THE PULSE

For the Personnel of the Laboratory for Nuclear Science

Volume 4 Number 2 ********** April 1996

The Pulse may now be viewed on the World Wide Web at location: http://mitlns.mit.edu/~elsye/pulse.html

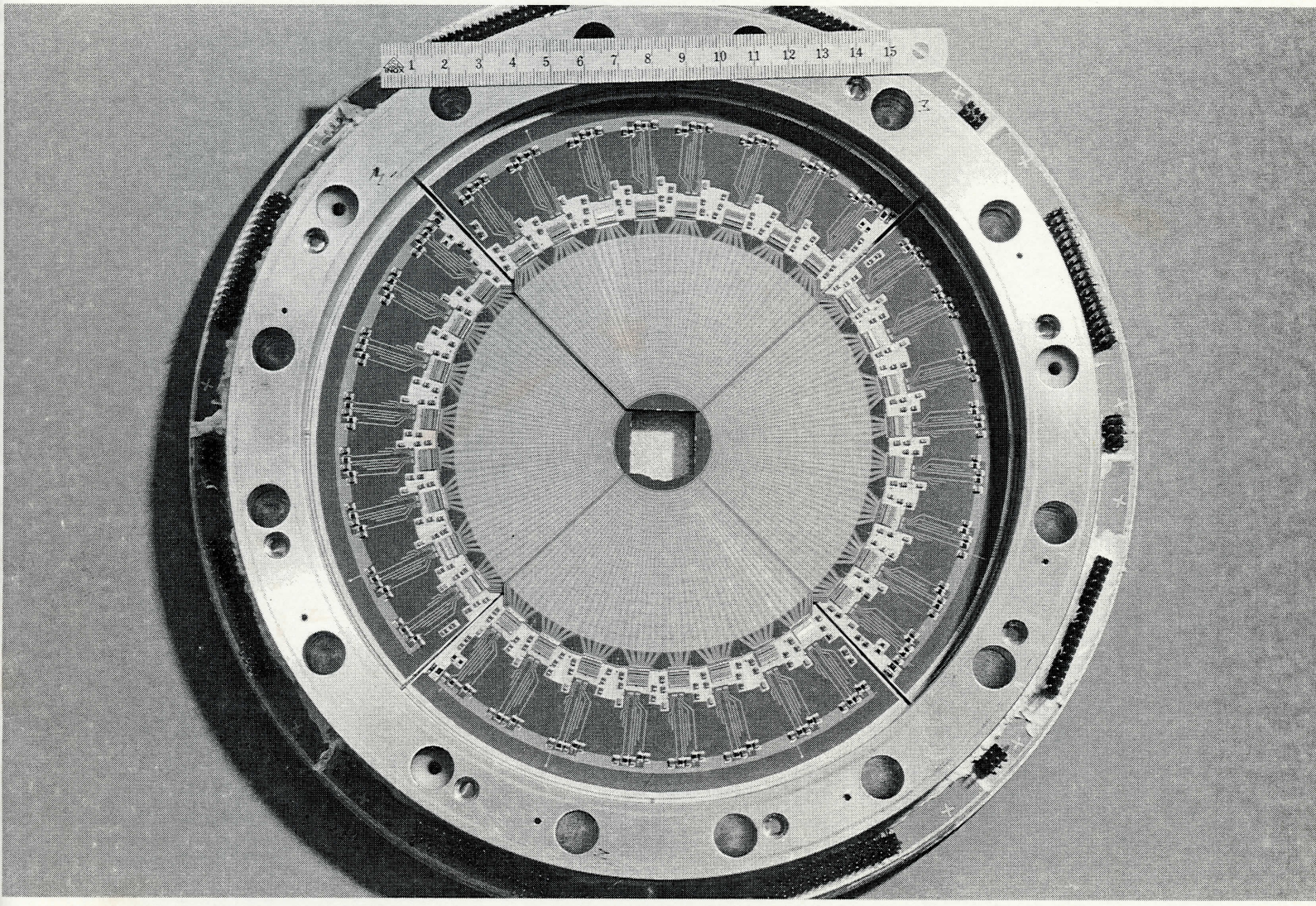


Photo courtesy of Peter Berges

Silicon Pad Multiplicity Detector for WA98 Experiment at CERN
Front page photograph

