Study guide Graduation Project

Master Applied Physics

Eindhoven University of Technology

Course code & credits	3MA45 (45 credits) / 3MA60 (60 credits) / 3APIDD30 (30 credits) / 3APIDD375 (37,5 credits)
Level:	Master
Program:	Applied Physics and Science Education
Responsible lecturer:	Prof. dr. ir. Henk Swagten, h.j.m.swagten@tue.nl
Contact person:	Cynthia Tarchichi, apse.education.coordinator.ap@tue.nl
Responsible Applied Physics supervisor:	Examiner appointed for the graduation project by the Examination Committee Applied Physics

Content

1. Introduction 2
2. Learning outcomes of the graduation project 2
3. Assessment of the graduation project 2
4. Planning a 45/60 credits graduation project 3
5. Monitoring process of the graduation project 3
5.1. Retake 3
5.2. Personal circumstances 4
6. Guidelines graduation project report and presentation 4
6.1 Confidentiality 4
7. Organization of the graduation project 5
7.1 Preparing the graduation project 5
7.2 During the graduation project 6
7.3 Finalizing the graduation project and the report 7
Appendix GRADUATION PROJECT MSC AP– Checklist for Report and Presentation 9

1. Introduction

The graduation project offers you the opportunity to apply your acquired knowledge, competences, and skills to a sizable 45 or 60 credits research project. The type and content of the project will depend on your background and ambitions. The subject and location of the graduation project needs to be chosen in close cooperation with a TU/e graduation supervisor, who should be an examiner appointed by the Examination Committee Applied Physics from a research group or research institute belonging to your chosen track.

The procedure for finding a suitable graduation project can differ per research group or research institute. General information about the research groups and the corresponding projects, can be acquired via the Applied Physics Marketplace Canvas page. Some groups have a notice board presenting all available projects. Other sections advise their students to contact a responsible Applied Physics supervisor of their interest to get an overview of the latest projects. In all cases, the initiative lies with you; well before the intended start of the project activities to identify a project should be started. For more information, click here.

2. Learning outcomes of the graduation project

After executing the graduation project, you have learned to apply your knowledge and skills to a complex research problem in the domain of Applied Physics. You have gained experience in a mono- or multidisciplinary team within a professional academic, applied sciences and/or engineering environment. This environment includes (A) a research group or institute within TU/e, or (B) a university, research institute or a company outside TU/e.

After finalizing the graduation project, you are able to:

- Formulate and analyze a scientific problem at an abstract level.
- Independently and iteratively set up, organize and perform a complex experimental and/or theoretical scientific research project, while reflecting on it within the working environment.
- Gather, understand and judge scientific literature about the research topic and incorporate the current insights in the literature into the research project.
- Carefully handle data, systematically investigate, critically interpret and formulate the results and conclusions.
- Clearly communicate about the research project both orally (presentation and discussion) and in written form (report) on a specialist level.
- Contribute to and take the lead in scientific discussions related to the research project.
- Illustrate and identify the scientific and societal relevance, impact, and limitations of the results and outcomes of the project.
- Contribute creatively and with perseverance to the research project.
- Show that he/she has the constructive and cooperative attitude to operate in a professional environment.

3. Assessment of the graduation project

You will finalize the graduation project with a graduation report, a presentation and defense at TU/e. A graduation committee will assess your graduation project on each of the grading criteria according to the rules mentioned in the Graduation project assessment protocol.

4. Planning a 45/60 credits graduation project

You can either carry out a graduation project of 45 credits or 60 credits, depending on how you have designed your own study program for the Master Applied Physics. The graduation project needs to be finished in a predetermined and fixed time period. By choosing a 45 or 60 credits graduation project, you determine the timeline and the end date of the graduation project, according to the following rules:

- For a 45 credits (short) graduation project, an effort of 1260 hours is expected (an equivalent of 31,5 weeks of full-time, 40 hours work per week).
- For a 60 credits (long) graduation project, an effort of 1680 hours is expected (an equivalent of 42 weeks of full-time, 40 hours work per week).
- When needed, you are allowed to use a limited amount of extra time to finalize the graduation project. For a 45 credits (short) graduation project, you receive 160 hours (or 4 weeks of full-time work) allowed extra time, for a 60 credits (long) graduation project, you receive 240 hours (or 6 weeks of full-time work) allowed extra time.

