NWNC

North West Nuclear Consortium

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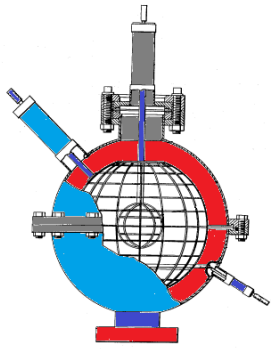
Offering the only nuclear engineering curriculum for Public High School students in the US

November 2012

Volume 1, Issue 6

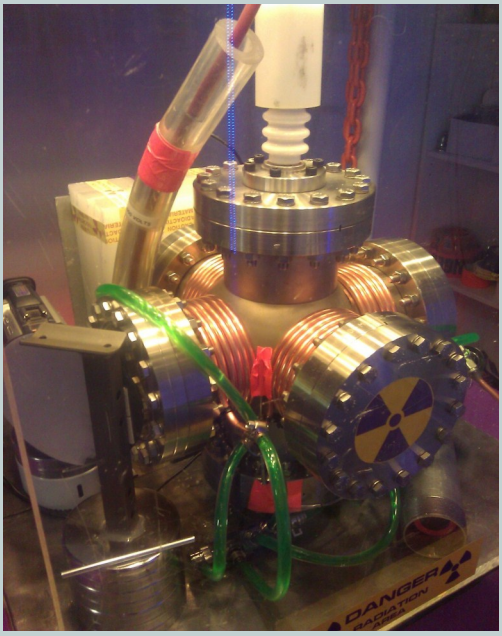


NWNC Overview:

The NWNC is a privately held club that meets to promote careers in fusion research, physics and engineering as well as STEM within the Public School System. The NWNC owns and operates a Farnsworth fusor, and physics laboratory in Federal Way Washington. The NWNC wishes to thank the Microsoft Corporation, FUSOR.NET and the all volunteer staff of the NWNC without which all of this would have been impossible. Inquires should be made to carl@kjnw.com

In this issue:

Reactor Chamber now liquid cooled



The stainless steel fusion chamber, cooling coils, and Koolance ™ plumbing.

After an errant electron beam heated a viewport until it failed in June, it was determined that the fusor could not be run for periods longer than 15 minutes without external cooling. The chamber temperatures involved were consistent with those encountered in hybrid computers running overclocked CPU chips, and therefore it followed that one approach would be to retrofit a cooling system from Koolance™ designed to cool high end computers.

4 copper coils have been form-fitted around each of the chamber ports and a Koolance™ cooling system capable of cooling a kilowatt of thermal energy was installed. Three thermistors, which come with the system, were then coupled to the chamber, mechanical pump and mechanical pump motor to provide constant monitoring and alarms.

The additional cooling has significantly extended the run times for the fusor, and allowed us to see changes in the plasma over time. These shifts in chamber plasma dynamics result in movement of the chamber "tipping point", which is the point at which chamber ionization rises to thermal runaway or descends to plasma shutdown. Balancing voltage, vacuum and gas flow on the tipping point is the process behind achieving a sustained thermonuclear reaction.

The tipping point is composed of many factors including mechanical, electrical, material and geometric chamber properties. These subtle shifts during operation cannot be measured except in longer duration runs.

The new school year brings new talent

In September we began a new school year with 12 students, 5 instructors and 2 advisors. Needless to say, our student to instructor ratio is more than optimum. Joining us this year from Nytec is Mr. Jim Lynch, who has worked with the University of Washington Fusion Lab in Kirkland and 5 new students. We also saw departures with Eugene Lee going to Amherst College, Ki Hann moving on to the University of Washington and Kenny Luu going to Highline Community College. We wish to welcome Jeesoo, Julia, Savannah, Rian and Kevin. We are also pleased to be offering new text books this year. The faculty selected "Fundamentals of Nuclear Science and Engineering (second edition) by J. Kenneth Shultis and Richard E. Faw. Sessions now include 1 hour of lecture and 1 hour of project team development. New projects are underway including calibration process development, and the blue-fire power supply. There are also several proposals on the table including flux imaging with CR-39 plastics and integrating Peltier chips into the reactor heat exchanger technology for precision chamber temperature control.

