SDC-92-386

MONTHLY REPORT of the SOLENOIDAL DETECTOR COLLABORATION

OCTOBER 1992

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I. PROJECT MANAGER'S SUMMARY

October 1992 was the month in which the DOE Project Review of the SDC occurred. This review transpired over a 5-day period, involved 55 reviewers and 83 SDC presenters; and investigated in detail all aspects of the SDC Project relating to technical performance, cost, schedule and management. Preparations for this review occupied a large fraction of the effort of SDC management during October. In addition, the start of fiscal year 1992 and the budgetary aspects of this event took up another significant fraction of managers' time across the project.

In the silicon tracking area, kinematic mount tooling was put out for bid, a cooling ring cover was obtained, and the first 360° cooling ring was assembled. This is a significant achievement for the delicate silicon support system. Advances were also made in the optical alignment and butane cooling systems for the silicon strips. The silicon detectors and their electronics saw continued progress by the groups in Europe, Japan and the US. Radiation tests showed the expected damage behavior up to 1 MRad in both the detector strips and the associated electronics. These components will therefore perform with the expected resistance to radiation damage. Some useful value engineering of the mechanical clips was achieved and its incorporation in the design is expected to lower fabrication costs of the silicon detectors. In the area of silicon tracker integration, some finalization of the power source was accomplished (no 415 Hz power will be used), cabling and utility routing were discussed and discussions of the source terms for IP and accelerator related sources of neutrons and protons were discussed with SSC accelerator experts. This work continues.

In the outer tracker area (straws), work continued on both the straw test module detectors and development of the space frame. Materials selection and characterization plus humidity testing occupied the mechanical support group at WSTC. At Indiana, a specification for the second trigger module mold and shells was written. Duke hosted a meeting in which wire and module survey methods were discussed in detail and strategies for alignment explored. Duke carried out some tests of wire position determination in straw modules that show 50 μ straw to straw correlation using both collimated electron and cosmic ray sources. This is an excellent result. Duke also carried out tests of straw sensitivity to neutrons and the crosstalk introduced by large recoil proton generated signals. The crosstalk for these big pulses is confined to adjacent straws. At Indiana, radiation damage tests showed that 100 SSC-year radiation exposures will not cause significant damage to straw module performance. Design improvements to the wire stringing and end connections are also underway. An order to a commercial vendor for 2000 straws was placed. Electrical connection work went forward at Colorado and simulation work at Indiana.

Work on scintillating fibers was concentrated on analysis of data from the BNL test run during Summer 1992 and preparation of a cosmic ray test stand. A meeting on fiber electronics was held at Fermilab.

The ITD work on gas microstrips was focused on fundamental aspects of the detectors including etching methods and materials, substrates and geometry of the electrodes. Some mechanical studies of deflection under pressure were pursued as well as radiation damage tests. This work has gone forward in England, Canada and the US. The US work has been funded by TNRLC and shows good promise. The RAL group in England is preparing 3 GMD modules for beam tests at CERN in November. GMD electronics development continued in October. The GMD development is moving forward steadily but still has a long way to go to achieve a demonstrated detector design for SDC. It is hoped that a useful assessment will be possible at the January Outer Tracker Review.

The Calorimeter Systems work focussed on the prototype barrel calorimeter wedge in October. Negotiations for the final agreement between SSCL Lab and IHEP Beijing for production of the steel hadron absorber were completed and the final formal attachment to the Interlaboratory Agreement was circulated for approvals. These are expected in November. Meanwhile, the mechanical drawings for the prototype wedge were being advanced in Fermilab and Argonne. A set of assembly drawings for the hadron absorber was sent to IHEP. The full set of detail drawings will be completed in November. These drawings will be used to construct prototype hadron absorber wedges in Fermilab and in the PRC. The two resulting prototypes will be instrumented for beam tests at Fermilab. The EM section for the prototype wedges is being designed at Argonne and WSTC. It will be cast Pb alloy with some stainless steel hadron plates added at high eta to match onto the hadron absorber. The mold design for the casting is nearing completion; final detail drawings for the steel inserts were completed and parts were ordered. Studies of radiation damage to the tiles, fibers and shower max strips continued at several institutions. Fiber routing studies continued at Fermilab on the wooden wedge model. A review of the tile fiber optics was held during October. This review concluded that the barrel tile fiber system with SCSN 38 scintillator will meet the SDC specification for light output over a 100 SSC year radiation exposure period. Design work on the endcap calorimeter was pursued intensively at LBL. The EM and hadron plug designs are both underway as is the design of a transporter that will be used to support and position barrel and endcap modules in test beams when this phase of the program is reached. A concept for hydraulic movement of the endcap calibration sources is being developed to overcome source driving difficulties caused by the endcap geometry. In general, the calorimetry work is proceeding well and the prototype should be ready in Summer 1992.

The Muon Magnet program was focused on the Preliminary Design Review of the Muon Barrel Toroid mechanical design and preparations for the DOE Review of the SDC Project. Both reviews had successful outcomes and the magnet program will soon move into the production of prototype toroid blocks. These are expected to be fabricated in Russia under supervision of the JINR in Dubna. The principal conclusion of the DOE Review (as in virtually all the subsystems) was that the schedule is very tight, especially for the installation process.

In the Muon Detector Module area, (both barrel and intermediate regions), there were many institutions involved in hardware, analysis and simulation studies. Most of the hardware work related to the muon drift tube development but significant amounts of work were also accomplished in the scintillation and RPC detector areas as well. A principal area of focus in the muon tube area involved the studies in many institutions of reliable sealing of endcaps to tubes. It begins to appear that a pure heat shrink method may not result in tight and reliable seals. It may be necessary to supplement the seal with epoxy bonds or rubber O-rings. These studies will continue. A significant amount of work also went forward on mechanical studies (FEA and analytical) of thermal and gravitational deflections of modules under SDC conditions. To achieve the spatial resolutions required, SDC must relay on corrections for module distortion in many angular orientations, and because thermal distortions of a few degrees can cause deterioration of measurement resolution, these studies are also of great importance. Studies of the muon scintillators focussed on light collection efficiency, coupling geometry and phototube performance. Conceptual studies of RPC arrays appropriate to SDC are underway in Italy as a possible alternate to the scintillator planes. Work on the alignment concepts (fenceposts) continued along with surveys of commercial products that could aide the alignment process (liquid-level detectors etc.). Simulation of the muon chamber tracking went forward with applications to triggering. As in the other SDC areas of work, considerable effort went into preparations for the October DOE Review and into preparation of MOUs and Amendments for FY93 for the many Muon System institutions.

The 30cm superconducting solenoid test coil has been completed and the winding method and epoxy cure demonstrated. This coil will soon be sectioned to examine the epoxy bonds in detail. The winding and epoxy method developed here is critical to success in the production of the prototype and full-length coils and it looks good so far. Success was also achieved in both the honeycomb and isogrid versions of the outer vacuum vessel wall. Soon the welding together and flanging of the prototype cryostat can begin. Useful conceptual design work went forward on the cryogenic systems and on the power supply system. A meeting was scheduled for the SC Solenoid Group in Japan to seek agreement on the detailed responsibilities for designing, building and installing the magnet and its cryogenic support systems at SSCL.

Development work in Electronics continued at a brisk pace. Design and prototyping activity went forward for straw, calorimeter, muon and scintillator front-end circuits. In the case of straws, electronic performance levels initially obtained from radsoft MOSIS development chip versions have been duplicated in the UTMC radhard chips. In the calorimetry area, the baseline charge recording technology (switched capacitor array) has been supplanted by a flash ADC charge measuring and digitizing method. This technology change followed a complete and rigorous comparative review of the competing designs by an impartial panel of experts. Because the SDC desires to implement a common charge processing technology for both the calorimeter towers and the shower max detector, the change from SDC to FADC will impact all calorimetry charge processing systems. The various electronics groups began coping with this switchover during October. A Cockroft-Walton tube base with low noise characteristics is under development at Fermilab. Various front-end and trigger circuits are being studied in the Muon System. A circuit error in a wire trigger chip developed at Michigan will be corrected in the next hardware version. A very high performance equal-time charge injection circuit for muon front-end testing was produced by the ORBIT process and tested at Harvard. This device will provide essential in-situ testing of the muon trigger system. The tricky problem of safe distribution of HV to hundreds of muon tubes in parallel was studied at SSCL. Some practical method of diagnosing and disconnecting shorted tubes from the group HV source is being sought.

Trigger and DAQ work also advanced at many SDC centers. The focus of DAQ effort is on the Portable DAQ so this can be used for beam testing and system checkout in a variety of institutional settings. The trigger work at level 1 is involved with hardware and simulation. Humble but essential work on crate counts, signal paths and connector specifications is also in progress. A strong simulation effort is going forward in the complex area of calorimetry triggers where the object is to identify electrons and photons from hadron showers by means of pattern processing of signals from calorimeter and shower max sources. An essential component of these studies is the input from accurate physics studies of top quark, Wand Z boson decays and their associated energy deposition signals in the calorimeter system. The current simulations validate the SDC baseline design and show good trigger efficiency with proper background rejection. Two important papers (SDC Notes) one on the Level 2 Trigger description and one on Trigger Tools and Techniques are in preparation.

This month we have the first reports from the Online Computing Group. We expect to eventually to include reports from the Offline Computing area as well. At this point in time, much attention is focused on improving SDCSIM and tool development. The architecture and strategy for handling, storage and interchange of SDC data (status as well as event calibration data) between the various computing environments of SDC is also an active topic. The PASS project is formally independent of SDC, but the viability of our future capacity for large data storage and retrieval capacity is linked to these techniques. Eight institutions in the US and Japan are already active in this area.

Also appearing this month are reports from the Integration Group. They are dividing their time between mechanical and electrical detail issues within the detector and

review of conventional support utilities and buildings that must be reviewed to verify that they meet the needs of SDC. Recent activities have included review of the Assembly Building and Interaction Hall Title I specifications and hosting meetings to define and refine the routing of cables and umbilicals from the central tracker systems to the outside of the calorimeter. Support points for the central tracker have also been the subject of current attention during October.

II. SDC SUBSYSTEM REPORTS

1.0 TRACKING SYSTEMS R&D SUMMARY

1.1 Silicon Tracker R&D

Subsystem Project Leader: A. Seiden
Subsystem Technical Manager: A. Grillo
Reported by A. Grillo

Summary of Activities

What you will read in most of the reports below is that much activity was expended during October in preparing for the DOE Review. No doubt that fact had a lot to do with the favorable report we received from that review process (See 1.1.7). But other activities of a more technical nature were also occurring. Progress in the mechanical area (1.1.1) was made towards a full stability test of the central region and final prototypes of the cooling wicks, all to happen this coming year. Radiation test results and noise measurements continue to agree very well with expectations (See 1.1.2). A meeting was held in the UK to agree on a protocol for the data transmitted from the Front-end Electronics to the Trigger system. The group is now ready to draft a target spec for the Digital Front-End chip and the Data Transmission protocol. Also, preparations are well underway for a December beam test of double sided detectors with front-end electronics at KEK. There is still much to do, but we are optimistic that we can have all the components ready early in December. That will be a major focus of activity in November.

1.1.1 Main Mechanical Assembly

Los Alamos National Laboratory

Technical Staff: Team Leader: W. O. Miller
Alignment/Assembly Work Station Development: R. Michaud, R. Ricketts, G. Jordan, H. Salazar, B. Wilds
Composite Structures: T. Thompson, C. Grastataro, G. Dransfield, D. Weinacht, E. Correa
Optical Alignment Development: J. Hanlon, W. Christensen, S. Schramm, D.C.Jones
Cooling System Development: K. Woloshun, M. Elder, J. Williams, L. Salazar
Reported by W.O. Miller

Alignment/Assembly Work Station Development

Requests for quotes for the fabrication of six prototype kinematic mounts, a shell test fixture, and one manipulator arm were submitted to four area machine shops. We expect this hardware to cost about $30K. Additional drawings have been submitted to Anorad for estimates to do complete alignment and assembly of the stacked stages with cable carriers. We expect to receive this hardware and the manipulator arm at about the same time in early January. Preparation of the fabrication drawings for the remainder of the assembly system will begin in about three weeks and is expected to continue through January. We plan to organize these drawings in subassembly packages that can be submitted for fabrication as they are completed. These will be prioritized to provide components in a timely manner for the development of control software. We still have some concerns about placement of the last silicon ladders on each central region assembly. Kinematic mount tests will begin about mid-January as well. Finite element models of the central region structures with the proposed mount are being used to determine the effects of mount preload, temperature variation, and external loads on the elastic shapes of the

structures. We still need information about cabling so that we can accurately model external forces.

Composite Structures

Sandia National Lab continues to produce the P75/954-3 composite cooling rings. The cooling ring cover mold is due back from the Teflon coating vendor this week. SNL will then begin producing cooling ring covers as well as cooling rings. Preliminary acid digest data for the P75-954-3 molding compound has indicated that our fiber to resin ratio is not what we had requested. The future material procurements should have this problem corrected, thereby giving us improved property results. Also, we will be directing our efforts towards achieving more consistently sized P75 fibers at 400μm length.

The first 360∞ cooling ring was constructed using the assembly tooling package. All tools worked well. For the initial assembly attempt, a 5 minute epoxy was used to glue the parts together since an oven large enough to cure the structural adhesive was not available. An oven has been ordered for the production effort. It was decided that a trim fixture would further aid the ring segment assembly process so the design of this tool is underway.

In another effort, we have been experimenting with UV curing adhesives for fabricating the bridge assemblies. The use of these types of adhesives especially for bonding the silicon wafers to the graphite rails has great potential.

Optical Alignment Development

During October, evaluation tests of the Huber goniometers shaft run-out and wobble were continued. This test phase was conducted to investigate several areas. First, the stepper motor furnished with the large goniometer was heating the goniometer and causing undesirable drift, and second, at slow speeds the motion was quite rough. A D-C servo-motor has been ordered to fix both of these problems. When the servo-motor is received the tests will be repeated.

We are also evaluating Lab-View software for collecting and displaying data from laboratory instruments. The software is being considered for the control software application on silicon module assembly work station. The electronic autocollimator used for goniometer testing represents a good application for learning and evaluating Lab-View. We believe Lab-View will save us considerable software development time, over our original C++ choice, for writing control and data acquisition software interface packages.

During the last week in October, we disassembled the holography laboratory, rearranged the optical tables and prepared for the arrival of a custom room for a controlled temperature space for precision assembly and stability testing. The room arrived November 2, and it will be assembled over the holographic optical table the first week in November. As soon as the room is built we will install the temperature controllers and start to set up for preliminary long-term stability measurements.

Butane Cooling System

Testing of the wick segments machined from bulk polystyrene material continued. These tests included polystyrene material impregnated with alumina to enhance the thermal conductivity of the wick-fluid matrix. The volume fraction ranged from 0.12 to 0.36. No improvement was noted in reducing the temperature drop through the wick. However, this test did provide the most uniform temperature distribution obtained during this particular test series.

In one test, the number of thermocouples was increased to determine if thermocouple location or quality of contact was having an impact on the measurement. It was shown that there was less than 0.2∞C variation, even though one thermocouple was deliberately placed deeper into the specimen. This result was important. To quantify the isothermality of the structure properly, we must be able to discern temperature differences to less than 0.25∞C. We have been conscious of a need to demonstrate this capability during our experimentation. This test was significant in that it provided a strong indication that the temperature resolution is quite good.

This wick test series is very near completion. The test results will be used to reconfigure the first generation polystyrene wick mold (Delrin material) geometry. We expect that the mold will be modified during the month of December.

Management/Integration

During the month of October we prepared for and presented to the DOE review team aspects of the Silicon Tracking system relating to the design concepts, prototype developments, cost, and schedule. From all outward appearances the material presented was well received. The primary response from the review team was that our proposed silicon shell stability test must receive high priority this year. Although this task will be our primary focus in the near term, there are many other essential tasks that must be completed this year if we are to maintain any semblance of the proposed schedule.

1.1.2 Internal Electronics

KEK

Barrel Silicon System

Reported by T. Ohsugi

We continue to measure the basic performance of the prototype sensor. Gamma-ray irradiation test of the prototype sensor is going at Hiroshima University. So far very good data have been accumulated. Up to 1 MRad, a leakage current increases as expected, while no serious damage effects on the surface have not been observed.

The integration study of the unit detector is continued at KEK in collaboration with Hamamatsu Photonics.

LBL

Prototype DSSD

Forward Silicon Disk System

Reported by M. Strovink

No activity reported

Front End Electronics System

Technical Staff Involved: C. Corradi (LBL), J. DeWitt (UCSC), J. Iler (LBL), I. Kipnis (LBL), N. Spencer (UCSC), H. Spieler (LBL), K. Shankar (RAL),

Reported by H. Spieler

1. Module/Hybrid (Corradi, Iler, Engineering Solutions/Fujitsubo)

An alternative low-mass connector using a Vespel (solid Kapton) clip was designed. The design could lower fabrication costs and simplify assembly. Parts are in fabrication for a test device. Gluing tests are continuing to determine the best type of glue and recipes for the reliable deposition of thin, contiguous layers.

2. Analog IC (Kipnis, Spencer)

The main emphasis in October was on preparing the detector and VME readout PC boards for the December beam test at KEK. Further effort was devoted to test procedures and boards for the AT&T analog ICs due in November.

3. Digital IC (DeWitt, Shankar)

The configuration of the digital readout IC was defined at a meeting at RAL. Optimization of power and die size are important considerations in the detailed design that is now commencing.

4. Management (Spieler)

Substantial effort and time went into preparations for the DOE review. The MOU and 1993 Amendment also required considerable time.

University of Oxford/RAL

Data Transmission, Liaison to Trigger & Data

Acquisition

Technical Staff Involved: Mr. K.Shankar, Dr. N.Kundu, Mr. N.Martin,
Dr. B.Brooks, Mr. R.Wastie
Physicists: A. Fox-Murphy, R. J. Cashmore, R. Nickerson
Reported by R. Nickerson

Most effort was expended in preparing for and attending the DOE review. We have continued to work on the design for the Si SLT. Progress on the design on the AMU option has been made and discussed with our Italina colleagues. Simulation of the algorithms is beginning again at Bristol.

University of California - Santa Cruz

Component Testing and Characterization

Technical Staff: E. Barberis, N. Cartiglia, D. Dorfan, S. Friedman, D. Goldin,
D. Hutchinson, E. Spencer, W. Rowe, H. Sadrozinski,
A. Webster
Reported by H. Sadrozinski

Continuing testing of the Tektronix TEKZ chip: radiation testing shows less than 5% loss in gain and less than 10% increase in noise in 3.5 Mrad (10 years of SSC dose). Wedged detectors are being characterized. Capacitances on double-sided detectors are measured: radiation tests are ok, noise on detector agrees with expectation. A draft testing program is being discussed.

1.1.3 External Mechanical Systems

No activity this month:

1.1.5 Silicon Pixel Detectors (not part of current construction plan)

Collaborative (see staff below)

Technical Staff: J. F. Arens, G. Jernigan (UCB-SSL);
B. Holbrook, S. Glenn, S. Mani, D. Pellett (UCD);
S. Augustine, C. Pfeiffer, S. Worley, G. Yacoub (Hughes);
T. Collins, F. Forti, S. Holland, G. Lynch, O. Milgrome, J. Millaud, D. Nygren, M. Wright (LBL);
P. Inzani, D. Menasce, L. Moroni, D. Pedrini, S. Sala (INFN-Milano);
P. Gutierrez, P. Skubic (Oklahoma);
P. F. Manfredi, G. Cesura, V. Re, F. Svelto (Pavia and INFN-Milano);
R. Amendolia (Pisa);
S. Shapiro, D. Cords, C. Simopoulos (SLAC)
Reported by D. Nygren

A collaboration meeting was held at LBL on October 22-23 with various interesting results reported.

1. Initial tests of LBL-2, an advanced test pixel cell IC designed by Michael Wright at LBL were reported. Good results were obtained for the time-walk performance and for the linearity of the time-over-threshold relationship. Specifically, for the input charge range of 1 - 8 fC, the time-walk observed in the integrator was less than 6 ns. Specifically, this means that time-tagging to one beam crossing appears quite feasible. For the charge measurement technique using time-over-threshold, linearity appeared to be better than 3% over the range 0.5 - 20 fC. These basic measurements support the validity of the design approach. A design error was found that leads to excessive noise due to charge injection by the integrator reset circuit for noise signals of the "wrong" polarity. This can be easily fixed with an additional transistor in the reset circuit, and a new test die will be submitted for fabrication at MOSIS on November 11. Further performance tests will be pursued during November.

2. The collaboration supported the recommendation for continued effort at Hughes Aircraft Company to perform basic tests on "CHIP 5", a 32 x 64 array designed and built at Hughes. After initial tests, and yield determination, the inventory of working CHIP 5 devices will be hybridized to pixel detectors fabricated at LBL. Further tests be made at UCB Space Sciences Laboratory, to characterize their particle detection performance prior to test beam investigations. CHIP 5 should become available from Hughes in about 3 months.

3. Plans and preparations to test CHIP 1, the Hughes pixel cell fabricated in a rad-hard SOS process are complete. The tests will commence at SLAC and UC-Davis.

4. An analysis of beam test data of a telescope using older Hughes non-smart pixel arrays were presented by Gerry Lynch of LBL; data were taken by Hughes, SLAC, Oklahoma, and UCB/SSL personnel in a 450 GeV/c FNAL muon beam. The spatial resolution results are the same in both x and y : 2.6 microns rms.

5. New Monte Carlo results showing the beneficial impact of pixels on tracking were presented by Oklahoma. The improvement appears most prominently for the highest energy tracks, presumably because these are associated with jets.

6. Additional results were presented on the LBL column-based architecture design, detector radiation damage studies at UC-Davis, the detector development and fabrication program at LBL, transistor conductance mismatch studies for H-P, ORBIT, and UTMC, an emerging plan for medium-luminosity pixel arrays with smaller pixels, and a long-range technology approach for monolithic pixel array development at UC-Davis.

1.1.7 Project Management

UC Santa Cruz

Technical Staff: A. Grillo, A. Seiden
Reported by A. Grillo

Almost all activity in October was focused on the DOE Review, both preparing for it and being present for it. The preliminary report we received at the end of the week review was very positive for SDC as a whole and also for the Silicon Tracker. The verbal communication we had with those reviewing the tracking subsystems was very complementary. Our Cost Book and all the associated spreadsheets are in very good shape. We may need to revise some numbers after reviewing the DOE Report, but that should be a minor amount of work. The project schedule as integrated into the SDC Integrated Schedule in OpenPlan still needs work. Somehow in the translation of data into OpenPlan at SSCL some of the data was lost or corrupted. We managed to put some patches in for the DOE Review, but the final corrections will take more time. We will have to sort that out with Dave Etherton after everyone recovers from the review week.

Many other items in the area of Project Management need to be cleaned up. One is publishing the schedule to all Silicon Tracker members so that everyone understands the targets we are shooting for. This will be done as soon as we clean up the SDC Integrated Schedule. Another area is specs. More attention will be given to getting them written in acceptable formats. There are several CDRs expected in the next few months and that implies a lot of spec writing and reviewing.

A big concern is the need for another staff member to support Project Management. That position was dropped from the FY93 budget due to expected funding shortages. Abe and I are looking at ways to fill the gap, but the organization will not run smoothly (e.g. monthly reports, document control and schedule tracking) until we find a solution.

We held a Silicon Tracker meeting at SSCL between the SDC collaboration meeting and the DOE Review. Having a Silicon Meeting at SSCL in conjunction with SDC meetings seems to work well and we will repeat that for our next meeting in February. The meeting and especially the informal discussions conducted during the time at SSCL were quite beneficial. It is clear that these working sessions should be an integral part of future Silicon Tracker meetings.

In the closing hours of October, two Silicon Tracker MOUs were signed off. A third is near completion. A big push will be put on to get the rest signed off early in November.

Univ. New Mexico

Technical Staff: J. Matthews
Reported by J. Matthews

No activities to be reported this period. A meeting on alignment will be conducted at the SSCL on November 12, 1992.

Electrical Integration with SDC

Technical Staff: H. Ziock (LANL)
Reported by H. Ziock

A meeting was held on October 1-2 at the SSCL which addressed both electrical and mechanical system integration issues for the SDC detector. Representatives from the silicon system present at the meeting were William Miller, Trivan Pal, and Hans Ziock. The topics discussed which were particularly relevant to the silicon system included finalization of the decision not to have a 415 Hz power system, changes in the length of the cable runs to the detector operations building and to the power supply gallery in the underground hall, power supply rack space requirements, and space requirements for the routing of utilities to the detector. Following the meeting new calculations for the sizes of the power cables were made, given to, and discussed with Ken Hess. At a silicon subsystem meeting held October 18-19, a discussion of electrical integration issues that will need to be addressed in the near future took place.

Accelerator Interface

Collaborative

Technical Staff: D.Coupal, G. Chapman , M. Hechler, N. Mokhov, T.Pal (SSCL); A. Palounek (LANL)
Reported by T. Pal

1. The modifications requested from N. Mokhov concerning the MARS code have been completed. T. Pal will start to perform checks on the code, before implementing the geometry relevant to the Silicon Tracker.

2. A meeting was held at the SSCL on October 23, 1992 concerning the particle fluences and activation of the SDC apparatus. The reason for holding this meeting was due to questions and requests that have been received from the SDC group members, experimental facilities group and the accelerator group concerning the particle fluences, activation levels, ...etc. in the experimental apparatus, detector halls, tunnels and the volume surrounding the low-beta quadrupoles. A working group will be set-up, and the next meeting will be held on 16 November, 1992 at the SSCL. For further details, see the minutes of the above meeting.

1.2 Barrel Tracker R&D

Subsystem Manager: Harold Ogren, Indiana University

For the Straw System we have progress reports from Colorado State University (Submitted by R. Wilson), Duke University (Submitted by A. Goshaw and S. Oh), Indiana University(Submitted by H. Ogren), University of Colorado(Submitted by W. Ford), Oak Ridge National Laboratory (Submitted by D. Davis), QRS(Submitted by B. Dunn) , and Westinghouse Science and Technology Center (Submitted by D. Hackworth and R. Swensrud)

Summary:

One of the principle activities of our group in October focused on the preparation for the DOE review and preparation of MOUs and amendments.

Indiana University and Duke University continued their work on running the 4 meter modules and analyzing the tracking. Colorado University, using a shorter test module, examined straw tracking resolution and electronics. There were continuing studies of the straw chamber operation, including wire scanning tests, radiation effects, and neutron studies.

Several new module shells were received and straightness tests performed. A new stereo module is under construction. During the last week of the month wire stringing began.

Work also progressed on trigger module construction. Composite Horizons completed the first shell from the new mold.

The DOE review presentations were given by W. Ford, A. Goshaw, and H. Ogren. An alignment meeting was held at Duke University to coordinate the barrel tracker efforts.

At all the universities there was continuing effort on detector simulation with an eye toward the January decision on Straws and Fibers.

Enclosed are the individual reports from members of the Straw group

They cover the following WBS items:
WBS 1.2.2 Support
WBS 1.2.5 Tooling
WBS 1.2.6 Utilities
WBS 1.2.10 Facilities
WBS 1.2.11 Management
WBS 1.2.12 R&D activities

1.2.2 Support

1.2.2.1 Support Cylinders

WSTC

Engineers: W. Barkell, R. Swensrud

1) Completed the draft report of the combined selection and material property matrix, and FEA baseline deflection study.

2) Completed the draft report on humidity testing done to date. WBS 1.2.2.2 Shim Rings and Attachments

3) Completed the report for the design and fabrication of module attachments and actuating tool prototype.

1.2.2.3 Spaceframes

WSTC

Engineers: W. Barkell, R. Swensrud

Completed the report for the Revised Straw Outer Tracker Subsystem Geometry Definition Report.

1.2.5 Tooling Equipment

1.2.5.1 Module Tooling

Indiana

Engineer: T. Collins

A specification for the second trigger module mold and shells was written. It is under going work at SSC before it can be sent out for bid. This hopefully will generate a secondary source of vendors for us.

1.2.5.2.2 Support Alignment

WSTC

Engineers: W. Barkell, R. Swensrud

Completed a subsystem overall requirements plan for the structure alignment work required during tracker structural component fabrication and final assembly.

1.2.5.2

QRS

Staff: M. van Haaren, W. Dunn, A. Yacout
Author: M. van Haaren

In October, we have established a measurement tasklist and have been trying to finish our MOU's for the 1993 fiscal year. We are trying to establish a thinking ground for measurement and alignment of the production machinery and the finished parts for the barrel straw tracker. We are planning to continue work on the specific tasks concerned with final global position measurement of the straw modules and we are working on a complete alignment plan for the spaceframe production as well as shim ring machining processes.

We are planning to test our module fiducial measurement technique at the SSCL in December. We are planning to build three to five fixtures to conduct this test using various sized balls.

1.2.5.4 Tracking Detector Alignment

Duke University

Physicists: Al Goshaw, Tom Phillips and Bill Robertson

On October 7th Duke hosted a straw tube tracker alignment meeting. This brought together about a dozen people from Duke, Indiana, ORNL, QRS, the SSCL and WSTC to share ideas for the survey and alignment of the outer barrel tracker. In addition, Jacques Govignon (Draper Labs) attended to provide the link with the muon tracker. The topics discussed include:

- straw tube wire alignment using electron (Seog Oh) and x-ray (Bill Dunn) scans
- status of module attachment scheme (Warren Barkell)
- attachment of fiducials and module rails (David Vandergriff)
- summary of alignment goals (Al Goshaw)

- plans for module alignment tests (Michael van Harren
- survey equipment and plans at the SSCL (David Veal)
- review of muon alignment plans (Jacques Govignon)

Part of the meeting was used to prepare for the DOE review and to discuss straw tube MOU preparation.

Based upon this meeting, areas of responsibility for the outer tracker survey were more clearly defined. These have subsequently appeared in the group of MOU's prepared by the Straw Tracker Subsystem. In particular, Duke will be given the responsibility of constructing a prototype wire scanner using electrons. We will maintain the possibility of an x-ray scanner but will not pursue hardware for this until after an internal straw review of wire scanning.

The module attachment rail and fiducials will be fabricated at ORNL with the design of the fiducials specified by work being carried out at QRS, and the rail being developed in cooperation with WSTC. QRS will work with David Veal to test the proposed module survey scheme at the SSCL. As mentioned in previous reports we are still waiting for delivery of the Wild Theomat 3000 at the SSCL. Calculations done by David Veal indicated that the module survey procedure should have the required accuracy. QRS (Michael van Harren) will work with Duke during FY93 on the more global inner tracker survey problems.

Duke will refine the alignment goals by studying the effects mis-alignments have on track reconstruction. Dr. Bao-tang Zou will arrive at Duke in mid-November to setup the SDCSIM program on our local VAX cluster.

1.2.6 Utilities for the Straw Tracker

ORNL

1.2.6.1.1 Straw Tracker Cooling Utilities

Engineer: R. Leitch

An alternative routing scheme has been developed for the cooling gas which allows the line of sight necessary for alignment of the tracker modules using fiducial points located axially along the straw tube modules. This scheme was presented at the Department of Energy (DOE) review late this month. In order to find sufficient space, access holes had to be cut into the support structure. Preliminary analyses are indicating that this is an acceptable approach. Initial discussions have began with the SSCL to establish the functional interfaces between the tracker system and the facility system.

