# REPORT ON LITHUANIA ASSOCIATE MEMBERSHIP AT CERN

# 2020

# prepared for Lithuania-CERN Joint Committee

***Introduction***

The Action Plan on CERN Associated Membership 2017–2021, approved back in 2016 by the National Strategic Council for Research, Development and Innovation under the chairmanship of the Prime Minister, indicates Ministry of Education, Science and Sport as the main coordinator and the Ministry of Economy and Innovation in charge of industrial networking and establishment of CERN Business Incubation Centres (BICs).

The new Government, formed in December after ordinary elections of the Seimas (Parliament) in the fall of 2020, envisages its considerable attention paid to the added value of products and services originating in Lithuania, necessarily revising the funding of quality studies and research as the basis for the former.

The Lithuanian Innovation Centre (LIC) – a public institution with the Ministry of Economy and Innovations, the Ministry of Education, Science and Sport, and the Confederation of Lithuanian Industrialists as its shareholders – is performing also as a national Liaison Office for CERN in industry[1].

In 2020, no particular changes or additions have been implemented in defining the representation of Lithuania at CERN by the Minister of Education, Science and Sport. Lithuania now has assigned representatives for the CERN knowledge transfer, the CERN knowledge from physics to medicine transfer, and an observer at the European Strategy Group. The representative of Lithuania at CERN Member State thematic Teacher and Student forum has been identified[2].

The collaboration with Latvia and Estonia regarding CERN areas of interests and the share of best practices has developed further within the CERN Baltic Group (CBG) established in 2018, where Kaunas University of Technology (KTU) and Vilnius University (VU) participate since the inception. Vytautas Magnus University in Kaunas became a member of CBG on October 12, 2020. Two general meetings of the group took place in 2020. A meeting of CBG CMS subgroup was organized on May 7, 2020[3].

The third year of Lithuania's CERN associated membership was the second year of term for the permanent leader[4] of the Centre for Nuclear and Particle Physics at the Faculty of Physics of Vilnius University (VU Centre). Under the supervision and annual recommendations of its International Advisory Board, the VU Centre further deals with challenges in absorbing the possibilities of

1 since 2019

2 Prof. Saulius Mickevičius of VDU, https://indico.cern.ch/category/8635/

3 https://indico.cern.ch/event/91368/

4 Dr Aurelijus Rinkevičius

membership. The VU Centre prepared their development plan until the end of 2021, but the whole funding program was not approved on the EU level and is currently revised under the guidance of the new Government.

The Baltic Assembly (BA), an international organization for co-operation between the parliaments of Lithuania, Latvia and Estonia, adopted a resolution[5] at a digital session, in which it addressed national parliaments, governments and the Baltic Council of Ministers – the institution of intergovernmental co-operation, on new partnerships in education, science and research, mentioning CERN. In the resolution, the BA called for the empowerment of potential of cooperation with CERN for the development of science, research and technology in the Baltic States, by commensuration of support from national budgets with the national CERN membership fees.

At present time, there is no clear institutional responsibility for participation in CERN Teacher and Student program, although Lithuania has a representative in the forum. Lithuania does not participate at all in a similar[6] thematic CERN Scientific Computing forum, having no particularly powerful scientific computing facilities or any CERN Tier nodes.

The performance of research and industry in CERN related areas remains on political agenda. The financial duty of year 2020 for CERN was fulfilled. The representatives of Lithuania regularly participate in the sessions CERN Council and its Committees. The summaries of reports in Lithuanian, provided by representatives, are published on the website of the Lithuanian Academy of Sciences[7]

***Research and development***

The research and development related to CERN programmes was further supported according to the Action plan for a period of 2018–2020 approved by the Minister of Education, Science and Sport (Action Plan)[8]. The Lithuanian Academy of Sciences coordinated implementation of seven high quality R&D projects carried out by research groups since 2019 and planned for two calendar years, until the end of 2020. Five of those were from Vilnius University (VU), investigating the radiation damage of Si detectors, developing fast scintillation detectors, theoretically investigating the CMS detector data, and developing CMS software. One group from Kaunas University of Technology (KTU) dealt with the improvement of the coatings used in accelerators at CERN. One more group, from the Lithuanian University of Health Sciences in Kaunas, investigated the tumour resistance to radiation therapy. The yearly reports of all the groups received positive responses from expert evaluators, the applications for funding in 2021–2022 have been obtained from the same 7 as well as 3 new groups, now 10 in total.

