2nd CERN Baltic Conference (CBC 2022)

Report of Contributions

Contribution ID: **1** Type: **not specified**

Evolutionary algorithms for hyperparameter optimization in machine learning for application in high energy physics

In contemporary high energy physics (HEP) experiments the analysis of vast amounts of data represents a major challenge. In order to overcome this challenge various machine learning (ML) methods are employed. However, in addition to the choice of the ML algorithm a multitude of algorithm-specific parameters, referred to as hyperparameters, need to be specified in practical applications of ML methods. The optimization of these hyperparameters, which is often performed manually, has a significant impact on the performance of the ML algorithm. In this talk we explore several evolutionary algorithms that allow to determine optimal hyperparameters for a given ML task in a fully automated way. Additionally, we study the capability of the two most promising hyperparameter optimisation algorithms, particle swarm optimization and bayesian optimization, for utilising the highly parallel computing architecture that is typical for the field of HEP.

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Contribution ID: **2** Type: **not specified**

Search for Higgs boson pair production in WWWW, WWtautau, and tautautautau decay modes based on proton-proton collision data recorded by the CMS detector in LHC Run 2

The discovery of the Higgs boson by the ATLAS and CMS collaborations a decade ago launched the particle physics community to a new era of research, with the primary goal of determining other properties of the boson. While it is true that the mass of Higgs boson, measured to be around 125 GeV, was the last remaining free parameter of the Standard Model (SM), there are plenty of well-motivated phenomenological models beyond the SM that foresee deviations in interaction rates involving the boson. A particularly compelling case is the production of Higgs boson pairs (HH), which directly probes still-elusive Higgs self-coupling and thereby provides access to the shape of electroweak potential, which is responsible for giving particles their masses, but also plays a key role in the stability of the Universe. It is therefore important to confirm that HH production rate really corresponds to the SM prediction.

This talk presents the searches of HH production in the WW^*WW^*, $WW^*\tau\tau$ and $\tau\tau\tau\tau$ decay modes. The analysis is based on 138/fb of proton-proton collsion data at $\sqrt{s} = 13$ TeV that was recorded by the CMS detector from 2016 to 2018. The final state of interest includes at least two to four electron, muons and hadronic tau decay products. Upper limits are set for nonresonant HH production, for a variety of effective field theory models, and for resonant HH production mediated by a heavy spin-0 or spin-2 particle. Constraints on the Higgs boson self-coupling are also presented.

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Contribution ID: **3** Type: **not specified**

MCNP calculations of the high-power LIEBE molten target at CERN for the production of radioisotopes

Higher beam powers are sought to enhance production of short-lived isotopes, therefore targets able to accommodate such powers are required. With this in mind, a liquid metal target prototype was designed and assembled at CERN, named LIEBE (LIquid Eutectic lead Bismuth for Eurisol). Flux and dose rate maps obtained from Monte Carlo simulations of a 1 mm radii monoenergetic 70 MeV –100 μA flux proton beam falling on the LIEBE target are presented. By a series of proton transport calculations the simulations were performed using the MCNP Monte Carlo code. The latest MCNP input was created with accuracy to the LIEBE target geometry and FENDL-3.1 cross-section data library was used. Performed simulations showed that at the edge of the diffusion chamber, where the proton beam interacts with the target, gamma and neutron dose rates reach almost 2 MSv/h each and around the target dose rates are much lower, roughly 361 Sv/h for gamma rays and 214 Sv/h for neutrons. The proton beam penetrates the liquid eutectic lead bismuth roughly 7 mm deep. Based on the distribution of the flux and dose rate around the target further required changes to the LIEBE target can be evaluated.

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Contribution ID: **4** Type: **not specified**

Higgs pair production at CMS

One of the most important parts of the physics programs for the future of the LHC is the investigation of the Higgs boson interactions. The Higgs boson potential, in particular its trilinear self-interaction, can be directly probed by looking at the Higgs boson pair production. In this presentation I will detail the searches for Higgs pairs and their combination, done by the CMS collaboration using run 2 data.

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Contribution ID: **5** Type: **not specified**

Prospects for Di-Higgs boson searches with multilepton final states in the qqHH production mode

CMS recently presented its first search for Higgs boson pair (HH) production in the WWWW, WWττ, and ττττ decay modes using the full LHC Run2 dataset with 138 fbˆ{-1} of proton proton collision data recorded by the CMS experiment at a center-of-mass energy of 13 TeV. The analyzed events contain two, three, or four reconstructed leptons, including electrons, muons, and hadronically decaying tau leptons. While the original analysis mostly focuses on constraints on the trilinear Higgs self-coupling and the HH signal component in the ggHH production mode, the presented work focuses on the feasability and prospects of extending the analysis focus to the sub-dominant qqHH production mode. While at a factor of about 5-10 lower cross section than ggHH, the study of qqHH allows to study the so far unmeasured VVHH Higgs boson (H) coupling to Vector bosons (V). The presented preliminary results for a final state with two same charge leptons (electrons or muons) and one hadroniclly decaying tau are quite promising, motivating a more dedicated study of qqHH in future analysis iterations.

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Contribution ID: **6** Type: **not specified**

Miniaturised Linear Accelerators for Medical Imaging

In a world with a fast-growing and rapidly aging population, where availability and accuracy of diagnosis is key to early detection and treatment of disease and injury, the development of enhanced medical imaging techniques will improve the wellbeing of unwell members of society. Miniaturised electron linear accelerators can be engineered to be a core component for a portable system for 3D X-ray imaging, that will combine the superior clinical diagnose of 3D with the lower running costs and radiation dose similar to traditional 2D radiography. My talk will describe the current challenges that prevent the commercialisation of such technology, as well as the ongoing research we are undertaking to overcome them.

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Contribution ID: **7** Type: **not specified**

Searching for Dark Matter Subhalos in Astronomical Data using Deep Learning

The search for dark matter (DM) has grown into an endeavour spanning many orders of magnitude in terms of potential DM particle candidate masses probed by numerous direct and indirect experiments. A potential new avenue to explore the nature of DM is to test the predicted abundance of dark subhalos in the LCDM framework. According to the current model of structure formation, our Galaxy has grown by mergers with smaller halos. Thus, hinting at a large population of subhalos orbiting the Galaxy with some of them completely void of stars. The dramatic increase in high-precision observations from current and future stellar surveys of our Galaxy (e.g. Gaia satellite) encourages the gravitational detection of subhalos using deep learning techniques. On the one hand, these methods have already unravelled the stellar substructure of the Milky Way. On the other hand, Milky Way-like galaxy simulations can be used to explore the Galactic dark substructure by training and testing machine learning algorithms. Motivated by the above, our work estimates the feasibility of using supervised and unsupervised deep learning methods on simulations and synthetic Gaia observations to detect disturbances in the stellar phase-space induced by orbiting dark matter subhalos. We quantify the magnitude of the perturbations using a deep learning based anomaly detection algorithm. The enormous sizes of current and future astronomical surveys call for further development of scalable computational methods to identify potential regions of interest in future dark matter searches.

