# MASTER OF SCIENCE IN MEDICAL PHYSICS

KATOLIEKE UNIVERSITEIT LEUVEN & UNIVERSITÉ CATHOLIQUE DE LOUVAIN

INITIAL ACCREDITATION • PANEL REPORT

FRAMEWORK FOR THE EUROPEAN APPROACH FOR QUALITY ASSURANCE OF JOINT PROGRAMMES

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# Table of contents


**1 Executive summary 5**

**2 Assessment – Standards for Quality Assurance of Joint Programmes 7**

*2.1 Eligibility 7*
2.1.1 Status 7
2.1.2 Joint design & delivery 8
2.1.3 Cooperation Agreement 9

*2.2 Learning Outcomes 10*
2.2.1 Level 10
2.2.2 Disciplinary field 10
2.2.3 Achievement 10
2.2.4 Regulated Professions 11

*2.3 Study Programme 11*
2.3.1 Curriculum 12
2.3.2 Credits 13
2.3.3 Workload 14

*2.4 Admission and Recognition 14*
2.4.1 Admission 15
2.4.2 Recognition 15

*2.5 Learning, Teaching and Assessment 16*
2.5.1 Learning and teaching 16
2.5.2 Assessment of students 16

*2.6 Student Support 18*

*2.7 Resources 19*
2.7.1 Staff 19
2.7.2 Facilities 19

*2.8 Transparency and Documentation 20*

*2.9 Quality Assurance 21*

**3 Final judgement 22**

**4 Assessment procedure 23**

**5 Overview of the assessments 24**

**Annex 1: Administrative data 25**

**Annex 2: Programme-specific Learning Outcomes 26**

**Annex 3: Composition of the panel 28**

**Annex 4: Schedule of the dialogue – site visit 29**

**Annex 5: Documents reviewed 30**

**Annex 6: List of abbreviations** **31**

# 1 Executive summary

The self-assessment report, the extensive programme materials previous to the online site visit and the conversations with highly motivated stakeholders have provided the panel with a comprehensive view of the programme. According to the panel, who based its assessment on the standards of the European Approach for Quality Assurance of Joint Programmes, the Master of Science in Medical Physics (MSMP) fulfils all standards.

There are convincing indications that the partners of KU Leuven and UCLouvain are equally involved in the successful implementation of the programme. The institutional commitment here is high and extends beyond this programme. The proton therapy centre and the research culture are excellent illustrations of this. The cooperation agreement covers all essential aspects to set up, manage and implement the MSMP programme as a joint endeavour between KU Leuven and UCLouvain.

The panel acknowledges that this programme is a first step towards bringing the medical physics education in Belgium up to speed with the European guidelines for medical physics education. This two-year initial master has the potential to enhance the quality of medical physicists in Belgium. The new programme is designed from the perspective of Belgian legislation - Royal Decree of 13 February 2020, known as the "Medical Exposures Decree" - and responds to the current need for certification of experts in medical radiation physics. In this sense, the programme is rather an approach to medical radiation physics, and a variant of what medical physics can be. Transparency about this specification towards students is a first recommendation that the panel would like to make in this regard. The programme would do well to keep its finger on the pulse of future developments regarding medical physics in a European framework. In this way, the study programme can continue to respond and keep the momentum to further strengthen the profile of medical radiation physicists.

The panel also suggests to consider some adaptations to further enhance the cooperation and excellence of the programme. The panel has the impression that the faculties at KU Leuven and UCLouvain still have a campus-based approach; there are bridges between the campuses, but there is room for further integration. Student mobility is a facet where campus-oriented thinking can be broken through good coordination across courses. There is in the plans of this programme a risk that in reality students will be forced to follow certain courses digitally, just because mobility between campuses is underestimated. This can be addressed by outlining and encouraging a number of pathways where that mobility can be realized and/or optimized (e.g. clustering courses at one campus in the same day). The QA system, with its structures, processes and procedures, is another facet where integration can be made more tangible for the stakeholders involved. The QA system is indeed in place, however, there is room to strengthen it into a common quality culture between and across the two universities and its hospitals.

The diverse enrolment of students from bachelor programs in physics, engineering sciences, chemistry, industrial engineering (nuclear technology), and bio-science engineering offers advantages, but requires good monitoring of the final attainment level. A good basic knowledge of oncology and the interplay of disciplines in medicine also merits special attention. Equal treatment (in terms of number of ECTS credits awarded) of the different courses is an additional point to follow up.

Last, the panel encourages the programme management to further develop the network of researchers to strengthen the offer of internships at other institutions. This is a requirement to continue to train students in the broad and current range of (classical) methods. It is also to make visible the outstretched hand that this programme offers to reach national agreements on the further development of the education of medical physicists.

Regardless of its suggestions, the panel has a good feeling about the programme and compliments the partner institutions for making the best use of each one's strengths to translate an ambitious vision about training medical physicists into a concrete new master programme. The recommendations are therefore to be seen in an enhancement perspective.

The Hague, 20 January 2022

On behalf of the expert panel convened to assess the Master of Science in Medical Physics,

Dirk Verellen
(panel chair)

Veerle Conings
(secretary)

# 2 Assessment – Standards for Quality Assurance of Joint Programmes

## 2.1 Eligibility

The panel assesses the Eligibility standard as compliant.

### 2.1.1 Status

*The institutions that offer a joint programme should be recognised as higher education institutions by the relevant authorities of their countries. Their respective national legal frameworks should enable them to participate in the joint programme and, if applicable, to award a joint degree. The institutions awarding the degree(s) should ensure that the degree(s) belong to the higher education degree systems of the countries in which they are based.*

KU Leuven and UCLouvain are both officially registered institutions for higher education in Belgium. The status of KU Leuven as university and degree-awarding body is recognised and protected by Flemish law. On the basis of Article II.172 of the Flemish Code of Higher Education, KU Leuven is allowed to organize their degree programmes as joint programmes with other universities in or outside the Flemish Community. Joint degrees or double degrees can be awarded at the end of these joint programmes. UCLouvain fulfills teaching duties, assigned by a decree of the French Community on 7 November 2013 concerning the regime of university studies and academic grades (Moniteur Belge: 18 December 2013), as well as research duties and other services to society.

