)

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- Making invisible (Higgs field) visible by energy: throwing a coin in a glass of water → splash (Higgs boson) – evidence of force field -Higgs field

2.2.2. CASCADE competition

Presented by Pete Watkins with input from Ivan Melo – [link to resources](#)

Efficient and enjoyable way to inform and engage many students with particle physics.

- Groups of students (16-18 years) work together in small teams and present 20 minutes performance together to other students (of similar age or younger).
- Enhances their knowledge and communication skills without too much researcher/teacher time
- Inspires other students = ‘Cascade’ of knowledge/interest (150 students in England give talks to 1500 other students...)
- National competition, judging from videos, final presentations at university, prizes
- Easy to organise and great fun for participants and audience
- Widely spread in England and popular also in Slovakia = other countries encouraged to join!

IDEA: Could be used as follow up to Masterclasses for motivated students

2.2.3. QUARK CLASH

Presented by Nicolas Arnaud

- A computer game based on particle physics (fight between particles – see video [here](#))
- Inspired by [Quark Poker cards game](#)
- Supported by Windows, Mac and web; in English; single player (against the machine) or 2 players modes; tutorial - 15 slides describing the game, the cards, the combinations, the rules and the battles (each card has three properties : attack, defence and a special ability; the longer the particle lifetime the more defence points it owns; heavier particles have more attack points)

2.2.4. SCIENCE FAIR in Chania, Crete

Presented by Christine Kourkoumelis

A science fair in Chania, Crete, 28/8.2015 – inspiring science for all ages

- Second year that this event was organized in the context of the International Conference of New Frontiers on Physics (ICNFP 2015), co-sponsored by GoLab EU outreach project
- Full day event addressed to everybody (9-99 years old)
- Program: MC - Analysis of real data from LHC, ATLAS, ALICE (quark-gluon plasma vs cosmological theories lecture), simple physics experiments (from Marge), puzzles, memory games, videos, animations...to help students understand latest developments in PP; Everything you wanted to ask (and never did) a physicist (Hans Peter); evening session with lectures and music of Big Bang
- Big success: 150 visitors (morning), 100 at lectures, wide press, TV coverage for several days

3. WORKING GROUPS AND ACTIVITIES

3.1. WG on HST&S PROGRAMS IMPACT

Presented by Jean Young

How would you know the impact or success of the program?

- First necessary to define **goals and objectives** – where you want to end up, what means success?

One must be specific on what exactly we want to achieve (the type of behaviour of students):
awareness (learn about PP) vs. **knowledge** (learn PP)?

- Objectives need to be measurable (not just 'it was great success') to do **evaluation**
For measuring success data are needed: Monitoring is good, but it is not an evaluation
In Museums/exhibitions- distribute a survey (difficult to develop)

Results of programs evaluation (assuming no or little prior knowledge):

- 1-2 days programs: Awareness level – learn about PP, creates interest, provides orientation:
Example: International Masterclasses
- One week programs: Knowledge level - participants will “know” about and be able to explain one to three major concepts/principles/procedures; teachers can teach it to their students:
Example: CERN National Teacher Programs
- Two to three weeks programs: Knowledge level - address a major topic in depth that students will “know” or teachers can teach.
Example: HST at CERN
- It takes at least four weeks for teachers or students to understand scientific research when working in a team with scientists – become ‘more scientifically literate’
Example: QuarkNet Research Internships

GOOD PRACTICE: As teachers are part of MC, countries could concentrate more on teachers and introduce preparation and follow-up courses for them as a part of MC.

GOOD PRACTICE: 3 days program/stage for students and teachers in Frascati, with feedback back to the teachers.

GOOD PRACTICE: After MC in Slovakia the email addresses of students are collected in view to ask them few year later, what was the impact of MC; problem could be that emails change often! – Facebook?

ISSUE: It seems, that for HST and NT programs at CERN and MC the goals, objectives and measures of success of these efforts have been never really developed...

TO DO: In 2010 Uta, Marge and Michael put together the documents about aims of MC and some study on MC impact have been done by Eric Johansson – put these documents together!

