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NEWSLETTER

**tascc**

News about Chalk River's Tandem Accelerator Superconducting Cyclotron facility for users and potential users

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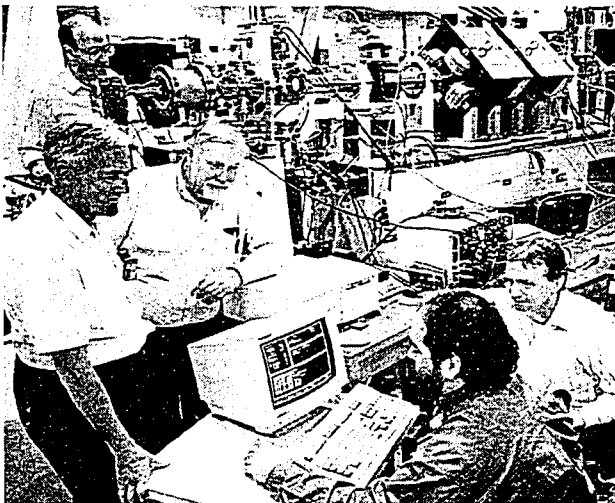
## Damage tests of satellite instrumentation

Researchers from two institutions in the U.S.A. and one in Canada used TASCC beams in early April for important tests of integrated circuits and other semiconductor devices proposed for installation in space satellites.

Three separate beams were chosen to simulate cosmic radiation that damages electronic circuitry in space. The beams included iodine accelerated to 1.9 GeV by the cyclotron, plus iodine and fluorine accelerated to a few hundred MeV by the Tandem.

According to TASCC Director John Hardy, "Only a handful of accelerators in the world can provide this type of beam and be available to outside researchers within a relatively short period of time."

The Canadian group examined damage to electronic parts such as digital signal processors, central processing units (CPUs) and co-processors commonly used in computers. The U.S.A. visitors looked at electrically-erasable programmable read-only memories (EEPROMs) and static random-access memories (SRAMs) commonly used in microprocessors that need to maintain their programs through power failures. *(Story continued next page)*



US and Canadian researchers test the effects of high energy particles on satellite instrumentation using TASCC beams.

## Tandem, cyclotron break records

A record voltage on the Tandem terminal of 16.0 MV was reached this month during conditioning tests without beam. Soon after, reliable operation with beam was achieved for five days at 15.2 MV. Modifications made to improve performance to this level included reconfiguring hoops near the terminal, regrading column resistors, controlling dust at the terminal, and increasing SF<sub>6</sub> pressure to 720 kPa.

Currently our MP machine matches the best of the Brookhaven accelerators as the highest performers of their type worldwide. The voltage increase also expands TASCC capabilities in producing coupled Tandem-plus-cyclotron beams.

In a recent cyclotron development run, a beam of germanium-70 was accelerated to 35 MeV-per-nucleon, which is above the "design limit" for the machine. This advance was made possible by first accelerating chlorine-35 to the same energy. This "equivalent" beam, with beamline and cyclotron parameters essentially identical to those of the germanium beam, has higher intensity, so was extracted in a normal manner.

The switch to germanium, at the same settings, was then relatively straightforward. Indeed, because of a much lower charge-state intensity, its development might not otherwise have been viable.

These beams were produced for experiments during April:

Ion	Energy (MeV)
<sup>6</sup> Li	28
<sup>7</sup> Li	24, 29, 32 & 175
<sup>14</sup> N	62 & 75
<sup>16</sup> O	85
<sup>19</sup> F	145
<sup>26</sup> Mg	153
<sup>35,36,37</sup> Cl	100
<sup>127</sup> I	137, 285, 330 & 1905

### Damage tests (continued)

The SEU experiments, which lasted four days, produced some very interesting results. Apparently, the higher energies produced by TASC beam cause catastrophic failures in electronics at a rate up to 1000 times faster than low-energy ions having the same stopping power. This was previously thought to be the most important factor in causing radiation damage.

"People in this field will have to rethink their theories of how cosmic radiation can damage instrumentation" reports Prof. John Davies, who acted as consultant to the visiting teams. A possible result of the work may be changes in the established protocols and specifications for electronic instrumentation destined for satellites.

The two U.S. institutions represented in the tests were Naval Research Laboratories, Washington and Rensselaer Polytechnic Institute, Troy, N.Y. The Canadian researchers came from Defence Research Establishment, Ottawa (DREO), which paid for the TASC beam time.