As stated in Article 1 of the Agreement concerning the Organisation of the Joint Degree Programme Master of Medical Physics, successful completion of the progamme leads to the award of the joint degree “Master of Science in Medical Physics”, hereafter abbreviated as MSMP, by the two degree awarding parties.

The self-assessment report has clarified the embeddedness of KU Leuven and UCLouvain in their relevant accreditation frameworks, and indicated where additional steps in the procedures for initial accreditation will need to be taken to activate the joint programme MSMP.

This programme MSMP, for which KU Leuven and UCLouvain are joining forces, aims to train ‘medical physics experts with a specialization in radiology, nuclear medicine or radiotherapy’ as defined by the Royal Decree of 13 February 2020 (Belgisch Staatsblad/Moniteur belge of 20 February 2020 - p. 10143 to 10147, afdeling/section 8).

In this joint programme, the KU Leuven and UCLouvain want to respond substantially to the recent scientific and technical evolutions in the field of medical physics. The centre for proton therapy is the flagship. Furthermore, by responding to the legislation in Belgium, as mentioned above, and by offering first answers to the European directives on the medical physics training, the programme wants to deliver graduates who are ready to fill the needs of the professional field.

This new master's programme replaces the existing advanced master's programme in medical physics at KU Leuven and the 'professional focus: physique médicale' in the master of physics at UCLouvain. The professional internship is offered at both universities in the form of a postgraduate certificate programme, to meet the criteria for obtaining the certificate of

'deskundige in de medische stralingsfysica/expert en radiophysique médicale' (expert in medical physics).

The panel understood from the dialogues during the online site-visit that the ambition of both partners is to take a first step towards a joint national programme in medical physics with this programme. The partners involved indicate that the two tracks - physics and engineering - are worth continuing in the further dialogue on the training of medical physicists with the other universities in Belgium. The panel is excited that the management of both institutions are expressing a strong commitment to support the set-up of this joint national programme in the future.

### 2.1.2 Joint design & delivery

*The joint programme should be offered jointly, involving all cooperating institutions in the design and delivery of the programme.*

The KU Leuven and UCLouvain have joined forces to create a common MSMP. Both educational committees of the current masters of medical physics in both universities (i.e. 'master in de medische stralingsfysica' at KU Leuven, and 'master en sciences physiques à finalité spécialisée: physique médicale' at UCLouvain) have jointly written the self-assessment report.

The new programme will be organized jointly by the two partners, with each of the institutions contributing to the programme from start to finish. Several elements of real jointness can be highlighted:

- A joint governance structure for the programme.
- A jointly designed academic curriculum, with all programme-specific courses being offered by an interuniversity team of lecturers. (A few courses will be borrowed from other faculties, where students will join students from other programmes. Here, students will have to choose between two options that are offered either at KU Leuven or at UCLouvain.)
- A jointly developed internship content, in line with the legal requirements written down in the document of the FANC that was published in the 'Belgisch Staatsblad/Moniteur belge' of 03 March 2020, p. 13094 to 13100 (for the advanced Internship 2). Students can choose to do an internship in one of the two university hospitals or in an affiliated hospital.
- A jointly developed range of master's theses with the possibility of carrying them out at one of the two university hospitals.
- Joint eligibility criteria and admission procedures for candidates.

According to the panel, there is convincing evidence that both partners contribute equally to the programme and will make joint efforts to make this programme a success. The commitment of management in both institutions is visible and transcends this programme. Indeed, at the institutional level, there are firmly established commitments from the state-of-the art infrastructure and a strong culture of collaboration in research in the field of medical physics.

The panel feels that both education committees of KU Leuven and UCLouvain have built many bridges of cooperation. Nevertheless, it recommends staying alert about possible challenges for a future-oriented, high-performance cooperation. This awareness from the perspective of

the students' needs could, for instance, be further enhanced by the concrete design of pathways between the two campuses and the timely elaboration of the calendar of courses.

The panel also recognises the strength of the KU Leuven partner in coordinating the QA system and sees opportunities here to grow towards more commonality in the organisational culture on the real work floor in both institutions.

### 2.1.3 Cooperation Agreement

*The terms and conditions of the joint programme should be laid down in a cooperation agreement. The agreement should in particular cover the following issues:*

- *Denomination of the degree(s) awarded in the programme;*
- *Coordination and responsibilities of the partners involved regarding management and financial organisation (including funding, sharing of costs and income etc.);*
- *Admission and selection procedures for students;*
- *Mobility of students and teachers;*
- *Examination regulations, student assessment methods, recognition of credits and degree awarding procedures in the consortium.*

The panel has studied the Agreement concerning the Organisation of the Joint Degree Programme Master of Medical Physics that describes the principles of the programme in all its detail. The Agreement lays down the purpose, the registration procedure and tuition fees, the applicable legislation and internal rules, the education and examination regulations, the governance structure, the duties and obligations of both universities, the financial arrangements and all necessary procedures determining the cooperation between KU Leuven en UCLouvain for the delivery of this joint Master programme. The Agreement covers all relevant matters, the reading is comprehensive.

The panel confirms that the Agreement covers all essential aspects to set-up, govern and implement the MSMP programme as a common endeavour between KU Leuven and UCLouvain.

The panel concludes that the evidence demonstrates that the programme is fully compliant with the different criteria in the Eligibility standard.

## 2.2 Learning Outcomes

The panel assesses the Learning Outcomes standard as compliant.

### 2.2.1 Level

*The intended learning outcomes should align with the corresponding level in the Framework for Qualifications in the European Higher Education Area (FQ-EHEA), as well as the applicable national qualifications framework(s).*

The 21 programme-specific learning outcomes of the MSMP are divided into five categories: knowledge and understanding, applying knowledge and understanding, developing opinion, learning skills, and communication. The self-assessment report demonstrates in Table 1 that the set of domain-specific learning outcomes is fully incorporated in the programme-specific learning outcomes.