1.2.6.1.2 Drift Gas Utilities

Engineer: R. Leitch

Similar to the cooling gas, routing layouts for the drift gas were revised this month to allow for visual access to alignment fiducials. No modifications to the support structure will be necessary to accommodate the new routing scheme. Initial discussions have began with the SSCL to establish the functional interfaces between the tracker system and the facility system.

1.2.6.1.3 Signal Electronics Utilities

Engineer: R. Leitch

Routing layouts were began this month for the straw tracker signal electronics cables. These layouts will be integrated with the cooling gas and drift gas layouts to produce an integrated utilities layout. It is expected that several iterations will be required in order to interface accurately with utilities from other SDC subassemblies.

1.2.6.1.4 Electrical Power Utilities

Engineer: R. Leitch

Routing layouts were began this month for the straw tracker high and low voltage power cables. These layouts will be integrated with the cooling gas and drift gas layouts to produce an integrated utilities layout. It is expected that several iterations will be required in order to interface accurately with utilities from other SDC subassemblies.

1.2.10 Facilities

1.2.10.1.1 Module Clean Room

Duke

In preparation for module construction at Duke in 1993, we have begun to expand the laboratory facilities in the Physics Building. We currently have two labs devoted to SDC straw tracker work. One will be expanded and we have been given approval by the Physics Department to take over a second large room. This second room will require considerable renovation. We are in the process of discussing the details of this with the administration.

Colorado State University

Physicist: R. Wilson

A preliminary layout for the production cleanroom prepared.

Indiana University

Engineer: T.Collins

Three clean room companies were contracted for bids on a module facility in Swain west. No quotes have yet been received.

1.2.11 Management

1.2.11.2 Scheduling and Reporting

Westinghouse

Engineers: F. Beninati, R. Swensrud

1) Transmitted to the SSCL the Itemized Tabulation for the Straw OuterTracker WBS 1.2 on October 1, 1992.

2) Revised and issued the Cost & Schedule Data Package Revision 1 for WBS 1.2 Straw Tracker to the SSCL on October 2, 1992.

3) Revised the WBS 1.2 Dictionary and transmitted it to SSCL.

4) Transmitted the Straw Tracker WBS 1.2 and The Dictionary to each subsystem institutions on Disk.

5) Issued the revised Straw Outer Tracker "SDC Full Cost and Schedule Book" for use at the DOE review.

6) Attended the SDC Collaboration meeting at the SSCL on October 22 &23 and participated in the efforts to prepare engineering and cost and schedule presentations for the pending October 26th DOE review.

7) Continued setup of the FY93 Engineering Budgets per the WBS with detailed schedule, well defined deliverables, and work task activities to facilitate Cost/Schedule Control System Criteria for Earned Value tracking.

1.2.11.5 Management, Scheduling and Reporting

Colorado State University

The MOU and amendments were prepared containing budget for FY93. Final details were still being worked out at the end of the month. Wilson attended the DOE review of the project at SSCL

Indiana University

Physicist: G. Hanson, H. Ogren

A good deal of time was spent preparing material for the DOE Reviews. Trips were made to SSCL on October 21-23 for preparation (H. Ogren) and on October 26-30 for the presentation (Ogren, Hanson, Rust, Collins, Wente, Luehring). During the DOE review we had a straw meeting, October 28.

There was a considerable effort on producing MOU and MOU amendments . Most of them were completed by October 30, 1992.

University of Colorado

Physicist: W. Ford

MOU and amendments were written and completed by the end of the month.

Management planning and preparation for DOE Review, including the Oct. 22-24 Collaboration meeting and a presentation at the DOE review on October 27, 1992.

1.2.11.5 Lead Engineer Program Management

Lead Engineer: R. Swensrud

1) Completed a draft costing proposal that includes all (W)STC straw tracker work for FY93.

2) Attended an Integration meeting addressing straw tracker mounting and cabling issues at the SSCL on October 1 to 2, 1992.

3) Attended an alignment workshop and (engineering FY93 SOW & detailed WBS) straw tracker subsystem meeting at Duke University on October 8,1992.

4) Attended a vendor contract award kickoff meeting at the SSCL on October 21, 1992. Specification review, technical questions, and design concepts were reviewed with the vendors with respect to the Hercules prototype cylinder and lamina tests and the Kaiser spaceframe testing program. The Hercules Specification is being revised with no change in price.

5) Attend the SDC Collaboration meeting at SSCL on October 22 to 24, 1992 and presented required straw tracker engineering.

ORNL

1.2.11.5 Program management

Engineer: D. Davis

The Oak Ridge National Laboratory (ORNL) memorandum of understanding and FY93 amendment were revised this month to show more detailed task descriptions and deliverables.

Also, several view graphs showing utilities routing were prepared to support presentations to the DOE on October 28. Presentations were given at the SSCL integration meeting held earlier this month.

1.2.12 R&D Prototypes

1.2.12.1 R&D on Modules

Colorado State University

Physicists: W. Toki, R. Wilson

The MOU and amendments were prepared containing budget for FY93. Final details were still being worked out at the end of the month.

- Began negotiations with candidate for senior technician position
- Acquired parts of the data acquisition system for straw testing
- Assembled and mapped high field magnet for straw tests

Wilson attended the DOE review of the project at SSCL

Duke University

Physicist: S. Oh. Chiho Wang
Engineer: William Lee

During October, Duke has been working on four projects.

1. Test of the electron scanner for measurement of wire positions.

This month, we have constructed an electron scanner using a collimated electron beam. The scanner is controlled by a PC to minimize human intervention. This is the first full scale scanner. Using the scanner, we have measured the position of sense wires (48 out of 159 in the module) and compared to the results obtained using cosmic ray tracks. We

found that there is an excellent correlation between the two. We estimate that the accuracy of the scanner is about 50 microns.

2. Study of the chamber response to neutrons.

We have obtained a neutron source to study the chamber response to neutrons. First we have measured the pulse shape from the chamber and from the Penn ASD's. As expected there are very large pulses caused by knocked out protons.

We have also measured the cross talk caused by such large pulses, and have found that the cross-talk is confined to the adjacent straws. We are continuing the study.

3. Construction of the interface board for the ORNL HV-ASD cards to connect to TDCs.

We have prepared to test the High Voltage-ASD card being produced at ORNL. For the test, we have constructed an interface board to map the wires and to connect the outputs from the HV-ASD card to the TDCs' and to the supporting structure around the module.

4. Manufacturing of tooling and cost estimates for the wire support.

We have started to design the tooling to produce the spiral wire support. We have come up with some clever ideas for the tooling design. This is in case the wire supports have to be produced at Duke. We are also continuing to explore the possibility of producing the wire supports using outside vendors.

Indiana University

Staff: B. Martin, E. Wente, T. Collins, M. Hampton
Physicists: G. Hanson, D. Rust, H. Ogren, F. Luehring

Work on a resistive termination for the far end termination of the straws has progressed. There was more work on the design of the termination. A memo on the design was written by D. Rust. Contacts were made with Columbine Plastics to use the existing Colorado mold to produce some conductive plastic parts. They have several conductive plastics that they will try.

The radiation damage test was completed. A single straw had been run at full voltage for several months. The straw seems not to have suffered any damage for equivalent current draw equal to 100 years at SSC design luminosity. A memo on this was written by D. Rust.

Several design approaches for easing wire stringing are underway. New variations on the endplate design have been worked out and Colorado has been in contact about the design changes. Contacts with the wire company to see if wire diameter could be varied a few microns with gold coating to grade the wire gain, indicated that this approach will not be feasible.

There has been more work examining wire resolutions. Further noise reduction was possible, but resolutions have stayed about where they were reported lst month.

An order for straws was submitted to Stone Industries. They should be ready to wind the straws during the second of November. This will produce about 2000 straws. This may be enough for all of the beam test chambers.

A 3-D CAD drawing of the module lay out was finished. This was used to check the Westinghouse calculation. No major problems were found.

One of our group (T. Collins) went to the Plastics USA conference in Chicago on October 13-14. He also attended an introductory course on plastics.

The second stereo module was assembled at IU. This module uses the cyanate ester shells delivered by CHI during the month. The new module used the Colorado design of the double V's. With the new design the leader wire could be easily blown through the straw for wire stringing. Modification of the endplate for several direct ground connections were also made. It is undergoing gas tests.

The module shells were measured and analyzed before gluing, after gluing, and after wire stringing. A memo is being written on the results.

We interviewed for a new assembly technician.

We hired Margo Hampton for the job.

The DAQ for the beam test was looked into. Contacts were made with SSCL concerning the best hardware. While at SSCL for the DOE review, the existing systems were looked at.

University of Colorado

1.2.12.1 R&D on Modules

Technical Staff:	B. Broomer, E. Erdos, G. Schultz, C. Zuelchner
Physicists:	D. Craig, W. Ford, S. V. Green, D. Johnson, P. Ranking, J. G. Smith

More measurements of crosstalk in the 12-inch prototype straw chamber/A-S-D8 system, with Fe55. Various approaches now indicating about 1-3%.

Began a set of measurements of the A-S-D8 output pulse width as function of input pulse charge.

Sent drawings to Cinch for quote on a spring-contact connector block containing blocking capacitors. This is part of an endplate scheme which will allow removal of both the front end board and capacitors for servicing.

Designed a modified routing board for use with a high-density prototype FEB to be built by Penn.

Received the remaining wire supports of our original 8000 piece order. Inspected a sample, measuring vee locations in a hexagonal lattice.

1.2.12.1 Beam Test Components

Westinghouse Science and Technology Center

Engineer: W. Barkell, R. Swensrud

Developed draft detailed WBS with activities and costs for the support structure for the FY93 R &D WBS 1.2.12.1 & 2 Beam Test Prototype program.

1.2.12.2 Beam Test Assembly and Mount Prototype

Westinghouse Science and Technology Center

Engineer: W. Barkell, R. Swensrud

Developed detailed WBS with activities and costs for the FY93 R &D WBS 1.2.12.2.1 Mount Prototype program as concepted.

SIMULATION

Colorado

Physicists: W. Ford

In the simulation effort, several tests to try to reconcile occupancy results with those measured by Indiana.

Indiana

Staff: E. Wente
Physicists: F. Luehring, G. Hanson

Installed and used new and better UNIX workstation (IBM RS/6000 model 560).

Calculated track trajectories using impact parameter for the first time (this is needed to assign *Z* correctly to stereo straw hits when B0 is large). Added many plots to improve efficiency and fake rate calculations.

Worked on Bjet to leptons. (Found reasonable lepton finding efficiencies).

Worked on Higgs search for the case where the silicon detector is not used, found *Z*'s and Higgs.

Went to SSC simulation meeting Oct. 21-23. To discuss simulation plans with rest of group (F. Luehring, G. Hanson) Partially resolved occupancy differences with Bill.

1.2.20 Tests of Scintillating Fiber Tracking at BNL

UCLA, UIChicago, Notre Dame, Penn State, Purdue, Rice

Physicists: M. Atac, J. Solomon, C. Chung, M. Wayne, R. Ruchti, R. Lewis, J. Passaneau, D. Koltick, B. Howell, B. Abbot, T. Zhou, E. Shibata, M. Corcoran, J. Elias

Analysis of data recorded during the beam test of 96 channels of fiber tracking at BNL. This includes studies of photostatistics, attenuation length, alignment and registration, and tracking efficiency and resolution. A meeting was held at Fermilab, October 1 , to review the status of various analyses and to focus the analysis and R and D efforts for the next several months.

Cosmic Ray Test of 1K Fiber/VLPC Channels

UCLA, Fermilab, Notre Dame, Penn State, Purdue, SSC Laboratory, UT Dallas

Physicists: M. Atac, J. Elias, M. Binkley, A. Baumbaugh, C. Rivetta, R. Ruchti, B.Baumbaugh, M. Wayne, R. Lewis, J. Passaneau, D. Koltick, J. Schmitz, B. Howell, F. Bird, J. Thomas, H. Fenker, T. Regan, R. Chaney, H. Hammack

Preparations continue for a 1K channel test of VLPCs and fibers in collaboration with the D0 experiment at Fermilab. The tests will be initiated in the winter of FY93 and beyond in LAB6 at Fermilab and will utilize cosmic rays. Additionally, a compact test stand for tests initially of 32 fiber/VLPC channels and later up to 128 channels is in preparation at SSCL. Goals of the small system are to provide test measurements in preparation for the SDC tracking review and to study HISTE-IV VLPCs once they become available.

1.2.26.3 ASD Development

Fermilab ,Notre Dame, ORNL, Purdue, UT Dallas, Rockwell EOC, Rockwell SC

Physicists: A Baumbaugh, A Bross, R.Ruchti, M. Binkley, B. Baumbaugh, M. Wayne, P.Besser,E.Anderson, M. Emery, J. Schmitz, H. Hammack

A meeting was held at Fermilab to discussion the amplifier shaper discriminator options for VLPC readout. Discussions began with consideration of the VLPCs and then continued with a review of existing circuitry including TIA, VTX, QPA02, and PENN ASD8 devices and boards. It was agreed that tests of Penn ASDs would be scheduled for mid November 1992 at Notre Dame, and that a readout board review would take place in early December 1992 at ORNL.

1.2.32 Preparation for the SDC DOE Review

FTG Group

The FTG Group presented three presentations at the Department of Energy Review of the SDC Detector: System Overview (R.Ruchti), Management Plan (D.Koltick), and Cost and Scedule (D.Vandergriff).

1.2.32 Presentation Preparation for the DPF Meeting at Fermilab

FTG Group

Preparations are underway for two papers to be presented at the 1992 Meeting of the Division of Particles and Fields. Papers include: (1) a review of the SDC fiber tracking option; (2) a review of beam, cosmic ray, and source tests of fiber tracking.

1.3 Intermediate Tracker R&D

1.3.1 GMD (Gas Microstrip Detector) Tiles

Carleton/CRPP

Technical Staff:	G. Findlay, P. Gravelle, E. Neuheimer, K. Miels, M. O'Niell, Y. Yu
Physicists:	M Dixit, P. Estabrooks, J Armitage, M. Losty, G. Oakham, G. Stuart, D. Paterson
Submitted by	M. Dixit

A new test cell to house the GMDs with individual anode readouts has been fabricated and is now operational. Low gain Fe55 signals have been observed with a 200 microns pitch aluminum electrode print on Tedlar using this cell. We have also received a number of 200 microns pitch gold electrode prints on ion-implanted Upilex. At present, the quality of the gold prints appears to be not as good as the aluminum ones. No signals have been observed with the gold prints so far. Because our 400 micron GMDs have worked better than the 200 micron ones in the past, a 400 micron pitch GMD mask with individual anode readout was also designed in preparation for the beam test. Unfortunately, there has been a delay in the fabrication of this mask by the manufacturer and no prints of this mask are available for testing yet.

Reported by M. O'Neill

Discussions with the National Research Council - Materials Division have taken place to collaborate on the development of the composite components for the ITD; tile backing, drift plane and support disks and support structure.

Molds for the largest and smallest tile backplanes and drift planes have been made and given to a manufacturer for prototype quantities of these. Fibreglass/rohacell backplane prototypes have been made by the same manufacturer.

The mounting jig and test frame for the November beam test of plastic substrates has been completed. Tile deflections under different boundary conditions was studied using hand and FEM (ANSYS) calculations.

Single tile deflections under 1/2 inch water pressure and 1 inch water pressure were also calculated using FEM.

The task of updating the radiation length report is progressing.

An engineering working meeting was held at Liverpool, discussions included tile design and mounting issues.

Liverpool

Technical personal:	A. Muir, C.D. King + Workshop
Physicists:	S. F. Biagi, T. J. V. Bowcock, T. J. Jones, S. Kiourkos
Submitted by	T. J. Jones

The keystone geometry mask has been resubmitted to UK industry. SFB visited the company and scanned the mask there. We are in the process of arranging production of about 10 MSGCs using the new masks. It is hoped that these devicec will be available by the end of November.

Work on the electrostatic simulation of MSGCs continues. Several geometries have been created and the results are being analysed. Work is also underway on a simulation of the H1 Radial Wire Drift Chambers. The results of this simulation, when compared to existing calculations and experimental data, will act as a check on the performance of the program.

Installation of the x-ray set continues. A 2-channel 400 Mega Samples per Second acquisition based on a Lecroy 9450 and a PC has been developed. This will allow precise measurements of the time structure of the MSGC pulses to be measured.

Tests of the RD20 front-end amplifier are underway. This amp will be connected to an MSGC in the near future.

A trial build of the complete system for the upcomming beam test has been completed at Liverpool and all mechanics has been delivered to RAL.

The design of the MSGC tiles and their mounting to the support disks is continuing.

Simple tests of pcb substrates for heat-transfer capability have been made.

Universte De Montreal

Physicists: Louis-Andre Hamel, Jean-Pierre Martin, Pierre Savard, Paul Taras
Reported by Paul Taras

Various tests have been carried out to try to establish why we have not seen a signal with our Si substrates (use of an Am source, plastic substrate with and without electrode passivation,...). The passivation epoxy we used seems to be inadequate - it will be replaced by the epoxy used by the Sauli group at CERN, the gas mixture will be changed from Ar/methane to Ar/isobuthane and lower voltages will be tried. In addition, the next batch of substrates, fabricated by our group, will have a thicker layer of SiO_2 (1.3 micron versus an initial thickness of 0.6 micron). Only the lithography remains to be done before they can be tested. We also intend to make thicker electrodes (1 micron versus 0.2 micron at present).

RAL

Technical Staff: J. F. Connolly, J. E. Bateman, R. Stephenson, A. Nichols
Physicists: M. Edwards
Submitted by J. F. Connolly

We have been concentrating on the preparation of 3 gas microstrip modules for testing in a beam in CERN in November. The modules consist of 1 mm thick glass plates mounted in a holder which carries the pre-amp. This is a modification of a hybrid amplifier designed at RAL. It has a rise time of 13 nsecs and a fall time of 25 nsecs, enabling studies to be made of the pulse shape from single anodes.

The support system for the GMD's has the facility to allow one of the GMD's to be rotated about a vertical axis. This will enable studies to be made of angled tracks.

Work on large area masks continues. A 210 X 155 mm keystone cathode pattern mask should be available before the end of this year. Further sources of even larger masks are being pursued. Small area (100 X 100 mm) keystone cathode masks have been produced using the EBL facility at RAL.

Tests with semiconducting glass substrates indicate that other than wet etch processing must used to achieve the best results. Imprved results have been obtained using plasma etch.

Purdue

Technical Staff:	I. Shipsey, P. Wang, T. Miao, M. Bishai, E. Gerndt, N. Menon
Submitted by	I. Shipsey

We are attempting to manufacture a large GMD using excimer laser ablation. A purdue negative chrome on quartz mask using a Hoya blank was able to take 70 mJ/cm^2 without damage. This is adequate for exposure of photo-resists and also for laser ablation of photo-resists.

Our first exposures have produced nicely ablated GMD patterns in Shipley AZ1350J on Tempax glass. To turn this into a GMD requires liftoff i.e. metalization and stripping. Since our normal mode of GMD production uses a wet etch tecnhique, we have first had to learn liftoff using conventional UV lithography. We are now adept, and expect to process the ablated pattern in the next few days. We are almost ready to attempt direct write of a metal layer. Positive Hoya blanks have now been received, and a lightfield chrome on quartz mask will be made and sent to resonetics along with metalized substrates for dirtect write in about a week.

We have continued to build working GMD's on Tempax at Purdue from Purdue masks.

We are extending our range of substrates to include Tempax, Fe-Vanadium glass and Upilex.

We are beginning the design work for a Bellazzini style buried-layer thin SiO_2 GMD. All facilities for manufacture exist in-house at Purdue.

We presented our GMD results at a meeting at the Ohio State University and at the CP Workshop at Cornell.

Both talks were very warmly received. At OSU we gave a lab demonstration of Purdue Tempax GMD's which was very sucessful.

Naresh Menon will present our results at the Undergraduate Science Symposium at Argonne on 7 November 1992.

We recently submitted a joint proposal by all the U.S. ITD groups to the TNLRC. It is our belief that if this proposal is successful it will greatly facilitate the timely completion of the laser ablation and buried layer work described here.

Texas A&M

Technical staff:	T.S.Elliott, L.T.Goss, T.B.Kasprowicz, V.P.Madduri, T.K.Mazumdar, Y.Pang
Physicists:	E.F.Barasch (now at Touro College, Dix Hill, NY), H.P.Demroff (full time), R.M.Gaedke (Trinity University, San Antonio, TX), P.M.McIntyre, H.-J. Trost, G.Vanstraelen (SSCL, Dallas, TX)
Reported by	Hans-Jochen Trost

The ion-implanted Kapton chamber (manufactured by Spire Corporation using our mask, has been tested at A&M and then irradiated with a 60Co source at Spire with a dose of 1 Mrad. Thereafter we measured an unchanged performance, the gain is the same as before irradiation and the 55Fe peak width at 5.9 keV is still at 17%. The dose corresponds roughly to the dose expected from 3 SSC-weeks at design luminosity. This exercise is scheduled to be extended to 10 Mrad or an equivalent of about 2 SSC-years. The control measurements are done with the 200 micron pitch chamber print.

A comparison of gain-cathode voltage curves at otherwise equal conditions of chambers with widely different surface resistivities indicates that with increasing resistivities larger gains are obtained. This effect is canceled out though by less mobility of charges on the surface leading to reduced rate capacity.

Our next activity will be to install a CAMAC readout of our test chambers into a PC with subsequent offline analysis capacity on, e.g., our VAX workstation.

In a coordinated single proposal with Purdue University (Ian Shipsey), Texas Tech University (Alan Sill), and Trinity University (Rudolph Gaedke), we have applied for funding to TNRLC for the period April 93 through March 94. Neither of the four institutions has support out of SSC money currently available, and neither expects any.

Texas Tech University

Reported by: A. Sill

Modeling and simulation are being done by the group at Texas Tech U. to study the layout options for the ITD and a possible backup option made entirely of silicon. The goals of this effort are to optimize the layout both of silicon and ITD component in order to achieve the best overall performance, reduce technical risk and lower cost.

Several models were run this month, and an option was found which can reproduce the performance of the TDR system over all eta with an all-silicon system which would add less than 10 square meters to the silicon system area. Clearance between the silicon system and straws would be too small in this system, so several new models are being investigated in order to preserve this perfomance while leaving enough clearance for mechanical support and readout cables. Other studies are also being done to determine the minimum overall "baseline" configuration (GMD/straw + silicon) which meets the needs as defined in the tracking requirements document.

Also, in collaboration with the Rochester group, Texas Tech is continuing investigation (using TNRLC funds) of the use of CDF silicon electronics for readout and test of small-scale GMD test chambers. This will speed the development of test chambers, especially those produced in the U.S. A subcontract was placed this month to have Lawrence Berkeley Labs (LBL) produce a set of CDF SVX-style Silicon Readout System / Silicon Data Accumulator (SRS/SDA) modules to be used in these tests. These should be complete and ready for use in approximately ten weeks.

Triumf

Physicist: R. Henderson M. Salomon
Submitted by M. Salomon

We have finished the first radiation damage run on a GMD. The conditions were the following: The print was made at Carleton and PPM, aluminum on Tedlar, 400 micron pitch, the gas was CF4+Iso(80,20), anode-cathode volt. was 760 V, drift was 1500 V and backplane same voltage as cathodes (ground) The source was a high intensity Sr90 (1 MeV

electrons) producing a count rate of about a MHz on an area of 0.5 cm^2. The gas gain was $5*10^3$ and the current at the anodes was 0.02 microamps.

The device ran for 16 consecutive days and accumulated a total charge of 22 miliCoulombs without significant change in pulse amplitude or rate. Inspection of the print at the end of the run showed one anode trace was broken. The run was stopped because of failure of the preamplifier.

1.3.2 Front End Electronics

Carleton/CRPP

Technical staff	E. Neuheimer, G. Findlay,
Physicists:	M Dixit, P. Estabrooks, J Armitage, M. Losty, G. Oakham, G. Stuart, D. Paterson
Submitted by	J. Armitage

We have been concentrating on getting electronics ready for a test beam run scheduled for November. We have built and debugged a 24 channel pre-amp/driver receiver board, based on commercial electronics, for this run.

Universite de Montreal

Personnel:	Louis-Andre Hamel, Jean-Pierre Martin, Pierre Savard, Paul Taras
Reported by:	P. Taras

We have tested and debugged part of the new electronic equipment built at Carleton for the November GMD beam tests This includes the preamp and line driver card, and the balanced receiver circuit. Speed and crosstalk were found to be acceptable with the full length cabling.

1.3.3 Mechanical Engineering

Carlton/CRPP

Technical Staff:	M. O'Neill, Y. Yu, K. Miels
Submitted by	M. O'Neill

A support disk was added onto the FEM support disk/cone model, it has been tested for deflection under various boundary conditions. This model was then modified so that the results obtained could be compared to the RAL model as follows: three superlayers which include a total of six disks were replaced by three sets of equivalent forces, and this model constructed with composite planes was further simplified to one with a single shell of material. A brief summary of the support disk/cone models has been written. The task of updating the radiation length report is progressing.

Discussions with the National Research Council - Materials Division have taken place to collaborate on the development of the composite components for the ITD; tile backing, drift plane and support disks and support structure.

Various support boundary conditions were added to the FEM model to investigate material requirements for the support disk.

Concepts for x,y and z mounts and adjustments for the ITD support to central tracker support frame are still being developed. Discussions with suppliers and fabrications continues on costing, materials and fabrication issues.

An engineering working meeting was held at Liverpool, discussions included support structure design and mounting issues.

Liverpool

Technical Staff: C.D. King, A. Muir, J.M.Morton
Reported by T. Jones

RAL

Technical Personnel: G. Tappern (40%), K. Goodchild (20%), R. Malton (75%)
Reported by G. Tappern

Finite Element Analysis has continued on the study of deflections in particular of the support structure now that it is supported from the Barrel detectors. It has been assumed that a Polymoderator of 90mm thick can be incorporated into the backplate.

Study of materials continues into the use of the Hexcell carbon fibre core and carbon fibre skins. An R&D program is being set up now to test for coeff of expansion and water absorption effects.

1.3.8 Installation

Carleton/CRPP

Submitted by M. O'Neill

Proposed methods of installing the ITD have been discussed with SSCL.

RAL

Submitted by G. Tappern

Two versions have been produced of a system to transfer the ITD from the barrel detectors to the End Cap. This is to give access to Barrel detectors for maintenance.

1.3.9 Project Management

Carleton/CRPP

Submitted by M. O'Neill

Budgets for NSERC funding applications have been reviewed and changes recommended. The TIMELINE schedule was modified to include the contingency allocated in the EXCEL spreadsheet analysis.

2. CALORIMETRY SYSTEMS R&D SUMMARY

Summary

Refinements to the designs and drawings for the barrel prototype EM absorber, hadron absorber, and the shower max detector continued during October. Materials for the EM mold were ordered. Drawings for the prototype hadron absorber were sent to the PRC for fabrication.

A cost estimate and schedule were prepared for the endcap EM calorimeter. Quotes for the hadronic endplug were received. A new method of making source grooves in steel using a plasma-arc is being developed.

Development activities continued in the source calibration system, the light flasher system, and the study of radiation effects on tiles.

2.1 Barrel Calorimeter R&D

ORNL

Technical Staff: T. A. Gabriel

No activity this month.

2.1.1.1 Module Structure

Fermilab

Technical Staff: M. Banas, L. Bartoszek, I. Churin, R. Da Silva, B. Hahn, B. Wheeler

We spent October on the design of trhe hadron wedge prototype. Drawings for the wedge prototype were ready by mid October. The rest of the month was spent checking and producing "rev A". Construction of tooling, steel procurement, and steel cutting has begun in China.

We are also currently working on the design of the two piece wedge which makes shipping costs from China less.

We are still working to resolve the routing of the source tubes by manifold in the crack between the barrel and end cap. We also continued to refine the calorimeter support structure. More analysis will be performed using finite elements on the cradle and support frames ("picnic tables").

We will begin design work on the end cap shortly in November.

2.1.1.2 Scintillator Assemblies

Saclay

Technical staff: F. Rondeaux, J. Heitzman, G. Besnard, P. de Girolamo, H. Duboue, D. Gauthereau, A. Giganon, S. Herve, C. Jeanney, E. Mossimo, D. Pierrepont

Shower Max Simulations

GEANT simulations:

Results on the Shower Max performance as a function of depth in the barrel EMC were presented at the Shower Max sub-system meeting at Rockefeller. The SMD position in cell #7 (η=0) and #3 (η=1.3) is very near the optimum for energy and position resolution as well as for e/π separation. Should a constant depth as a function of η be necessary, then cells # 4 or 5 are the best positions.

Results on the effect of photostatistics on the SMD performance were presented to the "Optics Review Committee" during the SDC collaboration meeting at the SSC Lab. For electron energy and position resolution, the effect of photostatistics is small compared with the intrinsic shower fluctuations if the light yield is larger than 1 photo-electron / m.i.p. (see figure).

Simulation of physics channels to determine trigger and reconstruction efficiencies:

A status report on the study of $t \rightarrow W \rightarrow \tau \rightarrow \rho \rightarrow \pi + \pi^0 \rightarrow \pi + \gamma\gamma$ was presented at the Rockefeller meeting. The usefulness of the SMD for reconstructing the mass of the rho was shown.

Shower Maximum Detector

Work has started on a second complete SMD module which will be installed in the SM slot of the mockup barrel wedge at Fermilab, covering 4x4 towers at large η. This should confirm the feasibility of the fiber routing which was demonstrated in August at η=0.

A SDC note on the design and installation of the barrel SMD (SDC-92-346) was submitted and presented at the SDC collaboration meeting.

Engineering on the SMD prototype (128 strips, 64 channels) to be installed in the EM endcap calorimeter prototype built by LBL is continuing.

2.1.1.3 Photomultiplier Tube System

University of Texas at Arlington

Technical Staff: P. Draper, L. Sawyer, G. Sickand, M. Sosebee, A. White
Reported by P. Draper

PMT Drift Monitoring

We have purchased a Laser Photonics LN203C Nitrodye laser with 600ps pulse width and 2ns trigger jitter for development of the laser calibration system for the barrel prototype. This system also includes a tunable dye cell that allow us to shift the wavelength into the green peak response of the photomultiplier.

We have been bringing up a Macintosh-based (LabVIEW) CAMAC data acquisition system for testing of Hamamatsu cooled PIN diodes. These diodes are being evaluated for use as a precision pulse intensity monitor for the laser, as well as the monitor for the pulse-to-pulse time jitter.

Phototube Assemblies

We have been using a test circuit for measuring the transparency of the analog MUX to be used at the input to the charge splitter circuit to feed in signals either from the charge injection circuit or from the PMT base. The MUX of interest is a Comlinear CLC532 2:1 with 12-bit settling within 17ns. We have been able to confirm some performance parameters, and are trying to get a noise measurement.

