Collaboration with CERN participation in experiments – state-of-play and further plans - LITHUANIA

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Ad interim chair of Centre for experimental nuclear and particle physics at Faculty of Physics, Vilnius University.

The Sunrise Valley - concentrated experimental physics and material science

Outline:

- A bit of history
- What did we to be invited to apply for an associate membership at CERN
- What did CERN Task Force team recommended
- Our answers
- Plans for future

About our activities in CMS it will be reports during the afternoon discussion:

dr. Andrius Juodagalvis – data analyze, IT and gaseous detectors (and outreach**)**

Myself – problems related with the upgrade of calorimeters and tracking detectors

Historical remarks:

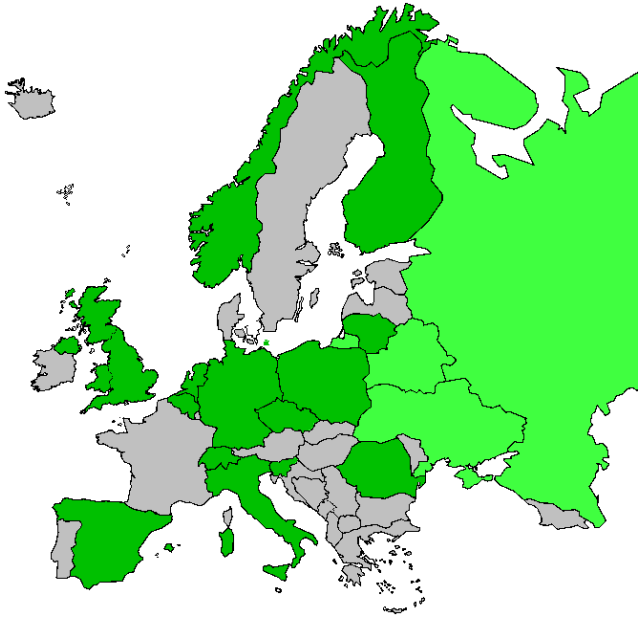
- Since 1960 - start of experimental nuclear physics: radioactivity, later Mösbauer effect and its application for materials research, later radiology, collaboration with CERN ISOLDE project;
- Since 1983 - interaction of proton beam with semiconductors, later Rutherford backscattering for materials research;
- Since 1995 – joining CERN projects: radiation hardness of pixel and strip detectors, new materials for detectors (tracking and calorimeters) **(CERN RD8, RD18, RD39, RD50, CERN FP5 AIDA, CERN Horizon2020 AIDA2020);**
- 2007 – joining the CMS experiment, start by IT, later – data analysis and gaseous detectors, for a short time semiconductor detectors - CEC (moved to RD50).

RD50 - Development of Radiation Hard Semiconductor Devices for High Luminosity Colliders

254 Members from 47 Institutes

38 European institutes

Belarus (Minsk), Belgium (Louvain), **Czech Republic** (Prague (3x)), **Finland** (Helsinki , Laappeenranta), **Germany** (Dortmund, Erfurt, Freiburg, Hamburg, Karlsruhe, Munich), **Italy** (Bari, Florence, Padova, Perugia, Pisa, Trento), **Lithuania (Vilnius), Netherlands** (NIKHEF), **Norway** (Oslo (2x)), **Poland** (Warsaw(2x)), **Romania** (Bucharest (2x)), **Russia** (Moscow, St.Petersburg), **Slovenia** (Ljubljana), **Spain** (Barcelona, Valencia), **Switzerland** (CERN, PSI), **Ukraine** (Kiev), **United Kingdom** (Exeter, Glasgow, Lancaster, Liverpool)



8 North-American institutes

Canada (Montreal), **USA** (BNL, Fermilab, New Mexico, Purdue, Rochester, Santa Cruz, Syracuse)

1 Middle East institut

Israel (Tel Aviv)

Detailed member list: http://cern.ch/rd50

M.Moll 10/2007

Now it is added:

France,

India,

Croatia

Austria

Berkely U

Scientific Organization of RD50

RD50 - Development of Radiation Hard Semiconductor Devices for High Luminosity Colliders

Spokesperson
Mara Bruzzi
INFN and University of Florence

Deputy-Spokesperson
Claude Leroy
University of Montreal

Material Engineering

- **Defect/Material Characterization** — *Bengt Svensson* (Oslo University)
- **Defect Engineering** — *Eckhart Fretwurst* (Hamburg University)
- **New Materials** — *Juozas V. Vaitkus* (Vilnius University)

