



AGENTUR FÜR
QUALITÄTSSICHERUNG DURCH
AKKREDITIERUNG VON
STUDIENGÄNGEN E.V.

FINAL REPORT

ADVANCED SPECTROSCOPY IN CHEMISTRY (ASC) (MASTER OF SCIENCE)

OFFERED BY

UNIVERSITY OF LILLE (FRANCE)

UNIVERSITY OF BOLOGNA (ITALY)

UNIVERSITY OF HELSINKI (FINLAND)

JAGIELLONIAN UNIVERSITY IN KRAKOW (POLAND)

LEIPZIG UNIVERSITY (GERMANY)

September 2025

Assessment following the European Approach
for Quality Assurance of Joint Programmes



Content

Decision of the Accreditation Commission of AQAS	3
I. Preamble	6
II. Accreditation procedure	6
1. Criteria	6
2. Approach and methodology	6
III. General information on the universities	8
IV. Assessment of the study programme	9
1. Eligibility	9
2. Learning outcomes	11
3. Study programme	15
4. Admission and recognition	18
5. Learning, teaching and assessment	19
6. Student support	21
7. Resources	23
8. Transparency and documentation	24
9. Quality assurance	25
V. Recommendation of the panel of experts	26

DECISION OF THE AQAS STANDING COMMISSION ON THE STUDY PROGRAMME

- **“ADVANCED SPECTROSCOPY IN CHEMISTRY (ASC)” (MASTER OF SCIENCE)**
OFFERED BY
- **UNIVERSITY OF LILLE (FRANCE)**
- **UNIVERSITY OF BOLOGNA (ITALY)**
- **UNIVERSITY OF HELSINKI (FINLAND)**
- **JAGIELLONIAN UNIVERSITY IN KRAKOW (POLAND)**
- **LEIPZIG UNIVERSITY (GERMANY)**

Based on the report of the expert panel, the comments by the universities and the discussions of the AQAS Standing Commission in its 26th meeting on 8 September 2025, the AQAS Standing Commission decides:

1. The study programme **“Advanced Spectroscopy in Chemistry (ASC)” (Master of Science)** jointly offered by the **University of Lille (France)**, **University of Bologna (Italy)**, **University of Helsinki (Finland)**, **Jagiellonian University in Krakow (Poland)**, and **Leipzig University (Germany)** is accredited according to the Standards defined in the European Approach for Quality Assurance for Joint Programmes.

The accreditation is conditional.

The study programme essentially complies with the requirements defined by the criteria and thus the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) and the European Qualifications Framework (EQF) in their current version. The required adjustments can be implemented within a time period of twelve months.

2. The conditions have to be fulfilled. The fulfilment of the conditions has to be documented and reported to AQAS no later than **30 September 2026**. The confirmation of the conditions might include a physical site visit within the time period of twelve months.
3. The accreditation is given for the period of **six years** and is valid until **30 September 2031**, provided that the conditions listed below are fully met. Otherwise, the accreditation may be withdrawn.

Conditions:

1. A full course description of the “Internship and transferable skills” module must be provided.
2. The programme must assure that qualifications in the field of entrepreneurship as described in the ILO are developed and assessed as part of the compulsory programme elements.

The following **recommendations** are given for further improvement of the programme:

1. The intended learning outcomes of the programme should be communicated more clearly to prospective students to ensure accessibility for other interested parties. This includes their explicit representation in the diploma supplement.
2. The consortium partners are encouraged to enhance the format of course descriptions to become more comparable and uniform to increase accessibility and transparency for students.
3. The consortium should consider implementing short interviews as part of the selection process to ascertain that the individual is in fact who they are believed to be.
4. The consortium should improve student support in Bologna.
5. The process in place to distribute students to the different partners should be more transparent and known to those affected by it.
6. The consortium should increase transparency and communicate more actively to provide information to students, e.g. on topics such as about student support, labour market connections, and expected workload peaks in the first semester.
7. The perspective of the labour market should be structurally embedded in the quality assurance of the programme, e.g., by reviving the advisory board.

With regard to the reasons for this decision the AQAS Standing Commission refers to the attached assessment report.

EXPERTS' REPORT**ON THE STUDY PROGRAMME**▪ **“ADVANCED SPECTROSCOPY IN CHEMISTRY (ASC)” (MASTER OF SCIENCE)****OFFERED BY**

- **UNIVERSITY OF LILLE (FRANCE)**
- **UNIVERSITY OF BOLOGNA (ITALY)**
- **UNIVERSITY OF HELSINKI (FINLAND)**
- **JAGIELLONIAN UNIVERSITY IN KRAKOW (POLAND)**
- **LEIPZIG UNIVERSITY (GERMANY)**

Visit to the university: 26-27 June 2025

Panel of experts:

Prof. Dr. Maria Fedorova	Associate Professor, Fedorova Lab, Center for Membrane Biochemistry and Lipid Research (ZML), Dresden University of Technology, Germany
Prof. Dr. Jolanta Kumirska	Professor, Faculty of Chemistry, Department of Environmental Analytics, University of Gdańsk, Poland (also QA)
Dr. Christoph Krafft	Research Department Spectroscopy and Imaging, Work Group Raman and IR Spectroscopic Analytics, Leibniz Institute of Photonic Technology, Jena (labour market representative)
Charlotte Proges	Master of Science Chemistry (recent graduate), University of Göttingen, Germany (student representative)

Coordinator:

Ronny Heintze	AQAS, Cologne, Germany
---------------	------------------------

I. Preamble

AQAS – Agency for Quality Assurance through Accreditation of Study Programmes – is an independent non-profit organisation supported by nearly 90 universities, universities of applied sciences and academic associations. Since 2002, the agency has been recognised by the German Accreditation Council (GAC). It is, therefore, a notified body for the accreditation of higher education institutions and programmes in Germany.

AQAS is a full member of ENQA and also listed in the European Quality Assurance Register for Higher Education (EQAR) which confirms that our procedures comply with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), on which all Bologna countries agreed as a basis for internal and external quality assurance.

AQAS is an institution founded by and working for higher education institutions and academic associations. The agency is devoted to quality assurance and quality development of academic studies and higher education institutions' teaching. In line with AQAS' mission statement, the official bodies in Germany and Europe (GAC and EQAR) approved that the activities of AQAS in accreditation are neither limited to specific academic disciplines or degrees nor a particular type of higher education institution.

II. Accreditation procedure

This report results from the external review of the master's programme "Advanced Spectroscopy in Chemistry" offered jointly by the University of Lille (France), University of Bologna (Italy), University of Helsinki (Finland), Jagiellonian University in Krakow (Poland), and Leipzig University (Germany).

1. Criteria

The programme is assessed against the criteria defined by the European Approach for Quality Assurance of Joint Programmes. The criteria are based on the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) 2015.

2. Approach and methodology

Initialisation

The university consortium mandated AQAS to perform the accreditation procedure in November 2024. The university consortium produced a Self-Evaluation Report (SER). In February 2025, the consortium handed in a draft of the SER together with the relevant documentation on the programme and an appendix. The appendix included e.g.:

- an overview over statistical data of the student body (e.g. number of applications, beginners, students, graduates, student dropouts),
- the CVs of the teaching staff/supervisors,
- information on student services,
- core information on the main library,
- as well as academic regulations.

