Volume 13, No. 5
January 30, 1985

Atomic Energy's spectrometer advances Canadian nuclear physics research

An "eight pi gamma-ray spectrometer" is being installed at the Atomic Energy of Canada Limited (AECL)'s Chalk River nuclear laboratories, where operating in conjunction with the laboratories' new superconducting cyclotron, it will help to keep Canada at the forefront of research in nuclear physics.

The Natural Sciences and Engineering Research Council (NSERC) and AECL are sharing the $5-million cost of the spectrometer that will be designed and constructed by the University of Montreal, McMaster University in Hamilton, Ontario and AECL at Chalk River. Once the facility is operational, it will be opened to qualified researchers from across Canada and throughout the world.

More capabilities

The three-metre diameter spherical spectrometer, which will be used to investigate nuclear shape, structure and binding forces, is expected to be the most advanced of its type in the world. It will have greater versatility and over-all data-gathering efficiency than other existing spectrometers.

The eight pi spectrometer is so named because of the properties of its two independent spherical arrays of detectors. The inner array covers a sphere and is said to subtend a solid angle of four pi. Each of the outer detectors is surrounded by an anti-Compton-scattering shield and thus has a solid angle of four pi for rejection.

Rapid results

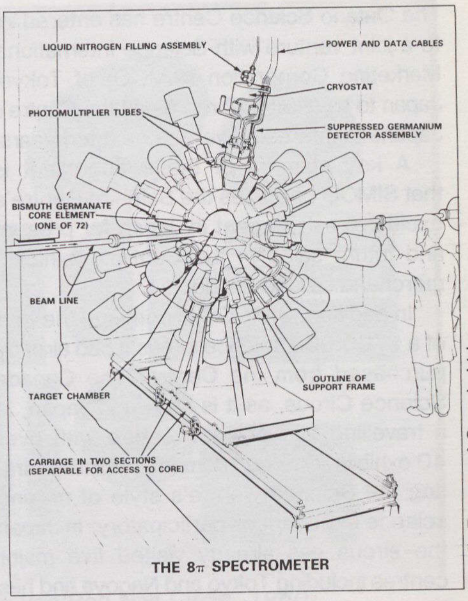
The inner sphere, consisting of 72 counters made of bismuth germanate, will give researchers an overview of each nuclear event by measuring the total number of gamma rays emitted and their total energy.

Small holes in the inner sphere allow some of the gamma rays unobstructed passage to the outer array of 20 special germanium detectors to give highly precise information on individual gamma ray energies and intensities.

Fusion of tin and silicon

The importance of the role of the spectrometer can be seen in an experiment conducted with tin and silicon.

Using the Chalk River cyclotron, scientists accelerate silicon nuclei to enormous velocities, then aim them at a target made of tin, positioned in the centre of the spectrometer. When one of the silicon nuclei hits the tin nucleus, the collision energy is so great that it overcomes the powerful electric forces that normally keep individual



Atomic Energy of Canada Ltd.

Artist's conception of the eight pi gamma-ray spectrometer being constructed in Canada for advanced nuclear physics research.

nuclei apart. The two nuclei then fuse together, spinning at the rate of a billion trillion revolutions per second.

Several neutrons escape the bonding process and "boil" away from the surface of the newly-forged nucleus. The nucleus itself then slows rapidly by radiating 20 to 30 bursts of energy in the form of gamma-rays, each having a characteristic wavelength corresponding to a precise unit of energy lost by the nucleus. The result is the creation of an atom of gadolinium — a rare element whose atomic nucleus combines the exact number of protons (64) found in tin and silicon.

The entire process takes only a billionth of a second. Almost the entire sequence of these nuclear events can be reconstructed from data collected by the gamma-ray spectrometer.

Knowing that if two or three rays are detected simultaneously, chances are good that they came from the same nucleus, nuclear physicists can then deduce partial information about that nucleus's energy levels. A statistical combination of gamma data for many collisions completes the picture of the rotation, structure, and even the shape of the nucleus.

As many nuclei in their ground state are not completely round, one of the tasks of the new spectrometer will be to examine the changes in shape and bonding that occur at the most rapid spin rates.

Canada-US firms create largest insurance brokerage

Reed Stenhouse Companies Limited of Toronto is finalizing arrangements to merge with Alexander and Alexander Services Inc. in New York city.

The deal, valued at $347 million (Cdn) or $20.90 a share to Reed Stenhouse shareholders, will form "the strongest truly international insurance broking group", said Reed Stenhouse president William Wilson.

The trust companies expect to complete the merger by the end of May, but the closing is subject to obtaining regulatory consents and the approval of shareholders of both companies. Shareholders are to receive full details by the end of March.

Reed Stenhouse, the largest publicly traded brokerage firm in Canada, has operations in the United States, Britain and 30 other countries.

The merger of the two firms will be effected through a recapitalization of Reed Stenhouse and an exchange offer under which Reed Stenhouse holders would receive the equivalent of two Alexander and Alexander shares for each three Reed Stenhouse class A or class C shares held.

Reed Stenhouse shareholders will own about 28.8 per cent of the common stock of Alexander and Alexander when the merger is completed. Alexander and Alexander will acquire all the class A and class C shares of Reed Stenhouse.

Continued Canadian dividends

As a result of the recapitalization, Reed Stenhouse shareholders will continue to have shares that pay Canadian dividends with correspondingly favourable tax treatment. Their shares are exchangeable into shares of Alexander and Alexander, which will own 100 per cent of the voting securities of Reed Stenhouse.

The corporate headquarters of the merged company will be in New York, but Mr. Wilson, who becomes chairman and chief executive officer of operations outside the United States, will remain in Toronto.

Mr. Wilson said the deal "enhances the development of a process to which we have been committed" since Reed Shaw Osler in Canada and Stenhouse Holdings of Scotland were brought together in 1973. Earlier, Reed Stenhouse acquired Stenhouse, which in turn owned 48.9 per cent of its equity.