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ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN **EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH**

PLENARY ECFA

110th meeting

Participation in person and by videoconference – 21–22 July 2022

Draft Minutes

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| | G. Veres | Hungary |
| | M. Vos | Spain |
| | W. Wislicki | Poland |
| | L. Živković | Serbia |
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| | D. Newbold | LDG Chair |
| | H. Abramowicz | Former ECFA Chair |
| | M. Krammer | Former ECFA Chair |
| | T. Nakada | Former ECFA Chair |
| Invited: | P. Allport | United Kingdom |
| | G. Arduini | CERN |
| | D. Boumediene | CERN |

| | |
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| N. Colino | CIEMAT |
| E. Previtali | LNGS |
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The meeting, held in hybrid mode, was called to order at 2.00 p.m. on Thursday, 21 July 2022.

1. OPENING REMARKS AND ADOPTION OF THE AGENDA

(Item 1 of the Agenda)

The CHAIR, expressing his pleasure that so many participants had been able to attend the meeting in person, presented¹ his opening remarks, welcoming the attendees and, in particular, the new cohort of PECFA members who had been appointed at the November 2021 meeting. Apologies had been received from J. Bielčíková, J. D'Hondt, M. Mezzetto, A. Read and C. Salgado Lopez.

The Agenda² was adopted.

2. DRAFT MINUTES OF THE 109TH MEETING

(Item 2 of the Agenda) (ECFA/RC/22/516/Draft)

CONDE MUÍÑO (LIP) informed the members that, following the circulation of the draft minutes among the members on 23 June, a correction had been received and the second sentence on page XVII modified as follows:

~~“The Pre-Lab phase had been launched, with the creation of t~~The International Development Team (IDT) ***had been created to prepare for the Pre-Lab phase***, and the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) had set up an expert panel to address issues related to technology development, international collaboration and cost sharing.”

The minutes of the 109th meeting of Plenary ECFA (ECFA/RC/22/516/Draft), as amended, were approved.

¹ See Indico: https://indico.cern.ch/event/1172215/contributions/4922957/attachments/2483335/4263405/Introduction_PECFA_2022.07.21.pdf

² See Indico: <https://indico.cern.ch/event/1172215/>

3. REPORT FROM THE CHAIR

(Item 3 of the Agenda)

The CHAIR presented³ his report, covering ECFA's statement on the Russian invasion of Ukraine and an update from the Ukrainian RECFA representative, M. Shul'ga, on the situation at the Kharkiv Institute of Physics and Technology and in Kharkiv more generally; the implementation plans for the 2021 ECFA detector R&D roadmap; the status of and plans for ECFA activities in relation to a future e^+e^- factory; recent RECFA country visits; the Joint ECFA–NuPECC–APPEC (JENA) Seminar in Madrid in May 2022 and other JENA activities; news on the ILC project; and the schedule for ECFA meetings and RECFA country visits in the second half of 2022 and in 2023.

NAKADA (EPFL) and VALLÉE (CPPM) explained that, to complement the work of the International Expert Panel that was being set up by the ILC International Development Team (IDT), KEK was drawing up a plan to address the critical and high-priority accelerator R&D items for the ILC project, in collaboration with ICFA and the international laboratories, and had already requested the necessary budget from the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT).

In reply to a question from VALLÉE concerning the seven detector R&D (DRD) collaborations that were being considered as part of the implementation plans for the detector R&D roadmap, the CHAIR said that, for each R&D topic, the full community had been involved in the roadmap discussions throughout 2021. The next step would be for the leaders of the various task forces to launch bottom-up discussions with all interested parties, including international partners, in order to determine a possible structure for the DRD collaborations, which would hopefully be finalised in summer 2023. More information would be provided in the talk under Item 11 c) of the agenda.

In reply to a further question from VALLÉE, the CHAIR explained that, while the existing detector R&D collaborations were overseen by the LHC Experiments Committee (LHCC), the future DRD collaborations, which would integrate the existing ones, would be reviewed by a new committee, the Detector Research & Development Committee (DRDC), set up at CERN. So far, the existing collaborations had indicated that they were satisfied with the planned oversight structure. The collaborations for certain topics where the way forward was less clear, such as quantum sensors and emerging technologies, were expected to take longer to set up, but the groundwork was already being laid for all of the topics. Confirmation had also

³ See Indico:

https://indico.cern.ch/event/1172215/contributions/4922958/attachments/2466245/4263883/PECFA_18-19Nov2021-draft5.pdf

been received from the CALICE collaboration that it could envisage integrating into the calorimetry DRD collaboration.