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Contribution ID: **8** Type: **not specified**

Compact Linear Collider: Investigation of electrical breakdown phenomena using multiscale and multiphysics simulations

Many high electric field applications, for example, Compact Linear Collider in CERN are significantly limited by the presence of the phenomenon of electrical breakdowns. In case of sufficiently high applied electric field, even in ultra high vacuum conditions, electrical discharge appears, induces disturbances into the operating regime of the device, causes material damage and generally, limits significantly operation of the device. Phenomenon itself is known for long time, however, it' s exact initiation mechanisms still remain elusive. Current hypotheses suggest, that electric field influence leads to a formation of field enhancing nanoscale tip. This tip will initiate significant field emission currents, evaporation of netural atoms, formation of plasma and finally –complete electrical breakdown. In current talk we explore these hypotheses of electric field assisted surface diffusion as the initiation mechanism of the field emitters by the studies conducted using multi-physics-multi scale simulation framework FEMOCS calclulations with nanoscale materials exposed to high field.

FEMOCS is a unique software that allows multiscale computer simulations, combining atomistic and electromagnetic field analyses together with heat transport calculations for the development of nanoelectronics, nanomaterials and nanoelectromechanical systems (NEMS). The software has been developed to solve materials technology problems of CERN particle accelerator designs, but also has applications in ITER, space applications and high-tech R&D.

The functionality of FEMOCS centers on nanostructure changes of materials in severe conditions by providing of a computational framework that combines Finite Element Analysis (FEA), atomistic simulations such as Molecular Dynamics (MD) and kinetic Monte Carlo (KMC), and Particle In Cell models, to investigate the effect of high electric fields on surface interactions.

In current talk, we will provide overview of application of FEMOCS in CLIC breakdown studies, it's development status and availability of involved technologies for wider use in field emission related applications.

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Contribution ID: **9** Type: **not specified**

AEgIS upgrades and Phase 2 developments

The Antimatter Experiment: Gravity, Interferometry, Spectroscopy (AEgIS) collaboration aims at performing spectroscopic studies and direct experimental tests of the universality of free fall also known as Weak Equivalence Principle (WEP) using antimatter-containing neutral systems (antihydrogen, positronium atoms, antiprotonic atoms).
AEgIS Phase 1 was a feasibility study of a pulsed antihydrogen source. It ended in 2018 with the formation of cold antihydrogen atoms in the trap.
Since then Extra Low ENergy Antiproton ring (ELENA) has been added to AD complex and has started operation in autumn 2021. The new decelerator allows one to capture more and colder antiprotons than previously.
The Phase 2 period aims to improve the antihydrogen production and conduct do a measurement of the antihydrogen free fall. To achieve these goals, significant upgrades have been implemented - a new trap, optimisation of the positron system and new electronics and control system.
The new trap allows positronium production on the trap axis which will increase the interaction time.
The positron system has been improved by adding mu-metal shielding and new coils which improves efficiency 3 times, and also the positronium conversion target can be baked during operation. The target nanochannel etching process has been improved which gives approximately 5x improvement on positronium yield.
The new ARTIQ/Sinara control system provides at nanosecond precision over extended periods of time. For the automation of the experiment, a Labview system was created enabling 24/7 data taking without supervision.

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Contribution ID: **10** Type: **not specified**

COMPARISON OF ELECTROCHEMICAL SYSTEMS FOR SENSING REDOX ACTIVE MOLECULES

Abnormal amounts of ascorbic acid (AA), uric acid (UA), and dopamine (DA) can cause and be symptoms of various disorders. DA could be monitored as a potential biomarker for SARS-CoV-2 infection because it reduces the immune response during infection. Additionally, AA and UA levels also aid in infection prevention. Therefore, monitoring these analytes is in a high demand for diagnosing physical conditions [1-4].
As a result, a simple and cost-effective method for producing self-standing reduced graphite oxide (SRGO) was developed. Scanning electron microscopy (SEM), Energy Dispersive X-Ray Analysis (EDX), and X-Ray Spectra Electron spectroscopy were used to investigate the electrochemical transducer (XPS).
Using voltammetry, the SRGO was used to detect DA, UA, and AA, as well as mixtures of these compounds. The voltammogram curve has three well-defined fully resolved anodic peaks, indicating that SRGO has significantly higher electrocatalytic activity toward the oxidation of analytes than bare carbon materials. It was found that SRGO modified with varying levels of functional groups present on the surface clearly influences analyte determination. The linear response ranges for DA, UA, and AA determination were obtained with a physiological limit of detection (LOD). Furthermore, in comparison to other electrode materials that will be presented, SRGO has high reproducibility and selectivity for determining DA, UA, and AA. The demonstrated capabilities can help diagnose metabolic abnormalities and detect infectious diseases in biological samples.

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[4] A. Baradoke, A. Santos, P. R. Bueno, J.J. Davis Introducing polymer conductance in diagnostically relevant transduction. Biosens. Bioelectron. 112705, (2020).

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Contribution ID: **11** Type: **not specified**

On-Shell renormalization of scalar sectors

The renormalization in models with particle mixing is still not completely understood, as such there are many renormalization schemes. Most of the difficulty revolves around gauge-independent and numerically stable renormalization of the mixing. In our previous work we have proposed an On-Shell and all-order renormalization scheme for fermions that trivially satisfies many of the needed mixing renormalization requirements. Currently we are working on extending the fermion approach to scalar sectors. At 1-loop the renormalization scheme seems to be easily carried over, however, when considering higher orders in perturbation theory, renormalization of non-physical scalar sectors becomes non-obvious. In this talk we present the progress so far and current obstacles.

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Contribution ID: **12** Type: **not specified**

Searching for Dark Matter Subhalos in Astronomical Data using Deep Learning

The search for dark matter (DM) has grown into an endeavour spanning many orders of magnitude in terms of potential DM particle candidate masses probed by numerous direct and indirect experiments. A potential new avenue to explore the nature of DM is to test the predicted abundance of dark subhalos in the LCDM framework. According to the current model of structure formation, our Galaxy has grown by mergers with smaller halos. Thus, hinting at a large population of subhalos orbiting the Galaxy with some of them completely void of stars. The dramatic increase in high-precision observations from current and future stellar surveys of our Galaxy (e.g. Gaia satellite) encourages the gravitational detection of subhalos using deep learning techniques. On the one hand, these methods have already unravelled the stellar substructure of the Milky Way. On the other hand, Milky Way-like galaxy simulations can be used to explore the Galactic dark substructure by training and testing machine learning algorithms. Motivated by the above, our work estimates the feasibility of using supervised and unsupervised deep learning methods on simulations and synthetic Gaia observations to detect disturbances in the stellar phase-space induced by orbiting dark matter subhalos. We quantify the magnitude of the perturbations using a deep learning based anomaly detection algorithm. The enormous sizes of current and future astronomical surveys call for further development of scalable computational methods to identify potential regions of interest in future dark matter searches.

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Contribution ID: **13** Type: **not specified**

Physical and biological property comparisons of 4He and 3He ion beams for applicability in radiation therapy

Background and aims
The importance and clinical significance of ion beam therapy for cancer treatment is sharply increasing due to the favorable physical and biological characteristics compared to conventional radiotherapy. With the established clinical use of proton and carbon ion beams, lately there is a growing interest for use of helium ion beams for cancer treatment due to improved physical and biological properties compared to protons, while having less demanding accelerator design compared to carbon ions. While the main focus from clinical perspective has been on He-4 ion beams, possible use of He-3 ions has been considered from accelerator physics perspective –with charge-to-mass ratio of He-3 ions, reduced beam contamination would be achieved at injection and smaller synchrotron ring could be used due to the lower beam rigidity.
The aim of this study is therefore to compare clinically relevant physical properties and associated biological effects for He-3 and He-4 ion beams.