When planning your graduation project, you and your supervisor should keep (public) holidays and part-time work into account, also for the allowed extra time. Before filling in the registration form and starting your graduation project, you should discuss your final planning with your responsible Applied Physics supervisor, and if applicable also with the external supervisor, and together come to an agreement on the final start and end date and the end date incl. allowed extra time of the project, based on the regulations above. The end date of the graduation project includes the submission of the graduation report, presentation, and defense.

By filling in the start and end date, and the end date includingThe allowed extra time on the registration form of the Graduation Project , you agree together with your supervisor that there is the commitment that the project is completed by these dates

5. Monitoring process of the graduation project

Near the initial end date of the project as indicated on the registration form, it is expected you finalize your Graduation Project. If this seems not feasible anymore, you automatically use your allowed extra time (see chapter 4) after confirmation from your Applied Physics supervisor.

5.1. Retake

In case the graduation committee has graded the project with a final grade <6.0, and/or the criteria ‘Report’, ‘’Presentation’’ and/or ‘Implementation of the work itself’ are graded <6.0, if the level of the project is substandard or if the report cannot be handed in 10 working days before the end date including allowed extra time the Graduation Project will be graded with an insufficient grade.

In that case a retake is offered. Together with your responsible Applied Physics supervisor you will agree on what actions need to be taken in order to improve the project, e.g., rewrite the report and/or deliver the presentation again. For both the 45 and 60 credits graduation project the time allocated for the retake is at most 480 hours (an equivalent of 12 weeks of full-time, 40 hours work per week). The end date of the retake is determined by the student in consultation with the responsible Applied Physics supervisor. The start and end date of the retake is communicated to CSA-AP by the responsible Applied Physics supervisor.

An extension of the retake is not possible. If by the end date of the retake the report is not handed in, the Graduation Project will be graded with a definite insufficient grade. In general, a new project should be started.

5.2. Personal circumstances

If personal circumstances will cause a delay, you and your responsible Applied Physics supervisor should get in contact with the MSc. academic advisor. You can discuss whether continuation of the current project would be a feasible option. When there is a possibility for continuation of the project, new agreements regarding the throughput time of the project need to be made and communicated to the education coordinator.

Permission for longer extension can be asked to the Examination Committee in certain conditions comparable to those mentioned in Appendix 2 to Article 1.3.3, paragraph e, of the Regulations of the Examination Committee. In any case the following personal circumstances must be recognized: Illness, exceptional family circumstances, pregnancy and childbirth, dual career (top talent), or other situations involving circumstances beyond the student's control.

6. Guidelines graduation project report and presentation

The outcomes of the graduation project have to be described in a compact, written report in English, preferably not exceeding 50 pages or 20,000 words, without supplementary material. The format of the report needs to be agreed by your responsible Applied Physics supervisor. A checklist can be found in the appendix of this study guide, to guide students and supervisors on the essential elements of the graduation project report and presentation. You must use the AP format for the title page graduation project AP.

During the graduation project, you prepare for the (final) presentation and defense. A checklist for presentation can be found in the appendix, to guide you on the essential elements.

6.1 Confidentiality

When you start your (external) graduation project, it is a potential requirement for the student and the research institute, company or university (and in some cases the TU/e as well) to enter into an agreement concerning the graduation project. This agreement lays down conditions/arrangements regarding such things as working hours, an internship allowance, intellectual property rights and (if necessary) a duty of confidentiality.

The research institute, company or university might have its own company contract; but it is preferred to use the TU/e's model work place contract. The contract can be a tripartite contract (you, the research institute, company or university and TU/e sign it) or a bipartite contract (only you and the research institute, company or university sign it).

You fill in the registration form graduation contract prior to the start of the graduation project. Do not sign your contract until it has been checked. A copy of the registration form will be sent to CSA AP.

- If you use a standard TU/e agreement (e.g. the work place agreement), CSA AP will have your contract signed by the managing director. (So, your responsible Applied Physics supervisor should not sign contracts)

- If you use a non-standard TU/e agreement (e.g. research institute, company or university contract) or if modifications have been made to the standard agreement, CSA AP will forward your contract to the education lawyers for a legal check. Then, the education lawyer will make sure you receive the final version of your contract that you can sign.

Please be aware that the process of reviewing, changing and signing a contract can easily take one month. Therefore, send your contract to CSA AP as soon as possible.

