Gran Sasso Science Institute
XXVI Cycle - A.Y. 2020-2021

LE-6 Exam Report

Monte Carlo Techniques

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Preface

This report presents the exam exercises solutions of the course "LE-6 Monte Carlo Techniques" for the academic year 2020/2021. C++ programming language together with `ROOT` framework classes have been employed. The codes written to obtain the results presented throughout the document are reported in a public GitHub repository at the link `https://github.com/sghislandi/GSSI_LE-6_Exam`.

1 Uniform Random Sampling

1.1 MINSTD algorithm

2 Random Sampling from other distributions

2.1 Inverse method

2.2 Inversion and rejection

3 Numerical estimate of π

3.1 Uncertainty evaluation

4 A toy Monte Carlo, RisiKo!

4.1 Basic probability

4.2 Planning an attack

5 Monte Carlo integration

5.1 Unidimensional integration

5.2 Integration in N dimensions

5.3 Extra exercise

6 Truncation errors

7 Tracking algorithms

8 Sampling of an interaction

8.1 Photo-electron

8.2 Fluorescence