QUARTERLY REPORT

FOURTH QUARTER FY97 BRAHMS ACTIVITIES

Infrastructure and Installation (WBS 7.1)

Work continued on the design of many of the infrastructure systems in preparation for fabrication, purchase and installation in early FY98.

The mezzanine for magnet power supplies in building 1002A was awarded to an outside contractor. Detailed prints of the mezzanine were reviewed and a few minor modifications requested. It is expected that the mezzanine will be installed on schedule (Nov.) and within budget. Design of the roll-up door for 1002A is in progress and the ventilation system was removed in preparation
for the mezzanine construction.

Design of the main power distribution started in Sept. This design will detail the distribution of the 440 volts A.C. from the substation to the various fused disconnect switches for power supplies, isolation transformers, and magnet cooling water system.

The lower blocks of the shield wall were grouted and installation of the shield wall continues. It is expected that the shield wall will be completed in the first quarter of FY98.

Design work on the platforms continues. The design for the pivot and track for the mid-rapidity spectrometer have been completed and are being checked. Purchase of various platform parts has begun including the pivot bearings for the mid-rapidity and front forward spectrometer.

A detailed layout and parts list for the magnet utilities tray was completed and a purchase order was released to get an accurate quotation of the cost. The purchase has not yet been awarded pending review of the cable routing.

Magnets and Power Supplies (WBS 7.2)

The fabrication of the D1 coils was completed and they have arrived at BNL. All three coils were damaged during shipping. However, the AGS technicians were able to repair the coils and they have been tested. The machining of the iron for D1 has been
Magnets and Power Supplies (WBS 7.2) (cont.)

delayed to determine if some SREL magnet iron found at BNL will be satisfactory. Samples of the iron will be made into rings and the permeability will be measured by late Oct. There appears to be sufficient iron for D1, D3 and the return yoke of D4, if the iron proves to be satisfactory. The machining cost for D1 was estimated by the BNL shops and is well over the CDR budget estimate.

However, if the SREL iron can be used then the cost savings on materials should keep the magnet cost within budget.

Work continued on magnets D3, D5, and D4. The D3 coils were sent to outside vendors for quotations. It is expected that the coil contract will be awarded in Oct. The D5 magnet has been assembled. It is expected that the mapping of this magnet can be done in Nov. after the coil buss work is completed. An AGS 18D72, which will be modified for D4, has been identified and the coils tested.

Magnet D2 is now fully designed. Technical drawings have been shipped to BNL. The order has been placed with 'Danfysik'. Detailed Tosca calculations have been completed. The magnet will be equipped with a 12mm-laminated shield towards the RHIC ring. The stray field at the collider center will be less than 7 Gauss at any point. The magnet will be equipped with 7cm thick field clamps at either end. Stray field beyond clamps will be less than 18 Gauss at 10 cm from the outside clamp surface.

The overall magnet length is 2m from the outside edges of the field clamps. A current of 2700 Amps produces a central field of 1.593 T, which is above the design specs. of 1.5 T, and has an integrated Bdl of 2.676 T-m.

The coils are in production. Iron has been procured. Assembly will take place at Danfysik towards the end of November. The D2 magnet is expected to be fully completed by the end of 1997, ready for shipment to BNL in early 1998. Field mapping will take place at BNL.

Preparations for mapping the magnets have begun. Parts from the E866 mapping jig will be used and a longer rail (10 ft) will be made for mapping the longer magnets. A three-axis hall probe has been purchased and test fitted into the mapping jig. Work on the software to readout the hall probes and control the stepper motors has begun. It is expected that the system will be ready for mapping D5 in Nov.

Detectors (WBS 7.3)

Forward Spectrometer TPCs (WBS 7.3.1)

T2 design was finalized. Plexiglas enclosure is ready at NBI. Pad plane support (G10) frame has been machined and assembled. Pad planes and other printed circuit elements have been produced. Connectors will be soldered onto pad planes within the next 2 weeks at NBI. Winding of sense, field, anode and gating wires will be done at IReS at the end of November. Full TPC will be assembled at NBI in December.

Printed circuit boards for gating grid power supply have been produced at CERN. Population of cards will take place at NBI during fall in parallel with TPC construction.