Be aware that your company might want to make your final report confidential and impose an embargo:

- The company where you conduct your research may impose a two-year embargo on its own, at least two weeks before you hand in your final report to your responsible Applied Physics supervisor. They do not need to send a request to AP (TU/e) for further approval on this. In case of a two-year embargo, you must write a public summary in addition to the final report. Send the public summary of the final report & the final report to the company & your responsible Applied Physics supervisor at least 10 working days before your final presentation. Only the final report is used for purposes related to the final assessment of your graduation project. The public summary will be published in the TU/e library until the embargo expires. Once the embargo expires, the final report is published in the TU/e library.

- In case of an embargo of two to five years, the company must send a request to the Dean AP at least two weeks before you hand in your final report to your responsible Applied Physics supervisor. If the Dean AP approves of the embargo of two to five years, you must write a public version of the final report in addition to your original final report. Send the public version of the final report & the final report to the company & your responsible Applied Physics supervisor at least 10 working days before your final presentation. Only the original final report is used for purposes related to the final assessment of your graduation project. The public version of the final report will be published in the TU/e library until the embargo expires. Once the embargo expires, the original final report is published in the TU/e library.

- In case the company wants to impose a non-disclosure agreement (NDA) for you and/or responsible Applied Physics supervisor /graduation committee, please inform your supervisor and email the NDA to CSA AP for further checks.

More information on contracts and on the confidentiality of your report can be found on these pages:
- Guidelines Graduate School
- Internship and graduation project agreements (tue.nl)

7. Organization of the graduation project

Properly organizing your graduation project will take some time. Following the steps below can help you with this. It's very important that you follow these steps proactively; it is your responsibility to make sure that you arrange things in time and follow procedures accurately.

7.1 Preparing the graduation project

When?	Who?	What?
A few months before start	Student	Make sure your study program has been accepted by the study program committee (apse.spc.ap@tue.nl) Check the prerequisites for starting the graduation project

graduation project		Find a suitable graduation project and TU/e graduation supervisor matching your interests and wishes. There are different ways to find a position: • Contact a professor or other staff member of the research group / research institute of your interest to ask for options for a graduation project, at the research group or outside TU/e (at a university, institute or company). • Find a graduation project via your own contacts. Keep in mind that you have to find a TU/e graduation supervisor with a research field matching the area of research at the organization/company. It is undesirable that students do both their graduation project as well as their external internship at the same external location. Exceptions can be requested to the Examination Committee AP
Approx. 4 weeks before the start of the graduation project	Student & responsible Applied Physics supervisor	1st meeting between the responsible Applied Physics supervisor and the student. Discuss: • The subject, scope, location and planning of the project, taking the size of the graduation project into account (45/60 credits) • When applicable, the external supervisor from the institute/company and his/her contact details
Before the start of the graduation project	Student & responsible Applied Physics supervisor	Student & responsible Applied Physics supervisor write a final proposal of the graduation project about subject and content, scope and planning and organization. In case of an external project, the proposal should be written in close collaboration with the external supervisor.
	Student	Enroll yourself for the correct course code in Osiris.
	Student	Fill in the registration form for the graduation project Master Applied Physics with the information as agreed upon by you and your responsible Applied Physics supervisor.
	Student	Read the assessment protocol for the graduation project Master Applied Physics.

7.2 During the graduation project

When?	Who?	What?
During the graduation project	Student & responsible Applied Physics supervisor	You work on your research project. You maintain regular contact with your responsible Applied Physics supervisor about your progress and development. At the project start, discuss together how you will maintain contact (i.e. face-to-face, e-mail/Teams) and with what frequency. During the project, adapt the communication when necessary. In the assessment protocol, you can find more information about the assessment criteria. The assessment of professional skills is embedded in the three assessment components, make sure to work on these skills and discuss the progress with your responsible Applied Physics supervisor. E.g. prepare and practice your presentation, reflect on the progress of the project, and how you work with colleagues/peers. When you are facing a problem(s) during the graduation project, more regular contact is needed. You are in the lead to discuss the faced problems with the responsible Applied Physics supervisor.
During the graduation project	Student	You work on your project and report, aiming to finalize the report at the scheduled end date. Discuss the feasibility with your responsible Applied Physics supervisor and, if applicable, your external supervisor. See the checklist for report on page 8.

