

Lawrence Berkeley National Laboratory

Recent Work

Title

HISS UPDATE

Permalink

<https://escholarship.org/uc/item/7813q037>

Author

Lawrence Berkeley National Laboratory

Publication Date

1985-11-01

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

APR 2 1986

LIBRARY AND
DOCUMENTS SECTION

HISS Update

November 11, 1985

PUB-493 c.1

For Reference

Not to be taken from this room

1 HISS Users Meeting

A meeting of HISS users and other interested parties has been scheduled for Thursday, December 5, the day before the Bevalac PAC meeting. People with approved HISS experiments have been invited to present updated plans for their work. There will be some additional talks by people who have an interest either in doing new experiments at HISS or in developing new equipment. This will be an opportunity for anyone considering experiments at HISS to explore the possibilities and learn more about current HISS detector capabilities. A schedule will be mailed shortly.

2 Experimental Progress

2.1 Experiment 772H

The first stage of data taking for experiment 772H was completed. This experiment is a study of projectile fragments using medium-heavy beams (^{40}Ar , ^{93}Nb and ^{139}La) at ~ 1.5 GeV/A. In addition to inclusive momentum spectra and isotopic distributions of projectile fragments, information about associated multiplicity and heavy fragment correlations is also collected. Initial measurements this Spring were made for the ^{40}Ar projectile. As discussed later in this report, this was the first experiment to take advantage of the new Čerenkov detector. Analysis is proceeding rapidly and preliminary $p_{\perp}$ distributions have been obtained for the observed isotopes.

2.2 Experiment 690H

Results have been obtained from the December run of 690H. Interaction cross sections were measured using beams of $^{3,4,6,8}\text{He}$, $^{6,7,8,9,11}\text{Li}$, $^{8,10}\text{Be}$ at 790 MeV/nucleon. The beams of radioactive nuclei were produced through the projectile fragmentation of 800 MeV/nucleon ^{11}B and ^{20}Ne and separated by magnetic analysis in the HISS beam line. Interaction cross sections for the separated beams were then measured using the HISS spectrometer. These extracted cross sections were analyzed in terms of Glauber-type calculations to deduce root-mean-square matter radii for He, Li, and Be isotopes. This work provides the first evidence for appreciable differences in the radii of isobars (^6He - ^6Li , ^8He - ^8Li and ^9Li - ^9Be). It was also found that ^{11}Li has a remarkably large radius, suggesting a large deformation or a long tail in the

PUB-493

matter distribution. Measurements are currently in progress extending the study to all p-shell nuclei.

3. Equipment Additions and Improvements

3.1 Velocity Detector

A new multiple element Čerenkov detector, developed and installed at HISS, produced excellent data on its maiden run in June. This detector system covers an active area of $100\text{ cm} \times 30\text{ cm}$ with two types of Čerenkov radiators to give a precise determination of both fragment Z and velocity. The Z determination is obtained with glass radiators (index of refraction, $n=1.51$) from the Z^2 dependence of the Čerenkov light production. The velocity comes from quartz radiators with a lower index of refraction, $n=1.46$; the trick here being to make the light collection efficiency a very sensitive function of the Čerenkov light opening angle. This sensitivity is accomplished by matching the selected particle velocity range to the critical internal reflection angle in the quartz radiator. A potential disadvantage in this scheme is that it can only work over a limited velocity region dictated by the Čerenkov radiator index of refraction. It is, however, well suited for projectile fragmentation studies where all the particles of interest are essentially at beam velocity. The first experiment, E772H, using this system in June, was a measurement of 1.65 GeV Ar fragmenting on a KCl target. Complete identification of A and Z was achieved for all the tracked particles ($Z = 5 - 17$).

3.2 Multiplicity Array

A multiplicity array of 120 scintillators was installed for use with targets external to the spectrometer magnetic field. This multiplicity array was developed jointly by the Hashimoto and Schroeder groups, and was used previously on beam line 30-2. It gives the multiplicity count for charge 1 and greater particles with scattering angles between 5 and 90 degrees. The energy threshold for protons in this device is approximately 20 MeV.

3.3 New Drift Chamber

Work is progressing on a new $2\text{ m} \times 1.5\text{ m}$ drift chamber which will become the primary large solid angle, tracking detector down stream from the HISS dipole.

Mechanically, the new chamber is, in many respects, a scaled up version of the existing $40\text{ cm} \times 30\text{ cm}$ prototype chamber that has been used successfully in a number of HISS experiments. The new detector will have 15 sense planes: 7 vertical and 4 each at plus and minus 30 degrees from the vertical. This is sufficient

redundancy for events with a moderate number of tracks. Traditional construction is used for the wire planes (ie wires bonded to NEMA-G frames), but the support for these frames is a unique design. Each plane is modular with the NEMA-G frame deriving support and alignment from a rigid window frame structure constructed from 3 in $\times$ 5 in extruded aluminum box beams. The function of the support frame is to provide a precise plane surface to maintain wire position. Normally, producing this surface would require a machining operation, but this costly operation has been avoided by casting a plane epoxy surface on the box beam construction with the aid of a granite table.