The learning outcomes are aligned with the core qualifications of master graduates as defined in the European Qualifications Framework (EQF), level 7, and by the national qualification frameworks, i.e. the 'Vlaamse kwalificatiestructuur' and the 'Cadre Francophone de Certification', both related to the European Framework. This verification against the qualification structure of the Flemish and French communities is included in Table 2 of the Self Assessment Report.

According to the panel, the learning outcomes of this programme are in accordance with the expectations of the professional field on a national level, the expectations from the current programmes in both institutions, and opportunities that exist in the research groups of both institutions.

The learning outcomes meet the current need for accreditation as provided in the Royal decree on the requirements for awarding the certificate of medical physics expert.

### 2.2.2 Disciplinary field

*The intended learning outcomes should comprise knowledge, skills, and competencies in the respective disciplinary field(s).*

The students need to acquire the discipline specific knowledge of medical physics related to the three specialties, i.e. radiology, radiotherapy and nuclear medicine. Students should be able to apply this knowledge in scientific research and in the context of a hospital environment. They must be able to develop an opinion and communicate clearly in this disciplinary field of medical physics. The programme aligns itself with the key competences for Lifelong Learning, as promoted by the European Commission.

The domain-specific learning outcomes cover the broad domain of medical physics. The panel estimates that KU Leuven and UCLouvain have translated these domain-specific learning outcomes into a specific learning outcomes programme that is more in line with medical radiation physics. The panel emphasises that the master's programme must continue to include the general knowledge and skills; the postgraduate programme cannot be a buffer to basic knowledge (such as non-ionising radiation aspects). The postgraduate programme can then be further developed to provide specialised knowledge and skills.

In this sense, the programme is a variant of what medical physics can be. The panel recommends that those in charge of the programme make this positioning in the domain of medical physics and medical radiation physics sufficiently clear to future students.

### 2.2.3 Achievement

*The programme should be able to demonstrate that the intended learning outcomes are achieved.*

In the self-assessment report (section 3.1), the education team provides a detailed look at the five thematic groups in the programme: i) Physics, Mathematics and Chemistry, ii) Medical-oriented courses, iii) Medical Physics and Technology, iv) Safety and Ethics, en v) Master's Thesis and Internship. A detailed list of the different courses in each group is provided in Table 4.

The panel finds sufficient evidence from the dialogue and the self-assessment report that the programme enables the students to achieve the intended learning outcomes. The curriculum mapping (presented in section 2.3 and annex 5) shows for each course in the programme which learning outcomes it will cover.

Each learning outcome is covered by at least two courses. The Master's thesis comprises the majority of the learning outcomes.

Almost all courses work on learning outcome 1 'The student has the required knowledge to start the internship necessary to obtain the certificate of expert in medical radiation physics according to the guidelines of the Federal Agency for Nuclear Control, or to perform other functions related to medical physics (in industry, government institutions, scientific research, applications, ...)'.

The programme is organized to cover all topics, except for the full 12 months of clinical training, that are required for obtaining the certificate of expert in medical physics. This is explored further in section 2.2.4 (Regulated professions).

### 2.2.4 Regulated Professions

*If relevant for the specific joint programme, the minimum agreed training conditions specified in the European Union Directive 2005/36/EC, or relevant common trainings frameworks established under the Directive, should be taken into account.*

The content of the curriculum is subject to the Royal Decree of 13 February 2020 on medical exposures and non-medical imaging exposures with medical radiological equipment ('Belgisch Staatsblad/Moniteur belge', 20 February 2020, p. 10143 to 10147, afdeling/section 8).

It is clear to the panel that the programme has been developed from the perspective of Belgian legislation. The programme complies indeed with current legislation. For the internship, there is the requirement that it covers at least one calendar year in one of the three specialisations, i.e. radiology, radiotherapy or nuclear medicine. For each of the three specialisations, the Federal Agency for Nuclear Control defined the topics that must be covered during the internship (published in the 'Belgisch Staatsblad/Moniteur belge' of 03.03.2020, p. 13094 to 13100). The internship is envisaged after this 2-year master's programme by the institutions involved - KU Leuven and UCLouvain - from the postgraduate certificate programme, which already exists at both institutions.

The programme management indicates that the content of this internship will be further adapted to the new Master's programme, which already includes part of the clinical training.

On the European level there are furthermore guidelines on Medical Physics Expert (document entitled 'Radiation Protection No. 174 – European Guidelines on Medical Physics Expert', as published by the European Commission, Directorate-General for Energy, 2014). However, these guidelines assume a 2-year academic training at master level, followed by a 2-year clinical training (reference is also made to the EFOMP-ESTRO core curriculum for Medical Physics Experts in Radiation Oncology, 3rd revision). The panel can therefore only recommend monitoring the evolution from guidelines to binding directives at the European level and, if the reality presents itself, adjusting the internship accordingly. In section 2.3.1, we discuss the difference in qualification level – level 7 for this degree and level 8 for the European directives.

## 2.3 Study Programme

The panel assesses the Study Programme standard as compliant.

### 2.3.1 Curriculum

*The structure and content of the curriculum should be fit to enable the students to achieve the intended learning outcomes.*

The curriculum has been given content from the aspects prescribed by FANC. During the online site-visit, the programme management also indicated that this puts some limitations on the ambition to go flat out for innovation. For the programme management, the real innovation lies in the elaboration of the internships and the opportunity for students to gain experience in the three specialisations. These internships allow each student to make a well-considered choice. The fact that physics, medical content and engineering content come together in this programme means that innovation in the future can be included from these three angles.

The panel is satisfied with the answer of the programme management to keep scenarios open in the discussions about further evolution towards a national programme, in order to work out parallel tracks for engineers and exact scientists. This openness gives room to grow towards scenarios that show a realistic balance between policy feasibility and institutional ambition.

The panel is also satisfied with the cooperation with other universities for the further development of a package of internships. The two-week internships are more about observation, but they do offer the opportunity for hands-on information to sink in during the programme for each of the three specialties.