Four weeks before the graduation committee meeting	Student & responsible Applied Physics supervisor	Decide whether the graduation project report should be handled confidentially (see chapter 6.1 above), check the following webpages for more information: - Guidelines Graduate School - Internship and graduation project agreements (tue.nl) Please note that in case of confidentiality, either an announcement or request must be made at least two weeks before the graduation committee meeting takes place. The responsible Applied Physics supervisor will indicate in the assessment form (see assessment protocol) how the report will be handled.
At the end of the graduation project	Student & external supervisor	In case of an external graduation project, prepare and deliver a presentation about your graduation project at the location where the project takes place. See the checklist for report on page 11.

7.3 Finalizing the graduation project and the report

When?	Who?	What?
Before the end date of the graduation project	Student and responsible Applied Physics supervisor	Determine the composition of the graduation committee according to the regulations set by the Examination Committee. Please note the additional requirements for the graduation committee for the acknowledgements Theory for Technology and Quantum Technology.
At least 10 days before the end date of the graduation project	Student	Hand in your graduation report at the external location (if applicable), to all members of the graduation committee Sign the TU/e Code of Scientific Conduct for the Master's thesis form
After handing in the report	Graduation Committee	The graduation committee will assess the report and the responsible Applied Physics supervisor will assess the implementation of the work before the presentation takes place.
End date of the graduation project	Student & Graduation Committee	Prepare and deliver a presentation and defense about your graduation project. The presentation should take about 20 minutes, with 10 minutes for a discussion afterwards. Thereafter, in a meeting with the committee only, the defense takes place lasting at most approx. 1 hour.
After the presentation and defense	Responsible Applied Physics supervisor	Your responsible Applied Physics supervisor, also first TU/e examiner, in consultation with the graduation committee, will grade your graduation project on each of the grading criteria according to the rules mentioned in the assessment protocol. After the evaluation, immediately following the presentation and defense, you will be directly informed by the responsible Applied Physics supervisor about the (sub) grades including a short motivation. The final written feedback and (sub)grades will be filled in on the assessment form and communicated to you by the responsible Applied Physics supervisor. **The first TU/e examiner sends the assessment form, the TU/e Code of Scientific Conduct for the Master's thesis form and your report (and if applicable the public summary or public version) to CSA-AP.**

		When the assessment form is handed in at CSA-AP, your grade will be processed, the report will be stored.

Appendix GRADUATION PROJECT MSC AP– Checklist for Report and Presentation

GRADUATION PROJECT – MSc APPLIED PHYSICS

CHECKLIST for REPORT

Assessment, length limit, scientific level, general recommendations

- ☐ The report will be **graded by the graduation committee**, which is the responsible supervisor and (at least) two other examiners. Other (daily) supervisors will be consulted when involved in giving feedback to your report.
- ☐ The **key assessment criteria** of your report can be consulted in the Assessment Protocol Graduation Project MSc Applied Physics. This includes all assessment elements listed under items: 1a. Introduction of research question and methods, 1b. Results & conclusion(s), 1c. Structure, style.
- ☐ The report is sufficiently compact. Without references and appendices, you should typically not exceed **50 pages or 20,000 words**. The length of individual sections/chapters should be carefully balanced considering their relevance and importance within the full report.
- ☐ The **scientific level of your report** should be such that typically other MSc-AP students in the research group, working on similar subjects, can basically follow the content. It can be assumed that topics and theory within BSc-AP courses, including related courses within your track, are familiar, and do not need to be repeated (see later in Main chapters / sections).
- ☐ To be able to judge the required level and other key elements of your report (as will be discussed below)**, ask your supervisor for exemplary reports**, which were delivered by other MSc-AP students. These examples may guide you in the writing process of the project.
- ☐ Before starting up the actual writing process, **discuss with your supervisor(s) the general outline and structure of your report**. This may guide you in carefully planning timely delivery of sections or chapters, including the required feedback from your supervisors and its implementation. For details on structure and chapters, see the next sections.
- ☐ Based on the outline of your report, it is strongly advised to **startup up the writing process at an early stage** of your project, to warrant sufficient progress and to prevent a too high workload at the end. Involve your supervisor in discussing the progress in your report, e.g. by identifying what sections can be written at an early stage, and how to deal with feedback and corrections.

