



Update from the CBG SPWG

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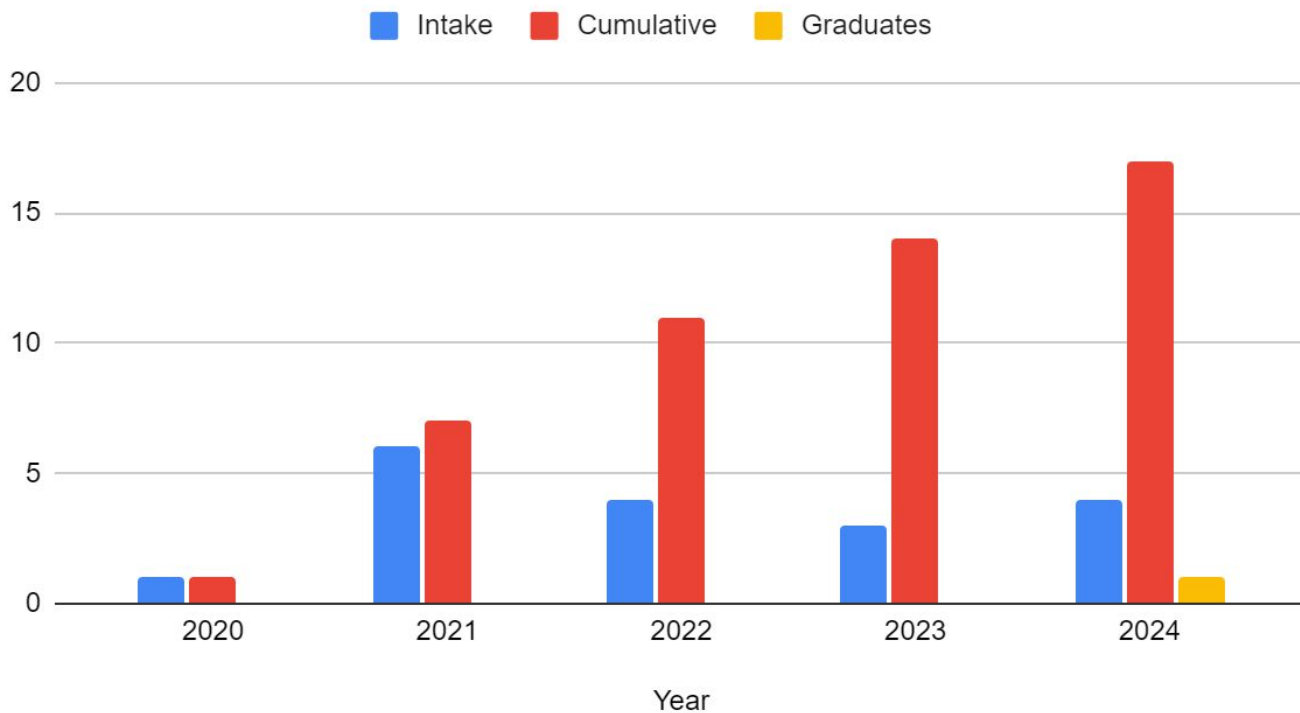
13th CBG General Meeting, CERN
22.03.2024

- Recap of the programme:
 - DSP “Particle physics and accelerator technologies” is implemented jointly by RTU and UL;
 - The development, implementation and oversight is done with the support of the CBG partners;
 - The programme has a dedicated study programme council consisting of 8 council members:
 - 2 representing RTU;
 - 2 representing UL;
 - 2 representing the CBG;
 - 2 representing CERN;
 - + 2 programme directors (1 from RTU, 1 from UL);
- Student attestation is performed yearly; for the academic year 2023/24 it is planned for the week of the 10th of June;
- This programme is expecting it’s first successful thesis defence in 2024 [or early 2025 at the very latest] !
 - crucial test of the success of our work !