3.2. WG PUBLICATIONS AND SPEAKERS COMMITTEE

Presented by Farid Ould-Saada

Committee on Publications and Speakers with set of rules established and mandated by IPPOG in 2012

Procedure:

- 1.) Collect information on upcoming conferences and inform IPPOGers about these opportunities
- 2.) Call for potential speakers
- 3.) Speakers selection
- 4.) Slides/Abstracts approved by IPPOG
- 5.) Proceedings
- 6.) Publications – collect for the IPPOG website (dedicated item on the website)

RECOMMENDATION / TO DO: Introduce **IPPOG notes** – for example Conference write-ups (especially before they become available in conference proceedings), other internal IPPOG notes, for example describing some work done within IPPOG like the outcome of some working group on discoveries, masterclasses materials... These would be clearly visible and referenceable notes to give a credit to the

work of people who have done something good on behalf of IPPOG, namely students (e.g. from CASCADE, or “Physics slam”), could be also MC moderators or IPPOG associates,...
IPPOG would decide case by case whether it is really on behalf of IPPOG, CMS, ATLAS, Icecube, etc...

TO DO: WG should take care of organising the rehearsals of the talks!

3.3. WG on BROADENING THE SCOPE OF MASTERCLASSES

Steering group on Masterclasses 2015/2016 - see the **full report from SG on MC** [here](#).

- The evolution of MC during last 10 years (2005 vs 2015): from 18 to 42 countries, from 58 to 139 institutes, from 72 to 255 MCs, from 3000 to 10 000 students, from 12 to 68 VCs

MC 2016: 1.2. – 23.3.2016

- Registration started 22.10.2015
- Signed up so far (good numbers already as of 5th of November 2015):
CERN: ATLAS W: 30 (37); ATLAS Z:81 (84); CMS WZH:42 (46); LHCb:30(28); ALICE:14(18);
FERMILAB: CMS WZH:13(28); ATLAS Z: (14)

NEWS:

- Social media initiative: IMC Twitter account
- World particle physics day – if done, than in October/November 2016
- New countries (~20), many others interested...
- Initiatives with international schools, International Baccalaureate Organisation (IBO)
- Initiatives with CERN and other schools for PhD students (Africa, etc...)

TO DO (Uta): Get the exact numbers of participants in MC to ensure correct statistics this year

TO DO: ATLAS promotes MC during ATLAS weeks, but other collaboration don't. Uta will prepare the slides to be distributed within all collaborations and will be made available in IPPOG DB.

TO DO (IMC team with IPPOG): Set up a team that contributes, or get central person on board; we need to identify people, who will take care of the social media in both IPPOG and MC on regular basis, to make this sustainable...

TO DO (ALL): If you are on twitter, please follow us. Also, please spread the word at home to teachers, students, and your institution to follow the IMC account as well.

TO DO: Follow up with all above mentioned CERN and other schools, investigate whether and how is it possible to include MC

TO DO: We need the plan that ends in WPD in Oct or Nov 2016; we need milestones, timetable, people, unclear who is going to do it, first ask if national contact points of MC are interested to do it and how – more discussion within WG. Also need to know, whether IPPOGers are really interested to do it.

TO DO: Find the way how to work with International schools and IBO in more collaborative way (Ken and Barbora)

4. PANEL DISCUSSIONS

4.1. EXPLAINING NEW PHYSICS

Presented by Farid Ould-Saada, Ivan Melo

What is considered by PP physicists as **UNKNOWN** (which are the things we are looking for, as clearly 99% is missing):

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- 1.) DARK MATTER – we know from gravity, that it exists, the new precision of measurements would explain dark matter...
 - 2.) Behaviour of GRAVITY at very short scales (also DARK ENERGY)
 - 3.) UNIFICATION – Do they have the same origin?
 - 4.) ANTIMATTER matters
 - 5.) EARLY UNIVERS – quark-gluon plasma, baryon-genesis, lepton-genesis,...