Structure

- ☐ When you are able to identify the **main conclusions based on the core results**, the whole report should revolve around explaining and supporting this. This requires an introduction and motivation of the project, and concise background theory and experimental or theoretical tools. Then you will report on results including discussion and conclusions. This is the core of your work, and the rest of the report should support this in a direct and compact way.
- ☐ In the chosen **structure of the report**, the reader is optimally guided through all chapters of the full report. All individual chapters and sections are carefully tied together and always placed within the larger framework of the report.
- ☐ Apart from the main sections or chapters (see below: Introductory part & Main chapters / sections), the report has **four compulsory parts**. The report starts with (1) **Title page**, (2) **Summary or Abstract**, and (3) **Table of Contents**, and is completed at the end by (4) **References or Bibliography**.

- ☐ **Appendices / Supplementary material** are usually added to give additional details in data and analysis, not suitable (in extent and/or detail) for the main chapters in your report. In the main chapters, properly refer to this additional material.
- ☐ The full report, main chapters including supplementary sections, should warrant the **replication of your research** (data, analysis, etc.). Others should be able to repeat and confirm the basic findings of your study, using the information given in your report.
- ☐ **Lists of Abbreviations, Symbols, Tables and/or Figures** can be optionally added to the report, usually before the start of the Introductory part. Keep the use of acronyms to a minimum.

Title page, title of the report

- ☐ The title page containing at least:

  (1) Title, optional subtitle (2) Student initials, surname, ID (3) Study load of graduation project, 45/60 EC (4) Name of Master's program(s) + master track (5) Month and year of finalized report (6) Name of supervisor (7) Supervisor's research group, department (8) Members of thesis committee (9) Indication on whether or not the thesis is public (10) Statement that the Master's thesis follows the TU/e Code of Scientific Integrity.

- ☐ The **title of the report is compact and contains key words** of the research, methods or techniques. It optionally hints towards the overall result or conclusion of the thesis work.
- ☐ A **subtitle is optionally added** when more detailed key words are required to frame the research, methods or conclusions.

Summary / Abstract

- ☐ The summary/abstract at least contains:

  (1) Background of the graduation work (2) Research objectives or hypothesis (3) Research methodology, and (4) Obtained main results and factual conclusions.

- ☐ The **abstract is sufficiently concise**, for the reader to have fast access to the impact of the work. Typically, it fits to half a page, and never exceeds a full page.

Introductory part

- ☐ To clarify the motivation and objectives of your work, the introduction usually starts with an adequate **scientific, technological and/or societal background** to the work, including a representative selection of references to relevant scholarly literature.
- ☐ After identifying the open issue or quest in the research field, the introductory part should clearly state **your motivation and actual research objectives** of the present study.
- ☐ In connection to motivation and objectives, the introductory part optionally includes a **short written outline of the remaining chapters/sections** of the thesis, to optimally guide the reader. It may also optionally include a preview of the main conclusions of your thesis work.

Main chapters / sections

- ☐ Following the Title page, Summary/Abstract and Table of Contents, (and preceding the references) the report contains a selection of logically structured main chapters/sections; typical examples:

  Introduction (see earlier), Background, Technology Assessment, Methods, Research Tools, Theory, Results, Interpretation, Discussion, Recommendations, Outlook.

Please note that these chapter/section titles are just examples, these are not mandatory!

A customized selection and ordering of these typical chapters/sections is used such that the actual results and discussion are well positioned within the entire report. Alternative titles for your chapters, that are specific for your project and your storyline, can be considered. As mentioned earlier, discuss this with your supervisor at an early stage!

☐ In view of the length-limit indication (50 pages or 20,000 words), **chapters on theory, methods and tools are carefully configured preferably without extensive reproduction of textbook-like elements**. Use appropriate references (ideally including hyperlinks) to other sources when writing these chapters, and keep in mind that these parts should be written in a way to optimally introduce the actual research results and discussion.

References/Bibliography and Appendices/Supplementary

☐ The **list of references/bibliography**, positioned at the end of the report, is logically structured and sufficiently clear, using a consistent format. In the main text, references to this list are systematic and precise. A reference management tool is recommended.
☐ A standard **reference/bibliography style** has been chosen that is commonly accepted, such as used in physics papers by American Physical Society (APS), Institute of Physics (IOP), or Nature/Science.
☐ **Appendices / Supplementary material** can be included to avoid a too lengthy or detailed report and/or to facilitate reproduction of the actual research.

