Bevalac Operations Update

February 1991

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We Survived the Tigers, but...

The Bevalac passed the recent Tiger Team assessment with flying colors, thanks to the unremitting effort of countless people over the last several months, pulling miles of cables, sending tons of "valuable" junk to salvage, painting, pushing brooms, writing operating procedures. It is time to look ahead now and plan for doing science again; however, it is not business as usual. The Bevalac survived, but not without changes. There are more procedures to be followed, safety appraisals to be made, training to be gone through. The primary goal is not just to get a task done, but to get it done in a safe manner according to code. If this means a delay in a run because enough time wasn't allotted for making a change in the setup, then the experiment will be delayed. Many of the obvious changes you will find the next time you come to work here are summarized in this newsletter. We will inform you of others as they are forthcoming. Also we will discuss these changes at our "We Survived the Tigers, but..." Users' Information Meeting at the Washington APS meeting. Details are inside. Please join us if you can.

***Peggy McMahan
Bevalac Scientific Users' Liaison***

This work was supported by the Director, Office of Energy Research, Office of High Energy and Nuclear Physics, Division of High Energy Physics, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

Spring/Summer Schedule

As you know, the Bevalac has instituted a schedule this year containing three modes of beamtime: biomed only (6 shifts/wk), nuclear science and biomed core running (the standard night and weekend scenario, 21 shifts/wk), and nuclear science only (21 shifts/wk). Due to Tiger-related safety issues which have impacted the nuclear science programs, we have been in a biomed only period since early December and will continue in that mode until late March. A schedule "dartboard" for FY91 is shown on Page 3. The major experiments to be covered during the remainder of the fiscal year are 938H (Guzik, B42), 848H (Madey, B42), 900H (DLS, B30), and initial tests on the new TPC detector (B42).

Schedule for future proposals

The annual PAC meeting, originally scheduled for June, has been postponed until after the next running period since the nuclear science running has shifted towards the end of the fiscal year. A rough schedule is given below for planning purposes. Actual dates have not yet been set.

<u>Date</u>	<u>Event</u>
Sept. 1	Call for proposals goes out
Nov. 1	Proposals due in ARC office
Early Dec.	(Date to be announced) PAC meeting
Late Dec.	PAC recommendation letters mailed

"We Survived the Tigers, but..."

Come to a

Bevalac Users' Information Session

and Social Hour

at the Washington APS Meeting

Watch for flyers with time and place

Bevalac Research Schedule - FY 1991

FY91 FY90

Nuclear Science Block Running - 21 shifts/wk

Core running - Nuclear Science and Biomed - 21 shifts/wk

Radiotherapy only - 6 shifts/wk

Holiday periods

Scheduled Shutdown periods

Accelerator Update

The Bevalac came up in mid-September with four weeks of block running for DLS followed by two weeks of night and weekend running for Tanihata in B42. Since then, with the exception of a two weekend NASA run after Thanksgiving, we have been running in a radiotherapy-only mode four days/week. It is projected there will be approximately 3000 research hours of operation this fiscal year, with about two-thirds going to nuclear science. Ten weeks of that is block running, a substantial increase over previous years.

Last month a motor winding on the West MG failed; the one that was rewound three years ago. In order to avoid major downtime for this MG, several windings were removed from the generator. It is now back in service with no change in the maximum achievable field.

The SuperHILAC has been shutdown since December and will be coming back up to provide beam for the Bevalac during the April running period.

Status reports of the Bevalac AIP projects are given below:

AIP 90 Control System / Beam Tune Reproducibility

Work is in progress to get the local injector onto the new Bevalac control system. One immediate benefit of the new control systems for experimenters is that the Bevatron control cluster is now linked for two-way data transfer to the Bevalac data acquisition system, allowing one to perform such tasks as monitoring and/or controlling magnets from SUN workstations in the counting areas.

AIP 91 Magnet Power Supply Distribution System Upgrade

This project was added after the pre-Tiger self-assessment process and will upgrade

the magnet power supply distribution system (i.e. cabling) in order to enable the safe delivery of power to the EPB magnets.

AIP 92 Main Magnet Power Supply Enhancements

This project will allow an extension of the duty cycle of the Bevalac from 25% to 80% for lower energy runs (≤ 590 MeV/u for U or 1.4 GeV/u for ions with a charge-to-mass ratio of $1/2$). This will be accomplished by 1) modifying the MG control hardware and timing software to eliminate limitations on the length of the flattop time, 2) installing filter traps to reduce the structure on the magnetic field and thus the extracted beam, and 3) replacing two quadrupoles in the extraction beamline that are limited in their power handling capabilities.

Facilities Update

There have been many changes in the External Particle Beam (EPB) area, mostly related to cleaning up the various power supplies and their peripheral control cables. The worst area, the B30-39-44 power supply area, was powered off until redone. The status of each beamline and its experimental equipment is listed below.

B26

The Streamer Chamber and its beamline were decommissioned during the summer of 1990.

B30

The cabling to the B30-2 and 30-3 magnets is being removed because the area does not meet code and there are no experiments planned there at present. For any future experiments in these areas, the cabling will have to be re-established. The DLS area will be recabled according to code before the scheduled run in August.