We try to explain, find what is '**HIDDEN**' by studying:

- 1.) SYMMETRIES – breaking the symmetries, SUSY (useful, otherwise we wouldn't be here...), phase transitions
- 2.) EXTRA-DIMENSIONS – new dimensions; the only way how to explain gravity on a small scale it to change the scale...
- 3.) SPIN
- 4.) NEW SCALES
- 5.) NEW STATE OF MATTER
- 6.) ROLE OF NEW SCALARS (beyond mass)

Also important are the complementary approaches taken by different experiments (e.g. between ATLAS and CMS, or between various type dark matter search experiments, neutrino oscillation experiments, etc) – complementary leads to better insights and are always important to confirm results and discoveries.

NEW PHYSICS TOPICS: after Higgs discovery we are entering a **new SCALAR ERA**

Discovery of Higgs doesn't mean the end of PP, but marks the beginning of a new scalar era (as Higgs is the only elementary scalar particle as we know today). There are more scalar fields out there, which need exploring (the hypothetical inflaton may be such a candidate for another fundamental scalar).

Physics associated with the Higgs potential is rich and interesting, but also very complex and not fully understood. There are several topics representing the basics in this field which could be tackled and efforts could be done to explain them to high-school students or broader public. These are: Theoretical/mathematical description of the Higgs potential as a real scalar field (Lagrangian) – Higgs vacuum energy density (energy density of empty space); Mexican hat representation; Electroweak symmetry breaking for being responsible to give mass to elementary particles 10^{-11} s after Big Bang (at the GeV scale, corresponding to a critical temperature $T \sim 200$ GeV), Higgs mass measured so far ~ 125 GeV yielding the vacuum expectation value of the Higgs field to be ~ 246 GeV which is representing the second order phase transition for the Standard model (what happens, however, if we go beyond Standard model at higher energies? First order of phase transition with remnants observed in astrophysics?); Chiral symmetry breaking offers an analogy where the QCD phase transition happens at 10^{-6} s after Big Bang, at much lower temperatures ~ 175 MeV, during which free quarks and gluons became confined in hadrons (as nucleons are much heavier than their building blocks, only 2% of mass comes from Higgs mechanism and 98% of mass is derived from QCD!) – Chiral perturbative QCD is described effectively with a potential similar to the Higgs potential, but at MeV scale and field composed of quark-antiquark pairs (condensate); Naturalness problem; Vacuum stability (measurement of Higgs' mass shows that our universe is metastable – we need more precision on measurements especially the top quark mass) - we need to be ready to explain Steve Hawking's statement that our universe is unstable because of the Higgs; Good for explanations is to use the analogy of Higgs mechanism - scalar field, phase transitions and symmetry breaking - in other well known systems, both composite (as superconductivity) and elementary (inflaton scalar field responsible for expansion of universe).

Find the new article from Ivan Melo dealing with these topics in the IPPOG database - [link](#).

ATTENTION: Before explaining what we want to discover, first explain well what has been already scientifically proven...Higgs mechanism of electroweak symmetry breaking through the phase transition; what does it mean symmetry in weak force (particles in one bag vs 2 bags – leptons and quarks, as we cannot easily explain how lepton changes to quark...). For the moment it is really complicated, but we are getting closer to the explanation. First we need to understand ourselves, and then decide how to explain to the others

⇒ **TO DO:** Send mailing list to get some more ideas (H-P)

TO DO: In past there was a ‘WG on Explaining Higgs’, very interesting, but no materials produced as an outcome. Producing the written material should become a habit – to do even a publication by IPPOG!

TO DO: However indirect impact/outcome: there were some widely well received documents prepared by Steve and Dave indirectly out of these discussions- collect these documents for IPPOG DB (Steve, Dave)

