

This report is to be delivered to SCNAT and is thus structured along the SCNAT guidelines.

## SUMMARY

### *Highlights of the Year*

CHIPP had a very intense year 2016 with a lot of activities. It started with hosting the [country visit of the Restricted European Committee for Future Accelerators \(RECFA\)](#) on 1<sup>st</sup> April 2016. Such a visit is organised every six to seven years in Switzerland, this time at ETH Zürich. It was the occasion to present all aspects of particle physics in our country for evaluation by RECFA. This was followed on 7–9 June 2016 by a [Strategy Workshop for High-Energy Particle Physics in Switzerland \(SWHEPPS 2016\)](#) held in Ägerisee (ZG) to discuss the status and future strategy of the CHIPP Pillar 1 on particle physics at the high-energy and intensity frontiers. In summer, the biennial [Zuoz Summer School](#) entitled “Exothiggs” was successfully held in the week before the [CHIPP Annual Plenary Meeting](#) organised this year in conjunction with the Annual Meeting of the Swiss Physical Society (SPS) on 23–25 August 2016 in Lugano (TI). A session was devoted to the **CHIPP PhD/Postdoc days**, offering an opportunity to the young generation of particle physicists to present their research work. The [CHIPP Prize 2016](#) for the best PhD student in particle physics was awarded on this occasion to *Mohamed Rameez* (Uni. Geneva) for his work on dark matter searches with the IceCube neutrino detector in Antarctica. The **CHIPP plenary** meeting was held on August 23<sup>rd</sup> with annual reports on CHIPP activities and on developments in international bodies dealing with particle, astroparticle and nuclear physics. Finally, on 16–20 October 2016, CHIPP supported the triennial [workshop on Physics, Symmetries and Interactions \(PSI 2016\)](#) held at the PSI.

The **CHIPP Board** was very active in the preparation of a coherent set of requests for the funding of large research infrastructures via the **FLARE programme** of the Swiss National Science Foundation (SNSF) for the next two to four years. It also approved the signature for the Memorandum of Understanding with the **International Particle Physics Outreach Group (IPPOG)**, thus making Switzerland a founding member of this organisation devoted to education and outreach. The **CHIPP outreach** activities evolved in 2016 with the porting of the multi-lingual “[particlephysics.ch](#)” to a new thematic portal hosted on the SCNAT website. Thanks to the SCNAT support, CHIPP could continue to keep this as a lively site with the addition of 14 interviews or other news articles in 2016. Another outreach activity was the screening of the movie “**Particle Fever**” (USA, 2013) in Lugano on 22 August 2016. The link with the Swiss media was also restored in 2016 with a new Swiss member in the **European Particle Physics Communication Network (EPPCN)**. A concrete outcome is the start of a list on the [media coverage of particle physics in Switzerland](#).

## SECTORS OF COMPETENCE: NETWORKING AND DEVELOPMENT OF SCIENCE

### Publications

A still incomplete summary of the Strategy Workshop for High-Energy Particle Physics in Switzerland (SWHEPPS 2016) has been written and presented in October 2016 at the Board meeting. This is however not an official document, but shall serve as basis to the preparation in 2017 of a strategic document on particle physics at the high-energy and intensity frontiers, referred to as the CHIPP Pillar 1 White Paper.

### Meetings, Workshops and Schools

CHIPP continued to work on its networking and educational goals and organised directly or through its members also in 2016 several meetings, schools and workshops:

- The annual [Zurich Phenomenology Workshop \(ZPW 2016\)](#) was devoted in 2016 to “Higgs physics at the LHC”. Sponsored by the Pauli Center for Theoretical Studies, this forum for particle physics researchers was held at the ETH Zürich on 6–8 January 2016.
- The [RECFA country visit](#) held on 1<sup>st</sup> April 2016 at ETH Zürich was the occasion for CHIPP to present all aspects of particle physics in Switzerland for evaluation and feedback by the Restricted European Committee for Future Accelerators (RECFA).
- The [Strategy Workshop for High-Energy Particle Physics in Switzerland \(SWHEPPS 2016\)](#) was held on 7–9 June 2016 in Ägerisee (ZG). It gathered 71 participants with the aim to discuss the status and future objectives in particle physics at the high-energy and intensity frontiers.
- The [Zuoz Summer School 2016](#) was entitled “Exothiggs” – in reference to the Higgs boson – and welcomed 82 participants at the Lyceum Alpinum of Zuoz (GR) the week of 14–20 August 2016. This 23<sup>rd</sup> PSI Summer School was also an official event of ‘Higgstools’, a EU Initial Training Network.
- The [CHIPP Annual Plenary](#) is the yearly gathering of the Swiss particle physics community. It was held on 23–25 August 2016 in Lugano (TI) in conjunction with the annual meeting of the Swiss Physical Society (SPS). The SPS TASK session was devoted to the CHIPP PhD/Postdoc days, where 42 talks and 18 posters have been presented.
- The [workshop on Physics, Symmetries and Interactions \(PSI 2016\)](#) was held on 16–20 October 2016 at the PSI and welcomed 172 participants from many countries all over the world.
- The [PhD seminar 2016](#) for particle physics PhD students in the Zurich area (PSI, UZH and ETHZ) took place this year on 24–25 November 2016 at ETH Zürich.

