Chapter 1

INTRODUCTION

MCNP is a general-purpose, continuous-energy, generalized geometry, time-dependant, coupled neutron-photon-electron Monte Carlo transport code.

The Monte Carlo method is a stochastic method that is used to solve the particle transport equation by randomly tracing a sufficient number of particles through the seven-dimensional phase space of time, position (3 coordinates), direction (2 coordinates) and energy.

Quantities of interest are evaluated by tallying the contributions of relevant interactions as they occur in the phase space.

In order to perform a "random walk", the following must be defined:

1. Particle source.
2. System Geometry.
3. Material and cross sections .
4. Tallying (scoring) of quantity of interest.

The random walk can be biased to improve the chance of scoring to the quantity of interest, by the use of "importance sampling" techniques.

The code's manual provides a detailed description of the input parameters, as well as the way physical processes are modelled (i.e. randomly sampled). In these notes, emphasis is given on addressing the physical aspects often encountered by users in the setting up of a problem . We begin by a brief introduction to the basics of the Monte Carlo method, then we show how the Boltzmann particle transport equation lends itself to solution by the Monte Carlo method, before addressing the specific aspects of the MCNP code.

After studying these notes, MCNP sample problems should be executed and the input and output be examined thoroughly, in view of the different aspects discussed in these notes.

One precautionary note, not all input instructions are tested here and you need to satisfy yourself that they work as intended.