Device Engineering

- **Pad Detector Characterization** — *Stanislav Pospisil* (Prague University)
- **New Structures** — *Mahfuzur Rahman* (Glasgow University)
- **Full Detector Systems** — *Gianluigi Casse* (Liverpool University)

(Now this schema changed)

J.Vaitkus – Deputy Chair of the Collaboration board
Chair – G.Kramberger (Ljubljana U)
Co-spokespersons: M.Moll (CERN) & G.Casse

WODEAN project: Methods-Institutes-Persons

FTIR:

Oslo University and Minsk Joint Institute of Solid State and Semicond. Physics: L. Murin, B. Svensson

C-DLTS:

NIMP Bucharest and Hamburg University: I. Pintilie, E. Fretwurst, G. Lindstroem

Minsk University: L. Makarenko

Oslo University: B. Svensson

I-DLTS:

INFN and Florence University: D. Menichelli

TSC:

NIMP Bucharest and Hamburg University: I. Pintilie, E. Fretwurst, G. Lindstroem

PITS:

ITME Warsaw: P. Kaminski, R. Kozlowski

PL:

Kings College London: G. Davies

ITME Warsaw: B. Surma

EPR: NIMP Bucharest: S. Nistor; ITME Warsaw: M. Pawlowski

Diode characteristics (C/V, I/V, TCT):

CERN-PH, Hamburg University, JSI Ljubljana: M. Moll, E. Fretwurst, G. Lindstroem, G. Kramberger

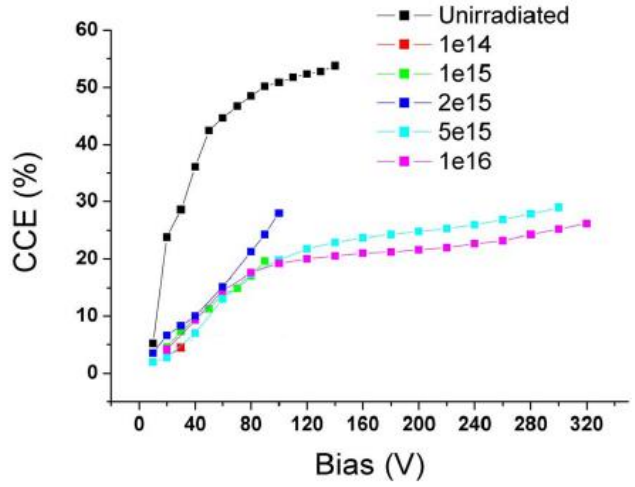
Recombination lifetime: Vilnius University: E. Gaubas, J. Vaitkus

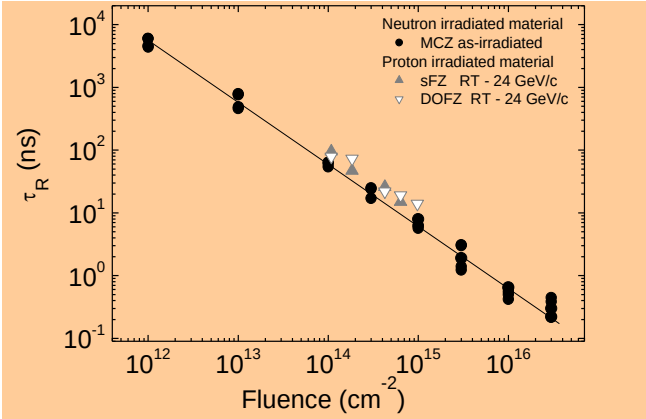
PC: Vilnius University: J. Vaitkus, E. Gaubas „obligatory“

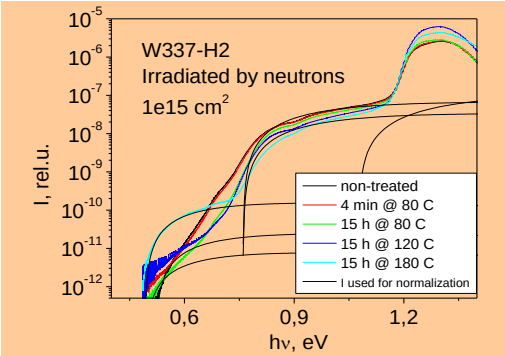
and ALSO: C, I, O - DLTS, C/V, I/V, TCT, TSC, EPR, BELIV

