IPPAT

1862
RIGA TECHNICAL UNIVERSITY

CERN Baltijas Grupas aktivitātes

Dr. Andris Ratkus

RTU Daļiņu Fizikas un Paātrinātāju Tehnoloģijas Institūta Pētnieks

13.10.2023

CERN Baltic Group

- CBG Studiju Programmas darba grupas aktivitātes
- CBG Baltijas skola
- CERN Baltijas Konference
- Daļiņu terapijas centra iniciatīva

CBG Studiju Programmas darba grupas aktivitātes

CERN Baltic Group

European Master in High-Energy Physics and Accelerator Technologies for Research and Industry

Development of the master's programme

- **Recap: Erasmus Mundus Design Measures (EMDM):**
  - Successful bid for EMDM funding in 2022;
    - 55 kEur (15 months until 31st of December 2023);
    - Deliverable: developed joint mechanisms for a new master's study programme;

- **Aims of the EMDM project:**
  - to develop joint mechanisms for admissions, evaluation, award of the degree, dissemination;
  - to develop the above mechanisms to be fully in line with the requirements for the Erasmus Mundus Joint Masters (EMJM) calls;
  - to develop a curriculum that would be highly competitive & desirable internationally (incl. to Western European students);

- **Aims of the planned master's programme:**
  - to develop the scientific capacity in modern fundamental physics and related technologies in the Baltic region;
  - to train and develop human resources with the skills and competencies desired by the local industry;
  - to increase the internationalisation of the higher education ecosystem in the Baltic region;

Development of the master's programme

- **Two-year academic master's** comprising **120 ECTS**, focused on HEP & HEP instrumentation relatable to:
  - Particle physics — HEP;
  - Particle reconstruction techniques — HEP & HEP instrumentation;
  - Detector technologies — HEP instrumentation;
  - Accelerator physics — HEP instrumentation;
  - Accelerator technologies — HEP instrumentation;

- Programme to be implemented by a **consortium of Universities** from the three Baltic states (as of October 12th, 2023):
  - Riga Technical University (RTU, lead), Latvia (LV);
  - University of Latvia (UL), Latvia (LV);
  - University of Tartu (UT), Estonia (EE);
  - Vilnius University (VU), Lithuania (LT);
  - Kaunas University of Technology (KTU), Lithuania (LT);

CBG Studiju Programmas darba grupas aktivitātes

CERN Baltic Group

European Master in High-Energy Physics and Accelerator Technologies for Research and Industry

Workshop on the development of the EMDM master's programme: "European Master in Particle Physics and Accelerator Technologies for Research and Industry"

Thursday 27 Apr 2023, 11:00 → 21:30 Europe/Riga

Riga Technical University (RTU)

Riga Technical University (RTU),	Latvia (LV);
University of Latvia (UL),	Latvia (LV);
University of Tartu (UT),	Estonia (EE);
Vilnius University (VU),	Lithuania (LT);
Kaunas University of Technology (KTU),	Lithuania (LT);

CBG Studiju Programmas darba grupas aktivitātes

CERN Baltic Group

European Master in High-Energy Physics and Accelerator Technologies for Research and Industry

Plānota klātienes darba grupas sanāksme 19.10.2023

CBG Studiju Programmas darba grupas aktivitātes

CERN Baltic Group

European Master in High-Energy Physics and Accelerator Technologies for Research and Industry

Plānota klātienes darba grupas sanāksme 19.10.2023

2025.g. sākumā EMJM projekta pieteikumam ir jābūt iesniegtam;
2025.g. Septembrī jāsāk Maģistra studiju programma

CBG Baltijas skola 2023

https://indico.cern.ch/event/1249205/

CERN Baltic Group

Topics covered in the summer school

- Quantum Field Theory
- Standard Model and Beyond
- Physics at Colliders
- Early Cosmology
- Dark Matter
- Gravitational Waves and New Physics
- Accelerator Technologies
- Accelerator Applications

Lecturers

Prof. Jonathan Richard Ellis
Prof. Yuri Dokshitzer
Dr. Maurizio Vretenar

From 2nd CBS: Prof. Leonid Rivkin, Paul Scherrer Institute, Switzerland

Newcomers:

Prof. Kārlis Dreimanis (Ryga Technical University (RTU), Latvia)
Dr. Aleksas Mazeliauskas (Institute for Theoretical Physics, Heidelberg University, Germany)
Prof. Yuval Grossman (Cornell University, USA)
Prof. Joao Seco (Heidelberg Ion Beam Therapy Center, Germany)
Prof. Toms Torims (CERN, Ryga Technical University (RTU), Latvia)
Prof. Tiziano Camporesi (LIP, Portugal / Boston University, USA)

CBG Baltijas skola 2021 - 2023

CERN Baltic Group

CBG Baltijas skola 2024

CERN Baltic Group

- **Proposed dates : the week of 29.07.-02.08.**

COMETA

CERN Baltic Group

- Planned location - **Kuldīga**!