In reply to VOS (IFIC Valencia), the CHAIR said that, due to the administrative overheads involved in setting up and running a DRD collaboration, their number would be limited to just one per technology area and they would, as a result, be large. Each community would be given free rein to define the structure of its own DRD collaboration and encouraged to use synergies wherever possible: for example, the silicon detector community (about 85% of whose members were already involved in RD50) and the gaseous detector community (about 50% of whose members were already involved in RD51) would be encouraged to work together on software developments under the umbrella of one DRD collaboration. Certain cross-cutting topics, such as mechanics and cooling, would be better addressed not by a dedicated DRD collaboration but by a separate, smaller entity, linked to each of the relevant DRD collaborations by a mechanism that remained to be defined.

In reply to HUSEMANN (Karlsruhe Institute of Technology), the CHAIR said that the proposed organisational structure for the detector R&D roadmap implementation phase had been presented first to the CERN Scientific Policy Committee and the Council and then to the funding agencies, after which discussions had begun with the existing R&D collaborations. RD50 and RD51 had initially been reluctant to support the proposal but, following constructive discussions with the management of both collaborations, consensus had been achieved on the need for a new structure, one notable advantage of which was that it would ensure continued employment for the many engineers and technicians currently working on the LHC experiment upgrades. RD50 and RD51 had also accepted the proposed review process, with some minor modifications. The details of the transition from the existing R&D collaborations to the DRD collaborations were still being discussed, but no particular difficulties were anticipated.

GIANOTTI, noting that all collaborations at CERN were reviewed by a scientific committee in order to ensure that the highest standards were met and upheld, said that RD50 and RD51, which focused primarily on R&D for the LHC experiments, were currently reviewed by the LHCC. However, it would not be feasible for the LHCC to take on the review of the new DRD collaborations, which would be numerous and would cover not only LHC-related matters but also fixed-target experiments and future projects. The former Detector Research Committee, where R&D for the LHC experiments had begun in the early 1990s, had provided a good model for the proposed new Detector Research and Development Committee (DRDC).

The CHAIR reiterated that a dedicated review committee was needed in order to deal with the wide range of topics that would be addressed under the roadmap, which included the

upgrades of the ALICE and LHCb experiments and detector developments for the Future Circular Collider, fixed-target experiments and the Electron–Ion Collider.

In reply to DOBRIN (Institute of Space Science), the CHAIR said that all interested parties would be invited to join the bottom-up discussions organised by the roadmap task forces, to identify an area to which they would like to contribute and to negotiate with their national funding agencies to secure the required financial and personnel resources for their institute. Each funding agency would then sign a memorandum of understanding.

In reply to a further question from DOBRIN, the CHAIR said that, as spelled out in the roadmap, many experiments had benefited significantly from blue-sky R&D in the past and its continuation was therefore considered to be essential. The funding agencies had been informed that funding strategic R&D alone was not enough and that some financial resources must be set aside for blue-sky R&D, as well as for any experiment-specific R&D that might emerge over time and branch off from the strategic R&D programme. Further investigation of the funding opportunities in each participating country was needed in order to ascertain how such resources could be secured.

In reply to BERNARDI (APC Paris CNRS/IN2P3), the CHAIR drew the Committee's attention to the statement on slide 30: "the Advisory Panel of MEXT for the ILC had concluded that it was premature to proceed towards the Pre-Lab, and recommended re-evaluation of the roadmap of the ILC project in a global context, taking into account the progress in other Higgs factory studies". As shown in its statement on slide 32, KEK intended to carry out the recommended re-evaluation while also continuing with its planned programme of accelerator R&D; a decision from MEXT concerning the funding for that programme was expected shortly. In addition, the IDT and the International Expert Panel planned to hold discussions with ministries in numerous countries and with the CERN Management in order to lay the groundwork for a global collaboration; MEXT would be kept in the loop throughout. ICFA had indicated that it would like to see some positive developments, such as a funding commitment from MEXT and the launch of international discussions, over the next year.

NAKADA added that the Pre-Lab could not be created until the Japanese government had officially expressed its intention to host the ILC, which it was not yet ready to do. Therefore, the question of which country would host the facility was currently decoupled from the R&D activities.

In reply to RIVKIN (PSI/EPFL), NAKADA said that, although preparations for the ILC were still at the engineering design rather than the technical design study stage, certain activities covered by the accelerator R&D roadmap, such as the development of superconducting

radiofrequency technologies and positron sources, also applied to the ILC, and the IDT had contributed to the drafting of the roadmap in those areas.

