

Minister of Education
Sanni Grahn-Laasonen
Ministry of Education and Culture
P.O. Box 29
FI - 00023 GOVERNMENT

ECFA/Secr./17/1737

25 July 2017

Subject: 2017 RECFA visit to Finland

Dear Minister,

It is my privilege to write to you on behalf of the European Committee for Future Accelerators (ECFA), which met in Helsinki on 19 and 20 May 2017, in accordance with its mandate to visit CERN's Member States on a rotational basis and to report its findings to the national scientific authorities, as well as to the CERN Council during its European Strategy Sessions.

During the visit the Committee heard presentations pertaining to the organisation, funding and scientific activities of the high-energy physics (HEP) community in Finland.

The meeting started with a very interesting presentation by Docent Riitta Maijala, the Vice-President for Research of the Academy of Finland and Chair of the National Infrastructure Committee, about the decision-making process behind the allocation of funds to national and international infrastructure projects. Finland has a remarkable commitment to keeping its top ranking in terms of R&D expenditure. This financial investment is matched by a relatively large number of students in science and technology. The Committee took note of the recent decrease in the percentage of GDP invested in R&D and hopes that this trend can be reversed.

The Helsinki Institute of Physics (HIP) coordinates research at CERN and FAIR at the national level, and provides local laboratory infrastructure. HIP has five member universities (the Universities of Helsinki and Jyväskylä, Aalto University, and the Tampere and Lappeenranta Universities of Technology) and is hosted by the University of Helsinki. The HEP community is focused on three projects at the Large Hadron Collider at CERN, the CMS and TOTEM experiments (Helsinki), which share the same interaction point at the LHC, and the ALICE experiment (Jyväskylä), making important and highly visible

contributions to the science and the detectors in each case. The Committee noted that the close cooperation between the CMS and TOTEM teams in Finland should serve as an example for cooperation between the two collaborations.

Finland's in-kind contribution to the phase-1 upgrade of the CMS and ALICE detectors is highly appreciated. In spite of the decline in the percentage of GDP invested in R&D, the Committee appreciates the efforts of the Ministry of Education and Culture and of the Academy of Finland to sustain the financial and human resources needed for the HEP community to actively participate in the current and future research programmes at CERN. The Committee hopes that the contribution to the upcoming phase-2 upgrade will also be secured in the very near future, to preserve the high standing of the Finnish groups.

The Committee felt that, at this very positive stage of development in the HEP community, it might be advantageous to broaden the scope of the research into areas such as neutrino physics or the science of electron-positron colliders. The latter would be important to strengthen the existing participation of Finnish accelerator physicists in future electron-positron colliders, such as the CLIC project at CERN. The upcoming European Strategy Update by the CERN Council, in which Finland should play an important role, could be a good time to consider long-range planning for the Finnish HEP community.

The overall quality of theoretical activities is broad and excellent. This is reflected by the fact that the theory community recently succeeded in attracting two ERC consolidator grants. The cooperation between Finnish theorists and experimentalists could be expanded, especially since some topics of research are common to both communities. The organisation of common discussion fora could indeed be profitable to both sides.

Finland's nuclear physics activities are well balanced, with a focus on the international flagship projects ISOLDE at CERN and FAIR at Darmstadt, as well as on the national accelerator facility JYFL-ACCLAB at Jyväskylä. There is a very interesting mix of ongoing and future projects, with excellent interdisciplinary activities ranging from basic to applied sciences, extending as far as archeology and the arts. JYFL-ACCLAB is to be commended for its strong national and international status and for the large number of foreign users. The Finland-Sweden consortium in FAIR, which involves common in-kind and cash contributions, is another basis for fruitful collaboration.

The Committee was also presented with metrology and instrumentation projects carried out in collaboration between HIP and the Radiation and Nuclear Safety Authority (STUK) in diverse fields such as nuclear safety, security and medicine, with a potentially significant impact on society. In atmospheric science and the related instrumentation, Finland is making a strong contribution to the multidisciplinary CLOUD experiment at CERN, which is dedicated to the study of climate change with the help of particle beams. These projects reinforce ties between universities, research centres, funding authorities, medical institutions and industry.

Cosmology and astrophysics are well represented in Finland. On the experimental side, Finland's contributions to the ESA Planck mission have been substantial and will continue with involvement in the future ESA Euclid project. Euclid is designed to answer fundamental questions about the Universe, including those relating to dark energy and dark matter, and to test cosmological hypotheses. The project is included in the national infrastructure roadmap. There is also involvement in the CORe satellite proposal. The satellite will study the cosmic

microwave background polarisation. Finland is also involved in several ESO observational cluster projects.