AQAS checked the SER regarding completeness, comprehensibility, and transparency. The accreditation procedure was officially initialised by a decision of the AQAS Standing Commission on 24 February 2025. The final version of the SER was handed in June 2025.

Nomination of the expert panel

The composition of the panel of experts follows the stakeholder principle. Consequently, representatives from the respective discipline, the labour market, and students are involved. Furthermore, AQAS follows the principles for the selection of experts defined by the European Consortium for Accreditation (ECA). The Standing Commission nominated the aforementioned expert panel in June 2025. AQAS informed the university consortium about the members of the expert panel and the university consortium did not raise any concerns against the composition of the panel.

Preparation of the site visit

Prior to the site visit, the experts reviewed the SER and submitted a short preliminary statement including open questions and potential needs for additional information. AQAS forwarded these preliminary statements to the university consortium and to all panel members in order to increase transparency in the process and the upcoming discussions during the site visit.

Site visit

After a review of the SER, a site visit to the university took place on 26-27 June 2025. On site, the experts interviewed different stakeholders, e.g. the management of the higher education institution, the programme management, teaching and other staff, as well as students, in separate discussion rounds and consulted additional documentation. The visit concluded by the presentation of the preliminary findings of the group of experts to the consortium's representatives.

Reporting

After the site visit had taken place, the expert group drafted the following report, assessing the fulfilment of the criteria. The report included a recommendation to the AQAS Standing Commission. The report was sent to the consortium for comments.

Decision

The report, together with the comments of the university consortium, forms the basis for the AQAS Standing Commission to take a decision regarding the accreditation of the programme. Based on these two documents, the AQAS Standing Commission took its decision on the accreditation on 8 September 2025. AQAS forwarded the decision to the university consortium. The university consortium had the right to appeal against the decision or any of the imposed conditions.

In October 2025, AQAS published the report and the result of the accreditation as well as the names of the panel of experts.

III. General information on the universities

Full name of the programme	Advanced Spectroscopy in Chemistry
EQF level	7
Degrees awarded	Master of Science (joint degree, multiple degree)
Number of ECTS points	120 ECTS
ISCED field(s) of study	0531 (Chemistry) and 0588 (Interdisciplinary programmes and qualifications involving natural sciences, mathematics and statistics)

The two-year master's programme Advanced Spectroscopy in Chemistry (ASC) is jointly developed and run by five European partners, i.e., the University of Lille (France), Leipzig University (Germany), University of Bologna (Italy), Jagiellonian University in Krakow (Poland) and University of Helsinki (Finland). Their long-standing collaboration originated in their membership in the Utrecht Network (a representative European-wide network of international universities).

Having been awarded a grant within the ERASMUS SOCRATES Curriculum Development programme, the programme has been further developed and later obtained the Erasmus Mundus label (2008-2013) as well as funding as Erasmus Mundus Joint Master Degree from 2016 to 2020 and from 2020 to 2026. The programme is now said to be an integral part of the educational degree programmes at the partnering institutions since 2007.

Courses are entirely taught in English and a successful completion of the programme leads to the award of multiple degree diplomas (a joint degree between Lille and Bologna) with a joint diploma supplement.

According to the Self-Evaluation Report (SER), the programme offers a range of international learning opportunities, links with global industry partners producing spectrometers (Bruker, Magnetech), regional competitiveness clusters (MATIKEM in Lille, NEU in Leipzig), and partnerships with prestigious research facilities such as synchrotron SOLEIL in France and ELETTRA in Italy as well as associated partner universities.

The programme is explained to provide students with top supervision, training, and equipment, preparing them for employment or further (doctoral) research in the fields of molecular synthesis, biology, nanotechnologies, modelling, pharmacy, green chemistry, materials, and sustainable energies. In addition, the SER emphasises the development of further skills such as competencies in entrepreneurship, project management, bibliographical search and synthesis in link with industry and knowledge of REACH legislation and intellectual property issues as well as a range of soft skills including intercultural communication, research experience, and scientific communication.

The documentation states that so far about 300 students from more than 50 countries have enrolled in the master's programme, with 56 % being male and 44 % being female. The SER also highlights the success of the programme and specifies that 100 % of their alumni found employment worldwide in the first few months after their graduation, 80 % pursued a PhD, and 20 % found employment directly after graduation, with 60 % in the industry and 40 % in academic positions.

All partner universities are higher education and degree-awarding institutions. The SER includes a table providing the accreditation status per institution as well as the types of degrees which are currently awarded and those which are planned for the 2021-2025 period. The University of Lille serves as the coordinator of the programme, while all other institutions are consortium partners.

IV. Assessment of the study programme

1. Eligibility

1.1 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.

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

1.3 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.*

Description

Joint design and delivery

The documentation outlines the long-standing collaboration between partner institutions, their decision to propose the ASC master's programme in 2019, and the motivation to ensure employability of students after graduation.

The joint curriculum is explained to be designed by the Academic Board with a focus on a personalised learning experience and gradual specialisation of students, as well as on the spectrum of techniques and fields of application. All first-semester courses, which are offered at the University of Lille, are mandatory and were designed jointly by the ASC Academic Board. The second semester is offered by three host institutions (Lille, Leipzig, and Bologna). There are plans that Lille and Leipzig offer the second semester, while Krakow, Helsinki, and Bologna will offer the third semester (for the current curriculum see section 6.1).

Each partner institution is explained to bring in a particular expertise:

- Bologna: sustainable chemistry; spectroscopy of fluids and condensed phases
- Helsinki: spectroscopy of atmospheric and green chemistry; computational chemistry
- Krakow: spectroscopy and imaging for nano- and biomaterials
- Leipzig: spectroscopy for bio-organics; catalysis and surface science
- Lille: spectroscopy for solid-state chemistry, environmental chemistry

The programme's transnational approach is meant to guarantee

- high quality of the course contents, teaching and learning methods
- diversity and complementarity of up-to-date spectroscopic techniques
- variety of spectroscopic applications in the fields of chemistry, physics, biosciences in service for industry and society
- opportunity for ASC students to be purposefully integrated into the socio-economic environment of each HEI

- added value for students and increased visibility of the programme by issuing double/multiple or joint degrees

According to the SER, all participating institutions have integrated the programme into their degree catalogues and recognise the respective degrees of the partners.

The SER also highlights joint activities such as a winter (and sometimes summer) school, a welcome workshop, an online learning platform, the joint evaluation of the master's thesis and its collaborative approach, as well as the implementation of a joint degree. Events are offered for students, alumni, teaching staff, representatives of associated partners (with the latter offering special-interest seminars or winter school lectures). The SER holds that the quantity and quality of joint activities have increased and aim to

- share good practice and harmonise teaching and training in our HEIs
- maximise the international experience of students *and* staff
- create a blend of scientific, transferable intercultural competencies for students and
- develop and foster scientific cooperation.