The T1 construction is proceeding at Strasbourg and should be complete by the first week of November. Production of T2 is going well. T2 construction is expected to be completed by the end of this year. We are planning a beam test, possibly at Aarhus, in early spring using FEE and Readout electronics.

<u>Forward Spectrometer TOF (WBS 7.3.2)</u>

Test scintillators were purchased from Bicron (BC420). Various dimensions were tested in a 580 MeV electron beam from the Aarhus storage ring. The test was completed on Oct. 8.

A typical scintillator for H1 (length 35 cm, cross section 1 x 1 cm2, BC420, wrapped in Al foil and black covering at factory) coupled directly to Hamamatsu 3478 fast 3/4" PM tube with mu-metal shield and passive voltage divider. Phillips leading edge discriminators, model 710, were used. Various arrangements were tested, main results were for a coincidence of two identical scintillator slats positioned at 90 degrees with respect to each other. Overlap region was 1x1 cm.

Tested scintillators were equipped with a PMT on one end only. The high voltage used was between 1700-1800 Volts. Measured pulse amplitudes were between 400-500 mV for 1 MIP. Full analysis not been completed yet, but on-line results indicate intrinsic time resolution better than 75 ps. Measurement had some problems from radio frequency pick up from the accelerator, so this can probably still be improved quite a bit.

<u>Forward Spectrometer TOF (WBS 7.3.2)</u> (cont.)

Proposed scintillator design based on BC420, 1cmx1cmx25-35cm slats coupled to 3478 tubes certainly fulfills the BRAHMS design criteria. Performance superior to design specs. can be anticipated. Technical drawing for mounting arrangement is available. Final design (segmentation) awaits final simulations of backgrounds. All PMTs and electronics are available.

<u>C1 (WBS 7.3.3)</u>

Work continued on the design of C1 in preparation of the detailed detector design, which will begin in October. Monte Carlo studies were conducted to examine issues of the detector's wall thickness on generating background into the detector. Results indicate that when C1 operates in the low momentum position (5 degrees relative to D1) that the wall is not a large source of background. The gammas from the interaction (Au-Au) have no line-of-sight to the wall on the beam side, thus there is little background generated in the wall.

C1 is not expected to be used in the higher momentum setting where D2 is 1.95 degrees relative to D1. Simulations indicate substantially more background from the sidewall if the detector were to be used in this configuration. The considerations which determine the wall thickness needs to be understood before the vessel designs are complete. A related issue is the technique that is used to charge the vessel with C4F10.

The purity of the gas (C4F10) is important in obtaining good detector performance. Two methods are under consideration. The first requires evacuating the vessel in place and then charging with C4F10. This method requires thick entrance/exit windows and thick sidewalls. The second method is to place the detector inside a large tank. The tank and the detector volumes are simultaneous evacuated. Then the large tank is slowly pressurized with air while the detector is charged with C4F10. This method allows for thinner windows and detectors wall. An evaluation of these completing techniques is in progress. The results will be incorporated into the final detector design.

RICH (WBS 7.3.4)

Work continues on optimizing the performance of the RICH with Hamamatsu PMTs (R5900-03 M4f). The PMT signal will be amplified and several amplifiers are under consideration. PMTs were obtained on loan from Hamamatsu for evaluation.

Drift Chambers (WBS 7.3.5)

A final design of the tracking detectors (T3, T4 and T5 Drift Chambers) required in the forward spectrometer operating in a high momentum mode was established during the recent Collaboration Meeting (August 97, BNL). A proposal to construct these detectors is ready for submission to RHIC Management. The construction of a T3 prototype is scheduled in the first phase of the project.
Sub-contractors for the frames and printed circuit boards have been selected. Procurement of materials and components will start as soon as funds can be transferred following the completion of the MOU.

Mid-rapidity TPC (WBS 7.3.6)

Mechanical work was completed on MTPC1 to enable the use of the STAR FEE cards and the readout card. A copper RF shield was added along with the mounting support/heat sink for the FEE cards and the readout card. A cosmic ray trigger has been setup to test the TPC; the test awaits completion of the receiver card.

Mid-rapidity TOF (WBS 7.3.7)

Data from the test beam is being analyzed. Comparison of the MIP performance relative to Bi source tests are being conducted to determine the extent that sources tests can be used to test the detector designs.