2.1.1.5 Tile Calorimeter Calibration System

Purdue

Physicists: V. E. Barnes, A. T. Laasanen, J. Ross, M. Fahling
Reported by V. E. Barnes

Long term wear tests of source drivers, dummy source wires, and source tubes with multiple bends continued at two test stations (VAX and PC) at Purdue and one PC test station at Fermilab. The wire in one of the Purdue test stations exceeded 40,000 extend-retract cycles in October. At the other Purdue test station the wire (ID#5B) failed on 30 September at 16:50 hours, at poke number 22,046. It broke 15 inches outside of the source tube into which it was fully inserted. Thus, it had never been flexed by any of the three 3-inch bends in any of the source tubes. It had experienced flexing only by wrapping onto the storage reel (radius = 3.25 inches), by passing through the S-bend nozzle tube (minimum bending radii ~~ 3.5 to 4.0 inches) and by passing through 180-degree arcs of nylon tubing (radius ~ 12 inches).

A new "wire" (ID #11) was made, including an enlargement bead. The 22 gauge hypodermic tubing was from a continuous 1000 foot reel which had been specially ordered. This source wire stock is noticeably softer (it takes a permanent curvature more readily) than the usual 20-foot straight lengths, but is also made of type 304 stainless steel. Due to the bead length and diameter being a bit large, (less than 0.004 inches of clearance in straight sections of the source tubes) the wire did not consistently pass all three bends in the source tubes until we increased the end-of-tube turn-off force by 25% . At poke number 3978 we discovered a significant set of kinks in the wire, 8' 9" from the tip, where it exits the storage reel while being pushed into the last bend in the source tubes. By poke number 4432, the wire had broken 6' 10" from the tip, and there was a 2-foot long section with a series of ripples which we attribute to buckling of the wire under the force of extension at the bends in the source tubes.

Further wires were made from the same continuous stock, and continued to show kinking from the extension force. According to the manufacturer, the usual 20' straight stock is straightened by drawing through a succession of increasingly shallow bends. This may increase the work hardening somewhat, but the manufacturer does not expect that to be very significant. We are exploring how to get 25-foot long (or longer) 22 gauge tubing in the fully hardened form to make the sources for the SDC barrel wedges.

Fahling: One more source driver had its wiring and electrical components installed and was mechanically tuned up. These drivers incorporate a number of mechanical design improvements based on experience with heavy use of source drivers in the past year at testbeams at FNAL and BNL.

Ross, Fahling: Investigating the nature of and solutions to the problems of inverting the source sharing convolution matrix for the cast Pb calorimeter, as well as implications of tube misplacement for accuracy of weighted sums and e/mu predictions. In simulations, the latter seem to be very little affected by tube misplacement (0.25% RMS errors) , while the unfolding of individual tile responses is seriously affected. Simulation

work was started on the possibility of using two different radioisotopes with different penetrating powers and hence different sharing fractions, (such as Co-60 and Cs-137) to measure both the individual tile responses and the displacements of all source tubes from the ideal positions centered in the lead layers.

Shen: Working on phototube base design, and exploring the possibility of using the Cockroft Walton base design for CDF, which could, in turn, be used for SDC.

2.1.2.1 Assemble Scintillator into Module Structure

Fermilab

Technical Staff: J. Carson, H. Fulton, A. Oleck, W. Foster, J. Freeman, B. Hahn, S. Gourlay

Fiber routing studies using a wooden barrel wedge mock-up.

Fibers have been routed at both ends of the wooden mock-up. Work is now focusing on PMT placement on the backbone.

SSC Laboratory

Technical Staff: C. Blocker, J. Budagov, H. Johnstad, J. Siegrist, M. Takashima, M. Turcotte, J .Yarba

2.1.7 Surface Assembly

Argonne

Technical Staff: J. Nasiatka, N. Hill, L. Balka

The shipping schedule reflecting the TITLE I building design, as well as incorporating the assembly/instrumentation of the Endplug, was completed. (See Figures 3 & 4) In addition, when further study of assembly area was done, it was found that the small crane will not clear the assembled calorimeter halves, and the lifting height on the main (50 Ton) crane may be too low to allow proper insertion of the last modules into the calorimeters. (Ref. memo to T. Kirk dated Nov. 6, 1992)

2.1.8.4/2.2.8.4 Project Coordination

Fermilab

A substantial effort during October was devoted to coordinating the development of the Memoranda of Understanding for institutions involved in the SDC calorimeter subsystem. Work assignments among institutions were firmed up. A Task Manager for the Final Assembly (Norm Hill) was appointed. Jim Hanlon, a physicist/computer specialist, joined calorimeter project management staff. Jim will develop software and data systems for survey, tile/fiber tracking, QC testing, data acquisition and WBS / schedule tracking.

A very profitable review of calorimeter optics for the barrel prototype was held. A recommended specification for most of the optical system emerged from the review. The use of single tiles or arrays of connected tiles ("megatile") remains to be resolved. The specification needs to be complete by December 1., 1992

2.1.8.5 System Engineering

Fermilab

Technical Staff: N. Bartlett, H. Fulton, J. Missig

An SDC/CC optics review with Jim Proudfoot as chairman was conducted October 23, 1992 in Dallas. SDC/CC reviews are being scheduled at a rate of one per month.

System engineering has had hardware installed and the "control drawing system" is operating at FNAL. Procedures for operating the system are presently in draft form. A preliminary charter is scheduled to be complete by 12-31-92

2.1.8.7 Quality Assurance

Fermilab

Technical Staff: J. Missig, D. Tinsley

The SDC/CC Quality Assurance plan is being modeled after plans used on previous programs such as the SSCL 50mm string test magnets recently completed at FNAL. Many of the same people will operate the new system for the Central Calorimeter. Plans from other laboratories will be integrated to achieve Q.A. consistency.

2.1.9 R&D / Prototype

LSU / SU

During the month of October, professors Imlay (LSU) and Fazely (SU) attended the SDC collaboration meeting held at the SSCLAB. Fazely presented the progress on optical design and radiation damage studies. Recently, we have been studying radiation damage due to neutrons. We are also in the process of writing a SDC note on the radiation damage studies we performed on non-Bicron tiles and fibers.

We received a 60 cm x 60 cm x 4.8 mm BC-408 scintillator sheet last week. We have cut this sheet into different sizes in order to study light collection due to size effect. Sam Khosravi, our technician, has worked almost full time on this project in the month of October.

2.1.9.1 R&D Tests

Argonne

Technical Staff: J. Nasiatka, D. Carbaugh, C. Keyser, L. Kocenko

The machining of the Ca-Pb samples for the High-Stress Creep test and additional Tensile Testing was completed, and the necessary strain gauges and mounting equipment have been ordered. The Creep Test support framework was completed and placed in the oven. The RTD's for temperature measurement were ordered.

The "Measurements Group" System 4000 Strain Gauge Scanner arrived and has been checked for accuracy. To assure that it was working properly, a known load was placed on a steel strap with a strain gauge mounted. The gauge output was compared to the calculated induced strain (823 uE), and plotted. (see Figure 2) The variance in the reading occurs because the strap used in the test was thin, and moved/twisted slightly during the test.

Fiber routing schemes are still being examined at Fermilab on the Trojan Horse wooden model. The focus this month was at the high eta end of the module, and concerned not only routing the fibers along the module face, but connecting them to the phototubes at the outside.

Fermilab

Technical Staff: A Byon-Wagner, M. Davidson, G.W. Foster, D. Green, F. Markley (FNAL), R. Gustafson, M. Rivard (University of Michigan), H. Mao et al. (IHEP, Beijing)

1. Long term, low dose rate test

The calibration of total dose measurements with the lead brick attenuators was completed. Design of long term, low dose rate test stand is being finalized which will be located in ^{60}Co source chamber at University of Michigan. Tile/fiber samples for this test were assembled at FNAL and shipped to University of Michigan.

2. Test on Final Base-Line tile/fiber configuration

Samples of base-line tile/fiber configuration (according to the preliminary decisions in October SDC collaboration meeting) are prepared at FNAL for the high dose rate radiation damage test at University of Michigan. Test will be done during the months of November through December.

3. Longer Wavelength Region

Samples of 3HF tile and O2 WLS fiber in standard box fiber path and in high density, multi fiber path configuration modules were assembled at FNAL and shipped to IHEP, Beijing for beam test. Test beam task for radiation of these two modules began at IHEP.

4. New Scintillators Development

Samples of Fermiscint#1 and gas tight container are ready for re-testing in nitrogen gas. The testing procedures are being written so that they can be shipped to University of Michigan along with all the materials including prepared WLS fibers.

Saclay

Technical staff: F. Rondeaux, J. Heitzman, G. Besnard, P. de Girolamo, H. Duboue, D. Gauthereau, A. Giganon, S. Herve, C. Jeanney, E. Mossimo, D. Pierrepont

Optical studies and radiation damage

The present status concerning light yield of SM strips was presented at the SDC collaboration meeting. The light yield of a SM strip read out by a WLS fiber is 1.3 p.e. / m.i.p. . This is measured with a 4mm thick SCSN81 scintillator strip (200x13)mm**2 read out by a 21 cm long WLS fiber (BCF91A) spliced to 2 m of clear PS fiber followed by another spliced 2 m long clear fiber. This set up is representative of the arrangement in the full size detector. The photodetector is a RCA 8850 PMT.

This light yield exceeds our requirement of 1 p.e. / m.i.p. To reach our desired safety margin of 2, it is sufficient to use SCSN38 scintillator instead of SCSN81, as

recommended by the "Optics Committee". A further gain of a factor of 1.6 can be achieved, if necessary, by gluing the fiber in its groove.

We are working on defining a procedure to make a quantitative measurement of the degradation of fibers (and in particular of splices) as a result of mechanical stress.

2.1.9.2 Barrel Prototype

Argonne

Technical Staff: N. Hill, V. Guarino, J. Nasiatka, E. Petereit, T. Kicmal

During the month of October, the following work was completed on the design and construction of the EM Section Prototype. All of the detail drawings for the EM Prototype were completed. They are being checked now, and the Final Assembly drawings are being finished. The necessary material for the Front/End Plate and the HAD1/EM Weldment is being ordered. In addition, the necessary supplies and equipment for EM mold assembly/disassembly (shelving, mold release, tools, etc...) is being ordered.

The design of HAD1 section of the EM module has been changed slightly, the inner radius of the HAD1 Weldment section has been moved outward radially by 1mm. This was done in order to avoid the possibility of the space being undersized for the insertion of the last aluminum spacer plate. A dimensional tolerance analysis showed that this was necessary. It was concluded that in order to prevent the possibility of not being able to insert the last aluminum spacer plate, the inner radius surfaces of the HAD1 weldment section should be deliberately increased by 1mm. Any lead flashing that might occur as a result of this change would either be left in place, or removed if necessary. This change in dimension caused minor delays in the completion of the final assembly drawings of the EMC.

A complete costing and production schedule for the Prototype EM Frames has been completed by the ANL Central Shops. This schedule is in agreement with the FNAL prototype production schedule. (See figure 1.)

Westinghouse is continuing its work on the design of the mold. They are currently looking at efficient ways of cooling the bottom of the mold. Initially they investigated forced air cooling, however this would have involved the welding many cooling fins to the bottom plate of the mold. This would result in unwanted distortion, as well as increased cost. It has been concluded that the temperature at the bottom of the mold can not be calculated very accurately for convection alone, and a forced air cooling system would not be flexible enough to make changes in the field.

WSTC is now investigating water cooling system which would spray the bottom of the mold with water. The resulting steam could be vented out of the top of the furnace. The cooling process can be controlled better with this system. They should be finished with the design of the cooling system by the end of November. The detailed design drawings of the mold itself should be finished and sent out for quotes by the end of November as well.

This month at ANL, two test weldments of the HAD1 section were completed. Each weldment consisted of two absorber plates and a spacer plate stacked together and held in place by 3 welded pins and a mig weld along the sides. The basic difference between the two samples was the design of the pins. In the first weldment the pin length was the same as the thickness of the stack and the pins were chamfered. The pins were then inserted in the holes in the absorber plates and the space between the chamfer on the pin and the absorber plate was filled with weld. After the pins were welded there was no

measurable shrinkage but the plates were .030" out of flatness. The sides of this weldment were then welded. No heat dissipation chills were applied to the weldment and the weldment warped badly.

On the second weldment, the holes in the absorber plates were chamfered and the pins had a .030" thick section extend past the surface of the absorber plates. The extended part of the pin was then fused to fill in the chamfer on the plates. This resulted in about half the heat being applied to the plates and as a result the plates were out of flatness only .015". This out of flatness was mainly due to the edges of the absorber plates flaring out. When the edge welding was done, the edges of the absorber plates were clamped down and a heat dissipation chill was used. This resulted in the heat being drawn quickly out of the plates, and as a result, the plate out-of-flatness was reduced to only .009", which is acceptable.

Fermilab

Technical Staff: S. Gourlay, M. Banas, L. Bartoszek, J. Carson, L. Chiplis, J. Freeman, W. Foster, A. Oleck, J. Ozelis, B. Robotham, B. Wheeler

Design and construction of two (2) barrel prototype modules.

All of the preliminary decisions regarding the prototype configuration have been made to allow necessary procurements to begin. Tile designs are being finalized. Work on the PRC barrel wedge steel has begun. Steel procurement for the FNAL hadron wedge is in process. Current schedule calls for August 1993 completion.

Florida State University

Personnel during the past month who have contributed towards the project:

Physicists: Vasken Hagopian and Kurtis Johnson
Students: Elizabeth Bartosz, Daril Davis, Chris Immer and Heather Whitaker
Engineers: Maurizio Bertoldi, Kerry Hu and James Thomaston
Principal Investigator: Vasken Hagopian

We are sending under separate cover is a copy of the paper written for the proceeding of the III International Conference on Calorimetry titled "Light Yield and Radiation Hardness of Scintillator-Fiber System". This paper contains a lot of the data that was used to choose the elements and parameters for the barrel prototype calorimeter.

We have shown that if we use 4 mm thick Kuraray SCSN38 scintillator tile with Bicron BCF91A 1mm fiber, then the number of photoelectrons at the exit of the tile-fiber system is 8.5 using a green extended phototube, such as Hamamatsu 10 stage R580-17. This tile fiber combination will loose about 10% of its light during the lifetime of the detector. The single most pressing problem is the 11 nsec decay time of the WLS fiber! Shorter decay time fibers exist, but are more radiation soft. We will continue to work with industry to solve this problem. For example, the G2 fiber which is very radiation hard in liquid, is very soft in polystyrene. Other polymerizations are now being attempted.

Since the SDC October meeting where the optics for the prototype for the calorimeter module was reviewed, the individual choices now have to be tested. We are now testing various white paints for reflectivity, radiation hardness and ease of application to the edge of the scintillator tile. Bicron BC620 is an excellent white paint, but it takes three tries with a brush, while the DEVRON white paint can be applied with a roller. Tests are now proceeding. Our group was given four action items for the calorimeter prototype and we are busy getting the results.

Purdue

Technical Staff: A.T. Lasanen, A.F. Garfinkel

Calorimeter Prototypes for 1993 calibration and testing

Laasanen: Software has been written to allow data to be taken on an IBM compatible PC using the 48/96 multiplexer. Phototube currents together with the source wire location can be read out. The data can be displayed in real time as well as written to disk.

Timing studies were made to measure the data taking rate under various conditions. The rate varied from 3 Hz when the source location was read out every event and data from one channel were plotted, to 18 Hz when the source location was read out every tenth event and no real-time graphical display was made.

Garfinkel: Has acquired a listing of the program MUX96 for controlling the ANL48/96 Analogue Multiplexer ADC and is looking into transferring it to the VAX. At the moment there is no link between the PC and the VAX.

2.2.1.1 Module Structure

Lawrence Berkeley Laboratory

Technical Staff:
Physicists: R. Kadel, M. Pripstein, G. Abrams, M. Barnett, D. Bintinger, A. Ciocio, K. Einsweiler, D. Groom, C. Hearty, I. Hinchcliffe, J. Kadyk, P. LeDu, M. Long, G. Przybylski, T. Weber, W.Wenzel
Engineering: J. Carrieri, M. Hui, D. Hunt, A. Lim, Y. Minamihara, W. Thur

Monolithic Endcap EM

- A detailed schedule and cost estimate for the monolithic ECEM is being prepared for the design review in mid-January. Budgetary quotes on the key mechanical components are being received, and will be incorporated in the new cost estimate.

- With Dave Scherbarth's help, we now have detailed a stand-alone draft ECEM WBS section (2.2.5), which is a vast improvement over the two year old baseline WBS in which the ECEM was "sprinkled" throughout the endcap WBS. We hope to use this new WBS section for tracking and reporting purposes as soon as possible.

- To illustrate the key features of the design, and to verify spatial relationships, we are working on a tabletop model of a small section of the ECEM perimeter. This model has forced us to clarify several previously ill-defined aspects of the design, including the massless gap and preshower regions.

- Physical tests of the long-term creep resistance of our calcium-tin lead alloy are underway. The critical geometries of bushing and spoke loads on the lead have been duplicated exactly, with creep displacements monitored by dial indicators. This is intended to be a long-term test, with no attempt at acceleration via elevated temperatures.

- Physical tests of the strength and stability of the "ears" on our sheet aluminum "curtains" are being planned. After some examination using finite element modeling, we have decided that conclusive results for a buckling mode failure can only be obtained by physical testing.

SDC Transporter Progress Report:

Preliminary conceptual design and layout drawings have been made. The design continues to evolve. Beam height has been set at 8 feet.

2.2.10 End Plug Calorimeter

Lawrence Berkeley Laboratory

Technical Staff:
Physicists: R. Kadel, M. Pripstein, G. Abrams, M. Barnett, D. Bintinger, A. Ciocio, K. Einsweiler, D. Groom, C. Hearty, I. Hinchcliffe, J. Kadyk, P. LeDu, M. Long, G. Przybylski, T. Weber, W.Wenzel
Engineering: M. Hoff, W. Pope

Replaceable Hadronic Plug:

- Absorber Structure Quotes--Five vendor quotes have been received for 2 each of the endplug absorber structure assembly weldment (including a full compliment of source tube grooves) and 2 sets of endplug support flanges. Three quotes were within 2 % of each other and about 13% above the latest (but not up-to-date) WBS estimated cost (not including EDIA or contingency) which did not include source tube grooves. Sherbarth (WSTC) will be revising the endplug WBS estimates to reflect these quotes with appropriately reduced contingencies and EDIA, and eliminating some older WBS categories which are not applicable to the existing design.

- "New" source tube groove fabrication method--LBL shop personnel have demonstrated that acceptable grooves can be made for calorimeter hadronic sections using a plasma-arc "gouging" torch at speeds of about 6 feet per minute. This cost effective technique will be used in the endplug, and may be applicable in other hadronic sections.

- Flexible Source Wire--We have acquired 3 of the 4 components required to assemble the flexible source wire (the tube, spring, and cable) and have demonstrated to our satisfaction that we can build a "flexible mechanical source positioner" capable of negotiating several, short radius, series 90 degree bends in a long length of tubing--significantly exceeding endplug (and other hadronic section) design requirements. This concept was displayed by Pope in sketch form at the 10/13/92 calorimeter teleconference. In our first feasibility pass, we selected (for convenience):

1) outer guide tube: 3/16 inch O.D. x .030 inch wall copper refrigeration tubing,

2) stainless steel spring: 0.096 inch O.D. x 0.048 inch I.D., and

3) an 0.036 inch diameter (7 x 19 strand) stainless steel aircraft cable.

The 3 foot length of copper tube contained 5 each, 25 mm radius, 180 degree reverse bends in series (formed with H2O in LN2). We could easily push the spring in and

out of the tube with a force (which was a strong function of the "sharpness" at the end of the spring) estimated at roughly one pound. We will fabricate a bullet shaped, dummy source capsule (which will be crimped to the cable) for a more realistic, full scale demonstration.

- Work on the hydraulically driven calibration source (alternative) has been temporarily suspended. With the above flexible mechanical option working successfully, we simply don't need it.

ate: 11/07/92 Page: 1 SDC CALORIMETER DESIGN & CONST

ach symbol = 1 Week

: Planned
= Actual
* Completed
M Milestone

IGN AND CONSTRUCTION OF COMPONENTS FOR THE SDC
CENTRAL CALORIMETER

Task	Start Date	1992 SEP 17	OCT 29	DEC 10	1993 JAN 21	MAR 04	APR 15	MAY 27	JUL 08	AUG 19	SEP 30	NOV 11	DEC 23	1994 FEB 03	MAR 17	APR 28
DESIGN OF ENDPLATE/FRONT PLATE	09/17	:														
	09/17	*														
DESIGN OF BULKHEADS	09/28		:													
	09/28		****													
HAD1/EMC WELDMENT DESIGN	05/01	:														
	05/01	*****														
HAD1/EMC ADAPTOR PLATE DESIGN	09/23	:														
	09/23	*														
SOURCE TUBE DESIGN	08/12	:														
	08/12	=========														
DES.BARREL/BARREL CONNECTION 0 DEG.	09/16	:														
	11/16			=												
DES. BULKHEAD/EMC WELDMENT CONN.	10/05		:													
	10/05		**													
FIBER ROUTING EMC/SMD	05/12	:														
	09/01	*														
FINAL ASSEMBLY DRAWINGS	10/05		:													
	10/30			==												
ATION OF 1ST END/FRONT PLATE	11/01			::::::::::::												
	11/01			=												
FABRICATION OF 2ND END/FRONT PLATE	12/01				:::::::::::											
FABRICATION OF 3RD END/FRONT PLATE	01/01					::::::::::::										
ABRICATION OF 4TH END/FRONT PLATE	02/01						::::::::::::									
FABRICATION OF 1ST HAD1/EMC WELD.	11/01			::::::::::::												
	11/06			=												
FABRICATION OF 2ND HAD1/EMC WELD.	12/01				:::::::::::											
ABRICATION OF 3RD HAD1/EMC WELD.	01/01					::::::::::::										
FABRICATION OF 4TH HAD1/EMC WELD.	02/01						::::::::::::									
ABRICATION OF BULK/WELD #1	11/01			::::::::::::												
ABRICATION OF BULK/WELD #2	11/01			:::::::::::::::												
ABRICATION OF BULK/WELD #3	11/01			::::::::::::::::::::::												
ABRICATION OF BULK/WELD #4	11/01			::::::::::::::::::::::::												
ABRICATION OF BULKHEADS #1	11/01			::::::::::::												
ATION OF BULKHEADS #2	11/01			:::::::::::::::												

SDC CALORIMETER DESIGN & CONST

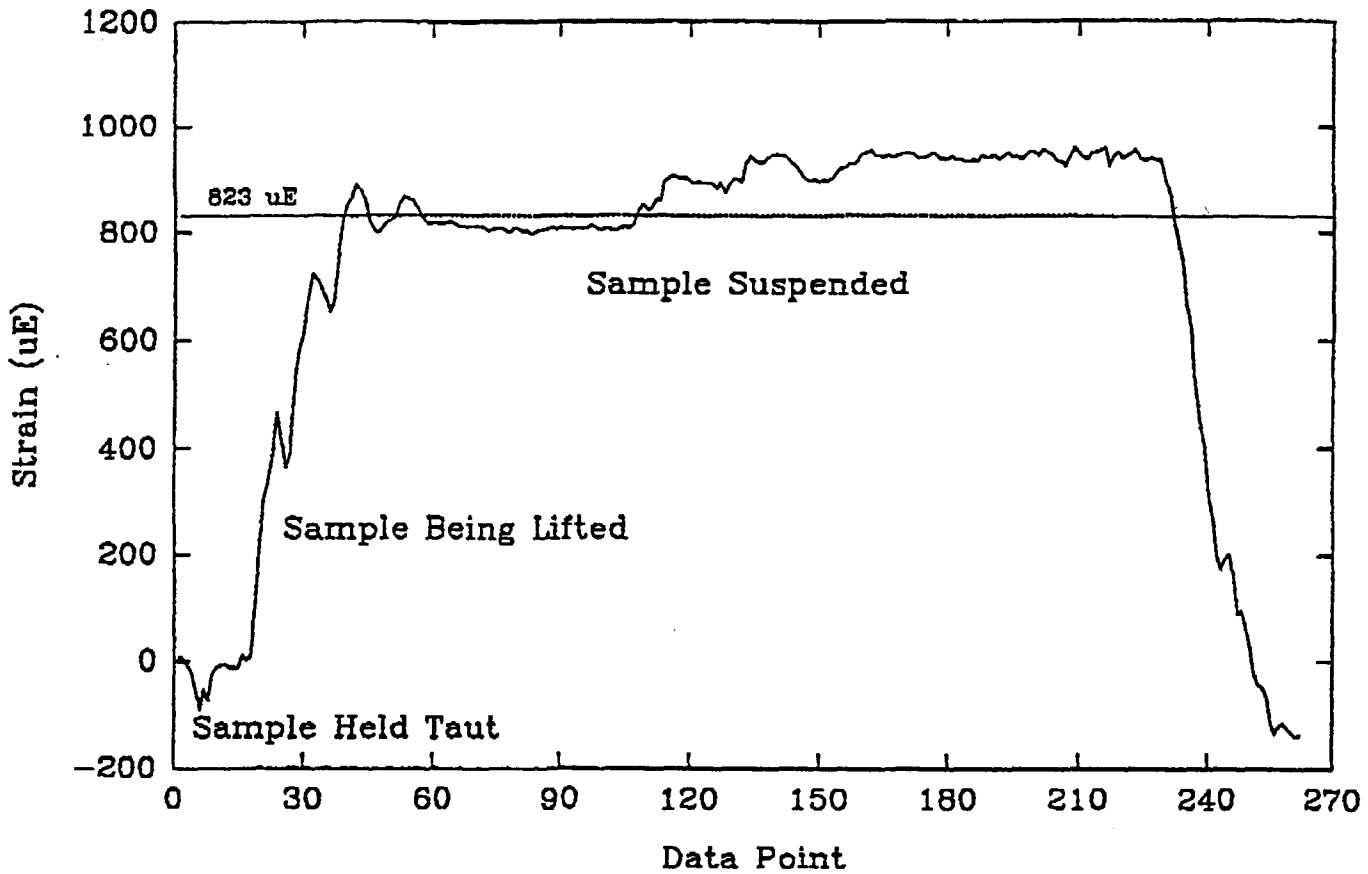
ch Symbol = 1 Week

: Planned
= Actual
* Completed
M Milestone

DESIGN AND CONSTRUCTION OF COMPONENTS FOR THE SDC
CENTRAL CALORIMETER

Task	Start Date	1992 SEP 17	OCT 29	DEC 10	1993 JAN 21	MAR 04	APR 15	MAY 27	JLY 08	AUG 19	SEP 30	NOV 11	DEC 23	1994 FEB 03	MAR 17	APR 28
FABRICATION OF BULKHEADS #3	11/01		::::::::::::::::::::::													
FABRICATION OF BULKHEADS #4	11/01		::::::::::::::::::::::::													
ASSEMBLY OF EMC FRAME #1	01/25				::											
ASSEMBLY OF EMC FRAME #2	02/22					::										
ASSEMBLY OF EMC FRAME #3	04/05						::									
ASSEMBLY OF EMC FRAME #4	04/26							::								
MOLD ASSEMBLY CASTING #1	02/08				:											
MOLD ASSEMBLY CASTING #2	03/08					:										
MOLD ASSEMBLY CASTING #3	04/12						:									
MOLD ASSEMBLY CASTING #4	05/10							:								
CAST EMC PROTOTYPE #1	02/15				::::											
CAST EMC PROTOTYPE #2	03/15					::::										
CAST EMC PROTOTYPE #3	04/19						::::									
CAST EMC PROTOTYPE #4	05/17							::::								
DIN CASTING #1 AND #2	04/12						:									
DIN CASTING #3 AND #4	06/14							:								

Strain Loading of a Thin Strap Under Tension



Estimate of the Strain on a Thin Strap Under Axial Loading

Given a thin strap under tension loading, determine the amount of elongation and the strain in the strap.

$L := 4.75$ Strap Length (in.)

$W := .500$ Strap width (in.)

$T := .002$ Strap Thickness (in.)

$E := 30.0 \cdot 10^6$ Youngs Modulus (psi)

$P := 24.7$ Weight of load (lbs.)

$A := W \cdot T$ x-sectional Area

$A = 1 \cdot 10^{-3}$

$\delta := \frac{P \cdot L}{(E \cdot A)}$ Elongation of Strap under load

$\delta = 0.004$

$\varepsilon := \frac{\delta}{L}$ Strain in strap

$\varepsilon = 8.233 \cdot 10^{-4}$ (in/in) $\varepsilon \cdot 1.0 \cdot 10^6 = 823.333$ uE (micro-strain)

Fig 2

3.0 MUON SUBSYSTEM

The members of the muon subsystem spent substantial time and energy preparing for the DOE review of the SDC program and the Preliminary Design Review (PDR) for the Muon Barrel Toroid (MBT), both of which took place this month. Although the final reports are not yet available, preliminary communications from the committees indicate that the reports from both reviews will be positive.

In the magnet system, we are beginning the final design for the barrel toroid. We are discussing with our JINR colleagues the procurement of two prototype blocks, one long and one short, for the MBT.

In the measurement system, design is continuing on the barrel, intermediate, and forward regions and on the trigger and alignment system. There was a visit by colleagues from IHEP, Protvino to summarize the work done on the forward muon system in Russia. A task force was organized to study the placement of trigger counters on layer 2 vs. layer 3 of the barrel and intermediate systems. Modifications to the muon lab at the SSCL (Stoneridge) necessary for the fabrication of the prototype barrel tower have begun.

The DOE review committee did point out that the schedule for fabrication and installation of the detector is very tight. We have been aware of this problem and we are continuing an active program of long range planning for the muon subsystem. A rigging company was brought "on board" to help develop a detailed plan to for installation of the muon toroid. The Resource Allocation Model (RAM) studies are in the "second round" to improve the detail in the model and understand the implications of various fabrication and installation scenarios. We are continuing to developing the resource loaded, schedule for the muon subsystem.

3.1 Magnet

3.1.1.1 Barrel Magnet

University of Wisconsin

Technical Staff:	Jeff Cherwinka, Glen Gregerson
Physics Staff:	Don Reeder, Duncan Carlsmith, Dick Loveless
Author of Report:	Jeff Cherwinka

Completion of the MBT Preliminary Design Review and the SDC DOE Review consummed most of the magnet work effort at UW-PSL in October. The final report of the MBT Preliminary Design Review is not completed, but the oral report and the draft report confirm that the basic mechanical design, detailed analysis work, and general procurement, saftey, and Q.A. plans are in order. The review produced some new ideas to consider, suggestions for refinements of some of the work presented, and direction for work before the Critical Design Review. UW-PSL participated in drawing and text preparation for the report. The organization of the review presentations and the presenting of material on the mechanical design were done by UW-PSL. Once the MBT PDR was completed, attention turned from technical details to cost and schedule. UW-PSL was responsible for the presentation of the MBT iron and coils to the SDC DOE Review. Some work was also done to help with preparations of the talks on the Forward Muon Magnets, Barrel Support, and detector installation. The principle comment from the DOE review relating to the MBT effort was that the schedule looks very tight, especially in the period of installation. This issue was already being addressed by a study of the installation process with Bigge (a heavy transportation and rigging company). UW-PSL participated in the preliminary meeting with Bigge and presented an outline of the critical issues related to the

transportation and assembly of the MBT. There were also meetings between represetatives of JINR, Atommash, and UW-PSL to refine the design to match the production capabilities of Atommash. The proposals of the thick machined plates (219mm) and alternate shear connection methods were discuss. Preliminary analysis of the effects of increasing the bolt size (due to the increased plate thickness) have been addressed at UW-PSL. Futher work must be done on the materials, bolt details, and shear connection before the ideas can be accepted. UW-PSL is working with the SSCL to develop specifications for the prototype blocks that incorporate the design modifications.