## INTERNATIONAL ACTIVITIES

### Scientific cooperation

Particle and astroparticle physics is compelled to extensive transnational and international cooperation, as the research projects in this domain are mostly large undertakings, representing an important intellectual and technological challenge and requiring a large amount of human and financial resources. Research in this field usually involves large infrastructures, which again are the result of national, regional and worldwide collaborations. The table below shows a snapshot of the current experimental collaborations involving CHIPP members.

Further, smaller cooperation projects exist; many of them occur naturally – between groups working in the same field or requiring the same type of infrastructure – or are coordinated bottom-up by CHIPP. Such collaborations may be carried out at an informal level and are sometimes not even noted at the level of the home institution.

Project	Swiss institutes	CHIPP Board Members	Institutes worldwide
High-Energy particle physics			
ATLAS	Bern, Geneva	Beck, Ereditato, Golling, Iacobucci, Mermod, Nessi, Sfyrta, Weber, Wu	180
CMS	ETHZ, PSI, Zurich	Canelli, Dissertori, Grab, Horisberger, Kilminster, Pauss, Wallny	194
LHCb	EPFL, Zurich	Bay, Nakada, Schneider, Serra, Straumann	69
LHC Tier-2	ETHZ, CSCS	Grab	> 200
HL-LHC	EPFL	Rivkin	55
CLIC	ETHZ, PSI	Rivkin	70
FCC	Bern, EPFL, Geneva, PSI	Blondel, Ereditato, Iacobucci, Rivkin	75
Astroparticle physics			
AMS	Geneva	Pohl, Wu	33
ArDM	Zurich	Rubbia	7
CTA	ETHZ, Geneva, Zurich	Biland, Courvoisier, Montaruli, Neronov, Straumann, Canelli	220
DAMIC	Zurich	Kilminster	10
DARWIN	Bern, Zurich	Baudis, Schumann	25
IceCube	Geneva	Montaruli	48
MAGIC+FACT	ETHZ, Geneva	Biland, Neronov, Pauss	25
XENON	Bern, Zurich	Baudis, Schumann	21
Neutrino physics			
GERDA	Zurich	Baudis	17
MICE	Geneva	Blondel	21
NA61 / T2K / HyperK	Bern, ETHZ, Geneva	Blondel, Ereditato, Rubbia	54
SBN (MicroBooNE)	Bern	Ereditato, Weber	30
SHiP	EPFL, Geneva, Zurich	Bay, Blondel, Kilminster, Mermod, Serra, Shaposhnikov	45
WA105 + DUNE	Bern, ETHZ, Geneva	Blondel, Rubbia, Weber	43
High-precision and muon physics			
CREMA	ETHZ, PSI	Hildebrandt, Kirch	9
GBAR	ETHZ	Rubbia	14
MEG II	PSI	Hildebrandt, Ritt	12
Mu3e	ETHZ, Geneva, PSI, Zurich	Blondel, Dissertori, Grab, Hildebrandt, Ritt, Straumann, Wallny	8
nEDM	ETHZ, Fribourg, PSI	Kirch, Weis	15

In parallel to these experimental collaborations and projects, Swiss theorists are involved in numerous international collaborations. The following list shows the largest and most important ones, in which Swiss theory institutes are key players:

- The [LHC Higgs cross-section working group \(LHCHSWG\)](#) was created in 2010 to produce agreements on cross sections, branching ratios and pseudo-observables relevant to the Higgs boson(s);
- The Workshop Series “[Physics at TeV Colliders](#)” are meetings held at Les Houches (France) every second year since 1999.

In addition, University of Zurich, ETHZ and PSI participate in '[HiggsTools](#)' (2014–2017), an FP7 Initial Training Network of the European Commission, whereas the University of Bern is coordinating the activity of the [Flavour Lattice Averaging Group \(FLAG\)](#) (since 2011).

