Annex 2. [Placeholder draft]

Discussion on the structure; including the semester structure and allocation of projects, etc.

After semester 1 all students should have:

- A broad qualitative understanding of particle physics:
    - Standard Model:
        - History;
        - Particle content;
        - Forces;
        - Structure & shortcomings.
    - Particle detectors:
        - dE/dX (ionisation, interaction lengths, etc.);
        - Detector types;
        - Detector systems.

- A broad qualitative understanding of accelerator physics:
    - Types of accelerators:
        - History;
        - Van der Graaf;
        - Linac;
        - Cyclotron;
        - Betatron;
        - Synchrotron;
    - Physics covering particle acceleration:
        - Electromagnetism;
        - Special relativity;
        - Synchrotron radiation;

- Strong base in computing and statistical analysis:
    - Programming:
        - Bash shell;
        - Versioning (Git);
        - Basic python skills;
        - Basic C++ skills;
    - Statistical analysis:
        - Bayes vs frequentist;
        - Distribution types (normal, binomial, poisson);
        - Significance & p-value;
        - “Look elsewhere” effect.

After semester 2 all students should have:

- Broad quantitative understanding of particle physics:
    - Rigorous understanding of the mathematics behind the Standard Model:
        - Principles of group theory;
        - Commutation relations, et. al. (Lie algebra);
        - Mathematical makeup of QED;

- Broad qualitative understanding computing:
    - Scaling of data;

    - Computational complexity problem;

- Specialist technical abilities:
    - Competences in technical drawing;
    - Competences in CAD modelling;
    - Competences in the use of 3D printers (?);

- Knowledge and competencies regarding radiation safety:
    - Biological and environmental impact of radioactive material & sources:
        - Dosimetry;
        - Absorbed vs effective dose;
        - Impact of ionising radiation on biologic tissue;
        - Challenges of handling % storage of radioactive material;

- Further/deeper specialisation in **either** particle physics or advanced technologies:
    - Qualitative understanding of quantum field theories;
    - Qualitative understanding of the general theory of relativity;
      or
    - Advanced knowledge in particle accelerator technologies:
        - Cryogenics;
        - Vacuum systems;
        - Plasma wakefield?

After semester 3 all students should have:

- additional specialisation relevant to **either** particle physics or advanced technologies …

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;

Other Credits.

C. Practical training 6.0 ECTS should be done during the first three semesters at some company or CERN or a research group different from the one the student will write the thesis.

D. Optional courses 9.0 ECTS could be from among the elective courses or anything the universities offer. Maybe languages could be recommended.

E. Thesis 30 ECTS.