The detector uses a silicon sensor to detect charged particles produced in heavy ion collisions. The annular sensor, 300μm thick, carries some 4,000 pads and is composed of four quadrant subassemblies. A novel feature of the sensor design is its use of integrated circuit-like processes to form ultra-thin metal traces connecting the internal sensor pads to bonding pads at the periphery: this minimizes the mass of the detector and makes the sensor easier to fabricate and assemble.

The silicon sensors were designed and produced by the National Central University, Taiwan. The front-end electronics and packaging, including the readout system, were designed, assembled and tested by the **LNS Electronics Facility** and the **Heavy Ion Group**. It took about one year to build and install the complete detector.

The detector was fully operational during the lead beam run at CERN in November, December 1995, and the data is now being analyzed for indications of new phenomena in lead-lead collisions at 160GeV/nucleon.

For more information on WA98 [www.cern.ch/WA98/welcome.html]

In this Issue

LNS VMS Computers to be a Single Cluster

On Monday, April 22, 1996 at 9 AM the LNS Computer Group will merge the existing VAX VMS and the ALPHA VMS into a single VMS cluster with a reboot of both of the existing clusters. The earlier requirement for the separation of the ALPHA architecture and the VAX architecture have been removed to take advantage of resource sharing.

Preparation for this has included a test merge of the Heavy Ion Group Vaxes with the LNS Alpha machines. The cluster reboot will add the remaining LNS Vaxes to the the alpha cluster.

The VAX cluster has many workstations, but most users are familiar with only IRENE and SAKRAI as boot nodes for the other computers. If you would like to see the other machines, use the command SHOW CLUSTER.

Most users will not notice the change except for the increased number of machines and disks that are visible. The HIG has already experienced the needed changes to ensure mail delivery, correct home directory, user ids and such.

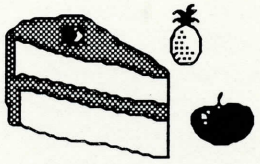
For further information on the merge, view the web page http://mitlns.mit.edu/~dsw/merger/.

If you still have questions or concerns, please send email to SYSTEM.

Bob Bruen
Manager
LNS Computing Facilities

Recipes from IAP International Lunch

CHEESE CAKE



1C Graham Crackers
4 EGGS

3 Tbsp. Sugar
1 C Sour Cream
3 Tbsp. Melted Butter
1 Tbsp.. Vanilla
4 8 oz. Pkg. Cream Cheese
1 21 oz. Can Cherry Pie Filling
1C Sugar
3 Tbsp. Floor

Combine Crumbs, sugar and butter. Press into bottom of 9" springform pan. Bake @ 325 for 10 minutes. Combine cream cheese, sugar and flour until well blended. Add eggs one at a time, mixing well after each addition. Blend in sour cream and vanilla. Pour over crust. Bake @ 450 for 10 minutes. Reduce to 250 and continue baking for 1 hour. Chill, top with cherry pie filling or any of your favorite toppings.

Submitted by
Mary Hogan

CINNAMON RAISIN BREAD

1 Bread Machine
Butter or veg. Oil
1 Pkg. Old Fashion Cinnamon Raisin Bread Machine Mix
10 oz. Water (room Temp.)

1) Add contents to dispenser
2) Add required amount of Butter or Vegetable oil
3) Add water
4) Add pkg. of yeast
5) Set timer according to directions
6) Turn on machine.