### **Institutional collaboration**

Several CHIPP members are acting as official delegates to international organisations in 2016:

- *Olivier Schneider* (EPFL) is the Swiss scientific delegate to the CERN Council since 2013 on mandate of the State Secretariat for Education, Research and Innovation (SERI).
- *Florencia Canelli* (Uni. of Zurich) represents Switzerland in the Council of the CTAO gGmbH company, which is currently ruling the Cherenkov Telescope Array (CTA) project, while *Ulrich Straumann* (Uni. of Zurich) is the Managing Director of this company.
- *Teresa Montaruli* (Uni. of Geneva) is the Swiss scientific delegate to the General Assembly of the Astroparticle Physics European Consortium (APPEC) since 2013.
- *Bernd Krusche* (Uni. of Basel) continued his longstanding mandate as Swiss representative in the Nuclear Physics European Collaboration Committee (NuPECC).
- *Michael Dittmar* (ETHZ) is the Swiss representative in the Advisory Committee of CERN Users (ACCU) since 2015.
- *Leonid Rivkin* (EPFL and PSI) is mandated by the CHIPP Plenary to represent the Swiss particle physics community in the Restricted ECFA (European Committee for Future Accelerators) from 2013 to 2018. In the Plenary ECFA, he is supported by *Olaf Steinkamp* (Uni. of Zurich, since 2013), *Sigve Haug* (Uni. of Bern, since 2014), and *Andreas Knecht* (PSI, since 2016).
- *Florencia Canelli* (Uni. of Zurich) is, since Nov. 2014, a member of commission C11 of the International Union of Pure and Applied Physics (IUPAP) on particles and fields.
- *Hans Peter Beck* (Uni. of Bern) is the Swiss representative (since 2009) and the co-Chair (since 2013) of the International Particle Physics Outreach Group (IPPOG).
- *Antonio Ereditato* (Uni. of Bern) is the ad interim contact for the Swiss funding agencies (SERI & SNSF) for Swiss participation in the neutrino programme at Fermilab, USA.
- *Marc Türler* (Uni. of Zurich) is, since 2016, the Swiss member of the European Particle Physics Communication Network (EPPCN).

## **COORDINATIVE TASKS**

### **Promotion of the next generation**

CHIPP members and CHIPP institutes continued their efforts to inform the public at large about particle and astroparticle physics and to attract young women and men to this field of research. Throughout Switzerland, more than 50 educational events like information days for BSc and MSc students, for pupils finishing high school and for high-school classes were organised involving more than 3000 young students. One should mention specifically the participation of more than 180 Swiss high-school pupils (at the Universities of Bern, Geneva, Zurich and the ETHZ) in the frame of the [International Masterclasses 'Hands on Particle Physics'](#), where over 13'000 Gymnasium level students in about 200 institutes in 52 countries actually work with real data from the CERN Large Hadron Collider (LHC). A few events for physics teachers have been organised: two at the ETHZ and three at the University of Geneva.

Each institute has its own programme towards young students and often organises special events. This year one should mention in particular the following activities. The University of Basel organised an event in Gelterkinden (BL) entitled '[Quanten und Nanowelten](#)' on 21 May 2016 including experiments, short presentations, etc., both for adults and children. In Bern, there has been among other visits two '**Freshers Days**' with a total of about 150 gymnasia pupils guided through the physics department and also the exhibition of a spark chamber at a Gymnasium. The **EPFL Open Days** on 5–6 November 2016 welcomed about 35'000 persons in total, but obviously not all to the activities proposed by particle physicists. Those were games where children collide beads against a hidden

target to guess its shape; a cosmic ray tracker built for the occasion with 10 planes of 32 scintillating bars each with a display of the events on screen; a series of posters and explanations on cosmic rays, dark matter, CERN, etc., as well as a live display of LHCb events on a big screen. The ETHZ reached out to about 10 secondary schools with [‘ETH-unterwegs’](#) proposing event days for students including hands-on experiments. In Geneva, the [‘Physiscope’](#) demonstrations were presented 344 times reaching 5952 kids! The physics department also participated to the biennial [‘Nuit de la Science’](#) (~25'000 visitors) held in Geneva on 9–10 July 2016 and prepared the exhibition on cosmic ray experiments to which it participates, namely AMS, POLAR and DAMPE. Entitled [‘L’UNIGE dans l’espace... à la chasse des astroparticules’](#) it was exposed from 18 August to 30 September 2016. Particle physicists at PSI are routinely guiding visitors (~1000 per year) through the facilities and a science exhibition in the frame of the PSI-Forum. School classes are also coming with their teachers to visit the PSI school laboratory [‘iLab’](#). Last but not least, the Physics Institute of the University of Zürich organised the [International Physics Olympiad 2016](#) on 11–17 July 2016. This event welcomed roughly 400 secondary school students between 14 and 19 years old from 86 different countries tested on their ability to tackle both theoretical and experimental physics problem.

About 50 visits to CERN were organised, not only for university students in physics and other disciplines, but also for children, high-school pupils, alumni, members of societies, the media, and the public at large. Many institutes also participated to the open day for children towards their professional orientation (‘Nationaler Zukunftstag’). CHIPP Board Members gave about 60 outreach talks on particle physics for high-school students, societies and the general public.

