NSCL

THE GREENSHEET

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HIGH PRESSURE GAS CELL WITH PLASMA WINDOWS

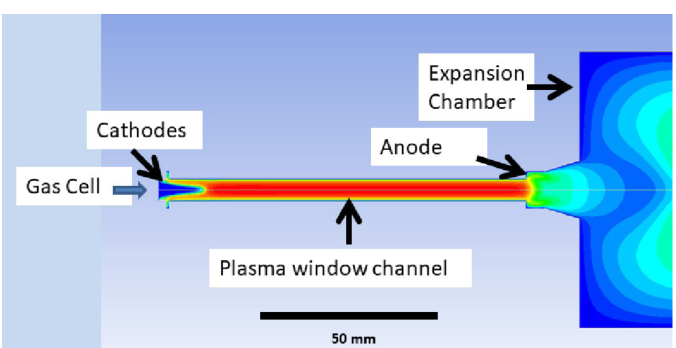
Contributed by F. Marti, J. Gao and A. Lajoie

The Helium Charge Stripper Team is developing a high-pressure gas cell, which can be used to remove electrons from ions (charge-stripping) or as reaction targets. The gas cell is enclosed by plasma windows, which are essentially high current arc discharges, to reduce the flow of gas from the cell (at about half the atmospheric pressure) to the rest of the accelerator, which is at vacuum. The plasma window is about 100 mm long and has a temperature of about 10,000 degrees Kelvin (about 17,500 degrees Fahrenheit).

The connection between the high-pressure cell and the rest of the accelerator must be large enough to let beams pass through without losses. The goal is to achieve an aperture with a diameter of 10-mm. It has already been demonstrated that the leakage rate can be reduced by a factor of 8 compared to the flow with a 6-mm diameter hole when no arc discharges are present. It is important to recirculate the helium gas in the cell to limit its consumption. To that end, a recirculating system was installed that pumps exhaust gas back into the high-pressure cell.

New components for the plasma window have been fabricated that will allow for measurements of the pressure and temperature along the arc. The team will also test plates of different apertures in the system.

In parallel with the experimental work, simulations that guide design changes to reduce the leakage with the 10-mm diameter aperture are being pursued. The figure shows the temperature in the gas simulated with the code Fluent. The color scale is from 300 K (dark blue) to 14,000 K (red).

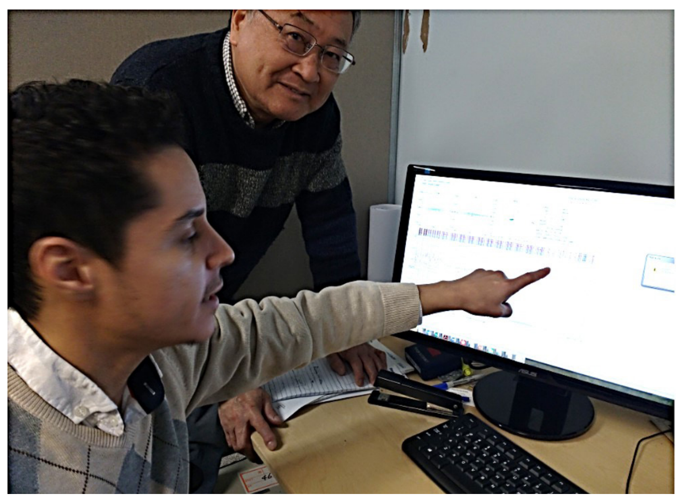


INVESTIGATING THE USE OF A 1.3 GHZ CAVITY FOR MEDIUM BETA HEAVY ION LINAC

Contributed by K. Saito and S. Shanab

Safwan Shanab, graduate student in accelerator science, performs research to increase the radio frequency (RF) accelerating gradient in future high-energy heavy-ion accelerators. A linear accelerator that operates at a high frequency has the advantages of reducing the size of the accelerator, providing a higher accelerating field and intrinsic quality factor. The higher field translates into a higher velocity gain of the ions and the higher quality factor increases reduces power losses in the linear accelerator. It also reduces the cost of the accelerator.

A accelerating cavity operating at 1.3 GHz (1.3 billion oscillations per second) was developed for the International Linear Collider (ILC). Safwan, and other members of the team, are investigating the possibility of using a 1.3 GHz cavity for a medium-beta heavy-ion multi charge-state accelerator. An important component of this research is focused on optimizing the so-called phase width. If the phase-width is too small, then some of the beam will be lost in the accelerator components.