A paid internship is nevertheless an issue from the perspective of students, alumni and the professional field. That is what the panel was able to ascertain from the conversations. Obviously, this is a question that goes beyond the assessment of this programme.

According to the panel, the following elements are included in the course content as presented in the self-assessment report, but these elements could be more explicit and could be further developed in order to sharpen the courses, if useful:

- The link between the technology/techniques (intensity modulation methods) and the actually delivered dose (challenging dosimetry) is so close and fundamental in radiotherapy that a more structured and specific adjustment of the curriculum is mandatory.

- In the ideal scenario, a course on technology in radiotherapy is offered, as in radiology (course description 25) and nuclear medicine (course description 27), as required by the Royal Decree of 13 February 2020 (p. 20 of the Self-assessment report). A discussed pragmatic approach is the integration of the linac (linear accelerator)-specific technological backgrounds in the planning course. This solution requires an extension of the ECTS course description of the course Fundamentals of Dosimetry and Treatment Planning in Radiotherapy (course description 26).

- Classic safety seems not sufficiently addressed in the curriculum. The Royal Decree of 13 February 2020 (p. 20 of the Self-assessment report) clearly stipulates “elements of classical safety”. The panel suggests to fine-tune the balance between radioprotection and classic (electrical and mechanical) safety within the course group Safety and Ethics.

- Oncology is an important medical domain for the medical physicist in any of the three disciplines. Therefore the panel emphasises that the medical-oriented courses should integrate oncology in their contents and competences.

- MRI imaging sequences are fundamental in the interpretation and optimization of medical images in oncology. MRI sequences are only slightly touched in the ECTS course description of the French (UCL) course Medical Imaging (course description 29). The recommendation is to emphasize the development of MRI sequences in both parallel courses (course descriptions 28 and 29) on Medical Imaging rather than offering a specialized elective course on MRI sequences from Biomedical Engineering (as was proposed during the online site-visit interviews).

In view of the European Guidelines on Medical Physics Expert that are formulated at level 8 (EQF), the programme management indicates that the postgraduate programme can serve as a buffer to provide answers in curriculum development from the European requirements that can be far-reaching. The panel favours the idea of keeping the focus in the master's programme on general courses, and using the postgraduate programme to impart more specialised knowledge and skills.

An important point of attention for the panel is that the course content is attuned to the various bachelor's backgrounds, with the ultimate goal of achieving the same learning outcomes after the completion of the master's degree. The courses in quantum physics and programming are examples of courses that will have to focus on eliminating prior knowledge differences.

The panel also believes that the elective, borrowed courses should be adapted to the finality of this programme (e.g. anatomy followed jointly with medical students requires adapted assessments and evaluations).

Furthermore, the equal treatment (in terms of number of ECTS credits awarded) of the different courses is a point to follow-up. There are sometimes small differences in the ECTS credits awarded in the same elective courses offered at KU Leuven and UCLouvain (e.g. 'Medical Imaging and Analysis' 6 ECTS and 'Medical Imaging' 5 ECTS; differences in credits for 'Radiation Protection'). This has grown historically from the existing programmes. The panel considers the start of this new programme an opportunity to eliminate these small differences.

The above recommendations are formulated at a detailed level and are intended to keep the exchange of ideas for this programme active. They do not detract from the basic quality of the curriculum that the panel believes in. Furthermore, the programme management much appreciated the detailed recommendations that help to fine-tune the programme before its actual start, if possible, in the next academic year.

### 2.3.2 Credits

*The European Credit Transfer System (ECTS) should be applied properly and the distribution of credits should be clear.*

Both universities follow the European Credit Transfer System (ECTS). The curriculum is made up of four semesters and 120 ECTS. The programme will consist of:

- 79 ECTS for courses,
- 26 ECTS for the master's thesis,
- 15 ECTS for two internships.

The panel understands how the allocation of credits is done and finds this reasonable.

### 2.3.3 Workload

*A joint bachelor programme will typically amount to a total student workload of 180-240 ECTS-credits; a joint master programme will typically amount to 90-120 ECTS-credits and should not be less than 60 ECTS-credits at second cycle level (credit ranges according to the FQ-EHEA); for joint doctorates there is no credit range specified. The workload and the average time to complete the programme should be monitored.*

The joint steering committee monitors the flow of students and the effective workload of the programme. Students are represented in this organ. Furthermore, there are the online student evaluations at both institutions. The general quality system COBRA also provides sufficient guarantees that the workload is examined by the stakeholders.

The students with whom the panel spoke indicate that the professors and the programme director are the first points of contact for addressing the workload.

The panel sees a point of attention in monitoring the workload of specific courses in function of the bachelor's background of the students. Also the workload of new courses needs to be monitored with special attention.

Furthermore, there is an opportunity for internships to monitor the workload, especially when an increasing number of other institutions will be involved for internships. The education team is considering developing a framework that facilitates comparability of workload in internships across institutions. The panel considers this a useful action.

## 2.4 Admission and Recognition

The panel assesses the Admission and Recognition standard as compliant.

### 2.4.1 Admission

*The admission requirements and selection procedures should be appropriate in light of the programme's level and discipline.*

The self-assessment report (p.27) describes that there is a direct inflow into this programme from the bachelor of physics. Students from other bachelors in engineering sciences, chemistry, industrial engineering (nuclear technology), and bio-science engineering have to follow an admission procedure and a limited preparatory programme. For other bachelor's degrees, e.g. bachelor in biomedical science, an admission procedure and a more extended preparatory programme are provided.

The diversity of influx of students has the advantage of interdisciplinary knowledge exchange. However, it requires the programme management to have a good overview of the starting competences and the possibility to reasonably remediate starting competences when needed. The panel therefore urges that the initial competences be made transparant (in function of the original education, e.g. level of (quantum) physics, mathematics and programming.) The panel is confident that the programme will then allow the final master's level to be reached. A possible future national programme, with two streams - engineering sciences and exact sciences - may be an answer if the bandwidth would become too large with further evolution of the programme.