In addition to the state budgetary funding, two VU teams have been successful in getting proposals from CERN itself for participation in CERN activities:

5 https://baltasam.org/images/1_2020/0_Session/2_Resol_2020_Adopted.pdf

6 https://home.cern/about/who-we-are/our-governance/member-states

7 http://www.lma.lt/ataskaitos

8 in Lithuanian

- IT R&D group at VU to develop and support the CMS online software in 2020;
- group at VU Applied electrodynamics and telecommunications institute to perform wide-band electromagnetic characterization of samples of materials used at CERN facilities.

***VU Center of Experimental Nuclear and Particle Physics***

The Center consists of the administration (chair, deputy for administration and an assistant), a postdoc (2020-2022) and formally affiliated personnel (three computer scientists and engineers, whose service contracts are hosted at the Center; two IT trainees that are stationed at CERN).

*Science at the Center*

A. Rinkevicius (Chair) is actively engaged in tracker ant top-Higgs activities with students, whereas diHiggs research is pursued with a postdoc (Alexandra Carvalho) based at CERN. The postdoc is funded via Lithuanian Research Council grant.

*Contracted services to CMS via the Center*

Computer scientists and engineers provide services to the CMS as per contracted service agreements. The services provided are database for the Phase 2 upgrades and the central data acquisition framework.

*University courses*

Currently, there are four undergraduate courses for particle physicists that are co-coordinated with the Center. Whereas an existing Master's course is being redeveloped to take into account the existing bachelor-level competences.

*Outreach and training*

The Center helps to plan and deliver from a couple to a dozen of outreach and training events for school students and teachers. The activities are coordinated by A. Kyniene via the Center.

*Cooperation and other activities within CERN areas of interests*

CERN Baltic group is a focal point for a regional collaboration. Activities such as joint research, university programs, and training are being developed. Due to the cross-country nature, it is a substantial effort that is progressing slowly but steadily.

***Planning the future activities***

The Center has been engaged with the Lithuanian government in the effort to establish a pixel detector laboratory primarily for the CMS Phase 2 upgrade. The government shows a positive attitude towards such activities, thus the common planning is ongoing. Assuming the success, a further planning of a deeper integration into the CERN programs is foreseen.

***Appendix 1 – Publications in 2020***

VU researchers are co-authors of a number of CMS research papers published in 2020: Gintautas Tamulaitis of 56, Juozas Vidmantis Vaitkus of 85, Aurelijus Rinkevičius of 87, Andrius Juodagalvis of 89. The Lithuanian Academy of Sciences (LAS) is recognized as a funding agency in those.
In addition, several articles have been published independently of CMS, the list is presented below.

1. E. Gaubas, T. Ceponis, L. Deveikis, V. Kalesinskas, G. Kreiza, T. Malinauskas, J. Pavlov, V. Rumbauskas, A. Mychko, and V. Ivanov, Study of the electrical characteristics of CdZnTe Schottky diodes, Mater. Sci. Semicond. Process. **105**, 104705 (2020), https://doi.org/10.1016/j.mssp.2019.104705
2. J. Pavlov, T. Ceponis, L. Deveikis, V. Rumbauskas, G. Tamulaitis, and E. Gaubas, Modification of characteristics of AlGaN photodiodes by 1.6 MeV proton irradiation, J. Instrum. 15, C01026 (2020), https://doi.org/10.1088/1748-0221/15/01/C01026
3. T. Heikkinen, J. Pavlov, T. Ceponis, E. Gaubas, M. Zając, and F. Tuomisto, Effect of Mn and Mg dopants on vacancy defect formation in ammonothermal GaN, J. Cryst. Growth **547**, 125803 (2020), https://doi.org/10.1016/j.jcrysgro.2020.125803
4. T.Ceponis, S.Lastovskii, L.Makarenko, J.Pavlov, K.Pukas, and E.Gaubas, Study of radiation induced defects in p-type $Si_{1-x}Ge_x$ diodes before and after annealing. Materials **13**, 5684 (2020), https://doi.org/10.3390/ma13245684
5. T. Ceponis, L. Deveikis, S. Lastovskii, L. Makarenko, J. Pavlov, K. Pukas, V. Rumbauskas, and E. Gaubas, Transient electrical and optical characteristics of electron and proton irradiated SiGe detectors, Sensors **20**, 6884 (2020), https:/doi.org/10.3390/s20236884

An EPO patent 3594723 “Double response ionizing radiation detector and measuring method using the same” was granted to E. Gaubas, T. Čeponis, D. Paipulas. V. Kalesinskas, and Č. Pavasaris. Two other patent applications were submitted or prepared for both the Patent Bureau of the Republic of Lithuania and EPO by the Prof. Eugenijus Gaubas’ group: “Magnetic analyzer for relativistic charged particles” and “Hybrid multi-layer sensor and method for large fluence dosimetry and fluxmetry”.