CERN Baltijas Konference (CBC 2023)

CERN Baltic Group

3rd CERN Baltic Conference (CBC 2023)

9–11 Oct 2023
Riga Technical University
Europe/Riga timezone

Scope and scientific topics

The scope of CBC 2023 includes the presentation of the most recent results of the Baltic scientific community in CERN-related fields of research, as well as dedicated sessions for the discussion of national and regional level scientific policy, higher education and industry engagement topics.

The scientific topics include, but are not limited to:

- Particle physics: experiment;
- Particle physics: theory;
- Accelerator physics;
- Accelerator and particle detector technologies;
- Medical physics.

Objectives

The main objectives of the CBC 2023 are to bring together the scientific community of the Baltic states and to provide updates on the most recent scientific achievements of the members of this research community working on CERN-related fields of research.

https://indico.cern.ch/event/1288731/overview

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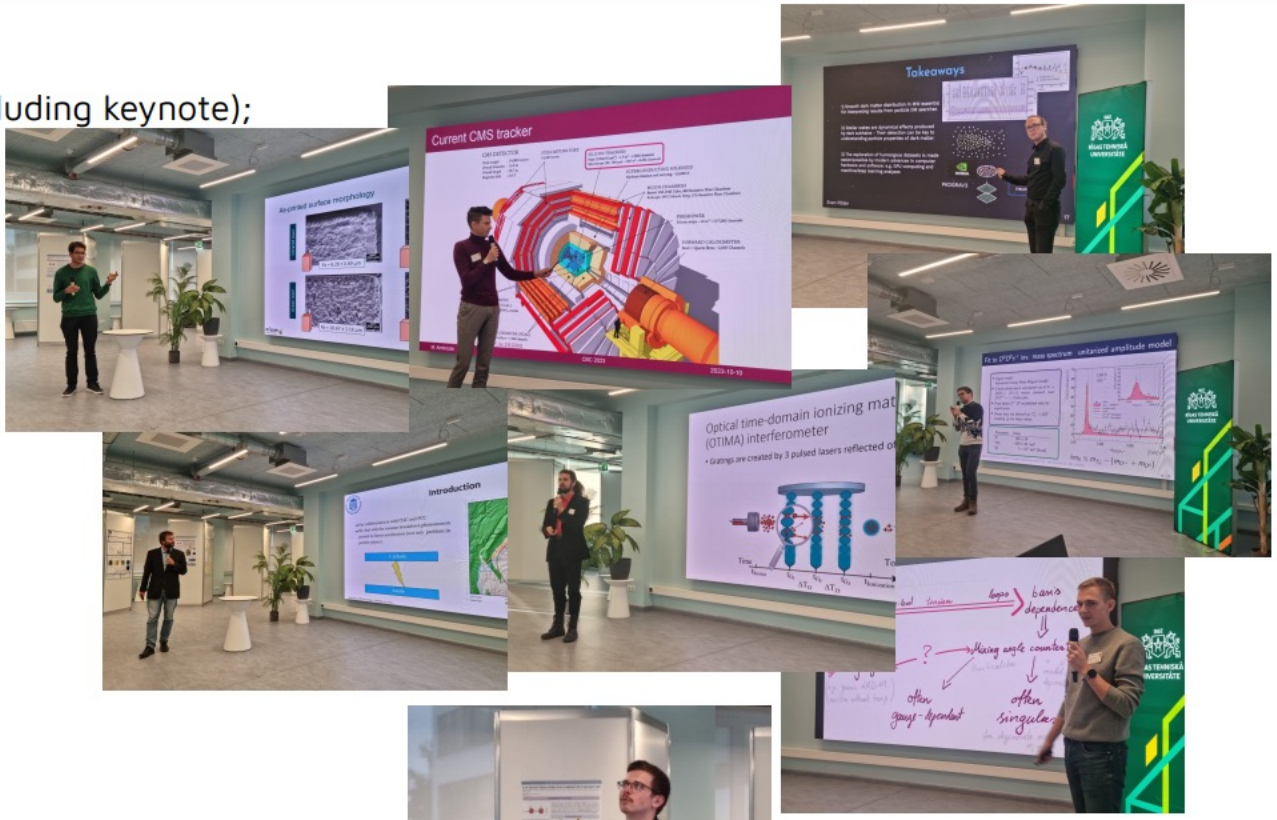
Scientific programme : talks