3.1.1.2 Barrel Coils

University of Wisconsin

Technical Staff:	Jeff Cherwinka, Glen Gregerson
Physics Staff:	Don Reeder, Duncan Carlsmith, Dick Loveless
Author:	Jeff Cherwinka

The coils for the MBT were reviewed at a lower level of detail in both the MBT PDR and the SDC DOE review. Concerns were raised about possible thermal problems leading to insulation abrasion and/or interference with the muon measurement. The coils were also covered in the installation meeting with Bigge. Information was provided to SSCL to develop a coil schedule and document safty concerns (CSAR). There was no new technical work on the coils this month.

3.2 Muon Measurement System

3.2.1.1 BW1 Module

University of Texas, Arlington

Technical Staff	D.Vanecek, M.Diver, R.Glenn, T.Lawley
Physicists	A.White, P.Draper, L.Sawyer, E.Gonzales, J.Perkins
Author of Report	A.White

The main thrust of our activities has continued to be the specification of the rennovation plans for the conversion of the Swift Center building on the UTA campus into the facility for assembly of BW1 modules. Detailed drawings now exist for the general building work and we have recently been focussing on the specification for the module assembly pad and hard ways/lifting device for module roll-out. A joint meeting was held between UTA personnel, SDC/SSCL personnel and Albert Halff Associates (the engineer/architect company hired by UTA for the rennovations). We are now awaiting a reply from Albert Halff concerning the installation of the assembly pad using a design based on that developed at SSCL.

We have received the $150,000 funds awarded to us by the National Science Foundation towards the rennovation work.

A special gantry system has been designed to allow roll-out of the completed modules under the low ceiling height of the Swift Center. This gantry will roll on hard ways that will extend out along the sides of the loading dock/ truck well to allow a lift/roll/drop operation from the pad to the truck bed.

We have also refined our process flow model for the operation of the Swift Center facility in the light of recent decisions to deliver completed tubes to UTA rather than perform on-site tube assembly. The results of the model provide important data on the

manufacturing operations cycle time, labor requirements and utilization, equipment utilization, and materials work in process.

During this work we have developed a graphical simulation of the operations needed for module assembly from receipt of materials, through actual assembly procedures, to module roll-out. This graphical (video) simulation approach will be extended to the muon assembly facility planned for the SDC area at the SSC site.

3.2.1.2 BW2 Module

University and INFN Pavia

Physics Staff :	S. Ratti, G. Boca, M. Cambiaghi,
G. Introzzi,	G. Liguori, P. Torre.
Author :	G. Introzzi

The basic ideas for a RPC's Muon System are outlined in the report "Resistive Plate Counters for the SDC Muon System" (*), presented to the Collaboration during the August meeting in Dallas. Since then, the major news concern the gas safety system. It seems to be feasible to run the RPC's using Isobutane instead of Butane, lowering the Isobutane % in the gas mixture below the point of flammability. Detailed calculations are in progress, made by J. Elias. As soon as we will get his results, we will test the suggested gas mixture with two prototype modules that are already installed and working in a test lab located in Naples.

3.2.1.4 BWT Tower

University of Washington

Technical Staff:	C. Daly
Physicists:	H. Lubatti
Author:	C. Daly

Details of the outer plates for the BW2/3 towers have been worked out in conceptual form. Access ports have been added and the size and location of these is being refined in collaboration with the BS2 access task group. FEA analysis will then be done to confirm that structural requirements are met. (C. Daly)

SSCL

Technical Staff:	J. McIntosh, Gary Pennycuff, J. Thunborg
Physics Staff:	D. Davisson, H. Lubatti, P. McBride, P. Schuler
Author:	Patricia McBride

Work has begun to expand the muon laboratory at the Stoneridge site. The hole for the assembly fixture pad has already been dug. The assembly pad should be completed before the end of November. H. Lubatti and J. Thunborg developed a preliminary schedule for the fabrication and testing of the BWT prototype at the SSC Muon Lab. H. Lubatti also developed a preliminary responsibility matrix for the items necessary for the BWT prototype fabrication.

H. Lubatti, K. Schlindwein and J. Thunborg met with represetatives of manufacturers of epoxy distribution systems and worked on conceptual development of epoxy distribution schemes. G. Pennycuff visited vendors of tube finishing machines and several large precision machine shops in California this month.

J. Thunborg worked on procurement of prototype materials. He also worked with the designers as a drawing checker and also as a liason between them and the vendors. G. Pennycuff and J. McIntosh have been organizing the SSC muon laboratory in preparation for the DOE safety review as well as in preparation for the prototype assembly.

D. Davisson has been working on the design of module assembly fixtures. H. Lubatti, C. Daly and D. Davisson have copiled a document outlining module assembly procedures. A first version of the assembly procedures document was issued. It will be updated as more information becomes available.

S. Day is working towards the December 31 deadline for the detail drawings for the prototype muon module bw2t4 and bw3t4, under the supervision of Colin Daley. This includes the design model showing tube and fastener location information and the accompanying assembly and detailed drawings. The model has been created and the detail drawings showing tube locations have been started.

3.2.1.5 Barrel Region (shared items)

University of Washington

Technical Staff:	C. Daly, R. Davisson, P. Reinhall, W. Song, Y. Chen, H. Guldenmann, R. Storch
Physicists:	H. Lubatti
Author:	C. Daly, H. Lubatti

Studying the thermal deformation and stress on the prototype drift tube module built in Seattle is underway. We expect to obtain preliminary results next month. (C. Daly, H. Guldenmann and T. Zhao)

A conceptual mounting design has been developed for the attachment of the BS2 panels to the surface of the muon modules. (C. Daly)

Structural Analysis of Detector Modules:

Two issues regarding the modeling and design of the detector modules have been considered.

a. How can we best minimize the deflections in BW1, 2, 3 when the tubes must be separated from each other?

b. Are the deflections of the modules, obtained via finite element modeling, sensitive to element aspect ratio and mesh density?

In order to address the first issue, we modeled BW3 with varying amounts of tube separation. It was first determined that the structure would become too flexible without any connection between the detector tubes. This is true for any spacing of the tubes. In order to decrease the overall deflection of the detector module it is necessary to insert a structural component between the tubes. We have considered a range of possible solutions. The most promising design is to attach thin plates between the tubes to minimize the rotation of the detector tubes during bending. Each plate should be attached tangentially and would run parallel to tubes. The finite element modeling of the detector modules is continuing.

The issue of mesh density dependence was considered in some detail. The existing ANSYS model of a 10-layer BW3 structure which was previously used to determine the elastic and shear moduli was revisited. It was found that the previously used coarse mesh gives satisfactory accuracy in the prediction of the global deflections. (P. Reinhall)

Drift cell tube database development. This database provides the information which will be used in developing the specifications of the bar code system and the assembly schedule. In addition, the database is also a meaningful tool for the management of the entire assembly procedure of the muon modules. (W. Song, R. Storch)

Preliminary design of the bar code system specifications. This design includes the determination of the bar code label system, investigation of inventory software, and conceptual design of the hardware requirements for the bar code system. A draft of the specifications has been prepared. (W. Song, R. Storch)

Z. Feng began to familiarize himself with SDC SIM in preparation for implementing it on the Seattle Silicon Graphics Indigo platform.

Considerable effort was spent in preparing for the DOE review. (All staff)

SSCL

Technical Staff:	K. Bramble, Gary Pennycuff, J. Thunborg
Physics Staff:	H. Lubatti
Author:	Patricia McBride

The enitre group spent much of October preparing for the DOE review. F. Kalinowsky joined the group in mid-October to help with purchacing and accounting.

P. McBride and P. Schuler have begun working on cable routings and integration issues. Questions of access to the space between BW2 and BW3 were addressed as well as access to the outside of BW3.

The question of cable routing to the modules in the detector has been raised in the broader context of general cable and gasline routing. The currently assumed path leads radially outward through the 2cm wide cracks between detector modules. It has been questioned whether this is really feasible. An alternate cable path, in particular also for the twisted pair signal cables, along the z-direction will be explored in cooperation with Jay Chapman and Ken Hess.

The access to high voltage and signal patch panels and possible interference with the scintillators was addressed in a special scintillator meeting which had been called by Rudi Thun. We will continue to communicate with him on this issue.

P. Schuler has been designing the gas and HV distribution systems for the barrel modules. The gas supply and return of the muon drift tubes requires fan-out (manifolds) with hundreds of channels per module. These will be straight tubes with gas outlets which connect via small diameter (1/8 inch OD) Nylon tubing to the muon drift tubes. Two different technologies are being pursued, based on either stainless steel tubing with welded outlets or extruded Noryl plastic tubing with thermally inserted outlets. For evaluation, we intend to build short (1 meter) demonstration models with about 50 outlets. Subsequently, we will construct full length units for the prototype muon tower.

It is planned to place the manifolds into the double-walled space at the periphery of the modules. While there is plenty of space for this purpose in the BW3 modules, there is precious little space in the BW2 modules and consequently the location of the BW2 gas outlets must be very carefully designed in order to avoid interference. This design work is in progress with assistance from Jon Thunborg and Scott Day.

Harvard University

Technical Staff:	Ed Sadowski, Frank Dalrymple, Rick Haggerty, Steve Sansone
Physicists:	Peter Hurst, Gary Feldman, George Brandenburg
Author	George Brandenburg, E. Sadowski

There are ongoing tests on end caps for gas tightness. We are investigating various sealing modes to obtain desired tightness, re: O-rings, epoxy grooves, different machine finishes etc. We are setting up to test 40 tubes - we meaning Harvard, Tufts, and Brandeis.

We are getting bids on the stamping of the end caps, for cost comparison, availability, and as second source information.

Tufts

Technical Staff:	L. McMaster, D. Dupuis (Physics Dept. shop technicians).
Physicists:	T. Kafka, W.A. Mann, R.H. Milburn
Author of Report:	W. Anthony Mann

Extensive trials of drift tube bonding to endcaps via heat application, with subsequent shrinking of the tubes onto the caps, were conducted throughout the month. An initial set of tests established the range of mechanical interference between tube and endcap diameters for which reliable bonding can occur. Followup testing showed that the endcaptube bond was not gas-tight to a desirable level, a fact that had not been appreciated previously. Bonding was then tried with small ridges of various widths machined into the caps; however these failed to yield a tight seal. New tests were then conducted using i) endcaps with "o"-rings, and using ii) endcaps grooved and loaded with epoxy and other sealants. Both approaches were found to be capable of yielding bonds which were very gas tight while remaining mechanically strong. More trials are planned to establish which approach is the best in terms of assembly line procedure. All of these studies were conducted in the Tufts physics shop, with close supervision by Brandeis, Harvard, and Tufts researchers.

3.2.1.5 Barrel Region (Shared Items)

IHEP, Protovino

Technical Staff:	M.Chernetsov, S. Votvud., K.Kachnov, V.Polyakov.
Physics Staff:	V. Brekhovskih, A. Gorin, V. Lapshin, I. Manuilov, V.Rykalin, Yu. Shamshin.
Author of Report	V.Rykalin

Several scintillator counters were fabricated. The number of photoelectrons from the rear from the PM end were on the level of 20.

Barrel Region Alignment Equipment

C S Draper Laboratory

Technical Staff:	F. Ayer, J. Govignon
Author of Report:	J. Govignon

Technical activities at Draper were centered on the conceptual design of a Fencepost and its calibration. A memo regarding some aspects of the mechanical design, and the data processing of the measurement obtained with a FP will be published shortly by F. Ayer.

3.2.1.6 Forward Region (Shared Items)

IHEP, Protovino

Technical Staff	L.Baliev, A.Levin, S.Nikitin, V.Starcev
Physics Staff	Yu.Antipov, V.Bezzubov, Batarin, A.Borisov, R. Fachrutdinov, A.Kozhin, A.Petrukhin, A.Volkov
Author of Report	Yu.Antipov

We completed to work with a data obtained during test runs. Report about activity was presented at SSCL and at Maryland U.

At our central workshops we completed the work for the model production. The main idea of this work was- to produce in our workshops with available technologies a geometrical model on which we could really measure with an optical instruments the available accuracies. 100 percent of necessary work were made.

With available technologies and tolerances we reached final accuracy in anode wires positions about 40 microns, that is close to the predicted value.

Report on this activity was prepared and results of this work were reported at SSCL and at Maryland Un.

We continued to work with Cf neutron source and Co gamma sources with different tubes options and various shielding trying to understand the various tubes sensitivity to various soft backgrounds.

We produce a 8 meter model of drift tube with wire field-shaping electrodes, and continue to measure the mechanical properties of such a tube with different HV. The main idea of this measurement was - to show that such a long tube with wire-field shaping could work and give an accuracies compared with a small ones.

The simulation group were calculating the soft neutrons and gamma backgrounds in various FMS detectors, and trying to estimate drift tubes efficiencies in various background fields.

IHEP, Protovino

Technical Staff:	E. Borisov, A. Chernikov, L. Filipenkova, E. Kochetova, N. Kryakov, S. Lavrukhina, V. Lezhnin, A.N. Levin, A.V. Levin, Yu. Orlov,V.Potapov, V. Pyatakov, Yu. Ryaboshapko,N. Skovorodnev, A. Surkov, Yu. Surkov, S. Trifonov, V. Tyunnikov,O. Tyunnikova, S. Vodvud
Physics Staff	V.Kochetkov
Author of Report	A.Surkov

The first version of the Conceptual Design of the Forward Muon System was presented during October SDC meeting. It includes about 146 pages with about 100 drawings and 20 pages of the text (SDC-000063).

This document includes:

- FMS Integration Scheme
- Forward Toroids
- Forward Absorbers
- Service Space Trusses

- Scintillator Counters
- FMS Cable Network
- SDC Beam Pipe
- Transport System
- Cart for Absorber Assembly
- FMS Assembly

3.2.2 Intermediate Region (summary)

3.2.2.2 Intermediate Region (shared items)

University of Wisconsin

Technical Staff:	Farshid Feyzi, Alan Pitas
Physics Staff:	Don Reeder, Duncan Carlsmith, Dick Loveless
Author of Report:	Farshid Feyzi

Most of the work in October was on more detailed structural analysis of the intermediate towers. FEA was done for all octants. Distortions were derived for most points of interest. From these models, shift of wire positions due to distortions of the endplates can be approximated. It is also possible to estimate maximum tube bend from these models. Support points and arrangement of constraints were optimized to give lower distortions and lower support reactions. The supports were also moved closer together to be completely in the 1.5 m thickness of the barrel toroid. This will allow for the installation of the barrel modules without interference with the

IWT mounts. New IW reaction loads were passed to the Barrel design group for inclusion in the model.

A preliminary set of drawings for all the IWT plates and rails were prepared.

These plates have no tube locating holes yet. A conceptual design of an access scheme for IS2 was done. A preliminary arrangement of on-module alignment and referencing system was derived. This scheme relies on optical straight line monitors in locations were distortions are predicted to be significant, according to FEA. Numbers for distortions of Barrel Toroid face due to IWT reactions were obtained from the design group. The distortions necessitate adjustment of IWT mounts in Z. A preliminary design for this adjustment was done.

Author of Report: Alan Pitas

Work began on the design of the tool used to position the tubes in the proper place. Three factors complicate the process. First, the position tolerances are difficult to meet in view of the dimetral tolerance of the tube. Second, there are widely differing views on how to proceed. A significant amount of time was spent to bring several approaches to a point where they could be compared on a rational basis. Third, the shortage of money eliminates several straight forward approaches to the problem.

In addition to determining how to hold the tubes in the correct place,work was done on developing a measurement scheme that could varify that the tool had been successful. Products from a number of vendors have been reviewed. Several products have been identified that would meet our needs. However, because of the limited amount of money available, a second search is being conducted to identify other products that will meet our requirements at a lower cost.

University of Minnesota

Technical Staff: Dave Maxam
Physics Staff: Nelson Christensen, Ken Heller
Author: Nelson Christensen

1) We are working with our technicians on the the design of the structure that will house the intermediate region's scintillators. We are also looking into issues related to the alignment of the intermediate region module.

2) We are investigating different data acquisition systems to be used for the muon system's scintillator test stand.

3) We have started to investigate the crazing characteristics of different scintillators. Bicron, Kuraray, and NE will be giving us scintillator that we will test. Crazing will be induced via applied stresses and through temperature cycling. Long term crazing of the scintillator is the motivation for this study.

4) We are looking into the price and performance of 3 inch diameter phototubes. The scintillators for the intermediate region have an end face area of 50 cm^2. A three inch diameter phototube will have an area of 46 cm^2, thereby providing better coupling than a two inch tube. Three inch tube options do exist, for example Thorne EMI #9821 or 9822, or Hamamatsu #R5004 or R4143.

5) We are continuing our investigation of a different scintillator geometry. For this system the light exits the scintillator via a reflection off a 45 degree cut at the end of the piece. This geometry, if successful, would allow scintillators to be placed side by side, without overlap, and without cracks. This geometry would then allow easier access to scintillators as none of them would be buried below another. Our initial tests showed that this configuration reduces the average number of photo-electrons by 30%. A realistic light guide configuration for this system is being made, and will be tested shortly.

3.2.2.4 FW4 Module - RPC's

University and INFN Pavia

Physics Staff : S. Ratti, G. Boca, M. Cambiaghi,
G. Introzzi, G. Liguori, P. Torre.
Author : G. Introzzi

The ideas underlying the RPC project for the forward regions have been changed since the August meeting. We suggest the use of 2 cm wide readout strips, as long as an octant (see Fig. 12 of Ref. *, were an aluminum strip is supposed to replace a scintillator horizontal band). The required time resolution would be assured by mean timers, with a time resolution of +/- 1 ns.

The gas mixture to be used would be the same to be suggested by J. Elias for the barrel region.

3.2.3 Forward Muon System (Measurement System)

3.2.3.1 FW1 Module

3.2.3.6 Forward Region (shared items)

Absorbers/Support Structures

C S Draper Laboratory

Technical Staff: J. Gorman
Author of Report: J. Gorman

Principal efforts in October were devoted to reviewing IHEP SDC FMS Concept Design report (SDC - 000063) in preparation for an interchange meeting with IHEP engineering personnel at SSCL on 19-21 October. Attended and moderated this interchange meeting and produced list of FMS integration issues/questions to be resolved jointly between IHEP and SDC/SSCL investigators. In addition to above, continued parametric modeling of FMS sliding and fixed absorber concepts. Formulated ANSYS FEM model of absorber/support sleeve using SDC Drawing sdd000081.c00 geometry, slightly modified to accommodate Hillman rollers. Results of same will be available early November.

3.2.4 Global (summary)

3.2.4.1 Global Tube

University of Texas, Arlington

Technical Staff W.Lutes
Physicists A.White, P.Draper, L.Sawyer, E.Gonzales, J.Perkins
Author of Report A.White

In our detector laboratory we are preparing to assemble a number of short lengths of muon drift tubes. We started out with lengths of the old 3 inch tube and had endcaps made in our workshop at UTA. Since then the tube diameter has increased to 4 inch. and we shall either make 4 inch endcaps to the latest design or have then supplied by U.Washington/SSCL.

We have designed a clean "room" to be set up in a corner of our detector laboartory in which to assemble the tubes. The assembly of these tubes will provide a valuable learning experience for ourselves and our students.

We have acquired the electronics items for the operation and readout of these tubes.

Our students have developed a detailed simulation of a small array of the muon drift tubes with the purpose of predicting tube characteristics such as pulse shape that will be measued when actual tubes are operated.

Brandeis University

Technical Staff: Pat Long, Matt McNeely, Glen Olsen
Physics Staff: H.F.Wellenstein, D. Kaplan, M. Styllar, D. Lorenzon
Author: H.F. Wellenstein

We are continuing to study the details of the manufacturing methods for the production of muon drift tubes.

Securing Endcaps

We are investigating cheap, mechanically sound, leak tight, and electrically secure methods of installing end caps on the muon drift tubes. Test done include the following. End caps were inserted using interferences between .002" and .008". It was found that most tubes had leaks of about 0.25 torr x liters / sec. By inserting the end caps more carefully (using very clean surfaces) into well aligned tubes with min-max diameters of less than 0.003" the leak was reduced to 0.03. We also tried ridges with .006" base-width and .003" high (45 degree), then ridges .020" wide, one ridge and two ridges (in all cases the interference was .002" for the remaining surface). Nothing seemed to help the leak was always in the rage of .02 to .05 t x l/ sec. By staining the cap we found after opening that the ink was transferred to the tube wall not uniformly but with small breaks every cm or so parallel to the tube axis. Maybe the contact was not uniform? We are still looking into it. We tried epoxies and other sealants applied in the back 3/8" of the interference, including a trench (.040 wide .020" deep) about 1/4" from the shoulder to take up some of the epoxy. The tubes were leak tight but the excess epoxy was squashed to the front of the end cap. We tried 'O'-rings of .058" diameter (cross section) imbedded in a .046" deep and .065" wide groove 1/4" from the front. The interference of the surface was .005". It went in easily and the leak was less than .0005 t.l/s. We are now trying smaller 'O'rings (.035") and less compression. This seems to be the most promising approach!

Wire Stretching

A PC controlled tungsten wire tensioning device using a "load cell" (strain gauge) and a stepping motor is being assembled. This devise can also be used to record strain versus time, i. e. observe "creep".

Back Diffusion Studies and Leak Test: We have build a gas handling system to be attached to a Residual Gas Analyzer (on loan) to measure the back diffusion though a potential leak, i. e. the air leak into the tube against the out flowing argon. We expect data by Nov. 15. A leak test for the assembled tube was designed which is potentially six orders of magnitudes more sensitive (or faster) than monitoring the pressure drop in gas filled tubes.

Checking Wire Position

We have completed design and have ordered all materials for the single tube test station (leak rate, wire position and tension) to accommodate tubes of 6.6 to 8.8 meters.

University of Colorado

Technical Staff:	Bruce Broomer, Eric Erdos, Gerhard Schultz,
Physics Staff	Mark Christoph, Quenten Van Egeren
	Mourad Daoudi, Victor Slonim
Reported by:	Uriel Nauenberg

1)We have completed the design of a wire stringer that is automatic,moves the full length of a 9 meter tube, and senses the wire tension to avoid brakage fo the wire. We propose to make a presentation at the earliest possible time to the muon engineering effort at the SSC. No work has taken place this month.

We have done a full cost estimate, contingency and labor not included, to build and test a full prototype for a 9 meter tube. The cost is $15,500

2) Similarly, we have designed a tensioning device that will tense the sense wire to a selected value to within a few percent of desired value. The system is based on a selectively controlled torquing system produced by Magpower corp. No work has taken place this month.

We have also costed the construction and testing of a prototype including its application to a 9 meter tube. The cost is $9,504, not including contingency or labor.

3)The cosmic ray tracker mechanical part has been completed and is almost installed. We are now going to install four borrowed LeCroy front end amplifier discriminator cards. The gas system is almost done. We will be able to do some rudimentary tests of the system with a scope to check that it is working. We expect to receive a front end electronics card from Harvard for the muon tube.

What is missing is the readout electronics. This incurs significant funds.

No further work will take place until new funds become available.

Ohio State University September 1992

Technical Staff	L.S.Durkin, T.Y. Ling, D. Fisher, R. Wells
Reported by	T.Y. Ling

We have designed and machined our own endcaps for producing short (1m long) prototypes of 90 mm diameter drift tubes, since we are unable to get an endcap sample from the Washington group. We will assemble the short prototypes as soon as all parts for the assembly are acquired.

Tables and stands have been built for the prototyping and testing of the drift tubes. Clean air filters have been installed in the lab.

Final details on shipment of full length (9 m) extrusion tubes,due on Nov 6, 1992, have been worked out.

University of Washington

Technical Staff:	R. Davisson, W. Dougherty, Y. Chen, S. Han, H. Guldenmann
Physicists:	H. Lubatti, T. Zhao
Author:	H. Lubatti, T. Zhao

A design report for the drift tubes is being prepared for the Preliminary Engineering Review. (R. Davisson, H. Lubatti and T. Zhao)

Preparation of the tube fabrication facility is continuing. (H. Guldenmann and T. Zhao)

A creep-measurement setup was initiated at the SSCL to measure the properties of the anode wires we expect to use. (R. Davisson)

A tool for machining tube ends was designed. The tool allows in one pass the performance of all necessary operations: 1) cutting T's; 2) providing a recess for end cap insertion; 3) facing the tube. A cutter for the field shaping electrodes was designed and is currently being fabricated. (H. Guldenmann)

Modifications and improvements to the clean room continued. During this month the enlargement of the clean room was completed. The preliminary shipment of 9-meter long field shaping electrodes has been received.

These will now be distributed to collaborating tube producers on request. (H. Lubatti, T. Zhao, student helpers)

A meeting of the tube committee was held at the SSCL in conjunction with the SDC collaboration meeting. Tolerance criteria for the tube field shaping electrodes, etc., were reviewed. The tube committee elected to adopt the current tolerance criteria with the understanding that continued study and evaluation of extrusions coming from several different vendors could possibly affect these tolerances. (H. Lubatti)

Tests on out-gassing of Noryl and its effect on drift velocity and gain were performed and no measurable effect was observed. (W. Dougherty)

A design for a stiff back using fiber carbon tubes was completed and material for a prototype was specified. (R. Davisson)

An organizational chart of tube manufacturing for the prototype module was developed. A schedule for tube manufacturing and responsibilities within the Seattle group were developed. (H. Lubatti, T. Zhao)

Two papers were prepared for presentation at the IEEE Nuclear Science Symposium: one on the overall SDC muon system design and one on the drift velocity measurements previously reported last month. (T. Zhao)

Drift velocity measurements:

Results of the drift chamber gas study were reported to the muon subgroup during the SDC collaboration meeting and in the IEEE Nuclear Science Symposium. The results show that 0.1% of nitrogen (or air) contamination to the chamber gas results in a 1% increase in drift velocity. At this level, the chamber resolution will be affected. This study, therefore, sets an upper limit for specifying the gas tightness of the drift tube. The gas of the muon system will have to be recycled. In principle, oxygen which entered into the system can be easily removed. Removing nitrogen, however, is not easy. If the system is not really gas tight, nitrogen gas content in the chamber gas can increase gradually which will have serious consequences for the chamber resolution.

The results also show that the drift velocity plateau can be improved by intentionally adding 1% of nitrogen into the Ar-CO2 90:10 mixture. The flat region of the drift velocity plateau extends to quite a high field.

A similar effect is expected for other Ar-CO2 mixtures. This interesting effect will be further investigated. (Y. Chen, S. Han and T. Zhao.)

R. Davisson attended several meetings of the alignment committee and continued to evolve the alignment schemes.

SSCL

Technical Staff:	K. Bramble, S. Day, J. McIntosh, Gary Pennycuff, J. Thunborg
Physics Staff:	T. Fukui, H. Lubatti, P. McBride
Author:	Patricia McBride

H. Lubatti held a meeting of the tube committe to review tube parameters and tolerances.

J. Thunborg and G. Pennycuff have evaluated several metal stamping vendors and have found several capable of making the aluminum end cap shells. A purchase order is currently in the system for the aluminum stamped parts. J. Thunborg has been working on evaluating end cap vendors and modifying our design so that it can be manufactured cost effectively.

J. Thunborg and G. Pennycuff, J. McIntosh have performed tests of the tube compenents. They have performed wire crimp tests and with P. McBride assembled a short 90mm prototype tube. J. Thunborg and J. McIntosh tested the end cap high voltage plug at 15 kV andthe resistance between the pins and ground was greater than 300Giga-ohms which is the limit of our high pot test machine.

D. Davisson and J. McIntosh have done a tube deflection test, a tube fixture (strongback) deflection test and performed preliminary wire creep test measurements.

K. Bramble has been working with J. Thunborg and H. Lubatti on the design and specification definitions of the end caps. The material thickness has changed to 2mm (.080") on the Flat End Cap, Boss End cap, and Ground Ring. This design change along with increases in non-critical tolerances will effect most parts in the End Cap. He also completed a 3-D Model and 90 % of the print files for the protoype Field Shaping Electrode installation tool.

T. Fukui continued to measure resolution of 75mm, 9m long tubes, studying it as a function of the signal propagation along the wire. It is 213 micron at near the readout and 224 micron at far end. He also is analyzing the data from the 90 mm tubes taken at BNL. Preliminary results of tube resolution about 230 micron without to subtract tracking error. The global tracking parameters are still under study.

D. Davisson, T. Fukui and P. McBride are beginning designs for a new cosmic test stand for the 9 cm tubes. The stand will consist of 5-10 short tubes and will be used for resolution studies and for test of the electronics.

3.2.4.2 Global Alignment & Monitoring

C S Draper Laboratory

Technical Staff: J. Govignon
Authors of Report: J. Govignon

The activities of this month have been dominated by the presentation to the DOE Committee. I made a presentation regarding the Alignment of the Muon Measuring System to the DOE reviewers on October 28, 1992. Persons interested in receiving a copy of the viewgraphs can contact me or the SDC Lab.

The Conceptual Design Report (CDR) Version 3.0 of the Alignment of the SDC Muon System has been released as part of the final report of the previous 3-month period.

A list of J. Govignon's meeting attendance for the month follows:

10/02 @ SSC Dallas, Integration meeting

10/06 @ Harvard with D. Eartly exchange dwgs and FPs design discussions, J. Oliver SLMs discussions ⇒ + J. Bensinger, C. Grinnell: SLM location

10/06 @ Draper with F. Ayer, D. Goodwin, G. Holden: SLMs, FPs, Global

10/08 @ Duke U., Durham (NC), Tracker Alignment and Interface with Muon System. Presentation. Al Goshaw, D. Veal.

10/09 @ Draper, F. Ayer(Eng.. memo), D. Goodwin, G. Holden: SLMs, FPs, Global

10/13 @ SSC Dallas, Alignment Engineering meeting (C. Grinnell) regarding cost.

10/14 @ U. of Wisconsin, Madison, Workshop on Intermediate Module's design and Alignment: Duncan Carlsmith, Farshid.

10/22-23 @ SSC Dallas, SDC Collaboration meeting, presentation of DOE review viewgraphs

10/26 @ Draper, F. Ayer, D. Goodwin, G. Holden. Progress on FP design and Math Model

10/26-29 @ SSC Dallas, DOE review presentation. Also Alignment meeting with Alignment Committee and C. Daly re. On-module SLMs and targets for survey.