This is the first commercial use of TASC, although several "applied" projects such as COG-funded projects (CANDU Owners Group) also pay for beam time. Of course, "basic research" teams supported by government grants receive beam time free.

### New staff welcomed

CRL nuclear theorists, Ian Towner and Anna Hayes, joined the Nuclear Physics Branch April 1. Their transfers were prompted by the dissolution of CRL's Theoretical Physics Branch, an action taken as a cost-cutting restructuring measure. Nancy Schmeing's attachment also transferred to Nuclear Physics.

Other members of the former branch transferred to the Neutron and Condensed Matter Physics Branch. The theorists will continue to work from their present offices and the administrative changes are not expected to affect their research programs.

### Science educators find TASC "fabulous"

The 18th Annual "Science for Educators Seminar" was held at Chalk River Labs April 15 - 17 and was again pronounced an outstanding success.

Over 88 science educators travelled from all but three Canadian provinces to attend the event, sponsored by AECL Research and the Science Teachers Association of Ontario. Eager participants toured numerous labs and attended demonstrations and seminars on a wide range of science topics, including physics, accelerators, biology, reactors, lasers, chemistry, engineering, and the

environment. As well, some teachers and educators signed up for field trips and lessons in glass-blowing and operation of powerful microscopes.

Says seminar program chairman Malcolm Harvey, Director of Physics, "Such gatherings are essential if we are to raise Canadian awareness of the crucial role that science and technology play in our society, not to mention the contributions AECL makes." Fully one third of the teachers were past seminar participants, with some returning for the fourth or fifth time.

TASC was represented in the formal sessions by Walter Davies, who gave a talk titled "Orbits for Planets and Accelerators", by Ian Towner, who gave a talk titled "Big Science Projects in Sub-Atomic Physics" and by Anna Hayes who participated on a physics discussion panel. In addition, Helena Lindqvist led a group of 12 visitors through a special tour of the facility. At the closing plenary session on Saturday, a non-AECL speaker, Ms. Beth MacGillivray of the Ottawa General Hospital, spoke on "Radioisotopes and Medicine."

Ten of the registrants for the "Share an Afternoon with a Scientist" session chose to arrive a day early to accompany five TASC staff members who explained the activities involved in operating such a facility and the experimental programs carried out.

Written comments collected later by organizers prove that this experience is valuable to educators. "Fabulous - it certainly takes it way beyond just reading about it." "Outstanding - all the researchers I met were most helpful" were two of many positive quotes relayed back to TASC volunteers.

Another comment heard frequently from visitors during the three day seminar was the pleasant surprise at seeing staff dedicating so much of their own time and effort to explain science to others.

### NPPAP panel assesses TASC programs

The Nuclear and Particle Physics Advisory Panel made a site visit to TASC on Monday, April 26. The Panel's mandate is to advise the federal government on Canadian activities, their merits and relative priorities, and to develop a long-range plan for the Canadian sub-atomic physics community, using a 10-year horizon.

The program for the one-day visit consisted of nine presentations by TASC researchers followed by one by M. de Jong describing the Accelerator Physics Branch program. In a separate session at the end of the day, Professors J. Barrette and S.K. Mark from McGill described their research with relativistic heavy ions, which is based at Brookhaven.

From TASC, the 10 NPPAP members heard reports on: an overview of TASC (J.C. Hardy); nuclei

### **NPPAP Panel (Continued)**

at high angular momentum (D. Ward); weak interactions and nuclear theory (I.S. Towner); nuclear reaction mechanisms (D. Horn); nuclear mass measurements (K. Sharma, University of Manitoba); interdisciplinary research (J.S. Forster); the TRIGAM proposal (J.C. Waddington, McMaster University); a proposal for an on-line Penning trap for exotic nuclei (G. Savard); and TASCAC accelerator operation and development (H. Schmeing).

Each talk addressed questions submitted by the Panel in advance; and each was followed by an informal question period. A two-way question and

answer session, involving Panel members and the audience, wrapped up the TASCAC portion of the program.

A lunch-hour tour of the facility for first-time visitors on the Panel was also squeezed into the busy schedule.

As the TASCAC session drew to a close, John Hardy thanked the Panel for its fair and balanced approach. "You have let us give it our best shot" he concluded. The Panel's first written report is expected to be submitted to the Deputy Minister of Industry, Science and Technology Canada in June.