NEWBOLD (STFC) underlined that, while the accelerator R&D roadmap had been designed not to include the items specifically needed for e^+e^- development, there was some overlap in terms of personnel, capabilities and time between the work to be carried out under the roadmap and the preparations for the ILC.

BURROWS (University of Oxford) said that if KEK successfully secured the resources required for its R&D programme from MEXT, any European contributions would focus on those activities that were also covered by the accelerator R&D roadmap.

The Committee took note of the report by the Chair and of the additional information provided during the discussion.

4. ENDORSEMENT OF NEW ECFA / RECFA AND ECR PANEL MEMBERS (Item 4 of the Agenda)

The CHAIR presented⁴ the list of new PECFA, RECFA and ECR Panel members, reminding the Committee that, in November 2021, following the change in ECFA's composition whereby major laboratories except for CERN were now represented through the Laboratory Directors Group (LDG), it had endorsed his proposal to phase out the current ECR Panel members from DESY and LN Frascati at the end of their mandates and to allow countries with laboratories in the LDG to add a fourth member to the ECR Panel.

The Committee unanimously endorsed the following PECFA appointments:

- A. Lucotte of France, replacing J.-L. Biarrotte;
- J. Albrecht of Germany, replacing B. Spaan.

The Committee unanimously endorsed the following RECFA appointments from among the existing PECFA members:

- M. Bogilomov of Bulgaria, replacing P. Iaydjiev;
- D. Bortoletto of the United Kingdom, replacing M. Klein, who would remain a PECFA member.

⁴ See Indico:

https://indico.cern.ch/event/1172215/contributions/4922960/attachments/2483338/4263890/Endorsements_PECFA_2022.07.21.pdf

The Committee further took note that Bulgaria had not yet nominated a new PECFA member to replace P. Iaydjiev, but was expected to do so prior to the November meeting.

On behalf of PECFA, the CHAIR thanked the outgoing members for their excellent work and their commitment to ECFA and welcomed the new members.

The Committee unanimously endorsed the following ECR Panel appointments:

- E. Bagnaschi of CERN, replacing J. Baglio;
- N. Zardoshti of CERN, replacing L. Brenner;
- G. Räuber of Austria, replacing G. Inguglia;
- J. Degens of the Netherlands, replacing A. Aggarwal;
- S. Klaver of the Netherlands, replacing L. Doremalen;
- L. Brenner of the Netherlands;
- J. Jovicevic of Serbia, replacing P. Milenovic;
- L. Gomez of Spain, replacing P. Manteca.

The Committee further took note that:

- in keeping with the decision to phase out representatives of DESY and LN Frascati at the end of their mandates, outgoing member H. Jansen of DESY would not be replaced;
- nominations for ECR Panel members from CIEMAT, IRFU, IJCLab, PSI and STFC-RAL were expected in November.

5. REPORT FROM THE EARLY-CAREER RESEARCHERS PANEL (Item 5 of the Agenda)

KIRSCHENMANN (Helsinki Institute of Physics) presented⁵ a report on the recent activities of the Early-Career Researchers (ECR) Panel, highlighting the working groups that it had set up on a variety of topics, its forthcoming survey on career prospects and diversity in

⁵ See Indico:

<https://indico.cern.ch/event/1172215/contributions/4922962/attachments/2483565/4263874/Update%20on%20activities%20in%20the%20ECR%20ECFA%20-PECFAJul22.pdf>

particle physics and the participation of Panel members in the JENA Symposium in May 2022. Finally, noting that the Panel had greatly appreciated its fruitful interactions with the ECFA Chair and Secretary to date, he underlined the importance of the Panel being informed, well in advance, of the items that would be discussed at each upcoming PECFA meeting, so that it could prepare its input effectively.

The Committee took note of the presentation by Kirschenmann.

6. REPORT FROM THE RECOGNITION TASK FORCE

(Item 6 of the Agenda)

BOUMEDIENE (CNRS/IN2P3 LPC Clermont-Ferrand) presented⁶ the main findings and recommendations of the JENA working group on the recognition of individuals in large collaborations, which had been set up following ECFA's community-wide survey on recognition in 2018, with the goal of obtaining more detailed feedback on recognition from a wide range of collaborations in order to produce a comprehensive report⁷, which had been published in May 2022.

The CHAIR thanked Boumediene and the rest of the working group for their hard work on a very important topic.