- 25 accepted scientific oral contributions:
  - Theoretical & experimental physics: 10; (← including keynote);
  - HEP detectors & scintillating materials: 4;
  - Medical physics & technologies : 2;
  - Accelerator technologies: 5;
  - ITC and "Big" & "small" data: 2;
  - cancellations 2.

  - Of these:
    - from Latvia: 13;
    - from Lithuania: 6;
    - from Estonia: 3;



- Significant update talk on the Ion Therapy Centre in the Baltics:
  - Kristaps Paļskis:

    "Baltic particle therapy center initiative:

    Status report, lessons learned and next steps";

https://indico.cern.ch/event/1288731/overview

CERN Baltjas Konference (CBC 2024)

CERN Baltic Group

Place: Tallinn or Tartu
Time: Oct 1-3 or Oct 15-17
decision in process

CERN Baltic Group

VILNIAUS UNIVERSITETAS 1579 UNIVERSITAS VILNENSIS

ktu kaunas university of technology 1922

TAL TECH

1862 RĪGAS TEHNISKĀ UNIVERSITĀTE

UNIVERSITY OF LATVIA

VENTSPILS UNIVERSITY OF APPLIED SCIENCES

RĪGA STRADIŅŠ UNIVERSITY

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

NICPB KBFI

LITHUANIAN ENERGY INSTITUTE

DAUGAVPILS UNIVERSITY

TARTU ÜLIKOOL 1632 UNIVERSITAS TARTUENSIS

VYTAUTAS MAGNUS UNIVERSITY MCMXXII

CERN

Baltijas daļiņu terapijas centra iniciatīva jaunākās akvitātes un tuvākie soļi

Iepriekšējā Latvijas CERN darba grupa sanāksmes

2022. gada 20. decembris

https://indico.cern.ch/event/1226518/

2022. gada 14.aprīlis

https://indico.cern.ch/event/1259867/

Sākotnējie soļi, Baltijas medicīnas kopienu uzrunāšana,
identificētie "problēmpunkti" un plānotie workshops

Sekot akvititātēm:

https://indico.cern.ch/category/16259/

Next Ion Medical Machine Study

nimms

CERN-based scientific collaboration (*under KT*) for development of next generation particle accelerators for cancer treatment with ion therapy

- Building on experience of PIMMS
- Federating large number of partners for key technology development
- **Partners can use the NIMMS technologies to assemle their own optimized facility**

CERN

CERN Baltic Group

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HELIUM SYNCHROTRON

A circular particle accelerator in development by NIMMS collaboration

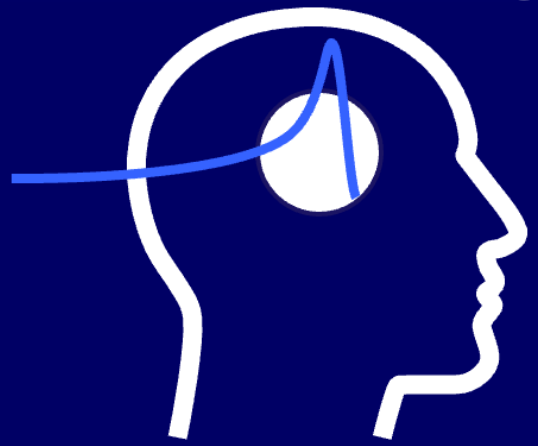
- Acceleration of protons and helium ions to treatment energies
- Higher energy protons for ion radiography purposes
- Possibility for heavy ion acceleration (carbon, oxygen) for biophysics research
- Possibility of ultra-fast dose rate delivery (*FLASH*)
- Possibility of parallel production of therapeutic and diagnostic radioisotopes

On initial design: **M. Vretenar**, E. Benedetto, M. Sapinski, M. E. Angoletta, G. Bisoffi, J. Borburgh, L. Bottura, K. Palskis, R. Taylor, G. Tranquille: *A Compact Synchrotron for Advanced Cancer Therapy with Helium and Proton Beams*