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## April experiments

**Experiment** : Irradiation of water samples to simulate radiolysis in CANDU power reactors.  
**Researchers** : A.J. Elliot, D.C. Oullette and P.M. Chenier (*System Chemistry and Corrosion Branch, CRL*); V.T. Koslowsky and W.G. Davies (*TASCAC*)  
**Beam** : 25 MeV/u  ${}^7\text{Li}$   
**Duration** : 3 days

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**Experiment** : Measurements of single-event upsets in large-scale integrated circuits.  
**Researchers** : A. Knudson, M. Barrett, W. Stapor and J.D. Mann (*U.S. Naval Research Lab.*); J. Howard and H. Dussault (*Rensselaer Polytechnical Inst.*); T. Cousins, T. Jones and B. Hoffarth (*Defence Research Establishment Ottawa*); J.S. Forster and H.R. Andrews (*TASCAC*)  
**Beam** : 137, 285, 330 & 1905 MeV  ${}^{127}\text{I}$ ; 145 MeV  ${}^{19}\text{F}$   
**Duration** : 5 days

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**Experiment** : Measurement of chlorine-36 content of 80 environmental samples and standards with AMS. The run enjoyed the best operational stability of any such run to date and the rejection ratios of the ion injector and of the velocity filter for species differing by one unit in mass from that selected exceeded  $10^6$  in both cases.  
**Researchers** : R.R.J. Cornett, L.A. Chant, S.J. Kramer, G.M. Milton and J.J. Sylvestre (*Environmental Research Branch, CRL*); H.R. Andrews, W.G. Davies, B.F. Greiner, Y. Imahori, V.T. Koslowsky, J.W. McKay and J.C.D. Milton (*TASCAC*)  
**Beam** : 100 MeV  ${}^{35,36,37}\text{Cl}$   
**Duration** : 4 days

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**Experiment** : Search for evidence of the beta decays of gallium-62; gamma-ray studies of the decays of vanadium-44, chromium-46, cobalt-52 and nickel-54.  
**Researchers** : G. Savard, E. Hagberg, V.T. Koslowsky, J.C. Hardy, M.J. Watson and W.L. Perry (*TASCAC*)  
**Beam** : 28 MeV  ${}^6\text{Li}$ ; 24, 29 & 32 MeV  ${}^7\text{Li}$ ; 85 MeV  ${}^{16}\text{O}$ ; 62 MeV  ${}^{14}\text{N}$   
**Duration** : 3 days

**Experiment** : Search for evidence of a rotational band in osmium-181 that characterizes the extended shape (2.3 : 1 axis ratio) predicted by R. Chasman.  
**Researchers** : D. Ward, H.R. Andrews, D.C. Radford and A. Galindo-Uribarri (*TASCC*); V.P. Janzen (*McMaster U./TASCC*); T.E. Drake, M. Cromaz and J. de Graaf (*U. of Toronto*); J.C. Waddington and G. Hackman (*McMaster U.*)  
**Beam** : 153 MeV  $^{26}\text{Mg}$   
**Duration** : 2 days

**Experiment** : Study of the low-spin spectrum of hafnium-167 in a backed-target experiment.  
**Researchers** : M. Cromaz and T.E. Drake (*U. of Toronto*); S. Pilotte (*U. of Ottawa*); D. Ward, H.R. Andrews and D.C. Radford (*TASCC*); V.P. Janzen (*McMaster U./TASCC*);  
**Beam** : 75 MeV  $^{14}\text{N}$   
**Duration** : 2 days

**Experiment** : Study of the low-spin spectrum of thulium-159.  
**Researchers** : D.C. Radford, D. Ward, H.R. Andrews, A. Galindo-Uribarri (*TASCC*); V.P. Janzen (*McMaster U./TASCC*); S. Pilotte (*U. of Ottawa*)  
**Beam** : 75 MeV  $^{14}\text{N}$   
**Duration** : 2 days

### Next month . . . . .

- Presentations to visiting Nuclear Physics Technical Review Committee
- AMS counter tests
- Spectroscopy of Bi-197,-198
- Development of several new cyclotron beams
- Study of decay of potassium-38
- Four-day facility maintenance
- Search for high-spin states in vanadium-47
- Search for superdeformation in terbium-145

### Facility operating record

Elapsed Time (Year-to-date)	2927
Beam Available	
Tandem Only	1558.1
Tandem + Cyclotron	362.4
Beam Development	410.0
Planned Shutdown	378.5
Forced Shutdown	218.0

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