In reply to FARRINGTON (University of Edinburgh), BOUMEDIENE said that the arguments for and against the sharing of internal documentation, such as unpublished papers and experiment results, had been the subject of much discussion, including by a dedicated working group in one of the collaborations. Each group that discussed the subject tended to come to the same conclusion, namely that it was risky to make internal documentation completely public, but sharing it with recruiters was generally acceptable, provided that it was treated confidentially. Thus, some collaborations gave their members free rein to share internal documentation in the context of a job application, while others were more cautious. At CERN, some sensitive results could also be shown during a PhD defence, provided that the publication of the thesis was delayed until the results were publicly available. In general, no single, clear rule governing the sharing of internal documentation existed and decisions tended to be made on a case-by-case basis.

⁶ See Indico:

<https://indico.cern.ch/event/1172215/contributions/4950359/attachments/2483643/4264007/ecfa-recognition-report.pdf>

⁷ The working group's full report can be found here:

http://nupecc.org/jenaa/docs/Recognition_20220512.pdf

In reply to a further question from FARRINGTON, BOUMEDIENE said that the working group intended to explore further the advantages of sharing information – not necessarily full scientific papers – with parties outside a collaboration.

The CHAIR and FARRINGTON remarked that the review of lengthy internal documentation represented a significant undertaking for recruiters.

ŽIVKOVIĆ (Institute of Physics Belgrade) said that internal documentation alone was not necessarily a reliable indicator of the contribution of an individual to a particular study and, in the context of a job application, should be accompanied by a letter from the experiment spokesperson or project leader, providing further details of the work undertaken by the candidate. Such a system undeniably placed an additional burden on the management of an experiment, but had been used by some collaborations in the past.

In reply to SPHICAS (CERN/University of Athens), who suggested that the collaborations be asked to provide official responses to the working group's recommendations on internal documentation in order to enable the working group and ECFA to better understand their views before continuing with their own discussions, BOUMEDIENE said that the working group had discussed the sharing of internal documentation with the collaborations while drafting its report.

SPHICAS pointed out that requesting an official response to a set of recommendations would trigger a different mechanism within the collaborations than a simple request for information, potentially involving different people, and might therefore result in a different response.

The CHAIR remarked that, although such an approach might produce a unanimous response from the large LHC collaborations, the smaller collaborations within the field of nuclear physics, for example, tended to have very different attitudes and policies. A good approach would be to send the working group's report to the collaborations and, if the working group agreed, to request feedback on the list of recommended best practices contained therein, to inform ECFA's future discussions. However, the collaborations should be free to decide for themselves which, if any, of the recommendations to implement and should not be scored on their performance, as had been suggested in the past. Any differences between the collaborations would, in any case, be revealed in the next iteration of ECFA's survey on recognition.

In reply to LEWITOWICZ (GANIL/NuPECC), BOUMEDIENE said that it was not clear whether the answers given by respondents to the recognition survey had been influenced by the COVID-19 pandemic, but the next survey would hopefully shed light on that question.

The CHAIR, referring to the working group's statement that the community should, "when confronted with external evaluation, keep explaining what are the tracers of recognition within the JENAS community, and what long author lists mean" (slide 29), said that, a decade previously, ECFA and the EPS-HEPP Board had produced an information document for people from outside the HEP community, explaining, among other things, what the role of convenor entailed and what it meant to be sent to give a plenary talk at a conference on behalf of a 3000-strong collaboration. Despite not being universally appreciated by all of the communities, the document had been a useful tool and the EPS-HEPP Board was considering producing an updated version, in collaboration with ECFA.

The Committee took note of the presentation by Boumediene and of the additional information provided during the discussion.

The meeting was suspended at 4.15 p.m. and resumed at 4.45 p.m.

7. REPORT FROM CERN (Item 7 of the Agenda)

MNICH (CERN) presented⁸ a status report on CERN, covering the successful restart of the LHC at the record energy of 13.6 TeV; the 2021–2022 dipole training campaign; the completion of the Phase 1 upgrades in preparation for Run 3; the status of LHC computing; the timeline for the completion and inauguration of the new CERN Data Centre in Prévessin; the impact of the Russian invasion of Ukraine on preparations for the HL-LHC and on the Phase 2 upgrades of ATLAS and CMS; the planned upgrades of ALICE and LHCb; the FCC Feasibility Study; developments at the Neutrino Platform; the CERN Council Resolutions on the future of the Organization's involvement with the Russian Federation, Belarus and JINR; the tenth anniversary of the Higgs boson discovery and the progress of the Science Gateway construction.