4.2. COSMIC RAYS GOING GLOBAL

- Idea to establish universal portal for cosmic rays through which successful cosmic rays studies programs can reach out to teachers and students worldwide, including data, analysis tools, detectors to be borrowed/purchased) - See more details in the [newsletter N1](#), page 3.
- Following the last meeting where this initiative was discussed and well received by IPPOG, Hans Peter had further conversation with APPEC director Frank Linde, who is very much in favour of closer ties with IPPOG, which could be beneficial for defining new projects and asking for European money (which should not be limited to Europe only...). In the meantime the APPEC outreach office moved from Paris to London and new London based outreach officer is going to be hired, therefore we are waiting for him/her to be found and settled in to push forward.
- **Design workshop** has been proposed to be organised for all the possible stakeholders in order to determine together the structure and all the requirements of the project (get inspiration from existing webpages, like Teilchenwelt and others)– possibilities: next International Cosmic Rays Conference ICRC, July 2017, South Korea (too far in the future), ICHEPP 2016 in Chicago

IDEAS: - Web portal accessible for everybody with helpdesk and forum

- Different ways how to process data: 1) Get data and analyse them
2) Get data out of the hardware through remote access and analyse them
3) Measure own data with the detector

- Like in normal collaboration students/schools would share the data

- Possibility of remote running of detector (detector available at CERN, CMS visitors site –

Wojciech Bialas, bld.27, detector has ability to turn on remotely, good if students cannot come to CERN)

OPEN QUESTIONS: - Do we want to have a common data format?

- How do we incorporate trainings for teachers?

LIST OF EXISTING PROJECTS: CERN@school (UK), COSMIX (France), COSMOS à l'ECOLE (France), CZELTA (Czech Republic), Extreme Energy Events (Italy), HELYCON@education (Greece), HISPARC (Netherlands, Denmark, Germany and UK), QuarkNet (US and worldwide), Teilchenwelt Netzwerk (Germany).

NEW POSSIBLE PARTNERS / Other interested projects:

- **University of Geneva:** contact Leila Haegel

1) [COSMIC PI](#)- low cost educational and open source cosmic rays detector, small scintillator 15x10 cm, 500 dollars, just connect to internet cable, Raspberry Pi computer for data storage and online analysis... (prototype in IdeaSquare at CERN?)

2) [Muon life time experiment](#) in laboratory, not heavily used, can be made available for students

- **CERN** – scintillator from CMS visitors site (mentioned above) – contact Wojciech Bialas

- [NUCLIO](#), [GALILEO TEACHERS](#), [HANDS ON UNIVERSE](#), [OPEN DISCOVERY SPACE](#), [INSPIRING SCIENCE](#), [GO LAB](#), [ESA](#), [Faulkes Telescope](#) (University of South Wales, UK) - contacts through Barbora

TO DO: Pursue conversation/negotiation with APPEC (H-P, Marge)

TO DO: Put together already now little website, where what exists could be put together (Rasmus can try to use it – as HST)

TO DO: Define goals/needs from the point of view of the teacher (Rasmus); Marge will loan him a detector from QuarkNet

TO DO: Organise a design workshop (Marge?)

TO DO: Follow up with all new contacts of possible partners

4.3. OPEN DATA AND THEIR USE

- Open data portal developed by CERN IT, includes data from ATLAS, CMS, LHCb,...which can be freely downloaded

BENEFITS:

- showing to the society, that we are open to share worldwide, even to CERN non-members, like Venezuela (interested in PP courses using CERN open data)

- it makes production of MC easier, no need to go through long process

- nothing more motivating for students (already at Bachelor level), than having a possibility to look at the real LHC data (not only simulations) – good way to motivate, recruit students to study PP

MANY PROGRAMS USING OPEN DATA:

- Masterclasses

- ATLAS Higgs challenge (learning programme), datasets already available, more easy going; mailing lists for people to give feedback, but not much feedback – we don't know who, how, if uses it... maybe add to MC website?

- Oslo university students used only IMC data and did nice analysis; many more interesting Bachelor students projects are created like this!

- University of Athens did path to optimise Higgs discovery with Hypathia, 2 hours exercise for 4th year students, available online for everybody

- Spain: competition about top quark, lot of interest from students (3rd, 4th year)

- Quarknet data workshop

- CMS rediscovery of Standard model - 'Particle physics playground', could be [downloaded](#) – good to add to open data portal to show nice examples and explain how to use the data

- CMS validation of data exercise – ready for end of 2015?