B39/Irradiation Station

B39 has been decommissioned. The cave and counting area are being used this spring for tests for Harvey Gould's pair-production experiment. The Irradiation Station has been cleaned up. Power should be restored to the counting area in the next few months and at that point the Irradiation Station will be available again for experiments. Presently it is being used for beam development.

B40

As part of the decommissioning of the Streamer Chamber line, B40 was renovated during the 1990 summer shutdown as a "model" beamline to show the Tigers. NASA calibrations were run there during the month of November.

B42

The power supply area for B42 is being cleaned up and grating installed over the cables. The cave area has been cleaned up and will be in heavy use during the next months.

The Guzik experiment (E938H) to measure fragmentation cross sections in liquid-hydrogen/helium targets, is scheduled to run in early April. Preparations are in progress, including cooling of the HISS magnet.

The main part of the neutron wall for the Kent State triple-differential cross section experiment was installed last summer in the back of the cave, to be left in place through the remainder of their beam time. Cabling needs to be established from the cave to the new counting area in the HISS 1 house.

The south end of the HISS 2 house has been renovated to accommodate the EOS-TPC. They will be using their scheduled test time in May to do trigger tests and will be ready to start assembling the TPC during the summer.

B44

B44 had two experiments scheduled to run this year before the condemnation of the power supply area threw a monkey wrench into things. The cabling will be redone as soon as B30 is complete and the line should be ready to run at the end of this fiscal year or early next fiscal year.

The intermediate-energy group installed a neutron wall built by the Bari group last summer which will be used as a trigger for their fragmentation experiments. As part of this, the large Japanese magnet, not in use any more, was removed, and the scattering chamber was moved upstream 1.2 meters.

The Japanese magnetic moment program is also ready to run once the beamline is finished.

B46

The B46 project is the replacement of the old B26 line with a new high-resolution radioactive beam line, coming off of Channel 1 and connecting to B42. This will allow the Tanihata radioactive beam program to use higher mass beams. The project has been on hold while manpower was diverted to clean-up work. The power supplies are in place and further progress on the beam line will occur as time permits.

Other Facilities

Data Acquisition/Analysis

The BEVAX 1 and 2 computers are being phased out over the next several months, with analysis capabilities removed now and acquisition to be removed after the spring running period. The BEVLAC file server is being phased out as well, replaced by small clusters of local workstations managed by the Computer Center. Data acquisition will take place in the future with front-end tapping off the VME crate and workstations for on-line monitoring.

Russ Wright has moved from the Software Support Group to the Computer Center to work on networking. This reduces the support for Bevalac users to two people, with most of their effort committed to development for the EOS-TPC. There will be a minimum of support for on-going programs, so please consult with Chuck McParland and your beamline coordinator well in advance of your beamtime as to your data acquisition needs.

AppleTalk

A local Macintosh network was installed last summer throughout the EPB area and is available for hooking up Macintoshes and printers. The network connects to the labwide Ethernet through a Kinetics bridge. It allows Macintoshes to be used as terminals, Apple printers for distributed Postscript printers, and access to the automated equipment pool through the Bevalac Macintosh FileServer.

Equipment Pool

The automated equipment pool is in full service now and can be accessed from any Macintosh on AppleTalk through the Bevalac FileServer. An undergraduate student, Matt Smith, maintains the pool.

Any suggestions for modifications to the system should be forwarded to Peggy McMahan or Mel Flores for possible implementation this coming summer. Some requests already received are: i) to allow transfer of modules between users from remote terminals, and ii) to allow searching on a type of module without a model number, e.g., scaler or ADC.

Please note that, at the moment, the procedure for movement of equipment described on page 13 applies also to equipment leaving the pool for other buildings. **You must call E&SHC first.**

Abstracts from Bevalac Experimental Results Published in 1990-91

Ed. Note: If you have some recently published Bevalac work that wasn't included here, it was probably because we didn't have a copy. Please keep us on your mailing lists.
- P. McM

B30

Proton Emission in La + La Collisions at E/A = 138 and 246 MeV

G. Claesson, G. Krebs, J. Miller, G. Roche, L.S. Schroeder, W. Benenson, J. van der Plicht, J.S. Winfield, G. Landaud, J.-F. Gilot, C. Hartnack, and H. Stocker
LBL, MSU, LSU, J.W. Goethe Univ.

Phys. Lett. B251, 23 (1990)

Proton cross sections with associated multiplicities have been measured in $^{139}\text{La} + ^{139}\text{La}$ collisions at $E/A = 138$ and 246 MeV. Data were taken at center of mass angles between 40° and 90° . At both energies the inclusive proton cross section is approximately isotropic over the range of CM angles covered. At $E/A = 246$ MeV the angular distribution of protons depends strongly on the associated multiplicity. We discuss the possibility that hydrodynamic flow of nuclear matter is manifested in the semi-inclusive cross section.