In reply to BORTOLETTO (University of Oxford), MNICH said that, as far as the ATLAS and CMS Phase 2 upgrades were concerned, the impact of inflation and the rising costs of energy and materials would hit the funding agencies in the participating countries hardest, although CERN would, of course, also be affected. The Management had presented an initial estimate of the cost increases at the April 2022 meetings of the Resources Review Boards, with the caveat that they were difficult to predict due to market volatility, as most notably illustrated by the factor-of-two increase and then rapid 30% decrease in the price of steel in a very short period of time. The foundries had already provided CERN with estimates of the forthcoming

⁸ See Indico:

<https://indico.cern.ch/event/1172215/contributions/4922963/attachments/2483556/4263856/JM%20PECF A%20Jul%202022-final.pdf>

increases in microelectronics prices. Thanks to the special conditions enjoyed by CERN and the collaborations, price increases would be capped at 7% in 2022 and 2023 but, with delivery dates often more than a year in the future, that cap would not apply to all of the items currently being manufactured. It was imperative to keep a close eye on market developments and speed up as many manufacturing processes as possible, particularly in electronics.

In reply to VALLÉE, MNICH said that the planned Russian contributions to the HL-LHC machine had amounted to 30 MCHF and had not required any special expertise found only in the Russian Federation. The components in question would now be produced at CERN, at an expected cost of 40 MCHF, and no delays were anticipated with respect to the original schedule.

GIANOTTI remarked that the insourcing of certain components had already begun before the invasion of Ukraine, as it had become clear that the Russian Federation would not be able to deliver all of its contributions on time.

In reply to a question from BERNARDI concerning the debate around the signing of scientific papers in the wake of the invasion of Ukraine, MNICH said that publication policy was in the hands of the experiment collaborations and decisions did not require the approval of the CERN Management or the Council. However, the Management continued to encourage the collaboration leaders, especially those of the large LHC experiments, which could serve as a model for the other collaborations, to seek a common solution.

In reply to HAUNGS (KIT Institute for Astroparticle Physics/APPEC), MNICH said that CERN-employed authors were, naturally, participating in the discussions around the signing of papers along with the other members of their collaborations, and had not received any official advice or guidance from the Management on the matter.

The Committee took note of the presentation by Mnich and of the additional information provided during the discussion.

8. REPORT FROM APPEC (Item 8 of the Agenda)

HAUNGS presented⁹ a report from the Astroparticle Physics European Consortium (APPEC), focusing in particular on the mid-term update of the European Astroparticle Physics Strategy for 2017–2026, which was set to be published at the end of 2022.

⁹ See Indico:
https://indico.cern.ch/event/1172215/contributions/4922964/attachments/2483362/4263457/PECFA_July_22_APPEC_Haungs.pdf

In reply to VOS, HAUNGS said that, although predicting the level of resources required to fulfil most elements of the Strategy was straightforward – for example, the cost and desired number of gamma-ray telescopes was clearly defined – the same was not true of the gravitational waves programme. The resources required for the construction of the Einstein telescope were not included in the gravitational waves section of the resources chart on slide 9, and ensuring that the project did not end up consuming the majority of the funding currently allocated to other areas would be a major challenge for APPEC and the wider astroparticle physics community.

In reply to a further question from VOS, HAUNGS said that the construction of the Einstein telescope would likely start in 2025, following the next update of the ESFRI Roadmap, would take 10–15 years and would cost 1.8 BCHF.

The Committee took note of the report by Haungs and of the additional information provided during the discussion.

9. REPORT FROM NUPECC

(Item 9 of the Agenda)

LEWITOWICZ presented¹⁰ a report from the Nuclear Physics European Collaboration Committee (NuPECC), focusing in particular on the NuPECC Long-Range Plan 2024, nuclear physics research infrastructures and networks in Europe and European involvement in facilities overseas, and the applications of nuclear science in society, which would be elaborated on in the forthcoming NuPECC Report on Nuclear Physics in Everyday Life.

In reply to VALLÉE, LEWITOWICZ said that the future European contribution to the Electron–Ion Collider (EIC) project in the United States could not yet be quantified, as the community-wide discussions had hitherto focused more on physics than funding. The United States had begun to discuss financial contributions with individual countries in Europe, but not with Europe as a whole.

The Committee took note of the report by Lewitowicz and of the additional information provided during the discussion.

¹⁰ See Indico:

https://indico.cern.ch/event/1172215/contributions/4922966/attachments/2482447/4263335/PECFA_NuPECC%202022%20Marek%20Lewitowicz%2021072022_vs.pdf

10. REPORT FROM LNGS

(Item 10 of the Agenda)

PREVITALI (LNGS) presented¹¹ a report from the Gran Sasso National Laboratory (LNGS), highlighting the Laboratory's leading role in direct dark matter searches, plans for a next-generation neutrino-less double-beta-decay experiment, the new LUNA-MV accelerator at the Ion Beam Facility, which was scheduled to start taking data at the beginning of 2023, the government-funded LNGS Future project to fully refurbish and upgrade the Laboratory, and plans for closer coordination between the deep underground laboratories in Europe.