- Existing students (HEP & atomic physics):
 - Andris Potrebko (Y4, RTU) Measurement of the top/anti-top mass difference at CMS;
 - Antra Gaile (Y3, RTU) Study of di-Higgs production in the WWZZ channel. ;
 - Valts Krūmiņš (Y3, UL) Optical interferometry system for anti-beam positron measurements at AEGIS;
 - Normunds Ralfs Strautnieks (Y3, UL) Study of lepton universality in top decays at CMS;
 - Conrado Munoz Diaz (Y2, RTU) Measurement of the boosted top quark mass at CMS;
 - Dimitrios Sidiropoulos Kontos (Y2, RTU) Study of the boosted top substructure at CMS;
 - Dace Osīte (Y2, RTU) Search for the dead-cone effect in b-decays from top quarks at CMS;
 - Ojārs Mārtiņš Ebrerliņš (Y1, RTU) Jet substructure and hadronization studies;
 - Robert Pleše (Y1, RTU) Final-state radiation photon studies in low pile-up events at CMS.
- Existing students (accelerator technologies & medical physics):
 - Lazar Nikitovic (Y3, RTU) Design of a high-frequency linear accelerator for injection into a therapy synchrotron;
 - Kristaps Paļskis (Y3, RTU) Optimization of ion beam parameters for very high dose rate (FLASH) radiotherapy;
 - Luca Piacentini (Y3, RTU) Integration of Systems, of a Carbon Ion Rotating Gantry for Medical Treatments;
 - Tobia Romano (Y2, RTU+PoliMi) Study of sintering behaviour of pure copper processed via binder jetting AM;
 - Vincenzo Sansipersico (Y1, RTU) Optimization and Integration of a $^4\text{He}^{2+}$ Synchrotron for Cancer Therapy.
- Aim to recruit 2+2 students for the academic year 2024/25; advertisement to be posted on inspirehep.net within a month.



Student statistics [planned by the end of 2024]



Development of the master's programme



- **Recap: Erasmus Mundus Design Measures (EMDM):**
 - Successful bid for EMDM funding in 2022;
 - 55 kEur (originally, 15 months until 31st of December 2023);
 - Deliverable: developed joint mechanisms for a new master's study programme;
 - Successfully applied for an extension on the deliverable due date - now due end of May, 2024.
- **Aims of the EMDM project:**
 - to develop joint mechanisms for admissions, evaluation, award of the degree, dissemination & communication mechanisms;
 - 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.
- **Crucial necessity: we must attain a single joint diploma !**

It is agreed by all partners of the consortium that without a joint diploma this programme will not be tenable !

Initial talks with Baltic Assembly to promote this have taken place; follow-up/update required.

- 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 March 22nd, 2024):
 - 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);
- Weekly meetings recently to finalize the programme implementation agreement (main deliverable of the EMDM).

- Encouraging (for us) discussion in the ECFA* report at the CERN Council last year: [the Taskforce] *"calls for the creation of a dedicated panel in this area under the auspices of ECFA, in consultation with organisations or communities representing neighbouring disciplines and ICFA";*

"The role of this coordination panel would primarily be to enhance the synergies between existing training programmes and stimulate the creation of complementary ones where relevant, in particular multidisciplinary schools or academia-industry-joined training programmes. The second equally important DCT sets out as a goal the creation of a European master's degree programme in HEP instrumentation [read: accelerator & detector physics & technologies], to also be a potential responsibility of this proposed panel to help coordinate." [from the R&D roadmap document: <https://cds.cern.ch/record/2784893>];