Technical requirements: figures, tables, equations, symbols, concepts

☐ For style/conventions/typefacing of **figures, tables, equations, symbols** etc., the guidelines in *Experimental Physics* courses of the *BSc program Applied Physics* at TU/e can be consulted.
☐ For style/conventions/typefacing, also **typical (applied) physics papers can be consulted**, see e.g. guidelines at the American Physical Society (APS), Institute of Physics (IOP), or Nature/Science journals.
☐ Relevant **physical/technological concepts, parameters and symbols** are introduced at their first occurrence. When using **equations and physical arguments** that are not derived or introduced in thesis, and which cannot be considered as basic physics knowledge, they should be properly cited.
☐ All **figures and tables carry a caption** containing all the information necessary to understand what is actually shown. The full interpretation/explanation of the figure/table should be in the main text, it does not belong to the caption.
☐ All **figures and tables are referred to in the main text**. Numbering is dictated by appearance in the text. All **equations carry a number**, unless they are integrated as part of the main text, and all **equations are part of a running sentence**. Automatic numbering of figures, tables and equations is recommended.

GRADUATION PROJECT – MSc APPLIED PHYSICS

CHECKLIST for PRESENTATION

Assessment, audience, duration, general recommendations

- ☐ The presentation will be **attended and graded by the examination committee:** the responsible supervisor, and (at least) two other examiners. Daily supervisors will be usually present and consulted for the assessment. Attendance by other group members (students, staff) is usually facilitated.
- ☐ The **key assessment criteria** for your presentation can be consulted in the Assessment Protocol Graduation Project MSc Applied Physics. This includes all elements listed at item 2a. Content and structure, and item 2b. Performance.
- ☐ The **presentation should last 20 minutes**, thereafter follows a **discussion of typically 10 minutes**. Generally speaking, presenters in physics often spend 1-2 minutes per slide, which means that presentations are typically supported by **10-20 slides** (excluding a series of slides belonging to an animated sequence).
- ☐ The **scientific level of the presentation** should optimally match the audience. Ensure that the presentation is at a level such that all other BSc-AP and MSc-AP students in your research group are able to grasp the essentials of your talk. It can be assumed that topics and theory within BSc-AP courses, including related courses within your track, are familiar. Still, those not directly involved in your project usually need more introduction and explanation than you might think.
- ☐ Unlike your report, your **presentation is not meant to show all you have done** in the project**.** In most cases, this means you have to boil down your work its essence and make it understandable even for the non-experts. Not all subjects covered in the report need to be contained in the presentation, also the order of subjects can be completely different.
- ☐ You are strongly advised to **carefully prepare and practice your presentation** well in advance, preferably with your supervisor(s) or other students working on similar subjects. This will help you optimize the timing (20 minutes), design and physics content, including your actual performance
- ☐ Before designing and detailing your slides, **discuss with your supervisor(s) the outline of your talk**, which is related to the main message and subjects to be discussed. See the following section.

Message and motivation, subjects, structure

- ☐ To make a strong outline, it is very important to **identify the main take-home message of the presentation**. Try to capture the message of your presentation in a single sentence. Identify which topics need to be explained and what results need to be shown in order to convey the main message. All you present is there to explain or support the take-home message!
- ☐ At the start of your talk, **try to immediately catch the attention** by clear opening sentences or statements. Consider showing a compact, catchy version of the project title or to immediately highlight the main take-home message. Carefully practice these first sentences, these are key in getting and keeping the attention of the audience. A catchy image on the opening slide may also help to attract attention.
- ☐ In the first part of the talk, you should carefully **introduce the motivation behind the project**. This requires giving sufficient background information about physics or technology in this particular field, within the research (sub)group.

- ☐ In the introductory part, clearly mention the **actual research question of your work**. This is typically followed after the motivation and narrows down to your actual contribution or quest. You may anticipate on the conclusions to better guide the audience through your presentation.
- ☐ Keep the attention of the audience by a **coherent and recognizable structure** of the presentation and consider implementing intermediate conclusions. As mentioned, be critical in selecting what is needed to support the message, in terms of background, theory, results, figures, etc. Be aware that the words you speak when moving from one slide to the other are very important in creating a clear storyline – prepare those links with care.
- ☐ Unlike your report, **a table of contents or outline is not required** to guide the audience, it may even weaken the narrative; a well-prepared message, storyline and supporting slides are much more essential
- ☐ For each figure, scheme or diagram you are showing, **take time to explicitly highlight and explain all details of graphs**, such as what is plotted along axes and what the different curves or data sets mean. You know what is in the graphs, but an audience needs enough time to consume this new information and recognize what is shown.
- ☐ You should finish the presentation in a natural way, which most likely puts the **main conclusions, take-home message, or outlook**, at the end of your talk. Keep the concluding part compact to regain full attention by the audience. Try to close the circle by answering the research question you posed at the start of the presentation.