AND VERY IMPORTAN TOO: Irraditions: JSI Ljubljana: V.Cindro; PS CERN: M.Glaser

New materials research line





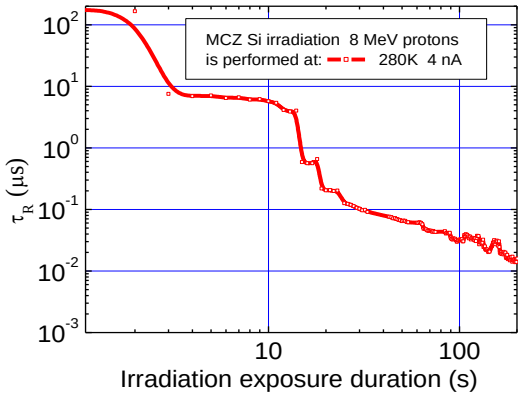


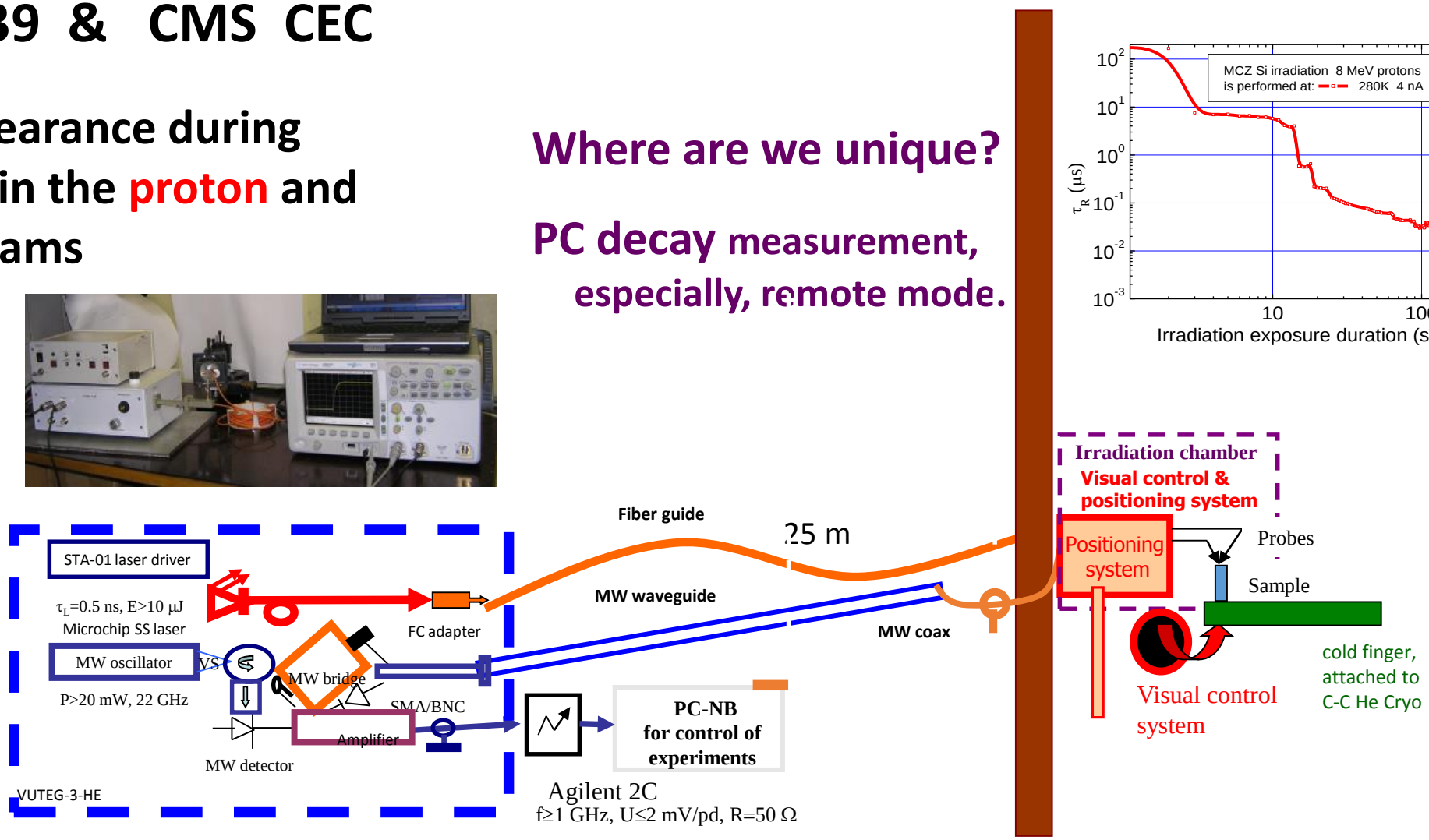
CERN RD39 & CMS CEC

Defect appearance during irradiation in the proton and neutron beams

Where are we unique?

PC decay measurement, especially, remote mode.