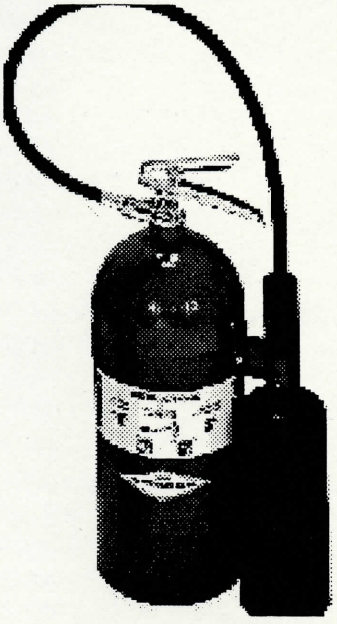
This bread is fat free, has no cholesterol and is all natural.

Submitted by
Al Beatrice

Thanks to Cheryl Cagnina for organizing this event.

Bottom Line
Do You Know Where the Fire Extinguishers Are?

In light of the recent electrical fire on the fifth floor of Bldg 26, Elsye Luc and Jeanne Hillery began to wonder about fire safety procedures for LNS and other occupants of Bldg. 26. After looking for fire extinguishers and/or any fire alarm boxes, we found three fire extinguishers in the xerox room and another in a corner of 26-516. We had several questions regarding fire safety in general. Is there an evacuation plan in case of fire? Does each department have a meeting place somewhere outside to account for all members? Why aren't the fire extinguishers in the hallways and more clearly marked? Does anyone know how to work a fire extinguisher? What are MIT's reporting requirements for fires?



Building 26 is a multi-use building with offices, classrooms and laboratories. Employees spend at least forty hours each week at work - we should have some knowledge of fire safety procedures in the event of fire or any other emergency. A little education today could prevent an emergency tomorrow.

Jeanne Hillery

Bottom Line is an opportunity for you to share your issues, questions, points of view and opinions with the LNS community. *Pulse reserves the right to edit articles and to refuse articles deemed inappropriate.*

Research Firsts

1951 – Martin Deutsch discovers positronium, an atomic system composed of a bound electron and positron. This discovery leads to many important applications in condensed matter physics, biology, and medicine.

Prepared by the MIT Office of Communications, 1987

What's New at Bates
Adapted from Status Report January 8, 1996

Overview

During the first quarter of FY96 the main activity was the commissioning of the South Hall Ring. The most important objective was to demonstrate high duty factor extraction. Other objectives included storage of a polarized beam and R&D efforts connected with development of a polarimeter for stored beams. The SHR runs started on October 12, 1995 at an energy of 370 MeV and injected peak currents of ~ 10 mA.

After all the necessary adjustments were made, the beam was extracted successfully from the SHR and transmitted to the B-Line target chamber. The duty factor was estimated from the secondary emission monitor signals. Optimizing for a 1.6 ms spill period, the duty factor was observed to be in the tens of percent range. This was encouraging for the first run with extracted beams. Implementation of an on-line duty factor monitor with appropriate resolving times will begin for the next SHR run.

Following the extraction studies, operation of the SHR was converted to storage mode. Polarized electrons were injected into the ring for the first time and stored for a known number of turns. The polarization vector was in the horizontal plane and precessed as the electrons circulated the SHR. After kicking the beam out of the ring, the electron polarization was measured using the B-Line Moeller polarimeter. Thus, the spin was followed for thousands of turns, and the frequency of the spin precession was very precisely measured. The spin precession in a circular accelerator depends only on the electron energy and fundamental constants. Using this technique, the stored beam energy was measured to better than one part in 10,000. This is undoubtedly the most precise measurement of an electron beam energy in a nuclear physics accelerator. Excellent knowledge of the beam energy will be particularly important for many of the experiments now underway at Bates, Mainz and CEBAF.

These first measurements with polarized beams in the SHR were encouraging. They demonstrated that the spin lifetime was excellent for storage times of several ms. In order to maintain longitudinal polarization in the ring for both stored and extracted beams, a Siberian Snake system has been designed and is being constructed in Novosibirsk. The present schedule calls for the device to be completed and ready for acceptance tests at Novosibirsk soon.

