DISCLAIMER

ENGINEERING DIVISION

NEWSNOTES

April - June 1990

Vol. 1 No. 2

FOREWORD

Engineering Division Newsnotes are short descriptions of significant contributions or items of general interest to the staff. They are prepared periodically by the principal contributors and submitted to the Director of Engineering through their Department Offices. This compilation of newsnotes is prepared quarterly and distributed as a communication tool for Engineering Division Personnel and Laboratory Management. Comments on the effectiveness of this document are solicited.

Pub-670 1-2/675

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BEAM SPILL FEEDBACK SYSTEM — April 1990

A new Beam Spill Feedback System has been developed for use by Nuclear Science experimenters at the Bevatron. It allows scientists to precisely control the particle rate over a range of 10^2 to 10^7 particles per second or even higher. Each individual particle or event is detected by an in-beam scintillator/photomultiplier tube. This is immediately followed by a feedback signal to the main control room's spiller chassis, where the system can meter out the proper particle rate so that the total number of particles or events will be achieved in the specified time interval. At low rates, the timing between particles is extremely good. At high rates, occasional pairs will arrive simultaneously due to beam statistics but, even in worst case, the overall average distribution is accurate to within 20%. Beam utilization is thus greatly improved by decreasing pile up and dead time between events.

Submitted by:
Mark Nyman, x6411, Real Time Systems Section
Greg Stover, x5831, Accelerator Engineering Section
Electronics Engineering Department

DNC SYSTEM FOR THE NC MACHINE GROUP — May 1990

The Mechanical Machine Shop (Building 77) has nine numerically controlled (NC) machine tools. These machines generate parts from numerical data (instructions) input from a tape. Typical tapes run from 10 and 80 feet in length. Once loaded, the machinist has a limited line editing capability. This procedure was acceptable until we became involved in an RFQ Vane Project. The tapes required to numerically describe these parts were longer than our tools' local memory could accommodate. Consequently, a portion of the tape was read into memory and those instructions executed. The machine would then sit idle on the part while the next group of instructions were read into the machine; this caused unacceptable surface blemishes on the part where the machine tool sat idle. A special procedure was required to feed the instructions to the machine without this "idle" time. We used a Macintosh with 512K of RAM and a 20 megabyte hard drive, a serial-to-parallel data converter, and a customized communications program to accomplish a direct link to the machine. The tape (in its entirety) was loaded into the "Mac" and plugged into the machine's tape reader port through the serial-to-parallel data converter. The instructions were then fed to the machine in a continuous fashion at a rate acceptable to the machine's internal memory. This gave us the equivalent of a huge spool of tape. Now all NC Machines are connected to "Macs" and are

also linked to our CAD/CAM workstations which are centrally located in the programming office above the machine shop floor. This concept is called "DNC" or Direct Numerical Control. Programs are now sent directly (down loaded) from the CAD/CAM workstations to the "Macs". Another significant benefit worth noting is the shortened down time which is reflected by the improvement in the overall cost effectiveness of being able to edit a program at the machine tool "Mac" while a part is being manufactured in that same machine in lieu of the machine standing idle for reprogramming (not possible before DNC). This development completes an electronic flow of part definition from the Mechanical Designers CAD workstation to our CAD/CAM workstation for NC programming to the machine tool for part manufacture.

Submitted by:
Richard M. Johnson, x5901
Machine Shop Section
Mechanical Engineering Technology Department

REPORTABLE EXCESS AUTOMATED PROPERTY SYSTEM **June 1990**

REAPS! The Reportable Excess Automated Property System has been accessed frequently over the last three years by the Mechanical Engineering Technology Department and has resulted in cost cutting in the extreme. We have acquired a number of excess usable items ranging from $20,000 microscopes to $20.00 torque wrenches. A large number of the items are listed as condition 4 (used, in good condition) or better. Accessing the system requires the issuance of a password from DOE's Office of Computer Services and Telecommunications Management. If a need for an item arises, contact either Ron Hall or Bill Love to access the system and scan the desired F-5C group or class code to ascertain the availability of said items. If available, the item will be shipped to LBL for the price of shipping. For items valued above $5,000, a 7000 series account number must be used for acquisition; less amounts require a 3000 series number. Approximately 60 days elapse from initiation of request to receipt. A significant savings can be realized if REAPS is used to its full extent.

Submitted by:
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Mechanical Engineering Technology Department

Engineering Division

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CATALOG LIBRARY COMPUTERIZED CARD FILE — June 1990

Our Mechanical Engineering Technology Vendor/Manufacturer's Catalog Library has been enhanced by producing a computerized database (MAC w/FILEMAKER) of name, address, phone number, product line, date, etc. Approximately 600 vendors/manufacturers representing over 3000 scientific and technical product types are obtainable by product "name" or "mfg". A catalog may be reviewed in B25 or borrowed for short-term (1 wk) by any LBL employee. Catalogs are kept current by adding and/or replacing at regular intervals. Card File discs may be obtained from Sheila Thomas, x5381, or accessed via network soon.

Submitted by:
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Mechanical Engineering Technology Department

KECK OBSERVATORY ACTIVE CONTROL SYSTEM — June 1990

The control loop (multi-element servo-mechanism) for the Keck Observatory Active Control System has been closed on an aluminum mirror. This test consisted of mounting an aluminum mirror on a dummy support cell located at the 14,000 foot high observatory in Hawaii. The mirror was equipped with three position sensors and three position actuators. Production software and hardware were used to support the sensors and actuators. The LBL group, consisting of R. Jared, J. Meng, B. Minor and R. Cohen, operated the system from the telescope headquarters at 2,000 feet over a computer link. The test consisted of controlling the attitude of the mirror with the position actuator lengths and the position sensors. Both tests were successful with the mirror position being stabilized to about 10 nanometers. No further certification tests will be done with the aluminum mirror. The next major test will be to control three glass mirrors in July of this year.