Cooperation agreement

The SER provides an overview of the general organisation of the ASC Network. The design of the network as well as the functions and responsibilities of the stakeholders are said to be formalised in the consortium agreement signed by the partner institutions.

The documentation specifies that the local coordinators of each partner university are members of the Academic Board, which is in charge of all academic affairs (course contents, validation of the course units and semesters, and approval of the individual mobility paths) and the student admission procedure. Academic, administrative, and financial regulations are said to have been designed jointly.

The Academic Board is the decision-making entity of the Network and gathers twice a year. Its meetings are followed by administrative staff of the universities in order to directly execute the decisions. The annual fall meeting is designed to welcome the new student cohort and to provide extensive information on the programme, the mobility path, and an opportunity to connect.

The SER also points out that there is an Advisory Board (chaired by the network coordinator and composed of representatives of the associate partners and external experts), which – due to the Covid pandemic and time restrictions of the representatives – only met once in the past few years but which is supposed to advise the Academic Board on the study programme or common policies on the basis of reports from visiting scholars, visiting academic staff of the programme, and student evaluations.

The financial centre of the joint programme is the coordinating institution (University of Lille) and in charge of collecting fees, paying grants to students and visiting scholars, accounting for meetings of the Academic and Advisory Boards and the Winter school. Participating institutions receive financial means to cover any costs related to the curriculum and services for students. In periods without external funding all financial management happens locally at the partner universities.

In addition, each institution is explained to perform the following individual tasks:

- The University of Helsinki is responsible for coordinating an internal evaluation procedure that assesses course content, materials and teaching methods.
- Jagiellonian University has developed a joint pedagogical platform which hosts the evaluation questionnaire and collects and makes available course content, materials, internship positions and master's thesis topics.

- Leipzig University is responsible for the coordination of the network efforts to issue a joint degree with as many partners as possible and to obtain the European Accreditation. A joint degree is already in place for Lille and Bologna for graduates since 2023. The SER also claims that a similar agreement for joint degrees is being signed by Leipzig University and Jagiellonian University. At this point, the ASC network issues multiple degrees together with a single joint diploma supplement for all other partner universities.
- The University of Bologna coordinates the organisation of ASC events (winter/summer schools).

Expert evaluation

The experts can confirm that all five participating universities are recognized as higher education institutions by the relevant authorities of their respective countries. Individual accreditation certificates were provided as part of the review. To this end, they are included in the relevant legal frameworks, which allows them to participate in joint programmes. The degrees awarded by each of the participating universities are related to the degree systems of the respective countries. In addition, a joint degree is awarded by the University of Lille and the University of Bologna. Plans are being proposed and currently being explored to extend the joint degree to other participants in the curriculum. This finds general support of the panel of experts.

As for joint design and delivery, the curriculum is developed and delivered in a clear, collaborative manner with each institution responsible for the specific tasks outlined above. In addition, several complimentary activities are developed to ensure the excellence of the study programme. The Academic Board, formed by a representative of each participating university, is a joint decision-making body that ensures the joint development and delivery of the curriculum.

A Consortium Agreement specifically drawn up for the ASC study programme is available. It provides, among other things, denomination of the degree awarded within the programme. The Consortium Agreement clearly covers the responsibilities of the parties, including the coordinating institution (the University of Lille) and all the partners involved. A separate section ("Allocation and use of funding") covers the financial organization, including funding, distribution of expenses and income. The procedures for the admission and selection of students are covered in the section "Selection of students and academics", which clearly defines the admission criteria and procedures. The section "Admission and recording of students" further defines the admission procedures. Student mobility within the network is described in the section "Agreement between students and the consortium". A separate section "Exchange of teaching and administrative staff" is presented. The examination rules, student assessment methods, recognition of credits and degree awarding procedures within the consortium are presented in the sections "Admission and recording of students", "Joint assessment methods", and "Degrees".

Conclusion

The criterion is fulfilled.

2. Learning outcomes

- 2.1 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).*
- 2.2 The intended learning outcomes should comprise knowledge, skills, and competencies in the respective disciplinary field(s).*
- 2.3 The programme should be able to demonstrate that the intended learning outcomes are achieved.*

2.4 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.

Description

Level

The master's programme ASC is equivalent to Level 7 of the European Higher Education Area Qualifications Framework (FQ-EHEA) and according to the SER, the programme fulfils the requirements for a second-cycle qualification. The universities hold that with successful completion of the master's programme, students will have gained knowledge of advanced spectroscopic techniques beyond undergraduate level. After their studies, students are said to have

- gained an in-depth theoretical understanding and hands-on practical experience and are provided with the opportunity to develop and/or apply new ideas, in a particular research context
- gained the ability to integrate knowledge and handle complexity, formulate judgments with incomplete or limited information, and reflect on social and ethical responsibilities linked to the application of their knowledge and judgments
- learned to communicate their conclusions in oral presentations and preparations of posters to specialist and nonspecialist audiences clearly and unambiguously
- developed skills to study in a manner that may be largely self-directed or autonomous such as, e.g. during a PhD

Disciplinary field

According to the SER, with a successful completion of the joint master's programme in ASC, students will have achieved the following intended learning outcomes (ILOs): Students will

- have an overall vision of the applications of high-end spectroscopy in chemistry and the science at its interface (physics, biology)
- understand the theoretical principles behind a vast range of high-end spectroscopic techniques
- apply their hands-on experience in a wide range of analytical techniques for research, development or quality control purposes
- integrate their analytical skills and competencies to solve complex problems in their chosen field of chemistry
- critically reflect on existing methodologies and research and identify possible weaknesses in analytical workflows
- design new experimental methods for research purpose

The SER holds that the programme's international approach further allows students to develop their intercultural competences and skills so that they can

- communicate verbally and non-verbally thanks to basic local language skills
- listen and observe others with respect, patience and perseverance in their professional or social environment
- understand, accept and adapt their behaviour to different cultural contexts and viewpoints
- show openness, curiosity, and thrive in an environment beyond their comfort zone.

The SER specifies the need of an advanced knowledge and application of techniques and both common spectroscopic tools (such as NMR, IR, Raman or others) as well as less common ones and points to the benefits

of the network to exchange experience and expertise with these techniques. This form of specialisation is explained to allow students to apply for specialist industry jobs or continue with a PhD.

Achievement

The SER underscores the success of the ASC master's programme by highlighting the low dropout rates and high completion rates within the proposed 4 semesters with good to very good results. The SER provides long-term statistics showing the following key findings/strategies:

- **Internationality:** The programme is appealing to students worldwide, with 36 % being self-financed students without funding (87 out of 242 from 52 countries so far) and with 60 % without funding from all over Europe (61 out of 102). The programme aims for more students from non-European countries.
- **Employability:** Employability rates are to be increased by measures such as the inclusion of socio-economic actors for transferable skills and exposure to the professional world, agreement to issue joint degrees, and expansion of the consortium beyond EU borders for visibility and sustainability.
- **Sustainability:** To improve sustainability and international visibility, the programme seeks to focus on the interplay between promotion activities, visibility, development of socio-economic environment, and collecting external funding. Further funding for ASC events (Winter Schools, Academic and Advisory Board meetings) is provided by the institutions themselves or through other forms of financial adjustment. Additional funding will be necessary to maintain the quality of learning activities and students' access to high-end equipment.