ISSUES: - Scientists don't like to call open data initiative Education/outreach exercise, but scientific activity. Importance of outreach is to be discussed!!!

- CMS released lots of data, but not easy to analyse, needs easier format

GOOD PRACTICE: Inspiration by Auger observatory, who released ~40 000 events to be downloaded on the webpage + suggestions of what could be done with data – needs effort to put the examples of programs, overview what one can do...

4.4. EXHIBITIONS

4.4.1. Exhibition in Austria

Presented by Natascha Hoermann

- to mark 50 years of Institute of HEP – HEPHY
- in Natural history museum in Vienna, September 2016 – January 2017
- 400 000 visitors expected; money from different sponsors, museums, institutes, companies
- concept: **'From Big Bang to present'** – 6 rooms of 500 m²:
 - 1) Visible universe – the galaxies would be depicted by artists
 - 2) Elementary particles – sound installations
 - 3) Dark energy/matter
 - 4) Big Bang room – photos collages
 - 5) Current experiments to explore the universe – how real CMS data look and sound
- lot of artists and physicists work together (big challenge to obtain mutual understanding!), not easy to work together (different cultures, risk of clash), but important to collaborate
- no information boards, only touch screens- who is interested, could read – question, how many people read the information in museums... ?

4.4.2. Exhibition in Portugal

Presented by Catarina Espirito Santo

- to mark 30 years of LIP (9/5/2016), **"Challenges of PP for next decades"**; February - May 2016
- 3 towns of LIP in Portugal: Lisbon, Coimbra, Braga; local universities, not inside but in the streets, at the main entrances, meant not only for students, but also for public, politicians – important that they understand that fundamental research is important!
- LHC interactive tunnel from CERN + small islands for each of challenges: 1. Hadronic matter, 2. Higgs, 3. Neutrinos, 4. Antimatter, 5. Dark matter, 6. Detectors, 7. Technology + About LIP + Projection area

IDEA: DESY - LHC communication office - have welmachine.de, maybe possible to get some objects from their exhibition or at least to get an idea, how to do

TO DO: Plan for the IPPOG website Exhibitions/Event calendar + in Database: Exhibition objects

5. IPPOG & EPPCN JOINT PANEL DISCUSSIONS

Journalists vs Scientists summarised by [animated gif](#) (Blog from Achyntia)

5.1. WHY DO WE NEED NEW BIGGER MACHINES (HILU LHC, FCC, ILC, CLIC)

Presented by Hans Peter Beck;

Scientific community needs to be able to answer this question, to justify the construction of other big machines after LHC. Now when Higgs was measured in LHC, and thus the Standard model completed, PP scientists look for understanding what is beyond the Standard model – what are the limits within the Standard model is valid and which model could be applied beyond this scope; in other words measuring the Standard Model at unprobed energy scales. **Expanding the scale** at which a model is probed will either further strengthen the validity of the model or will tell when the model collapses and a new model will need to be found.

Good way how to explain this is to point out to the analogy with known examples, clearly showing that **scale matters** (even when a model is axiomatically well defined). Take for example the '**Beyond Flat Earth Model**': Even a good and axiomatically well motivated mathematical model i.e. Flat Earth –or, if you want, the Standard Model, is only as good as it has been tested by experiment. As the flat Earth is a good approximation in our local environment, knowing the Earth is round doesn't help building a better house –your architect doesn't rely on knowing R_{Earth} when drawing your new house. However, already when measuring the trajectory length from CERN to Bern (130 km), the sizeable discrepancy between theoretical prediction and measurement appears (1%), which will build up slowly with increasing distance scale. You may detect further unknown territory while on your way out to India via going west. It is exactly the deviation from the predicted value that tells how a better model can be constructed. Old models embed in the new and better model describing the world and keep their validity within a limited but now well understood scope. Another example is Newtonian mechanics which is truly embedded in Einstein's General Relativity (Newton's theory is useful for almost any engineering project, including some space projects, but for GPS we need Einstein's theory). Once we know how to **expand out of the Standard model**, we may be in a position to understand Dark Matter or even Dark Energy, find new particles or something completely else. This could be done only by **exploring new higher energy scales and measuring with higher precision**, possible at the machines like High-lumi LHC, FCC, ILC, CLIC etc.