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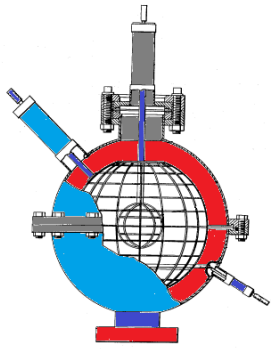

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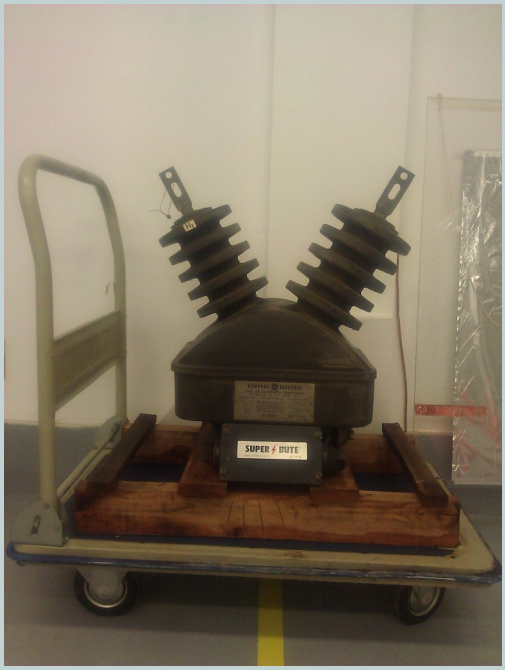
In this issue:

Blue Fire - The Ultimate Power Supply



Since the beginning of our work on the fusor, we have used neon sign transformers as the primary voltage supply for our Cockcroft-Walton voltage multiplier. The voltages we need to achieve for any real measurable fusion are above 30 KV. While the fusor only consumes about 300 watts in actual electrical power applied to the chamber in this scenario, it forces us to push our neon sign transformers to about 150% of their voltage limitation. On numerous occasions we have fried components in our Cockcroft Walton because the peak voltage it was designed to achieve was just inside the optimum operating range of our fusor. At last, it has become necessary to design a hardened supply that has adequate capacity for long run times as well as head room to protect vital components from spikes due to the inherent arcing that can occur in the plasma chamber during normal operation. The down side is that this supply must exist outside of the current fusor console on a separate cart. The upside is that the power supply can be leveraged for other experiments that need high voltage DC. With that criteria in mind, we consulted Dr. Frankenstein and he recommended this wonderful primary transformer for our new Cock-Croft Walton. At 345 pounds, it was delivered to our lab on a pallet. It will lope along at 24,000 volts at about 3KW. Additional components are on the way. It will join our 500,000 volt Tesla Coil and our 250,000 volt Van De Graf.

Bubble, Bubble Toil and Trouble...

These four bubbles were the result of a 20 minute fusor calibration run. Our HE3 tube indicated between 18,000 and 20,000 neutrons per second isotropic, and this device called a "bubble detector" is a calibrated dosimeter for measuring neutrons from the Chalk River nuclear laboratories in Canada. It is a 44bs/mrem model that agrees nicely, at 20CM from the point source of our fusor, with our HE3 tube. That means that the total neutron flux is about .0625 mrem per hour at 40 CM unshielded in this experiment. The fusor resides in a full castle shield weighing over 1,800 pounds, and a second bubble detector was taped to the outside of the shield during the same run, and showed no activity. That again agrees nicely with our film badge program that has badges with a neutron etch, and are read monthly by the Radiation Detection Company out of California. During the last two years of operation, not one single dose of radiation has been recorded on any of the 18 film badges worn by the faculty and students of the NWNC. We continue to be a ZERO-RAD program relative to radiation exposure during the 2012 school year.