Midrapidity π^-/π^+ Ratios in 1.05 GeV/nucleon $^{40}\text{Ca} + ^{40}\text{Ca}$ Collisions

J.W. Harris, J. Miller, H.G. Pugh, P. Renteln, G. Roche, L.S. Schroeder, R.N. Treuhaft, P.N. Kirk, G. Krebs, R. Brockmann, and K.L. Wolf
LBL, LSU, GSI, Texas A&M

Phys. Rev. C41, 147 (1990)

The π^-/π^+ ratio in 1.05 GeV/nucleon $^{40}\text{Ca} + ^{40}\text{Ca}$ interactions was measured using a magnetic spectrometer system. The ratio was found to be unity over the entire range of measurements covering $\theta_{\text{lab}} = 10^\circ, 20^\circ, 25^\circ, 30^\circ, 65^\circ$, and 90° and laboratory momenta

$100 \leq \text{plab} \leq 350$ MeV/c. The ratios exhibit no visible effect of Coulomb forces from the nuclear charge distributions.

The Dilepton Spectrometer

A. Yegneswaran, S. Beedoe, J. Bystricky, J. Carroll, S. Christo, G. Claesson, P. Force, R. Fulton, J.F. Gilot, J. Gordon, T. Hallman, D.L. Hendrie, G. Igo, P. Kirk, G.F. Krebs, E. Lallier, G. Landaud, A. Letessier-Selvon, L. Madansky, H.S. Matis, D. Miller, T. Mulera, C. Naudet, D. Nesbitt, P. Oillataguerre, G. Roche, L.S. Schroeder, P.A. Seidl, R. Welsh, Z. Wang, and I. Xu
LBL, UCLA, LSU, John Hopkins Univ.,
Univ. de Clermont, Northwestern Univ.

Nucl. Instr. and Meth. A290, 61 (1990)

The dilepton spectrometer (DLS) at Lawrence Berkeley Laboratory's Bevalac has been designed and constructed to investigate the production of electron-positron pairs with low mass and low transverse momentum in proton-nucleus and nucleus-nucleus collisions for incident-beam kinetic energies of 5 AGeV and less. This article briefly recalls the physics objectives of the program, discusses the methodology of the measurement, presents details of the design of the spectrometer and the detector elements, and reports on their performance. Selected experimental results are given to illustrate the capability of the DLS and to demonstrate the level to which it is possible to realize the physics objectives with the spectrometer.

B40

Resonant Transfer and Excitation for U^{90+} Projectiles in Hydrogen

W.G. Graham, K.H. Berkner, E.M. Bernstein, M.W. Clark, B. Feinberg, M.A. McMahan, T.J. Morgan, W. Rathbun, A.S. Schlacter, and J.A. Tanis
Queen's University, LBL, Western Mich. Univ., LLNL, Westlayan Univ.

Phys. Rev. Lett. 65, 2773 (1990)

Resonant transfer and excitation (RTE), resulting from simultaneous electron capture and K-shell excitation in a single collision, has been measured for 97-150 MeV/u U^{90+} ions in hydrogen. Distinct maxima, attributed to RTE contributions from the formation of intermediate excited states, were observed superimposed on a monotonically decreasing background due to single-electron capture. This measurement, the first for a very heavy projectile, provides a test of relativistic dielectronic-recombination theory.

Electron-Electron Interaction in Projectile Electron Loss

H.-P. Huelskotter, B. Feinberg, W.E. Meyerhof, A. Belkacem, J.R. Alonso, L. Blumenfeld, E.A. Dillard, H. Gould, N. Guardala, G.F. Krebs, M.A. McMahan, M.E. Rhoades-Brown, B.S. Rude, J. Schweppe, D.W. Spooner, K. Street, P. Thieberger, and H.E. Wegner
Stanford Univ., LBL, BNL, Berkeley High

to be published, Phys. Rev. A, 1991

In ion-atom collisions where the projectile is ionized, target electrons act not only coherently by screening the target nucleus but they may also act incoherently by directly ejecting a projectile electron. This electron-electron interaction should be relatively most important for targets which have a low nuclear charge, since the cross section for a neutral target is roughly proportional to $Z_t^2 + Z_p$, where Z_t^2 is the contribution due to the target nucleus and Z_p comes from the target electrons. In order to investigate the electron-electron interaction, we have measured and calculated cross sections for Li^{2+} , C^{5+} , and O^{7+} on H_2 and He, and U^{90+} on H_2 . The collision energies range from 0.75 to 405 MeV/N. The calculations have been performed in the plane-wave Born approximation. We demonstrate that for energies where the target electrons have sufficient kinetic energy in the projectile frame to ionize the projectile, the electron-electron interaction can lead to a significant increase in the total electron loss cross section.

Determination of the Cross Sections for the Production of Fragments from Relativistic Nucleus-Nucleus Interactions.

I. Measurements

J.R. Cummings, W.R. Binns, T.L. Garrard, M.H. Israel, J. Klarmann, E.C. Stone, and C.J. Waddington
Univ. of Minnesota, Washington Univ., Cal Tech.