### 2.4.2 Recognition

*Recognition of qualifications and of periods of studies (including recognition of prior learning) should be applied in line with the Lisbon Recognition Convention and subsidiary documents.*

For this programme, the recognition of qualifications and periods of studies will be applied in accordance with the Lisbon Recognition Convention. Students can apply for an exemption from a course, given previous studies and work experience. If applications are accepted by the steering committee, previous studies or work experience will be taken into account according to the procedures established at the coordinating university.

## 2.5 Learning, Teaching and Assessment

The panel assesses the Learning, Teaching and Assessment standard as compliant.

### 2.5.1 Learning and teaching

*The programme should be designed to correspond with the intended learning outcomes, and the learning and teaching approaches applied should be adequate to achieve those. The diversity of students and their needs should be respected and attended to, especially in view of potential different cultural backgrounds of the students.*

A variety of teaching methods is used to achieve the learning outcomes of the programme. These teaching methods vary across the five thematic groups in the programme (see self-assessment report p. 29). The panel appreciates the range of teaching methods used in this programme. Some points that the panel would like to emphasise are given below.

FANC considers the 10 weeks clinical internship in the master, split up into two periods, as part of the 52 weeks internship that is requested in the Royal Decee on the protection of the population, employees and the environment against the danger of ionizing radiations.

Today, student mobility between the campuses and university hospitals of KU Leuven and UCLouvain seems to be approached as an obvious element. The panel sees opportunities to break through the campus-oriented thinking by outlining a number of pathways where such mobility, certainly in the elective courses, can be realised. Each (elective) course can be followed digitally or on campus. However, the risk lies in the drawing up of the calender of courses, so that, in practice, students end up taking certain courses digitally, simply because the complexity of mobility between campuses is underestimated. Students confirm that the mobility between campuses and the coordination between courses emerges as critical success factors of the programme. The challenge lies mostly in the borrowed courses. It might be good practice to simulate some model tracks to assess the practical challenges.

The information file indicates that the elective courses, of which currently one option is offered in English and the second option in French, will eventually move to an all-English offering. The panel recognizes the cultural value of the French courses, still considers the all-English evolution in this programme a correct ambition that fits in an internationally oriented strategy. Students do not consider it a great professional added value to offer courses in French that are equivalent in terms of course content to the English language equivalent. Students indicate that English is the language of the professional field. For international students, an all-English programme is most appropriate.

In order to enable outgoing international mobility, the programme would do well to establish first partnerships.

### 2.5.2 Assessment of students

*The examination regulations and the assessment of the achieved learning outcomes should correspond with the intended learning outcomes. They should be applied consistently among partner institutions.*

The evaluation policy of the Faculty of Science at KU Leuven is applied to this programme. The organizing committee will develop a programme-specific view on qualitative evaluation, based on the faculty-wide evaluation policy.The steering committee monitors hereby the quality of the evaluation and also suggests the representative examination committee to the Faculty.

The panel finds the overall explanation of student assessment in the self-assessment report and the dialogues convincing. Both institutions offer institution-wide technical and

pedagogical support, for classical assessment approaches such as written examinations or multiple choice questions, and for less classical tools such as a portfolio or peer review.

The panel makes the following specific recommendations that are in line with recommendations or points of attention made in view of the other standards:

- For the assessment of the internship (report), an evaluation grid is recommended that allows streamlined, equal feedback to the students, independent of the internship supervisor(s). It is appropriate to provide such assessment at mid-term, not at the end of the internship, and going beyond pass/fail;
- The evaluation of elective courses (borrowed from other faculties) should be tailored to this programme.
- In some equivalent elective courses there are differences in the ECTS credits awarded (see above 2.3.1). Here, equal fairness is required.

## 2.6 Student Support

The panel assesses the Student Support standard as compliant.

*The student support services should contribute to the achievement of the intended learning outcomes. They should take into account specific challenges of mobile students.*

The informative conversation between each student and the programme director, before the start of the programme, is the moment when prior knowledge differences and specific student needs can be considered. Furthermore, the programme organises a half-day information session for new students with key lecturers and the programme directors. There is also a guided tour of the campuses. Additionally, students can make use of all institution-wide student facilities and student services, such as the Student Health Centre and International Office.

In the dialogue with students, the accessibility and approachability of the coordinators, study progress counsellors and lecturers is mentioned as a strength. The students also see a potential strength in the fact that specific infrastructure and research opportunities are available on two campuses.

The panel has the impression from the dialogues that the overall support mechanisms, such as support for people with disabilities, list of extracurricular activities, counselling, mentorship options ... are not actively promoted by the existing programmes. The panel recommends making the existing support mechanisms more visible. Support can then refer to (financial) support for student mobility between the campuses, highlighting contact points for psycho-social welfare, the facilities policy, etc.

According to the panel, student support can be approached more proactively: ‘give the new students a meeting place, create a community, organise a kick-off event, draw inspiration from good practices in your own institution’.

## 2.7 Resources

The panel assesses the Resources standard as compliant.

### 2.7.1 Staff

*The staff should be sufficient and adequate (qualifications, professional and international experience) to implement the study programme.*

The self-assessment report confirms that the number of staff members in the various disciplines is sufficient to carry the workload for education assignments. There are extensive research programmes in the three specialist areas of medical physics; moreover, both institutions reinforce each other in this regard.

The panel did not have any doubts about the qualifications and experience of the staff. Here lies an absolute didactic strength.

However, the panel does encourage making gender and diversity balance a priority. The diversity policy and institution-wide inclusion actions can be deliberately included in this programme (e.g. How can women finish their courses or their internship when they are pregnant?). The programme management is aware that role models in the teaching and research staff, as well as in the professional field, are crucial to realise that diverse influx. Here, there is room for (didactic) quality improvement and the strengthening of a sense of belonging for students, as a result of greater inclusion.

### 2.7.2 Facilities

*The facilities provided should be sufficient and adequate in view of the intended learning outcomes.*

The lecture rooms, auditoria and laboratories of the KU Leuven and UZ Leuven, UCL Louvain-La-Neuve and Woluwé campuses will be used for the programme. With a starting estimated student number of 30 (up to possibly 60 in a few years' time), the infrastructure is adequate.