The Committee was pleased to hear that last year Finland joined ApPEC, the Astroparticle Physics European Consortium, through the University of Oulu, which should help to strengthen international ties. The Committee also welcomes the existing contacts between the astronomy and particle physics communities, and encourages further development of these relations.

Finland plays a strong and internationally recognised role in instrumentation. The focus is on the development of semiconductor and GEM detectors. HIP has access to top-class clean-room facilities at Micronova, a local clean room and instrumentation lab on the Kumpula campus. A successful collaboration on high-density interconnects for pixel semiconductor detectors has been established with the Advacam company. This collaboration was central to Finland's contribution to the current phase-1 upgrade of the CMS pixel detector and will continue to be important for the CMS phase-2 upgrade in the future.

The instrumentation activities at HIP constitute a bridge between the activities of different universities. Furthermore, they show a remarkable gender balance, with women in the majority in senior positions, and they attract many PhD students from abroad.

In the early days of Finland's membership of CERN, the technology transfer and industrial activation network was a strong, well-organised framework, which served as a model to other CERN Member States. The national support for technology transfer and industrial activation has unfortunately ceased, and the industrial return from CERN has declined. The Committee appreciates the efforts made in the framework of the recent CERN Roadshow in Finland to enhance the awareness of industrial opportunities associated with CERN's research programme, and underlines the need for a well supported Industrial Liaison Officer.

In accelerator science, Finland has a highly successful and internationally well positioned research facility at the Jyväskylä Accelerator Laboratory. In Helsinki, the work within the CLIC collaboration has successfully led to novel technologies for high-field acceleration. This activity will follow the future orientation of CERN's accelerator R&D. The Committee encourages the development of accelerator education for graduate students, which could be jointly conducted by Jyväskylä and Helsinki Universities.

The computing facilities available through CSC, the Nordic Grid and PRACE are instrumental in the success of the experimental and theoretical research programmes and are highly visible internationally. For the increasing demands in computing, in particular for the LHC Grid and Cloud computing, it will be important to provide sufficient computing and storage resources for the next decade and beyond, and to continue the successful research and development of distributed computing.

The Committee was impressed by the scope of the outreach programme, in particular by the level of coverage of high schools and by the number of high-school pupils and teachers visiting CERN. The programme also engages PhD students, who see it as their mission to attract the interest of the public and of future students in natural sciences and particle physics. The Committee highly appreciates the vital support from the Finnish National Agency for Education for the national CERN high-school network and hopes that this support will be maintained at the current level. The Committee also congratulates the community on its

leading role in promoting open data access, making real data from CERN experiments available to students and to the general public.

An important part of the visit was the presentation by a PhD student reflecting on education and future career possibilities. In general, Finnish students express a high degree of satisfaction with their research, their PhD programmes, their participation in major international research enterprises and their relative independence in choosing their research topics. The students appreciate the HIP summer student programme, which allows the most talented undergraduate students to spend three months at CERN, as well as the support for longer-term stays at CERN. Such stays foster networking with young researchers in Europe and beyond. The Committee would recommend help for PhD students to organise themselves into an association covering all Finnish sites and research projects. This could be a valuable addition to the current PhD educational programme.

Future career possibilities are a source of concern to the students. The career pyramid, which comprises an adequate number of postdocs and PhD students supplementing the few professorships, seems adequate. However, while it is very positive that an important number of new faculty positions have recently been opened and filled, the number of research positions opened in Finland each year is small. This results in a substantial fraction of young researchers having to leave the field upon completion of their PhD. The fraction of scientists with a doctoral degree conducting research in industry is unusually small. Dedicated activities would appear to be needed to enhance public awareness of the importance of PhD education for society.

All in all, the Committee found a young and thriving community with a high international impact. The Committee was particularly impressed by the activities of HIP, which result in an excellent research programme with outstanding achievements commanding high international recognition, and recommends that HIP's leading role be supported to the full. The highly positive impact of such a core organisation provides a very good example for the organisation of HEP in other countries.

Yours sincerely,



Professor Halina Abramowicz
ECFA Chair

cc:

Ministry of Education and Culture:

Permanent Secretary Anita Lehtikoinen

Director-General Tapio Kosunen

Academy of Finland:

Professor Heikki Mannila, President

Dr. Riitta Majjala, Vice President for Research

CERN Council Delegation:

Ms. Katja Majamaa, Academy of Finland

Mr. Ossi Malmberg, Academy of Finland

Dr. Pentti Pulkkinen, Academy of Finland

Chair of the HIP Board: Professor Jouko Väänänen, Vice President of Research, University of Helsinki