Expert evaluation

Based on the documentation provided and follow-up discussions with all relevant stakeholders on-site, the experts confirm that the ASC Master's programme equips students with advanced knowledge, skills, and methods necessary to meet both academic and professional standards in the application of spectroscopic techniques to chemistry in a broad sense. The intended learning outcomes (ILOs), as defined by all participating universities, align with Level 7 of the Framework for Qualifications in the European Higher Education Area (FQ-EHEA) and with the applicable national qualification frameworks.

The ASC Master's programme provides all students with a range of transversal skills, including competencies in project management, bibliographic research and synthesis in connection with industry, as well as knowledge of REACH legislation and intellectual property issues. It prepares students to become experts with international competencies suited for doctoral studies and/or professional industrial careers in chemical analysis and structural characterisation within molecular synthesis, biology, nanotechnology, modelling, pharmacy, green chemistry, materials, and sustainable energy. Students are offered multiple opportunities to acquire additional soft skills, such as intercultural communication, research experience, and scientific communication, enabling them to adapt seamlessly to future international professional environments. The ILOs are appropriately defined for the programme and aligned with the relevant frameworks, encompassing knowledge, skills, and competences within the respective disciplinary fields (0531 Chemistry and 0588 Interdisciplinary programmes involving natural sciences, mathematics, and statistics) at the appropriate level.

During the accreditation process, including the review of the self-evaluation report, on-site discussions with stakeholders, and examination of selected master's theses, it was confirmed that the programme's joint nature is appropriately reflected in the ILOs. These outcomes provide clear added value to students, reflecting the programme's international profile. Integration of study content is ensured through the structured requirement for students to transfer between universities within the consortium, supported by the careful organisation of the curriculum. Cooperation between the academic focal points at each participating university further strengthens this integration. Effective communication plays a central role within the ASC programme, with assessments such as paper defences and presentations providing opportunities for students to articulate their ideas and

findings clearly. The inclusion of elective areas allows students to pursue individual interests, a feature explicitly supported by the panel of experts.

From the experts' perspective, the ASC programme is designed to enhance students' scientific capabilities across multiple dimensions, focusing on developing advanced knowledge, research proficiency, effective communication skills, and a strong sense of responsibility. The curriculum incorporates varied assessment methods, including written examinations, case studies, presentations, and a master's thesis, all carefully structured to assess the programme-level intended learning outcomes.

However, the ILOs are not always communicated comprehensibly and transparently to applicants and students (e.g., in official programme descriptions and documents such as the Diploma Supplement) or to external stakeholders, including potential employers. While the ILOs are well-formulated and documented for accreditation purposes, they are currently insufficiently presented on the programme website, in brochures, student handbooks, and syllabi. From the experts' perspective, the detailed ILOs should be communicated more clearly to prospective students (for instance, on a dedicated webpage describing programme composition) to ensure accessibility for other interested parties, such as employers and professional bodies, who may be interested in the programme's outcomes (**Finding 1**). This would also ensure that the ILOs are easily accessible to other stakeholders. Additionally, the ILOs were not included in the version of the Diploma Supplement reviewed by the experts; this version lacked a dedicated section for ILO documentation, which should instead be incorporated into the annex of the Diploma Supplement.

Nonetheless, the universities demonstrated that the programme successfully achieves its intended learning outcomes. Discussions with alumni and current students during the site visit highlighted the practical value of the skills acquired through the programme. The combination of theoretical content with practical internships and project-based learning ensures that graduates leave with both academic expertise and practical experience in the application of spectroscopic techniques to chemistry and related fields. These experiences allow students to apply their knowledge in real-world contexts, expand their professional networks, and enhance their employability. By developing the ability to communicate complex concepts precisely, students not only strengthen their academic skills but also cultivate essential competences for collaboration and leadership in professional environments. The success stories of graduates substantiate the adequacy of the programme's objectives. The panel of experts also had access to several final thesis and students works demonstrating that the ILOs are achieved and that the programme clearly meets the Master level of the European Qualifications Framework.

The experts conclude that the success of ASC graduates in the international job market attests to the programme's effectiveness in preparing students for diverse career paths. Graduates exhibit a holistic skill set and interdisciplinary perspective, leaving them well-prepared and competent for various roles. The programme's high employability rate and the diverse career trajectories of its alumni further underscore its relevance and impact.

The minimum training conditions specified in European Union Directive 2005/36/EC, or relevant common training frameworks under the Directive, do not apply to the study programme under review.

Conclusion

The criterion is fulfilled.

3. Study programme

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

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

3.3 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 doctor-ates there is no credit range specified. The workload and the average time to complete the programme should be monitored.

Description

Curriculum

The ASC master's programme seeks to provide students with an extensive overview of state-of-the-art spectroscopic methods used in chemistry, with a particular focus on the most advanced issues and applications addressed by these technologies. The overall aim is explained to

- provide excellent scientific education
- broaden the students' professional horizon by creating an international teaching and learning environment
- homogenise the students' basic knowledge in the field of advanced spectroscopic techniques in chemistry before moving towards a more specialised understanding of available techniques and applications, also displayed in the increasingly personalised curriculum

The SER provides an overview of the curriculum for the Joint Master's Programme in Advanced Spectroscopy in Chemistry (ASC) as well as an overview of courses offered by all partner institutions. The curriculum differentiates between mandatory and elective courses and is divided into four semesters, which are designed as follows:

- Semester 1: common SEMESTER 1 (Lille)
- Semester 2: pre-orientation SEMESTER 2 (Bologna, Leipzig, Lille)
- Semester 3: specialization SEMESTER 3 (Bologna, Helsinki, Krakow, Leipzig, Lille)
- Semester 4: Master thesis SEMESTER 4 (Bologna, Helsinki, Krakow, Leipzig, Lille)

According to the SER, the curriculum seeks to enhance the cooperation between partner institutions and ensure student mobility through a modified mobility scheme (see table below) and joint modules.

semester 1 common core courses	semester 2 pre-orientation courses		
 Université de Lille	 Université de Lille	 UNIVERSITÄT LEIPZIG	 ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
Quantum Chemistry and Chemical Bonds 5 ECTS Nuclear Magnetic Resonance 5 ECTS Optical Spectroscopy 5 ECTS X-ray diffraction 5 ECTS Mass Spectrometry 5 ECTS English and professionalisation 5 ECTS	Imaging and Chemometrics 5 ECTS Physical organic chemistry 5 ECTS Advanced chemical kinetics and catalysis 5 ECTS Methodologies in inorganic chemistry 5 ECTS Experimental method. in environmental sciences 5 ECTS Spectroscopy for Biology 5 ECTS Organometallic chemistry 5 ECTS Applied molecular spectroscopy 5 ECTS Synchrotron radiation and its applications 5 ECTS	Modern methods in theoretical chemistry 5 ECTS Computer-aided drug design 5 ECTS Receptor Biochemistry 5 ECTS Selected Topics of NMR Spectroscopy 5 ECTS Machine learning – fundamentals and applications 5 ECTS Surface Spectroscopy – methods and applications 5 ECTS Modern Concepts in Catalysis 5 ECTS Separation techniques and advanced “-omics”-techniques 5 ECTS Structural analysis in inorganic chemistry 5 ECTS Synchrotron radiation and its applications 5 ECTS	Physical organic chemistry 5 ECTS Structural inorganic chemistry 5 ECTS Fundamentals of Industrial Chemistry and polymers 5 ECTS Spectroscopic Identification of organic Compounds 5 ECTS Applied Electrochemical Methods 5 ECTS Environmental Chemistry 5 ECTS Synchrotron radiation and its applications 5 ECTS