Methods
Work has been done under collaboration of Riga Technical University, CERN Next Ion Medical Machine Study (NIMMS) group and German Cancer Research center (DKFZ).
Datasets of initial beam energies corresponding to 100 to 150 mm treatment range for He-3 and He-4 pencil beams impinging on water and muscle tissue have been acquired with Monte Carlo simulations in GEANT4 environment. Initial energies have been calculated according to Bethe-Bloch formalism, no initial energy spread was applied for the beam.
Integrated depth doses, lateral dose distribution profiles, primary particle and fragment fluences, kinetic energy distributions and linear energy transfer maps have been calculated and evaluated. Pristine peak weights have been calculated to deliver a single field uniform spread-out Bragg peak. Correspondingly, relative biological effectiveness (RBE) values have been calculated with Microdosimetric Kinetic Model. Moreover, neutron production and kinetic energy distributions have been calculated for neutron biological effect estimations.
For estimation of He-3 and He-4 ion beam feasibility for *in-vivo* range monitoring, two detection methods have been considered - positron emission tomography and prompt gamma imaging. For positron emission tomography (PET) based verification production yields of positron-emitting isotope fragments have been calculated, corresponding activity distributions have been calculated and positron range effects have been considered. For prompt gamma imaging information of photon emission vertices has been registered - photon energy, spatial coordinates and corresponding nuclear reaction process.

Results
A throughout simulation data comparison has been made for He-3 and He-4 ion beams, regarding their physical dose distributions, associated radiobiological effects and neutron dose, while also investigating feasibility for positron emitter and prompt gamma based in-vivo range monitoring methods.
Based on the acquired data He-3 ion beams stand as a viable option and clinical alternative to He-4 ion beams for use in radiation therapy, due to their comparable physical dose deposition characteristics and associated biological effects. Differences have been observed in the theoretically achievable signal for the considered in-vivo range monitoring methods which should be further benchmarked and confirmed with experimental measurements due to complexity of Monte-Carlo modelling for nuclear processes.

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Contribution ID: **14** Type: **not specified**

CONCEPTUAL DESIGN OF ADVANCED PARTICLE THERAPY CENTER IN THE BALTIC STATES

OBJECTIVE
In the field of radiation oncology, particle therapy is promising to be more efficient cancer treatment modality due to favourable physical and biological properties over conventional gamma radiation therapy. In clinic, particle therapy has already shown benefits in treatment of paediatric oncological malignancies, brain and head and neck region tumors and other localizations in vicinity of critical vital organs. Moreover, particle therapy has shown the clinical possibility of treatment for tumors that are otherwise radioresistant to conventional radiation therapy, such as gliomas and sarcomas. The Baltic States is one of the only regions in Europe without a dedicated infrastructure for the highly beneficial particle therapy treatment.
With the active work of CERN Baltic Group in close collaboration with CERN scientists from Next Ion Medical Machine Study (NIMMS) collaboration, a conceptual design proposal has been made on Advanced Particle Therapy facility in the Baltic States. The aim of this work is to report on the progress made and current status of the conceptual design of the proposed facility, outlining key clinical and physics rationales of particle therapy, clinical treatment improvements, novel research pathways and industrial sector involvement possibilities.

METHODS
This conceptual design report covers the overall technical concept of the proposed facility and focuses on the three main functions of it: clinical treatment center, novel research facility and a dedicated infrastructure for involvement and development of relevant industry sectors. The technical concept for the proposed facility is based on a design in development at CERN by the researchers of the NIMMS collaboration –the helium synchrotron. The design of helium synchrotron is a novel and „first - ever"medical treatment synchrotron made specifically for acceleration of helium ions. A dedicated section in the paper gives the main technical details regarding the proposed accelerator complex.
From the clinical perspective, the physical properties and associated biological effects of helium ions are explored in comparison with the clinically used proton and carbon ion beams. Applicability of helium ion therapy is given from the treatment perspective, identifying oncological malignancies benefiting the most from the novel treatment.
The technical design of the proposed accelerator complex includes dedicated section of the injection linear accelerator for production of medical use radioisotopes. Thus, possibilities of exotic radioisotope production are given and potential benefits and applications in the nuclear medicine field have also been identified.
The proposed facility provides infrastructure for novel research possibilities in the fields of radiation oncology, medical physics, nuclear medicine, radiation chemistry and nuclear physics, radiobiology, accelerator physics and engineering and others. Possible research directions have been identified, delivering world class research in the corresponding fields. Pathways of relevant industrial sector involvement in construction of the facility have been identified and future perspectives of research and development of technology innovations are proposed, adressing the needs of the international particle therapy community.

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Contribution ID: **15** Type: **not specified**

Latvia - CERN Collaboration

Update talk on Latvia - CERN collaboration covering all aspects and future perspectives

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Contribution ID: **16** Type: **not specified**

Advancements of integration and mechanical design of gantries for ion-therapy

This presentation outlines the recent progresses on the mechanical design and integration of components of gantries for ion-therapy of cancer, which is are crucial steps toward the development of the next ion medical machine. A comparative study of multiple scenarios was conducted based on robustness of the design, size, weight and complexity, deformation and precision performances and costs, as well as environmental impact. Four prospective scenarios were identified, each of them capable of providing beam to at least 220° around the patient. One scenario is capable of providing treatment angles of 360°. Results show that in statically balanced scenarios, considerable improvements can be reached in terms of safety, deformation, precision performances, complexity and costs of implementation. All scenarios are deemed suitable for further gantry design development. Further steps in the integration studies are outlined, such as the study of the effect of mechanical errors on the optic elements of the transfer line and general system integration.

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Contribution ID: **17** Type: **not specified**

Report on project - Advanced Particle Therapy center in the Baltic States

Information on where we stand with the project vis-a-vis decision makers, policy implementers and medical communities

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Contribution ID: **18** Type: **not specified**

Charged lepton flavor violation in the Grimus-Neufeld model

We provide constraints on the connection between the scalar and the neutrino sector from the charged lepton flavor violating decays in the tiny seesaw scenario of the Grimus-Neufeld model. We discuss the similarities between the Grimus-Neufeld model, the scotogenic model and the scoto-seesaw model in this parameter region and interpret our results in the context of all these three models.

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Contribution ID: **19** Type: **not specified**

Laser Polishing of Additively Manufactured RFQ Prototype

Additive manufacturing and laser powder bed fusion in particular are offering significant benefits in designing and manufacturing parts with complex geometry that can be used for accelerator component manufacturing. But one of main drawbacks of this technology is the surface roughness of finished product.
The main goal of this project was to explore possibilities to reduce surface roughness and porosity of radio frequency quadrapole (one of main components in a linear particle accelerator) built with additive manufacturing of pure copper by laser polishing. It was done in 2 steps: publications of aluminium laser polishing were studied and then recommended laser parameters for initial experiment of copper laser polishing were derived.

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Contribution ID: **20** Type: **not specified**

Yukawa couplings in the Grimus-Neufeld model

The Grimus-Neufeld model is an appealing minimal extension of the Standard Model that can explain neutrino masses. In the case of a very small seesaw scale the model gains approximate symmetries that allow a simpler parametrization of the Yukawa couplings. This parametrization has the additional advantage of allowing a very precise and simple display of the free parameter space of the model that can be used to study Charged Lepton Flavour Violating decays.
I will present the Yukawa couplings and the logic of their construction.