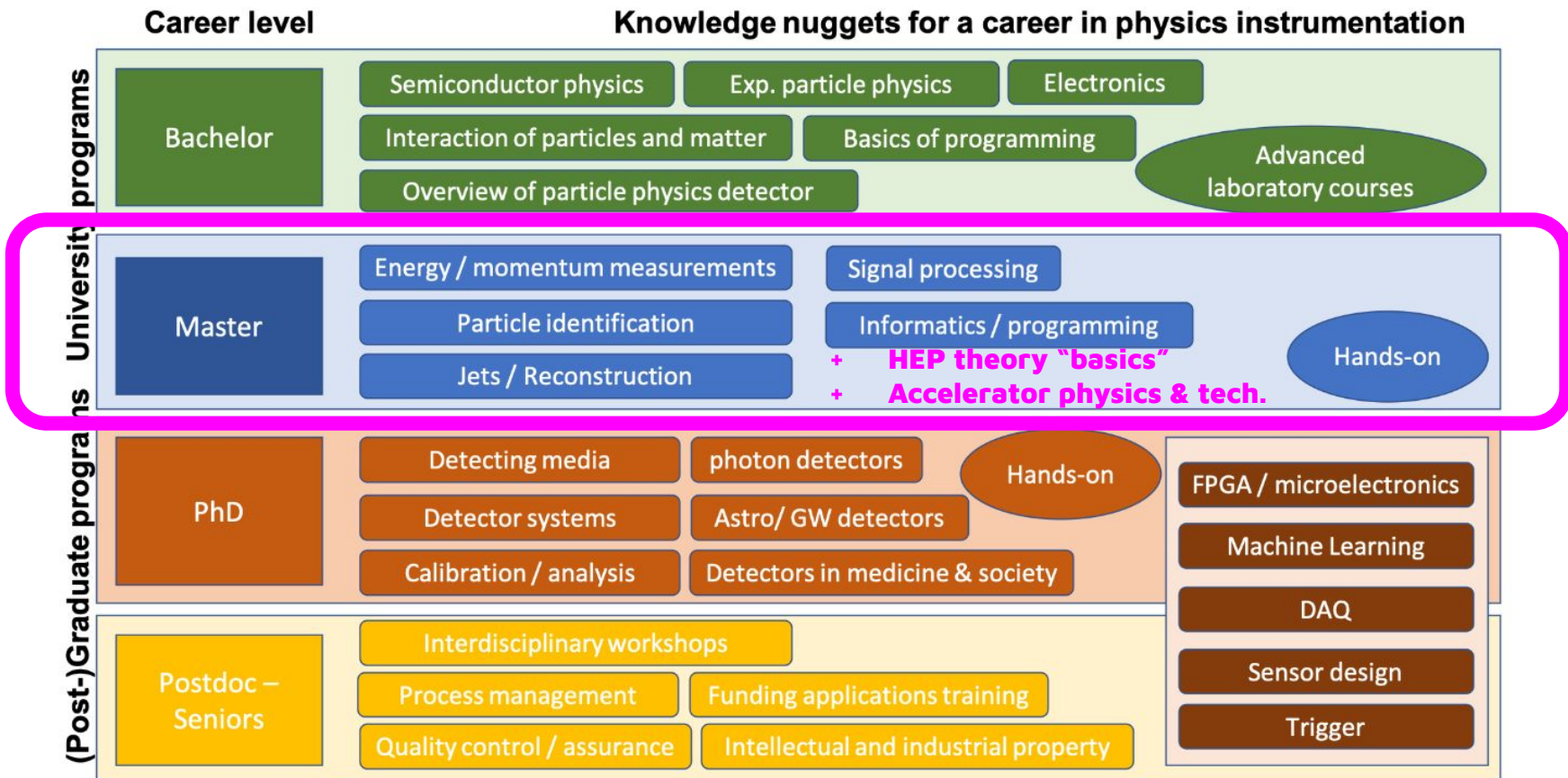
additionally,

"ECFA recognizes the need for the experimental and theoretical communities involved in physics studies, experiment designs and detector technologies at future Higgs factories to gather."

- There is great interest in our planned activities from CERN and the accelerator-based research facilities!
- We have contacted ECFA and received an enthusiastic and full endorsement of this activity + a promise of an official letter of support when applying for the EMJM funding !

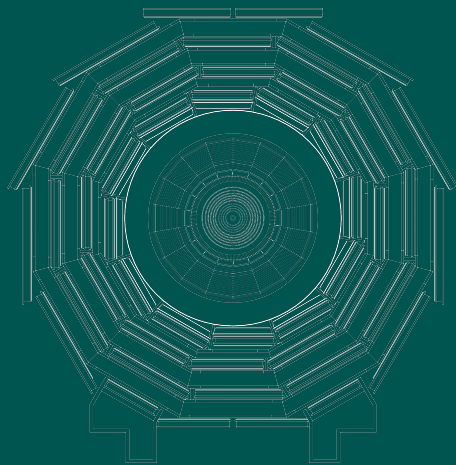
* European Committee for Future Accelerators

HEP & HEP Instrumentation





- Doctoral study programme is doing extremely well (though still requires some work to rejig some courses, etc.).
- Otherwise, the last 18 months have been extremely challenging!
- Work EMDM project implementation was continuously postponed, due to lack of time/resources; now fully on track as a high-priority item !
- Current due date for the EMDM deliverables - 31st of May 2024 [we do seem to be on track !]
- EMJM project proposal submission targeted for February 2025.
- If successful, first EMJM cohort would start in the academic year 2026/27.
- **Crucial[!]**: the Joint Master's programme 100% go/no-go dependent on the joint diploma availability.



