THE GREENSHEET

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ART FROM OUTER SPACE

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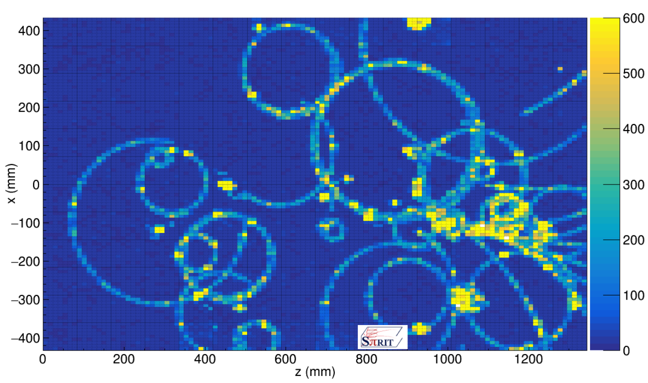
Accelerators such as our K500 and K1200 Cyclotrons and the FRIB linear accelerator currently under construction allow physicists to study the properties and structure of nuclei and nuclear matter. At NSCL, beams of atomic nuclei (both stable and radioactive), can be accelerated and collided with stationary nuclei in a target foil. Scientists use specialized detector systems to study the reaction products generated from the nuclear system created in the collision.

Recently, the HiRA group built a Time Projection Chamber (TPC), called the SπRIT (SAMURAI pion Reconstruction Ion Tracker) TPC, which can be used to visualize nuclear collisions in three dimensions by utilizing a two dimensional readout plane and time of detection. After it was completed, the SπRIT TPC was shipped to RIKEN, Japan in 2014. It is the main detector for the SπRIT collaboration, which is an international effort to constrain the symmetry-energy term in the nuclear Equation of State (EoS) at high densities. At RIKEN, the TPC is used in conjunction with a large dipole magnet called SAMURAI magnet. The SπRIT experiments that were conducted in May were discussed in talks this past week by scientists from Korea University and NSCL.



The pad-plane view of a cosmic shower inside the SπRIT TPC. The closest analogy of the pad plane is a TV screen with 12096 electronic channels (pixels).

Since beams from large accelerators are expensive to use and limited in availability, the SπRIT group used natural accelerated beams from outer space, also known as cosmic rays, to test and check the TPC before and during the experiments. Cosmic rays are atomic nuclei that have been accelerated in the cosmos by processes that are not completely understood. Even though most (~80%) of cosmic rays are protons, some are heavier nuclei. The percentage of cosmic rays that are heavier nuclei decreases with mass. Nuclei as heavy as iron constitute a small (<0.02%) part of the cosmic ray flux.

Many cosmic rays appear as single tracks in the TPC. Occasionally, the interaction of cosmic rays with the atmosphere or other materials produces a cosmic ray shower which contain many fast particles. In the presence of a magnetic field, the charged particles in the cosmic rays will curve, and for these low energy particles, a spiral may form. The multi-tracks of the cosmic showers as observed in the TPC with circles and curved lines can be quite beautiful. One example is shown in the picture. Currently, there are plans to use some with art to science outreach projects for K-12 students. More images of the cosmic rays are available here.

SHUTDOWN UPDATE

The "A" dog-leg from the K1200 cyclotron is complete and a test fit confirmed the proper alignment. The spare Dee from the K1200 cyclotron (the former "stand-alone" C dee) needs to have its water lines modified to work with the new dog-leg. Test fitting of both parts is being completed this week as well as modification of the water lines. The superconducting quad doublet AA213 was removed from the N4 vault Tuesday afternoon to make room for the Advanced Gas Stopper, which will be installed at a later date. The cryo-welding group is terminating the cryo-lines left open by AA213's removal this week. Completion is expected by the end of Monday, September 12th.

WHAT IS A CONFINED SPACE?

A confined space does not necessarily mean a small, enclosed space. It could be rather large, such as a tank or a pit. Confined spaces have three defining features:

- Large enough to allow an employee to enter and perform work;
- Limited or restricted means of entry and exit;
- Not designed for continuous human occupancy.

Confined spaces are categorized into two groups, non-permit and permit-required. Non-permit spaces have no hazards present or the hazards have been mitigated. Permit-required confined spaces have hazards that cannot be mitigated. Examples include:

- Flammable or toxic gases that cause the atmosphere to become life threatening;
- Oxygen content of the air below the level required to sustain human life;
- Physical hazards, such as moving equipment or energized electrical circuits;
- Tanks and other enclosed spaces filled with materials that can engulf or smother the entrant.

Conditions in a confined space can change quickly. For example, a confined space with sufficient oxygen might become an oxygen-deficient space once a worker begins welding or performing other tasks. Line Managers should ensure they select the **"Perform work that will involve entering, or assisting someone who is entering, a confined space"** competency in the Laboratory training system for any employee whose job responsibilities require them to enter a confined space.

SEMINARS

- MONDAY, SEP 12 AT 12:30 PM
  Biomedical & Physical Sciences Bldg., Rm. 1400
  Luke Roberts, MSU
  'The Long Term Supernova Neutrino Signal'
- TUESDAY, SEP 13 AT 11:00 AM
  Theory Trailer Conference Room
  Jhilam Sadhukhan, Variable Energy Cyclotron Centre, Kolkata, India
  'A Roadmap of the Microscopic Theory for Spontaneous Fission'
- WEDNESDAY, SEP 14 AT 4:10 PM
  NSCL Lecture Hall
  Daniel Bardayan, University of Notre Dame
  'Nuclear Astrophysics Measurements with the TwinSol Separator'

PEOPLE AT THE LAB

- Spencer Drake is a Cryogenic Assembler who joined the Lab this week.
- Devon W. Thompson joined the Lab as a Professorial Assistant for Remco Zegers.

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THE ARCHIVE OF PREVIOUS GREENSHEETS IS AVAILABLE HERE

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