Phys. Rev. C42, 2508 (1990)

Relativistic iron, lanthanum, holmium, and gold projectile nuclei with several different energies have been fragmented in targets of polyethylene, carbon, aluminum, copper, and lead. Our detectors cleanly resolve the individual charges of the heaviest of these fragments and provide some limited information on the masses. We have measured 1256 elemental partial cross sections for the production of fragments from interactions in these target materials. Values have been derived for another 417 cross sections in a hydrogen medium. These cross sections depend on the energy and mass of the projectile nuclei as well as on the nature of the target. Total charge-changing cross sections were also found, but only in a composite target, and have been shown to be weakly dependent on energy. The mean mass losses observed for fragments that have lost a few protons show that typically many neutrons are lost with each proton, producing fragment nuclei that must be highly proton rich, and consequently very unstable. The cross sections for charge pickup on heavy targets show a rapid increase with decreasing energy, particularly for the heaviest targets. The systematics of the dependencies of the partial cross sections will be discussed in a companion paper.

Total Charge and Mass Changing Cross Sections of Relativistic Nuclei in Hydrogen, Helium, and Carbon Targets

W.R. Webber, J.C. Kish, and D.A. Schrier
Univ. of New Hampshire

Phys. Rev. C41, 547 (1990)

This is the first in a series of papers describing the results of a systematic study of total, elemental, and isotopic cross sections measured in hydrogen, helium, and carbon targets. These fragmentation studies are based on measurements using 42 beams of 12 separate nuclei for ^{12}C to ^{58}Ni . This has resulted in the measurement of more than 100 secondary elemental cross sections and over 300 secondary isotopic cross sections in addition to the total charge changing and mass changing cross sections reported in this paper. These measurements have been made at energies from 300 to 1700 MeV/nucleon and include ten separate energies for ^{56}Fe , for example. The measurements have been made with the objective of interpreting the production of secondary nuclei during cosmic-ray propagation in the galaxy in order to better estimate the source elemental and isotopic composition of cosmic rays. At the same time they provide a valuable data base for nuclear physics and the understanding of peripheral interactions of energetic heavy nuclei. In the work reported in this paper ~100 total charge changing and mass changing cross sections have been measured for various targets and energies. The mass changing cross sections we measure are found to agree with earlier cross section measurements using energetic protons incident on targets composed of heavier elements to within ~2% in cases where comparisons can be made. The systematics of this new data set are described and a new, more accurate cross section formula is presented and discussed.

B42

Inclusive Neutron Cross Sections at Forward Angles from Nb-Nb and Au-Au Collisions at 800 MeV/nucleon.

R. Madey, W.M. Zhang, B.D. Anderson, A.R. Baldwin, M. Elaasar, B.S. Flanders, D. Keane, W. Pairsuwan, J. Varga, J.W. Watson, G.D. Westfall, C. Hartnack, H. Stocker, K. Frankel
Kent State Univ., MSU, J.W. Goethe Univ., LBL

Phys. Rev. C42, 1068 (1990)

Inclusive neutron spectra were measured at 0° , 4° , 8° , 15° , 30° , and 42° from Nb-Nb and Au-Au collisions at 800 MeV/nucleon. A peak that originates from neutron evaporation from the projectile appears in the spectra at angles out to 8° . The shapes and magnitudes of the spectra are compared with those calculated from models of nucleus-nucleus collisions. The differential cross sections for Au-Au collisions are about four times those for Nb-Nb collisions. The predictions of the Vlasov-Uehling-Uhlenbeck (VUU) and QMD theories agree with the angular distributions of the differential cross sections except at small angles; the VUU prediction overestimates the angular distributions from a few degrees to about 20° , whereas the QMD prediction underestimates the angular distributions from about 8° . The Firestreak-model overestimates the angular distribution for Nb-Nb collisions and underestimates it for Au-Au collisions. Also, the VUU and QMD models agree with the measured double differential cross sections in more angular and energy regions than the Firestreak and intranuclear cascade models; however, none of the models can account for

Onset of Flow of Charged Fragments in Au-Au Collisions

W.M. Zhang, R. Madey, M. Elaasar, J. Schambach, D. Keane, B.D. Anderson, A.R. Baldwin, J. Cogar, J.W. Watson, G.D. Westfall, G. Krebs, and H. Wieman
Kent State Univ., MSU, LBL

Phys. Rev. C42, R491 (1990)

The reaction plane of high-multiplicity Au-Au collisions at 650, 400, 250, 150, and 75 MeV/nucleon was determined by measuring the transverse velocity of charged fragments.

Measurements of the collective flow of charged fragments reveal that the onset of flow in high-multiplicity Au-Au collisions occurs at a finite beam energy below 60 MeV/nucleon.

B43

Squeeze-Out of Nuclear Matter as a Function of Projectile Energy and Mass

H.H. Gutbrod, K.H. Kampert, B. Kolb, A.M. Poskanzer, H.G. Ritter, R. Schicker, and H.R. Schmidt

GSI, Univ. of Munster, LBL

Phys. Rev. C42, 640 (1990)

Squeeze-out, a component of the collective flow of nuclear matter, is the preferential emission of particles out of the reaction plane. Using the sphericity method the out-of-plane/in-plane ratio of the kinetic energy flow has been analyzed as a function of multiplicity and beam energy for Ca+Ca, Nb+Nb, and Au+Au collisions measured with the Plastic Ball detector at the Bevalac. Also, azimuthal distribution of the particles around the flow axis are presented together with the extracted out-of-plane/in-plane ratios. Finally, the rapidity dependence of the out-of-plane/in-plane ratio has been investigated with a new method using the transverse momentum components of the particles.

