1 Introduction

This course is taught in English. There are some good reasons for this.

1. My knowledge of Spanish is sufficient for talking, but I don't know all the physics words (many of these words I don't even know in Dutch, my native language). In addition I would have to think more about the proper use of the language than about the physics.

2. English has become the international language of science. In your further career it will be inevitable that you will have to use English. Better get used to it as soon as possible.

3. I couldn't possibly write the lecture notes in proper Spanish.

If there is something you don't understand, either because of the physics, or because of the language, please ask. You will do yourself a disservice if you spend the rest of the hour not understanding what is going on.

When you are trying to do the homework, and it turns out that you have some questions, you can send me an e-mail at t68@nikhef.nl. I cannot guarantee a speedy answer, but usually things should go at a decent pace. Make sure that a possible answer does not get killed by your spam filter. When sending questions, please use plain text files. I hate .doc files. If you like to include formulas in fancy typesetting or graphs, please present the results as a .pdf file.

In this course we will see how to compute crosssections and decay modes from the purely utilitarian point of view. Many formulas will not be derived; they will just be given. A derivation either has been given in or will have to wait for a more formal course. It is assumed that you have access to a computer running Linux or a derivate (like the terminal windows in OS-X or Cygwin). We will use the C compiler and in the last lecture(s) the symbolic program FORM. In addition we use the LaTeX typesetting program and a number of libraries. The C compiler and the LaTeX system come with the Linux system. If you don't have FORM on your computer, you can pick up the sources from the github (github.com/vermaseren/form). There is a link to it in the FORM web site: http://www.nikhef.nl/~form where you can look also for the lecture notes. If you cannot compile the Form sources on your computer there is a decent chance that you can pick up a workable executable from the github, as there are a few available there. All libraries and support programs that we will be using can be found in the Form site as well. If you have problems installing the programs please ask either a fellow student or ask me. Don't continue without these programs, because you will not be able to do the homework[1].

Some results are made visible with the use of LaTeX and axodraw[2] [3]. The TeX/LaTeX system is part of a complete Linux distribution and axodraw can

[1] I do know that some of the homework is hard. Trying is at least as important as getting it perfect.

[2] In these notes and the programs we will use the more modern version axodraw2. It can be picked up from the FORM site as well. It also comes with some of the TeXdistributions.

[3] If you ever have to prepare documents with axodraw (not axodraw2) figures, it is most convenient to use the Java front-end program named Jaxodraw. The Jaxodraw/axodraw combination has become quite popular in theoretical particle physics.

be obtained from the FORM site as well. What we use here is just an example of how results can be presented. There exist much fancier systems, but these require the installation of considerably more software. The advantage of the libraries provided in this course is that they are rather simple and concise. This allows you to have a look at what is done inside and to have complete control over them, including altering them to suit your own taste.

This brings us to the real reason for this course. There exist programs that can calculate reactions (semi)automatically. Given a Lagrangian, you only have to specify the reaction and they create a program that will calculate this reaction for you. Eventually you may use these of course, but if you become a professional, you better know what goes into these systems, what are the tricky points that they may not always get perfect, how one can improve efficiencies, etc.

Files that we will use:

- FORM (only in the final lectures). It is best to pick up the sources from github, and compile it on your computer. This way you can be sure that it runs properly.
- All files in http://www.nikhef.nl/~form/maindir/courses/uam2019. This directory will be regularly updated during the course.
- Axodraw2 which can be obtained from the FORM pages as well (both the axodraw2.sty file and the manual. If you like to use pdflatex you will also need the axohelp.c file and compile it).