NSCL

THE GREENSHEET

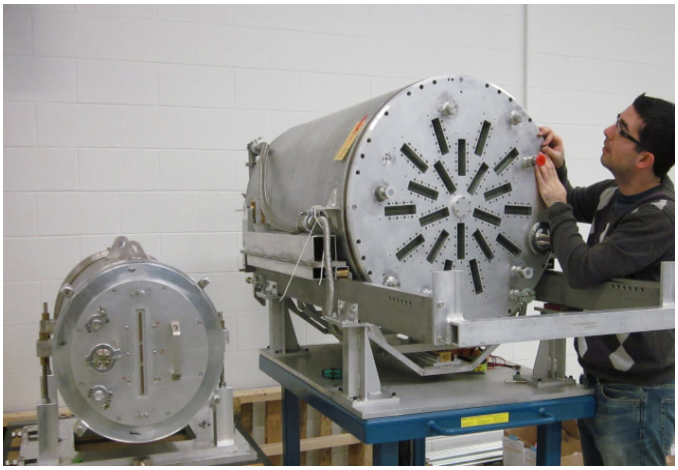
MARCH 7 2014 | VOLUME 33 NUMBER 10

FROM SMALL TO BIG: THE AT-TPC AND ITS PROTOTYPE

Contributed by Daniel Bazin and Wolfgang Mittig

An active target is an important device to overcome the limited intensities of secondary beams. An active target time projection chamber (AT-TPC) satisfies these conditions:

- In order to achieve a maximum efficiency we need a thick target.
- This target must have the maximum reaction probability without losing energy resolution necessary to determine which nuclear states had been populated.
- The reaction products should be detected over a large solid angle.
- The detector gas is the target for the reaction, this allows for charged particles the reconstruction of the place where the reaction takes place, and detect the reaction products over a large solid angle of essentially 4π.



At the left the ½ size prototype completed in 2011, at the right the full size AT-TPC to be commissioned this month.

In order to achieve the high resolution, the detector is placed in a magnetic field, and the curvature of the trajectory of the charged particles provides the energy measurement. A very fine granularity of the position measurement is necessary. This leads to a large number of channels, for the AT-TPC ten thousand, instrumented using electronics developed in an international GET (General Electronics for TPC) collaboration.

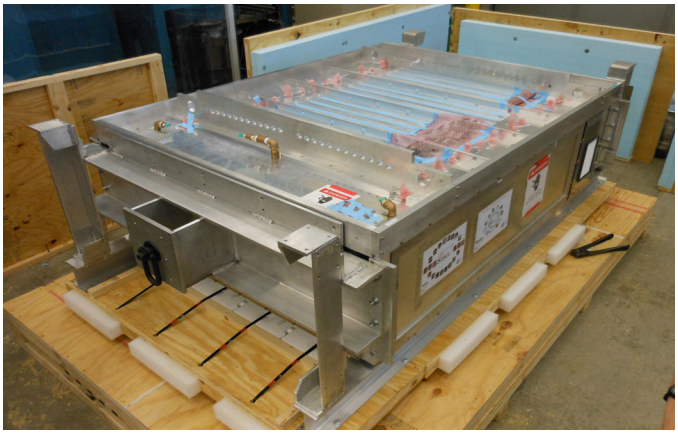
In 2010 we decided to construct a half size prototype in order to test essential parts at a reduced cost. This was our "learning horse." It allowed us to perform original technical developments, which you can read more about here: D.Suzuki et al., NIMA 660 (2011) 64, NIMA 691(2013) 39.

Experiments in the energy domain of the NSCL re-accelerator of secondary beams ReA were started with this device. We studied how light nuclei may organize into cluster structure (D.Suzuki et al., Phys. Rev. C 87 (2013)054301) especially as a function of the number of extra neutrons, for neutron rich secondary beams such as ^{6}He and ^{10}Be.

The figure shows the prototype together with the full size AT-TPC. We are in the final stage of assembling the full size model, and it will be commissioned this month using a stable ^{4}He beam of ReA with ^{4}He as detector gas. Besides debugging possible problems, we hope to be able during this commissioning run to get a precise measurement of the disappearance of Mott oscillations in the ^{4}He+^{4}He system in this low energy domain. At the energy of disappearance, the angular distributions become flat over a wide angular domain called transverse isotropy. More information on the disappearance of Mott oscillations can be found here: L.F.Canto etal., Phys. Rev. C 89 (2014) 024610.