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Presenter: GAJDOSIK, Thomas (Vilnius University (LT))

Contribution ID: **21** Type: **not specified**

Design of DTL for acceleration of ions with charge-to-mass ratio of 1/2 with a potential production of radioisotopes

Background and Aims
Radio-frequency linear accelerators (LINACS) are used as the first stage of particle acceleration for injection into a synchrotron. Ion accelerator complexes have found a crucial place in the medical field for cancer treatment. In that field, LINAC design requirements are very strict concerning their dimension, but at the same time, they need to be able to accelerate various particle types with different charge-to-mass ratios. On the other hand, in the last few decades, there is a growing interest in the use of alpha-emitting radioisotopes for target therapies in nuclear medicine, such as Astatine-211 (211At). It has been shown that such radioisotopes could be more efficiently produced with linear accelerators compared to conventional cyclotron-based methods.
In this study, the initial results of the Drifting Tube LINAC (DTL) design for the acceleration of ions with q/m=1 and q/m=1/2 have been reported for the use of the injection into the synchrotron and potential production of radioisotopes.
This study has been done under WP7.4 of HITRIplus project –Linac Injector Design (Advanced conceptual design of an optimized linac injector for multiple ions at 10 MeV/u).

Methods
Following WP7.4 of the HITRIplus project, the main design requirements for efficient LINAC structure in medical facilities have been identified in terms of its length, output energy, and type of accelerated particles. Additional design constraints have been considered for fixed parameters such as operational frequency and input energy.
To accomplish mentioned design requirements, the four possible cases (each with two separate tanks of DTL structure) have been considered with different output energy of the first tank and the type of possible particles which can be accelerated per tank.
As input parameters, the geometry of both tanks in each case has been used and the corresponding EM field distribution has been simulated using Poisson Superfish codes. From simulation results, the accelerator output parameters (e.g. tanks output energies, total DTL length, and all accelerator's figure of merits) have been extracted for the intercomparison of the four proposed DTL structures. Validation of the proposed simulation workflow has been done by benchmarking output parameters of each DTL case with a well-known LINAC structure: LINAC4. Mentioned DTL structure parameters have been evaluated against initial design requirements.

Conclusions
Four possible DTL structures have been developed for the acceleration of particles of charge-to-mass equal to 1 and 1/2, or just for 1/2, with capabilities for the potential production of radioisotopes. Following the accelerator's output parameters for each of the structures and initial requirements, the most favorable DTL structure has been chosen as one of the possible candidates for injector linac for the WP7.4 HITRIplus project.

Primary author: Mr NIKITOVIC, Lazar (Riga Technical University (LV))

Co-authors: VRETENAR, Maurizio (CERN); Prof. TORIMS, Toms (Riga Technical University (LV))

Presenter: Mr NIKITOVIC, Lazar (Riga Technical University (LV))

Contribution ID: **22** Type: **not specified**

Characterication and Calibration of the RD53B CMS Chip

The High-Luminosity LHC is expected to start its operation in 2029. All the detector experiments around the LHC will also have significant improvements (the so-called Phase-2 upgrade) to ensure optimal performance with 10 times higher than nominal instantaneous luminosity. The innermost layers of the upgraded detectors must have higher granularity with more readout channels, and be significantly more radiation-hard than the current ones.
The CMS experiment is preparing a completely new silicon tracker unit, consisting of two separate parts: the Inner and the Outer Tracker. The Inner Tracker will feature pixel detectors with 6 times smaller pixels, compared to the current ones, and will have 12 forward disks instead of the current 3, making the total number of pixels reach around 2 billion. It will feature a radiation-hard readout chip, developed by the RD53 collaboration for both CMS and ATLAS experiments, and will be able to provide the necessary data transmission rates.
The preparation works for the CMS Inner Tracker upgrade are well underway and the 2nd generation chip prototypes, the RD53B CMS (also called CMS ReadOut Chip or CROC for short), are already being tested and optimized. A dedicated data acquisition and control framework is used for chip calibration and testing. The most recent chip characterization and calibration results will be presented during the talk.

Primary author: AMBROZAS, Marijus (Vilnius University (LT))

Co-author: MERSI, Stefano (CERN)

Presenter: AMBROZAS, Marijus (Vilnius University (LT))

Contribution ID: **23** Type: **not specified**

Development of the MTD Control and Safety Systems at CMS

The Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) will undergo extensive upgrades during the long-shutdown 3 (LS3) scheduled for 2026-28. One of the most prominent aspects of the upgrade will be the introduction of a new detector sub-system, the MIP Timing Detector (MTD), situated between the outer tracker and the electromagnetic calorimeter. The MTD is a timing layer, which aims to provide a charge-track time resolution on the order of tens of picoseconds. As with all detector systems at CMS, the MTD will be controlled and monitored using detector control and detector safety systems (DCS and DSS). DCS and DSS are one-of-a-kind purpose-built prototype software systems, constructed using the WinCC software package.

Primary author: GAILE, Antra (Riga Technical University (LV))

Presenter: GAILE, Antra (Riga Technical University (LV))

Contribution ID: **24** Type: **not specified**

CHEMICAL SEPARATION AND PURIFICATION OF STABLE 45SC FROM CERN-MEDICIS MASS-SEPARATOR COLLECTION FOILS

Radionuclides of chemical element Scandium can be used in radionuclide targeted therapy and positron emission tomography (PET/CT), where 44Sc or 43Sc would be used for diagnostic imaging purposes and monitoring therapy response and 47Sc for therapeutic purposes or SPECT diagnostics [1].
CERN MEDICIS (MEDical Isotopes Collected from ISolde) produces medical radionuclides by recovering the 1.4 and 1.7 GeV proton beam from CERN-PSB (Proton Synchrotron Booster) before it reaches the beam dump using thick targets placed behind the ISOLDE (The Isotope mass Separator On-Line facility) targets. These radionuclides are then extracted and separated according to their atomic mass via MEDICIS mass-separator and implanted in a Zinc or Aluminium covered gold or salt foils [2]. Mass-separation is the only way to separate medical 43,44,47Sc radionuclides from the long-lived ones, such as 46Sc. After collecting the radionuclides on the foil, radiochemical manipulations are necessary to get rid of isobaric (equal mass) impurities.
Ion exchange chromatography is one of the most powerful and widely used methods for radiochemical separations. With a proper choice of conditions, ion exchange is very useful for separating carrier-free radionuclides from a bulk target having a significantly lower affinity toward the resin [3].
Method for stable Scandium separation from Zinc and Aluminium standard solutions was developed using DGA resin. ICP-MS analyses were performed on each of the collected samples to determine the concentration of zinc, aluminium, and scandium ions. In this method DGA resin trapped more than 90% of the total scandium ions present in the stock solution. Afterward, this method was used to separate stable scandium from CERN MEDICIS mass –separator collection foils with Zinc coating (500nm). In total, more than 90% of Zinc ions were separated from the sample. Most of the Zinc ions were separated in feedthrough and waste fraction. Less than 1% of Zinc ions were in the product fraction. As it is planned to implant Scandium on Aluminium coated gold foils in the future, separation of scandium from Al/Au foil was performed. In total more than 90% of Aluminium ions were separated from the sample.

Keywords: ion exchange chromatography, scandium, mass-separator.