Progress was made in understanding, in greater detail, the operation of the SHR during these commissioning runs. Two or three such extended runs will be needed to fully characterize the SHR. At that time, it would be available for physics. It is likely that the upcoming OOPS experiments would be the first to use the SHR. Operation with polarized beams would probably not occur until FY97. Optimistically, the Siberian Snake could be installed during a shutdown next summer.

Accelerator Upgrade

A program of accelerator upgrade activities has been underway for more than a year. The main goal is to improve reliability and beam availability. All of the necessary hardware for this first phase of the planned improvements is now in-hand. The highest priority activities during the shutdown will be to install this hardware, carry out preventive maintenance, and bring the accelerator to full operational status.

The activities which are now in various stages of being completed include:

- installation of new high-power RF windows at the klystrons;
- installation of new load assemblies (elbow, window, directional couplers, loads) on the centerline accelerator waveguide sections;
- installation of new vacuum pumps at the RF windows;
- installation of vacuum pumps at all the RF hybrids;
- installation of new isolation valves on the linac centerline;
- installation of a fully refurbished and instrumented injection chicane;
- installation of new NIKHEF beam position monitors along the linac centerline;
- installation of 20 recirculator dipoles and output chicane dipoles with greater vertical aperture, and a collimation system;
- reconfiguration of the ECS chicane with collimation system for high peak current non-recirculator operation;
- realignment of recirculator quads, some centerline quads and wire lute assemblies;
- installation of new Panofsky-type recirculator dispersion correction quads (4);
- preventive maintenance on

transmitters (inductrols, crowbar-circuits, modulator decks, drive klystron system, flow-switches, etc.);

•rebuild modulator high voltage power supplies;

•rebuild the failed 3000 gpm circulating pump for the secondary cooling system;

•install LN2 supply tank adjacent to the North Hall to optimize SAMPLE running;

•convert operation of accelerator and beam line magnetic elements to RCS/EPICS;

•replace damaged cabling in the beam switchyard;

•install high performance toroid cables to selected locations;

•install high performance cables to RF load directional couplers;

•improve beam line instrumentation;

•and implement a pilot RF phase and amplitude monitoring system.

The possibility of using higher polarization crystals in the injector is being explored. An InGaAsP crystal, supplied by Novosibirsk, is in use at NIKHEF on their new polarized injector. It is a strained crystal which operates at up to 2% quantum efficiency with beam polarizations up to 54%. The quantum efficiency is essentially the same as Bates typically operates with, but the polarization is much higher. The gain in figure-of-merit by reproducing these results in our gun would be at least a factor of two. A quantity of crystals has been purchased from Novosibirsk and we are preparing an appropriate environment for installing them in the next few months.

A decision was made to install the 100 kV SLAC-style Wien filter instead of our original 300 kV unit. There appear to be many advantages to this approach. The unit mounts immediately below the gun and above the 300 kV column. It is much simpler to install and service. The device has a 2 cm gap, in contrast to the 1 cm gap of the 300 kV filter. It also would serve simultaneously as a velocity selector for deflecting backward traveling charged ions. As such, the ions should now fully clear the crystal. We previously observed significant improvements in crystal lifetime, while operating with the velocity selector on. The Wien filter is now being assembled. It will then be baked out and installed on the injector beam line. Installation in this case will not interfere with accelerator operations.

Continuing efforts have been made to improve the laser system, in particular the overall stability. At present, the pulsed beam light intensity does not have the required flatness over the pulse length. This leads to energy variations at the end of the accelerator. This is especially a problem for SHR operations where high peak currents (~ 40 mA) and short pulse lengths (~ 1.3 ms) increase the degree of difficulty. Schemes are being investigated for improving performance.

A 100 kV Mott polarimeter is being designed which is based on an existing CEBAF design. The polarimeter will be used to measure the polarization off-line before a gun is installed on the accelerator.

Status of current experiments

"These experiments provided theses data for ten graduate students."