semester 3 specialization courses

	
Protein Crystallography	5 ECTS
Computational Chemistry of Solids	5 ECTS
Bioorganic Chemistry	5 ECTS
Nano Structured Catalytic Systems	5 ECTS
Surface Analysis of Solids	5 ECTS
Function control at complex surfaces	5 ECTS
Methods and Procedures for Trace Analysis	5 ECTS
Physical Chemistry of Clusters	5 ECTS
Internship and Transferable Skills	10 ECTS

	
Spectroscopy of Condensed Phases	4 ECTS
Sustainable Industrial Chemistry and Polymers	5 ECTS
X-ray Techniques and Operando spectroscopy	3 ECTS
High Resolution Molecular Spectroscopy	4 ECTS
Organometallic Chemistry for Catalysis and the Environment	4 ECTS
Polymers for Environment and Energy Applications	4 ECTS
Organic Chemistry for Nanotechnologies	4 ECTS
Internship and Transferable Skills	10 ECTS

	
Quantum-Chemical Molecular Modeling	10 ECTS
Forensic Chemistry	5 ECTS
Multivariate Analysis in Chemistry	5 ECTS
Spectroscopy of Hydrogen-bonded Systems	5 ECTS
Advances in Spectroscopic Characterization of Nanomaterials	5 ECTS
Spectroscopic methods for Characterization and Imaging of Biomaterials	5 ECTS
Challenges of Modern Chemistry: Emerging contaminants	5 ECTS
Internship and Transferable Skills	10 ECTS

	
Basics of Atmospheric Chemistry	5 ECTS
Aerosol measurement techniques	5 ECTS
Basics in Polymer Chemistry	5 ECTS
Materials characterization	5 ECTS
Medicinal Chemistry	5 ECTS
Radiochemistry	5 ECTS
Internship and Transferable Skills	10 ECTS

Being a key aspect of the master's programme, student mobility is promoted accordingly as one of the programme's most central assets. The figures above (semester 1-3) specify the course programme with mandatory "common core courses" in semester 1 in Lille as a common basis for all students and the course programme for Bologna, Leipzig, and Lille in semester 2, which serves as pre-orientation and already prepares students for further individualisation. Further specialisation takes place in the second year, with semester 3 spent on practical training in the form of an internship or research project and semester 4 on the completion of the master's thesis.

Credits

According to the SER, the study programme is divided into four semesters. At all universities, credit points are awarded according to the European Credit Transfer System (ECTS). The documentation specifies that students earn **30 ECTS per semester** and **120 ECTS in total**. One ECTS point thereby corresponds to a workload between 25 and 30 hours, which includes in-person classes and activities such as lectures, seminars, practical training as well as self-study and exam preparation. Students earn 5 ECTS per module. ECTS are credited once students pass an exam or evaluation (the regulations are indicated in the student agreement and by the respective institutions).

Workload

The ASC master's programme amounts to a total of 120 ECTS. According to the SER, the design of the modules ensures that 30 hours workload per credit point are not exceeded. Course evaluations and the annual joint ASC survey take students' experience of the workload into account. The documentation holds that most

students complete the programme in two years, suggesting that the workload of the programme is adequate and manageable.

Expert evaluation

From the point of view of the panel of experts, the curriculum represents a very good combination of courses covering all major aspects of modern spectroscopy, including underlying technology and application areas. Importantly, each of the partner universities provides specific areas of specialisation, allowing students with diverse interests to find the most attractive sub-disciplines for their specialisations.

All aspects of the curriculum are well described and - based on the interviews with students and faculty - effectively implemented. Considering the available documents, transparency and also comparability might be increased with course descriptions / syllabi presented in a more uniform format to increase accessibility and transparency for students (**Finding 2**). The curriculum is jointly developed by the five participating universities. Some universities create specific courses to complement the ASC curriculum, while others provide a wide range of spectroscopy-focused course options that are also open to other students. The curriculum is constantly discussed at the network level (local coordinator meetings) as well as at the local level of each participating university. New courses are introduced, and new faculty members are actively recruited to participate in teaching activities. The curriculum is therefore constantly being improved. For example, since 2016, the joint Semester 1 has been introduced and organized by Lille to provide common ground, to ensure the homogenization of knowledge, and to develop team spirit through specific activities. Since 2019, the Semester 2 has been provided by the three universities. The continuous revision of modules and teaching staff is based on student assessment feedback.

Each participating university has a reputation in the academic field with a proven track record of excellence in specific areas of spectroscopy application. Importantly, each of the partners has established the infrastructure for educational and academic activities necessary to support the Master's programme both in theoretical education and in the provision of practical and hands-on experience. All this makes it possible to prepare young professionals with a competitive skillset for future academic and industrial careers. However, more detailed description of the "Internship and transferable skills" module should be provided as currently the role of this module is not well explained, *and* the contribution to the skill development, its supervision and assessment is lacking. (**Finding 3**). Semester 1 in Lille serves to bring together students from different backgrounds at the same level, providing lecture courses as well as individual tuition. Semester 2 focuses on orientation, while Semester 3 and Semester 4 provide specialisation and master thesis projects. The programme ensures a good distribution of students between the partner universities for Semester 2, Semester 3 and Semester 4. Some differences in the delivery of courses exist due to the differences in educational systems in the different countries. There is no duplication between courses in the different locations. Specific topics are also covered by guest lecturers. The exercises are adapted to the level of the students and various forms of teaching are available, including classical lectures, interactive courses, seminars, practical exercises before examinations, adaptive assignments. Industry, research institutes and site partners actively participate in the curriculum and provide special lectures, site visits, as well as places for internships and master's projects. For master's theses, a list of possible topics is provided together with individual guidance from coordinators. Master's theses are reviewed by representatives of two universities.

During Semester 1, a guided introduction to the choice of universities, including courses, structures and topics for specialisation, is provided through a personal visit by all coordinators. In addition, an online chat tool (Discord) is always available for consultation and guidance of the coordinators (here, students acknowledge the high level of availability of the coordinators and the low hierarchy, which greatly helps with the choice of course and topics). Several general educational face-to-face seminars are organized, starting with introductory events during Semester 1. Winter/summer schools are organized either on a specific topic in spectroscopy or with a broad scope, including the involvement of alumni, guest lectures, industry and labour market representatives.

In general, the curriculum ensures that students can earn 30 credits per semester. However, ECTS calculations vary slightly between universities due to local and country specificities, ranging from 25 to 30 hours per ECTS. Against this background, on the long run the ECTS calculation could be made more uniform in the curriculum to ensure reliability and transparency for students and other stakeholders.