In reply to BORTOLETTO, PREVITALI said that the aim of the Workshop on EU Underground Laboratories, which had taken place in April 2022, had been to bring together representatives of the various underground laboratories in Europe to develop a common programme for next-generation rare event searches. The workshop had revealed that some laboratories were much more advanced than others in certain areas; for example, LNGS had particularly well-developed safety policies, while others were more advanced in materials screening. The laboratories had agreed to set up information-sharing mechanisms and to develop a common strategy for the future of their field; it was hoped that the approach to drafting that strategy would be well defined by the end of 2022, when it could be presented to APPEC. In addition, the laboratories were working on a joint request for European Union funding in order to develop a specific project of common interest.

The Committee took note of the report by Previtali and of the additional information provided during the discussion.

The meeting was suspended at 6.35 p.m. on Thursday, 21 July 2022 and resumed at 9.00 a.m. on Friday, 22 July 2022.

11. IMPLEMENTATION OF THE EUROPEAN STRATEGY

(Item 11 of the Agenda)

a) Follow-up on the FCC Feasibility Study

ZIMMERMANN (CERN) presented¹² a status report on the FCC Feasibility Study, covering the cost estimate and spending profile for the first-stage FCC-ee machine, highlights

¹¹ See Indico:
https://indico.cern.ch/event/1172215/contributions/4922967/attachments/2483867/4264480/LNGS_ECF_A.pdf

¹² See Indico:
https://indico.cern.ch/event/1172215/contributions/4922975/attachments/2483984/4264687/220722_FCC-FeasibilityStudyStatus-AP.pdf

from the FCC Week 2022 in Paris, preparations for the 2023 mid-term review, the results of the recent sustainability and carbon footprint studies, the latest plans for the placement and layout of the machine, ongoing and planned activities in collaboration with the French and Swiss authorities, the updated collider parameters for the FCC-ee and the FCC-hh, an overview of the organisational structure of the Feasibility Study and the status of the global FCC collaboration.

In reply to HUSEMANN, ZIMMERMANN said that the percentage of energy from renewable sources was currently around 50% in Switzerland and 20% in France. However, the energy landscape in Europe was likely to change significantly by the start of the FCC era and, in addition, the possibility of CERN installing photovoltaic stations to generate its own energy had not yet been studied. A document covering the plans and deliverables for the 2023 mid-term review was being prepared for presentation to the Council in September, at the latter's request.

In reply to CARON (Nikhef), ZIMMERMANN explained that the beam current and bunch configuration in the FCC-ee could be adjusted, enabling the machine to run at different energies depending on the amount of power available. Once the details of such adjustments had been worked out, they would be included in future presentations.

In reply to VALLÉE, GIANOTTI said that, in addition to the FCC-ee spending profile (slide 4), a funding model was being developed. The project would be funded from a combination of CERN's budget and special contributions from outside stakeholders. The next step would be to discuss the model with the French and Swiss authorities in the coming weeks, and it would then be presented to the Council for feedback, hopefully in December, with the ultimate aim of producing a consolidated funding model by the end of 2023.

The Committee took note of the report by Zimmermann and of the additional information provided during the discussion.

b) Implementation of the Accelerator R&D Roadmap

NEWBOLD presented¹³ a report on the Accelerator R&D Roadmap, focusing in particular on the proposed coordination structure for the implementation phase, the financial and personnel resources required and the input received so far from funding agencies, and the goals and organisation of each of the five technical areas covered by the roadmap, namely high-

¹³ See Indico:

https://indico.cern.ch/event/1172215/contributions/4922976/attachments/2484005/4264733/LDG_Update_220722.pdf

field magnets, laser/plasma acceleration, RF structures, muon colliders and energy-recovery linac (ERL) technology.

In reply to BORTOLETTO, NEWBOLD said that the vast majority of the expert panels involved in drafting the roadmap had concluded that the technology that they had studied was viable, but would not be affordable without the industrialisation of the individual components. For example, collaboration with industry on high-temperature superconducting and Nb₃Sn technologies must begin as soon as possible in order to ensure that the required conductors and magnet assemblies would be available for use in the next generation of colliders. Collaboration with industry naturally carried a financial cost, but the spending could be justified.