Absolute truth doesn't exist, but excellent and well-test asymptotically accurate descriptions/understanding within the scales studied exist.

Presented by James Gillies

Big journals like Economist, Physics World,... often state that physicists should forget about big machines and concentrate on plasma wake fields and alike...However, on the big machines like HiLu LHC or FCC one can go from discovery to the precision. Take an example of the machine in the past, how many new opportunities and discoveries arose when going from LEP to LHC. Science is not about the certainty but the degree of uncertainty.

5.2. COMMUNICATION AND OUTREACH AT BIG CONFERENCES (ICHEP' 16)

-Recently the sessions on Education, Communication and Outreach in science at international conferences became more popular.

-Opportunity for people (also young) to be aware of what they could do in ECO domain?

-Usual challenges – communication with press, setting-up the press room, make sure that different languages are represented...

2015: IPPOG E&O session in HEP EPS in Vienna (Uta, Dave) and APS- DPF in USA (Marge)

2016: ICHEPP in Chicago – Challenge: How to attract audience during the vacations – local organisers...

IDEA: There exists academic discipline: 'Public opinion and research', maybe we should get more contacts on education research professional evaluator's community? (Terry O'Connor)

5.3. HOW TO HANDLE APOCALYPTIC PROPHECIES APPEARING IN MEDIA

Presented by Terry O'Connor

LHC restart has been blamed for some predicted catastrophes on internet and in media. What to do?

-Encourage the scientists to give accurate and personal responses on social media (not only through official channels!)

-
- Beware trolling (posting messages in an online community such as a newsgroup, forum, chat room, or blogs, with the deliberate intent of provoking readers often for the own amusement of bloggers)
 - Make sure that backgrounders are known to be used
 - Cosmic rays arguments always help
 - Humour could be used, but careful as humour often only works within cultural scope and maybe miserably misunderstood outside of the cultural scope.

TO DO (EPPCN/IPPOG ALL): Please, send your comments on what would you like to be handled by IPPOG/EPPCN later in the future.

6. VARIOUS REPORTS

6.1. PHYSICS FOR EVERYONE – HIGGS IN THE SKY

Presented by Michael Kobel

Useful for public talks: “Nature’s hadron collider produces Higgs boson all the time, high in the sky”

Bachelor thesis of Josua Unger (TU Dresden, Nov 2014), CERN thesis 2014-313:<https://cds.cern.ch/record/2019394>

Recently covered in [Guardian](#), [Reference Frame](#), [Science Mag](#), [Computer Oiger](#), [Schattenblick](#)

- Using the spectrum of cosmic rays (CR), the percentage of proton-proton collisions in atmosphere resulting in Higgs production was studied.
- As the proton flux in atmosphere is much higher than in LHC, the primary CR produce 1 Higgs ~every 8 seconds in the atmosphere, which is comparable or more than the LHC did during runtime 2012 and will be even more with LHC upgrade at higher luminosity. In atmosphere the distribution is of course, over much bigger volume. Even though the production by secondary CR (decay to secondary particles, what would further increase the atmospheric rate) was not considered in this analysis, it is not expected to affect the results a lot.
- Nature does the biggest production of Higgs bosons at much lower energies than LHC: By far most of the production happens with incoming protons of $E(p) = 100\text{TeV} - 2000\text{TeV}$, corresponding to centre of mass energy $E_{\text{CM}}(pp) = 0.45\text{TeV} - 2\text{TeV}$, which is much lower than LHC or Tevatron.

INSPIRATION for questions asked by journalists:

- Is the Higgs produced in LHC dangerous (H-P in [Migros magazine 2015](#))
- Why do you need LHC if Higgs is produced in atmosphere? LHC is even cost-efficient, as 27 km compared to Earth spanning detector.