Electronically, the new chamber will again be essentially the same as the prototype chamber. The front-end electronics (amplifier, discriminator and delay line) are the same, and time will be recorded using the LeCroy 4290 TDC system as has been done with the older chamber. For ADC's, however, we will use fast bus, LeCroy 1885. Assembly and installation of the new chamber should be completed in December and initial testing will begin at that time.

3.4 Low Mass Beam Particle Vectoring System

Improvements are being planned for the beam particle trajectory determination. At HISS, tracking of the beam particles upstream from the target is required for momentum analyzing the outgoing particles. This information is currently provided by two upstream wire chambers which run in air at atmospheric pressure. The resulting large "in beam mass" generates considerable background which is particularly troublesome for measurements at near zero degree scattering angle where back vectoring cannot be done with sufficient accuracy to determine if the reaction occurred in the target or upstream from it. An alternate low mass system is being considered which would allow complete evacuation of the beam line including the target region. A parallel plate avalanche counter system, similar to that used in the plastic ball beam line, is now the detector of choice as it has demonstrated sufficient position resolution and count rate capability with only 1.2 mg/cm² "in beam mass".

3.5 Acquisition Computer Upgrade

A used VAX 750 is being purchased from the computer center to replace the aging 11/45 data acquisition computer. This should result in fewer hardware failures and with the increased memory (2 megabytes) will allow direct buffering of the data so that tape writing can proceed during the accelerator spill off period. The MONA acquisition software, developed by the plastic ball group, will be adapted for the 750, and, as before, the shared disk will provide the data link to monitoring programs on the VAX 780.

3.6 Code for Display of Simulated Trajectories

An export version of an event simulation program is now available for use on VAX computers (VMS 4.2). This interactive program provides a visual display of generated tracks overlayed on the HISS cave geometry and is used as an aid in detector placement. The event generator is a moving thermal source of either bound fragments or unbound clusters that undergo two particle decay. The source parameters as well as the location of the interaction region (target) can be varied to examine acceptance possibilities for the kinematic regions of interest. The executable image, starting instructions, and all necessary files may be found in `HISS::SYS_USER:[HISS.LIBR.EXPORT.CAVE]`.

4 Personnel

John Young, on sabbatical from Chico State, is joining the UC Davis part of the HISS collaboration and will spend ~ 6 months at LBL. One of his projects will be working on the analysis of experiment 665H, a ($^3\text{He}, t$) measurement made at HISS to look for missing Gamow Teller strength.

Walter Müller, a past collaborator on HISS projects, has joined the HISS group at LBL for 2 years. Walter was formerly a member of U. Lynen's group at GSI. One of his interests while visiting LBL is developing a new multiple sampling ionization chamber (MUSIC) capable of tracking particles in three dimensions.

Howard Wieman has joined the HISS group as technical director. One of his duties is to act as contact for outside collaborators at HISS. Howard was previously employed by GSI in the plastic ball collaboration.

HISS collaborator Douglas Olson has taken a position with the University of California at Riverside. He will, however, continue to reside at LBL and participate in HISS work.

5 Experiments Scheduled for FY 86

Date: (week)	Exp. No.	Title	Group
10/28-11/03 11/4-11/10	690H	Exotic isotopes	INS (Tanihata)
1/13-1/19 1/20-1/26	772H	Proj. Frag. Inklus. Measurements	Kobayashi
3/10-3/16 3/17-3/23	761H	Entropy production	MSU (Westfall)
4/21-4/27 4/28-5/4	684H	Multi-pion correlations	Beavis

PUB-493/11-85/385 Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720. An Equal Opportunity Employer. This work was supported by the U.S. Department of Energy under Contract Number DE-AC03-76SF00098.



Lawrence Berkeley Laboratory

University of California
Berkeley, California 94720
Telephone 415/486-4000

ARC Office
Building 51 Room 208
Telephone 486-5185

November 11, 1985

TO: Bevalac Physical Sciences Users' Organization
FROM: Howard Matis, Bevalac Scientific Liaison Officer

HISS Users' Meeting

A open meeting, for those people wishing information on the HISS Facility, will be held at LBL on December 5, 1985. Please contact Howard Wieman at (415) 486-6953. A copy of the HISS newsletter is enclosed.

General Bevalac Users Meeting

A symposium on Bevalac Physics, sponsored by the Bevalac Physical Science Users Organization, will be held on Friday and Saturday April 18-19, 1986 at LBL. This date has been selected to be convenient for outside users who wish to attend the Quark Matter Meeting at Asilomar (April 13-17, 1986). Groups with interesting Bevalac results are encouraged to send contributed papers to the Users' meeting. If you wish more information about this meeting, please contact Howard Matis at (415) 486-5031.

Workshop on the Nuclear Matter Equation of State

This meeting (April 21-23, 1986) will be held at LBL immediately following the Users' Meeting. An announcement of the workshop is enclosed.

Enclosures