Harvard University

Submitted by George Brandenburg, John Oliver

Work is continuing on the Straight Line Monitors which record deformations in the muon tube modules, and on the Fencepost monitors which track movement of modules with respect to each other . The SLMs contain a single modulated LED with lens and quad-photodiode. The fencepost contains a system of interleaved SLMs. The electronic readout of these devices (synchronous detection) is being redesigned into a VME format. A single VME controller will handle somewhere between 16 and 32 such monitors as packaging density allows. The fencepost also requires proximity sensors to track movement of the muon modules relative to the fencepost. We are investigating optical sensors for this purpose as they would allow us to use the identical electronic readout as the SLMs.

Brandeis University

Technical Staff: None
Physicist: Steve Behrends
Author: Steve Behrends

Work has continued on developing a program package for evaluating the impact on full/off-line muon momentum resolution of proposed alignment scenarios. A geometric interface program was created to propagate the accuracy of sensor elements within the Barrel fenceposts into uncertainties on Barrel Supermodule alignment (i.e., limits on translational and rotational errors); a second package converts these errors into contributions to momentum resolution. We are presently awaiting a full rigid-body analysis of the alignment system from Draper Labs that will correlate the numerous RER and internal-fencepost measurements, which is predicted to improve the accuracy of Supermodule alignment knowledge beyond the accuracy of the single sensors composing the fenceposts.

SSCL

Technical Staff:

Physics Staff: D. Davisson, P. McBride, P. Schuler
Author: Patricia McBride

D. Davisson has continued to work on the conceptual design for the alignment system. P. McBride has continued to work on alignment and monitoring development and P. Schuler has joined the alignment group. Alignment requirements for the prototype tower were discussed at several meetings at the SSCL.

Fermilab

Technical Staff: J. Morrison (senior designer)
Physics Staff: D. Eartly
Author of Report: D. Eartly

The mechanical design for a sectioned alignment fencepost between optics/sensor station blocks has been completed. We believe that this is the prototype structure and we are ready to proceed with development.

A 102mm diameter round fencepost remains under long term stability test. Analysis of the first few weeks of data indicate a DX, DY thermal motion of the tube of 40mm at the MBW3 sensor positions as compared to 70mm for the 102mm x 102mm square tube. Adddtional data is being analyzed. The round tube has also been put through a local heating thermal cycle test in excess of 20 degrees F. Analysis is underway.

The Capacitec liquid level sensor cluster indicates individual sensor long term resolutions of 11 to 32 mm standard deviation (average 19mm) Taking sensor differences generally improves resolutions with sensor pair differences of 6.6-26.5mm. There is thermal structure in these differences due to non tracking thermal behavior of the input amplifiers. The units were returned to the vendor who has matched the +-15v capacitors using special new Seimens units. Vendor tests indicate substantially improved stability. The units are being returned to us for re evaluation. Also after some prodding,Mechanical Technology, Inc has finally submitted a prototype sensor and electronics for evaluation. Lion Precision is also submitting a prototype for evaluation after visiting us. These are the other major vendors of precision analog capacitive devices in the USA. With all three systems, we can determine the system of choice for expansion in muon prototype tooling tests.

3.2.4.4 Global Surface Facilities

University of Washington

Technical Staff: C. Daly, W. Song, R. Storch
Physicists: H. Lubatti, R. Davisson
Author: W. Song

The first release of the assembly procedure document for the muon modules has been completed and will be revised over time as the level of detail is increased.
(R. Davisson, C. Daly and H. Lubatti)

Investigation of the required inputs and interfaces with the RAM model. An entire set of inputs for the barrel modules has been reviewed. (W. Song, R. Storch).

Fermilab

Technical Staff: J. Morrison (senior designer)
Physics Staff: D. Eartly

Author of Report: D. Eartly

A significant amount of time was spent on DOE preparations and the review itself. In addition, a complete model muon phase 1 and phase 2 assembly-installation outline has been developed which is consistent with the 9/15/92 RAM analysis and the present detector master installation schedule. We will incorporate this into the RAM model which has the detailed operation analysis of module assembly to evaluate resource and scheduling impacts. More storage, handling, and fixture studies have been done.

3.2.4.6 System Engineering

SSCL

Technical Staff Matt Piazza, Payson Willard
Physics Staff: none
Reported by: Matt Piazza

We compiled Muon magnet and measurement schedule activities, network logic, durations, and resources. Held meetings with Jeff Cherwinka, Jeff Tseng, and Charlie Grinnell to develop project schedules. Milestones were added and keyed for specials reports.

Used MacProject Pro™ and Open Plan™ to load schedule data into the computer. We used Open Plan™ to produce graphical reports showing milestones, critical activities, summary activities , resource histograms and funding profiles based on cost estimates.

These reports were used in the DOE Review documentation and presentations.

November plans include development of working schedules with Jeff Cherwinka and Charlie Grinnell, documentation of procedures for schedule development, review and status, loading new budget into COBRA™ software, and determining Muon Systems FTE numbers.

C S Draper Laboratory

Technical Staff: G.Holden, J. Gorman, C. Grinnell
Authors of Report: G.Holden, J. Gorman, C. Grinnell

Engineering Coordination, Planning and Tracking

C. Grinnell

The month began with attendance at the SDC integration meeting at SSCL followed by a Muon Measurement System Installation workshop at Harvard. Both meetings, while very useful, continue to highlight our need for bringing more dedicated people onto the staff to work these issues.

Development of the project schedule continued to devour considerable amounts of effort to get the task structure correct and the resources from the cost estimate properly loaded and distributed. Although this schedule took a lot of resources to develop, and was more than adequate for the purposes of the DOE review, it's critical inadequacies mean that it must be abandoned in favor of a more detailed working schedule ASAP. The working schedule development began with a focus on fleshing out the development phase of the project(engineering design mainly).

A very small engineering meeting was held at SSCL on the 13th to discuss specific plans and levels of effort required for the engineering in the coming year. This provided the input basis from the lead engineers into the working schedule development in progress.

Preparation for and attendance at the DOE review consumed the last two weeks of the month with almost constant residence in Dallas. The Engineering Plan presentation was given to the DOE on the 27th and included the new WBS structure, schedule development, general safety and QA, global engineering and installation cost estimates.

System Design, System Engineering

G. Holden

A summary of the muon system engineering model and its uses was completed.

Work has continued on the tube placement algorithms. Two dimensional Intergraph drawings have been generated showing the placement of the theta tubes in the barrel and intermediate regions, and the phi tubes in the barrel region. These are created from the model outputs and text files of tube position arrays. Text files describing the tube positions being used by C. Daly have been accessed and a script has been written that re-formats these files, so that they can be analyzed in Matlab, and used to generate Intergraph drawings.

The beginnings of a file storage system has been started on the Intergraph workstation, zambia, at Harvard. Several members of the SDC muon system community have been given accounts on zambia. Drawings and files can be accessed from the directory /home/zambia/prd/muon. There are several outstanding issues with respect to tube placement that need to be addressed. Specifically, the need for the intermediate phi tubes to be to be placed based on projections from the barrel phi tubes, triggering concerns, tracking of tube configurations, and the distribution of tube position information.

Access to a DEC 5000 workstation at Harvard was obtained. This is now being used to backup zambia. Use of this workstation for support of file sharing and printing from the Intergraph workstation(s) is being investigated.

Martin Marietta

Technical Staff Involved: J. Bakken, J. Brogan, R. Hund
Reported by: J. Bakken, J. Brogan, R. Hund

Muon RAM Modeling

Changes to the detailed RAM procedures for the Barrel chamber assembly were completed, resulting in a reduction of overall span time. The IWT assembly RAM procedure was completed. A high level change, now in the RAM, was the offload of the BW1 end modules to the University of Texas, Arlington facility, required to maintain the schedule. However, the BW1 center modules are still built at the SSCL. Paper copies and disks of the RAM input sheets have been sent to the Universities of Washington and Wisconsin for analysis. The forward octant chamber and structural assembly above ground procedures have been completed and inserted into the RAM. The experimental hall assembly of the FW supermodule has been started.

The resource failure analysis that was begun last month was completed. This feature provides the number of anticipated failures of individual resources over the life of the project and then determines the extra amount of time needed to complete the project due to these failures. The RAM option of allowing certain resources to "float" to determine

how many are really needed to finish the project without introducing waits was implemented. Only resources that one can readily provide more of, such as slings or workers, are allowed to float. Resources that one can not easily provide, such as access shafts or cranes, are limited to their correct number as before. Also implemented was the RAM option of providing actual job time and overtime in addition to just span clock time. Three additional items currently being worked are: 1) increasing the detail of the simulation, 2) extracting the "people time" for each activity and providing a direct input to the WBS, and 3) improving and automating the porting of the RAM output to MacProject Pro and Open Plan.

Muon System Safety

Work continued this month on the muon safety outline and plan. Two meetings with Bob Lavelle were arranged and some good technical dialog resulted. Discussions about roles and responsibilities, organization and required products were discussed and better understood. A list of identified hazards and safety evaluation tables were obtained from Bob for review and comments. Review of the revised CSAR began so that any muon system impacts could be assessed. Prepared safety information for and attended the Trigger Counter Placement Task Force meeting. Three action items including emergency rescue of a incapacitated person, normal and emergency lighting requirements and communication requirements were assigned and will be worked near term.

Simulation

SSCL

Physics Staff: T. Fukui, N. Khalatyan, P. McBride, A. Wang
Author: Patricia McBride

N. Khalatyan has been looking at the hit information generated by the SDCSIM program. He has also been studying the accpetance of the Central muon system.

A. Wang has been working on a new trigger scheme for the SDC muon system. In the trigger simulation studies, she has completed a set of equations which completely describe all straight tracks through a contiguous triplet. These equations describe cases wehre the momentum and timing can be obtained from the drift information only(65%), and the remaining cases where a straight track can be identified and momentum obtained, but the timing must come from an external

source such as a scintillator (36%). She has found a set of isolation cuts which would reduce the number of early false triggers from this scheme when taking two triplets from the same superlayer in coincidence. Turning ot the case of non-contiguous triplets, which is needed for a true 3/4 trigger, she has found a set of equtions which describe 70% of all tracks. She has begun to study coincidences of triplets from different superlayers. An SDC note is being prepared on this trigger.

Since the muon trigger is sensitive to the occupancy of the muon drift tubes, so the muon group is getting involved in the matter of neutron fluence, knockout protons, delta rays and bremmstrahlung. The radiation enviornment is severe for the forward muon system, and may also be a matter of importance for the barrel muons as well. Angel is attending the interface group meetings (Accelerator, SDC, GEM Exp. Fac.) and the Neutron fluence/activation meetings (SDC, Accel, Exp. Fac., LANL, ORNL). The muon simulation group plans to work with the Fluence/Activation group to determine the most sensitive parameters for the muon system performance.

University of Colorado

Technical Staff:
Physics Staff: Mark Christoph, Mourad Daoudi, Quenten Van Egeren, Uriel Nauenberg, Victor Slonim.
Reported by: Uriel Nauenberg

1)We are doing simulation in collaboration with Shuichi Kunori from U. of Maryland, Walter Toki of Colorado State University, Sue Willis and Vladimir Sirotenko of Illinois, Steve Ball of U. of Kansas, and Jon Bakken of Martin Marietta Science Systems.

The people in Colorado are Mourad Daoudi, Victor Slonim and myself. We have been joined by two undergraduates Mark Christoph and Quenten Van Egeren who developed expertise in UNIX and our analysis packages during the summer workshops.

Our program is to work on the track fitting, track matching and pattern recognition. We will also work on the barrel trigger algorithms. All this work is proceeding satisfactoriy.

Northern Illinois

Physics Staff: Suzanne Willis, Vladimir Sirotenko
Author: Suzanne Willis

Work on developing the muon reconstruction program for the barrel chambers (package MI) continued. The first version of the program has been written and tested on Monte Carlo events. Each event had 5 muons with momenta equal to either 50 GeV or 500 GeV. The results obtained show the track reconstruction efficiency equals 70\% and fake track creation probability is about 10\%. The momentum resolution was around 20\% for 500 GeV and 17\% for 50 GeV. This is just the beginning and work is in progress; the main goals are to adjust the algorithm, improve efficiencies and speed, and test the program on complicated events with background and noise.

We are beginning to look into the effect that the neutron backgrounds may have on the muon chambers, both in the barrel and the forward region. Information is being gathered from the people building the chambers, to get an idea of how sensitive the chambers are to neutrons of various energies; from the people doing the neutron rate calculations, to get an idea of the rates of neutrons of various energies in various parts of the detector; and from the people doing measurements of neutron rates, to get an idea of the reliability of the calculations.

4.0 SOLENOID MAGNET SYSTEMS SUMMARY

4.1 Superconducting Solenoid

KEK

Technical Staff: Akira Yamamoto, Yasuhiro Makida, Ken-ichi Tanaka, Takahiko Kondo
Author of Report: Akira Yamamoto

Prototype coil winding:

Coil winding practice has been carried out by Toshiba Corporation.

A test coil with a full diameter and an axial length of 30 cm was successfully wound with superconductor by using a coil winding machine recently developed. After curing the coil, electrical insulation was checked. The test coil is to be cut and the cross section will be observed to verify physical coil configuration (uniformity), epoxy bonding boundary between the coil and the outer support cylinder etc.

Honeycomb Vacuum Vessel R&D:

The curved honeycomb panel was successfully assembled to a complete cylinder. A inner vacuum wall and bulk heads has been completed. Assembly of a test vacuum vessel with the honeycomb outer wall is being prepared.

Fermi National Accelerator Laboratory

Technical staff: Bob Kephart, Charles Grozis, Rich Stanek, Ron Fast, Andy Stefanik
Author of Report: Ron Fast

Status report on vacuum vessel for prototype solenoid:

Two of the three isogrid panels for the outer vacuum vessel have been machined by Camarillo Dynamics Company and the third should be finished early in November. The first panel has been completely inspected; all dimensions conform to the specifications on the drawing.

Amro Fabricating Corporation has formed the first panel to the required 2004-mm inner radius. During the forming, which is done on a 1000-ton break press, a minor deformation occurred when a 300 x 1000 mm area was overformed. Although this deformation has no effect on the allowable pressure/vacuum rating of the shell, special tooling is nevertheless being designed to reform the affected area. Amro will begin forming the second panel on November 9.

The fixture to be used when welding the isogrid panels into a shell and machining it to length and drilling and tapping the bolt holes has been designed and material has been ordered.

The inner vacuum shell has been rolled at Amro and the flanges have been welded on both ends. The fixture to go inside the inner shell to maintain it as a circular cylinder during further machining is about 75% complete. The machining of the inner shell to length and the drilling and tapping of the bolt holes should be complete in November.

The Fermilab drawing of the annular bulkhead was reviewed and approved by Toshiba for construction. Material has been ordered and a fabrication contract placed with Amro; fabrication will begin November 10.

Akira Yamamoto and Charles Grozis visited Amro and Camarillo on October 22 and observed the isogrid machining and forming.

We are presently working on the inspection and testing procedures for the vacuum vessel.

Superconducting Super Collider Laboratory

Technical Staff: Jim Krebs, Warren Kampmeier
Author of Report: Warren Kampmeier

Per Kenn Hess(SDC Integration), the power supply for the superconducting solenoid will be located in the surface utility building, and the interconnecting power bus will be water-cooled. An air-cooled bus configuration was considered, but was discounted for reasons of shaft space, unconventional technology, cost uncertainty, etc.. Work continues on detailed equipment layouts and definition of scope and responsibilities.

4.1.2 Solenoid Power Supply System

SSCL and KEK

Technical Staff: Larry Schneider (SSCL), Akira Yamamoto (KEK)
Author of Report : Larry Schneider (SSCL activities only)

A trip to Tokyo to visit Akira Yamamoto and the KEK facilities is scheduled for December 8-11, 1992. Along with discussions of the cryogenic system for the superconducting solenoid magnet, a definition of the responsibilities of the SSCL in the area of the DC power supply and quench protection system is planned. A draft plan defining responsibilities and technical interfaces with KEK will be written in the near future.

4.2 Cryogenic Systems

KEK, National Laboratory for High Energy Physics

Technical Staff: Akira Yamamoto, Yasuhiro Makida, Ken-ichi Tanaka, Takahiko Kondo
Author of Report: Akira Yamamoto

Conceptual design study for the SDC solenoid cryogenics has been carried out. A system flow diagram and S-T diagram have been made. The various operational mode have been studied to verify component functions and the system configuration.

Superconducting Super Collider Laboratory

Technical Staff: Charles Collins, Jim Krebs, Matthew Wilson, Warren Kampmeier, Gerry Chapman
Author of Report: Matthew Wilson

A proposed expansion of the KEK contribution to WBS 4.0 to include the cryogenics systems and power supply in under discussion. Of particular concern is management of the many interfaces relating to the cryogenics system and associated

controls. Discussions continue in order to better define the responsibilities and management plan. These discussions will result in a Statement of Scope document (covering WBS 4.0 in it's entirety) to be reviewed and approved during a meeting of the SDC Superconducting magnet Technical Board held in Japan December 7-11. This document will clearly define scope, responsibilities, cost, schedule, and deliverables for WBS 4.0.

The cryogenic systems design is past the conceptual phase and is nearing completion of the preliminary phase. As agreed in earlier discussions, KEK has provided a draft copy of a paper by Yoshikuni Doi entitled " Conceptual Design Study of a Cryogenic System for the SDC Thin Superconducting Solenoid Magnet". This paper constitutes the cryogenics system requirements from the standpoint of the solenoid design. Per the agreement, SSC will build upon this design from a standpoint of system integration and operations to create the "Preliminary Design" to be reviewed per the new SDC PMP requirements.

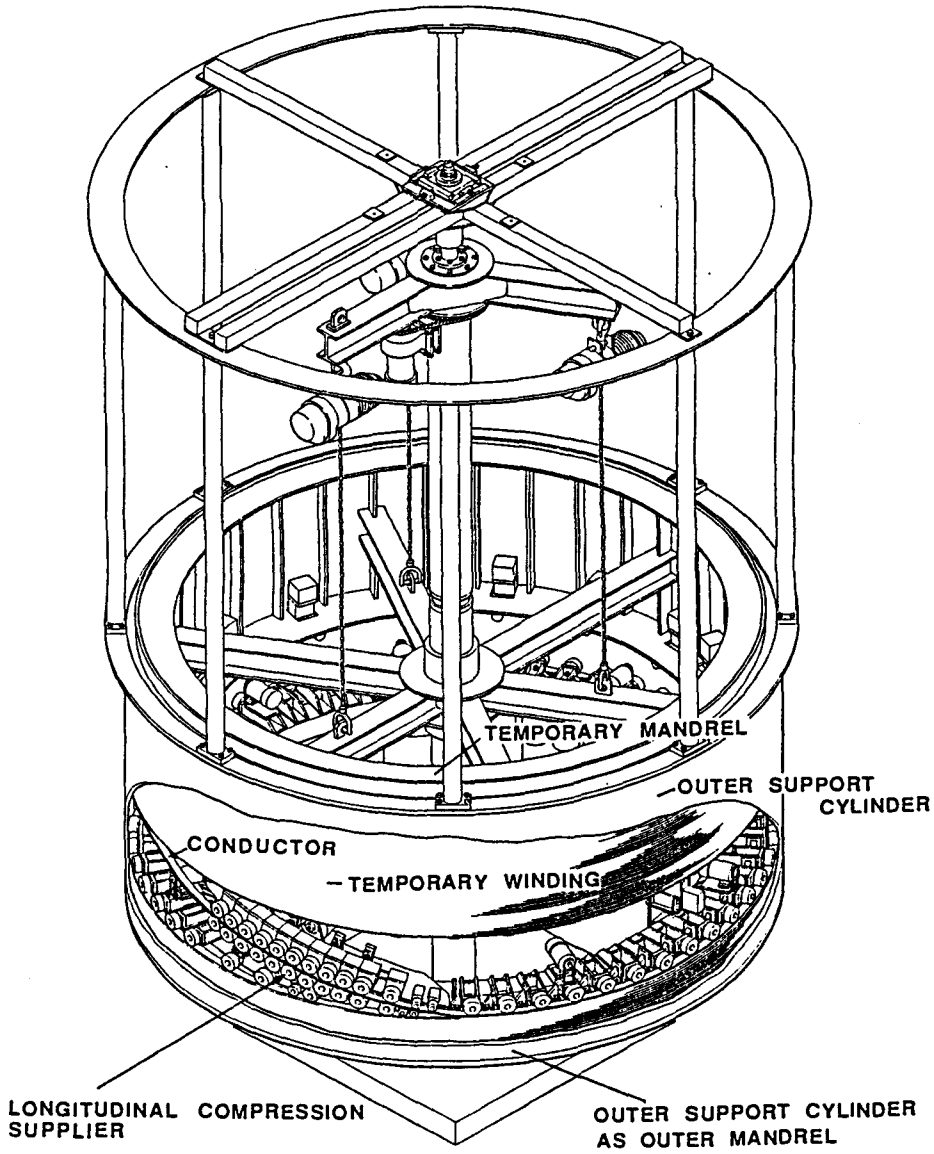
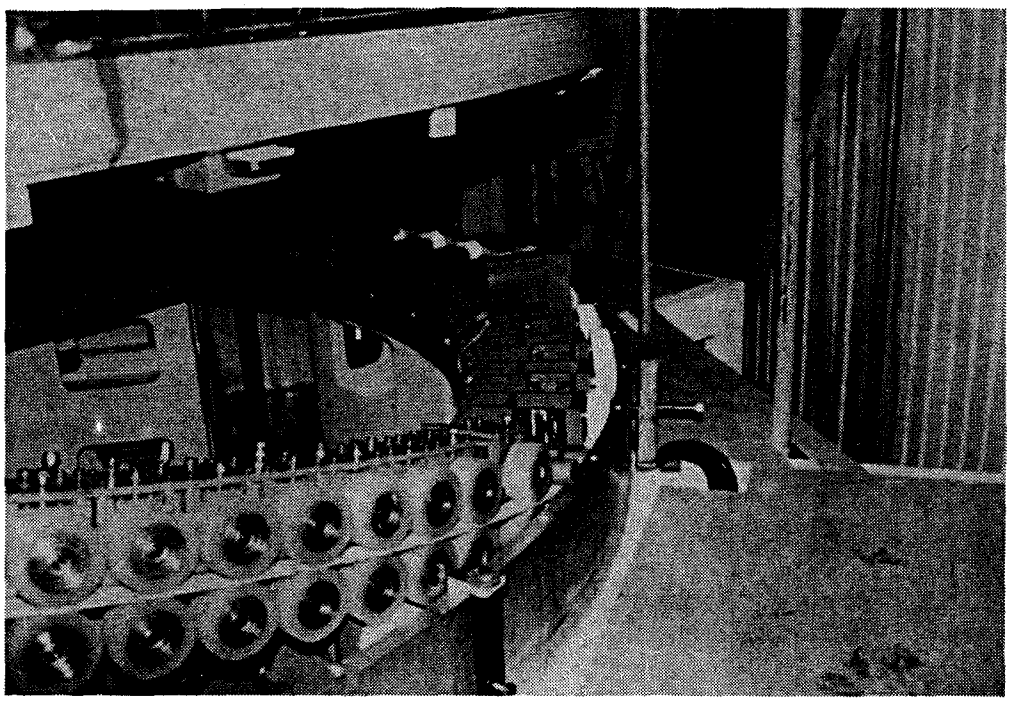


Fig. 1 Schematic view of coil winding machine



(from outside)

(from inside)

Fig. 2 Pictures of coil winding

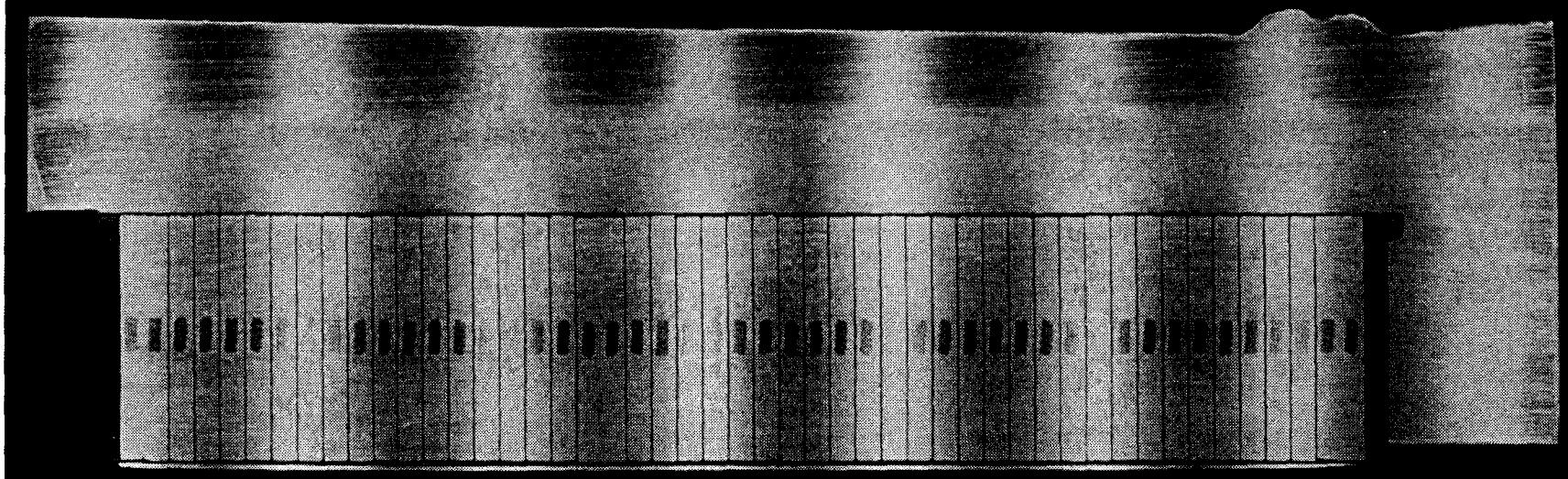


Fig. 3 Cross section of the test coil winding

5.0 ELECTRONICS SYSTEMS SUMMARY

Effort continued for three WBS items:

5.1 Front-End Electronics
5.2 Data Acquisition System
5.3 Trigger System

5.1 Front End R&D

Reports for four WBS items follow:

5.1.1 Scintillating Fiber Tracker Front-End Electronics
5.1.2 Straw Tracker Front-End Electronics
5.1.3 Calorimeter/Shower Max Front-End Electronics
5.1.4 Muon System Front-End Electronics

5.1.1 Scintillating Fiber Tracker Front-End Electronics

Fermilab

Technical Staff Involved: A. Baumbaugh, A. Romero, K. Knickerbocker,
Reported by: A. Baumbaugh

The fiber storage/trigger/readout board which was used in the test beam effort is now being looked at in terms of modifications which will bring it more in line with the final system boards, and in preparation for a several thousand channel test. These efforts continue.

We also continue the task of putting together a test stand for use with tracking boards as well as boards used by the calorimeter. We are procuring IBM clones and Bit3 interface cards from the PC to VME so that we can set up simple DAQ and control functions from the PC into the VME crate. We are also looking into setting up more sophisticated automated test stands.

We continue working with the Fiber Tracking Group and Rockwell to set the specifications for the VLPCs and cassettes.

5.1.2 Straw Tracker Front-End Electronics

Work proceeded at eight institutions, whose reports follow. Progress was made on a broad front, including on development of prototype ASD's, TMC/L2B's, trigger chips, data collection chips, and HV/ASD and Time & Trigger assemblies. Work also progressed on cables, electronics mounting, radiation length studies, and trigger studies.

University of Colorado

Technical Staff: B. Broomer, E. Erdos, C. Zuelchner
Physicists: D. Craig, W. Ford, S. V. Greene, D. Johnson, P. Rankin
Reported by: W. Ford

Loaded components for about eight ASD8/T4 front-end boards.

Sent drawings to Cinch for quote on a spring-contact connector block containing blocking capacitors. This is part of an endplate scheme which will allow removal of both the front end board and capacitors for servicing.

Designed a modified routing board for use with a high-density prototype FEB to be built by Penn.

University of Pennsylvania

Technical Staff:	N. Dressnandt, T. Eckenberg, J. Cook, R. Pearce
Physicists	R. Van Berg, H. H. Williams, F.M. Newcomer
Reported by:	R. Van Berg

Preliminary Design Document

We did not make our original goal of a major revision to the Preliminary Design Document before the October DOE review. It will be necessary to expend some additional effort in November to try for closure on getting updates on all of the technical advances that should be included in the PDD (or whatever the official name is).

Amplifier/Shaper/Discriminator Design and Production Models

We have received the following bonded ASD chips: thirty two 68pin PLCC and thirty 68p in EPIC packages. We have placed an order for an additional fifty 68 pin ceramic chips for the muon group.

The ASD T4 boards are arriving on a regular basis from Colorado, approximately 3 per week. Eric Erdos of Colorado is the lone stuffer. We have agreed to test. We finally get to keep one. One was sent to TMU.

One will be borrowed by the microstrip group for three weeks. We have 3 that can be sent out.

ANYONE WITH AN IMMEDIATE NEED, EMAIL or CALL

(mitch@upenn5.hep.upenn.edu or 215-898-4456)

A prototype board designed by Nandor Dressnandt came back and seems to work well. There was some difficulty attaching the 25mil lead spaced EPIC packages and we may have lost a couple of chips due to stuffing errors or possibly the yield for EPIC packaged chips is not as high as for the PLCC's. We need to develop a test fixture for the EPIC packages and will investigate the possibility for using shin-flex and a compression fit to a prototype.

We met with Prof. Asano from Tsukuba to discuss his progress on the muon electronics. We discussed possibilities for a shared, Spring run which would include an update of the ASD-8 and a single-channel muon ASD.

Measurements of the ASD and ASD T4 board:

Noise Simulation- Note that the baseline for intrinsic noise is set by the termination resistor in our present system. Ignoring sources of pickup SPICE predicts about 2600e equivalent (input) noise charge, ENC, when the ASD is capacitively coupled to a 100 ohm anode wire and capacitively coupled to a 300ohm termination. Coupling capacitors were 100pF and 70pF. Strays were 10pF.

Noise Measurements- The present method of running differential inputs has its costs as well as its benefits. I measure about 5pF between inputs as well as about 10pF to ground on each. This is equivalent to a 20pF stray on each input, much more than the final system needs to have. ENC was measured at about .6fC, suggesting that a reasonable threshold should be 2.5fC at least, or about -0.7V.

Removing the traces at the chip, the strays then are 2pF to GND for each input and 0.8pF between inputs. For comparison purpose this is similar to 5pF at one input.

PRELIMINARY measurements are:

CINPUT	ENC electrons
5p	1300e
10p	1700
15p	2100
28p	3000

We have one measurement that is about 200e lower in the first 3 values and are trying to duplicate it.

Input impedance - An apparent discrepancy between measured and SPICE calculated input impedance at low frequency (10 ohms) was found to be due to unmatched power supply settings Vcc=3.0 (spice) ..vs.. Vcc=2.7V measured chip.

A paper on the ASD was given by F.M. Newcomer at the Nuclear Science Symposium in Orlando.

ASD/HV Assembly Production Model - Revised AZTEC Layout

A new layout was finished for a board mechanically and electrically compatible with the ORNL physical design, but with several experimental modifications intended to allow us to test a number of new features. The most important of these are:

1) Two HV decoupling resistors in series to provide greater breakdown protection. We have tested SINGLE board mount chip resistors to >1500 Volts without breakdown (in air) and thus have some indication (although not statistical proof) that a double resistor ought to be sufficient to prevent sympathetic damage from neighboring breakdowns.