The overall workload is in line with the FQ-EHEA requirements. Semester 1 generally is perceived to be rather intensive, but it is recognized by all parties (both students and academic staff) that there is a need to ensure harmonisation of students' knowledge. Feedback on workload is discussed at board meetings based on feedback from students' assessment. Overall, the workload is considered adequate, with most students completing the programme within 2 years. Importantly, ASC students are considered to have a wider range of experience than typical master's students and have high employability, with 75% progressing to PhD study and 25% taking up positions in industry.

Conclusion

The criterion is fulfilled.

4. Admission and recognition

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

4.2 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.

Description

Admission

The SER holds that the programme's competitive selection procedure is based on the Marie-Curie European Integration Fellowship system. The procedure takes into account the applicants' academic performance and credentials based on the criteria agreed upon in the consortium agreement.

The application process, accessible via a joint online application platform, is supported by staff members of the ASC office. The admission process involves the following steps:

- Application call (November)
- Eligibility check (academic record, scientific background of undergraduate studies)
- Individual evaluation step
- Monitoring statistics, consensus and final ranking

Recognition

According to the SER, the consortium agreement regulates the mutual recognition of academic achievements within the ASC. All modules and courses within the ASC are recognised at participating institutions, while in addition all institutions apply their own regulations on the recognition of students' previous courses and credits. Compatible content must be recognised unless the universities clearly indicate that it is not relevant for the study objectives of the ASC.

Expert evaluation

The number of eligible completed applications has increased up to 528 in the past years which demonstrates the interest in the ASC programme, successful advertisement in the Erasmus Mundus conference, helpful

word of mouth and recommendations of alumni. From an expert's point of view, the admission criteria and their weights of students' applications are adequately defined and include (in the order of importance) the academic records, the scientific background, ranking of institution, motivation letter, level of English, recommendation letters, practical experience, and awards and grants. An online evaluation procedure was established to assess each application by an academic board member of each partner. A consensus is achieved, and a final list of candidates is determined during a meeting by all members of the programme board. This procedure follows the principles of the Erasmus+ rules considering the academic and professional excellence of applicants, the motivation and objectives according to the applicant's specialisation, and the criteria for ensuring equal opportunity. The appropriateness of the admission procedure can be derived from the numbers of admitted students and the alumni employability that were given as additional materials. The difference of both numbers is less than two in the reported period between 2020 and 2023 which indicates the high rate of students' completion of the programme and the low rate of students that did not finish and/or did not find an employment. The latter number was not explicitly stated.

Overall, the selection procedure is adequate for the programme, and the admission procedure gives a selection of 40-60 candidates from which ASC students are selected. There are no interviews in the selection process so far. Based on the perceived high need for levelling in Semester 1 and the advent of ChatGPT and other large language model AI since November 2022, assessing true competencies for admission based on paper and letters might become a concern in the future. Brief interviews might help to ascertain that the individual is in fact who they are believed to be (**Finding 4**).

It was stated in the self-evaluation report that partners automatically recognize the course units that are offered within the programme and agreed upon by the host universities in the student learning agreement. The ECTS credits that students achieved at partner universities lead to the award of the degrees. Overall, the recognition of the courses is appropriate.

Conclusion

The criterion is fulfilled.

5. Learning, teaching and assessment

5.1 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.

5.2 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.

Description

Learning and teaching

The SER states that the first semester in particular serves to bring all students to a similar level of knowledge and further highlights the flexibility of the study plan and the possibilities of individual specialisation from the second semester onwards. The programme allows students to undertake independent research work, to take practical modules with one-to-one supervision, and to form a local research group as part of their master's thesis. Internships and tutorials are said to cater to students' individual needs and learning curves.

Assessment

According to the SER, the programme offers both oral and written exams, practical work, and other forms of examination in accordance with the respective intended learning outcomes. Differences such as retakes are due to individual regulations of each institution but are communicated transparently before students decide on a mobility. Remote retake exams are offered to minimise any negative impact of a mobility period on students' study progress. The SER holds that students are assessed according to joint examination regulations. The consortium uses a joint conversion grid to convert grades (see consortium agreement).

Potential forms of examination include written exams, oral exams, home assignments, individual and/or group presentations on given topics, bibliography reports, practical or project, or online quizzes. For the internships in the third semester, students are assessed based on written reports. The master's thesis is explained to be jointly reviewed by an internal and external reviewer.

According to the documentation, the module description specifies the criteria for assessment and are made available on the ASC joint pedagogical platform, the website and the detailed course catalogue provided to all students upon arrival in the program.

Since 2015, all master's theses are explained to be evaluated jointly through a double reviewing procedure. Each thesis is reviewed independently by two peers (using a joint evaluation grid): one internal reviewer belonging to the HEI at which the thesis project was carried out, and one external reviewer from another HEI. The defence of the master's thesis is then organised according to the local regulations of the partner institutions. The second reviewer is invited to a defence whenever possible.

Expert evaluation

As for learning & teaching, in the discussion with the students and labour market representatives both groups highlighted that they value the skills the programme conveys and are satisfied with their learning outcomes. The students especially highlight the possibility of building an international network of professional / scientific, but also social connections. In this regard the summer and winter schools are much appreciated. Also, the international focus equips them with enhanced adaptability in different social and cultural contexts. The programmes also give students the possibility to pursue a highly specialised course of study that they can adapt to their interests, at the same time already putting them into a good position to continue in a PhD or industry. The international composition of the student body poses several challenges: These include harmonising the knowledge base that students bring with them, orienting them in a foreign country, and supporting them upon arrival. The experts heard that the joint first semester in Lille effectively addresses these challenges. Bringing everybody up to the same level of knowledge will always mean compromising to some extent, with some students having to repeat certain parts and others having a higher workload. However, they are generally satisfied with the courses offered in the first semester to achieve this.

The experts also positively acknowledge that the first semester is being developed further to address student feedback, for example by moving the X-ray diffraction course and implementing other skills instead. The organisational challenges are also met well during this first semester, especially regarding the planning of the further course of studies. Students report that this was eased by the possibility to easily reach out to the local coordinators, as well as the in-person orientation event.

Regarding the assessment the design of methods generally meets the requirements and also the students do not report any problems and there are also nonapparent in the documentation. The students discussed with the experts that they were aware of no conflicts between mobility and assessments, since the smaller number of students allows for an individual solution if a student, for example, misses an examination but continues their studies elsewhere. As mentioned above, the module descriptions (including the assessment descriptions) could be improved. It is also unclear how skills in 'entrepreneurship' are assessed, given only peripheral

coverage of the topic (e.g. at summer/winter schools). The programme should assure that these qualifications are developed and assessed as part of the compulsory programme elements as they are also described to be part of the intended outcomes (**Finding 5**).

Conclusion

The criterion is fulfilled.

6. Student support

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

Description

According to the SER, the programme and institutional network offer a number of activities to ensure students' involvement and integration, such as the induction period in semester 1, an *Autumn Welcome Workshop*, a winter school, an internship or research project in semester 3, and additional efforts to further international experience.