Thank you

Semester 1 - Latvia:

A:

- | | | |
|--|----------|------|
| 1) Introduction to particle physics and detectors, | 6.0 ECTS | RTU; |
| 2) Introduction to accelerator physics and technologies, | 6.0 ECTS | RTU; |
| 3) Statistical Methods in Data Analysis, | 3.0 ECTS | UL; |
| 4) Programming for Research, | 3.0 ECTS | UL; |

B:

- | | | |
|--|----------|------|
| 1) High-Performance Computing in Physics | 3.0 ECTS | UL; |
| 2) Quantum Mechanics | 6.0 ECTS | UL; |
| 3) Advanced electrodynamics | 6.0 ECTS | UL; |
| 4) Object reconstruction in HEP | 6.0 ECTS | RTU; |

[other elective courses]

Semester 1: Total A: 18; Total B: 12;

Semester 2 - Estonia:

A:

- | | | |
|---|----------|-----|
| 1) Mathematical Structure of the Standard Model | 6.0 ECTS | UT; |
| 2) Computational Physics | 3.0 ECTS | UT; |
| 3) Technical Graphics | 3.0 ECTS | UT; |
| 4) Radiation Safety | 3.0 ECTS | UT; |

B:

- | | | |
|--|----------|-----|
| 1) Quantum Field Theory I | 6.0 ECTS | UT; |
| 2) Differential Geometry for Physicists | 6.0 ECTS | UT; |
| 3) General Theory of Relativity | 6.0 ECTS | UT; |
| 4) Dosimetric and Scintillation Materials | 3.0 ECTS | UT; |
| 5) Applied physics project | 3.0 ECTS | UT; |
| 6) Vacuum and Cryo-engineering | 3.0 ECTS | UT; |
| 7) Plasma Physics and Its Applications | 3.0 ECTS | UT; |
| 8) Practical works on Physical Measurement and Calibration | 3.0 ECTS | UT; |

[other elective courses]

Semester 2: Total A: 15; Total B: 15;

Semester 3 - Lithuania:

A:

- | | | |
|--|----------|------|
| 1) Particle Physics Data Analysis | 5.0 ECTS | VU; |
| 2) Physics object reconstruction | ? ECTS | VU; |
| 3) Advanced materials for particle detectors | 9.0 ECTS | KTU; |

B:

- | | | |
|--|----------|------|
| 1) Cosmology | 5.0 ECTS | VU; |
| 2) Quantum Field Theory II | 5.0 ECTS | VU; |
| 3) Radiation detectors in CERN experiments | 5.0 ECTS | VU; |
| 4) Artificial intelligence | 5.0 ECTS | VU; |
| 5) Methods of parallel computations in physics | 5.0 ECTS | VU; |
| 6) Dynamics of Nonlinear Systems | 6.0 ECTS | KTU; |
| 7) Radiation Therapy Physics | 6.0 ECTS | KTU; |
| 8) Development of Innovations in Physical Science and Technology | 6.0 ECTS | KTU; |
| 9) Research Project 3 | 6.0 ECTS | KTU; |

[other elective courses]

Semester 3: Total A: 14; Total B: 16;

- We explicitly aim to develop a program eligible to be submitted to the Erasmus Mundus Joint Masters (EMJM) call;
- EMJM calls typically close in mid-February → aim to have a project proposal ready for February 2025;
- EMJM:
 - Supports the implementation of Joint-Masters programs for up to 74 months (renewable);
 - Allows for the support of up to 4-5 full editions of a 2-year master's cohorts;
 - Financial support:
 - Institutionally: 750 Eur/month per student for up to 100 students;
 - Stipends: 1'400 Eur/month stipend for up to 60 students;
max. 10% of stipends to students of the same nationality;
- At least 1 semester in 2 partner-HEIs other than in the country of residence of the student;
- For our program, at least 1 semester in each of the three Baltic countries;

- We aim to create a highly competitive and unique-in-Europe master's programme aimed at HEP and HEP instrumentation;
- We must strive to create a curriculum and a study experience that is attractive to everyone interested in the field!
- We are small Baltic countries without highly-recognised HE sector in the West; we must seek to change that!
- Mantra:
 - *Where other programmes offer 5 lecture-hours per ECTS, we must offer 6;*
 - *Where other programmes offer 1 tutorial hour per ECTS, we must offer 2;*
 - *Where other programmes are localised on the campuses of their respective Universities, we offer a chance to spend a semester in three different countries!*
- We will also aim to offer, in collaboration with our industrial partners and CERN, internships in the inter-year summer.