2) Explicit semiconductor clamps. A Harris fast, low capacity, bipolar, overvoltage protection circuit, packaged fourteen to a 16-pin SOP protects 24 of the channels on this board. Twenty four have only the dual resistors.

3) Extended B inputs. The "other" input to the ASD chip is routed alongside the normal input, either up to the board edge or halfway along.

4) No use of blind or buried vias to reduce the final production cost of the boards.

5) A potentially simpler method of ground connection (utilizing plated board edges) is being tried.

This board should be available for test in November.

The layout primitives used in this effort will be carried over to a design compatible with the Colorado scheme for HV capacitor mounting.

Long Cable Prototype

We have been in communication with the vendor who has been working on the experimental long flexible cable - the task is proving perhaps a little more difficult than he had originally estimated, but with revised front/back jigging he still expects to be able to produce a viable product.

Production Model L2I

The full four-channel L2I has been submitted to MOSIS. Additional simulations continue to imply good behavior. The Tiny Chip single channel version L2I (with known counter problems) has been tested both at Penn and at SSCL (on the HP 82000). The chip behavior seems to be consistent with the simulations, although the race condition in the counter layout makes it difficult to verify.

Preliminary work is underway to integrate the TCC/AMU and L2I on a single die. The circuit changes necessary to allow this have been identified and alternate schematics simulated. It is likely that this will require a re-layout of the L2I to be consistent with the

TCC/AMU layout, but given the present state of the Cadence tools this is not regarded at a large effort. As noted above, the L2I (as well as the latest version of the TCC/AMU) have been tested at the SSCL high speed IC tester. Penn has been awarded funds (in a separate infrastructure grant) by the DOE to purchase a similar machine to speed circuit testing.

We expect to be able to specify and go to bid on such a machine in November and, with great luck, have a facility ready by Groundhog's day. This facility will, of course, be available to others.

Project Management - Project Planning

A completely revised schedule and correlated re-costing of the Straw Electronics task (5.1.2...) has been translated into an October 1992 version of the Straw Electronics Cost and Schedule Book. This riveting story of struggle and triumph along the Waxahachie will be available soon at all WaldenBooks - in the meantime a request to rick@upenn5.hep.upenn.edu will get you your very own copy.

The total cost has remained roughly constant at a bit over $12.5M including contingency (~20%) and the schedule can be kept consistent with the Straw Tracker schedule using only the resources that we expect to actually have available to us - there is, in fact, a moderately comfortable margin of six months or so over the next six years. The incremental cost per straw is still about $50.

This Cost and Schedule have been reported to the DOE review panel at SSCL at the end of October.

University of Toronto / McGill University

Technical Staff:	G. Stairs, A. Holscher
Physicists:	P.K. Sinervo, K. J. Ragan
Reported by:	P. Sinervo

DCC - FMUX

G.Stairs continued to document the data flow that takes place between the TMC/L2B and the DAQ system through the Crate Interface Card. A detailed specification of the pin assignments for the baseline FMUX was written up and distributed to other members of the Straw Tube electronics group.

FETX

Design of a prototype FETX ASIC was started. This device will be designed to interface with the prototype FMUX currently in fabrication and will be used to demonstrate the ability to drive the data from the FMUX's the necessary distance from the microcrate to the Crate Interface Card. G.Stairs is developing the detailed design and A. Holscher began the layout of the prototype device.

Trigger Interface Circuitry

P.Sinervo and K.Ragan held a meeting with H.H.Williams to begin preliminary design of the trigger interface circuitry necessary to transfer the data signals for the L1 and L2 tracking trigger to the trigger processors via the Crate Interface Card.

The assumptions underlying this scheme were that a single bit from each straw tube module was sufficient for a L1 trigger, whereas the location of a track segment to within a straw diameter (0.4 mm) was required for the L2 tracking trigger. A scheme using the output of the Mean Timer Circuits was proposed that was consistent with the baseline design and these assumptions.

Data Buffer

G.Stairs continued conceptual design of the data buffering and collection that takes place on the Crate Interface Card. A number of detailed sketches of a possible architecture for this device were created.

DAQ and Trigger Interface

K.J.Ragan began to assemble the hardware and software necessary to bring up the SDC Portable DAQ system. This system is being prepared in order to test the prototype data collection system that will be assembled from the prototype devices currently in fabrication.

5.1.2.2 Straw Tracker Front-End electronics - Design and Production Models

KEK

Technical Staff:	M. Ikeno
Physicists:	Y.Arai, S.Odaka, T.K.Ohska
Author of report:	T.K. Ohska

HV/ASD assembly

A manufacturer who does a printed resistor pattern (like on hybrids) was located who has experience up to 400k ohms. They never have tried this for inner layers or for high voltages. A test pattern having such printed resistors on an inner layer was sent to Aika. We will receive the test boards soon for the test. If this works, it will save some real estate on these HV/ASD boards.

Time and Trigger Assemblies (Microboard)

Layout/artwork was done with Zeken CAD. Originally used a design rule of Aika-Electronics Corp. which is one of the significantly better PCB manufacturers in Japan. Due to the pin spacing of 0.5mm on standard packages originally suggested by Toshiba, through holes and via holes (0.35mm dia.) totally block passage of a trace between them; hence auto-routing failed miserably. (Layout according to the circuit diagram presented at August meeting). Totally manual layout was done, and most traces (94.8%) were connected. Photoplots of each layer were done and were presented at the DOE review.

Note that we changed the design rule given by Aika since their suggested via hole pad diameter was 0.7mm and was found to be too large so that 0.5mm was used instead. This value was not verified by Aika yet, nevertheless the layout was done this way. It has 4 layers of pattern (traces) per side plus (common) GND and power layers, making it a 10-layer board.

We may need to reconsider these design rules to get the final layout done in an acceptable way. One thing we concluded was that we should combine TMC and L2B in one package even though it will cause a loss of flexibility in the course of designing. Another possibility we are working on is a larger package with 0.65mm lead spacing. This is under study at Toshiba.

Microcrate radiation Length

A preliminary radiation length calculation showed a rather large value. This may make a good argument to move microcrates (at least for the inner 2 layers) outside. We will start cable tests as a parallel effort with Penn. Radiation length of HV/ASD and end cap were not included yet. Need to work together with people working on them.

TMC

Toshiba design of TMC (and simple L2B) was completed by Oct.12th. Toshiba will deliver 20 engineering samples to KEK on the 27th of October. Typical delivery time will be 2 WEEKS! after a submission of chip layout. We will test them right away. An additional 200 pieces will be delivered by early November for further tests.

Oak Ridge National Lab

Technical Staff:	G.T. Alley, M.S. Emery, R. Maples
Physicists:	Tony a. Gabriel
Reported by.	Michael S. Emery

So far testing of the ASD boards has shown no surprises other than a fabrication error on one board. A via connecting the power bus "VE3" was apparently not plated through as called for in the design files. No oscillations have been observed with the current test setup. Improvements need to made to the test setup in order to improve grounding connections and reduce some ringing attributed to long ground leads.

We have now received a total of 24 EPIC-packaged ASD chips from Penn. This will permit a complete module to be instrumented. A module was assembled without the electronic components mounted and sent to Seog Oh at Duke University to verify mounting procedures. According to conversations with Seog, the module seems to fit well. They are machining a plastic jig for support and expect to be ready for a fully instrumented module from us. Our top priority now is to complete a fully instrumented module and deliver it to Duke University for testing with their straw module.

Tokyo Metropolitan University

Physicists: T. Hirose, R. Hamatsu, M. Chiba, K.Kondo, K. Yamauhi

- Design and Production Models: Time and Trigger Assembly

System Level Tests

The 1-foot long Indiana straw chamber now operates at TMU after stopping gas leaks. They have done cosmic ray tests to get efficiency measurements. There are quite a few channels that has high enough current leakage when HV is applied so that only 16 channels out of 64 were used for the test. They requested next test chamber at the earliest date so that they can do better tests in a future, unless the current leakage could be fixed.

They also would like the new boards as soon as possible since there are not much point in fighting with the crosstalks on the old board.

Trigger study (simulation)

J.Chapman's simulation program is now understood and is used to study trigger design as a collaboation with J.Chapman.

Tokyo University of Agriculture and Technology

Physicists: T. Emura, F. Sudo

Toshiba design of simple L2B (and TMC) was completed by Oct.12th.

This is the same piece as above (WBS 5,1,2.2.2.6). Toshiba will deliver 20 engineering samples to KEK on the 27th of October. Typical deivery time will be 2 WEEKS! after a submission of the chip layout. We will test them right away. Additional 200pcs will be delivered by early November for further tests.

Tokyo University of Agriculture and Technology

Physicists: T. Emura, F. Sudo

Straw Tracker Front-End Electronics L2B

Toshiba design of simple L2B (and TMC) was completed by Oct.12th.

This is the same piece as above (WBS 5,1,2.2.2.6). Toshiba will deliver 20 engineering samples to KEK on the 27th of October. Typical deivery time will be 2 WEEKS! after a submission of the chip layout. We will test them right away. Additional 200pcs will be delivered by early November for further tests.

University of Michigan

Technical Staff: J. Mann, J. Geld
Physicists: J. Chapman, S. Vejcik, B. Ball, C. Miao
Author of Report: J. Chapman

The straw trigger chips fabricated with the radiation hard UTMC process exhibit the same properties as the radiation soft versions previously fabricated through MOSIS. The UTMC design extended the features of the trigger chip slightly. These new circuits function as designed and the elements of the circuit are ready for incorporation into a pre-

production design. The ability of these circuits to provide a crossing tag and to divide a 32ns interval into 16 separate intervals with exceptional accuracy has been demonstrated.

Straw Tracker Trigger Synchronizer - Tests

The cosmic ray test stand for the small 64 straw configuration is functional and awaits the attachment of the new straw trigger chips. The cosmic ray rate is quite low and we will have to operate this test stand for extended periods to demonstrate the effectiveness of the trigger in a real detector environment. Although the integrated circuit tester provides definitive tests, it is felt that operation of the circuits on actual straw tubes will offer a final convincing demonstration.

Straw Tracker Trigger Synchronizer

Simulation

The straw trigger simulation has been extended to include both straw triggering and muon detector signal simulation. This combination has been pursued in order that we may study the level 2 trigger algorithms needed to improve the muon triggering with the addition of central tracker information. With both central tracking and muon tracking activated, the program is markedly larger and slower. As we develop a better understanding of the problems associated with this combined simulation, we will be in a better position to estimate the time required to perform these level 2 trigger simulations.

5.1.3 Calorimeter/Shower Max Front-End Electronics

Fermilab

Technical Staff:	
R. Yarema	C. Rivetta
J. Hoff	A. Romero
M. Sarraj	A. Baumbaugh
S. Hansen	K. Knickerbocker
D. Grauptman	M. Sarraj
E. Barsotti	
Reported by:	G.W. Foster

In October we continued to look into second-source, higher performance alternatives to Orbit Semiconductor as the silicon foundry for the Digitizer ASIC. Nondisclosure agreements were signed and Spice models obtained from both Harris Semiconductor and Texas Instruments. It appears that the devices from both companies will have significant AC and DC performance advantages over the Orbit process for the Current Splitter ASIC. The availability of high-performance PNP's in the (recently-announced) Harris process would have a number of advantages, particularly in the design of an on-chip FADC buffer. Work will continue on fabrication of a full-function Digitizer ASIC in the Orbit process, however, due to advantages in cost, turnaround time, and our experience with this process.

Extensive new cost & schedule documentation was prepared for the October DOE review. Vendor quotes were obtained for components and assembly of the PMT base/digitizers, based on an explicit circuit diagram and board layout.

The layout of a second flash ADC subcircuit was completed and submitted for fabrication. This design uses a comparator bipolar differential pair input and a set of four CMOS interpolating latches. In simulation, this comparator design settles to 1mv accuracy following a full-scale step in 6ns. The power dissipation is approximately

0.5mw/comparator at 60MHz. If successful, this design would allow construction of a 9-bit FADC with ~1/3 the power consumption of the 8-bit FADC in our baseline design.

Measurements of a Cockroft-Walton prototype circuit were performed. These included load regulation, ripple, and power dissipation. Measurements were made of the effective coupling capacitance of the anode to different dynodes inside a representative PM tube in order to understand the ripple specifications at each dynode. A decision was made to produce further prototypes using both the "stacked washer" PC board assembly technique (expected to be best for RF shielding), and a mechanical design based on a single PC board (easier to prototype and potentially cheaper).

A thermal analysis of the base/digitizer assembly was performed and an acceptable packaging scheme was developed. In this scheme a thin copper plate extends directly under the PC board containing the Flash ADC to conduct heat outside the base/digitizer assembly. It appears that air-cooling of the bases will not be a problem. A prototype is being worked on.

Lawrence Berkeley Lab

Technical Staff:

T. Collins	I. Kipnis	R. Minor	E. Theil
S. Dow	S. Kleinfelder	L. Pope	S. Wunduke
J. Franck	L. Luo	P. Salz	J. Zelver
G. Gabor	O. Milgrome	D. Santos	K. Shimada
R. Jared	T. Merrick	T. Shimizo	

Physicists: M. Levi, P. LeDu, M. Wong
Reported by: R. Jared

The effort in this period was associated with six main areas: Switched Capacitor Array (SCA), Beam Test Card, Preamplifier design, Floating Point Adder design, Analog to Digital Conversion (ADC), and Management of new and on going efforts. A brief synopsis of the work in these areas is listed below:

The SCA work was mainly associated with preparation of the new SCA for testing. This effort will end when the new SCA is tested. The effort spent was 0.1 man months. (Merrick)

The Beam Test Card had little work this month. It is planned to complete the testing next month with the new SCA. This small testing effort will complete the card. Effort spent was 0.1 man months. (Wunduke, Jared)

The main effort on the front end was directed at the CMOS current splitter for Shower Max. The current splitter and sample and hold are being modeled with SPICE. Effort spent was 0.6 man months. (Dow, Jared)

Work continued on a Floating Point Adder used in the calorimeter readout. The simulated device is being ported to a Cross Point FPGA. Effort has been started to develop a VHDL model for a VME interface. Effort spent was 0.8 man months. (Wunduke)

Documentation of the common ramp ADC design was performed in this period. The effort spent was 0.4 man months. (Milgrome)

Management consisted of direction of ongoing efforts, development of system designs, preparation of budget material and attending meetings.

Work was started on SDC electronics system engineering. Effort spent was 0.7 man months. (Jared, Minor)

University of California, Irvine

Technical Staff:	R. Atmur, C. Stratton
Physicists:	A. Lankford, M. Schernau, B. Schmid, R. Schwarz, E. Van Drunen
Author of Report:	B. Schmid

Work continued on developing a system for testing wide dynamic range calorimeter electronics. A portable data acquisition system of the sort expected to be standard for SDC tests was integrated and software for completely automated testing was written. The design of a VME based calibration control card continued and preliminary software for its operation was written.

5.1.3.2 Shower Max Front-End Electronics

CE - SACLAY (FRANCE)

Technical staff:	Ph. Baron, A. Joudon, F. Lugiez, M. Rouger
Physicists :	R. Hubbard, P. Le Du
Author of Report:	P. Le Du

Prior to the selection of the Digital PMT Readout for calorimeter towers in September, and in view of the 1993 beam test of the preproduction prototype, a complete electronics channel was been defined in May 1992.

It is organized around the analog memory (SCA) developed at LBL.

We have studied several functional units implemented in three integrated circuits (ASIC's).

1.ASIC #1: - 16 channels

- Charge integrator (input: 15fC - 60pC; output: 1mV - 4V) with linearity better than 1%.
- Line driver
- Two versions are developed to accomodate signals of opposite polarities coming from MCPMT's and from APD's with a preamplifier.

2. ASIC #2: - 16 channels

- shaper
- Variable gain (3-15) to accommodate MCPMT gain variations between channels.
- Fast comparator with variable threshold to provide a level 1 trigger signal for a group of 16 channels.
- Output buffer to analog memory.

3. ASIC #3: - Analog multiplexer behind the memory, 16 IN, 1 OUT

   - Gain selector: 0.5, 2 and 8.

A Showermax group meeting was held at Rockefeller University.

The purpose was to review the status of the different parts of the read-out chain from the photodetector to the trigger. Plans for beam test were also discussed.

The status and expected performances of the ASIC's developed for the analog readout scheme was presented by M. Rouger.

1) ASIC #3 (range detection) has been fabricated. Its evaluation with an 8-bit, 20-MHz FADC is underway.

2) ASIC's #1 (charge integrator) and #2 (shaper-gain adjustment & level 1 trigger) will be fabricated by MIETEC, starting in November 1992. The way to use them as a technology test bed in the photodector read out test at BNL was presented by P. Le Du. Only ASIC's #1 and #2 will be used in connection with standard commercial ADCs.

In addition to the production of these ASIC's, the Fermilab "all digital" design for the calorimeter electronics is now being evaluated for its adaptation and use in the SMD. M. Rouger and F. Lugiez spent a week in the US to investigate with the FNAL team all the technical aspects of such a chain. Since the showermax requirements are less severe than the calorimeter, a "downgraded" version in CMOS technology of the calorimeter ASIC is under study. Global simulation of the different elements of the chain will be carried out during the next few weeks. In particular:

1) the current splitter.
2) the gated integrator.
3) the range detection.
4) the fast digitizer.

The system aspect and common features with the calorimeter readout part is underway in collaboration with the LBL group (R.Jared). In addition J.C. Brisson from the level 2 trigger team is looking at the digital storage part in order to define the optimized "feature extraction" scheme for the level 2/DAQ data stream.

A first technical document on the Shower Max Front End Electronics has been published (SDC note 92-347). It contains information about the specification of the SMD read-out chain and details about the work on the analog read outscheme.

5.1.4 Muon System Front-End Electronics

University of Michigan

Technical Staff:	K. Hashim, C. Murphy
Physicists:	J. Chapman, S. Hong
Author of Report:	J. Chapman

Revision B of the muon scintillator trigger chip has been received and is being tested. The test are almost complete and no design flaws have been found. This chip will serve as part of the mini-tower test being readied for installation at KEK in Feb 1993. A full length SDC scintillator with phototubes, amplifiers, and discriminators will be assembled and instrumented with the trigger chip circuits. These test will serve to evaluate

the proposed SDC muon trigger scheme. This scheme also uses projective wires for momentum selection. The mini-tower test will include a 32 tube array provided by KEK. Discriminated output from these tubes will be sent to a wire trigger chip also developed at Michigan. Revision A (version 1) of the wire chip has been under test at Michigan for about a month. A second revision of this chip will also be necessary since a malfunction has been discovered within the circuits. The muon wire trigger chip has circuits for 3 programmable momentum selections. The circuit that develops the lowest of these three selections does not generate any output. The higher two selection units are fully functional. When the failing portion is understood, we will repair the design and resubmit it for fabrication. This Revision B wire trigger unit should be available by early December, in time for inclusion in the mini-tower test.

The output from both the scintillator and wire circuits will pass onto a coincidence board being prepared by the University of Washington. This coincidence board will under program control do the 2 of 4 trigger pair correlation and store the result for readout. The triggering process will be sequenced by a TEM (trigger emulation module) provided by the University of Wisconsin. Revision B of the wire chip and the preparation of boards, scintillators, lightguides, and scintillators for the mini-tower test will be the major muon trigger activities through February 1993.

5.1.4.1 Muon System Wire chamber electronics

Harvard University

Technical Staff: J. Oliver, H. Hill, S. Harder, J. O'Kane
Physicists: G. Feldman, P. Hurst
Reported by: J. Oliver

The 16-channel ASD board for supertower prototype was tested and found to be fully functional. This version contains the Penn single channel amplifiers and hybrid shaping circuits. The octal CMOS charge injection circuit for timing calibration was received from Orbit. It was tested and its performance matched Spice predictions quite well. Its function is to inject from 1 to 400 fC of charge into preamp front ends with high (<1ns) timing accuracy. Channel-to-channel timing accuracy was measured to be well below the required 1ns. Its measured crosstalk is below approximately 1 fC into non-pulsed channels. This device will allow in-situ timing calibration and testing of trigger patterns directly through the amplifier front ends.

The mini-boxes which house the ASC cards are being constructed. A version of the ASD card which utilized octal Penn ASDs will be designed starting next month.

SSCL

Physics Staff: P. Schuler
Author: Patricia McBride

A high voltage system with 20 channels of +8kV/0.2mA per channel has been ordered from CAEN and partially received. This system will be controlled through a VME interface.

A suitable high voltage distribution to the tubes has been considered. Since many tubes (>100) need to share the same high-voltage channel for economical as well as practical reasons (cables!), it is important to minimize the effect of wire breakage or other ill effects in one tube on the associated tubes.

With a choice of 100 Mega-Ohm inline resisters, the maximum current/tube in the case of a short circuit to ground is limited to 65 micro-Amp @ 6.5kV. This may be acceptable on a temporary basis for a power supply that delivers 0.2mA or more. The current monitoring of the remaining healthy channels will, however, be compromised and it is desirable to be able to disconnect the faulty tube from the high voltage during a suitable machine shutdown. For this purpose the high voltage distribution should be routed through an accessible panel on the surface of the muon modules.

5.1.4.6 Muon System Front End Electronics Project Management

University of Michigan

Techical Staff:	C. Murphy
Physicists:	J. Chapman
Author of Report:	J. Chapman

The WBS entries for 5.1.4 have been individually reviewed and updated to correspond to the design evolution and to reflect the results of a systematic recalculation of the material and manpower requirements. To this reevaluation has been added the unit costing including the updates to the channel counts representative of the current design parameters. The project has been input to our management software, intervals defined for the various elements, and resources assigned. The results of this cost and schedule effort has been transmitted to the SDC central cost and schedule team.

In addition, a management team has been assembled and responsibilities defined for the muon system. Since the two major institutions participating in the muon electronics are KEK and Michigan, the task leaders were selected from these institutions. The management proposal will be presented to the DoE Review in late October.

5.2 Data Acquisition R&D

Monthly reports from five institutions follow. Work focused on preparations of cost, schedule, and technical reports for the DOE review, on data collection from the front-ends, and on the SDC Portable DAQ system.

University of Illinois

Technical Staff:	T. Brandys, M. Haney, E. Hughes
Reported by:	J. Thaler

Todd Brandys continued his work on structural models of the DCC. He presented a poster at the NSS at the end of the month. We are considering putting together a low cost demonstration version of the DCC using programmable logic arrays and memory.

Eric Hughes continued his work on encapsulation. We are beginning to collaborate with Alex Booth of SSCL to plan SDC DAQ architecture simulations. When a plan has been formulated, Eric will resume this part of his work.

5.2.1 DAQ Project Management

Fermilab

Technical Staff:	E. Barsotti, J. Urish
Physicists:	I. Gaines
Reported by:	I Gaines

Work this month concentrated on preparations for the DOE review at the end of October, where we gave presentations on technical, management, cost and schedule aspects of the SDC Online Computing and DAQ Systems. Additional work was done on updating of cost and schedule data for Dave Etherton and on the FY93 DAQ budget and MOU's.

5.2.13 DAQ Online Computing Interface - Portable DAQ

SSCL, KEK, U. Michigan, LBL

Author of Report: M. Nomachi

Before the October collaboration meeting, C. Timmermans and Bob Ball (U.Mich) stayed at SSCL for installing RUNCONTROL and LOGBOOK programs. During the meeting, the silicon beam test at KEK was discussed.

The current status of portable DAQ was reported as follows:

template	SSCL	: Frame of DAQ routines
message tool	SSCL	: communication tool for DAQ processes
NOVA	KEK/T.I.T.	: Buffer manager
RUNCO	U. Mich	: run control
OPERATOR	U. Mich	: Graphical User interface
LOGBOOK	U. Mich	: Error logging & MURMUR interface
XPC	U. Mich	: Overall process monitor and coordinator
COLLECTOR	SSCL	: routine that readsout hardware
RECORDER	SSCL	: routine that logs the data
ANALYZER	SSCL	: routine that monitors the data
SunOS CAMAC driver	(TIT)	
ULTRIX CAMAC driver	(KEK)	
VxWorks CAMAC driver	(SSCL)	

Some documentation exists, but a unified user manual needs to be put together. We are now:

1 cleaning up the directory structure,
2 making a distribution kit,
3 sending to users for investigation,
4 writing more manuals. #1-#3 will be done by 10/31. #4 will take more time.

We installed the system at the MUON-lab at SSCL. It will be installed at LBL for silicon beam test and calorimeter beam test.

Lawrence Berkeley Lab

Technical Staff:	W. Greiman, D. Hall
Physicists:	G. Abrams, A. Ciocio, P. LeDu, S. Loken
Author of Report:	G. Abrams

We have started to develop some of the software needed by the Portable DAQ to support the Silicon beam test at KEK in December, 1992. The specific LBL activities focus on the readout of the digital sequencer and data monitoring.

University of Michigan

Technical Staff:	
Physicists:	R. Ball, B. Roe, C. Timmermans
Author of Report:	R. Ball

We have worked with the SSCL to integrate our software portions of the Portable Data Acquisition System (variously called 3po, sdc_pack and RoundUp) with those portions written at the SSCL and KEK. Divergences in the two courses were smoothed out and a working whole was put together for the SUN Sparc platform using the Solflower VME interface and the KEK CAMAC via VME driver. Subsequently g++ was installed on a Michigan DECstation with a turbo-channel to VME adaptor, and the combined software system was made to work on both this and the Michigan HP 9000/720 system (Bit3 VME interface). The software can now be tranferred via tar file to any of these three, unwound, compiled and linked without operator intervention.

5.3 Trigger R&D

Monthly reports for six institutions follow. Work proceeded on conceptual design of both the first and second level triggers. Work also proceeded on clock and control design and on crate and rack engineering.

University of Chicago

Technical Staff:	Northrop, H. Sanders
Physicists:	H. Frisch, G. Sullivan, M. Miller
Reported by	G. Sullivan

Continuing work on standard crate and rack for SDC trigger electronics. We have begun work on setting up a standard two-crate trigger rack based upon 9u x 400 mm VME. The rack, heat exchangers, and blowers are in hand or ordered. We are in the process of specifying and getting cost estimates for the crates, backplanes, and power supply components.

5.3.1 First Level Trigger: Conceptual Design

University of California, Irvine

Physicists:	A. Lankford, A. Lipniacka, R. Schwarz, B. Schmid, D. Stoker, E. Van Drunen
Author of Report:	D. Stoker and A. Lipniacka

Improvements are being made to the simulation of the level 1 trigger. The effect of track-shower matching on electron identification is being studied as a function of calorimeter trigger tower size. Studies of the dependence of level 1 trigger rat es on calorimeter signal time structure were initiated.

University of Chicago

Technical Staff: Harold Sanders
Physicists: Henry Frisch, Greg Sullivan, Marshall Miller
Author of Report: Greg Sullivan

Continuing work on Level 1 design issues of crate counts and connector/fiber density into level 1 crates.

5.3.1.1 First Level Straw Trigger

5.3.1.2 Calorimeter Level 1 Trigger - Electron Trigger Studies

University of Wisconsin

Technical Staff: T. Gorski, J. Lackey, W. Temple
Reported by: S. Dasu, W. Smith

Electron Trigger Studies:

We have completed a report about high statistics results from simulations of electron trigger in SDC. The results include studies of electron trigger performance at the luminosities of 10^{32}, 10^{33}, and 10^{34} cm^{-2}-s^{-1}. We have studied the effects of cuts on hadronic to electromagnetic energy deposit, transverse isolation, trigger tower size, track requirement and shower maximum detector hit matches for all these cases. The results also included bench-mark studies of efficiencies for identifying electrons from Top quark decays, and W and Z boson decays. These results show that the base line design of the SDC trigger, reduces the rates to adequate levels while maintaining good efficiency. Transverse isolation option is important to achieve the best energy thresholds and efficiencies.

We have started efforts on making a public distribution of the fast Monte Carlo program that we have been using to study trigger rates and efficiencies. We are setting up a code management system to develop the program along with collaborators from Irvine and Chicago.

Calorimeter Preamp:

We presented a paper at the IEEE NSS on the previous SDC R&D work on the Calormeter preamplifier:

D. Panescu, J. Lackey, P. Robl, W. H. Smith "A Fast Low Noise PMT Preamplifier".

5.3.1.5 Global Level 1 Trigger System

University of Michigan

Technical Staff: J. Srage, C. Murphy
Physicists: J. Chapman
Author of Report: J. Chapman

We have begun design of a data phasing chip that samples digital input synchronously every 16ns according to an externally provided 62.5Mhz clock. The sampling point relative to the 16ns cycle is programmable in 2ns steps. In addition, the sampled data is staged through programmable depth shift registers so that it emerges N

16ns intervals following its arrival at the chip. The maximum depth is 128+1 16ns intervals. A 10-bit digital input controls the 3-bit phase sampling and the 7-bit shift delay. With the unit, data arriving at the central trigger synchronous with the crossing clock can be brought into phase synchronization over a full 2 microseconds with a 2ns accuracy. An 8-channel version is planned. All channels have the same 10-bit input control.

University of Wisconsin

Technical Staff: T. Gorski, J. Lackey, D. Panescu
Reported by: S. Dasu & W. Smith

System Design

We have continued studies of the new system design of the Level 1 trigger.

We have also evaluating the feasibility of various hardware realizations of the design. As part of this we have designed, simulated, fabricated and are now testing a 4 x 12-bit CMOS adder, which is a common component of several boards in the present circuit design.

As part of the development of the interface between trigger and front end electronics and trigger and data acquisition, we are building the Trigger Emulation Module described below.

CMOS 4 x 12-bit Adder:

A common component found in several places in the present trigger system design is an Application Specific Integrated Circuit (ASIC) that adds 4 12-bit numbers and can operate in the clocked 16-ns trigger structure. As a result, we have fabricated a pipelined domino logic two-stage adder\cite{Cadd}. The device has been fabricated in 1.2um CMOS technology. We have built a tester for the ASIC that contains a VME interface, 4 blocks of memory for the operands, 1 block of memory for the result and a controller. The tests of this ASIC reveal that the best case throughput is 16.5 ns and the worst case is 18 ns. The power dissipation is 0.75 W and the yield of chips is ~80%.

We have presented a paper to the IEEE on this subject:

D. Panescu, T. Gorski, Y. H. Hu, J. Lackey, P. Robl, W. H. Smith

"A Pipelined 4 by 12-bit Domino Logic VLSI Adder".

5.3.1.6 Level 1 Clock & Control

University of Wisconsin

Technical Staff: T. Gorski, J. Lackey, D. Grimm, A. Penpek
Physicists: S/ Dasu, W. Smith, M. Thompson
Reported by: S. Dasu & W. Smith

System Design:

We are continuing to study the revised global clock and control system in light of our experience in designing the Trigger Emulation Module (see below) and our interactions with other subsystems as part of this process.

