Report #2

DOE-ER-10550-2

Title: CCNY Collaboration with BNL in R&D for ISABELLE Detectors

MASTER

Technical Progress Report for the period November 1, 1980 to June 10, 1981

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Contract # DE-AC02-79ER-10550

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Abstract

The difference in ionization loss of particles as a function of their velocity is widely used as a technique to identify the particles.

We have studied the ionization loss in gas samples an order of magnitude smaller than previously investigated. In order to do this we have developed and employed new techniques which use a longitudinal drift ionization detector and fast analog to digital conversion techniques which allow us to effectively slice a piece of track into very small samples by electronic means using a small prototype chamber. We have demonstrated that this technique can substantially improve the mass resolution capability of gas particle detectors. We have also shown that only a rather coarse analog to digital converter (ADC) resolution is required to capture all the information needed with the truncated mean sampling method we employ to determine the relative energy loss.

Thus we conclude these new developments can substantially increase the sensitivity of particle separation by ionization measurements via gas particle detectors.

We are now testing a larger ten-layer prototype which will allow us to optimize the design for a large type of test chamber which could then be utilized to design actual experimental measuring equipment.

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SIGNIFICANT RESULTS OBTAINED

I. The analysis of the test run in the summer of 1980 was completed and published in the Reference attached. ^{removed (pub. lit.)} The results established that with the small one-layer test chamber, that we had employed our new method of small electronic sampling of tracks in a longitudinal drift chamber increased the sensitivity for particle identification by a factor of about two.

II. During this year we have, with the additional collaboration of a University of Lund group constructed a ten-layer prototype chamber 4" wide by 10" high with 40 cm of gas path along the beam. The purpose of this chamber was to allow us to apply the technique to a multi-layer model chamber which is a prototype of a large chamber for spectrometer experimental use.

We developed and built ultra fast analog to digital converters (ADC's) to enable us to sample the drift chamber pulse shapes in 10 ns intervals corresponding to about 1/2 mm of track length.

We have run a shakedown test at BNL in a 3.5 GeV/c test beams. The results of this test indicate that our ten-layer chamber results are consistent within the experimental errors with our expectations.

A critical test of this ten-layer chamber is planned this summer using a test beam at CERN (the BNL test beam will not be available again till next April). This test should provide us with the necessary information to optimize the design for the large ten-layer module we plan to build as a demonstration of a practical type device using these new techniques.

There is no objection from the present point of view to the publication or dissemination of the documents stated in this letter.

BROOKHAVEN PATENT GROUP

7/4 1981 By C. P. S.

COMPLIANCE WITH AGREEMENT

The work done under this contract falls within the scope and is in compliance with the agreement.

The Principal Investigator devoted approximately 15% of his time for 12 months.

TECHNICAL REPORTS

T. Ludlam, E.D. Platner, V.A. Polychronakos, S.J. Lindenbaum, M.A. Kramer, and Y. Teramoto. "Relativistic Rise Measurements with Very Fine Sampling Intervals". IEEE Transactions on Nuclear Science Vol. NS-28, No. 1, 439(1981).

T. Ludlam, E.D. Platner, V.A. Polychronakos, S.J. Lindenbaum, M.A. Kramer, Y. Teramoto, T. Akesson and G. Jarlskog. "Prototype Particle Identifier Using Multiple Layers of Gas and the Fine Sampling Method". Paper submitted to 1981 Nuclear Science Symposium, October 21-23, 1981, San Francisco, California.