Information on additional support is displayed on the website. The website provides comprehensive descriptions of course objectives, academic contents, and activities (course catalogue, language policy, mobility, winter school), application process, financial conditions and possible grants, internal regulations, practical information about partner universities, and contacts of local coordinators, administrative and academic staff.

The University of Lille equips students with an information package upon the beginning of the programme (including an admission letter describing financial conditions; Erasmus+ certificate on scholarship award when applicable; an invitation letter, an accommodation form; a student guide and maps). The student guide is explained to include all academic and practical information (regarding visa application; housing facilities; cost of living; enrolment formalities and list of documents to be provided by the students upon arrival; library; sports; medical house and other facilities available on campus).

International students are offered additional assistance with e.g., visa applications, and an alumni/PhD at Lille provides additional orientation and support (e.g., with accommodation contract, opening of bank account, enrolment, resident permit, orientation on campus). The institutions ensure similar support at the beginning of the mobility periods at partner institutions (e.g., a "buddy" programme at Leipzig University).

Accommodation is booked in halls of residence on campus upon request by the students in all HEIs whenever possible. Help can be provided for families or people with special needs requiring a private accommodation and adapted services, provided all needs are expressed when confirming attendance. Dining facilities are available in all universities. The SER states that there is child-care support for students with children. Students with special needs also receive additional support. According to their individual needs and in agreement with necessary conditions in the research labs, individual study plans can be organised.

Full insurance coverage is provided to all students. Any additional costs for mandatory national health insurance is reimbursed to the students by the ASC Consortium. These costs are covered by the tuition fees paid by the students to the Consortium.

Expert evaluation

Overall, the experts learned from the interviews that the students feel well supported and it is also evident from the documentation, that the unique challenges this international programme brings are taken seriously. This

begins with support for the students regarding visa applications as well as finding accommodation. Also, the social and emotional challenges of moving to a new country are addressed. And the orientation events in the beginning of the semester were well received from the students, especially the module covering what to expect in terms of culture shock etc. Students discuss the difficulties they experience, since every move means that they have to build up a new support system and must adapt to a new environment. Mental health support to students should be offered continuously after the initial orientation phase or referring them to existing university resources. The feedback regarding the decision-making process and organisation of the mobility (Semester 2-Semester 4), was very positive. After being informed of the different possibilities in the first semester, during an event where the local coordinators introduce their local universities and courses / specialities students chose where they want to continue their studies and the local coordinators are always approachable for questions and advice. Additionally, there is support staff at every location that helps students with visa application and other organisational matters. The students see this as a great advantage. However, compared to other locations, they perceive the support in Bologna to be less helpful than at other universities. Students feel like they must find out for themselves how the visa application process works, as well as how to find housing. While all other locations offer the possibility of living in university accommodation, this is generally not an option at the University of Bologna. This means that students not only choose based on their scientific interests, but also on the support system in place. It is unfortunate that students who have studied in Bologna are very satisfied with the courses on offer, and an even distribution of students across locations would also be better for the programme's sustainability. Consequently, addressing this issue would benefit also the balanced distribution of students in the consortium (**Finding 6**).

In conclusion the programme offers very individual and tailored support to the students in educational, as well as organisational matters, which makes it possible for them to benefit from a high degree of mobility and specialisation that would be hard to achieve outside of such a support structure. Such an approach relies heavily on the personal contributions of those involved, particularly the local coordinators. While this can be a weakness, the experts have found extensive handover processes in place to address this issue. Nevertheless, some processes could be more formalised and documented.

The experts agree that the current system is well suited for the students' needs, but in case a conflict arises it could be beneficiary for all sides to be able to rely on formalised processes. One issue that was discussed extensively with students was ensuring an even distribution of students across locations. If there is a mismatch between the students' choices and the programme coordinators' expectations (even if it is a rare occurrence), There should be a transparent process in place to address this instead of relying on the students to discuss it among themselves, with the student representatives possibly having to advocate on behalf of the coordinators instead of their fellow students in this situation (**Finding 7**). Responsibility for transparency lies with the coordinators. For conflicts that might arise more often, a jointly agreed process would complement the successful individual process well.

Conclusion

The criterion is fulfilled.

7. Resources

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

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

Description

Staff

According to the SER, the teaching staff is highly qualified and has international experience. Practical case studies and other practical course contents are said to be supervised at least by PhD students working in the field. The total number of students admitted and the distribution of students among the five universities is explained to take into account the resources available both in terms of number of staff and available lab space. The SER also specifies the procedure for managing guest lecturers from other institutions to develop and strengthen partnerships.

Facilities

According to the SER, all universities provide a suitable learning environment fit for the purposes of the programme with a sufficient number of lab course laboratories and required state-of-the-art equipment, i.e. advanced spectroscopic equipment and more. The documentation provides an in-depth overview and comprehensive technical details of facilities and equipment such as instruments and apparatuses at each institution.

Expert evaluation

The ASC Master's programme is jointly offered by five universities, with the University of Lille serving as the consortium coordinator. The consortium has established collaborations with leading global industrial partners specialising in spectrometer production, such as Bruker and Magnetech, and maintains close ties with regional competitiveness clusters, including MATIKEM in Lille and NEU in Leipzig. Strategic partnerships have also been developed with major research infrastructures, notably the SOLEIL synchrotron in France and ELETTRA in Italy. Additionally, several academic institutions, such as V. N. Karazin Kharkiv National University, Harbin Institute of Technology, and the Lebanese American University, are informally affiliated with the consortium.

The existing staff provides strong support for the programme and is well-balanced in relation to the organisation of the partnership led by the ASC network. The universities involved demonstrate a wide breadth of expertise among the main teaching staff, ensuring high-quality delivery of the programme. All five institutions are leading universities with well-established facilities that effectively complement the programme. These facilities are well-documented and were partially demonstrated during the site visit to Leipzig University and through online materials and represent a key asset for the programme. The ASC network offers sufficient infrastructure, with access to up-to-date literature, databases, and related resources fully ensured.

The experts are highly satisfied with the qualifications of the teaching and support staff across the partner universities, who are well-prepared to deliver the curriculum to a high standard. The teaching staff is appropriately qualified in terms of subject knowledge and pedagogy, with particular strengths in delivering an international curriculum tailored to a diverse student body. The quantity and quality of the teaching staff are sufficient to deliver the curriculum in a way that enables the achievement of the intended learning outcomes. Notably, one of the key strengths of the programme is that students have direct access to the researchers and advanced facilities available at each partner institution. The experts were particularly impressed with the research and thesis opportunities provided to students across the consortium.

The ASC network offers state-of-the-art equipment and expertise, covering the application of spectroscopic techniques within chemistry in a broad context. The programme provides students with high-level supervision and training, alongside access to a unique range of laboratories and equipment. It prepares students to become experts while developing international competencies for doctoral studies and/or professional careers in chemical analysis and the structural characterization of materials within molecular synthesis, biology, nanotechnologies, modelling, pharmacy, green chemistry, materials science, and sustainable energy fields. The programme is well-equipped to enable students to achieve the intended learning outcomes.