In reply to a question from the CHAIR concerning the growing interest in muon colliders in the United States, NEWBOLD noted that the deputy chair of the Accelerator R&D Roadmap Panel had been from Brookhaven National Laboratory and had thus been in a position to provide it with valuable insight into the plans for the future of particle physics in the United States, where muon colliders were indeed gaining in popularity and had been discussed in detail during the Snowmass process. A potential muon collider would need to be a worldwide project and the International Muon Collider Collaboration welcomed the increasing interest. If US plans for a muon collider progressed significantly, Europe would need to adapt its own plans accordingly.

In reply to VOS, NEWBOLD said that, as shown in the “Five-year contributed resources” chart on slide 7, R&D towards ERLs was already benefiting from a substantial amount of funding, mostly in France, Germany and the United Kingdom. However, for the work under way in those countries to deliver results, more funding would be needed.

In reply to a further question from VOS, NEWBOLD said that the ongoing study of the applicability of ERL techniques to e^+e^- Higgs factories, which was being carried out in the framework of the accelerator R&D roadmap, had established that ERL technologies were unlikely to undergo any transformational technological development that would radically change the design of the FCC-ee or the ILC. However, further study was needed, and was provided for in the roadmap. If the resources available for R&D towards ERLs proved to be insufficient, such studies would likely become decoupled from the roadmap and be pursued independently, which would not be beneficial for the field. It was therefore important to ensure that adequate funding was allocated to developing ERL technologies under the umbrella of the roadmap.

The Committee took note of the report by Newbold and of the additional information provided during the discussion.

c) Implementation of the Detector R&D Roadmap

ALLPORT presented¹⁴ a report on the detector R&D roadmap, focusing in particular on the General Strategic Recommendations set out therein, the ongoing discussions with funding agencies, the proposed organisational structure of the DRD collaborations and the timeline for the implementation phase.

In reply to VALLÉE, ALLPORT explained that the Detector Research and Development Committee (DRDC) would probably meet to review the work of the DRD collaborations fairly frequently at the start of the implementation phase, while the activities were getting under way, before settling into an annual rhythm in the longer term.

In reply to HUSEMANN, ALLPORT said that the goal was for the DRD collaborations to be up and running by 2024, but 100% of the resources could not be expected to be in place by then, especially given the different funding cycles in the participating countries. Discussions with funding agencies continued and their commitments would hopefully ramp up gradually over the coming years, reaching a steady state around 2026.

The CHAIR added that it would, indeed, be impossible to find a launch date for the DRD collaborations that would suit the funding agencies in all of ECFA's 25 member countries.

In reply to AUFRAY (CERN), ALLPORT explained that each of the detector R&D roadmap task forces would be asked, in autumn 2022, to start organising open meetings of each of the communities within their field, to discuss the appropriate structure and composition of the future DRD collaborations. The existing RD 50 and 51 collaborations, which fell within the scope of task forces 3 and 1, respectively, were expected to play a major role in helping to bring their communities together. Similarly, the CALICE and Crystal Clear collaborations, along with European Union-funded initiatives such as the AIDAInnova project, would provide a good starting point for rallying the calorimetry community.

The CHAIR added that, due to the significant administrative overheads involved, it was not practical to form a separate DRD collaboration for each specific sub-topic. The proposed DRD collaborations were therefore relatively broad in scope and might wish to introduce substructures to divide up their activities into sub-topics, while ensuring that the synergies between the latter were exploited to the fullest extent.

¹⁴ See Indico:

https://indico.cern.ch/event/1172215/contributions/4922978/attachments/2483927/4264653/Plenary_ECF_A_Detector_RD_Roadmap_Implementation_220722.pdf

ALLPORT remarked that, although each DRD collaboration would be expected to study all of the detector R&D themes identified for its area (slide 5), they would be free to organise their work packages however they saw fit.

In reply to JORAM (CERN), who expressed the hope that the R&D proposals to be prepared by summer 2023 would be concise, as the roadmap already contained details of the proposed programmes, ALLPORT indicated his agreement and added that the DRDC's review of the DRD collaborations' activities would be lightweight, so as not to overburden them with bureaucracy; indeed, the proposed structure for the roadmap's implementation phase had already been thinned down to make it more agile.

In reply to SCHOPPER (CERN), ALLPORT said that the proposed funding stream and structure for the implementation phase (slides 13–14) applied only to the strategic and not to the blue-sky or experiment-specific R&D. Funding would flow to the DRD collaborations through the participating institutes, in line with the model currently used by the CERN experiments, and the institutes and collaboration boards would be in charge of the resources and deliverables. The collaborations might also be involved in activities funded separately by individual institutions, some of which might feed into neighbouring disciplines, but without any requirement for reporting under the mechanism outlined in the presentation.