Riga Technical University

Hēlija sinhrotrona tehnoloģijas un piedāvāto iespēju pilna integrācija modernā klīniskajā centrā un lielmēroga, multi-disciplinārā zinātniskās izpētes institūcijā

Zinātniskās pētniecības institūts



Klīniskais centrs

Daļiņu terapija un nukleārā medicīna

Infrastruktūra industrijas iesaistei

For more details on conceptual idea, refer to: Conceptual design idea report and Presentations from last bi-lateral meeting

October 2022 Presentation at the 8th Baltic Radiology congress

Autumn of 2022 Bi-lateral meeting in each of the Baltic states

January 2023 Presentation at Lithuanian Society of Radiation Therapy conference

March 2023 Presentation for Latvian Therapeutical Radiology Association

June 2023

- Presentation at 19th Nordic-Baltic Conference on Biomedical Engineering and Medical Physics
- Brief introduction to initiative ISRS Educational Course

- Conceptual idea has been discussed with Baltic Nuclear Medicine Association
- Seminars are foreseen with the 3 medical physicist associations in the Baltic States, as well participation in 16th International Conference & Workshop *"Medical Physics in the Baltic States 2023"*

Zinātniskās kopienas perspektīva

March 2023 Enhanced Dialogue on R&I System with European Commision – presented as one of the scientific research facility initiatives in the region

May 2023 The helium synchrotron design status presented at IPAC'23 "*CONCEPTUAL DESIGN OF A COMPACT SYNCHROTRON-BASED FACILITY FOR CANCER THERAPY AND BIOMEDICAL RESEARCH WITH HELIUM AND PROTON BEAMS*" with a dedicated section on possible development and implementation of the design in the Balt States "*A FACILITY FOR THE BALTIC STATES*"

Updates from working group at CBG General meetings

Conceptual design of a **compact synchrotron**-based facility for **cancer therapy** and biomedical research with **helium and proton beams**

M. Vretenar,[1] M.E. Angoletta,[1] J. Borburgh,[1] L. Bottura,[1] R. Taylor,[1] G. Tranquille,[1] E. Benedetto,[2] T. Torims,[3] K. Paļskis,[3] M. Sapinski,[4] D. Adliene,[6] E. Korobeinikova,[7] M. Kalniņa,[5] E. Gershkevitsh[8]

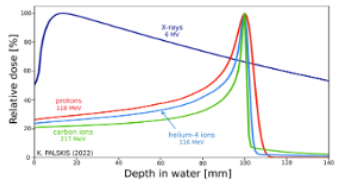
CERN

Helium Ions for Cancer Therapy

Helium radiotherapy trialed since **1975** at LBL, USA.

- Sharper Bragg peak compared to protons
- Reduced fragmentation compared to carbon ions
- Increased RBE and reduced OER to protons
- Reduced neutron risk compared to carbon ions

- Compromise of dose conformity & biological effectiveness.
- High potential for helium ion FLASH therapy treatments.



Accelerator Design

Ion Source

- Two ECR ion sources: >2 mA for protons and $^4He^{2+}$.
- Delivering 8 x 10^{10} ions from synchrotron (2 Gy/l).

LINAC Injector (352 MHz)

- RFQ up to 2 MeV/u.
- Three DTL tanks:
  - 5 MeV/u Helium for synchrotron injection.
  - 7 MeV/u Helium for At-211 isotope production.
  - 10 MeV protons for synchrotron injection.

Compact Synchrotron

Triangular ring, 33m:

Implementation in the Baltic States

- The Baltic States are without a particle therapy centre. Support is growing in the region to construct such a facility.
- Incidence rate of 630 cases per 100 000 inhabitants: 34% receiving radiotherapy.
- 28 radiotherapy LINACs in region: **Sufficiently developed to move towards particle therapy.**
- Plans for head and neck tumours, sarcomas, complex localisations & paediatric cancers.
- Above treatment, provides **opportunities in accelerator technology, medical physics and (pre-)clinical research.**

Courtesy of: NIMMS collaboration

Workshop: "Considerations to create a novel particle therapy center"

An educational workshop
"Clinics and research: considerations to create a novel particle therapy center"