Submitted by:
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WARM LIQUID CALORIMETER — June 1990

As part of an international collaboration, LBL engineers and physicists are building accelerator beamline scale calorimeters using a room temperature ionizing liquid. If successful, this technology could be a serious contender for the large scale detectors now being planned for the Superconducting Super Collider. A 10 ton calorimeter, using Tetra Methyl Pentane (TMP) as the ionizing liquid, has been designed and built at LBL and is now operating at Fermilab. In this unit, the TMP and ionization collecting electrodes are contained in stainless steel "boxes" interleaved with lead absorber plates; thus the TMP is in contact only with the stainless steel container and a few small ceramic insulators. A second generation design, known as the "swimming pool" version, recently passed its preliminary design review by the collaboration. A more direct construction is used, which immerses some 7200 lead absorber/electrode plates directly in the ionizing liquid. Challenges lie ahead in terms of liquid contamination (tens of parts per billion), voltage holding and vacuum pumpout.

Submitted by:
William Thur, x5689
High Energy Physics Detectors Engineering Group
Mechanical Engineering Department

WATER TEMPERATURE CONTROLLER FOR THE ALS — June 1990

A close loop water temperature control system has been developed to keep the water temperature of the Linac and RF cavities in the ALS to within +/-0.5 degree. Precise water temperature control is required for these components due to their frequency sensitivity with temperature. The system for the Linac utilizes an Omega Engineering thermocouple Model DP285T-RA with a Copper Constantan thermocouple as the temperature sensor. Digital read out of the temperature in Celsius or Fahrenheit are provided along with trip point alarms and other record keeping features. The analog output voltage from this unit is sent to a controller which compares this signal with a preset reference voltage level. The error signals are then handled separately with two polarized amplifiers. A positive error signal indicates that heating of the water in the system is required whereas a negative error signal indicates that cooling of the water in the system is required. The loop gain of the two channels can be adjusted separately. The heating channel provides a OV to +10V signal for controlling an external heater. The cooling channel provides a 4 mA to 20 mA signal for controlling an external cooling water valve. The option for computer control has been

designed into the system. In the ALS environment the ILC (Intelligent Local Controller) can be used to set the temperature, read the sensor output and provide a correction signal if so desired. The selection of local control or computer control is done via a toggle switch.

Submitted by:
C. C. Lo, x5400
Accelerator and Fusion Section
Electronics Engineering Department

ARC DETECTOR FOR THE ALS RF SYSTEM — June 1990

An Arc Detector has been developed to monitor arcing in waveguides, Klystron, circulators, etc. within the ALS RF system. Upon the detection of a spark, the system activates electronic switches as well as mechanical switches to shut down RF drivers and alerting computers that a breakdown condition has occurred. The optical sensor is a Siemens BPX 65 PIN photodiode which has a spectral response from 350 nm to 1100 nm with the peak response at 840 nm. The quantum efficiency at 850 nm is 0.8 and the spectral phosensitivity at 350 and 1100 nm is 10% of the maximum of 0.55 A/W at 850nm. The dark current is less than 1 nA with a reverse bias of 20V. The rise and fall time of the photocurrent is 30 and 80 nS respectively. A low noise transimpedence amplifier is used to convert the photocurrent to a voltage signal which is further amplified by another amplifier stage. The overall transfer ratio is 1V/10nA. A comparator is used to trigger the electronic switches and a relay. The tripping level of the comparator is adjustable from OV to 2.5V. A test lamp is included in the unit to provide test light to the sensor. Two pieces of 10 foot optical fiber are used for light transmission to and from the component being monitored. Remote or computer and local control of the test lamp and the reset functions have been designed into the unit.

Submitted by:
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ALS Electronics Engineering
Electronics Engineering Department

Engineering Division

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ADVANCED ELECTRON CYCLOTRON RESONANCE SOURCE June 1990

A second Advanced Electron Cyclotron Resonance Source(AECR) has been developed at the 88 Inch Cyclotron. The source operates at 14.5 gHz and has produced world record amounts of 0^{6+} (370eμA), 0^{7+} (103eμA), and 0^{8} (10eμA). Completion of the source was in November, 1989, and since then it has been operating in an experimental mode. Upon completion of the beam transport system on June 25, 1990, beam was injected into the cyclotron and accelerated. The first beam extraction utilizing AECR beam was on June 29, 1990. The device consists of conventional water cooled solenoid field magnets around a neodymium-boron-iron permanent magnet sextupole field. This new source will expand the capabilities of the cyclotron by providing greater beam intensities and higher energies.

Submitted by:
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Mechanical Engineering Department

ALS MAGNET FABRICATION June 1990

All the magnets for the Advanced Light Source Booster ring have been installed on their girders and all but one of the 12 completed girders have been installed in the ring. The magnet fabrication activities have entered the production phase of the storage ring magnets. The production of these magnets is a major phase of the magnet fabrication effort. As of this date, 5 of 37 required gradient magnets, 5 of 75 required quadrupoles and 8 of 49 required sectupoles have been assembled. The pace of production appears to be higher than that needed to complete all the required magnets on schedule. The coordination of the required magnet measurements is underway and excitation and field quality data will be collected for the completed storage ring magnets as they come off the production line.

Submitted by:
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