Beam-Beam Counters (WBS 7.3.9)

Monte Carlo studies are being conducted to determine the optimum array design. The effects of backgrounds on the detector occupancy and timing distributions are being examined. The primary background appears to be from gamma conversions in the beam pipe. The background considerations may be an important factor in the discriminator choice, i.e., leading edge or constant fraction.

<u>Centrality (WBS 7.3.10)</u>

At the Brahms Collaboration meeting of Aug 25-26 it was decided to pursue a parallel development of a Si-strip detector array and a scintillator tile/fiber array. A final decision on the centrality detector configuration will be decided at a meeting scheduled for Dec. 19 at BNL. GEANT simulations indicate that a hybrid array comprised of both types of detectors may result in

<u>Centrality (WBS 7.3.10)</u> (Cont.)

the best overall performance while staying within the budget guidelines.

Several issues need to be resolved before the Dec. 19 meeting. A realistic cost for the scintillator tile/fiber readout system needs to be determined. The cost for Wayne State University to machine the tile pieces for BRAHMS needs to be included. The performance that can be achieved with the tiles using the green-extended phototube (R580-17) and best wavelength shifting fibers from Kurara, requires further work. The Si strip detectors require additional effort for optimizing the electronics configuration and establishing the performance that the Si strip detectors can achieve.

The cost of manufacturing the tiles is currently being negotiated with Wayne State . A R580-17 phototube has been purchased through BNL to test the performance of an existing prototype tile.

Two Si strip detectors have been purchased from Micron Semiconductor (through BNL) for testing. A 133Ba source has been ordered for these bench tests. A prototype preamp circuit based on the LeCroy HQV810 chip has been constructed and set up using QCD readout. Prior to the source delivery, which is expected in early November, a mounting scheme needs to be devised for the strip detectors and the detectors and associated electronics tested using a pulser and signals from cosmic rays.

<u>DAQ (WBS 7.4.1)</u>

DAQ development continued. A prototype DAQ with CAMAC support was developed. This system can be used for testing detectors. The E866 SBE/CAMAC drivers were ported to VxWorks. A JAVA based GUI and communications software interfacing workstations/PC to VME processors was developed. Database access using Objectivity/C++ was tested. The event builder VME processor/software was upgraded to MVME2603.

The hardware setup for slow controls has begun. A single Power PC processor is used in VME and will run the VxWorks operating system. The software to be used for slow controls will be based on the Experimental Physics and Industrial Control System. (EPICS) To assist in the development of the slow control system, we have also installed a VMetro VMEbus analyzer. High Voltage monitoring and slow control will be done over

DAQ (WBS 7.4.1) (Cont.)

ethernet/arcnet to the Lecroy 1458 mainframes and over serial lines for the older 1440 systems.
The TPC's will be readout by
STAR Radstone SBCC that communicates with the Front End Electronics (FEE) on the TPC through an HDLC interface board.
The electronics chain has been completed from the SBCC board to the HDLC board.

Software development is just now beginning. We are gaining experience with VxWorks, EPICS and VME. Basic operations such as booting VxWorks on a Power PC and starting communications with a STAR Radstone SBCC board have been learned.

Software (WBS 7.4.3)

STAF has been investigated in the last quarter to see how it might be used in BRAHMS' initial stage of analysis. To that end, two STAF example modules have been written. One reads the C-stream files generated by GBRAHMS and generates a table of hits. The other is a 0th order iteration of a routine for the TOF that takes the hit table and performs operations on it and outputs another STAF table. It was also demonstrated that these tables can be written as STAF XDR files and read again into STAF.

GBRAHMS is also currently being installed in Oslo and Bergen. Compilation and tests have been successfully carried out at the Bergen RS/6000 and are currently being performed on the Oslo Sun/Solaris system.

Data flow diagrams for C1, RICH and TOF have been generated and sent out for further comments.

A pad monitor program was adapted from NAYA/STAR and is operational for BRAHMS.

The calculation part of Sonata++ has been completed and more or less debugged and is demonstrated to work for a relatively wide variety of BRAHMS events in the forward spectrometer. The program, developed under Windows NT using Microsoft Visual C++, can compile under gcc on nearly all of the platforms in the RCF as well as CXX on VMS using the same makefile. Some benchmarks to
further refine BRAHMS CPU needs have been initiated.