The physics program carried out this past year and planned for FY96 is based mostly on the priorities established by the PAC meeting in May 1994. A total of 2310 hours was delivered for research in FY95. These experiments provided theses data for ten graduate students. Given the current budget situation, the realistic goal for FY96 is less than 2000 hours.

SAMPLE

This experiment involves the elastic scattering of longitudinally polarized electrons from protons. The parity violating asymmetry has contributions from the well-understood interference between the neutral and electromagnetic currents. Strange quarks in the nucleon also would contribute to the asymmetry. The objective is to obtain a measure of these strange quark matrix elements.

Major progress on the SAMPLE experiment was achieved last year. The improvements in the polarized injector, accelerator, beam switchyard, and control system have allowed us to develop the stable achromatic tune which is needed for SAMPLE. The useful data which was obtained is now being analyzed in preparation for the extensive runs which are planned for FY96. It should be possible to make significant progress to finish the hydrogen experiment this year.

OOPS

A unique system of four small magnetic spectrometers is being constructed. The basic idea is to arrange the spectrometers in a cone symmetrically about the momentum transfer. It is believed that the simultaneous measurement of several asymmetries will allow for the isolation of the interference structure functions with very high accuracy. The required control of kinematic variables, and other experimental parameters, is expected to be reduced greatly in comparison with the usual technique of sequential measurements. Large out-of-plane angles can be readily accommodated. This is impractical with typical large magnetic spectrometers.

The spectrometer modules and detector systems are complete. Two satellite supports have been built, and a detailed engineering design of the gantry to support a pair of modules is finished. The gantry should be available by the end of 1996. Mounting of a three-spectrometer mini-OOPS system in the South Hall has begun. Commissioning experiments on the deuteron and N -> Δ are expected to start by June 1996.

An OOPS collaboration meeting was held at Bates on November 12-13, 1995 at which both the commissioning and first set of experiments were discussed.

BLAST Update

During the summer, a revised design was developed for BLAST. While it retains the original toroidal magnet, the drift chambers, which are the major cost drivers for BLAST, were reengineered. The new design uses simpler technology, has fewer channels and has an overall reduction of ~ 30% in total acceptance. Most of the original physics program would still be possible. The total cost was reduced to 4.0M$ from the original 6.5M$.

A BLAST collaboration meeting was held at Bates on March 18-19, 1996. The first day of the meeting was dedicated to an in-depth discussion of the scientific program. Several theorists were involved in these discussions. The second day focused on the technical aspects of the detector, targets and collaboration infrastructure.

Conclusions

A Technical Advisory Panel has been assembled for the polarized injector as recommended at the Operations Review in March of 1995. The panel was asked to review the recent progress in delivering high quality polarized beams and our planned source improvements for the next year.

The Laboratory continues to operate under high pressure to upgrade the accelerator and do physics at the same time. Evidence for the much improved operations is clear from the FPP and SAMPLE experiments last year. Much has been accomplished, and we are very proud of the efforts made by all the Bates staff.

The Bates web page may be viewed at location: http://mitbates.mit.edu

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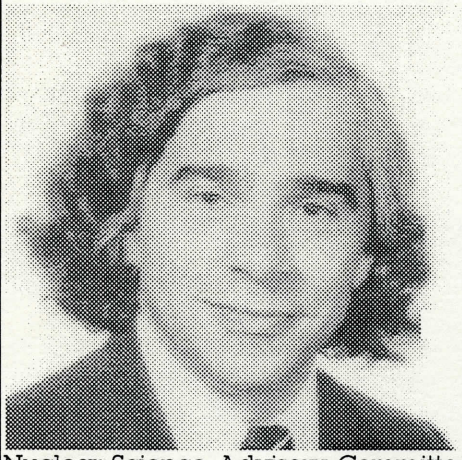
Congratulations

Ignacio (Nacho) Diaz received his U.S. citizenship on December 14, 1995.

Lauren Saragosa - Katrina Rose, born on April 8, 199,6 7lbs 1oz.