The [CHIPP Prize 2016](#) for the best PhD student in particle physics was awarded to *Mohamed Rameez* (University of Geneva). The laudatio says: “For his leadership in the searches for dark matter annihilation in the sun with the IceCube Neutrino Observatory and his contribution to their theoretical interpretation”. He presented his thesis work at the CHIPP Plenary and received the diploma and the prize money (3000 CHF).

### **Information and coordination tasks supporting research and science**

[CHIPP’s website](#) contains news, documents, minutes of all meetings, as well as the complete membership database. The continuous dialogue between the institutes, which is enshrined in the [CHIPP Statutes and By-Laws](#), aims at having at hand in a timely and transparent manner the information about current and planned research activities. This information is collected annually in the so-called **CHIPP Long-term Financial Tables** and includes for each experiment or project the manpower involvement per institute and the attributed funds for past and current years, as well as projections and needs for the future years. Reformatted in 2015 for an easier edition by the individual project leaders, the tables have been updated again in 2016. It was very useful to have the overall picture with the projection until 2020, especially for the projects intending to request money allocated by SNSF for Funding LArge international REsearch (FLARE) facilities. The process of self-evaluation and self-moderation of ambitions within CHIPP via discussions at the Board meetings reached its objective by having CHIPP projects submitted by 15 November 2016 to be below the total FLARE funding envelop in the period 2017–2020. It is worth noting here that the former steering committee – the so-called **Lenkungsausschuss FLARE** (LA FLARE) – for defining FLARE priorities in the astrophysics and particle physics communities was discontinued this year and is replaced by a short prioritisation talk at the FLARE Panel meeting to be held on 19–20 January 2017.

As in previous years, CHIPP took an active role in the biannual meetings of SCNAT’s **Round Table International**. This information forum on the participation of Swiss groups in international research facilities comprises also representatives of the SERI, SNSF, and ‘Swissuniversities’. With the widening of its scope to other fields of natural sciences than only astronomy and particle physics and it is now officially called Round Table International Organisations and Research Infrastructures (RoTIORI).

Since an agreement in November 2013, *Teresa Montaruli* (Uni. of Geneva) acts as the CHIPP observer in the **College of Helvetic Astronomy ProfessorS** (CHAPS), while *Xin Wu* (Uni. of Geneva)

is since March 2015, the CHIPP observer in the SCNAT **Commission for Space Research (CSR)**. CHIPP also maintained its links with the **Swiss Physical Society (SPS)** with *Hans Peter Beck* (Uni of Bern) who was in 2016 in the SPS Committee as representative of the TASK (“Teilchen-, ASTro- und Kernphysik”) section.

### **Dialogue with society**

The porting of the multi-lingual CHIPP outreach website ([‘particlephysics.ch’](http://particlephysics.ch)) to a new **SCNAT thematic portal on particle physics** was an important development in 2016. The SCNAT offers a firm place with increased visibility among the other fields of science for the material prepared in the frame of the SERI project ‘Verflixtes Higgs’ in 2012–2013, and the follow-up SNSF-supported Agora project ‘Interactions’ (Feb. 2013 to Jan. 2015). The site was kept lively throughout 2016 with the addition of 14 interviews and other news articles. As approved by the CHIPP Board, the articles are authored by *Benedikt Vogel*, a science journalist collaborating with CHIPP since many years, while *Hans Peter Beck* is responsible for their scientific content and *Marc Türler* publishes them on the SCNAT portal both in German and English. CHIPP is grateful to SCNAT for supporting this activity as an important dialogue with the society.

After having screened **the movie “Particle Fever”** (USA, 2013) at Open Air cinemas in 2015 in Lucerne, Aarau and Sion, the last screening was organised this year in Lugano on 22 August 2016. The idea was to reach also the Italian-speaking part of Switzerland at the occasion of the SPS/CHIPP Annual Meeting with success.

An important development was the signature on 4 November 2016 for the Memorandum of Understanding with the **International Particle Physics Outreach Group (IPPOG)**, which officially established itself on 19 December 2016 as a new formal international collaboration (see [CERN Courier March 2017 p5](#)). With CHIPP’s signature, Switzerland becomes a founding member of this organisation devoted to education and outreach. Support from SCNAT was gratefully attributed to cover the annual membership fee.

With *Marc Türler* as new Swiss member in the **European Particle Physics Communication Network (EPPCN)**, CHIPP has now again a link between the CERN press office and the Swiss media, as well as with the communication offices of the institutes related to CHIPP. The contact has been established and a measure of the [media coverage of particle physics in Switzerland](#) is provided on-line.

In addition to the various events, exhibitions, and visits at CERN and PSI, as well as the outreach talks already mentioned in the section on the promotion of the next generation, about 5 interviews were given for the TV, radio or journals. Around ten articles were also written for the CERN Courier and other magazines, newspapers and newsletters.

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