Vilnius University: current collaboration with CMS and future projects

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A summary following guidelines (1/4)

Approximate people count:

- Faculty
  - Experimental particle physics – 1 (GEM)
  - Theoretical particle physics – 2 (theory)
  - Material Science (MS) – 3.5 (MTD)
- Non-faculty
  - Engineers – 0; technicians – 0; postdocs – 1 (MS)
  - PhD students: 1 (finishing) in HEP, 4 in MS
  - MSc students: 2 (1 in experimental and 1 in theoretical HEP), *x* in MS
- Forecast
  - Expected average number of PhDs per year
    - In HEP – 0.2
    - In MS – 1
  - Faculty hirings – 1

A summary following guidelines (2/4)

Hardware projects:

- Currently engaged in, taken responsibilities
  - GEM: construction and conditions DB, interface between the DB support group and other groups, DB use in the CMSSW and other software
  - MTD: scintillating material studies, suggesting the most proper for barrel system
- Projects in the pipe (writing stage)
  - None
- Could be of interest, but no engagement yet
  - EPIX
- Expertise
  - Software: CMSSW, CRAB, ROOT, DB-read
  - Scintillating material response and properties

A summary following guidelines (3/4)

Research (HEP and related) projects:

- Currently engaged in
  - SMP *pp* data analysis – the Drell-Yan process
  - Higgs physics – ttH
  - Materials – superfast scintillating crystals
  - Theory:
    - Two-Higgs doublet and multi-Higgs models, Higgs properties
    - Heavy Majorana neutrinos, grand-unified theories (GUT)
    - Few-nuclei reactions (non-CERN)
- Projects in the pipe
  - Marie Curie fellowship, Twinning (writing stage)
  - HCAL calibration by *γ*+jets
- Projects that could be of interest, but no engagement yet
  - ttX properties (X ~ Higgs), double Higgs studies
- Expertise
  - Electrons, tops, MEM, particle property measurements

A summary following guidelines (4/4)

- A topic of choice to present
  - Th.Gajdosik presentation on theoretical studies

Thank you for your attention!

Back-up slides

Lithuanian-CMS collaboration structure

1. Lithuanian Academy of Sciences (administrative)
   - The LAS president prof. J.Banys
   - The Lithuanian Team Leader dr. A.Bernotas

2. Vilnius University
   - Deputies: prof.A.Juozapavičius and dr. L.Bukauskas (both from Faculty of Mathematics and Informatics)

Faculty of Mathematics and Informatics

- Many students come to CERN every year
- CMS Offline, DAQ, PPD, DBs

Faculty of Physics

1. Experimental Nuclear and Particle Physics Center
   - New since 2017. Outreach. Research coordination?
2. Institute of Photonics and Nanotechnology
   - Since 2017. Former Institute of Applied Research + Department of Seminconductors
   - CMS Precision timing detector
   - CERN participation: RD18, RD50, AIDA2020
3. Institute of Theoretical Physics and Astronomy
   - Nuclear and particle physics group
   - CMS GEM, *pp* standard model physics analysis

Faculty of Mathematics and Informatics (FMI) CERN group

- **Info from: http://www.ff.vu.lt/en/cern/researchers-teams/**
- Team leader: **prof. Algimantas Juozapavičius**

- **Current research activities**
  - LHC CMS Data Acquisition Systems (DAQ)
  - LHC CMS databases and tools for Detector configuration, calibration and alignment
  - LHC CMS Data Monitoring and Physics Data Certification
  - LHC CMS Run Coordination

- **Field of interest within the Center?**
  - LHC CMS Data Acquisition Systems (DAQ)
  - LHC CMS Data Monitoring and Physics Data Certification
  - Data Science and Machine learning methods at HEP

- **Available resources (Instrumentation, irradiation facilities etc.)**
  - 3x low-end desktop computers
  - Virtual server infrastructure within FMI

Several Lithuanians work at CERN on CMS DAQ, PPD/PdmV, CMSSW, etc. Not necessarily associated to Vilnius University.