Set-up of the event

- Conceptually – Educational lectures by the leading experts from European ion therapy centers (CNAO, HIT, MedAustron) on clinical indications, medical physics, scientific research and practical experience
- **Event was held on 28th of June, 2023 as part of the annual HITRI*plus* project meeting in Riga, Latvia**
- Event was open to everyone interested, with invitations to professional associations and societies, as well as reaching out to relevant university study programmes to reach students as well
- **57 registered participants**

Clinical aspects and rationales of particle therapy ***Dr. Ester Orlandi (CNAO)***	▪ Rationales and clinical gains of particle therapy compared with conventional radiation therapy ▪ Oncological indications and cancer types eligible for particle therapy ▪ Current clinical evidence, community consensus statements, on-going clinical trials . . .
Medical physics and quality assurance in particle therapy ***Dr. Markus Stock (MedAustron)***	▪ Differences and key-aspects for particle therapy treatment planning compared to conventional ▪ Role of radiobiology for particle therapy treatment planning - LET and RBE. ▪ Aspects of quality assurance procedures for particle therapy and particle accelerator complex
Helium ion therapy. Heavy ion therapy research ***Prof. Thomas Haberer (HIT)***	▪ Rationales and current status of the novel helium ion therapy for cancer treatment ▪ Important considerations before starting the use of a new particle therapy modality clinically ▪ Main research directions in various scientific fields for the heavy ion therapy
Practical experience of setting up a treatment center ***Dr. Sandro Rossi (CNAO)***	▪ Experience and "lessons learned" by current European ion therapy centers ▪ Process of working with CERN-based projects like Proton Ion Medical Machine Study (PIMMS) ▪ Considerations to make in the designing and project development stage

A joint, dedicated workshop
"Particle therapy - future for the Baltic States? State-of-play, synergies and challenges"

Set-up of the event

- **37 participants** (*mainly on site participants*) – Baltic medical community representatives, CNAO radiation oncologist, CERN and NIMMS experts, members of political bodies – Baltic Assembly
- **5 sessions** dedicated to each of the core discussion areas identified with **reporters on subject matter and moderators of the session**

Cancer statistics and indication profile in the Baltic States. Status of radiotherapy technologies in the Baltic States.	▪ Cancer statistics in the Baltic States – number of patients diagnosed and treated with RT yearly ▪ Most common malignancies, with a correspondence to eligibility for particle therapy ▪ Technological level of currently used radiation therapy techniques, statistics of RT equipment
Clinical indications for proton and particle therapy. Existing clinical evidence and on-going clinical trials.	▪ Main cancer types and oncological indications eligible ▪ On-going clinical trials for evidence-based medicine are to be discussed ▪ Existing consensus statements and alternative approaches for patient selection
The technology of helium synchrotron: technology readiness level and research needed.	▪ Current status of the technology and technology readiness level ▪ Potential challenges in the development and construction stages ▪ Scientific research inputs necessary
Current status of nuclear medicine in the Baltic States. Trends and research pathways going into the future.	▪ Current status of the nuclear medicine field within the Baltic States ▪ Insights gained from PRISMAP project - focus on novel radioisotopes ▪ Technical aspects and scientific research needed to develop production of such isotopes
Educational necessities and possible solution pathways for clinical and technical personnel training.	▪ Key educational necessity areas ▪ International educational opportunities and collaborations ▪ Educational aspect implementation paths early-on within the project initiative

A joint, dedicated workshop
“Particle therapy - future for the Baltic States? State-of-play, synergies and challenges”

Set-up of the event

There would be no workshop without the reporters and moderators

Erika Korobeinikova *(Lithuanian Society of Radiation Oncology, LSMU, Clinic of Kaunas)*
Anna Maria Camarda *(CNAO)*
Dace Bogorada-Saukuma *(Latvian Association of Therapeutic Radiology)*
Maija Radziņa *(Latvian Radiology Association, University of Latvia)*
Andrejs Ērglis *(University of Latvia)*
Manjit Dosanjh *(University of Oxford, CERN)*
Maurizio Vretenar *(CERN)*
Elena Benedetto *(SEEIIST Association, CERN)*
Taylor Rebecca *(Imperial College, CERN)*
Edgars Mamis *(University of Latvia, CERN)*
Diana Adlienė *(KTU, CERN Baltic Group)*
Toms Torims *(RTU, CERN Baltic Group)*
Kristaps Palskis *(RTU, CERN)*

Atskaite par “Particle therapy - future for the Baltic States?”

