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NEWSLETTER

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tascc

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

Cyclotron fully commissioned with production of uranium

A 3 MeV-per-nucleon beam of uranium-238 was successfully produced at TASCC on October 24. The achievement of this important milestone completes the commissioning requirements of the superconducting cyclotron, a Chalk River invention designed and built by CRL's Accelerator Physics Branch.

The uranium beam was extracted at conditions very close to the design limits of the cyclotron, including a magnetic field of 4.81 Tesla, a deflector gradient of 125 thousand volts per centimetre, and a superconducting extraction magnet at the 90% limit of its critical current.

The first beam,10 MeV-per-nucleon iodine, was extracted from the TASCC cyclotron in September of 1985. Some physics experiments started four months later but stopped for Phase II construction– the installation of nine target locations. Intense commissioning began in June 1988 and has continued in parallel with physics experiments ever since.

Significant steps along the way included: production of a diagnostic probe that snakes into the narrow extraction channel to monitor beam position there; overcoming radiofrequency heating problems in the pi mode of operation, unique to our cyclotron; developments to reach the record high voltages required by the beam-extraction deflector; overcoming the challenges of detecting and phase-controlling very low beam intensities; and use of computers to predict, monitor and control many parameters, including beam-energy stabilization.

With the push to develop the full range of beams required to complete commissioning, many improvements in reliability and operability were made, resulting in round-the-clock operation for periods longer than a week whenever required.

Facility summary

The Tandem was conditioned and put back into operation at the start of October, following its two-week shutdown for cleaning and maintenance. However, a 70-minute power outage delayed an early startup of the first experiment, channeling in silicon with a high-energy bromine beam from the cyclotron.

An ISOL run and an 8π spectrometer experiment were followed by first extraction of a uranium beam from the cyclotron. The latter experiment was delayed two days by two forced openings of the cyclotron to investigate and repair a failed deflector component.

Beams produced by the Tandem were 12 to 20 MeV protons; 7.4 MeV carbon-12; 95 and 100 MeV fluorine; 120 and 125 MeV sodium-23; 235 and 250 MeV nickel-58; 118 MeV bromine-79; and 46 MeV uranium-238.

Along the way, 42 different beams have been produced by the cyclotron, with energies ranging from a few MeV per nucleon to 50 MeV per nucleon, and with masses ranging from carbon-12 to uranium-238. Researchers have made good use of this capability, using 15 of the beams to date and planning expanded programs in the near future.

However, the work of the cyclotron team is not yet over; other difficult beams within the design limits will be added to the list, beam currents will be increased to their limits, and the ease of operation and reliability of all the sub-systems will be optimized.

Congratulations go to all those who have worked so determinedly to achieve full commissioning status.

New AMS method tested

The AMS group recently tested an alternative technique for distinguishing chlorine-36 ions from the interfering ion species in a mass-resolved beam.

The high resolution of the Q3D magnetic spectrometer was used to separate interfering ions from a chlorine-36 beam. Separation is based on the different energy loss experienced by different beams on passing through a thin uniform foil located at the spectrometer's "source" position.

This ion-selection scheme may prove to be a viable alternative to the gas-filled magnet method currently used in AMS studies.

New member for ISOL group

A new staff member was added to TASCC's Nuclear Physics Branch this month. He is Guy Savard, who fills a vacancy in the ISOL group.

Guy obtained his Ph.D in nuclear physics from McGill University and then spent three years as a post-doctoral fellow at Mainz University. While there he performed mass measurements of radioactive isotopes with a Penning trap, as a member of the CERN group using the ISOLDE mass separator.

TASCC safety for visitors

We have recently prepared a set of simple instructions for TASCC visitors to follow if emergency situations arise. The instructions, to be given to all visitors on arrival, cover site-wide signals as well as the various safety warning devices within the TASCC facility.

A set of instructions, in both official languages, is included with this newsletter for your information.

October experiments

Experiment : Study of resonant transfer and excitation in He-like bromine channelled in a silicon crystal
Researchers : J.S. Forster, W.G. Davies, G.C. Ball and J.S. Geiger (*TASCC*); J. Andersen (*U. of Aarhus*); H. Geissel (*GSI-Darmstadt*) and E. Kantor (*Argonne N. L.*)
Beam : 18 MeV/u $^{79}Br^{+22}$
Duration : 7 days

Experiment : Determination of energies of very weak γ–rays in chlorine-32 and manganese-50 with the He-jet system
Researchers : E. Hagberg, J.C. Hardy, V.T. Koslowsky, G. Savard and M.J. Watson (*TASCC*); J. Hykawy (*TASCC/U. of Manitoba*) and P. Unger (*U. of Manitoba*)
Beam : Protons at 12 to 20 MeV
Duration : 3 days

Experiment : Collection of high-spin spectra of antimony-111 and -115 and survey of γ-rays from other nuclei
Researchers : V.P. Janzen (*TASCC/McMaster U.*); D. Ward, A. Galindo-Uribarri and D.C. Radford (*TASCC*); S. Mullins and D. Prévost (*McMaster U.*); D. LaFosse and R. Hughes (*SUNY, Stoneybrook*) and G. Zwartz (*U. of Toronto*)
Beams : $^{23}Na^{+9}$ at 120 and 125 MeV; $^{19}F^{+8}$ at 95 and 100 MeV
Duration : 4 days

Experiment	: First extraction of uranium-238 at 3 MeV/u; redevelopment of carbon-12 at 10 MeV/u for operator training on the superconducting cyclotron
Researchers	: TASCC Beam Commissioning Team
Beams	: $^{238}U^{+19}$ at 3 MeV/u and $^{12}C^{+3}$ at 10 MeV/u
Duration	: 7 days

Experiment	: Identification of gamma-rays from antimony-109
Researchers	: V.P. Janzen (***TASCC/McMaster U.***); D. Ward, A. Galindo-Uribarri and D.C. Radford (***TASCC***)
Beams	: $^{58}Ni^{+11,19}$ at 235 MeV; $^{58}Ni^{+13,19}$ at 250 MeV
Duration	: 1 day

Next month.....

- Superdeformation studies of dysprosium-152 with the miniball
- Single Event Upsets in microcircuits
- Radiative Electron Capture in high-T_c superconductors
- Deuteron radiolysis of water samples
- Particle reaction detector tests with high-energy carbon
- ISOL mass measurements of iodine isotopes
- Study of high-spin states in gadolinium-141
- AMS of natural samples

Facility operating record

Elapsed Time (Year-to-date)	7200 h
Beam Available	
Tandem Only	2870.3
Tandem + Cyclotron	3486.1
Beam Development	1948.7
Planned Shutdown	1188.6
Forced Shutdown	576.6

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