POESCHL (IJCLab) commented that both the existing R&D collaborations, such as CALICE and Crystal Clear, and CERN's ongoing involvement with the AIDAInnova project functioned very successfully and the goal should be to bring the best of those two worlds together to lay the groundwork for future R&D in the field of calorimetry.

ALLPORT remarked that the success of the task forces in bringing people together constructively during the roadmap drafting process made them the ideal groups to lead the implementation phase and to unite the various communities to form effective DRD collaborations.

In reply to a follow-up comment from POESCHL, who noted that the existing R&D collaborations provided another useful starting point, ALLPORT said that, while work would need to start from scratch in certain areas, the intention was indeed to take advantage, wherever possible, of what already existed.

The Committee took note of the report by Allport and of the additional information provided during the discussion.

The meeting was suspended at 10.45 p.m. and resumed at 11.10 a.m.

d) Physics Beyond Colliders

ARDUINI (CERN) presented¹⁵ a report on the Physics Beyond Colliders (PBC) study group, highlighting its input to the 2020 update of the European Strategy for Particle Physics, its recently updated mandate and its ongoing studies of the various options for post-LS3 activities in the North Area and long-lived-particle and fixed-target programmes at the LHC, as well as for a number of non-accelerator-based experiments.

In reply to the CHAIR, ARDUINI explained that the PBC study group would review the physics potential of the various possible post-LS3 activities at the ECN3 beamline and support the experiment collaborations in preparing their proposals. The SPS and PS Experiments Committee (SPSC) would then analyse, first, the need for a high-intensity facility at ECN3 and, second, the proposals themselves. The final decision on each proposal would be taken by the Research Board (RB).

GIANOTTI added that the SPSC would make its recommendation to the RB based on the scientific value of each proposal. The RB would first decide whether it agreed with the SPSC's analysis and then assess the resources required for each proposal. The work done so far on post-LS3 ECN3 options was highly promising.

The CHAIR remarked that it was good to see a timeline now in place for the review of the proposals by the SPSC.

VALLÉE, underlining that the role of the PBC study group was to work with the experiment collaborations to prepare the technical, scheduling and funding aspects of each proposal, as well as to investigate the physics reach of the various options and how they would complement other experiments at CERN and beyond, said that the study group intended to produce, by summer 2023, a document containing all of the information that the SPSC would need in order to make its recommendations, including a summary of each proposal.

GIANOTTI stated that the PBC study group's assessment of the infrastructure required for each proposal and the feasibility of a high-intensity facility, as well as its study of topics such as radiation protection, would provide essential input for the SPSC, which was not in a position to carry out such technical work itself.

¹⁵ See Indico:

https://indico.cern.ch/event/1172215/contributions/4922979/attachments/2483928/4264894/PBC_ECFA_22072022_22072022.pdf

VALLÉE remarked that physics reach, ~~another parameter that neither the SPSC nor the individual collaborations could assess for themselves~~, in the worldwide context was another important topic for the PBC study group. For example, it had created benchmarks to compare the reach of the various proposals for the study of feebly interacting particles (FIPs).

In reply to a question from RIVKIN concerning the body or bodies involved in assessing global physics priorities, LANFRANCHI (INFN Frascati) said that, in the field of feebly interacting particles, the FIP Physics Centre had undertaken to produce an overview of potential future experiments at CERN and worldwide, inviting input from representatives of a range of neutrino and long baseline experiments. The October 2022 Workshop on Feebly Interacting Particles, which would be attended by representatives of the world's major particle physics laboratories, would provide a good opportunity to explore the subject more deeply, compare plans and create synergies.

GIANOTTI said that the PBC study group had been set up with the twofold goal of both exploiting the CERN injector complex with experiments that were complementary to the LHC and supporting other experiments in Europe, for example in the areas of magnet development and measurement of the proton electric dipole moment.

In reply to a further request for clarification from RIVKIN, VALLÉE said that the ~~PBC study group~~ FIPs Physics Centre was the overarching PBC body in charge ~~of the ongoing assessment of global physics priorities~~ of assessing the physics reach of FIPs projects, but that complementary work was being done elsewhere. For instance, the Beyond the Standard Model (BSM) PBC working group ~~at the FIP Physics Centre~~, which dealt with all aspects of BSM physics, had recently invited certain eminent theorists to participate in discussions around flavour physics at the ECN3 beamline. The overview document that the PBC study group planned to draw up would assess the relevance of the HIKE programme in particular and, to some extent, the TauFV experiment, in comparison with other experiments worldwide, including Belle II and the B-physics programme at CERN.

The Committee took note of the report by Arduini and of the additional information provided during the discussion.

The minuted part of the meeting ended at 11.45 a.m.