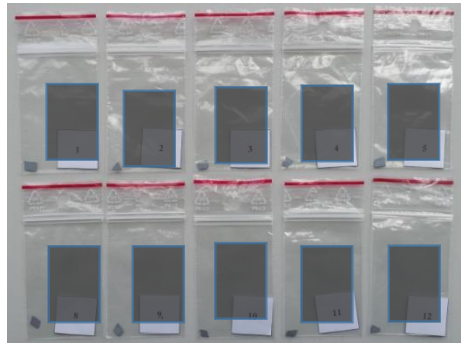


Modules outside irradiation area

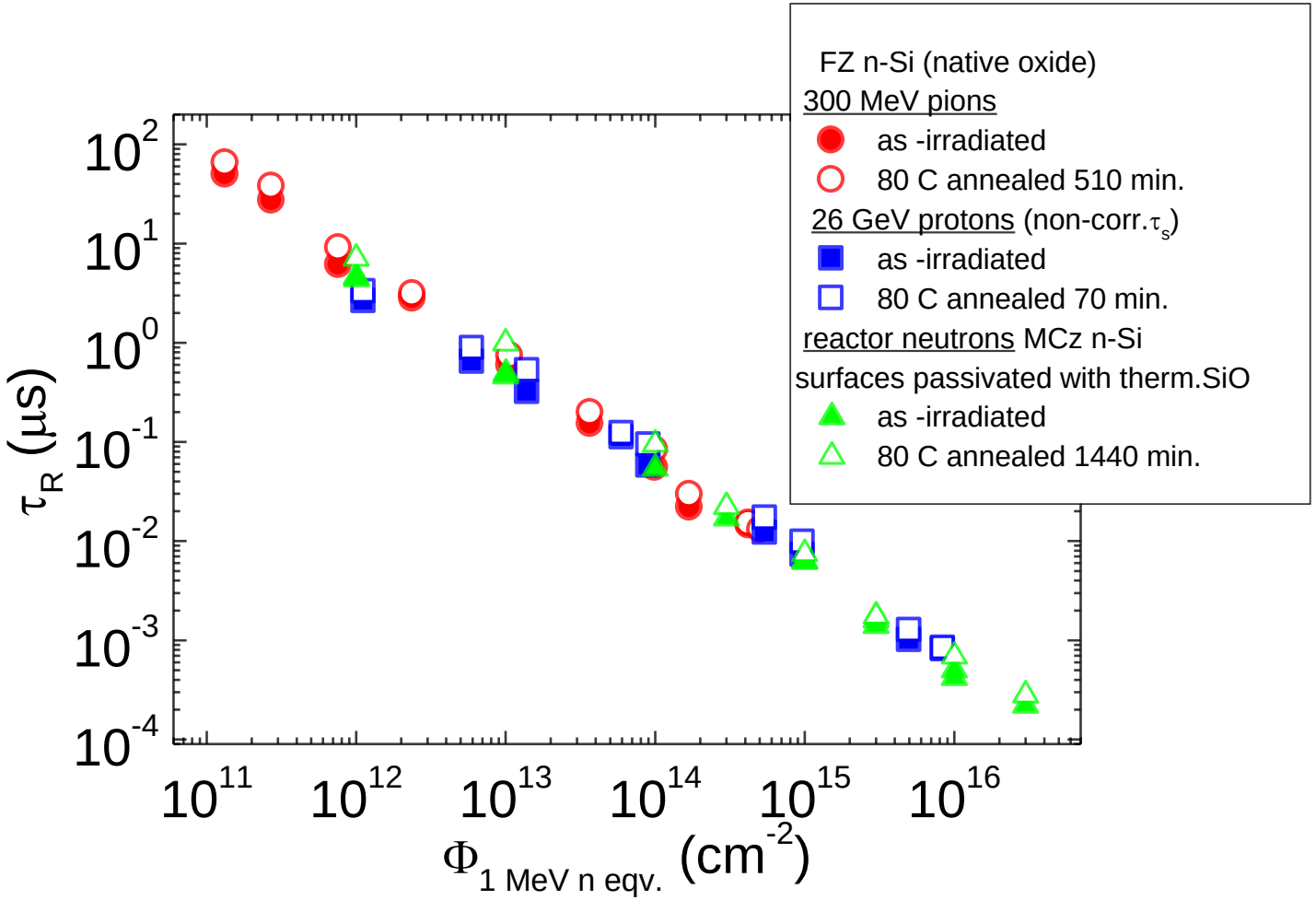
Accelerator laboratory

The microwave probed photoconductivity (MW-PC) modules for the direct measurements