There is access to the research laboratories and equipment of the clinical departments in both institutions and hospitals. There is access to the second beamline of the proton therapy centre at UZ Leuven that is designed for research and teaching purposes.

It goes without saying that the proton centre is the infrastructure par excellence to build a research culture on. However, the panel recommends continuing to train students in classical methods and or technologies that are not present in the laboratories of the KU Leuven and UCL Louvain-La-Neuve (e.g. Hybrid MRI-linacs) so students are fit for the broad working field. The expansion of a network for internships in other institutes is necessary to be able to broadly cover this classical training.

Students have access to the digital and physical libraries of both institutions. There are two e-learning platforms: Toledo (at KU Leuven) and Moodle (at UCLouvain). Toledo will be chosen for the joint courses, courses at UCL will use moodle. The panel favours a future evolution towards a single platform. For the sake of transparency for the student, one lecturer-in-charge will be designated per course.

A permanent point of attention, as the dialogues show, is the practical time students get during the master's programme to learn how to work with medical machines and technologies (hands-on).

## 2.8 Transparency and Documentation

The panel assesses the Transparency and Documentation standard as compliant.

*Relevant information about the programme like admission requirements and procedures, course catalogue, examination and assessment procedures etc. should be well documented and published by taking into account specific needs of mobile students.*

The master will be marketed as a joint master, with joint communication and announcement to students. There will be a joint information session about master and internship. The panel supports the programme's intention to create a joint website containing information on all phases of study, the Education and Examination Regulations (OER), the online programme catalogue, the ECTS course descriptions and the professional career opportunities.

Students indicate that the information on the current programmes on the websites of the institutions involved could be more accessible, but that this shortcoming is more than compensated for today by the great approachability of coordinators and student counsellors.

The panel recommends clear communication to students about the effect of prior knowledge differences from inflow from the various bachelor's (bachelor of physics, bachelor of engineering sciences, bachelor of chemistry, bachelor of industrial engineering: nuclear technology, and bachelor of bio-science engineering) on the study duration of the master's programme and the potential abridged programmes.

The institutions use either Toledo or Moodle for communication between students and staff. There is the KU Loket application where the individual study programme, the class schedules, the individual examination schedule and the student's academic progress file can be consulted. At UCLouvain, there is a similar system MyUCL. Because KU Leuven is the coordinating institution, MyUCL will be available to all students, but will hardly be used.

From the dialogue with students it also appears that more transparency about the recognition and finality of this degree in other European countries is desirable. Certainly for international students, this information is currently insufficient. Transparency about required supplementary programmes is therefore needed.

It is also advisable that the generic class schedules for the courses and the impact on travel time between the campuses are made known to students well before the start of the academic year. The panel sees this as a quick win, which will be very valuable to students.

## 2.9 Quality Assurance

The panel assesses the Quality Assurance standard as compliant.

*The cooperating institutions should apply joint internal quality assurance processes in accordance with part one of the ESG.*

Every four years, the programme and the core courses are included in the COBRA evaluation cycle, KU Leuven's own quality assurance system. Quantitative and qualitative information is included from the perspective of internal and external stakeholders: students, teaching staff, staff members, professional field, alumni and international peers.

For each course, students can state their opinion on the quality of the course and the quality of teaching at least once every three years via an online survey. The steering committee takes care of the validation of the assessment.

Furthermore, there is a KONDOR curriculum evaluation where a broad set of questions is offered to alumni and students to assess the programme as a whole.

With its Quality of Academic Programme Offer Support Service (QOPA), UCL follows the KU Leuven approach with a similar system based on the principles of autonomy, accountability and transparency. Evolution in a perspective of continuous improvement is paramount.

The steering committee, including academic and administrative representatives from both institutions, will be installed for the programme and will be responsible for the policy and operational aspects of the programme, as well as for quality assurance and permanent monitoring of the curriculum.

Summarised: as KU Leuven is the coordinating university for the MSMP programme presented here, the COBRA quality assurance system and the KONDOR curriculum evaluation will be used at programme level. At course level, the KU Leuven online student's evaluation system will be applied to all KU Leuven and joint KU Leuven-UCLouvain courses. For the hired courses from other faculties, the QA system of those faculties in KU Leuven or UCLouvain will be followed.

The panel considers the system, with its structures, processes and procedures, to be coherent and firmly in place. The two quality cultures come together in it, from a working method based on trust and participation. Nevertheless, the panel sees room to evolve towards a shared quality culture between the institutions. Fully fusing into one quality culture is an evolutionary process that will take time. It is necessary to actively pursue the realisation of a shared quality culture.

Furthermore, the panel recommends that an alumni network be actively involved in the programme as a source of information and goodwill. After all, a good alumni cooperation is an essential part of a well-functioning QA system.

# 3 Final judgement

The panel is positive about the Master of Science in Medical Physics that is proposed as a joint, English taught (and for the time being, for elective courses, also partly French taught) programme by the partner universities KU Leuven and UCLouvain.

There is no doubt that the programme satisfies all standards of the framework for the European Approach for quality assurance of joint programmes.

The panel emphasises the absolute strengths of the programme: it is a unique educational programme in Belgium; the master's programme is open to disciplines other than exact sciences; the programme responds to the professional need for a larger influx of medical experts; there is top-class medical equipment and infrastructure; and the forces are combined in both institutions that are already strong in medical physics today.

The panel acknowledges that this programme is a first step towards bringing the medical physics education in Belgium in line with efforts being made to create a European curriculum for medical physicists. The new programme is designed from the perspective of Belgian legislation - Royal Decree of 13 February 2020, known as the "Medical Exposures Decree" - and responds to the current need for certification of experts in medical radiation physics.

The panel has nevertheless formulated a number of recommendations that could help the MSMP partners to fine-tune their common endeavour. These can be interpreted as mere next steps towards quality enhancement.

