Abstract

The usefulness of synchrotron radiation in a wide range of diverse disciplines has now been well established. The continuously expanding dedicated synchrotron facilities and the broad spectrum of research being carried out at these sources put very stringent requirements on its instrumentation. Beam monitoring is one of the important tasks which greatly influences the results of the experiments being performed. There are many experiments, such as EXAFS, in which it is desired that the intensity of incoming beam be synchronously monitored before it passes through the sample. The relative accuracy of this monitoring is a critical parameter in the sense that it influences the results of the experiments being performed. During this project a high precision beam intensity monitor for synchrotron radiation has been developed and tested using a 2kW x-ray tube. The test measurements showed that the dominating noise in the system is due to Poisson statistics. Furthermore, the ionization chamber plateaus obtained at different x-ray intensities show the flat portions of less than 2% per 1000 volts. The linearity of the system was also checked and the chamber was found to behave linearly with respect to incident photon flux up to the achievable x-ray intensity. The systematic errors were experimentally identified and analytically worked out. It was shown that the space charge effect poses a very serious problem specially at high flux rates. The mechanics of the chamber has been so optimized such that the space charge effect does not deteriorate the measurement precision to unacceptable levels at high incident photon flux. The effects of gas flow and barometric shift have also been thoroughly investigated.

Project supervisor: Prof. Dr. A. H. Walenta
External examiners: Prof. Dr. H. D. Dahmen
Prof. Dr. N. Pavel

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