of the carrier decay transients by employing MW absorption are assembled.

AIDA and AIDA-2020

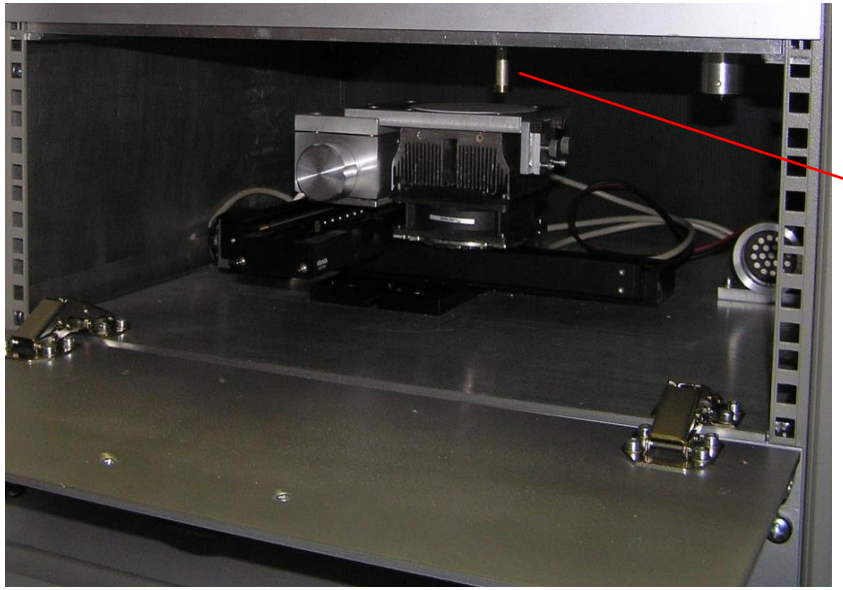


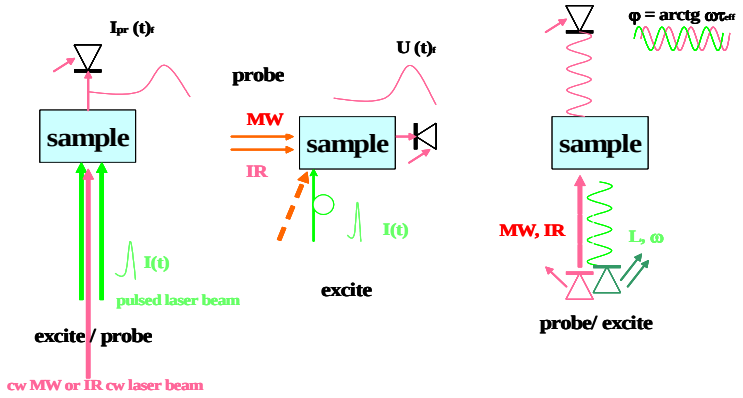
The device for integrated fluence monitoring