Moniz Nomination as OSTP Associate Director of Science Confirmed



The United States Senate confirmed the nomination of Dr. Ernest J. Moniz for the position of Associate Director for Science at the Office of Science and Technology Policy (OSTP) on December 22, 1995. Moniz officially assumed the position on January 2, 1996. In this capacity, he will serve as White House Co-Chair of the Committee on Health, Safety, and Food Research and Development and the Committee on Fundamental Science. Moniz replaces Dr. Cathie Woteki who had been Acting Associate Director for Science since May 1995.

Prior to this appointment, Moniz was Head of the Department of Physics at the Massachusetts Institute of Technology from 1991-1995. From 1992-1995 Moniz served the Department of Energy and the National Science Foundation as chairman of the Nuclear Science Advisory Committee leading a Long Range Plan development for American nuclear physics. During his official tenure at OSTP, he will be on leave from MIT, where he has been on faculty since 1973 and a Professor of Physics since 1983. Moniz has consulted with OSTP in the past on special projects, such as preparation of the Science in the National Interest policy statement and will bring a great depth of expertise to OSTP and the National Science and Technology Council (NSTC).

Reprinted from United States Government Department of Energy Memorandum
February 16, 1996

The Dean's Advisory Committee Meeting

The Dean' Advisory Committee meeting will be April 18-20, 1996. The committee members are:

Prof. James Bjorken - Stanford University

Dr. Peter Bond - Brookhaven National Lab

Prof. Ernest Henley - University of Washington

Prof. Noémie B. Koller - Rutgers University

Prof. Alfred H. Mueller - Columbia University

Prof. Roberto Peccei (Chairman) - University of California, Los Angeles

Prof. Charles Y. Prescott - Stanford Linear Accelerator Center (SLAC)

Prof. Michael Zeller - Yale University

PARENTS FORUM Update

Eve Sullivan, senior editorial assistant in LNS, has been invited to present "PARENTS FORUM: a new resource for parents and professionals" at the International Family Therapy Association 8th World Congress in Athens, Greece, July 4-10. A similar presentation has been accepted for a conference of the World Association for Infant Mental Health in Tampere, Finland, later in July, which PARENTS FORUM board member, Bonny Carroll, Director of the Somerville Council for Children, may attend.

PARENTS FORUM, founded in 1991 by Eve Sullivan out of some difficult family experiences, has grown over the last several years with encouragement and support from within MIT, including an Entrepreneurs Club "social venturing award" in 1993, and from outside MIT. Recently the program was given office and meeting space at Cambridge Family and Children's Service, (929 Mass. Ave., Cambridge) where evening parent workshops are being offered in March, April, and May.

PARENTS FORUM has a home page http://web.mit.edu/annals/parentsforum/ and a column appearing in the *Cambridge Town Crier* http://civic.net/ctc.html.

On Line

Graduate programs in higher education are failing to prepare college administrators to manage campus technology.

That is the conclusion of Robert Bruen, a computing administrator in the Laboratory for Nuclear Science at the Massachusetts Institute of Technology.

His review of higher-education programs at 77 institutions this past summer found that only four required students to take a course on technology. Eleven offered technology courses as electives.

"They should have to have some exposure," says Mr. Bruen, who describes his findings as "appalling."

"Ignorance of technology leaves officials unprepared to make decisions about it--especially when computer administrators differ over which technologies are needed," he says.

"There are all kinds of religious wars about this. If you have to mediate these wars, how can you make an intelligent decision?"

Reprinted from the Chronicle of Higher Education November 10, 1995

LNS Administrative Guide

The LNS Administrative Guide will now be on the LNS web page at location [http://mitlns.mit.edu/~elsye/administrative.html], and will be accessible only to LNS employees.

Paper copy of the Administrative Guide will not be distributed.

THE PULSE is a publication of the Laboratory for Nuclear Science for the LNS Community.

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If you have any ideas and/or suggestions for new features in THE PULSE please let us know. Address inquiries to Pulse, 26-537.

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