

# Overview of CERN-Related Activities in Lithuania 2019

## Experimental Particle Physics

### Summary

The groups actively contributed to CMS Drell-Yan and ttH physics analyses, where both studies are preparing for Run 2 legacy publications. Detector activities included CMS GEM Data Performance Group (DPG) tasks and new chamber commissioning activities at CERN test site. An intent to switch to CMS tracker was demonstrated by sending a graduate student to CERN for learning the CMS tracker phase-2 DAQ (early prototype) system.

### People

Research prof. A. Rinkevicius

Senior researcher A. Juodagalvis

Graduate student M. Ambrozas

With volunteers in outreach events: prof. E. Norvaisas, assoc. prof. A. Kyniene, and graduate students from inside and outside of Lithuania.

### Various activities in detail

- Published Drell-Yan differential measurements with 2015 CMS data.
- Joined EU COST Action (CA16201) "Unravelling new physics at the LHC through the precision frontier (ParticleFace)".
- Graduate student M. Ambrozas was awarded a one-year research stipend.
- New experimental undergraduate particle physics lecture was finalized and started in 2020.
- Made several outreach events, including European Researcher's Night 2019 together with a live feed from CERN (CMS virtual visit).
- Made two CMS institutional reviews.
- In November 2019, the international advisory committee to the Experimental Nuclear and Particle Physics Center at VU visited Lithuania and left their conclusions and recommendations report.

# Theoretical and Phenomenological Particle Physics

## Summary

The group pursued several phenomenological studies including Higgs physics, neutrino physics, and model building based on two Higgs doublets and global constraints.

## People

Assoc. prof. T. Gajdosik

Senior researcher D. Jurciukonis

Staff scientist V. Dudenas

Graduate student S. Drauksas.

## Various activities in detail

- Working on Grimus-Neufeld model, lepton mixing, Higgs doublets, and seesaw neutrinos.
- Working on improving FlexibleSUSY spectrum generator.
- Joined EU COST Action (CA16201) "Unravelling new physics at the LHC through the precision frontier (ParticleFace)". CA together with funds distributed via Academy of Sciences allowed the student to attend an MC school "School of Analytic Computing in Theoretical High-energy Physics", while the staff scientist participated in the "Matter to the Deepest" conference and working meetings at STSM, Lisbon.
- Refreshed undergraduate and graduate particle physics courses.

# Material Science (VU Photonics Group at the Institute of Photonics and Nanotechnology)

## Summary

Semiconductor Photonics Group at the Institute of Photonics and Nanotechnology continues research in the field of studying excitation transfer and recombination processes in picosecond domain in scintillators prospective for development of fast radiation detectors. The group is implementing two four-year national projects on scintillation detectors and takes part in Horizon projects AIDA2020 and ATTRACT SCINTIGLASS. The group participates in the activities of Crystal Clear Collaboration (RD18) at CERN and is currently involved in the preparation of

specifications to select LYSO:Ce scintillation crystals for the Barrel Timing Layer, which is being developed for CMS upgrade.

## People

Prof. G. Tamulaitis (PI) and his team.

# Material Science (VU Photoelectric Phenomena Group at the Institute of Photonics and Nanotechnology)

## Summary

GaN/AlGaN type diode (material) studies that focus on performance studies after 1.5-1.8-MeV proton irradiation. The aim is to develop wide-band semiconductor detectors and dosimeters. The search for new annealing techniques was performed for irradiated (electrons and alpha) Si. Additional material diagnostics were done for GaN and CdZnTe in the search for radiation-hard materials. LGAD and PIN Si diodes were both modeled and tested in the search for high-gain fast-readout modes.

## People

Prof. E. Gaubas (PI)

Assoc. prof. T. Ceponis

Assoc. prof. E. Zasinas

Staff researcher J. Pavlov

Staff researcher V. Rumbauskas

Graduate students L. Deveikis, K. Pukas.

## Various activities in detail

- Several publications were published in accordance with the performed studies.

# Material Science (KTU)

## Summary

The group was mostly focusing on the research project to study thin-films for coating particle-accelerator beam pipes. Such research should help to reduce the formation of undesired (parasitic) charged plumes in the beam pipes of future accelerators due to charged bunches passing by. These are the surface effects that can be fought against with a proper coating.

## People

Prof. S. Tamulevicius (PI)

Assoc. prof. B. Abakeviciene

## Various activities in detail

- Actively participate in CERN Baltic Group
- Helping with arrangements to the upcoming CERN Accelerator School in Kaunas, March-April 2020.
- Arranged a couple of outreach events (including a masterclass) with CERN topics in mind.
- Encouraged local students to apply to CERN Technical Studentships.
- Group is promoting CERN activities to other technological groups at KTU.

# Computer Science (VU)

## Summary

The group is actively engaged in maintaining CMS database infrastructure for detector upgrades needs.

## People

Assoc. prof. V. Rapsevicius (PI) and his team.

## Chemistry (VU)

### Summary

The group has put new efforts to start synthesizing scintillators, in particular YAG:Ce and LuAG:Ce garnets that were produced. A boron and magnesium doping was performed on YAG:Ce in order to study the proof of concept of such a process. Corresponding excitation spectra were measured. Although these particular scintillators are not very fast, they serve as a stepping stone to Lithuanian to-be-born scintillator chemistry community.

### People

Assoc. prof. R. Skaudzius and his graduate student.

## Medical Research (LSMU)

### Summary

The group performed a project to study molecular mechanisms to withstand therapeutic radiation damage and pharmaceuticals to alleviate the impact. Resveratrol and kaempferol were the chosen pharmaceuticals. Irradiation of 2 and 10 Gy was used. Both pharmaceuticals proved to be potent in sensitizing the tissues.

### People

Prof. E. Juozaityte (PI)  
Research professor R. Ugenskiene

## Business Engagement

### Summary

In 2019 Lithuania made a twofold increase in business tenders both in the net amount and in the number of companies signing the deal. In addition, the number of Lithuanian companies registered for tenders has tripled. The Lithuanian Innovation Centre (LIC) has put active efforts to continue the growth of business relations between CERN and Lithuania: a CERN procurement representative gave a talk in Lithuania at the Annual Economics Forum and in

January 2020 a business mission to CERN took place. Currently Lithuania and CERN are in the process of selecting future start-ups for a business incubation later in 2020.