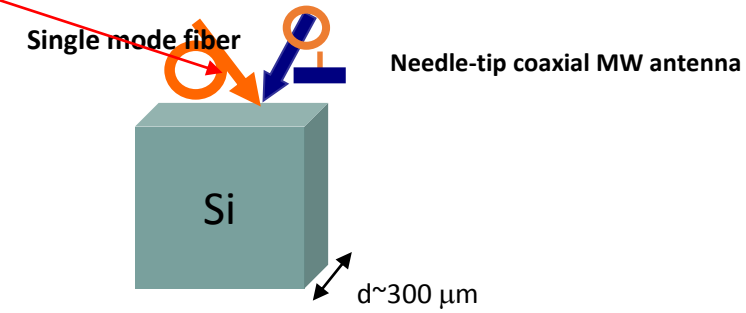


This device for 2D integrated fluence imaging up to 3“.

It can scan sample in different regimes: transmission, reflectance and probe







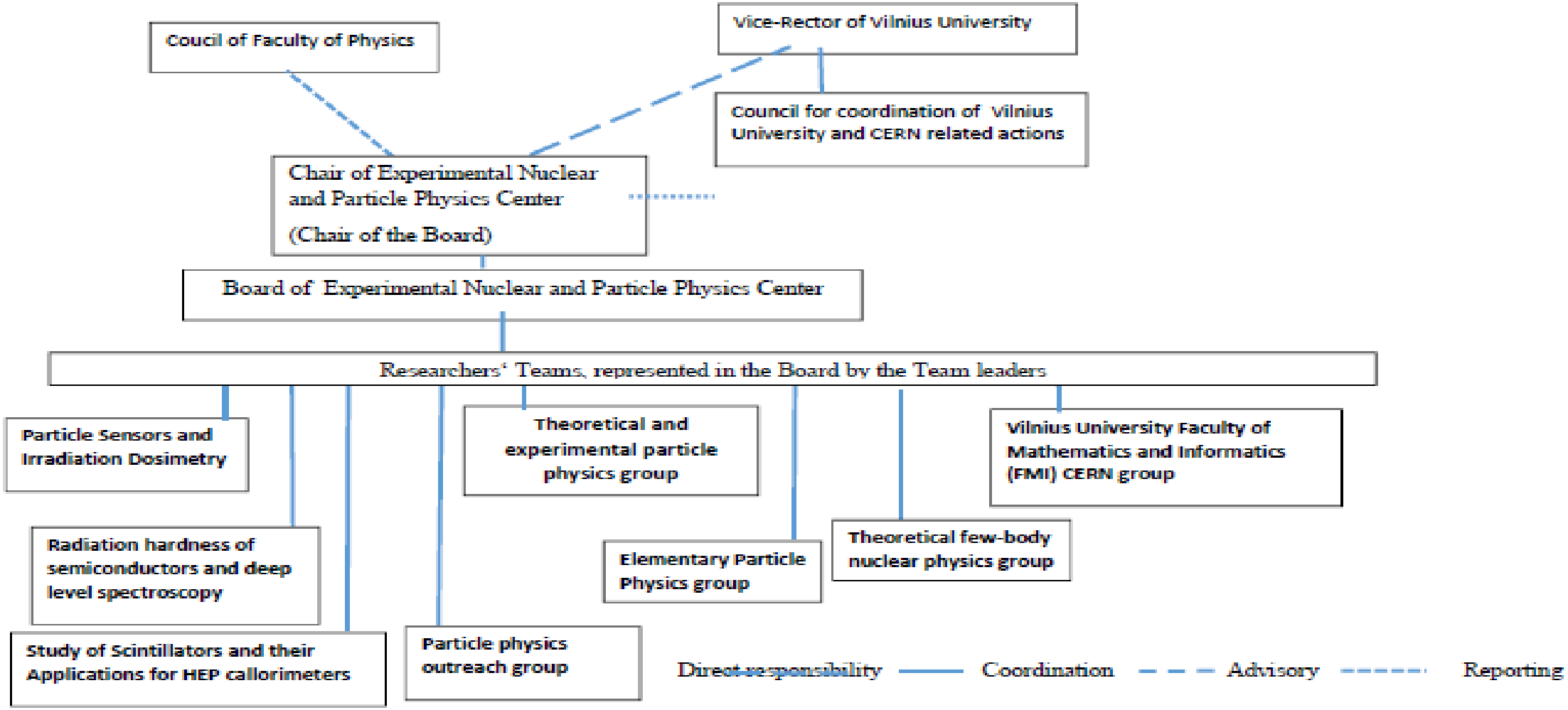
CERN Task Force

- The Task Force has reached the following conclusions with respect to the Associate Membership criteria:
- a. **existence within the applicant State of a solid basis in elementary particle physics, both theoretical and experimental,** adequately funded both for the support of the research within the country and also for payment of travel and living expenses to enable the scientists of that country to participate in CERN activities;
- Experimental particle physics started developing during the nineties with efforts to establish collaboration with CERN. These initiatives culminated with the establishment of a Cooperation Agreement with CERN in 2004 followed by joining the CMS Collaboration in 2007 (as well as RD39 and RD50).
- The Task Force also noted :
  - the lack of a Chair of experimental particle physics to coordinate the engagement in a manner that is relevant for the scientific goals of CERN.
  - It is necessary strengthen the studies related to HEP.

The organisational structure

of the Experimental Nuclear and Particle Physics Center

The Center was founded as *sui generis* division at Faculty of Physics, therefore its rights and duties reflects the Mission of the Center.



Researchers teams

- Elementary particle physics group

  Team leader - **dr. Thomas Gajdosik**

  Phone: +370 611 69425, e-mail: tgajdosik@yahoo.com

- Particle sensors and irradiation dosimetry

  Team leader - **Dr. Sc. Eugenijus Gaubas**

  Phone: +370 5 223 4480, e-mail: eugenijus.gaubas@ff.vu.lt

- Particle physics outreach group

  Team leader - **Dr. Aušra Kynienė**

  Phone: +370 5 223 4646, e-mail: ausra.kyniene@tfai.vu.lt

- Radiation hardness of semiconductors and deep level spectroscopy

  Team leader - **Prof. Dr. Sc. Juozas Vaitkus**,

  Phone: +370 5 223 4503 e-mail: juozas.vaitkus@ff.vu.lt

- Study of scintillators and their applications for HEP callorimeters

  Team leader - **Prof. Gintautas Tamulaitis**

  Phone: +370 61557525, e-mail: gintautas.tamulaitis@ff.vu.lt

- Theoretical and experimental particle physics group