References:

1. C. Shaun Loveless, Jose R. Blanco, George L. Diehl III,Rawdah T. Elbahrawi, Tommaso S. Carzaniga, Saverio Braccini, and Suzanne E. Lapi, “Cyclotron Production and Separation of Scandium Radionuclides from Natural Titanium Metal and Titanium Dioxide Targets,”
2. C. Duchemin, J. P. Ramos, T. Stora, and MEDICIS collaboration board, “CERN MEDICIS: A Unique Facility For The Production Of Non-conventional Radionuclides For The Medical Research”,11th International Particle Accelerator Conference, Caen-France, 2020,
3. J. Am. Chem. Soc. 1959, 81, 19, 5262–5263

Primary authors: MAMIS, Edgars (University of Latvia (LV)); PAJUSTE, Elina (University of Latvia (LV)); LAMBERT, Laura (CERN); KALNINA, Patricija; KHAN, Qaiser (Pakistan Atomic Energy Commission (PK)); STORA, Thierry (CERN)

Presenter: KALNINA, Patricija

Contribution ID: **25** Type: **not specified**

Dose rates and specific activities of LIEBE target at CERN after the irradiation with the high-power proton beam

The widespread approach to increasing the yield of radioactive isotopes in the accelerators is to increase the beam intensity. The creation of targets capable of accommodating these high-power beams is the main task in achieving higher radioactive isotope production. A prototype target named LIEBE (Liquid Eutectic lead Bismuth for Eurisol) was designed and assembled for that purpose at CERN. The proton transport simulations with the MCNP code were performed to generate neutron flux densities and spectra at the LIEBE target and its surroundings. The FISPACT code with the TENDL 2021 nuclear data library was used for the LIEBE irradiation simulations using the MCNP-produced data and considering the irradiation durations of 1 hour, 1 day and 1 week at full power. The neutron-induced activation, contact dose rates and dose rates at a 30 cm distance were determined at several time slices after the shutdown and the end of irradiation. This data can be used to evaluate required changes for the LIEBE target to produce a higher yield of radioactive isotope production.

Primary authors: Mr SLAVICKAS, Andrius (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety); Mr TOGOBICKIJ, Benjaminas (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety); Dr STANKUNAS, Gediminas (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety); Dr POVILAITIS, Mantas (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety)

Presenter: Mr SLAVICKAS, Andrius (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety)

Contribution ID: **26** Type: **not specified**

Top quark physics results from CMS

Recent results on top quark properties and interactions are presented, obtained using data collected with the CMS experiment during LHC Run 2 and Run 3 at 13 and 13.6 TeV center-of-mass energies, respectively. Measurements are performed for the inclusive and differential top quark pair production cross sections in several top quark final states. The mass of the top quark is extracted using several methods, including indirect constraints from the measured cross section. Cross sections for the electroweak production of single top quarks in both t-channel and tW associated production are measured, and limits are set on s-channel production. Further results include measurements of top quark properties, such as the W helicity in top decays, the top pair charge asymmetry, the top quark polarization and spin correlation, as well as the search for anomalous couplings in both pair and single top-quark production. Rare processes, such as tt and single top production associated with W, Z and gamma, are explored. The results are compared with predictions from the standard model.

Primary author: SEIDEL, Markus (Riga Technical University (LV))

Presenter: SEIDEL, Markus (Riga Technical University (LV))

Contribution ID: **27** Type: **not specified**

ttbar simulation and jet energy studies (towards a measurement of the ttbar mass difference at CMS)

Both CMS and ATLAS, the two general-purpose detectors at the LHC, need a vast array of large Monte-Carlo data samples, in order to probe the Standard Model. Common MC samples allow for assessing differences in detector performance and analysis strategy. A new ttbar sample based on the Sherpa generator is compared to CMS and ATLAS data using the Rivet validation framework. The measurement of the top/antitop mass difference requires careful energy calibration of the jets initiated by different quark flavors. The current status is presented, including first studies of quark vs anti-quark jet energy response in simulation.

Primary authors: POTREBKO, Andris (Riga Technical University (LV)); DREIMANIS, Karlis (Riga Technical University (LV)); SEIDEL, Markus (Riga Technical University (LV))

Presenter: POTREBKO, Andris (Riga Technical University (LV))

Contribution ID: **28** Type: **not specified**

RTU High energy physics and accelerator technology centre activities in Accelerator Projects

Riga Technical University High Energy Physics and Accelerator Technology centre's one of two core specialisations is accelerator technologies with established three main research directions: innovation and development of accelerator technologies; accelerator medical application and accelerator environmental applications. All those research directions are related to accelerator technology projects where the centre researchers have been involved and students' thesis are related to projects.
Within the project, Innovation Fostering in Accelerator Science and Technology our team is involved in the development of accelerator technologies and environmental applications as well as project management, coordination and dissemination tasks.
Hadron therapy for cancer treatment is studied in the Heavy Ion Therapy Research and Integration plus project and our team is in the tasks that are covering innovative high-frequency linear accelerator design research and Integration of an innovative superconducting gantry by dealing with mechanical designs, systems and concepts.
Within Next Ion Medical Machine Study project is working towards developing new technologies for the future generation of accelerators for cancer therapy.
Hybrid Exhaust-gas-cleaning and Accelerator Technology for International Shipping Collaboration was established between multiple partners based on promising results of the Accelerator Research and Innovation for European Science and Society PoC where the Development of a hybrid electron accelerator system for the treatment of marine diesel exhaust gases.
That all is collaborative work with field experts and that provides promising outcomes.

Primary author: RATKUS, Andris (Riga Technical University (LV))

Presenter: RATKUS, Andris (Riga Technical University (LV))

Contribution ID: **29** Type: **not specified**

Research on the design development of accelerator components by additive manufacturing

During the last decades, engineering inventions and technological developments are progressing significantly. Metal additive manufacturing and subatomic particle accelerators are relatively new technologies whose joint potential is not realized yet as an industrial solution. The main reason for that is low trustability and skepticism on quality, accuracy, and repeatability of additively manufactured parts from the accelerator community side. Furthermore, AM still has very limited applications in the high-energy physics field. Some additional causes of that are highly specific requirements like chemical purity, vacuum tightness, and voltage holding. These characteristics of AM products are not explored yet at enough level of trustability. However, AM technology already is certified for high complexity and high-performance parts in such fields as aviation, space, medicine, automotive, and other hi-tech level demanding industries. This talk contains a brief report on the first promising results of AM performance on pure copper HF-RFQ prototype design and manufacturing, including postprocessing, which is developed in H2020 I.FAST WP10.2. collaboration. This research is a step toward whole AM technology development for accelerator parts design and manufacturing to reduce life cycle costs and improve society's access to advanced technologies.

Primary authors: PIKURS, Guntis (Riga Technical University (LV)); VRETENAR, Maurizio (CERN); Prof. TORIMS, Toms (Riga Technical University (LV))

Presenter: PIKURS, Guntis (Riga Technical University (LV))

Contribution ID: **30** Type: **not specified**

Production, extraction and mass-separation of medical ^{43,44,47}Sc radionuclides at the CERN-MEDICIS facility

The CERN-MEDICIS facility at CERN specializes in extraction and mass-separation of wide range novel medical radionuclides, produced in reactions from 1.4 GeV and 1.7 GeV protons on thick targets at CERN Proton Synchroton Booster (PSB), as well as externally irradiated samples from nuclear reactors and cyclotrons. The extracted radionuclides are typically delivered in the form of singly charged atomic ions, but with development of more versatile ion sources, molecular species could be successfully extracted as well.

