Status of the FAUST Detector


During the past year, progress has been made in constructing and testing the FAUST detector. A significant amount of work was devoted to electronics development. The detectors were checked off-line, mounted in the final configuration and three on-line tests have been conducted.

The front end electronics are packaged as follows: The Si and Photodiode preamplifiers are mounted inside the vacuum chamber. The shaping and timing amplifiers will be packaged in NIM standard double-wide modules consisting of eight channels per module. The cable system from preamplifier to CAMAC interface will consist of RG196-A/U and a planar coaxial cable assembly. The gain sensitivity for the Si and CsI were measured experimentally using the 8.785 MeV alpha peak from a $^{228}$Th source; the sensitivities were 3.98 mV/MeV and 0.228 mV/MeV, respectively. The main shaping amplifier allows a gain adjustment from 1 to 100. A timing amplifier is also included with an adjustable gain of 1 to 10.

The off-line tests were performed with standard electronics and a $^{228}$Th source. The energy resolution for the CsI detectors ranges between 2% and 4.2% (standard deviation for the 8.875 MeV alpha line). This variation in energy resolution is possibly due to differences in the optical coupling between photo-diodes and light-guides and is being investigated. The Si detectors showed in all cases an energy resolution better than 0.5%. The resolution will be improved with the final custom-built electronics.

The on-line tests were performed with the telescopes arranged in their final configuration with all the custom-built preamplifiers. A 35 MeV/A Ne beam on a Au target was used for these runs. The main goal of the test was to verify that we get isotope resolution for fragments up to $Z = 6$. Figure 1 shows the isotope lines in one of the telescopes. Work has to be done in order to reduce the electronic noise from the beam line and increase the resolution between the different masses in the $Z = 6$ line. Another important part of the on-line tests was to develop beam tuning procedures to avoid hitting the detectors. Also, in the on-line test, the mechanical arrangement
and the cabling system were checked to ensure proper connection and grounding. Minor modifications were made to improve the operation of the detector. In general, the detector is ready for use with adequate resolution and all electronics are expected to be finished shortly.

Status of the CsI Ball


More progress has been made in constructing and testing the CsI ball during the past year\(^1\). We briefly report this progress and the current status of the CsI ball.

Off line \(\alpha\) source tests with \(^{241}\text{Am}\) have shown that the energy resolution and the light transmission efficiency are very sensitive to the surface finish and wrapping of the light guides. The surfaces of the light guides were diffused by using very fine sand paper. The light guides were shortened and rewrapped. Figure 1 shows the improvement in energy resolution achieved for detectors in different rings of the CsI ball.

In order to improve the heavier ion identification and reduce the energy thresholds, small ionization chambers have been designed to replace the plastic scintillator foils. A copper housing coated with Nickel was mounted in front of each CsI crystal to serve as the cathode of the ionization chamber. For the large backward detector, an additional metal mesh was also glued to the front of copper housing. The aluminum coated mylar foil on the front surface of the CsI crystal, which serves as a reflector of light, is also used as the anode of the ionization chamber. Figure 2 shows a diagram of the whole detector. Figure 3 presents the total energy versus the energy deposited in the ionization chamber for a Ring 1 detector with 100 Torr CF\(_4\) gas. The beam was 30A MeV.

References


\(\text{Figure 1. The energy resolution versus the ring number of the CsI ball determined by offline } \alpha \text{ source tests with } ^{241}\text{Am for several kinds of the light guides.}\)