SPIRIT TPC ARRIVES IN JAPAN

Contributed by Bec Shane



The TPC being packed for shipping from MSU, it arrived safely at RIKEN last week.

The SAMURAI Pion-Reconstruction and Ion-Tracker (SPiRIT) TPC will be used in an international effort to constrain the density dependence of the nuclear symmetry energy. Constructed over the past three years here at the NSCL, with some design and fabrication done at Texas A&M University, it was sent this week on a 6500-mile journey to the RI Beam Factory at RIKEN. There, it will be used in conjunction with the recently commissioned SAMURAI Spectrometer to measure relative yields of charged pions (and other light particles) produced in heavy-ion collisions. These data will place constraints on the symmetry energy at around twice saturation density.

The SPiRIT TPC is lowered three stories down through a large hole in the ground to the experimental area at RIKEN.

We would like to thank everyone in the lab who has helped us reach this point, especially John Yurkon and the fabrication department.

PROTECT YOUR HEARING

Noise is unwanted sound. It can interfere with communication when you are talking to someone. Noise can have both psychological effects – startling you or disrupting your concentration, and physiological effects – pain, even nausea, and hearing loss. Hearing loss is so gradual, even in intense exposures, that by the time you realize that you can't hear as well as you used to, the damage has been done and can't be reversed. As a consequence, it can interfere with your job performance, your safety, and your enjoyment of life.

Here are some general rules for assessing noise levels:
If it is necessary for you to speak in a very loud voice or shout directly into a person's ear in order to be understood; if you have buzzing or ringing in your ears after exposure to noise; if speech or music sounds muffled to you after exposure to noise. These are all indications that you may be exposed to damaging levels of noise.

Hearing protectors reduce noise levels at the inner ear. Hearing protectors are available in several forms, such as ear plugs or ear muffs. Hearing protection is particularly important when noise exposures cannot be controlled adequately by engineering controls. Good protection depends on a good seal between the surface of the skin and the surface of the ear protector. Protectors have a tendency to work loose as a result of talking, chewing, or moving, and they must be re-seated from time to time during the workday. Ear plugs should be made of soft material such as neoprene. A properly designed, well-fitted hearing protector is as easy to use as a pair of safety glasses. The use of hearing protection does not make it more difficult to understand speech or to hear warning signals when worn in a noisy environment. Most of the available protectors, when correctly fitted, provide about the same amount of protection. The best hearing protector, therefore, is the one that you can wear properly.

CCF OPERATIONS

Last weekend, the cyclotrons ran a beam of ^{36}Ar for a nuclear-structure experiment in the S2 vault that finished at noon on Tuesday. A beam of ^{86}Kr was developed next, which was used for a test run of a nuclear-reactions experiment in the S3 vault. On Thursday, ^{36}Ar was redeveloped and sent to the N4 vault the next morning for an experiment with the gas stopping system.

SEMINARS

- TUESDAY, MARCH 11 AT 11:00 AM
  NSCL Seminar Room
  Thomas Duguet, CEA/IRFU/SPhN
  "Symmetry-Restored Coupled-Cluster Theory"
- WEDNESDAY, MARCH 12 AT 4:10 PM
  NSCL Lecture Hall
  Thomas Duguet, CEA/IRFU/SPhN
  "First Steps Toward the Ab Initio Description of Mid-Mass Open-Shell Nuclei"
- THURSDAY, MARCH 13 AT 11:00 AM
  NSCL Lecture Hall
  Ragnar Stroberg, MSU NSCL/Physics
  "Single-Particle Structure in Silicon Isotopes and the Collapse of the N=28 Shell Closure"

MSU SCIENCE FESTIVAL: VOLUNTEER RECRUITMENT

The MSU Science Festival needs volunteers. The event is three weeks away. Please sign up on the science festival website.

PEOPLE AT THE LAB

Alex Peterson is a student employee who started at the lab this week for FRIB. He will be a Professorial Assistant, Chris Compton is his line manager.

Cyril Lapinski began working at the lab this week in the Cryogenic Fabrication Group. Shelly Jones is his line manager.

Joseph Diffendal is a Planner/Inspector/Analyst II who started at the lab this week in the Facilities Group. Brad Bull is his line manager.

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Operation of NSCL as a national user facility is supported by the Experimental Nuclear Physics Program of the U.S. National Science Foundation