- The programme is rather an approach to medical radiation physics, and a variant of what medical physics can be. Transparency about this specification towards students is a first recommendation that the panel would like to make in this regard.
- Student mobility is a facet where campus-oriented thinking can be broken through good coordination across courses by outlining and encouraging a number of pathways where that mobility can be realised. Digital teaching methods can be an added value, but should remain to be a choice and not compulsory because of potential difficulties in mobility.
- During the intake interview and certainly before the start of the master's programme, students need to be clearly informed about which abridged programmes they need to take and what the effect of these courses is on the study time, depending on the student's bachelor's background.
- The enrolment of students from diverse bachelor’s programmes offers advantages, but requires good monitoring of the final attainment level.
- The panel encourages the programme management to further develop the network of researchers to strengthen the offer of internships at other institutions (including training of the internship supervisors).
- The QA system, with its structures, processes and procedures, is in place, however, there is room to strengthen it into a common quality culture between and across the two universities and its hospitals.
- Furthermore, an alumni network, as an essential part of a well-functioning QA system, should be actively involved in the programme as a source of information and goodwill.

Regardless of these recommendations, the panel confirms it is very enthusiastic about the quality and expected added value that the MSMP programme will bring to the field of Medical Physics.

# 4 Assessment procedure

The assessment was carried out in line with the 'Framework for the European Approach for Quality Assurance of Joint Programmes – November 2020'.

The panel prepared itself for the assessment on the basis of the Self-Assessment Report and annexes submitted by KU Leuven and UCLouvain when applying for initial accreditation. Prior to the preparatory meeting of the panel, each panel member formulated initial impressions and questions to be discussed. During the preparatory online meeting on Monday 29 November 2021, the panel discussed all information received with the application and also prepared the virtual dialogue with the programme (institutions). Impressions and questions were collected and merged into a well-ordered and handy document before the dialogue with the institution.

The virtual dialogue took place on 1 and 2 December 2021. The digital platform used was Zoom. The dialogue included discussions with representatives of KU Leuven and UCLouvain.

During the dialogue the panel investigated the context of the joint programme and the Institutions, KU Leuven and UCLouvain, and collected all required information to make a judgement on the quality of the joint programme.

During a closed meeting of the panel on 2 December 2021 the panel discussed all information obtained and translated it into a judgement per standard and for the programme as a whole. The panel took this conclusion in full independence.

All information obtained led to a draft assessment report that has been sent to all panel members. The feedback from the panel members has been processed. The assessment report adopted by the chairperson was submitted to NVAO on 20 January 2022.

# 5 Overview of the assessments

The panel presents its assessments per standard and for the programme as a whole, as outlined in chapter 2.

| Standard | Assessment |
|---|---|
| 1 Eligibility | Compliant |
| 2 Learning Outcomes | Compliant |
| 3 Study Programme | Compliant |
| 4 Admission & Recognition | Compliant |
| 5 Learning, Teaching & Assessment | Compliant |
| 6 Student Support | Compliant |
| 7 Resources | Compliant |
| 8 Transparency & Documentation | Compliant |
| 9 Quality Assurance | Compliant |
| **Programme as a whole** | **Positive** |

# Annex 1: Administrative data

| | |
|---|---|
| Institutions | • Katholieke Universiteit Leuven (coordination)<br>• Université catholique de Louvain |
| Address, institution website | Under construction |
| Qualification | Master of Science in Medical Physics |
| (Additional) title | Not Applicable |
| (Parts of) field of study(s) | Sciences, Engineering, Medicine |
| Specialisations | - |
| Programme routes | Not applicable, except fot the internship that provides a specialisation in:<br>• Radiology<br>• Radiotherapy<br>• Nuclear medicine |
| Location where the programme is offered | The programme is taught at the KU Leuven and UCLouvain campuses and university hospitals (i.e.UZ Leuven – University Hospital Leuven – and Cliniques universitaires Saint-Luc at Bruxelles Woluwe). |
| Teaching language | English |
| Study load (in credits) | 120 ECTS |

# Annex 2: Programme-specific Learning Outcomes

The programme-specific learning outcomes (PLO) are organized in five categories:

KNOWLEDGE AND INSIGHT

1. The student has the required knowledge to start the internship necessary to obtain the certificate of "expert in medical radiation physics" according to the guidelines of the Federal Agency for Nuclear Control, or to perform other functions related to medical physics (in industry, government institutions, scientific research, applications, ...).
2. The student has a profound knowledge of the aspects of medical and biomedical sciences relevant to professional action within the context of medical physics.
3. The student has a thorough theoretical and practical knowledge of and insight in the fundamental aspects of ionizing and non-ionizing radiation physics and of the legal aspects relevant to medical physics.
4. The student has a profound knowledge of the techniques and mathematical methods (including ICT) related to the three specializations within medical physics, and has in depth knowledge of his/her own specialisation.
5. The student has acquired the skills to get familiar with the most recent developments in a research domain of medical physics.

APPLYING KNOWLEDGE AND INSIGHT

6. The student has the skills and insight to take the following steps in his own (both fundamental and clinical) scientific research, to solve advanced problems from medical physics, embedded in a research group:
    a) define a research topic, formulate a research question and adjust it during the research
    b) consider and plan an appropriate experimental and / or theoretical solution procedure
    c) carry out and implement a risk analysis of the experiments to be carried out
    d) carry out a scientific study independently and accurately, with attention to originality and creativity
    e) process and evaluate/interpret the data found (statistically) with a critical-scientific attitude
    f) and all this taking in account the appropriate ethical rules of conduct within the discipline.
7. The student possesses the skills to make people in his/her environment (both laymen and colleagues) aware of the importance of radiation protection and quality control, and is able to communicate this to the medical team.
8. The student can identify and apply the imaging and treatment techniques specific to medical physicists in the hospital environment
9. The student has insight into clinical questions.