6.2. BEAMLINER FOR SCHOOLS

Presented by Markus Joos

- BL4S is a worldwide competition for teams of students, aged 16 - 18 years and guided by a teacher (or another adult), to use a fully equipped beam line at CERN’s Proton Synchrotron
- Teams have to propose an experiment which uses particle beams. They have to submit a proposal (max. 1000 words) and a one minute video
- Volunteers from CERN chooses 2 winning teams, who will be invited to CERN for about 10 days to carry out the experiment
- Started in 2014 (linked to CERN 60th anniversary): 290 proposals, in 2015: 110 proposals; in total more than 4000 students
- Financed by CERN & Society programme and supported by HEP community (Fermilab, Italy,...)

NEW in 2016 (deadline 31st March 2016):

- A ½ page presentation of BL4S in many languages
- More prizes (e.g. particle detectors and t-shirts for shortlisted teams), additional prizes may be offered at the national level (not only to winning teams who come to CERN, but recognition to all who did good work)
- More verbose documentation to help the team coaches with background information
- Additional channels for making publicity – advertising is clearly missing!
- Additional volunteer physicists to act as national / regional contacts

TO DO: -Potential IPPOG involvement in 2016:

- Help to translate the ½ page document (done!)
- Make publicity for the competition: 17 Nov. 2015 - 31 Mar. 2016
- Assist the teams with their proposals: Until 31 Mar. 2016
- One or several contact persons (not necessarily all IPPOG members) per nation (How to cover nations without IPPOG representative?)
- Participate in the selection committees in April and May 2016
- Identify potential donors and national prizes / follow up

6.3. EPS-HEP 2015 E&O SESSION

Presented by Dave Barney (organised by Dave and Uta)

E&O session at EPS-HEP summer 2015, [webpage](#), details in [newsletter 1](#) (p.2)

Excellent audience participation (60-80), lot of young people

- 1) E&O talks (10)
- 2) E&O panel (6 people from IPPOG and LHC experiments)
- 3) Physics slam- cutting edge physics in 3 minutes (12 physicists presenting their posters at conference)
- 4) Interviews with journalists (e.g. from Nature)

LESSONS from TALKS (E&O talks considered better than at other sessions of conference):

- Less is more: bare-bone slides + engaging speaker; focusing on key messages (no “padding”)
- Show the power of young people involved in E&O, making a difference with very few resources
- REHEARSAL is IMPORTANT !!!
- Doing E&O helps to do better presenters!

LESSONS from panel discussion:

- Personal touch in E&O activities is the best (not e-learning, lectures, seminars)
- Interactions with high-school teachers sometimes difficult (unlike scientists teachers don't like to be asked Q to which they don't know the answer)
- Many initiatives to address gender imbalance in HEP
- Use of art to interest people is growing, but needs adequate follow-up

LESSONS LEARNED:

- Advertising! Use posters/flyers with people's description – attracts more audience
- Engage the audience->people are interested in participating: need encouragement & support
- “Physics Slam”: great opportunity to tune presentation skills (but needs more preparation); Poster presenters are eager to do more!

TO DO: Make the video from Physics slam available (Natasha send to Dave)

IDEA: Produce together outreach materials from students giving 3-minutes talks about their posters

6.4. APS-DPF 2015 E&O SESSION

Presented by Marge Bardeen (organised by Marge and Pedro?)

- 1.) Lunch & Learn: moderated Q&A session with free lunch – 250 participants!!
- 2.) 2 parallel sessions on E&O with variety of interesting topics
- 3.) Special guest's lecture ("From the Big Bang to the End of the Time: Scientific Creativity and the Limits of Knowledge")

IDEAS: Making science communication a conversation

- Science cafes
- Communication trainings and public engagement by and for grad students, early career researchers, ...
- Practice-based workshop: develop skills, create an original portfolio of digital media and oral presentations

6.5. E&O RESOURCES – BOOK “FROM HERE TO BIG BANG”

Presented by Barbara Sciascia LNF-INFN

Book for kids (14-18) in [IPPOG database](#)

Written and published thanks to [E&O at LNF-INFN](#): >15 years of experience with 8-14 kids

Three main directions: - researchers visiting kids at school
- kids visiting the Laboratories
- big events (Open Day, Researcher's Night)