D.Abdurachmanov, D.Bugelskis, A.Norkus, D.Šimelevičius, M.Stankevičius, and others

Current and future interests of the Faculty of Mathematics and Informatics (FMI) in CMS

V.Rapševičius info

- **Focus: Collaboration-wide development and support**

- **CMS Online Monitoring System**

  Development was initiated by CMS Run Coordination in the fall of 2016.
  Since 2018 the project leadership is taken over by CMS DAQ group.
  Deployment to production is planned in 2018.
  Team of 2 researchers and 1 programmer from VU FMI works on the presentation layer.

- **CMS Central Data Certification support system (Run Registry)**

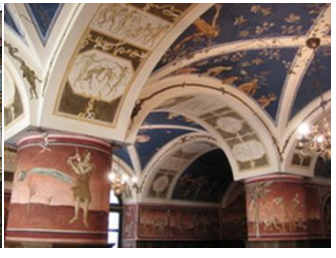
  Set of applications were developed and are supported since 2009.
  VU FMI supports the tool and is **looking for possibilities to proceed with upgrade in 2018**.
  VU FMI researcher and doctoral student are involved in Data Certification Machine Learning effort.

- **CMS Detector Databases and Applications**

  Since 2011, developed and supported by VU FMI.
  Used by many sub-detectors at CMS: HCAL, Pixel, GEM, HGCAL, Tracker, others about to join.
  Working in close cooperation with FNAL (U.P.Joshi).







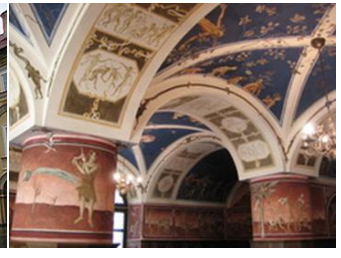
- Participation in **Detector Performance Groups** (VU representative in IB – A.Juodagalvis)
  - Hadron calorimeter (HCAL) 2014-2015 (oficially not withdrawn)
    - FMI was involved in DB (they started earlier)
    - DPG task: Detector calibration using physics processes (A.Juodagalvis)
  - Gas electron multipliers (GEM) since December 2015
    - FMI was involved in DB (they started earlier)
      - Including help with online visualization tools
    - DPG tasks:
      - CMSSW interface between DCS, DAQ and DB, relation to AlCaDB (A.Juodagalvis)
      - Optimization of gas composition for muon detectors (J.Tamulienė)


GEM2/1 demonstrator

- Possible future involvements:
  - HGCAL (since it contains Si, VU has experts on semiconductors) or
  - MIP Precision timing detector (fast scintillators, prof.G.Tamulaitis team)







Institute of Theoretical Physics and Astronomy

- Participation in **CMS physics data analysis**
  - Standard-model physics Drell-Yan process differential cross-section measurement
    - Precision measurement of the dilepton $d\sigma/dm$, $d^2\sigma/dm \cdot dy$, with 2016 data maybe $d^3\sigma/dm \cdot dy \cdot dp_T$
    - Current cooperation with Seoul National University (Korea), University of Nebraska (USA), Panjab University (India), others
    - Since 2017, a BSc student M.Ambrozas learns the $e\mu$ method
    - A.Juodagalvis contributes since 2010
  - Earlier contributions:
    - Work on data/MC event efficiency scale factors in the electron channel (endorsed by EGammaWG)
    - Analysis of H and WH decays in the τ and/or μ channel (BSc and MSc student work)
- A.Juodagalvis, Th.Gajdosik and V.Dūdėnas perform **VU institutional reviews of the CMS physics papers**

EPR and shifts@P5

- Points of experimental physics responsibility (EPR) by members of Vilnius University are obtained by performing DPG tasks

- Shifts at P5 are carried out since 2015
  - Pictures of A.Juodagalvis at DAQ and D.Jurčiukonis at DCS workplace below
  - Other IT students and specialists are also contributing. “It’s a kind of magic…” (i.e. fun)