Trigger Emulation Module:

We assembled and have begun to evaluate the first Trigger Emulator Module prototype. Initial results look very positive, with approximately 50% of the evaluation complete, including a top-level functional test of almost all card features, and no major design problems encountered. During this month we also designed and ordered the

TEM Power Adapter PCB, a companion card to the TEM, which brings ECL power in on user-defined pins on the J2 connector. Power Adapter cards will be shipped with each TEM, to provide safe and robust ECL power distribution to that card.

We have set up a VME crate, with Motorola processor (MVME147), running OS9 operating system, to debug the Trigger Emulator Module (TEM). We have preliminary versions of debugging programs working. We are in the process of developing detailed suits of test programs. In addition, we are also working on a simple but generic VME diagnostics language to write quick tests involving memory pokes and dumps, including some looping and macros.

5.3.2 Second Level Trigger

University of California, Irvine

Physicists:	E. Altshuler, G. Griffin, A. Lankford, A. Lipniacka, D. Stoker, J. Tarazi
Author of Report:	A. Lankford

Simulation studies of electron identification at Level 2 continued. Studies of the accuracy of phi matching between shower max and tracking systems as a function of shower max algorithms were completed. Rejection of charged and neutral pion overlaps in min imum bias events continued to be investigated for these shower max algorithms. Studie s of algorithms to reject conversion electrons continued. Studies of electromagnetic showers in the shower max detector using EGS4 were initiated.

University of Chicago

Technical Staff:	Harold Sanders
Physicists:	Henry Frisch, Greg Sullivan, Marshall Miller
Author of Report:	Greg Sullivan

Continuing work on Level 2 design and on an SDC note (in collaboration with Patrick LeDu from Saclay) giving the conceptual design of the level 2 trigger system.

Saclay

Technical staff:	J.C. Brisson, F. Bugeon, O. Gachelin, B. Thooris
Physicists:	J. Bystricky, J.F. Glicenstein, R. Hubbard, P.Le Du
Author of Report:	P. LeDu

Work is progressing along four parallel paths:

1) Physics simulations are in progress: implementation of SDCSIM and TRIGSIM achieved. First results of Monte Carlo on top $\rightarrow b \rightarrow e$ and tau physics are expected soon.

2) Simulations of algorithms for finding electron, gamma and hadron clusters are continuing using a SIMD parallel processor (ASP) simulator. These algorithms

are being tested on a real machine. This machine with 1024 processors is now available. Optimization of jet, SMD centroid algorithms is underway.

3) Investigation to understand and define the technique to extract the information for the level 2 in an optimized way.

Since the choice of a digital calorimeter readout has been made recently, an example of such an extraction scheme is now being investigated both for the calorimeter and the showermax.

J.C. Brisson spent a week in the US to present the global level 2 trigger update at the Chicago trigger meeting. He has also discussed with the DAQ head engineer (Ed. Barsotti) the connection between common functionalities of the L2 and the DAQ systems (common L2-DAQ buffer ?, nature of the data collection link, synchronization...).

In addition a detailed study of the data throughput at each level of the readout chain , from each front-end crate to the DAQ data collector (eventsize) has been done to investigate the nature and requirement of data link speeds.

4) A document (SDC note) which summarizes all the specifications and requirements of the level 2 trigger from the Physics to the Interfaces is in preparation in collaboration with the Chicago Trigger group. Material for another note concerning the "Level 2 trigger Tools and Techniques" is also being assembled.

For path #2 above, a detailed study of algorithms used in the SDC level 2 trigger is under way:

- programming of procedures and logic for the massively parallel processor ASP

- optimization and evaluation of the time needed for each task. A SUN station (SPARC STATION-2) under UNIX is used for this work.

The selection of events is based on two algorithms running simultaneously on two ASP machines: the first analyses the tracking data, the second the calorimeter data. The two results are compared to make a trigger decision.

For the calorimeter, the full detector is mapped onto an array of 64x64 eta-phi cells, each cell being assigned two associative processing elements (APE). The complete information of one physical tower is concatenated into the data registers of two adjacent APE's. Algorithms have been written for electron, gamma, hadron, and jet selection. The simulations for the calorimeter are described in Rapport de Stage, DESS de Mathematiques Appliquees et Outils Informatiques, Universite de Nancy (ISIAL): Etudes d'algorithmes de trigger et programmation sur calculateur parallele ASP.

5.3.2.1 Second Level Trigger - Tracking Systems: Silicon Tracker

Bristol University

Physicists: H.F. Fawcett, B. Foster, G.P. Heath, S. George
Reported by: B. Foster

The month has been largely taken up with preparing for and attending the DoE review. We have continued to work on the design for the Si SLT and have had discussions

with our Italian colleagues on new design ideas. Work on Monte Carlo simulation of the algorithms has now begun again.

5.3.3 Trigger Project Management

University of Wisconsin

Technical Staff Involved:	R. Craven, T. Gorski, J. Lackey
Reported by:	W. Smith

Trigger Cost & Schedule:

The resource-loaded trigger schedule has been revised in collaboration with SDC project management at the SSCL. The overall schedule has been reviewed. The cost estimate has been rechecked for internal consistency and compared with other SDC electronics cost estimates. Documentation was prepared for the DoE review.

5.4 Ancillary Systems Control

Lawrence Livermore National Laboratory

Technical Staff	Thomas L. Moore, Eugene Oberst
Author of Report	Thomas L. Moore

6.0 COMPUTING SUMMARY

WBS No WBS numbers for offline computing activities as of yet

Reports are included from 8 institutions (UC Davis, Maryland, SCRI, LBL, SSCL, FNAL, KEK for Japanese institutions, and IBM)

U.C Davis

Technical Staff: None

Physicists: Forest Rouse, Keith Wear (Graduate Student Computer Science)
Author: Forest Rouse

We are currently working on the iconAnalysis system as a possible SDC prototype system. Currently the program works but we are trying to increase functionality. The immediate goals are to produce a hyper-text style data browser and help system and to have a C-interpreter to define types and to allow variable cuts as a "tool" from within the program.

We have two major activities currently. One is to evaluate two interface builders. We have brought in Interviews (available from anonymous ftp from stanford) and we will soon purchase VUIT. Interviews produces C++ code and is itself written in C++. We have imported the gnu c++ complier and have been trying to build the interviews package. We have not yet completed the task but we are making steady progress. VUIT is a commercial product that produces C code. Interviews is for plain vanilla X-windows and VUIT is for MOTIF.

The second goal is to get iconAnalysis to a generally usable mode. We are now fixing the code to write the visual program to disk and retrieve it. As soon as this is complete, I will send Soren Fredrickson an updated copy of the program. After this task is complete, we will bring the draw editing functions up to snuff and start moving on the C interpreter (again).

U. of Maryland

Technical Staff	None
Physicists	A.Barden, S.Kunori
Author	S.Kunori

S.Kunori worked as a chair person of the Simulation task force. The task force had a video conference on Octber 21st and heard a report from the Core Software Task Force (S.Frederiksen) and dicussed on data structure in the future SDC offline software. Next task force video conference will be on November 19th.

Next release of SDCSIM (Version 6) is in preparation. It will be released in the middle of November.

S.Kunori had an informal meeting with people working on the C++ project at SSCL. The project is studying feasibility of writting pysics application code in C++ and structuring the offline code in object oriented way. The project is still at learning stage but planning to do quick prototyping by the end of this year, although this schedule seems very tight now.

SCRI

Author: Martyn Corden

I have been debugging the tracker simulation at high luminosity, and generating high-luminosity events on the SCRI IBMRT cluster for distribution to SSCL and elsewhere.

I have also been trying to collect and document all the assumptions and approximations that go into the tracking simulation. At the collaboration meeting, we collectively agreed on an updated list of channels and luminosities to simulate for making tracking system comparisons prior to the outer tracking decision forseen for the new year.

Saul has been doing his usual thing, extending TYPES, developing a parallel version of GVerify, and setting up the data dictionary to be able to use zhist, zdisplay etc with all the present SDCSIM banks. (with a bit of help from Dong Xiao).

Steve Wasserbaech is just starting to try to port SDCSIM to the Alpha.

(Aside: The Alpha seems to have good error detection. We found that porting ALEPH to the ALPHA revealed a considerable number of BOS-related bugs which went undetected on VMS. So I anticipate this will be a good test of whether Shuichi's shell stuff has helped us to avoid similar problems with Zebra in SDCSIM).

Lawrence Berkeley Laboratory

Technical Staff: Christopher T. Day
Physicists: [None]
Report Author: Christopher T. Day

Organized and conducted final interviews for staff position at LBL to increase effort on Database Computing Project. Candidate selected and offer underway.

Hosted PASS Collaboration Meeting at LBL. The meeting discussed progress to date and made plans for the next fiscal year. We had a presentation from Arie Shoshani, of LBL, regarding his group's HPCCI project on large scale data storage. Tony Johnson, at SLAC at the moment, attended the first day of the meeting and expressed interest in joining the collaboration. I also had discussions with the ANL, UIC and SSC groups regarding the internal design and operation of ObjectStore. We all went off to redesign some of the database loading and querying programs for greater efficiency.

In my ObjectStore database loading program, I replaced the Sun data conversion routines, which make about 10 function calls per word, with some crude inline byte swapping routines. (These are used to read a Ybos tape directly. Ybos tape format uses VAX binary representations.) This change cut the CPU time of the load program in half and reduced the clock time from 3:45:00 to 2:22:00, approx. (SPARC 1). I believe that the clock time did not reduce as much as CPU time because relatively more time is now being spent in the server process, which does not count as loader CPU time. Running the processes on separate computers will likely improve things. Meanwhile, there are additional conversion inefficiencies which can be removed.

Three days of vacation were actually spent at the Windows NT Driver Developer's Conference to monitor technology development. Microsoft perhaps has enough clout to redirect the movement toward a unified Unix environment. Given the lengthy time scale of SDC it is prudent to keep and eye on NT. The core of NT, the Executive and Kernel, were

designed and written by Dave Cutler's team, arguably the best in the business. They can take credit for RSX-11m, VAX/VMS and VAXeln. This part looks

very clean, robust and expandable. However, it is not directly accessible to application developers. Programs are meant to use the Win32 API, an extension of the Windows 3.1 API. This API seems a bit clumsy to me so far, but that may be unfamiliarity. However, it does provide for independently scheduled threads.

Programs can also be written to an OS/2 character mode interface, no interest to HEP, or a POSIX 1003.1 character mode interface. The latter has only become available this month. It explicitly does not include any Unix-like command interface (POSIX 1003.2), threads or X, but these will likely show up as third-party products soon.

SSCL

Author: Soren Frederiksen

During the month of October I worked on the following:

- Worked on the "cleanup" of SDCSIM. The same SDCSIM.CRA and SDCLIB.CRA can be used on both UNIX platforms, and VAXes. I checked through the compilation of SDCSIM.F, and discovered that about 1/2 do not need to be recompiled (the library version can be used), and modified the build the procedure so these routines will not be rebuilt, reducing the size of SDCSIM.F. We (Alain, David and I) are now waiting for input from the various package managers so we can get the next release ready.

- Attended the SDC meeting at the SSCL, where I participated in the Computing Group meetings. During that meeting we discussed comments that we received from reviewers regarding the "SDC Offline Software Concepts" document. Following the collaboration meeting Irwin Gaines, Larry Price and I discussed modifications that needed to be made to the document, and divided up the document among the three of us for future work. During the meeting we also had Core Software Task Force meeting, and arranged to have a number of people start rapid prototyping of the Process Control, Communication, and Graphical User Interface. This work will be overseen by Alan Fry and I, and the final integration will be performed by Alain Gauthier, David Schmid and I.

- I also spent some time getting the PDSF Hideout set up. I set up the two workstations (strange and gluon) such that their NIS are connected to PDSF, which means that only people with accounts on PDSF can log onto the two machines. These machines are now available for use by SDC visitors. I have also been attempting to get an HP printer to work in that same area, but at present I have run into a major snag (it has the wrong network connection, and no postscript driver), so the simplest solution might be to buy a new printer.

- I have been having discussions with Irwin Sheer about a common .login and .cshrc for GEM and SDC on PDSF. We have reached a tentative agreement and are now starting to talk to John Dassonvile to use these new files for all new SDC accounts. Once we have the final files, I will also be recommending to all SDC people that they should use these to replace teir old .login and .cshrc. The next phase will probably be a common .Xdefaults and then a window manager set up, if we can agree on a "standard" window manager for SDC on PDSF.

SSCL

Author of report: Dave Schmid

SDCSIM & CORE software

1) Cleaned up the SDCSIM documentation in preparation for Release 6. Updated and added some sections to the main documentation file sdcsim.doc. Instigated some new policies for how documentation files will be handled for future releases.

2) Updated the 'shelldoc' utility to also display bank descriptions.

3) Created a new utility script 'sdcentry' that finds where routine names are declared in the source code (inspired by 'd0entry' for d0 software libraries). Wrote a C++ program to create the databases that sdcentry looks at.

4) Found a bug in the SF package that pointed out differences between various platforms about how arithmetic exceptions are handled. Bernard and I are looking into a general solution to the problem.

5) Started to work on updating the SDCSIM example programs and supporting files, which no longer worked.

6) Started to work with the SDC calorimetry group here at the SSCL (Marc Turcotte and Jim Siegrist in particular) with a long term goal of contributing to their electron-id analyses. For the short term, I have been working with a photon-transport program called LTRANS that will be used to simulate the response of the fiber-inside-scintillator plates used in the SDC calorimeter. I made changes in the original VAX-based code so that it ran under Unix, and also converted it to use HBOOK4 instead of HBOOK3, which allowed the use of PAW to easily examine the program output. It is a rather unfriendly program, so next I plan to add some crude graphics so that it is easier to visualize what it is doing.

7) Started to examine SDC calorimetry software from Marc Turcotte, with the goal of helping to convert it to be a new SDCSIM package.

Supercomputer Computations Research Institute, Florida State University

Technical Staff:	Phillip Rulon
Physicists:	Martyn Corden, Steve Wasserbach, Dong Xiao, Saul Youssef
Author of Report	Saul Youssef

During this month, we have made substantial improvements to VFand especially to the zHist package. After constructing a VF libraryfor SDC, we are now able to generate histograms and displays of all the SDC zebra defined data structures. A substantial effort has gone into making zHist easy to use. Thus, a few simple commands suffice to interactively investigate a data sample working directly from the raw zebra data. We have written and tested parallel code to also extract n-tuples from zebra files also. To extract n-tuples we have had to solve the non-trivial problem of extracting a set of n-tuple records from a zebra tree.

dParallel has also made substantial progress in this month. We have a working version of dParallel on AIX which allows parallel programs to be written with a single

subroutine call as interface. A single version of the source code is used both for serial and parallel versions and a single executable image can run either as the serial program, as a parallel program or as a remote task. We have adopted the 20,000 line GVerify application to dParallel which involved changing only three small subroutines. We are now in the process of porting dParallel to other unix machines.

(1)KEK,
(2)Tohoku Univ.,
(3)Tokyo Metropolitan Univ.,
(4)Fukui Univ.,
(5)Naruto Univ. of Education,
(6)Hiroshima Univ. of Technology,
(7)Wakayama Medical College,
(8)International Christian Univ.,
(9)Kyoto Univ.

Staff: F. Abe(1), Y. Watase(1), Y. Morita(1), H. Fujii(1), M. Nomachi(1), Y. Yasu(1), A. Manabe(1), H. Sakamoto(1), J. Kanzaki(1), T. Tsuboyama(1), S. Kabe(1), Y. Takaiwa(1), K. Amako(1), K. Abe(2), K. Hasegawa(2), T. Hirose(3), R. Hamatsu(3), S. Kitamura(3), M. Chiba(3), M. Kawaguti(4), H. Yoshida(5), M. Asai(6), M. Daigo(7), T. Yamagata(8), R. Kikuchi(9)

Author: K. Amako (KEK)

On October 9th, we had a regular Japan SDC computing meeting at KEK. The following is a short summary of the meeting.

1) Y. Takaiwa reported the present status of the activities related to the SDC Data Modeling Task Force. He also gave a status report on the activities of the SDC Simulation Task Force.

2) R. Kikuchi reported his test of "erdraw" on his Sun workstation. On his workstation, he installed 'erdraw' which is a database schema design tool developed at LBL, and 'qtsys' which is a Query Translation Tools system. The 'erdraw' utility works well without any trouble, but he got an error on 'qtsys' because it needs a metadatabase and a database which he doesn't have on his machine. He is going to make further tests and give a report at the next meeting.

3) K. Amako reported the SDC computing project management plan proposed by I. Gaines. The deputy in Japan proposed in the plan was the major issue of discussions. The conclusions of the discussions were (a) K. Amako will be the deputy, (b)Y. Takaiwa helps K. Amako, (c) the function of the deputy has to be clarified in more detail.

4) K. Amako briefly explained a new project started at KEK. The project is to try to investigate possibility of applying OOP to a HEP application program. Although the activity is not directly connected to SDC, it may give some contributions to the SDC computing in future.

IBM Federal Systems Company - Houston, Texas

Technical Staff: Glenn Kubena, Larry Roberts, Ken Liao, Bob Ennis
Author Larry Roberts

Status

Accomplishments: Arranged for the installation of AIX Workbench and supporting software at the SSCL for evaluation purposes.

Plans: Participate in incorporating review committee comments into SDC Offline Software Concepts document, as directed.

Fermilab SDC Simulation group

Technical staff (none)
Physicists; A. Beretvas, J. Butler, D. Green, J. Marraffino, and W. Wu
Author: Andy Beretvas

The paper: "Study of the process $H(800) \rightarrow Z_1 Z_2 Z_1 \rightarrow q\bar{q}$, $Z_2 \rightarrow \tau_1 \tau_2 \rightarrow \rho \nu$ for the SDC Calorimeter", W. WU, A. Beretvas, D. Green, and J. Marraffino is now almost finished.

John Marraffino has generated high energy electromagnetic showers using EGS4 on a silicon graphics computer so that we can study the issues of radiation damage.

Weimin Wu has continued to study $H \rightarrow \gamma\gamma$.

Weimin has also written a first draft of a paper on the complete work done by the SDC simulation group.

This paper will be presented at a meeting in Tallahassee on Monte Carlo programs.

III. SDC SUPPORT AND MANAGEMENT SUMMARY

7.0 CONVENTIONAL SYSTEMS SUMMARY

7.1 Mechanical Systems

Superconducting Super Collider Laboratory

Technical Staff: Henry Santos, Marvin Hecht
Author of Report: Marvin Hecht

Preliminary design requirements have been drafted and reference materials have been compiled for the low conductivity system. A sketch of the equipment layout has been prepared and is ready for preliminary drafting. A water analysis of the makeup water sources for both the cooling pond and domestic water has been requested from infrastructure. This analysis is required for final sizing of the water treatment system.

The hall and detector ventilation systems are under revision due to radiation requirements. Title I documents for the hall (shell only) have been reviewed.

Meetings were held with a vendor for a "leakless cooling system" for electronic racks. The use of this cooling system is now under study by Ken Hess.

7.2 Electrical Utilities

Superconducting Super Conducting Laboratory

Technical Staff: Warren Kampmeier, Kathy Stringfellow, Larry Schneider
Author of Report : Warren Kampmeier / Larry Schneider

A grounding system conceptual design report was completed and distributed to Collaboration members. Comments are due back Nov. 6, 1992. This paper will form a basis for a Preliminary Design Requirements Review (PDRR) due January 1993. We completed a review of PB/MK's Phase 1 Hall design (10% review) which addresses the foundation of the technical grounding system.

The requirements for a 415Hz power system are being questioned due to the high initial cost of the system. A memo addressing this issue has been delivered to SDC collaboration members involved in electronic subsystem designs. Ken Hess has requested a response by November 9, 1992.

Work continues in refining locations and sizes of loads in the SDC Hall. A PDRR is scheduled for early Jan. 1993. Estimates of time-phased power demand were re-examined to determine mandatory temporary power requirements through the third quarter of 1996. EFD is maintaining an open line of communications with the CCD Electrical group on this sensitive subject.

Requirements for technical communications in the SDC Experimental Hall are being gathered in preparation for a March 1993 PDRR. A meeting was held with a potential communications equipment supplier who has offered to deliver a fairly complete set of drawings and specifications on a proposed system the week of Nov. 2.

A Cable Tray Standards Document has been completed for the SDC Experimental Hall and will be distributed for review the week of Nov. 9.

7.3 Personnel Access Safety System

Superconducting Super Conducting Laboratory

Technical Staff: Larry Schneider
Author of Report : Larry Schneider

No activity during this reporting period.

7.4 Structural Support and Detector Access Systems

Superconducting Super Conducting Laboratory

Technical Staff: Jim Krebs, Gary Tulk, Randy Gates
Author of Report: Jim Krebs

Prepared cost, schedule and technical design presentation materials for the Doe review which was held at SSCL October 26 thru 30.

7.5 Accelerator Related Systems

Superconducting Super Conducting Laboratory

Technical Staff: Gerry Chapman
Author of Report : Gerry Chapman

No activity during this reporting period.

8.0 INSTALLATION AND TEST SUMMARY

8.1 Test Beam R&D

Reported by Jim Siegrist

For WBS 8, test beam, there is no activity to report for October.

8.1.1 Fixturing

8.1.2 DAQ

8.1.3 Labor

8.2 Installation and Assembly

9.0 PROJECT MANAGEMENT SUMMARY

9.1 Project Planning

Prepared by Dave Etherton

9.2 Project Tracking

SSCL

Reported by

Mechanical

Electrical

Tracking

9.3 Document Control

SSCL

Reported by Norm Wells

Specification/Document Status

Work Breakdown Structure Dictionary--Completed WBS Dictionary in time for distribution at the DOE Review.

Project Management Plan--Helped rewrite the SDC Project Management Plan (PMP). Participated in the management review of the document in preparation for the DOE review.

Detector Specification

No action this month.

Interface Book--A draft of the Interface Control Document (ICD) with the collider was revised and distributed at the Collider-Detector Interface Working Group for comments.

Interface Status

The Interface Control Document (ICD) with the collider is being revised as a result of the last interface meeting which provided new information. The collimator will be approximately three meters in diameter and extend from 18 to 20 meters from the interaction point (IP). A letter was sent to PMO indicating that SDC wanted the low beta quad magnets at 20 meters from the IP.

Studies and Analyses

Detector Alignment and Adjustment Study-- Lead alignment session at the SDC Integration meeting 1-2 Oct. The tracker community seems to be very much against the idea of making the tracker suspension system adjustable, because of the stress such a system might have on the tracker space frame. With both the muon and calorimeter jacks

easily moveable in the vertical direction, lateral movement might be all that is needed of the tracker. However, the amount of motion required of the calorimeter and tracker must be determined. The tracker has much tighter requirements than the calorimeter. Scheduled Alignment meeting where all subsystem representatives will present their requirements. Will try to determine a strawman position on how precisely the calorimeter will move and how much the tracker must move to meet its requirements.

Technical Design Reviews

The Preliminary Design Review of the Muon Barrel Toroid (Magnet System) was held on October 14-16. No major problems were noted. The nine outside reviewers are completing their report.

Reviewed the program schedules and identified the subsystems for which design reviews have not been scheduled.

Test Program Status

No action yet.

Configuration Management

Reviewing and commenting upon the PRD Configuration Control Policy.

Found that most SDC personnel were not receiving changes to the SDC Experimental Facilities User Requirements specification. Working with EFD and SSCL Document Control Center personnel to get the distribution list to include SDC personnel.

Management Information Systems

A new Request for Proposals is about to be released for a SSCL Document Management System. This RFP allows bidders three months in which to modify existing systems. The scheduled shows this system operational next summer. However, it does not include all of the capabilities currently existing in the SDC Document Tracking and Storage System (DTASS). It will be about two years before DTASS can be replaced.

Received a commitment from the head of Information Services to upgrade DTASS to a faster and more-capable computer with more storage since we will need to use it for about two more years.

The SSCL Document Control Center is now using DTASS to manage the Lab documents.

Quality Assurance

No action.

Other

Made a presentation on Management Systems at the DOE Review which took place 26-30 Oct. The presentation included plans and procedures for systems engineering, configuration management, document management, technical design reviews and quality assurance. No problem areas were uncovered.

Wrote up the review of the SSCL Mechanical Workmanship Standards Manual. Our engineers found that the manual addressed part of the standards covered by national

standards but was not complete enough to be a stand-alone document that we could have our collaborators use. Determined that forcing the collaboration to use the SSCL manual in place of the national standards that they already use would be confusing and counterproductive.

Prepared listing of the names and addresses in the SDC Name and Address database. The database system has been tested; the data needs to be checked for accuracy before being put on line.

Systems Engineering prepared three abstracts of papers on the SDC detector for presentation at the International Industrial Symposium on the Super Collider (IISSC) in May 1993.

9.4 Quality Assurance

9.5 ES&H

9.6 Detector Integration

SSC Laboratory

Technical Staff: Jon Piles, Ken Hess, Mike Hechler, Tom Winch, Kurt Pennington, Lori Okay, Tim Stephens, Lewis Lemoine, Daniel Scott
Author: Jon Piles

Throughout the month of September the integration group worked on numerous items. A brief description of the major items follows with more details available in the next level. The first week of the month was spent organizing and holding a integration/engineering meeting at SSCL. Meeting notes were released under separate cover. Numerous meetings were held with the subsystems ironing out any differences in understanding for the installation costs and responsibilities of installation. The last part of the month was spent preparing and participating in the DOE project review of SDC.

9.6.1 Mechanical Integration

SSC Laboratory

Technical Staff: Jon Piles, Ken Hess, Mike Hechler, Tom Winch, Kurt Pennington, Lori Okay, Tim Stephens, Lewis Lemoine, Daniel Scott
Author: Jon Piles

Mechanical Integrations' main foci during the month was the interaction with Russian collaborators on the forward muon system. Other items were tracker cable routing, tracker subsystem mounts, preparation for the DOE review at the SSCL and Title 1 review for the underground hall shell package.

a. tracker cable routing- The cable and utility routing drawings and spreadsheets were updated to reflect changes from the Silicon Group.

b. tracker subsystem mounts-During the October integration meeting mounts for the tracker systems were presented and reviewed by the group. More information is required from the calorimeter group on exact mount location before final definition can be determined.

c. DOE review preparation and participation-Presentations were made in two different parallel sessions covering 9.6 detector integration during the review.

d. Title 1 review- Title 1 for the underground hall shell package was received and reviewed with comments issued back to the EFD group.

9.6.2 Electrical Integration

SSC Laboratory

Technical Staff: Jon Piles, Ken Hess, Mike Hechler, Tom Winch, Kurt Pennington, Lori Okay, Tim Stephens, Lewis Lemoine, Daniel Scott
Author: Jon Piles

The electrical integration groups' work beyond what has already been discussed above was as follows: revision of Detector Ops' building, low voltage cable lengths, DC power bus lengths and the review and comments for PB/MK underground title 1 package.

a. Detector Ops' building- All floor plans and layouts were modified for the operations building to reflect latest shaft layout and radiation requirements.

b. Low Voltage Cable Lengths-Layouts were generated illustrating the lengths of various low voltage cables

c. DC power bus length-Layouts were generated illustrating the length of the DC power bus.

d. Review and Comments- Title 1 for the underground hall shell package was received and reviewed with comments issued back to the EFD group.

9.6.3 Installation and Assembly

SSC Laboratory

Technical Staff: Jon Piles, Ken Hess, Mike Hechler, Tom Winch, Kurt Pennington, Lori Okay, Tim Stephens, Lewis Lemoine, Daniel Scott
Author: Jon Piles

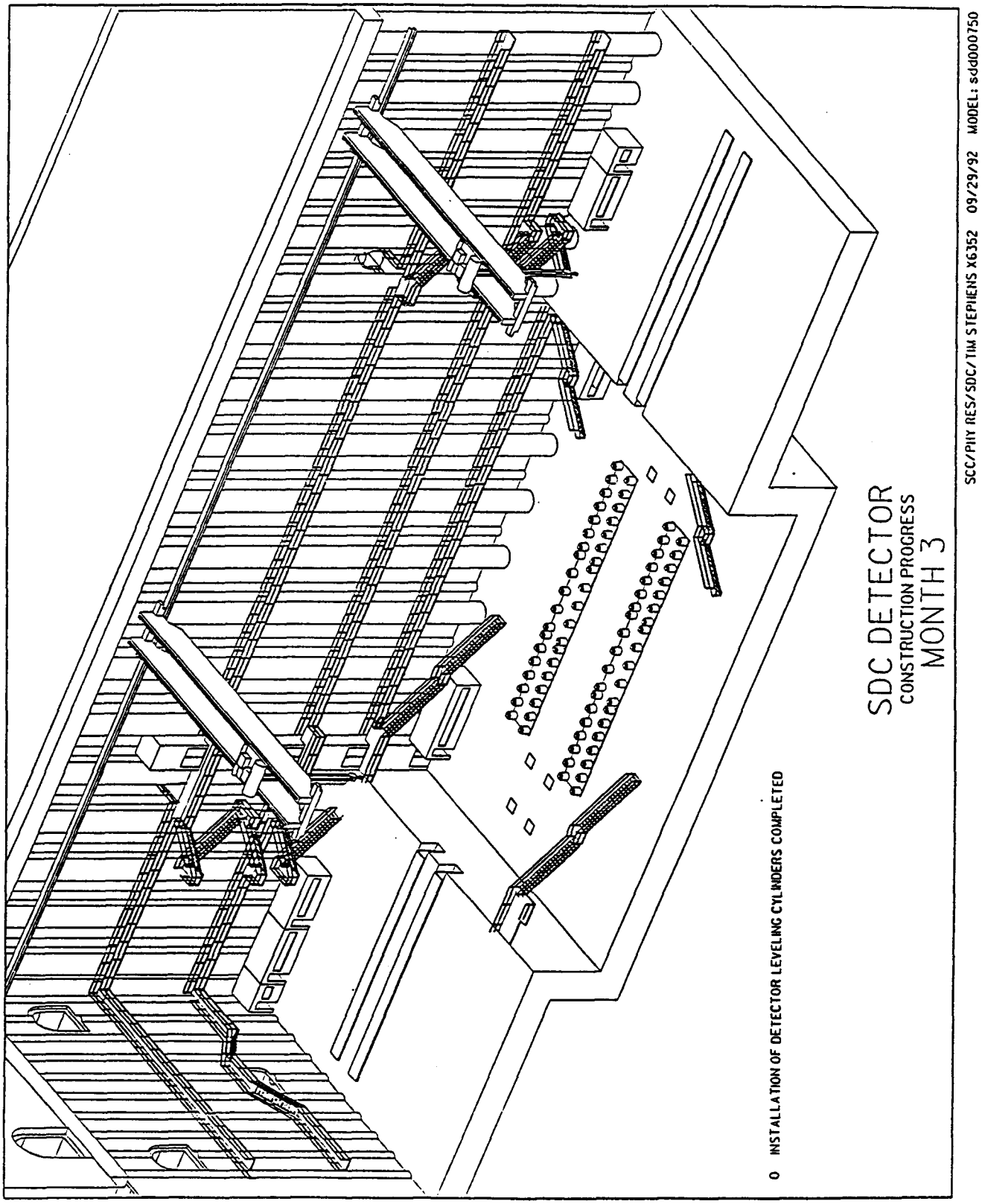
Numerous meetings with subsystem leaders were held to verify understanding of the installation cost and responsibility of the operations. A trip was made to Harvard to meet with the muon measurement group to discuss these items and then meeting were held at SSCL with the calorimeter, tracker and solenoid groups. The basic message was that the money in 8.2 is to cover labor costs in the underground hall only. Specific costs of items required solely for the subsystem installation was to be covered in their WBS.