Multifragment Events from Heavy-Ion Collisions: Sources and Excitation Functions

Y. Blumenfeld, N. Colonna, P. Roussel-Chomaz, D.N. Delis, K. Hanold, J.C. Meng, G.F. Peaslee, Q.C. Sui, G.J. Wozniak, L.G. Moretto, B. Libby, A. C. Mignerey, G. Guarino, N. Santoruvo, and I. Iori
LBL, Univ. of Maryland, INFN Bari, Univ. di Milano

Phys. Rev. Lett. **66**, 576 (1991)

Multifragment events from 35, 40, 45, and 55 MeV/nucleon $^{139}\text{La} + ^{12}\text{C}$, ^{27}Al , ^{40}Ca , ^{51}V , ^{nat}Cu , and ^{139}La reactions can be assigned to sources characterized by their velocity. At each bombarding energy, the probabilities of threefold, fourfold, and fivefold events increase substantially with decreasing source velocity, but are independent of the target mass. To remove the bombarding-energy dependence, a simple transformation has been applied which gives the excitation energy of the fused system in the simple incomplete-fusion model picture. These "excitation functions" appear to be independent of both the system and bombarding energy.

Equilibrium and Non-equilibrium Complex Fragment Emission in 50-100 MeV/u $^{139}\text{La} + ^{12}\text{C}$ Reactions

D.R. Bowman, G.F. Peaslee, N. Colonna, R.J. Charity, M.A. McMahan, D. Delis, H. Fan, K. Jing, G.J. Wozniak, L.G. Moretto, W.L. Kehoe, B. Libby, A.C. Mignerey, A. Moroni, S. Angius, I. Iori, A. Pantaleo, and G. Guarino
LBL, Univ. of Maryland, Univ. di Milano, INFN Bari

to be published in *Nucl. Phys. A*, 1991

Complex fragment emission ($Z > 2$) has been studied in the reactions of 50, 80, and 100 MeV/u $^{139}\text{La} + ^{12}\text{C}$. Charge, angle, and energy distributions were measured inclusively and in coincidence with other complex fragments, and were used to extract the source rapidities, velocity distributions, and cross sections. The binary signature of the coincidence events and the sharpness of the ve-

locity distributions illustrate the primarily 2-body nature of these reactions. Calculations based on statistical compound nucleus decay have been compared with experimental data.

The emission velocities, angular distributions, and absolute cross sections of fragments of $20 \leq Z \leq 35$ at 50 MeV/u, $19 \leq Z \leq 28$ at 80 MeV/u, and $17 \leq Z \leq 21$ at 100 MeV/u are consistent with the binary decay of compound nuclei formed in incomplete fusion reactions in which the ^{139}La projectile picks up about one-half of the ^{12}C target. At 80 and 100 MeV/u, statistical model calculations are also able to reproduce the isotropic portion of the cross section for lighter and heavier fragments. However, a significant fraction of the total cross section for these fragments is due to non-equilibrium emission. Although the emission process is still mainly binary, and the relative velocity between the fragments is determined by their mutual Coulomb repulsion, the anisotropic angular distributions and the magnitudes of the absolute yields are incompatible with standard compound-nucleus statistical decay.

Response of a Prototype Module of a Neutron-Multiplicity Calorimeter

A. Pantaleo, L. Fiore, G. Guarino, V. Patitichio, G. D'Erasmo, E.M. Fiore, N. Colonna, G.J. Wozniak, and L.G. Moretto
INFN Bari, Univ. di Bari, LBL

Nucl. Instr. and Meth. **A286**, 250 (1990)

The performance of a prototype module of a calorimeter for the measurement of the neutron multiplicity associated with reverse-kinematic heavy-ion reactions has been tested with 14 MeV neutrons. Its response was well reproduced by Monte Carlo (MC) calculations. Utilizing the experimental response, the detection of "groups" of mono-kinetic neutrons with known multiplicity has been simulated. These simulated results compare favourably with the MC calculations and show little sensitivity to the details of the response function at the lowest amplitudes, where possible noise could arise. A new neutron γ -ray discrimination technique has been successfully used to identify neutrons from 50 and 80 MeV/nucleon heavy-ion induced reactions at the Bevalac.

Procedural Changes

This section is not a formal documentation of procedures, but is designed to let you know what is different and what you need to do to get tasks done, from the point your experiment is approved to when you ship your equipment back home. Some of these procedures are still in a state of flux, so expect some changes, and the most important thing to remember is: Allow plenty of time!