Molecules have been studied as a method to efficiently deliver beams of release-limited elements by forming and extracting volatile molecules of otherwise refractory species such as medical ^{43,44m,44g,47}Sc radionuclides which are very promising in "matched theranostic pair"radiopharmaceutical development for cancer treatment. The development of molecular beams is fostered by some desired radionuclide low volatility and vapour pressure, possible improvements to beam extraction, efficiency, radionuclidic and chemical purity. For instance, extracting radionuclides on a molecular sideband shifts the mass of interest, and can therefore be used as a technique to improve beam purity by changing the isobaric contamination.

In this study, natural titanium targets were irradiated at the MEDICIS target irradiation station with 1.4 GeV protons. The presence of contaminant isotopes such as ^{46}Sc in the final product for radiolabeling with radiopharmaceuticals is not acceptable, therefore produced Sc radionuclide separation step, according to their mass is mandatory. Nevertheless, ^{46}Sc could be used for extraction studies long after decay of medical Sc radionuclides.

Scandium fluoride molecular beams were studied with a Versatile Arc Discharge Ion Source (VADIS). ISOL and mass-separation is mandatory and effective to obtain high purity and yield ^{43,44m,44g,47}Sc, but chemical separation from collection foils and isobars must be done after extraction to prepare for radiolabeling.

Primary authors: DUCHEMIN, Charlotte (CERN EN/STI/RBS); BERNERD, Cyril (KU Leuven (BE)); MAMIS, Edgars (University of Latvia (LV)); PAJUSTE, Elina (University of Latvia (LV)); LAMBERT, Laura (CERN); Prof. RADZINA, Maija; ROTHE, Sebastian (CERN); STORA, Thierry (CERN)

Presenter: MAMIS, Edgars (University of Latvia (LV))

Contribution ID: **31** Type: **not specified**

Diffusion processes in metals at the nanoscale: experimental studies

Cu electrodes are widely used in accelerators, for example in CLIC [1]. One of the problems arising in the accelerator is the breakdown phenomenon [2] causing damage to the accelerating structures and disturbances in the accelerated beam. The cause of the vacuum breakdowns is still under investigation and the electrodes regularly investigated for clues. According to one of the models, breakdowns can be initiated by high-aspect-ratio nanoscale protrusions that appear on Cu surface due to diffusion of Cu atoms driven by high electric field gradient [3].
In our studies, we investigate the effect of strong electric field on the behavior of various metal surfaces using nanomanipulation platform installed inside a scanning electron microscope. Our approach enables to study morphological changes in metal structures in real time with nanoscale resolution. Moreover, we investigate the consequences of vacuum breakdowns in Cu electrodes using various microscopy techniques.

[1] Compact Linear Collider (CLIC), last accessed 31 Jan 2021, URL: http://clic.cern/
[2] A. Palaia et al. "Effects of rf breakdown on the beam in the Compact Linear Collider prototype accelerator structure", Physical Review Special Topics - Accelerators and Beams, 16, 8 (2013) 081004. 10.1103/PhysRevSTAB.16.081004
[3] V. Jansson et al. "Growth mechanism for nanotips in high electric fields", Nanotechnology 31 (2020) 355301

Primary authors: KYRITSAKIS, Andreas; VLASSOV, Sergei; ORAS, Sven (University of Tartu); Prof. ZADIN, Veronika (University of Tartu (EE)); DAMERCHI, elyad

Presenter: VLASSOV, Sergei

Contribution ID: **32** Type: **not specified**

The Zb\bar{b} vertex in a CP-conserving Left-Right model

We study the one-loop corrections to the Zb\bar{b} vertex in the framework of a left-right model. A CP-conserving left–right model with two additional heavy gauge-bosons, two charged scalars, two pseudoscalars and four physical scalars is under consideration. We compute the couplings in an arbitrary gauge and show that the divergent contributions cancel. However, the contributions of the new scalars produce a negative corrections to the couplings, which does not help to solve the anomaly of the Zb\bar{b} vertex.

Primary authors: JURCIUKONIS, Darius (Vilnius University (LT)); FONTES, Duarte; LAVOURA, Luis (Universidade de Lisboa)

Presenter: JURCIUKONIS, Darius (Vilnius University (LT))

Contribution ID: **33** Type: **not specified**

Axions in the sky and on tables

Tuesday, 11 October 2022 09:25 (45 minutes)

Presenter: KIM, Hyungjin (DESY)

Session Classification: Invited Speaker

Contribution ID: **34** Type: **not specified**

Higgs pair production at CMS

Tuesday, 11 October 2022 10:10 (20 minutes)

Presenter: CARVALHO ANTUNES DE OLIVEIRA, Alexandra (Vilnius University (LT))

Session Classification: High Energy Physics: Experiment

Contribution ID: **35** Type: **not specified**

Search for Higgs boson pair production in WWWW, WWtautau, and tautautautau decay modes based on proton-proton collision data recorded by the CMS detector in LHC Run 2

Tuesday, 11 October 2022 10:30 (20 minutes)

Presenter: EHATAHT, Karl (National Institute of Chemical Physics and Biophysics (EE))

Session Classification: High Energy Physics: Experiment

Contribution ID: **36** Type: **not specified**

Prospects for Di-Higgs boson searches with multilepton final states in the qqHH production mode

Tuesday, 11 October 2022 10:50 (20 minutes)

Presenter: SEEBA, Norman

Session Classification: High Energy Physics: Experiment

Contribution ID: **37** Type: **not specified**

Top quark physics results from CMS

Tuesday, 11 October 2022 11:10 (20 minutes)

Presenter: SEIDEL, Markus (Riga Technical University (LV))

Session Classification: High Energy Physics: Experiment

Contribution ID: **38** Type: **not specified**

ttbar simulation and jet energy studies (towards a measurement of the ttbar mass difference at CMS)

Tuesday, 11 October 2022 11:50 (20 minutes)

Presenter: POTREBKO, Andris (Riga Technical University (LV))

Session Classification: High Energy Physics: Experiment

Contribution ID: **39** Type: **not specified**

Searching for Dark Matter Subhalos in Astronomical Data using Deep Learning

Tuesday, 11 October 2022 12:10 (20 minutes)

Presenter: PÕDER, Sven (National Institute of Chemical Physics and Biophysics (EE))

Session Classification: High Energy Physics: Experiment

Contribution ID: **40** Type: **not specified**

Evolutionary algorithms for hyperparameter optimization in machine learning for application in high energy physics

Tuesday, 11 October 2022 12:30 (20 minutes)

Presenter: TANI, Laurits (National Institute of Chemical Physics and Biophysics (EE))

Session Classification: High Energy Physics: Experiment

Contribution ID: **41** Type: **not specified**

Charged lepton flavor violation in the Grimus-Neufeld model

Tuesday, 11 October 2022 14:20 (20 minutes)

Presenter: DUDENAS, Vytautas (Vilnius University (LT))

Session Classification: High Energy Physics: Theory

Contribution ID: **42** Type: **not specified**

Yukawa couplings in the Grimus-Neufeld model

Tuesday, 11 October 2022 14:00 (20 minutes)

Presenter: GAJDOSIK, Thomas (Vilnius University (LT))

Session Classification: High Energy Physics: Theory

Contribution ID: **43** Type: **not specified**

On-Shell renormalization of scalar sectors

Tuesday, 11 October 2022 14:40 (20 minutes)

Presenter: Mr DRAUKŠAS, Simonas (Vilnius University (LT))