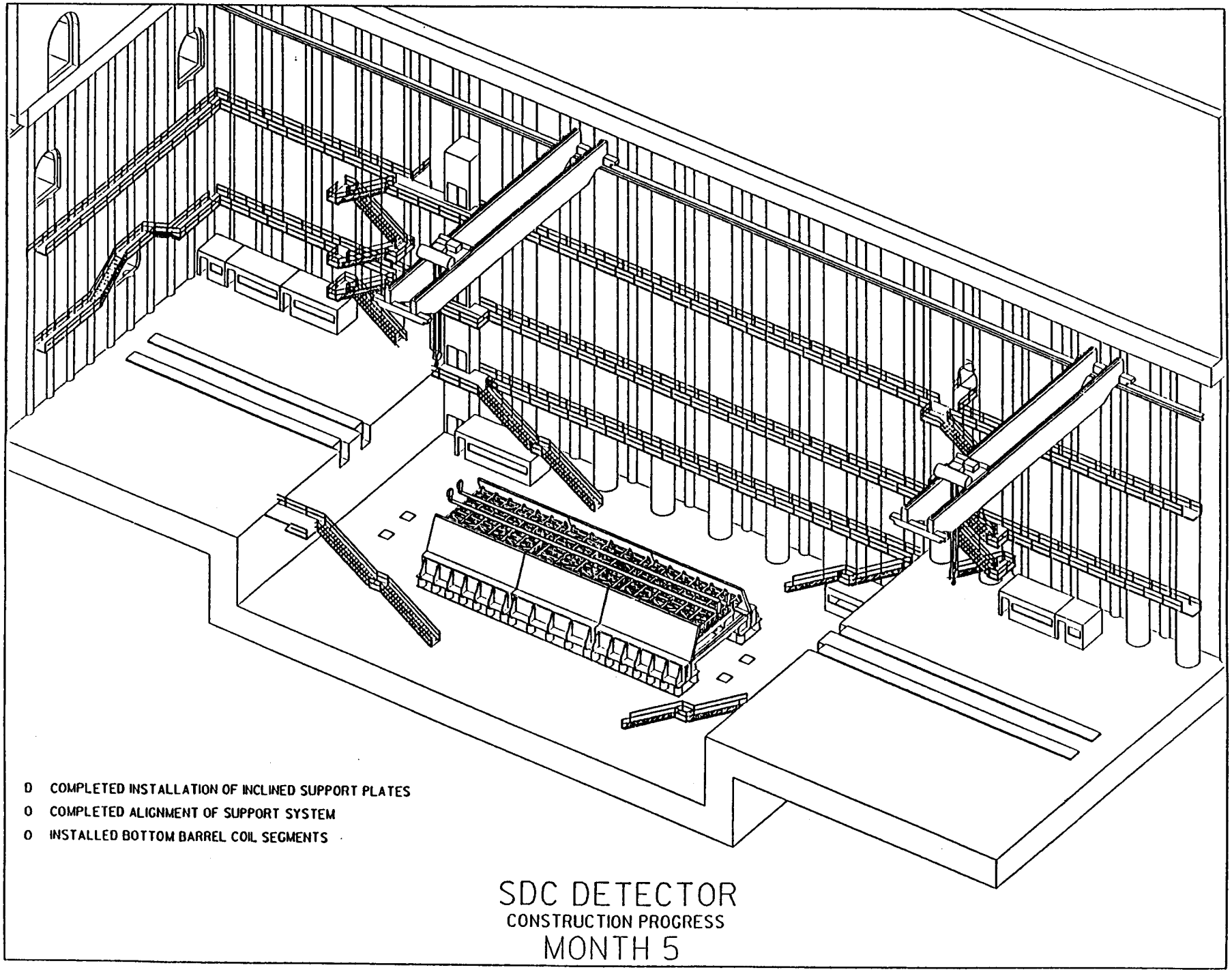
Participation in the Muon Barrel Toroid Review. Presented the assembly and transportation scenarios for the blocks from Russia to IR8.

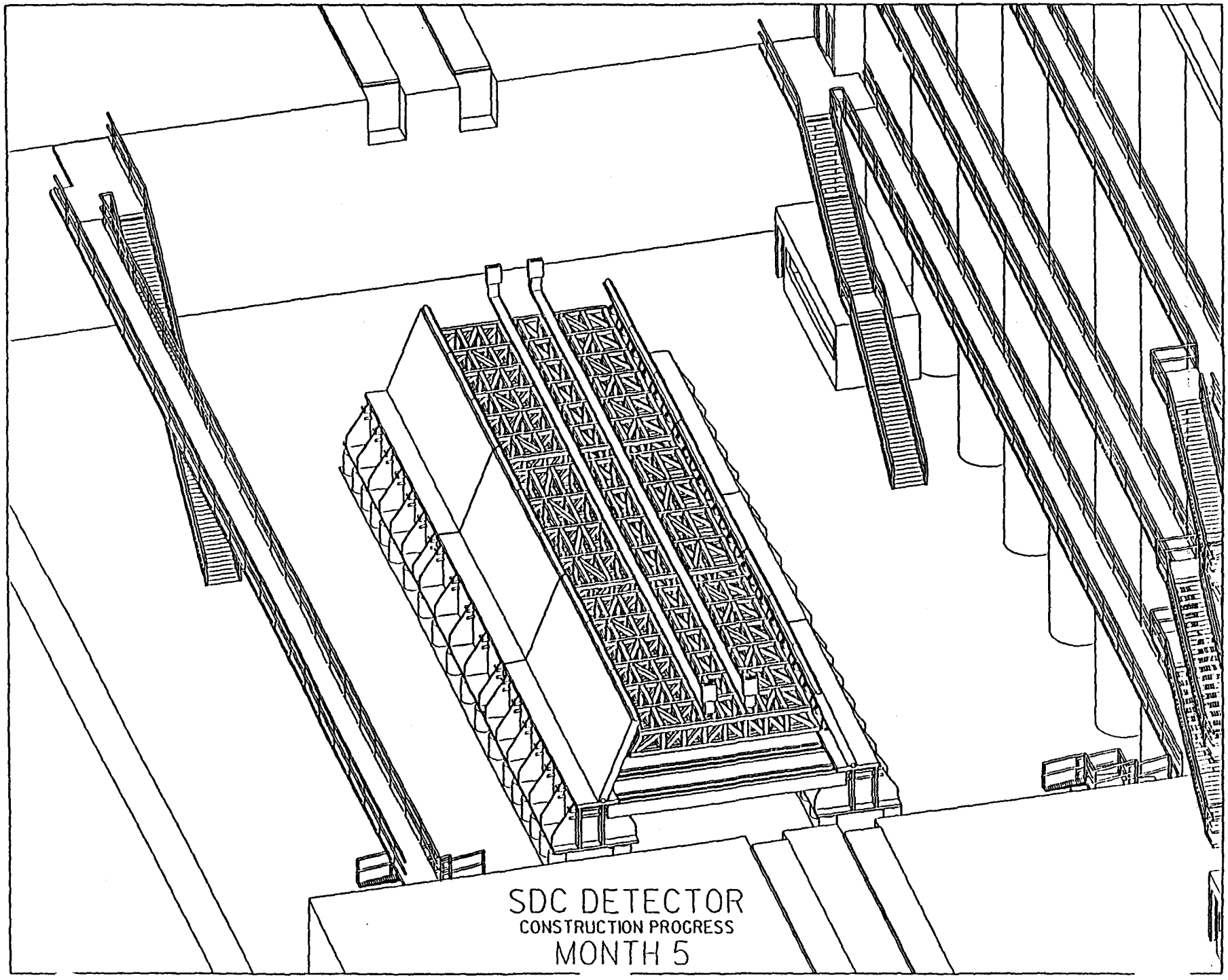
Gave two presentations at the DOE review at the end of the month. One was during the main session and the other was during the parallel sessions.

All of the designers time was spent in generating the month by month installation pictures for the SDC detector. The months that are completed so far are on the following

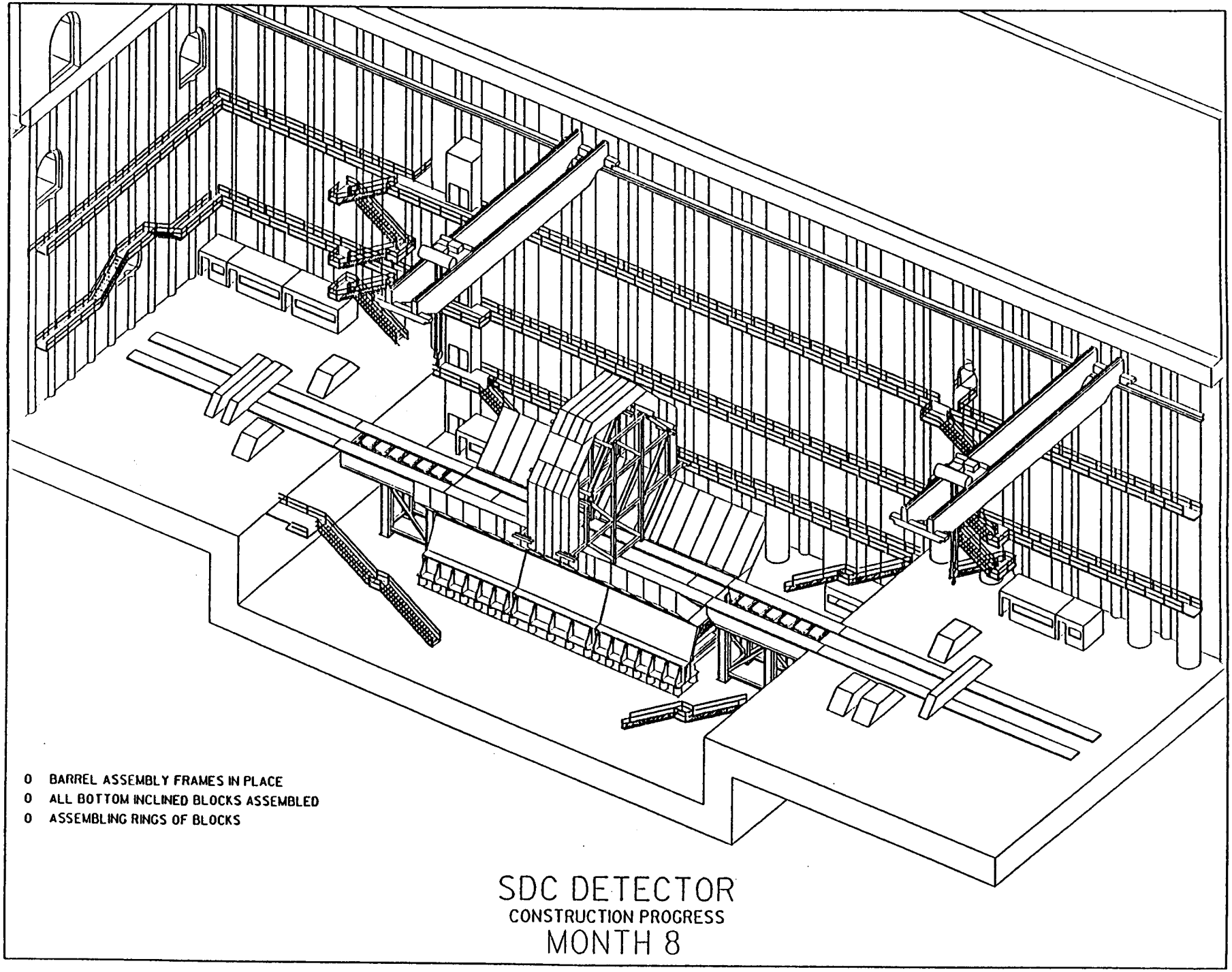
pages. These drawings reflect the current schedule presented to the scheduling group for the DOE review.

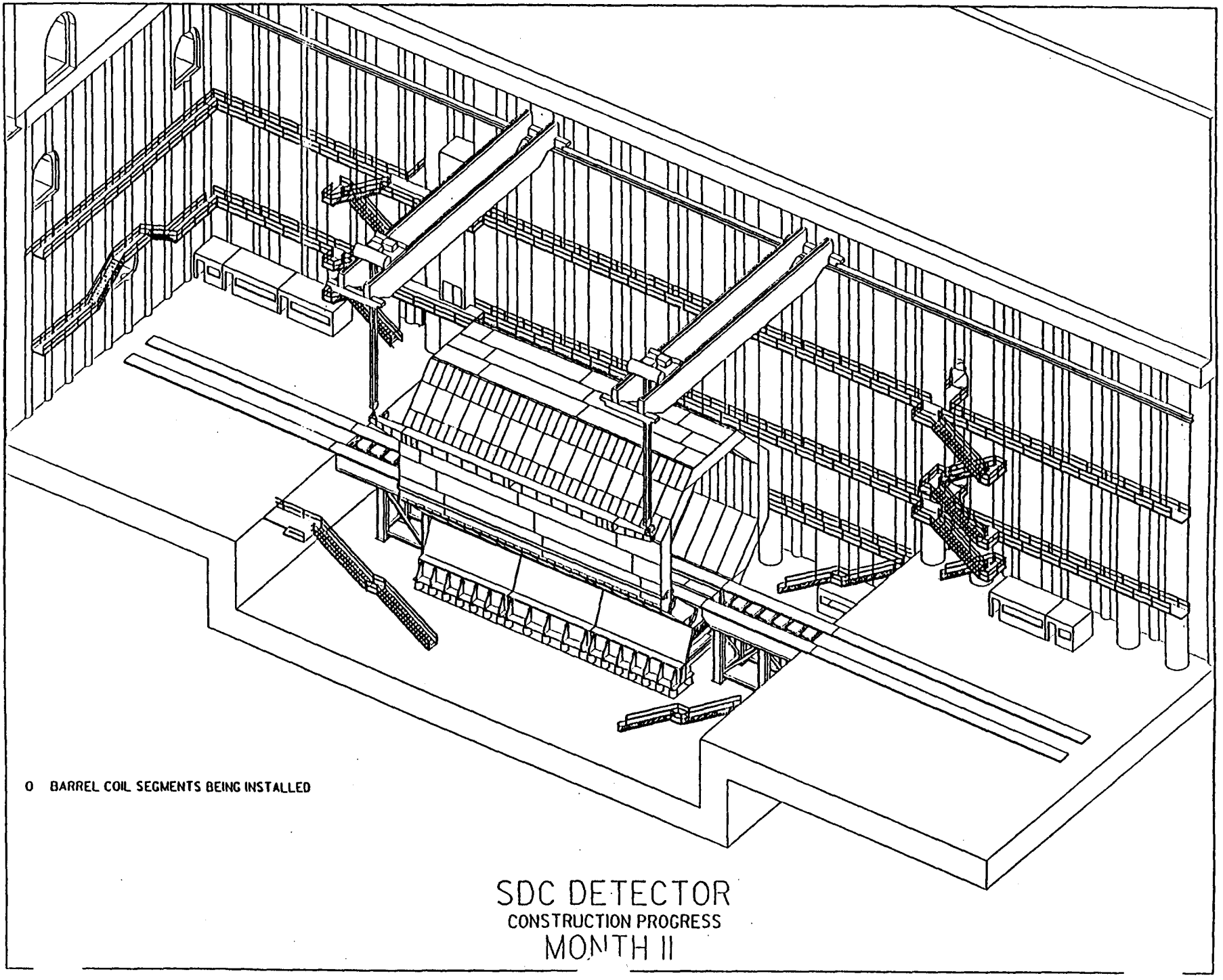


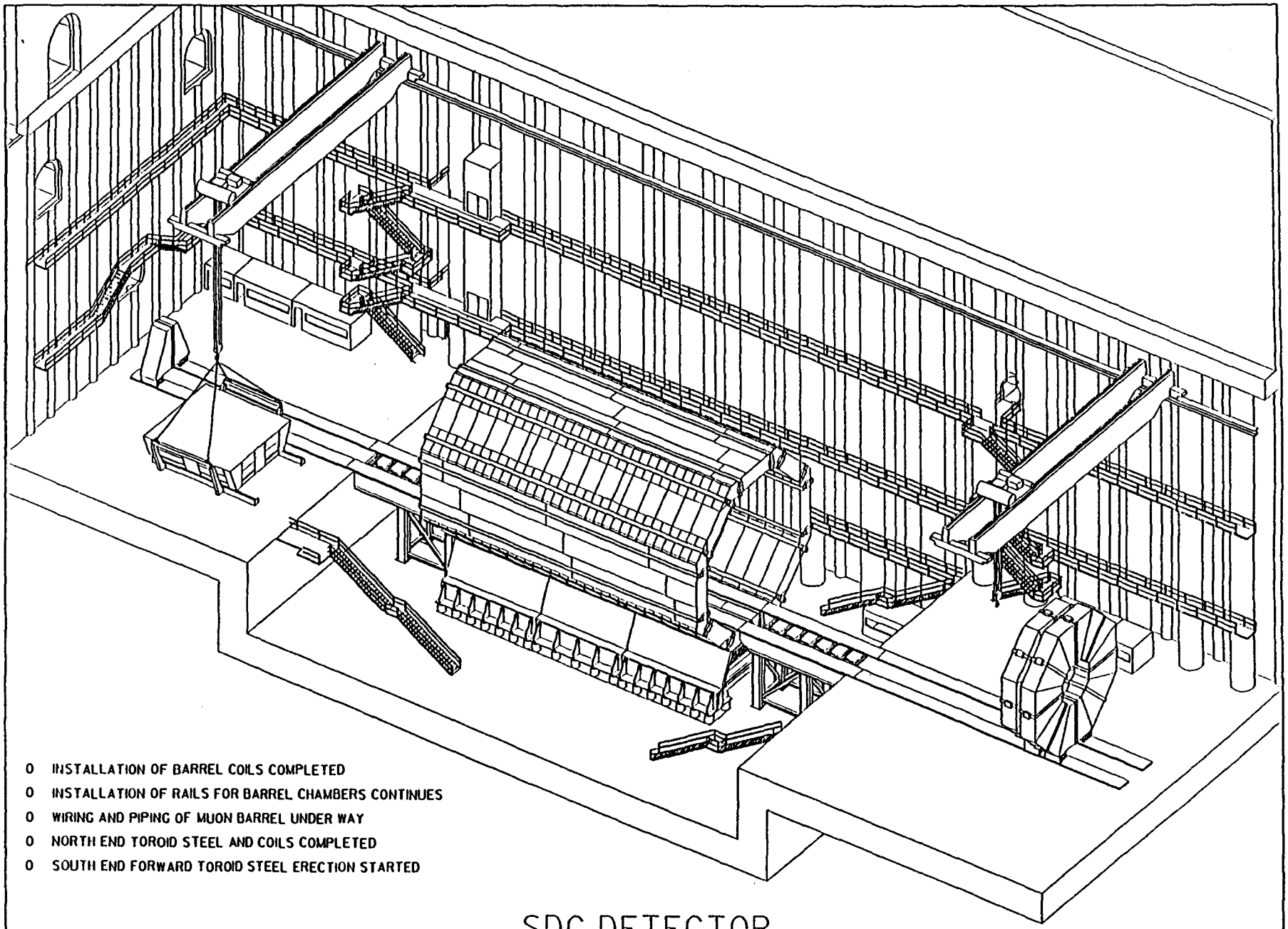

D COMPLETED INSTALLATION OF INCLINED SUPPORT PLATES
O COMPLETED ALIGNMENT OF SUPPORT SYSTEM
O INSTALLED BOTTOM BARREL COIL SEGMENTS
SDC DETECTOR
CONSTRUCTION PROGRESS
MONTH 5
SCC/PHY RES/SDC/TIM STEPHENS X6352 09/30/92 MODEL: sdd000756



SCC/PHY RES/SDC/TIM STEPHENS X6352 10/01/92 MODEL: /57


0 BARREL ASSEMBLY FRAMES IN PLACE
0 ALL BOTTOM INCLINED BLOCKS ASSEMBLED
0 ASSEMBLING RINGS OF BLOCKS
SDC DETECTOR
CONSTRUCTION PROGRESS
MONTH 8
SCC/PHY RES/SDC/TIM STEPHENS X6352 10/16/92 MODEL: sdd000798

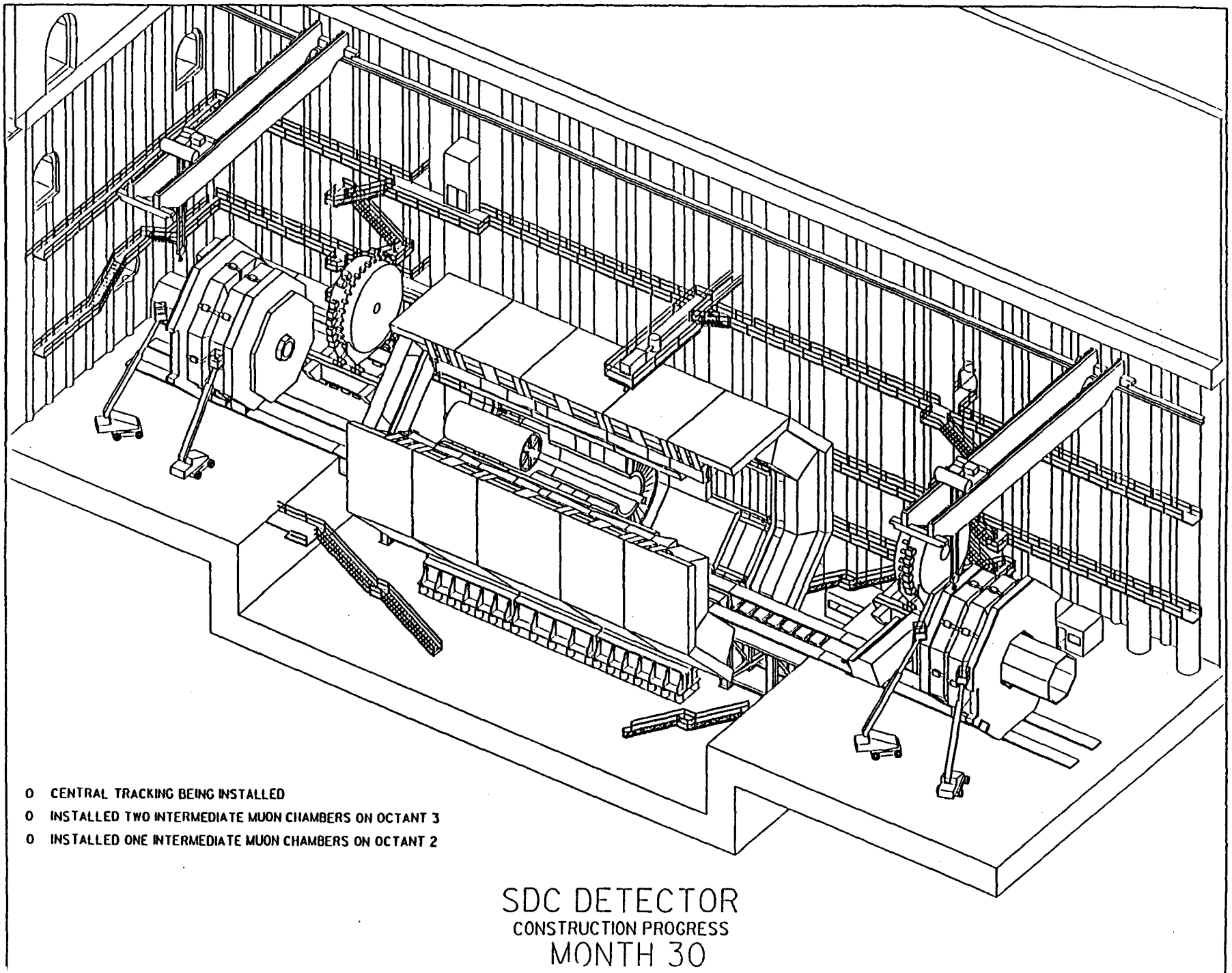

0 BARREL COIL SEGMENTS BEING INSTALLED
SDC DETECTOR
CONSTRUCTION PROGRESS
MONTH 11
SCC/PHY RES/SDC/TIM STEPHENS X6352 10/19/92 MODEL: 8 845



- 0 INSTALLATION OF BARREL COILS COMPLETED
- 0 INSTALLATION OF RAILS FOR BARREL CHAMBERS CONTINUES
- 0 WIRING AND PIPING OF MUON BARREL UNDER WAY
- 0 NORTH END TOROID STEEL AND COILS COMPLETED
- 0 SOUTH END FORWARD TOROID STEEL ERECTION STARTED

SDC DETECTOR
CONSTRUCTION PROGRESS
MONTH 13

SCC/PHY RES/SDC/TIM STEPHENS X6352 10/26/92 MODEL: sdd000847


O CENTRAL TRACKING BEING INSTALLED
O INSTALLED TWO INTERMEDIATE MUON CHAMBERS ON OCTANT 3
O INSTALLED ONE INTERMEDIATE MUON CHAMBERS ON OCTANT 2
SDC DETECTOR
CONSTRUCTION PROGRESS
MONTH 30
SCC/PHY RES/SDC/TIM STEPHENS X6352 10/29/92 M
.dd000898

IV. COST SUMMARY

WBS	ITEM/ INSTITUTION	COSTS THIS MONTH	FY93 COSTS TO DATE	FY93 COMMIT-MENTS	FY93 BUDGET	SOURCE OF FUNDS
1.1	Silicon Tracker R&D					
	LANL	105,000	105,000			
	UCSC	12,094	12,094			
	LBL	42,194	42,194			
1.1.1	Main Mechanical Assembly					
1.1.2	Internal Electronics					
1.1.3	External Mechanical Systems					
1.1.6	Assembly/Test/Special					
1.1.7	Project Management					
1.2	Option -- ORNL			none		
1.2.1	Barrel Tracker R&D					
	Indiana University					
	Duke University*					
1.2.5.4	Alignment					
	QRS					
1.2.11	Management					
1.2.12	R&D Prototypes					
	University of Colorado					
	QRS					
	WSTC					
	ORNL					
2.1	Barrel Cal R&D					
	Argonne	64,709	64,709	71,164	0	
	ANL					
	Fermilab	74,600	74,600	28,400	0	
	FSU	0	0	0	0	
	LSU	3,560	3,560			
	Purdue	4,911	4,911		0	
	Sackay	50,334	50,334		1,023,000	
	Rockefeller					
	SSCL	0	0	0	0	
	U. of Texas-Arlington				0	
2.1.1.3	Photomultiplier tube system					
	U.T.A.	No	Budget			
2.1.1.5	Tile Cal. calibration system					
	U.T.A.					
	SSCL					
2.1.9	Tile/fiber fabrication					
	U. of Tsukuba					
2.1.9.1	R&D Tests / FSU	0	0	0	0	
2.2	Endcap Cal R&D					
	LBL	50,200	50,200	12,000		
	ORNL			0		
	Saclay	3,061	3,061		97,000	
2.2.1	Calibration					
	Purdue					
2.2.10	End Plug Calorimeter					
	LBL					
	SSCL					
2.3	Forward Calorimeter					
	Rockefeller					
2.3.1	Design Documentation					
	U. of Toronto					

2.3.2.1	Construction of Liquid Scint Text Module U. of Toronto					
2.3.2.3	Measurement of Capillary Attenuation Lengths U. of Manitoba Texas A&M					
3.1.1.1	Barrel Magnet U of Wisconsin	11,094	11,094			SSCL
3.1.1.2	Barrel Coils U of Wisconsin	3,713	3,713			SSCL
3.1.1.3	Barrel Support					
3.1.2.1	Forward Iron					
3.1.2.2	Forward Coils					
3.1.2.3	Forward Support					
3.1.3.1	Power Supplies					
3.1.3.2	Monitor & Controls					
3.2.1.1	BW1 Module					
3.2.1.2	BW2 Module					
3.2.1.3	BW3 Module					
3.2.1.4	BWT Tower					
3.2.1.5	Barrel Region (shared items) Tufts U. of Washington Harvard	 3,300 3,300 2,443 528 6,350 7,950	 3,300 3,300 2,443 3,413 21,650 7,950	 6,600 6,600 3,647 1,000 300 ---		 Tufts HEP Base TNRLC SDC TNRLC TNRLC
3.2.2.1	IWT Tower					
3.2.2.2	Intermediate Region (shared items) U of Wisconsin U. of Minnesota	 18,315 -0-	 18,315 -0-			 SSCL
3.2.2.6	Intermediate System Design U of Wisconsin					
3.2.3.1	FW1 Module					
3.2.3.2	FW2 Module					
3.2.3.2.3	FW2 Frames U. of Maryland	 $5,000				 SSCL
3.2.3.3	FW3 Module (option)					
3.2.3.4	FW4 Module					
3.2.3.5	FW5 Module					
3.2.3.5.3	FW5 Support U. of Maryland Muon RAM U of Maryland					 SSCL U. of Maryland
3.2.1.5.3.1	BR Alig. Equip. Draper	?	0	8,333		SSCL
3.2.3.6	Forward Region (shared items) U of Maryland U of Maryland Draper					 SSCL R&D University SSCL
3.2.3.6.1	FR TUBE DESIGN U. of Maryland	 2,000				 HEP base
3.2.3.6.3.2	FR Abs./Sup Draper	?	0			SSCL
3.2.3.6.4	Muon Assembly U. of Maryland	 2,000				 SSCL
3.2.4	Global (summary)					

3.2.4.1	Global Tube					
	Brandeis	1,130	1,130	1,019		TNRLC
	Ohio State	3,000	3,000			OSU
	U. of Washington	12,416	44,473			SDC
		6.213				NSF
	U. of Colorado	1,567	1,567			HEP base,
		1,262	1,262			University
		2,152	2,152			TNRLC
3.2.4.2	Global Alignment & Monitoring					
	U. of Washington					SDC
	Harvard					TNRLC
	Draper					SSCL
	Fermilab					
3.2.4.3	Global Trigger Counters					
3.2.4.4	Global Surface Facilities					
	U. of Washington					SDC
	Fermilab					
3.2.4.5	Global Gas Systems					
3.2.4.6	System Engineering					
	Draper	?	0	27,778		SSCL
	Martin Marietta	37,982	37,982			SSCL
4.0	Solenoid Magnet Systems Sum					
5.1	Front End R&D					
5.1.1	Scint. Fiber Tracker FE Electronics					
	Fermilab					
5.1.2	Straw Tracker Front End Elec.					
	University of Colorado**					
5.1.3	Cal/ShowerMax FE Elec.					
	Fermilab					
5.1.3.1.1	LBL					
5.1.4	Muon Systems FE Elec					
5.2	Data Acquisition System					
	University of Illinois					
5.3						
	U. of Wisconsin					
	Michigan					
5.4	Ancillary Systems Control					
6.0	Computing					
7.0	Conventional Systems					
8.1	Test Beam R&D					
8.2	Installation and Assembly					
9.1	Project Planning&Tracking					
9.2	Detector Integration					
9.3	Systems Engineering					