Getting on the long-range Schedule

An approved experiment will now have to pass two levels of formal safety reviews before it is run. This was done informally in the past. In the future, when you receive a letter from LBL management approving a Bevalac experiment, it will contain a statement to the effect that a formal safety inspection has to be made before the experiment can be run. It will also include a form called the *Bevalac Initial Safety Checklist*. A sample copy of this is on Page 16. The form must be filled out and returned before being considered for inclusion on the schedule. The two purposes of this form are i) to identify potential safety problems well in advance and ii) to designate a person from the collaboration as the group safety coordinator. This person will be responsible for working with the beamline coordinator on all aspects of the safety of the experiment, from getting the proper inspection to writing relevant Operational Safety Procedures (OSP), (which list the hazards associated with a item of equipment and their mitigations), to making sure everyone in the group is properly trained. The group safety coordinator and the beamline coordinator together will go through the safety checklist and identify potential problems. They will also inform representatives of the Environmental & Safety Hazards Control Department (E&SHC) of any anticipated radiation hazards. The experiment can then be considered for inclusion in the long-range schedule. The *Initial Safety Checklist* should be returned as soon as possible af-

ter beam time is approved, but at least six months before you hope to run for small experiments, twelve months for larger ones.

Getting Started

Radiation Safety Training

The radiation training required to come in to run an experiment as a participating guest now consists of a 1½ hour video and a written exam. A portion of the training must be repeated at two year intervals. To make this procedure less time-consuming, we are offering to mail the video and the test to the various institutions involved in a collaboration. The completed test and video can either be mailed back in advance or brought in when arriving at the laboratory. Participating guest paperwork can be requested in advance as well for new participants. Requests should be made to the beamline coordinator or the ARC office at least one month prior to arriving.

Access to the Bevalac

Once you arrive on site, you will need to make your first stop the Accelerator Research Coordination (ARC) office or the Main Control Room (MCR) (after hours and weekends). There you can get your film badge and a key to the building. **If you expect to arrive off hours, it is very important that you make arrangements ahead of time.** A new fence has been erected around the Bevalac complex defining a "Controlled Area for Radiation Protection." The fence and the locked doors limit access to Buildings 51, 51 Annex, EPB Hall, 64 high bay and 71 (west). The primary purpose of the fence is to limit access by visitors to the "Radiation Areas" posted at the Bevalac.

If you have a visitor while you're working on site, they need to be escorted, get a dosimeter, and avoid or minimize time spent in "Radiation Areas". Children under 18

years are not allowed in the controlled area.

If you need to provide access for a repairman, they do not need a dosimeter if they are on site for a limited time, unless they are working in a "Radiation Area". If they are not a laboratory employee, they will, however, need to be escorted. They also need a map delineating the radiation areas to avoid, available from the ARC office or MCR.

Getting your experiment on the air

There are other changes in policies and procedures which you may find frustrating if you are strapped for time. Here's a list of some of the major ones. Be forewarned.

Other Training

There are numerous other aspects of life at the Bevalac that now require some form of training. Some of this is on-the-job training which can be handled quickly by your group safety coordinator. Other will require arranging a more formal session. Some examples of training which have come up recently are listed here. The list is sure to grow.

Shop Safety - Required before using the machine shop. Does not cover lathes or milling machines. Given by Bob Aita.

Radioactive Sources - Required before using radioactive sources. Given by E&SHC. See your beamline coordinator.

Beamline Search and Secure - Run-through of the procedure for maintaining a searched and secure cave. Given by your beamline coordinator or group safety coordinator.

Laser Safety - Any user of a Class 3 or 4 laser must have proper training through E&SHC.

OSPs

According to the LBL Health and Safety Manual, Pub-3000, Operational Safety Procedures, or OSPs, must be written for

any piece of equipment or activity for which one of the following could potentially occur: 1) serious personal injury, illness, or death, 2) significant adverse environmental consequences, 3) substantial equipment or facility damage, or 4) significant disruptions to the research program. Examples of equipment requiring OSPs are liquid-hydrogen targets, flammable gas systems, cryogenic equipment, or high-pressure equipment. The need for one or more OSPs should be determined in the initial safety check and considered in the design phase of the experiment. Existing OSPs must be updated for each run. The beamline coordinator and the group safety coordinator should work together on any needed OSPs.

Safety Review

A formal safety review will take place after the experiment is set up and in place and before the operations staff is given permission to tune beam. The safety review consists of a mechanical, electrical, and operational safety inspection sheet signed off by designated members of the Bevalac Safety Committee, the beamline coordinator, the group safety coordinator, and the Section leaders for Research Coordination and Operations. It would be advisable to have the experimental set up in place several days ahead of the time beam is scheduled in order to obtain the appropriate signatures. Changes made after the safety review is complete will have to be re-inspected. A copy of this *Experiment Safety Review* form is shown on Page 17.

Chemicals and Gases - Acquisition, Storage and Disposal

Chemicals that are hazardous to health or the environment are controlled items and must be obtained through the Plant & Maintenance Technicians (PMT) Supervisor, Bob Berninzoni. Other common chemicals such as epoxy, are readily available, but special care should be taken on disposal.