Session Classification: High Energy Physics: Theory

Contribution ID: **44** Type: **not specified**

Critical dark matter

Tuesday, 11 October 2022 15:00 (20 minutes)

Presenter: VIPP, Venno (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Session Classification: High Energy Physics: Theory

Contribution ID: **45** Type: **not specified**

The Zb\bar{b} vertex in a CP-conserving Left-Right model

Tuesday, 11 October 2022 15:20 (20 minutes)

Presenter: JURCIUKONIS, Darius (Vilnius University (LT))

Session Classification: High Energy Physics: Theory

Contribution ID: **46** Type: **not specified**

Advanced Particle Therapy center in the Baltic States

Tuesday, 11 October 2022 16:00 (20 minutes)

Primary author: Prof. TORIMS, Toms (Riga Technical University (LV))

Co-author: PALSKIS, Kristaps (Riga Technical University (LV))

Presenters: PALSKIS, Kristaps (Riga Technical University (LV)); Prof. TORIMS, Toms (Riga Technical University (LV))

Session Classification: Nuclear Medicine, Radiotherapy and Radiology

Contribution ID: **47** Type: **not specified**

Advancements of integration and mechanical design of gantries for ion-therapy

Tuesday, 11 October 2022 16:20 (20 minutes)

Presenter: PIACENTINI, Luca (Riga Technical University (LV))

Session Classification: Nuclear Medicine, Radiotherapy and Radiology

Contribution ID: **48** Type: **not specified**

Physical and biological property comparisons of 4He and 3He ion beams for applicability in radiation therapy

Tuesday, 11 October 2022 16:40 (20 minutes)

Presenter: PALSKIS, Kristaps (Riga Technical University (LV))

Session Classification: Nuclear Medicine, Radiotherapy and Radiology

Contribution ID: **49** Type: **not specified**

Baltic representation in Innovative European Radionuclide Network project - PRISMAP

Tuesday, 11 October 2022 17:00 (20 minutes)

Presenter: Prof. RADZINA, Maija

Session Classification: Nuclear Medicine, Radiotherapy and Radiology

Contribution ID: **50** Type: **not specified**

Current status of radiation therapy in Lithuania

Tuesday, 11 October 2022 17:20 (20 minutes)

Presenter: KOROBEINIKOVA, Erika (LSMU)

Session Classification: Nuclear Medicine, Radiotherapy and Radiology

Contribution ID: **51** Type: **not specified**

Miniaturised Linear Accelerators for Medical Imaging

Tuesday, 11 October 2022 17:40 (20 minutes)

Presenter: BARRANCO CÁRCELES, Salva (University of Edinburgh)

Session Classification: Nuclear Medicine, Radiotherapy and Radiology

Contribution ID: **52** Type: **not specified**

Production, extraction and mass-separation of medical 43,44,47Sc radionuclides at the CERN-MEDICIS facility

Wednesday, 12 October 2022 10:00 (20 minutes)

Presenter: MAMIS, Edgars (University of Latvia (LV))

Session Classification: Advanced Technologies for Society

Contribution ID: **53** Type: **not specified**

Chemical Separation and Purification of Stable 45Sc from CERN-Medicis Mass-Separator Collection Foils

Wednesday, 12 October 2022 10:20 (20 minutes)

Presenter: KALNINA, Patricija

Session Classification: Advanced Technologies for Society

Contribution ID: **54** Type: **not specified**

Dose rates and specific activities of LIEBE target at CERN after the irradiation with the high-power proton beam

Wednesday, 12 October 2022 11:00 (20 minutes)

Presenter: SLAVICKAS, Andrius (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety)

Session Classification: Advanced Technologies for Society

Contribution ID: **55** Type: **not specified**

MCNP calculations of the high-power LIEBE molten target at CERN for the production of radioisotopes

Wednesday, 12 October 2022 10:40 (20 minutes)

Presenter: TOGOBICKIJ, Benjaminas

Session Classification: Advanced Technologies for Society

Contribution ID: **56** Type: **not specified**

Superconducting magnet core fixation and alignment system

Wednesday, 12 October 2022 11:40 (20 minutes)

Presenter: Mr VILCANS, Janis (Riga Technical University (LV))

Session Classification: Advanced Technologies for Society

Contribution ID: **57** Type: **not specified**

RTU High energy physics and accelerator technology centre activities in Accelerator Projects

Wednesday, 12 October 2022 12:00 (20 minutes)

Presenter: RATKUS, Andris (Riga Technical University (LV))

Session Classification: Advanced Technologies: Accelerators

Contribution ID: **58** Type: **not specified**

Research on the design development of accelerator components by additive manufacturing

Wednesday, 12 October 2022 12:20 (20 minutes)

Presenter: PIKURS, Guntis (Riga Technical University (LV))

Session Classification: Advanced Technologies: Accelerators

Contribution ID: **59** Type: **not specified**

Design of DTL for acceleration of ions with charge-to-mass ratio of 1/2 with a potential production of radioisotopes

Wednesday, 12 October 2022 12:40 (20 minutes)

Presenter: NIKITOVIC, Lazar (Riga Technical University (LV))

Session Classification: Advanced Technologies: Accelerators

Contribution ID: **60** Type: **not specified**

Compact Linear Collider: Investigation of electrical breakdown phenomena using multiscale and multiphysics simulations

Wednesday, 12 October 2022 14:00 (20 minutes)

Presenter: Prof. ZADIN, Veronika (University of Tartu (EE))

Session Classification: Advanced Technologies: Accelerators

Contribution ID: **61** Type: **not specified**

Laser Polishing of Additively Manufactured RFQ Prototype Content

Wednesday, 12 October 2022 14:20 (20 minutes)

Presenter: LACIS, Viesturs (Riga Technical University (LV))

Session Classification: Advanced Technologies: Accelerators

Contribution ID: **62** Type: **not specified**

Comparison of Electrochemical Systems for Sensing Redox Active Molecules

Wednesday, 12 October 2022 15:00 (20 minutes)

Presenter: BARADOKE (BARADOKELAB), PI Ausra

Session Classification: Advanced Technologies: Materials

Contribution ID: **63** Type: **not specified**

AEgIS upgrades and Phase 2 developments

Wednesday, 12 October 2022 15:40 (20 minutes)

Presenter: KRUMINS, Valts (University of Latvia (LV))

Session Classification: Advanced Technologies: Detectors

Contribution ID: **64** Type: **not specified**

Characterication and Calibration of the RD53B CMS Chip Content

Wednesday, 12 October 2022 16:00 (20 minutes)

Presenter: AMBROZAS, Marijus (Vilnius University (LT))

Session Classification: Advanced Technologies: Detectors

Contribution ID: **65** Type: **not specified**

Development of the MTD Control and Safety Systems at CMS

Wednesday, 12 October 2022 16:20 (20 minutes)

Presenter: GAILE, Antra (Riga Technical University (LV))

Session Classification: Advanced Technologies: Detectors

Contribution ID: **66** Type: **not specified**

Registration to CBC2022

Monday, 10 October 2022 09:30 (20 minutes)

Session Classification: Conference Opening

Contribution ID: **67** Type: **not specified**

Welcome words

Monday, 10 October 2022 09:50 (10 minutes)

Session Classification: Conference Opening

Contribution ID: **68** Type: **not specified**

Baltic Assembly and CERN

Monday, 10 October 2022 10:00 (10 minutes)