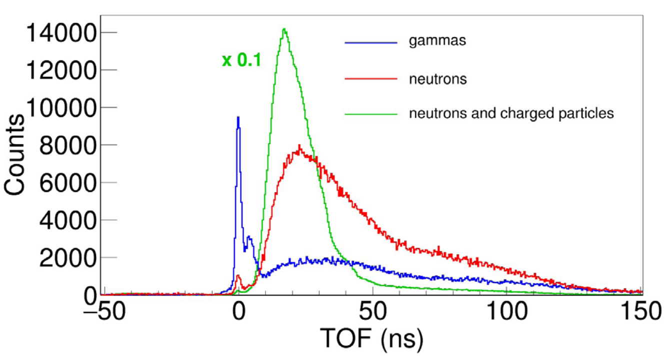


EXPERIMENT OF THE WEEK

Contributed by Kyle Brown

The first experiment to use a new charged-particle veto wall in conjunction with the Large Area Neutron Array (LANA) has been running for the last two weeks. The experiment is to measure the energy spectra for protons and neutrons emitted in reactions of a calcium-40 beam with targets of nickel-58 and tin-112. The amount of neutrons and protons emitted in these heavy-ion collisions is sensitive to the nuclear equation of state, which is important for understanding neutron stars.

The veto wall was constructed at Western Michigan University and consists of 25 overlapping bars of fast plastic scintillator, each 1 cm thick. The bars cover the entire area of LANA, which contains two walls of 2-meter-long liquid scintillator bars, stacked 2 meters high. In these heavy-ion collisions, lots of particles and gammas are emitted, and the goal is to separate out just the neutrons from the background of the other radiation. Additionally, the neutron detection is rather inefficient, so there are about 10 times more charged particles detected. By using liquid scintillator, LANA already has the capability to distinguish between gamma rays and other particles by the difference in light output caused by the radiation's interaction with the scintillator. Charged particles and neutrons cannot be separated by this technique since they create very similar light output. Since the veto wall bars are very thin, they are sensitive to the charged particles and not to neutrons, and can therefore be used to reject the charged particles from the measured neutron spectra. The figure below highlights this separation with preliminary time-of-flight data taken over the last weeks. From the difference in light output we separate the gamma rays (blue) from the charged particles and neutrons (green), and then with the veto wall rejection of the charged particles only the neutrons remain (red).



Time-of-flight spectrum between a start detector located near the target and LANA for 40Ca+112Sn at E = 140 MeV/A. The combined neutrons and charged particles (green) have been scaled down by a factor of ten to have them on the same scale as the separated gamma rays (blue) and neutrons (red).

CCF UPDATE

This week, the cyclotrons continue a long run of calcium-40. A nuclear-structure experiment using HiRA and the neutron walls has been taking beam for a little over two weeks.

REA UPDATE

This week at ReAccelerator, the linear accelerator (LINAC) was scaled with a 85-Rubidium 30+ charge state beam for the upcoming 18502 experiment. A Colutron created 76-Selenium beam is being developed through the Electron Beam Ion Trap, Radio Frequency Quadrupole, and LINAC. Optimization and transport of this beam is being improved for the upcoming experimental campaign. Today, the Segmented Germanium Array (SeGA) is being aligned and attached to the general purpose line in the ReA3 hall.

SEMINARS

- MONDAY, FEB 26 AT 11:00 AM
  NSCL Lecture Hall 1200
  Nabin Rijal, Florida State University
  'Measurement of ^{7}Be+d Reaction in the Gamow Window at the Big Bang Nucleosynthesis'
- MONDAY, FEB 26 AT 12:00 PM
  NSCL Lecture Hall 1200
  Amy Lovell, NSCL
  'A Deeper Understanding of the Inputs for Reaction Theory Through Uncertainty Quantification'
- TUESDAY, FEB 27 AT 11:00 AM
  NSCL Lecture Hall 1200
  Rodolfo M Id Betan, Institute of Physics Rosario Ocampo and Esmeralda, Santa Fe, Argentina
  'Shadow Poles in a Coupled-Channel Problem Calculated with Berggren Basis'
- TUESDAY, FEB 27 AT 1:45 PM
  Biomedical & Physical Sciences Bldg., Rm. 1400
  Jordan Myslik, Lawrence Berkeley National Laboratory
  'Recent Results from the MAJORANA Demonstrator'
- THURSDAY, FEB 28 AT 11:00 AM
  NSCL Lecture Hall 1200
  Simin Wang, NSCL
  'Puzzle in the Two-Proton Radioactivity of Kr-67'

PEOPLE AT THE LAB

- Darrel Simons is a new Electrical Technician in the Lab.
- Kieran Nehil-Puleo joined the Lab as a Student.

EDITOR: ERIN O'DONNELL | 517-908-7198 | ODONNELL@NSCL.MSU.EDU
THE ARCHIVE OF PREVIOUS GREENSHEETS IS AVAILABLE HERE

National Superconducting Cyclotron Laboratory
Michigan State University
640 S. Shaw Lane, East Lansing, Michigan 48824-1321
Phone 517-355-9671 www.nscl.msu.edu

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