There are strict rules for the storage of chemicals and gases. Flammable chemicals must be stored in a flammable chemical locker. There is one for users located in the B26 counting area. Radioactive sources need to be stored in labelled locked areas. There are two special safes for users located in the B26 and the B44 counting areas. Gas bottles not in use cannot be stored inside, and there is a strict limit to the number of flammable gas cylinders that can be stored outside the Bevalac. **All orders for gas must go through Bob Berninzoni.** Also, all chemicals stored in the building must be inventoried annually for the city of Berkeley, so the area safety coordinator **must** have a key to any locked storage cabinets you have.

To dispose of chemicals, you must have a MSDS (Material Safety Data Sheet) for the chemical, which provides a legal "Right to Know" of its environmental and health hazards. Then obtain a disposal form from Bob Berninzoni and arrangements can be made for the chemicals to be picked up. **Do not dispose of chemicals in the trash, salvage, or down the drain.**

Getting home

The first order of business when a run is complete is usually the end-of-run party. This has changed, too - **No Alcohol!** (This not only applies to the end-of-run party but to the hill in general. Don't bring in beer when you're on shift.) This regulation was always around but is now being strictly enforced.

The second order of business is shipping your equipment home. This is more complicated now, because the regulations state that **no equipment** can leave a controlled area (i.e. the Bevalac) without being monitored by personnel from E&SHC. If you call transportation, they will insist on this, but even if you transport things in your car or carry them across the street to Building 50, they must have been monitored and tagged by a qualified person. See your beamline coordinator for details, as these procedures are presently being reviewed.

Where to Find Safety Material

Pub-3000 - LBL's Health and Safety Policy Manual

- 1) On-line on CSA computer system
- 2) All counting areas
- 3) MCR
- 4) ARC Office

MSDSs - Material Safety Data Sheets

- 1) On-line on CSA3 computer system (log on and type MSDS)
- 2) ARC office
- 3) B26 shack for chemicals stored there

OSPs - Operational Safety Procedures for Accelerator or Equipment

- 1) MCR
- 2) on file in ARC office
- 3) for experimental equipment, in beamline and/or counting area

Bevaiac Organization Chart

BF - Organization -
2/91

Committees

Area Safety Coordinators

Report any safety problems you see to the following persons depending on area. They can also answer questions concerning safety and code issues, or direct you to someone who can.

B30	Gary Krebs
B39	Peggy McMahan
B40	Mel Flores
B42	Jim Brannigan
B44	Peggy McMahan
B26 House	Mel Flores
Equip. Pool	Gary Krebs
Staging Area	Peggy McMahan
51L (VAX house)	Peggy McMahan
Irradiation Stat.	Harvey Syversrud

Bevalac Users' Executive Committee

Elected Members

Paul Brady	UC Davis
Jim Carroll	UCLA
Declan Keane	Kent State
Alice Mignerey	U. Maryland
Doug Olson	LBL
Rolf Scharenberg, Chair	Purdue
Kenneth Toth	Oak Ridge

Ex-Officio Members

Jose Alonso	AFRD
Klaus Berkner	AFRD
Ben Feinberg	Bevalac
Gary Krebs	Bevalac
Fred Lothrop	Bevalac
Peggy McMahan	Bevalac
Lee Schroeder	NSD
James Symons	NSD

Bevalac Safety Committee

Robert Aita	Mech. Tech.
Bob Berninzoni	MM
Gerd Behrsing	Mech
Warren Faust	MG
Benedict Feinberg	Chair
Mel Flores	Users
Jack Henderson	Elect
Gudrun Kleist	EM
Tim Renner	Biomed
Bob Stevenson	Admin.
Harvey Syversrud	Oper.
Oliver Wiggins	Riggers
Emery Zajec	R&D

Bevalac Program Advisory Committee

Sheldon Datz	Oak Ridge
Konrad Gelbke	MSU
Albert Goldhaber	Stony Brook
Miklos Gyulassy	LBL
Walter Henning	GS
Frank Plasil	Oak Ridge
Vic Viola, Chair	Indiana

Ex-Officio Members

Peggy McMahan, Executive Secretary
Rolf Scharenberg, BPSUEC Repr.
Lee Schroeder, Bevalac Scient. Director

INITIAL SAFETY CHECK FOR BEVALAC USERS

Before your experiment can be scheduled, you must fill out and return to the Bevalac Accelerator Research Coordination Office the following preliminary safety check list. The Principal Investigator of your group must designate a Group Safety Coordinator. The Bevalac Beam Line Coordinator, as designated in the PAC approval letter, will work with your Group Safety Coordinator and develop a plan for the safe conduct of the experiment. The Bevalac Safety Committee will review the plans and participate in a final review of the setup prior to run-time.