Presenter: Prof. VUCĀNS, Jānis (President of the Baltic Assembly)

Session Classification: Policy and Strategy

Contribution ID: **69** Type: **not specified**

Baltic Ministries and CERN

Monday, 10 October 2022 10:10 (10 minutes)

Session Classification: Policy and Strategy

Contribution ID: **70** Type: **not specified**

Overview of CERN

Monday, 10 October 2022 10:20 (30 minutes)

Presenter: HEUER, Rolf (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Policy and Strategy

Contribution ID: **71** Type: **not specified**

CERN Activities in Latvia

Monday, 10 October 2022 11:20 (20 minutes)

Primary author: Prof. TORIMS, Toms (Riga Technical University (LV))

Presenter: Prof. TORIMS, Toms (Riga Technical University (LV))

Session Classification: National Activities and Education

Contribution ID: **72** Type: **not specified**

CERN Teacher Program

Monday, 10 October 2022 11:50 (10 minutes)

Presenter: WIENER, Jeff (CERN)

Session Classification: National Activities and Education

Contribution ID: **73** Type: **not specified**

Millennium Schools Programme

Monday, 10 October 2022 12:00 (10 minutes)

Presenter: ŠARPIENE, Judita

Session Classification: National Activities and Education

Contribution ID: **74** Type: **not specified**

Network of Lithuanian STEAM Education Centres

Monday, 10 October 2022 12:10 (10 minutes)

Presenter: TAMOŠIŪNAS, Paulius

Session Classification: National Activities and Education

Contribution ID: **75** Type: **not specified**

Panel discussion

Monday, 10 October 2022 12:30 (50 minutes)

Session Classification: National Activities and Education

Contribution ID: **76** Type: **not specified**

Estonian ILO experience

Monday, 10 October 2022 14:20 (20 minutes)

Presenters: AARE, Robert (Estonian Business and Innovation Agency); AARE, Robert (National Institute of Chemical Physics and Biophysics (EE))

Session Classification: Industry Engagement and R&D

Contribution ID: **77** Type: **not specified**

Do you have a femtosecond @ CERN

Monday, 10 October 2022 14:40 (10 minutes)

Presenter: GINIŪNAS, Linas (Light Conversion)

Session Classification: Industry Engagement and R&D

Contribution ID: **78** Type: **not specified**

High-performance electronic oscilloscopes and generators

Monday, 10 October 2022 14:50 (10 minutes)

Presenter: ROSOSKIS, Jakovas (Eltesta)

Session Classification: Industry Engagement and R&D

Contribution ID: **79** Type: **not specified**

Panel discussion

Monday, 10 October 2022 15:00 (1h 10m)

Session Classification: Industry Engagement and R&D

Contribution ID: **80** Type: **not specified**

Superconducting magnet core fixation and alignment system

Hadron therapy for cancer treatment has been studied for decades and also the European Organization for Nuclear Research support by doing Next Ion Medical Machine Study are still actual and by coordinating other projects. Hadron Therapy is effective due to the reduced impact on healthy tissue. Moreover, by using a rotating gantry as a tool that provides precise patient treatment angles - effectiveness can be raised even more. Therefore, a superconducting rotating gantry is being designed within Heavy Ion Therapy Research and Integration project. However, there innovative solutions are needed to support superconductive magnets within the cryostat to ensure required tolerances and maintain those tolerances during gantry rotation as well as reducing thermal exchange with the environment. There those two main challenges are conflicting, so they were taken into account and the most critical magnet was analyzed further. The 6 fixed rod solution was chosen as a solution to support the magnet, where calculation for each rod in all gantry positions was performed. As a result of collaborative work with experts provided the promising design of a superconducting magnet support system.

Primary authors: RATKUS, Andris (Riga Technical University (LV)); PERINI, Diego (CERN); Mr VILCANS, Janis (Riga Technical University (LV)); DASSA, Luca (CERN); PIACENTINI, Luca (Riga Technical University (LV)); UBERTI, Stefano (Università degli Studi di Brescia); Prof. TORIMS, Toms (Riga Technical University (LV))

Presenter: Mr VILCANS, Janis (Riga Technical University (LV))

Contribution ID: **81** Type: **not specified**

Baltic CMS TIER II HPC grid –a scaleable federated cloud for CERN's CMS computational needs

Recap on recent meeting with members from the CERN Offline Computing team - an overview of CERN CMS experiment annual increase in computational and data storage requirements. Proposed architecture of federated cloud based TIER II HPC site piloted by the Riga Technical University and the University of Latvia. Opportunity to expand it to a Baltics scale scientific HPC resource pool.

Primary author: Mr IRBE, Janis (Riga Technical University)

Presenter: Mr IRBE, Janis (Riga Technical University)

Contribution ID: **82** Type: **not specified**

Baltic CMS TIER II HPC grid –a scaleable federated cloud for CERN's CMS computational needs

Tuesday, 11 October 2022 12:50 (15 minutes)

Presenter: Mr IRBE, Janis (Riga Technical University)

Session Classification: High Energy Physics: Experiment

Contribution ID: **83** Type: **not specified**

International Masterclasses

Monday, 10 October 2022 11:40 (10 minutes)

Presenters: JUODAGALVIS, Andrius (Vilnius University (LT)); Dr KYNIENĖ, Aušra (Vilnius university Physics faculty, Experimental nuclear and particle physics center); Dr ABAKEVICIENE, Brigita (Kaunas University of Technology)

Session Classification: National Activities and Education

Contribution ID: **84** Type: **not specified**

VILNIUS TECH Distance Learning Platform ”Future Engineering”

Monday, 10 October 2022 12:20 (10 minutes)

Presenter: MYKOLAITIS, Henrikas

Session Classification: National Activities and Education

Contribution ID: **85** Type: **not specified**

CERN Baltic Group

Monday, 10 October 2022 10:50 (10 minutes)

Presenter: KOEL, Ants (TalTech)

Session Classification: Policy and Strategy

Contribution ID: **86** Type: **not specified**

Critical dark matter

We study a classically scale invariant Higgs-dilaton model of dynamical symmetry breaking extended with an extra scalar field that plays the role of dark matter. The Higgs boson is light near a critical boundary between different symmetry breaking phases, where quantum corrections beyond the usual Gildener-Weinberg approximation become relevant. This implies a tighter connection between dark matter and Higgs phenomenology. The model has only three free parameters, yet it allows for the observed relic abundance of dark matter, produced via freeze-in or freeze-out, while respecting all constraints. The direct detection cross section mediated by the Higgs boson is determined by the dark matter mass alone and is testable at future experiments.

Primary author: VIPP, Venno (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Presenter: VIPP, Venno (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Contribution ID: **87** Type: **not specified**

Axions in the sky and on tables

In this talk, I will discuss several different ways to search for axion-like particles in the sky and on tables. I will briefly review recent discussions on the hierarchy problem and how it leads to a new insight for new physics search, especially in the context of axion-like particles. We then discuss several different ideas for terrestrial axion searches and astrophysical searches. As a concrete example, we discuss axion search through atomic/molecular spectroscopy and also through gravitational waves.

Primary author: KIM, Hyungjin (DESY)

Presenter: KIM, Hyungjin (DESY)

Contribution ID: **88** Type: **not specified**

Diffusion processes in metals at the nanoscale: experimental studies

Wednesday, 12 October 2022 14:40 (20 minutes)

Presenter: VLASSOV, Sergei

Session Classification: Advanced Technologies: Accelerators