Experimental Balloon Tested at PPPL's High Bay

In December, it looked as if you could embark on a trip "around the world in 180 days" at the motor generator high bay area of PPPL's D-site.

At one end stood a gigantic balloon — eight-and-a-half meters in diameter — made of 36 nylon panels and inflated with helium for testing.

The balloon, fabricated at Princeton University, will eventually be transported to Italy for the new Borexino Solar Neutrino Experiment at the Laboratori Nazionali del Gran Sasso. The Princeton University Nuclear Physics Group has a major role in the development of this experiment, which is designed to detect low-energy solar neutrinos, in real time, using 300 tons of liquid scintillator in an unsegmented detector. Neutrinos are elusive, sub-atomic particles.

Members of the borexino team brought the balloon to PPPL to test it for leaks, measure distortion, and check out its geometry.The Borexino experiment involves about 100 collaborators from several institutions. Researchers are from three countries, the U.S., Germany, and Italy. Ernst de Haas, a former PPPL'er on the project team, suggested D-site for testing the balloon because of the large, open space available there.

"They needed a place that had a crane and was free from any wind," noted PPPL's Gene Baker.

Said Princeton University graduate student Laura Cadonati, "The main goal of Borexino is to measure the flux of neutrinos from the electron-capture decay of 7Be in the Sun. This is one of the thermonuclear fusion reactions that produce the Sun's energy." The number of these neutrinos emanating from the Sun is lower than expected. Scientists are attempting to understand why.

"The balloon will be filled with a liquid scintillator at the project site in Italy. It will be the first of its kind able to detect low-energy solar neutrinos in real-time," said Allan Nelson, a member of the Princeton team.

Cadonati noted that the liquid scintillator being used in Borexino is pseudocumene, a benzene-like organic liquid, doped with fluorescent compounds. "This mixture produces light when hit by a particle such as a neutrino; this light is then detected by an array of photomultiplier tubes," she said.

The balloon will go inside a larger balloon that will be placed into a stainless steel sphere. Pointing to the balloon at D-site, Princeton University Physics Professor Tom Shutt said, "This will be the center of the experiment."

The balloon tested at PPPL is a prototype. It or a new balloon is expected to go to Italy for futher tests sometime before the spring.

A special thanks goes to everyone at PPPL who assisted with the effort by lending tools, giving the team training on equipment, and conducting safety checks. PPPL staff who assisted with the effort are: Mounir Awad, Gene Baker, Larry Dudek, Chris Gilton, Bob Horner, Jerry Levine, Colin McFarlane, Lewis Meixler, Bob Parsells, Bill Slavin, and Mike Viola.

Borexino Group

The Borexino Group at Princeton University includes Jay Benziger, Frank Calaprice, Laura Cadonati, Mark Chen, Tom Shutt, Ernst de Haas, Richard Fernholz, Richard Ford, Cristiano Galbiati, Beth Harding, Aldo Ianni, Steve Kidner, Paul LaMarche (project manager), Fred Loeser, Allan Nelson, Andrea Pocar, James Semler, Andrew Sonnenschein, and Charles Sule. ●

From left in front of the balloon are Laura Cadonati, Princeton University graduate student; Tom Shutt, Princeton University physics professor; Allan Nelson, technical staff member at Princeton University; and Richard Fernholz, Princeton University engineer.