Chapter I

INTRODUCTION

In many phases of nuclear study, it is necessary to investigate time coincidence between nuclear events. The study of coincidence between beta rays, gamma rays, x-rays, etc. give information on the nuclear schemes and also make a powerful method of measuring absolute activity. Coincidence measurement made possible the study of the direction of incidence of the particles as well as the simultaneous production of many particles in cosmic ray physics. The half-lives of the order of 1 μsec or less makes possible by delay coincidence technique.

The experiments designed to measure nuclear constants and reaction cross section are dependent upon the knowledge of the source strength. Indeed, the ultimate accuracy of many measurements is determined by the accuracy with which the disintegration rate of a standard sample is known.

The techniques available for absolute counting fall into two broad categories. First, there are the methods where some of the radiation is detected under conditions of well-defined counter geometry, efficiency, scattering etc., or all the emitted radiations are detected; these are described under the heading direct counting methods. Second there are the coincidence methods where, by measuring suitable counting rates, the disintegration rate may be determined without accurate knowledge of the counter parameters (solid angle, efficiency, etc.).

The application of coincidence counting to measurement of disintegration rate was introduced as a beautifully simple absolute

method; continued search for improved accuracy has replaced the simplicity with somewhat complex correction formulate but the method remains probable the most powerful in the field of absolute standardization.

This thesis discribes an investigation of the simple coincidence counting technique in order to measure the absolute activity of cobalt-60 and manganese-56. The purpose of this study is to set up a simple coincidence counting system and utilize this instrument to measure the absolute activity of the radioactive sources. The investigation will cover the measurement of the standard cobalt-60 source and compare the absolute activity calculated from coincidence counting data with the labeled activity, the measurement of the absolute activity of manganese-56 produced by 5 Ci plutonium-238/beryllium source. The neutron flux at the position of the irradiation of manganese will be calculated from the absolute activity of manganese-56.