Date:	Experiment No.		
Principal Investigator:			
Group Safety Coordinator:			
Beamline Coordinator:			
QUESTIONS	ANSWERS		
1) What gases do you intend to use in your apparatus??	_____		
2) Will your apparatus utilize:	_____		
2.a high pressure or vacuum vessels?	_____		
2.b cryogenic systems?	_____		
3) If you intend to use a radioactive source during the course of your experiment, complete the following: (Notice: DOE Regulations require documented training for all users of radioactive sources.)	Isotope: _____ Radiation emitted: _____ Activity: _____ Ownership: _____		
4) Will you require high voltage to operate your experimental apparatus? Voltage levels used:	_____ _____		
5) Do you anticipate using any toxic substances or hazardous chemicals in your experimental set-up?	_____		
6) Do you anticipate requiring special mechanical or rigging support for your apparatus??	_____		
7) Do you expect any part of your apparatus to become radioactive during the course of your experiment?	_____		
FOR BEAMLINE COORDINATOR ONLY:			
8) The experimental setup has been reviewed and meets the safety codes and regulations as outlined in Pub. 3000			
SIGNATURE _____		DATE _____	

EXPERIMENT SAFETY REVIEW

Before beam is tuned for your experiment, the final experimental set-up must be inspected and this sheet signed and filed in the MCR and the ARC office, along with any necessary OSPs. If any modifications are made to the setup after this inspection, it must be reinspected by the appropriate parties and an addendum attached.

Dates of Run:	Experiment No:
Principal Investigator:	Beamline:
Group Safety Coordinator:	Beamline Coordinator:
Description of Experimental Apparatus: (attach sheet if not enough space)	
List of attached OSPs:	List of Experimenters: (Attach sheet if not enough space)
<p><i>This apparatus meets all mechanical and fire health and safety requirements:</i></p> <p style="text-align: center;"> ☒ _____ Date _____ (Signature of Mechanical Representative of Bevalac Safety Committee) </p>	
<p><i>This apparatus meets all electrical health and safety requirements:</i></p> <p style="text-align: center;"> ☒ _____ Date _____ (Signature of Electrical Representative of Bevalac Safety Committee) </p>	
<p><i>This apparatus and beamline meet all operational health and safety requirements and the proper procedures are in place:</i></p> <p style="text-align: center;"> ☒ _____ Date _____ (Signature of Operational Representative of Bevalac Safety Committee) or the Operations Section Leader </p>	
<p><i>All experimenters who will operate this experimental apparatus and beamline have had the necessary training:</i></p> <p style="text-align: center;"> ☒ _____ ☒ _____ (Signature of Group Safety Coordinator) (Signature of Principal Investigator) </p>	
<p><i>To our best knowledge, all the mechanical, electrical, and operational requirements for this experimental setup have been met and all the experimenters have had the proper on-the-job training for using the equipment.</i></p> <p style="text-align: center;"> ☒ _____ ☒ _____ (Signature of Beamline Coordinator) (Signature of Research Coordination Section Leader) </p>	

Useful Phone Numbers

Phone numbers, addresses, and bitnet addresses where available are listed below for many of the persons and groups mentioned in this newsletter. The phone prefix is (415)-486-xxxx or from FTS, 451-xxxx. 5 digit numbers beginning with 3- are for internal LBL use only.

<u>Name</u>	<u>Phone</u>	<u>Office</u>	<u>What to Call For</u>	<u>BITNET</u> (@LBL)
Emergency (on-site)	x7911		any on-site emergency	
Environmental & Safety Hazards Control (E&SHC)				
	x5251		general number	
Ken Biscay	x7606	75B-113	monitoring of equipment	
Pager:	19-272-319			
Rick Donahue	x5255	75B-112	radiation physicist	
Roger Kloepping	x5251	75B-121	radiation physicist	
Jim Haley	x7603	75B-116	radioactive sources	
Bevalac				
	x5575		general paging - B51	
	x6471		general paging - B71	
ARC Office	x5185		paperwork, access	
FAX	x7285			
B26 Shack	x6195			
B30 Cave	x3-1294			
B30 Shack (DLS)	x5240			
B30 Shack (30-2/3)	x6196			
B39 Shack	x5791			
B40 Cave	x3-1253			
B40 Shack A	x5243			
B40 Shack B	x7718			
B44 Cave	x3-1291			
B44 Shack	x5592			
EM Shop	x5373	51-16		
MCR	x3-1240	51-22		
Ben Feinberg	x7725	51-208	operations manager	FEINBERG
Lee Schroeder	x7308	70-316	scientific director	LSS
Peggy McMahan	x5980	51-208	users' liaison,	MCMAHAN
			B44, B39, pool	
Fred Lothrop	x7726	51-208	scheduling	BEVOPS
Gary Krebs	x7727	51-208	EPB, riggers, B30	G_KREBS
Mel Flores	x5243	B40 shack	B40, pool	
Jim Brannigan	x7005	64-203	B42, HISS	
Harvey Syvesrud	x5578	51-200D	accel. operations	
Bob Aita	x7715	51-12	mech. technicians	
Jack Henderson	x4801	64-215	electrical	
Bob Berninzoni	x5387	51-17	chemicals, gases, maint. machinists	
Computer/Network Support				
Chuck McParland	x6956	70-305	VME code, problems	MCPARLAND
Eugene Yee	x6965	70-315	Bevax, BEVLAC	SYSTEM@ BEVAX
RTSS	x6411		Computer Hardware	
Ken Woolfe	x7739	64-205	AppleTalk	