The DAQ System and Preliminary Data Analysis Program for the Schottky Detector at CSRe

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Due to the capability of non-perturbing detection of a Schottky resonator, it is one of the significant measuring instrument for nuclear mass and decay experiments. A new data acquisition (DAQ) system for the Schottky resonator at the experimental cooler storage ring (CSRe) in Lanzhou and its accompanying preliminary data analysis program has been developed. During the beam time in Dec. 2016, the new system succeeded in continual collection of hundreds of data files, which met the requirement of the planned nuclear decay experiments. Also, the preliminary data analysis program could correctly display the frequency spectra of the acquired data.

KEYWORDS: Schottky spectroscopy, DAQ system, data analysis

1. Introduction

A Schottky resonator, a non-perturbing beam diagnostic instrument in a storage ring, permits to measure important beam parameters, e.g. the revolution frequency, momentum spread, etc. Data acquisition for the Schottky resonator is a process of sampling the signals from the resonator, converting the resulting samples into digital values and collecting the required data for the further off-line spectrum analysis. The DAQ system coordinates the processing devices and controls this procedure. With the help of an appropriate DAQ system, the Schottky resonator can exploit its advantage to obtain the beam information and thereby be utilized in the nuclear mass and decay experiments.

The DAQ system for the Schottky resonator at CSRe was a commercial product spectrum analyzer (Tektronix RSA3408B) with its optional data storage accessory before 2016 [1]. One distinct drawback of that system is being only operable manually, which means using the remote desktop to set parameters and save data is the only way when the users can not approach the analyzer. It absolutely increases the risk of instability and unreliability. Time costly of the manual setup is an additional problem. Another limit is that the maximum size per file is 51.2 MSample. Taking the typical decay experiment setting as an example, the sampling rate is 500 kHz, thus the collecting time is limited to 102 s. For the sake of high ion yields, our experiment favors the region near the stability line. The upper limit is unfortunately inadequate for measuring the lifetime. Besides, the users has no access to the data files before copying them from the spectrum analyzer. Online analysis of the data to acquire detailed knowledge of the experimental situation could not be done efficiently. In summary, a new system is in high demand to overcome the aforementioned shortcomings.