DEVELOPING AN OPINION

10. The student can look up professional literature, also in foreign languages, assess its validity, and use it for research and development purposes.
11. The student can independently process, critically interpret and comment on the results of both his / her own research and literature research in the light of a specific research question.
12. The student has a good knowledge of the ethical aspects of research in medical physics and is able to act accordingly. Can participate in a social debate.
13. The student can identify the essence of a situation and draw up a working model for this. Can design experimental and / or theoretical procedures to study contemporary research problems in medical physics and to improve existing solutions.
14. The student is able to take decisions about radiation protection independently and with a sense of responsibility.

15. The student has insight into the detection of technical errors in equipment and/or procedures in medical physics and can estimate the consequences thereof.

LEARNING SKILLS

16. The student is able to explore new domains in the field through independent study and get acquainted with new insights, results and methods.
17. The student is able to conduct research and tackle scientific problems, paying attention to originality and creativity.
18. The student has (acquired) an attitude of lifelong learning, both as to knowledge and skills.

COMMUNICATION

19. The student has acquired the necessary attitudes and skills to participate as a team player in a multidisciplinary professional environment.
20. The student is able to report, communicate and present the results of his/her own research in Dutch and English and both in writing and orally to national and/or international colleagues and to a wider audience, taking in account the ethical rules.
21. The student can take a reasoned position and defend this orally to peers and experts and communicate this in writing to the general public.

# Annex 3: Composition of the panel

The composition of the panel that assessed the quality of the Master of Science in Medical Physics of KU Leuven and UCLouvain was as follows:

**Prof. dr. Dirk Verellen** *(chair),* Full Professor at Antwerp University, Faculty of Medicine and Health Sciences, director of the Medical Physics Group in the Department of Radiotherapy of the Iridium Cancer Network Antwerp, Belgium;

**Prof. dr. Alain Seret** *(panel member)*, Chargé de cours, Experimental medical imaging, Physics Department & GIGA CRC In-vivo imaging, University of Liège, Belgium;

**Prof. dr. ir. Carlos De Wagter** *(panel member)***,** Senior Full Professor Radiation Physics at Ghent University, Faculty of Medicine and Health Sciences, Head of Department – Department of Human Structure and Repair, member Department of Radiation Oncology at Ghent University Hospital, Belgium;

**Dr. Rolf Heusser** *(panel member)***,** former director of the Swiss Agency for Accreditation and Quality Assurance in Higher Education, Coordinator within program "Smarter Health Care" of the Swiss National Science Foundation (NRP 74), Lecturer at University of Zurich and ETH of Zurich, Switzerland;

**Anna Klampfer** *(student panel member)*, member of ESU's Quality Assurance Experts Pool and master's student MSc Material Science and MSc Physical Energy- and Measurement Engineering at Technical University of Vienna, Austria.

The panel was assisted by:

- **Dagmar Provijn**, policy advisor Flanders NVAO, process coordinator;
- **Veerle Conings,** secretary.

All panel members and the process coordinator/secretary have signed NVAO's code of deontology.

## Annex 4: Schedule of the dialogue – site visit

The dialogue and site visit (online) by the panel were organised on 1 and 2 December 2021 as part of the external assessment procedure regarding the Master of Science in Medical Physics of KU Leuven in collaboration with UCLouvain. The schedule was as follows:

**1 and 2 December 2021 – virtual meeting**

| Time | Meeting |
|---|---|
| ***Wednesday 1 December*** | |
| *14:00–15:00* | *Session 1 – Programme management* |
| *15:20–16:20* | *Session 2 – Students* |
| *16:40–17:40* | *Session 3 - Alumni and Professional Field* |
| *18:00–19:00* | *Presentation on Proton Therapy Center* |
| ***Thursday 2 December*** | |
| *09:00–10:00* | *Session 4 - Teaching staff* |
| *10:30–11:30* | *Session 5 - Supporting staff* |
| *12:00–12:30* | *Session 6 - programme management* |
| *15:30–16:00* | *Closing dialogue panel and programme representatives* |

# Annex 5: Documents reviewed

During the site visit the programme management presented the following documents:

*Information file*

- Self-Assessment Report

*Annexes to the information file*

- Cooperation agreement
- ECTS course descriptions
- Structure of the curriculum / programme
- Academic staff CVs (all partners)
- Curriculum mapping
- Overview of the teaching methods used in the different courses
- Overview of the evaluation methods used in the different courses
- Assessment Roster and Appreciation Scale for the master's thesis evaluation

*Documents made available during or leading up to the dialogue* – virtual table site visit

- Federaal Agentschap voor nucleaire controle, Technisch reglement houdende de vaststelling van de stageprogramma's medische stralingsfysica voor radiotherapie, radiologie en nucleaire geneeskunde, Belgisch Staatsblad, 19 februari 2020.
- European Commission (2014), Radiation Protection NO 174, European Guidelines on medical physics expert.
- Regulations on Education and Examinations – _KU Leuven 2021-2022: https://www.kuleuven.be/education/regulations/2021/?faculteit=50000405&locatie=8
- Guidelines for the master thesis: https://wet.kuleuven.be/studenten/mastersthesis.
- University-wide website on evaluation
- Faculty website on scientific integrity, internships, etc. (in Dutch): https://wet.kuleuven.be/sbook/opleidingsverantwoordelijke/visie-beleid.

## Annex 6: List of abbreviations

| | |
|---|---|
| ECTS | European Credit according to the European Credit Transfer and Accumulation System |
| FQ-EHEA | Framework for Qualifications in the European Higher Education Area |
| LO | Learning outcome |
| MSMP | Master of Science in Medical Physics |
| NVAO | Accreditation Organisation of the Netherlands and Flanders (Nederlands-Vlaamse Accreditatieorganisatie) |
| PLO | Programme-specific learning outcomes |

The panel report has been ordered by NVAO for the initial accreditation of the Master of Science in Medical Physics of KU Leuven and UCLouvain according to the Framework for the European Approach for Quality Assurance of Joint programmes.

**Colofon**

Master of Sciene in Medical Physics
Katholieke Universiteit Leuven & Université catholique de Louvain
(VL131113-21)
Initial accreditation • Panel report
*20 January 2022*

**Nederlands-Vlaamse Accreditatieorganisatie**
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