Recent Progress on the STAR Experiment at RHIC

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During the summer of 2002 we have completed the construction of four of the 30° sectors of the endcap calorimeter and successfully installed them on the STAR detector at RHIC. Progress continues with the stringing of bundles of optical fibers, PMT boxes, and the associated electronics. A detailed review of the status of the construction is contained in the Contributions section of this report. Here we summarize only the activities of the past several weeks.

Fig. 1 The mechanical structure for the first (lower) half of the STAR endcap electromagnetic calorimeter as it is craned into the Cooler building for assembly.

The project to build an endcap electromagnetic calorimeter has been underway for 3 years. The project was born in response to the announcement by the NSF a number of years ago that they would be ending funding for nuclear physics research using the cyclotrons and Cooler. A number of the faculty (Les Bland, Will Jacobs, Jim Sowinski, Ed Stephenson, Steve Vigdor and Scott Wissink) decided to look for new physics to explore after the local program was phased out. They found a research program investigating how the spin of a proton results from the spin of its pieces, quarks and gluons, to be very interesting and that there were excellent opportunities for this physics at a new accelerator called RHIC at Brookhaven National Lab. The accelerator would have the highest energy polarized protons ever produced and collide them creating violent interactions between the quarks and gluons.

The group joined a large collaboration at BNL organized around using the STAR detector for basic nuclear research. The detector is a large solenoidal magnet or cylinder mostly filled with detectors. The calorimeter under construction here at IUCF will be

Fig. 2. Jim Sowinski standing in front of the STAR poletip. The detector built here will cover this full surface with many layers of lead and scintillator.

used to detect very high energy gamma rays and electrons (10 GeV or higher) and will be located on one circular face of the cylindrical detector. The almost $7M project is funded by the NSF. The project is directed at IUCF by Will Jacobs and much of the activity is centered here, with a number of other institutions collaborating including Argonne National Lab, Kent State, Texas A&M, Brookhaven National Lab, Lawrence Berkely Lab, and JINR in Dubna, Russia.

The detector being built is called an electromagnetic calorimeter because it contains all the energy of incoming high energy gamma rays and electrons (known as electromagnetic particles). This is done by stacking up 23 layers of lead as shelves for scintillator on the mechanical structure shown in the first picture of this article. Each full 360□ layer weighs just under 1 ton. The incoming gamma rays or electrons generate many more electrons and gamma rays of lower energy by interacting with the lead. The number of particles created in this "shower" of particles is counted with scintillator by the intensity of the light produced.

The megatile production facility, supervised by Keith Solberg, was probably the first big takeover of space for the STAR project. Initially used for prototyping, the facility is now manufacturing production megatiles (scintillator panels), which has been underway for about 1 year now and will continue through the summer of 2003 to machine all the megatiles required for the project. Jeff Jones has recently taken over the scintillator machining from Larry Skirvin who has run the machine for the past year. The megatiles are assembled by Jason Hammock, Jeremy Brashear, Brian Layden and tested by Alexander Klyachko. All except a few special purpose megatiles for this year's installation are already complete.

Fig 3. Larry Skirvin working with the CNC router in the megatile production facility

Since late last year a large area outside CIS (and an even bigger area on top of the Cooler roof beams) has been taken over to laminate the lead radiator plates for the calorimeter. Since lead is soft and not strong structurally it is covered with thin stainless steel to add some integrity. Terry Sloan has been supervising the laminations with the help of Alan Eads and an hourly (most recently Alan's dad, Larry). Currently all the laminations for the first half have been completed and work will continue into the summer to complete the second half. The same crew has also recently begun to assemble radiator plates to the structure.

Fig. 4. Terry Sloan, Alan Eads and John Vanderwerp lowering the top layer of stainless steel onto a lamination.

The electronics group is also involved in a very challenging part of the STAR project. They are designing state of the art data acquisition electronics to read out the signals from some of the calorimeter photomultiplier tubes. The digitization of the

signals must take place in the boxes with the tubes rather than in far away electronics crates, presenting many design challenges. This, as the rest of the project, could not be accomplished without the many talented people at IUCF. We regret that not everyone can be recognized here by name.

You can expect a lot of activity on the STAR project over the next few months. The plan is to assemble the lower half of the detector over the next month and ship it to BNL for installation in July. Installation of phototube boxes and electronics, most of which will pass through IUCF on the way, will continue into the fall. The second (upper half) is planned to be installed in the summer of 2003, so much of the local activity will continue for another year.