Conclusion

The criterion is fulfilled.

8. Transparency and documentation

8.1 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.

Description

According to the SER, all relevant information on the programme is available on the ASC website. Prospective students can access any information on the admission procedure, the course catalogue, and general assessment procedures online on the general website, while regional and local regulations are displayed on the partner universities' websites. The SER highlights that the section on application procedures is particularly accessible. Information on the programme is also distributed via the DAAD brochure's information on international study programmes in Germany, the ERASMUS Mundus website, or at study fairs visited by the participating universities.

Experts' evaluation

The framework conditions for admission, study and examination regulations are appropriately and bindingly defined on the ASC website. The structure and the content of the study programme are also adequately documented on the ASC website. The relevant information on the study programme is accessible to students on the internet regardless of their current place of study. Various information packages are available for students which also includes not only learning modules but also visa and local registration procedures. Besides the official document in the local language, even English translations of the regulation documents are provided. Only few information needs better documentation. The syllabi are sometime not properly updated and by the time students are supposed to make their choices specific offers are not always clear. As example the situation in Helsinki was described that some courses are only offered in even or odd years. In view of cultural changes and new places, some students face challenges and ask for guidance where to receive psychological support. More information would be highly appreciated in this context.

During the site visit some discussions raised transparency issues. Positively, the students explained that usually there is good responsiveness and a solution for issues. However, some elements might not be clear with regards to who takes responsibility to move ahead. Above, the issue of transparency regarding mobility was already discussed. The panel also learned that within the consortium there is good sources of information how students find contact with representatives of the labour market, however, this does not always reach the students, and greater transparency should help them to see what is possible. In the context of teaching culture, the workload in the first semester should be addressed through greater transparency and proactive

communication (**Finding 8**). Some students expressed their wish for a more transparent decision-making process regarding mobility.

Conclusion

The criterion is fulfilled.

9. Quality assurance

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

Description

The SER holds that after the 2008-2014 Erasmus Mundus funding period, quality assurance has been carried out jointly with the guidance of an Utrecht Network representative to ensure that the programme meets the EHEA guidelines. The continuous reviewing processes include the following measures:

- All participating institutions follow their own national quality assurance procedures and the programme is regularly evaluated internally and/or externally through the institutions themselves or on a national level for each accreditation period. The SER specifies the various measures established in Lille, Leipzig, Krakow, and Bologna. At Leipzig University, individual courses and modules which are also part of the local curriculum are evaluated via student surveys. A student survey was also implemented at the winter school in 2024 to receive feedback on the master's programme (see results in annex).
- To ensure the programme's development and the coordination of quality assurance at the individual institutions, the coordinator of each university provides feedback on these institutional and/or national assessments during the ASC Academic Board meetings.
- The ASC External Advisory Board (EAB) and the ECTN Euromaster label are said to account for external quality assurance. The EAB comprises associated partners from the industry, competitiveness clusters, research centres, and large-scale facilities, first- and second-year student representatives, an alumni representative, a member of the Utrecht Network, and a member of the Academic Board, as well as extern experts if needed. The EAB identifies necessary improvements and forwards them to the Academic Board.
- The European Chemistry Thematic Network (ECTN) "Chemistry Euromaster" label has been renewed in 2018 and ensures that the training programmes follow the recommendations of the Bologna process, a conditional renewal has been awarded recently (for all graduates before 30 September 2028).
- Joint internal quality assurance includes student surveys on individual courses and the entire programme. The questionnaires are updated and improved regularly, now including a section on intercultural and social experience, personal experience and experience with staff and peers. An additional questionnaire for feedback on teaching staff is in preparation.
- Invited scholars and guests also provide written feedback after their stay on the organisation of the programme and on their students.

The SER states that ASC coordinators and administrative staff at each institution uphold the Erasmus+ aims and objectives and ensure a close-knit network of communication and exchange.

Expert evaluation

Internal quality assurance tools are developed at different levels, including evaluation carried out at each university and department according to local evaluation criteria and strategies. For example, as a general rule at the University of Bologna, each course is evaluated during its implementation (after 2/3 of the course duration) and if any weak points are identified, this is discussed at a special department meeting. Similar measures are implemented at other universities. Nevertheless, more standardised ILO documentation along with the syllabus for all courses should be provided to allow a more specific follow up in the QA processes (**see Finding 1**). As mentioned before, the transparency of ETCS/hour allocation should be increased across universities. : The panel also learned that external perspective of the labour market initially planned *is* to be included into the quality assurance through an Advisory Board. Due to a lack of possibility and the upcoming COVID-19 pandemic, this board however only met once. The panel highly encourages to bring new life to this initiative and structurally include an active Advisory Board of professionals in order to assure that the labour market perspective is included beyond individual contexts of teaching staff and the coordinators (**Finding 9**).

Also, special ASC evaluation procedures are implemented using questionnaire-based assessments for lecture courses and winter/summer schools. The results of the internal evaluation are discussed by the ASC Study programme Advisory Board and changes are made to the curriculum or other activities on an ongoing basis. The University of Helsinki is responsible for evaluating the results and informing all stakeholders.

Conclusion

The criterion is fulfilled.

V. Recommendation of the panel of experts

The panel of experts recommends accrediting the study programme “**Advanced Spectroscopy in Chemistry (ASC)**” (**Master of Science**) offered by

- University of Lille (France)
- University of Bologna (Italy)
- University of Helsinki (Finland)
- Jagiellonian University in Krakow (Poland)
- Leipzig University (Germany)

without conditions.

Commendation:

The program is highly commended for its international approach, offering students a diverse and rich learning environment. The curriculum is well-structured, with a strong emphasis on both theoretical knowledge and practical experience in advanced spectroscopic techniques. The program's success is highlighted by its high employability rate, with 100% of alumni finding employment shortly after graduation, and a significant number pursuing PhDs. The collaboration with global industry partners and prestigious research facilities further enhances the program's quality and relevance. Additionally, the program's commitment to developing students' soft skills, such as intercultural communication and project management, is noteworthy. Overall, the ASC program stands out for its comprehensive and well-rounded approach to education in the field of spectroscopy

Findings:

1. The intended learning outcomes of the programme should be communicated more clearly to prospective students to ensure accessibility for other interested parties. This includes their explicit representation in the diploma supplement.
2. The consortium partners are encouraged to enhance the format of course descriptions to become more comparable and uniform to increase accessibility and transparency for students.
3. A full course description of the “Internship and transferable skills” module has to be provided.
4. The consortium should consider implementing short interviews as part of the selection process to ascertain that the individual is in fact who they are believed to be.
5. The programme should assure that qualifications in the field of entrepreneurship as described in the ILO are developed and assessed as part of the compulsory programme elements.
6. The consortium should improve student support in Bologna.
7. The process in place to distribute students to the different partners should be more transparent and known to those affected by it.
8. The consortium should increase transparency and communicate more actively to provide information to students, e.g. on topics such as about student support, labour market connections, and expected workload peaks in the first semester.
9. The perspective of the labour market should be structurally embedded in the quality assurance of the programme, e.g. by reviving the advisory board.