A joint, dedicated workshop
“Particle therapy - future for the Baltic States? State-of-play, synergies and challenges”

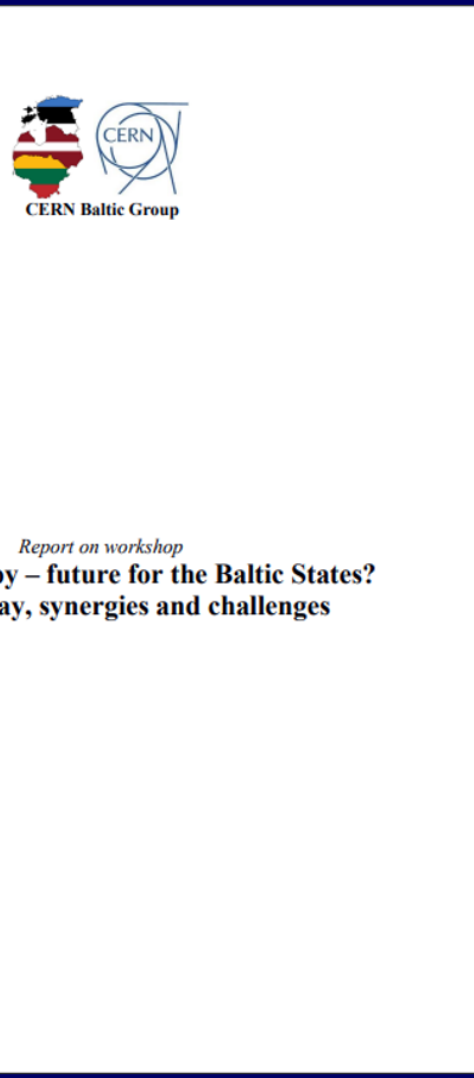
Workshop atskaite

Darba grupas vadītājs un komanda ir sagatavojuši šī *workshop* atskaiti *(skat. pielikumu Indico)*, kuru pārskatījuši un apstiprinājuši pasākuma moderatori un runātāji

Atskaitē iekļautie rezultāti un atziņas ir prezentēti:
- CERN-NIMMS kolaborācijas sanāksmē (29.septembris, 2023)
- 3. CERN Baltijas konferencē (9. oktobris, 2023)

Vakar atskaite prezentēta un apstiprināta 12. CERN Baltijas grupas sanāksmē

Atskaite turpmāk kā viens no projekta iniciatīvas pamatdokumentiem



Lai turpinātu iesākto:

Pilna mēroga projekta priekšizpēte – *feasibility study*

Klīniskā daļa un epidemioloģija	Tehniskie aspekti	Biznesa un ekonomiskie aspekti

Lai turpinātu iesākto:

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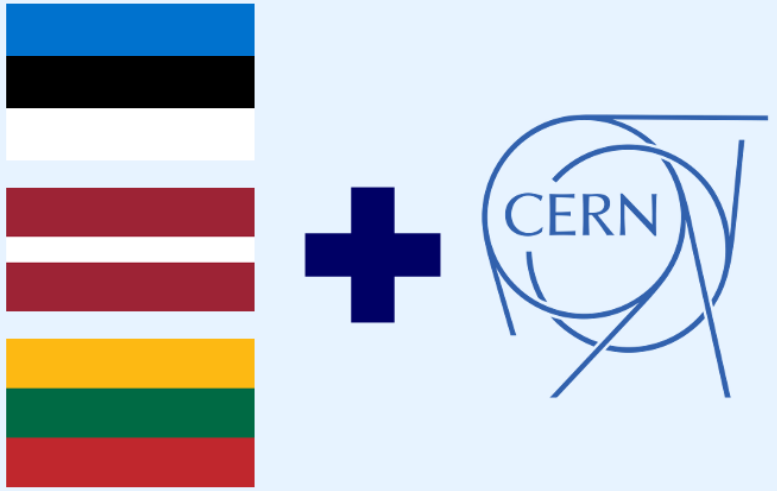

Tehniskie aspekti

Biznesa un ekonomiskie aspekti

Notiek CERN / sadarbībā ar CERN

Lai turpinātu iesākto:

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Klīniskā daļa un epidemioloģija	Tehniskie aspekti	Biznesa un ekonomiskie aspekti
+ CERN	+ CERN	+ CERN

Notiek CERN / sadarbībā ar CERN

Feasibility study **konceptuāli atbalstīta CERN Baltijas grupas līmenī, tās uzsākšana – viena no CBG centrālajām aktivitātēm 2024.gadā**

Thank you!