Stage performance

- ☐ By preparing yourself optimally, you should be able to demonstrate **engagement, confidence, enthusiasm, and liveliness**. Since this is one of the key elements for a successful presentation, specifically ask for feedback on these aspects during practicing the presentation with others.
- ☐ It is **natural to be nervous for your presentation**. You have to learn to recognize the symptoms and to appreciate them for optimizing your performance. By systematically practicing and analyzing your presentations, you gain experience and nervosity may actually help your performances. You may consider using video recordings of your presentation in the preparation phase.
- ☐ When **speaking to the audience**, your voice should be loud enough with a clear articulation and lively intonation. Use a conversational pace but try to make variations when appropriate. Use body language or even supporting tools and try to continuously keep eye contact with your audience.
- ☐ As a **junior scientific presenter**, the sentences you are using should be compact and at a proper scientific level, and your explanations and reasoning should be correct and clear, and structured in a logical way. Only use physics terms and English that you feel comfortable with. Make sure that all your statements are supported by either data or references.
- ☐ A good way to test your presentation is to record yourself on camera and then **critically review your own performance** given all the feedback you already received. Compare it with your own experience of what you liked and disliked at other presentations or lectures. Obviously, you may consider sharing your recordings with fellow students/friends for asking additional feedback.

Technical requirements

- ☐ When designing your slides, **use current TU/e templates** online available.
- ☐ Mention your name, supervisors, research group or location (usually but not necessarily all on the title slide). Acknowledge others that contributed to your work; number your slides. Give correct reference when using pictures and other material, from literature or other sources.

- ☐ To ensure the audience is mostly concentrating on you and your narrative, **use a limited amount of compact phrases or words on your slides**. The format/layout of these text elements on your slides should be coherent and well-readable during the full presentation. In many cases, a slide is carrying a dedicated title of your slide with a limited amount of words, and the main conclusion of that slide is displayed as well – make this coherent for the full presentation.
- ☐ Put great effort in **carefully designing your figures, schemes and diagrams**, preferably eye-catching and as simple as possible, containing limited elements that are very well visible in size and color. Consider breaking up figures or diagrams into parts and introduce them sequentially. As a rule of thumb: figures/graphs from the report should be fully redesigned for using it in your talk. Often figures from literature need to be remade or simplified. Properly align different graphical elements and text to assure a structured layout.
- ☐ Using **tables with numbers** is in most cases not recommendable, as well as **mathematical derivations**. In case of showing **formulas or equations**, usually try to show these in a compact, understandable and attractive way.
- ☐ Use **animations in your slides** when it will benefit your narrative and performance, e.g. when explaining a complicated concept, or when elements in figures are added sequentially. Make sure to carefully prepare and practice animated sequences when you do add them. Avoid too many control/mouse clicks – in particular assure that information stays projected enough time.

Questions and discussion

- ☐ After **finishing the presentation**, usually an applause will be given, and the audience (including examiners) are allowed to ask questions. As a rule of thumb: do not end with a question, in particular “Are there any questions?”, but you may thank the audience for their attention, and you could add “I will be happy to answer any of your questions”. Discuss with your supervisor in advance who is initiating/regulating the questions, which is usually the chair of the meeting.
- ☐ For all **questions after the talk**, repeat the question in your own words and direct your answer to the entire audience. When needed, immediately go back to the slide in question for supporting the discussion (in PowerPoint: type slide number, press enter)
- ☐ In **answering questions**, explain your thoughts natural and open-minded, similar to scientific discussions. Show respect for all types of questions and try to judge whether your answers are well received. When you do not fully understand the question, ask for further clarification.
- ☐ Be prepared for unexpected **questions or interruptions during your presentation**. Discuss with your supervisor in advance how to handle these situations.
- ☐ Consider having **back-up slides** when you anticipate additional discussion on specific results or subjects. Make sure you are able to quickly navigate to this supporting material.