  Team leader - **dr. Andrius Juodagalvis**

  Phone: +370 5 223 4658, +370 619 19146, e-mail: andjuo@hotmail.com

- Theoretical few-body nuclear physics group

  Team leader - **dr. Arnoldas Deltuva**

  Phone: +370 5 223 4653, e-mail: arnoldas.deltuva@tfai.vu.lt

- Vilnius university Faculty of Mathematics and Informatics (FMI) CERN group

  Team leader - **prof. Algimantas Juozapavičius**

  Phone: +370 5 2195009, e-mail: algimantas.juozapavicius@mif.vu.lt

Upgrading the studies

It was taken into account, that the experimental particle physics covers:

a) the HEP data analysis,
b) the design of instruments, materials and methods for the upgrade of LHC experiments and for the future experiments,
c) IT
d) Infrastructure (radiation monitoring, accelerators, hadron beam control and etc.

Therefore it was created:

I. the new subjects opertional for HEP in the study programme „Physics“

Basic for self-learning systems
UNIX systems
Theory of particle physics I/II
Introduction to HEP experiments data anaysis.

and

II. the different subject programs (in the other study programs) were upgraded by adding the parts related to the experimental particle physics. **(Materials research, Materials science, Sensors, Basic of photonics, including the new laboratory works);**

and

III. **It was delivered a series ot lectures on HEP subjects and"Particle interaction with matter: practical aspects". by colleges at CERN (Ch.Shaefer and N.Riggaz).**

Future plans

- Strengthening existing and search for new researchers teams to collaborate with CERN.
- **Upgrading studies in HEP subjects**, (including TCAD simulation, ALIBAVA system) and analysis a possibility of master level studies. (Doctoral studies requests adaptation to peculiarities of HEP).
- **Tightening contacts and collaboration with CMS experiment.**
- Increase of outreach activities
- As recently Lithuania became an associated member at CERN, and for our **Centre provided a role of coordinating body for all research institutions in Lithuania**, and when the „permanant“ Chair will be selected by the International Advisory Committee, the coordinating of all CERN related activities will be added.

A part of this work is coherent with CERN RD50 collaboration.

THANK YOU
FOR YOUR ATTENTION!